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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Installation Restoration Program Phase I: Records Search of Hanscom Air Force Base, Massachusetts		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER ~~2-817-01-601-02~~ IRP-I-Hanscom
7. AUTHOR(s) K. R. Boyer		8. CONTRACT OR GRANT NUMBER(s) Air Force BOA F08637-83-G006
9. PERFORMING ORGANIZATION NAME AND ADDRESS JRB Associates, A Company of Science Applications International Corporation 8400 Westpark Drive, McLean, VA 22102		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE August 1984
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) HQ AFESC/DEVP Tyndall AFB, FL		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A

16. DISTRIBUTION STATEMENT (of this Report)

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

A Phase I Initial Assessment under the Installation Restoration Program was conducted at Hanscom Air Force Base, Massachusetts. Past and current employees were interviewed, records were reviewed, regulatory agencies were contacted, and ground reconnaissance was conducted. Past waste handling and disposal practices were evaluated, and 23 past waste sites were identified. Thirteen sites were assessed using the Hazard Assessment Rating Methodology (HARM), Phase II monitoring programs were recommended for nine sites.

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EXECUTIVE SUMMARY

This report presents the findings of the Installation Restoration Program (IRP) Phase I Records Search/Installation Assessment of Hanscom Air Force Base (AFB) in Massachusetts. As intended by Phase I of the Air Force IRP, this investigation identified the potential for environmental contamination from past waste management and disposal practices and assessed the probability of contaminant migration that could have an adverse effect on public health and the environment.

Installation Description

Hanscom AFB is located in Middlesex County, Massachusetts, 17 miles northwest of downtown Boston. The base occupies land in the towns of Bedford, Concord, Lexington, and Lincoln. The site was established as a public airport in 1940, and military aircraft activity began in 1942. The airport was donated by the Commonwealth of Massachusetts to the Air Force in 1952. The primary mission of the base is command, control and communications systems acquisition by the Electronic Systems Division. The base's runways and adjacent land were returned to the Commonwealth of Massachusetts in 1974 and are now operated by the Massachusetts Port Authority as Hanscom Field, a civilian airport.

Major historic base activities have included the following:

- State-owned civilian airport and support facilities (1940 to 1952 and 1974 to present)
- Air Force airfield and support facilities (1952 to 1974)
- Lincoln Laboratory Research and Development Facility (1952 to present)
- Air Force Cambridge Research Center (1955 to present, now partly the Air Force Geophysics Laboratory and two divisions of the Rome Air Development Center)
- Air Systems Integration Division (1957 to 1960)

- Air Material Command Electronic Systems Center (1959 to 1961, some functions incorporated into ESD, others into Air Force Logistics Command)

- Air Force Command and Control Development Center (1959 to present, now the Electronic Systems Division)

- Electronics Systems Center (1960 to present, now part of the Electronic Systems Division).

Environmental Setting

The review of the environmental setting of Hanscom AFB and Hanscom Field revealed the following geologic, pedologic, hydrologic, and ecologic conditions that influence the movement of hazardous materials in the environment or may be adversely affected by the presence of hazardous materials:

- A dual aquifer system exists at Hanscom AFB and comprises an upper unconfined aquifer consisting of outwash deposits and a lower semi-confined aquifer consisting of tills. These two units are separated by low-permeability lacustrine deposits.

- The bedrock surface exerts considerable control over local groundwater flow; however, the overall groundwater flow system is controlled by topography and surface hydrology.

- Groundwater flow is generally in the north or northeast direction

- The outwash and till aquifers are not used as sources of water at the base due to low production rates. The water supply for the base, with the exception of the Air Force Trailer Home Park which uses Bedford well water, is the Quabbin Reservoir in western Massachusetts, provided by the Metropolitan District Commission.

- All three wells located in Bedford's new well field north of Hartwell's Hill have been taken off line due to the detection of trace levels of TCE, and iron and manganese concentrations.

- Water from monitoring wells at Hanscom Field contains varying concentrations of TCE, DCE, toluene, and other volatile organic compounds.

- Surface water drainage is primarily controlled by the storm sewers throughout the base.

- The storm sewer system discharges into the Shawsheen River and Elm Brook.

- Soils in the vicinity of base have been drastically disturbed by construction activities. These soils, however, reflect the properties of native soils existing prior to construction of the base. Hence, soils are similar to the native soils present outside the base perimeter.

- Most of the soils severely limit land use because of saturation.

Findings and Conclusions

The review of past operations and waste management practices at Hanscom AFB has resulted in the identification of 13 sites which may have resulted in environmental contamination and have potential for contaminant migration. Other industrial operation sites were reviewed and eliminated from further evaluation based on the methodology presented in Section 1.4

The identified sites have been evaluated and ranked using the Air Force Hazard Assessment Rating Methodology (HARM). The HARM evaluates potential receptors, waste characteristics, and migration pathways in order to determine the relative potential of uncontrolled hazardous waste disposal facilities to cause health or environmental damage. The results of the rating methodology applied to the identified sites are summarized in Table ES-1.

Based upon an evaluation of the 13 identified sites, recommendations have been made for further investigation of 9 sites through a Phase II confirmation effort. In summary, each of these sites should be subject to a combination of sampling and analysis.

TABLE ES-1

SITES AT HANSCOM AFB EVALUATED USING THE HARM METHODOLOGY

Rank	Site Name	Dates of Operation of Occurrence	Overall HARM Score
1	Fire Training Area II	Late 1960-1973	86
2	Paint Waste Disposal Area	1966-1972	86
3	Jet Fuel Residue/Tank Sludge Area	1959-1963	85
4	Sanitary Landfill	1964-1974	80
5	Fire Training Area I	1950-1960	77
6	Former Filter Beds	1940's-1984	71
7	Industiral Wastewater Treatment System	1955-1974	69
8	Scott Circle Landfill	1950's-1973	65
9	Administration Bldg. Jet Fuel Spill	1954	59
10	Mercury Spill Bldg. 1128	1975	48
11	Various Fuel Spills on Runways and Taxiways	1960's-1973	45
12	AAFES Service Station Gasoline Leak	February 1981	6
13	Motor Pool Spill	December 1981	6

1.0 INTRODUCTION

1.1 BACKGROUND AND AUTHORITY

The United States Air Force (USAF) has long been engaged in a wide variety of operations involving toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate environmental and health hazards in a responsible manner. The primary Federal legislation governing disposal of hazardous waste are the Resource Conservation and Recovery Act (RCRA) of 1976, as amended, and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

Under Sections 3012 and 6003 of RCRA, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and state agencies to inventory past disposal sites and make the information available to requesting agencies. Under Section 105 of CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) was revised to provide Federal authority to respond to the problems of abandoned or uncontrolled hazardous waste disposal facilities. Section 104 of CERCLA and Executive Order 12316 place authority for carrying out the provisions of the NCP as they apply to Department of Defense (DOD) facilities with the Secretary of Defense. DOD and EPA entered into an agreement on August 12, 1984 to clarify each agency's responsibilities and commitments for conducting and financing response actions under CERCLA. The agreement, titled Memorandum of Understanding Between the Department of Defense and the Environmental Protection Agency for the Implementation of P.L. 96-510, The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), is provided in Appendix A.

To ensure compliance with these hazardous waste regulations, DOD developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental [illegible]ality Program Policy Memorandum (DEQPPM) 81-5, dated December 11, 1981, a[illegible]mplemented within the Air Force by a message dated January 21, 1982. [illegible]1-5 reissued and amplified all previous directives and memoranda on the IRP. The IRP is the basis for response actions on Air Force installations under the provisions of CERCLA. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that result from these past operations.

The Air Force IRP is a four-phase program, consisting of the following:

- Phase I: Installation Assessment/Records Search - Identifies the potential for environmental contamination from past disposal practices and assesses the probability of contaminant migration that could have an adverse effect on public health or the environment. Recommendations are made for Phase II efforts.

- Phase II: Confirmation/Quantification - Based on the findings of Phase I, potential contamination sites are assessed through sampling and analysis to confirm the presence and extent of contamination. Recommendations are made for actions to mitigate adverse environmental effects and prevent migration.

- Phase III: Technology Base Development - Supports the development of a project plan for controlling migration or restoring an installation, and responds to research requirements identified in Phase II.

- Phase IV: Operations - Implementation of remedial measures (construction, containment, or decontamination) required to control hazardous conditions.

1.2 PURPOSE

This investigation constitutes the IRP Phase I Installation Assessment for Hanscom Air Force Base (AFB) located in Lexington, Concord, Lincoln, and Bedford, Massachusetts. The objective of this investigation is to identify the potential for environmental contamination from past waste management practices, evaluate the probability of contaminant migration, and assess the potential hazard posed by past disposal activities. The extent of environmental contamination has been determined through detailed analyses of available site records and interviews of base personnel, including a review of installation history and environmental conditions that may contribute to pollutant migration (AFESC, 1983).

The results of the investigation are presented in this report and are intended to provide sufficient information to determine the requirements and scope of Phase II confirmation efforts.

1.3 SCOPE

The scope of the Phase I investigation of Hanscom AFB covers Air Force and Air Force contractor activities on currently and previously owned and leased Air Force properties, including the following:

- The current confines of Hanscom AFB (see Section 3)
- The following off-base Air Force facilities:
  - Prospect Hill Electronics Research Annex
  - Sudbury Electronics Research Annex
  - Maynard Geophysics Research Annex
  - Solar Radio Observatory at Sagamore Hill
  - RADC Electromagnetic Test and Measurement Facility
  - Fourth Cliff Recreation Annex
  - North Truro Air Force Station
- The current confines of Hanscom Field (see Section 3), formerly part of Hanscom AFB and currently owned and operated by the Massachusetts Port Authority (Massport).

The Phase I activities included:

- Obtaining environmental information from Federal, State, and local agencies
- On-base visit including the following:
  - records review
  - personnel interviews
  - field investigation
  - helicopter overflight and aerial photographic coverage
  - photographic coverage of existing facilities and conditions
- Evaluation of disposal practices and application of the Air Force's Hazard Assessment Rating Methodology
- Recommendations of a scope for Phase II.

This report presents the findings of the above activities.

1.4 METHODOLOGY

The methodology used for this Phase I investigation was that specified by the USAF as shown in Figure 1-1. The investigation was conducted by JRB Associates, a company of Science Applications International Corporation, under contract to the Air Force Engineering Services Center (AFESC) at Tyndall Air Force Base. The following team of professionals contributed to this investigation:

- John P. Meade, Project Director and Environmental Engineer
- Kevin R. Boyer, P.E., Project Manager and Civil Engineer
- Alfred N. Wickline, Records Search Team Leader and Soil Scientist
- Claudia A. Furman, Geologist
- Robert M. Scarberry, Chemical Engineer
- Robert A. Smith, Ecologist.

Resumes for these professionals are provided in Appendix B.

JRB began the Phase I investigation by reviewing information provided and related by base personnel at the project pre-preformance meeting conducted on January 31, 1984, at Hanscom AFB. (The meeting is documented in minutes dated February 8, 1984.) From February 20 to 24, 1984, an investigation team visited the base and conducted file searches, personal interviews, and site visits. The file search included on-base civil engineering and bioenvironmental engineering files. Forty-six personnel were interviewed in person or by telephone and are listed in Appendix C. The on-base and Hanscom Field facilities were visited by automobile and on foot, and the remote off-base facilities (listed under Scope) were overflown by helicopter arranged by Hanscom AFB.

The facility visits and the helicopter overflight were intended to identify visible potential sources of environmental contamination caused by disposal practices and other activities. Such visible signs of contamination could include:

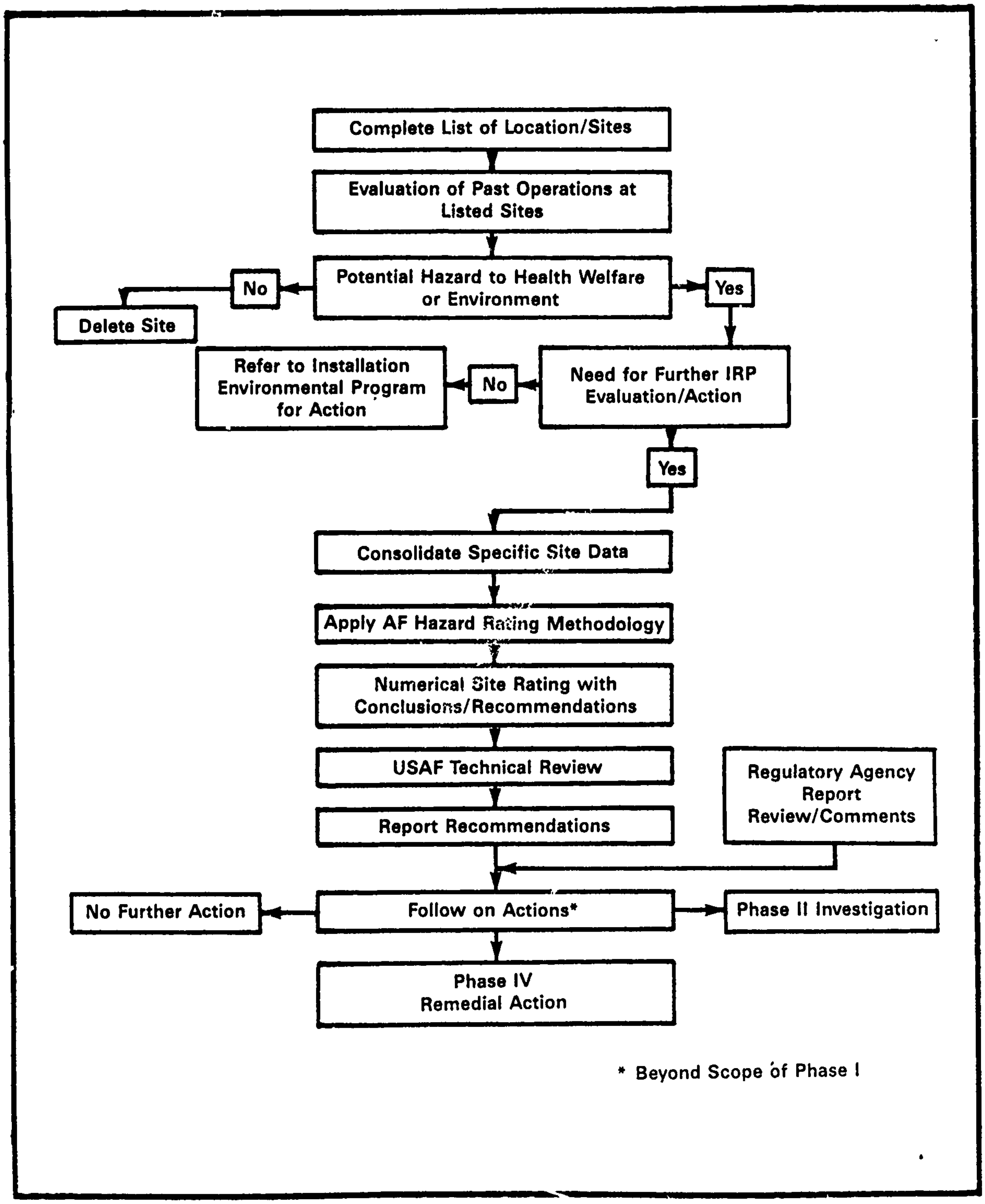


Figure 1-1. IRP Phase I Records Search Flow Chart.

- Leachate seeps
- Vegetative stress
- Discolored or stained soils
- Evidence of disposal activity (e.g., drums).

At various points in conducting the project, the following Federal, State, and local agencies were contacted and/or visited for information regarding the ..vironmental setting of the facilities included in the investigation:

- Commonwealth of Massachusetts Department of Public Works, Boston, Massachusetts
- Massachusetts Water Resources Commission, Boston, Massachusetts
- Bedford Municipal Water Authority, Bedford, Massachusetts
- Middlesex Conservation District, Littleton, Massachusetts
- Massachusetts Port Authority, Boston, Massachusetts
- U.S. Geological Survey, Reston, Virginia
- U.S. Environmental Protection Agency, Region I, Boston, Massachusetts
- Massachusetts Department of Environmental Quality, Boston Massachusetts
- Massachusetts Natural Heritage Program, Massachusetts Division of Fisheries and Wildlife, Boston, Massachusetts.

From these investigation and records review activities, past disposal sites and potential sources of hazardous material release were identified and assembled for analysis. Based on available data, each disposal site was assessed for its potential for contaminant migration. If the potential for contaminant migration was considered significant, the site was evaluated and prioritized using the Air Force's Hazard Assessment Rating Methodology (HARM). Conclusions resulting from the assessment are provided in Section 5, and completed HARM scoring forms are provided in Appendix D.

The results of the hazard rating for each disposal site indicate the relative potential for environmental contamination and migration. For each site rated as part of this effort, recommendations have been made on the degree and scope of further investigation required during an IRP Phase II confirmation investigation. These recommendations are provided in Section 6.

2.0 INSTALLATION DESCRIPTION

2.1 BASE HISTORY

The property presently occupied by Hanscom AFB was initially established as the Auxiliary Boston-Bedford Airport on May 14, 1941, by an act of the Great and General Court of the Commonwealth of Massachusetts. This act of legislation provided the Commonwealth with the authority to acquire the necessary land holdings on which to build an airport. On June 29, 1942 the Commonwealth formally transferred this land area containing 500 acres to the Federal government for the purpose of constructing an air field, which was constructed and used by the Army Air Force during World War II. The air field was renamed and officially dedicated in 1943 as Laurence G. Hanscom Field in memory of a local reporter for the Worchester Telegraph and amateur pilot who died from injuries resulting from an airplane crash at the field on February 9, 1941.

Military flying activities at the field began in 1942 with the arrival of P-40 fighter aircraft and continued for 31 years until September 1973. During this period, base personnel serviced and repaired a variety of aircraft ranging in size from T-7 trainers to KC-135 or C-124. In October 1951, the Secretary of the Air Force petitioned the Governor of Massachusetts to donate Laurence G. Hanscom Field to the Air Force for use as a military installation. The Commonwealth of Massachusetts and the Federal government agreed on the following property arrangement in May 1952:

- o 396 acres were ceded by the Commonwealth to the United States Government
- o 641 acres were leased by the Commonwealth to the United States Government
- o 83 acres were retained by the Commonwealth.

The term of the lease was for 25 years, with an option to renew for an additional 25 years in 1977.

In April 1952, the first of the Lincoln Laboratory buildings was completed. Also in 1952, the 6520th Test Support Wing was activated to fly aircraft in support of Lincoln Laboratory's development of the SAGE air defense system and to maintain all operations for Laurence G. Hanscom Field.

From 1955 to 1960, the field continued to grow in size and sophistication. In June 1955, the Air Force Research Center in Cambridge, Massachusetts was moved to the field, followed by the establishment of the Air Defense Systems Management Office (ADSMO) in 1957. This unit was subsequently redesignated as the Air Systems Integration Division (ASID) in 1958. This division was deactivated in November 1959 when the Air Material Command's Electronic Systems Center and Air Research and Development Command's Air Force Command and Control Development Division were established. In January 1960, the 6520th Air Base Group was redesignated the 3245th Air Base Wing.

In April 1961, the Air Force Command and Control Development Division and the Electronic Systems Center were combined to form the Electronic Systems Division (ESD) of the Air Force Systems Command, and an electronics-oriented community has since evolved at Hanscom AFB. The community's high degree of technical acclaim can be attributed to the work of the ESD, Lincoln Laboratory, The MITRE Corporation, Rome Air Development Center, and the Air Force Cambridge Research Laboratory (presently called the Air Force Geophysics Laboratory).

In August 1974, the original lease permitting the operation and maintenance of the runway and flightline activities was cancelled following the termination of Air Force flying activities in 1973. The remainder of the base was retained by the Air Force was redesignated L.G. Hanscom AFB. The air field reverted to State control in August 1974 and was redesignated L.G. Hanscom Field, currently operated by the Massachusetts Port Authority (Massport) as a civilian airport. Also in 1977, L.G. Hanscom AFB was redesignated Hanscom AFB.

Table 2-1 provides a chronological summary of the major historical events that have transpired at Hanscom AFB since 1941.

TABLE 2-1

HISTORICAL CHRONOLOGY OF HANSCOM AFB

1941 - Commonwealth of Massachusetts acquired 509 acres of land for the Boston Auxiliary Airport at Bedford.

1942 - 79th Pursuit Unit activiated at the airport.

1943 - Boston Auxiliary Airport dedicated as Laurence G. Hanscom Field.

1945 - Cambridge Field Station activated in Cambridge, MA.

1947 - Five-year lease negotiated between Army Air Forces and the Corps of Engineers for joint use of the field.

1949 - Cambridge field Station designated the Air Force Cambridge Research Laboratories (AFCRL).

1950 - MIT asked to establish an air defense laboratory.

1951 - AFCRL became the Air Force Cambridge Research Center and subsequently became the landlord at L.G. Hanscom Field.

1952 - First MIT Building occupied.

1952 - Twenty Five Year lease established between the U.S. Government and Commonwealth of Massachusetts.

1955 - AFCRC moved to L.G. Hanscom Field.

1956 - Lincoln Laboratories charter formalized.

1957 - The Air Defense Systems Management Office (ADSMO) established at L.G. Hanscom Field.

1959 - Electronics System Center activated at L.G. Hanscom Field.

1960 - AFCRL activated at Hanscom Field.

1960 - Air Defense Systems Integration Division discontinued.

1961 - The Electronic Systems Division (ESD) activated at L.G. Hanscom Field.

1963 - New ESD Building opened (Bldg. 1606).

1970 - Transfer of Haystack Microwave Antenna to MIT.

1972 - AF weather observations discontinued at Hanscom Field.

1973 - Air Force flying activities terminated at Hanscom Field.

1974 - Redesignated L.G. Hanscom AFB.

1977 - AFCRL redesignated Air Force Geophysics Laboratory.

1980 - Major basewide construction activities approved.

Source: A Historical Chronology of Hanscom AFB, 1941-1980.

Support services are provided by Hanscom AFB to seven off-base Air Force facilities. Table 2-2 provides a synopsis of the history and missions of each of these facilities.

2.2 LOCATION

The area presently occupied by Hanscom AFB is located at latitude west 42° 28' 10" and longitude north 71° 17' 30" in the central part of Middlesex County, Massachusetts. The base is located 14 miles northwest of downtown Boston and 11.5 miles south of downtown Lowell. Hanscom AFB occupies property in the towns of Bedford, Concord, Lexington, and Lincoln. The base location and the locations of the seven off-base Air Force support facilities are shown in Figure 2-1.

From 1941 to 1945 an additional 600 acres were acquired around the existing base perimeter by the Army Air Force. Throughout the 1950's and early 1960's a vigorous land-acquisition program was implemented to accommodate increased expansion of research facilities and associated base service buildings. In 1965, the total land area under jurisdiction of Hanscom AFB encompassed 1846 acres, illustrated in Figure 2-2, the maximum area occupied by Hanscom AFB. Table 2-3 presents a breakdown of the base real estate in 1965.

Following the cancellation of the lease for the air field property, the air field reverted to State control. The resulting boundary of the base, which remains the current boundary, is shown in Figure 2-3.

Table 2-4 provides a synopsis of Air-Force-owned land holdings and facilities in 1975.

2.3 MISSION AND ACTIVE UNITS

The current principal mission of Hanscom AFB is to support the Electronic System Division (ESD) of the Air Force Systems Command (AFSC). At the present time, the ESD, the 3245th Air Base Group, the Air Force Geophysics Laboratory,

TABLE 2-2

HISTORY AND MISSIONS OF HANSCOM AFB OFF-BASE FACILITIES

Facility Name and Location	Period of Operation	Major Events and Activities	Facility Size (acres)	Present Facility Mission
Prospect Hill Electronics Research Annex Waltham, MA	1952-Present	o 1952-Ground-to-aircraft communications systems research o 1964-installation of 29-foot-diameter millimeter wave antenna	6	Provide research on millimeter wave propagation.
Sudbury Electronics Research Annex Sudbury, MA	1966-Present	o Facility used as a field site by AFGL	10	Performs research relevant to Air Force functions on detection of high-altitude nuclear explosions and airborne magnetic detection of military targets.
Maynard Geophysics Research Annex Maynard, MA	1958-Present	o Digisonde station for receiving high-frequency radio signals for application on the state-of-the-ionosphere and for monitoring distant longwave radio signals	60	Research and development of radar and related sensing devices to help solve weather-related problems encountered in AF operations. Develops techniques such as lidar, passive infrared and microwave radiometry.
Solar Radio Observatory Sagamore Hill Hamilton, MA	Late 1960's-Present	o Late 1960's Radio Telescope designed and built by AFGL o Air Weather Service site for Radio Solar Telescope Network	32	Support Air Force requirements in areas of communications, detection, navigation, and guidance.

TABLE 2-2 (continued)

HISTORY AND MISSIONS OF HANSCOM AFB OFF-BASE FACILITIES

Facility Name and Location	Period of Operation	Major Events and Activities	Facility Size (acres)	Present Facility Mission
RADC Electromagnetic Test and Measurements Facility Ipswich, MA	1940-Present	o 1940-Present-USAF research and development facility	65	Support research on antenna radar and radio target reflections, perform scientific testing on electromagnetic scattering characteristics of various-shaped objects.
Fourth Cliff Recreation Annex Scituate, MA	1918-Present	o 1918-U.S. Navy Radio compass station o WWII-Army Coast Guard Artillery Installation o 1948-Air Force Cambridge Research Labs experimentation facility o 1958-Present-USAF recreation facility	56	Provide an off-base recreation area for military personnel and their families.
North Truro Air Base North Truro, MA	1951-Present	o Late 1945-First radar station for the Air Defense System o Late 1950's-First BVIC I organization o 1966-First BVIC center to receive computerized equipment (BVIC H) o Presently equipped with BVIC III interceptor control equipment	145	Support Air Force radar and tracking needs.

Source: Hanscom AFB Civil Engineering Files

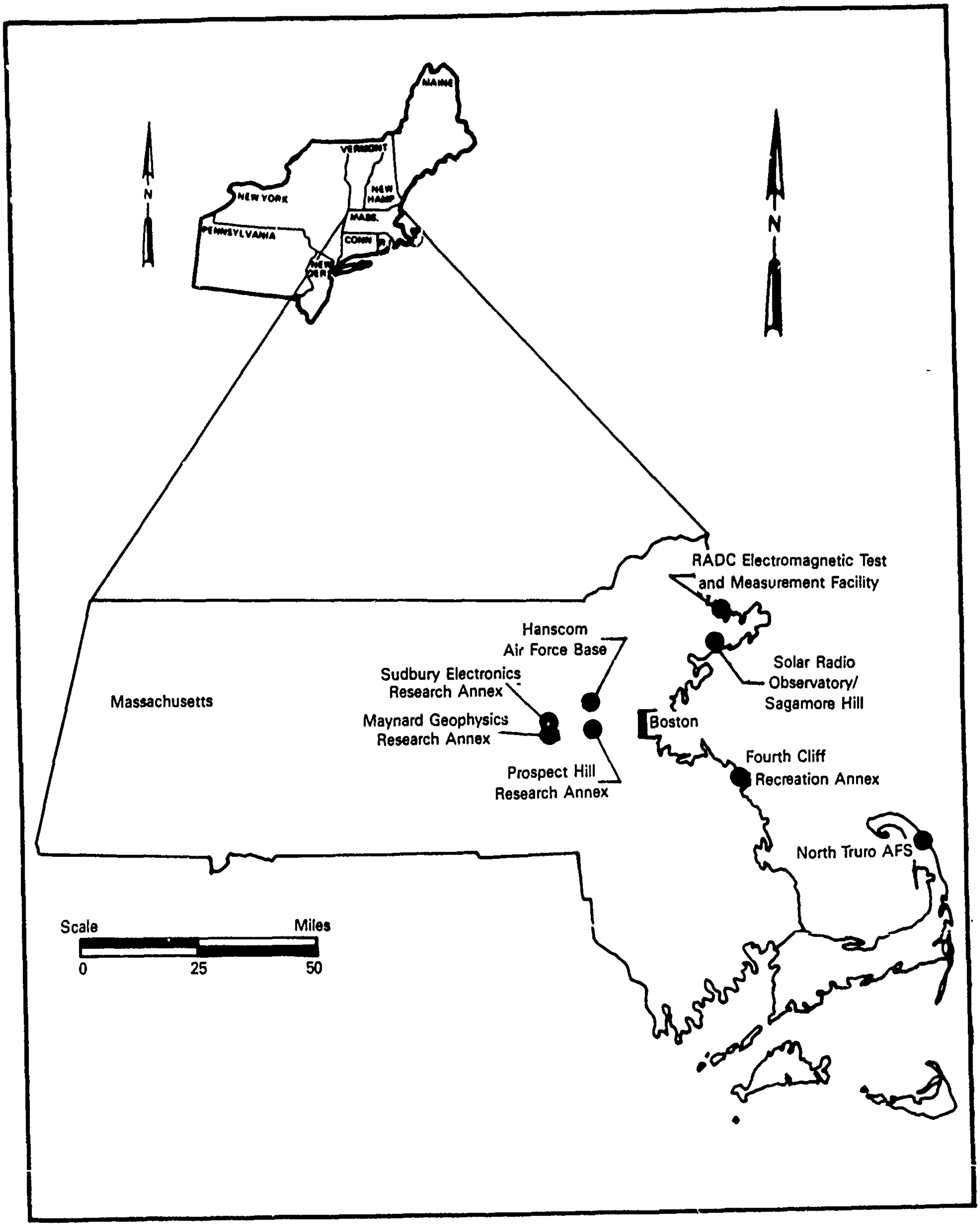


Figure 2-1. Locations of Hanscom AFB and Off-Base Facilities.

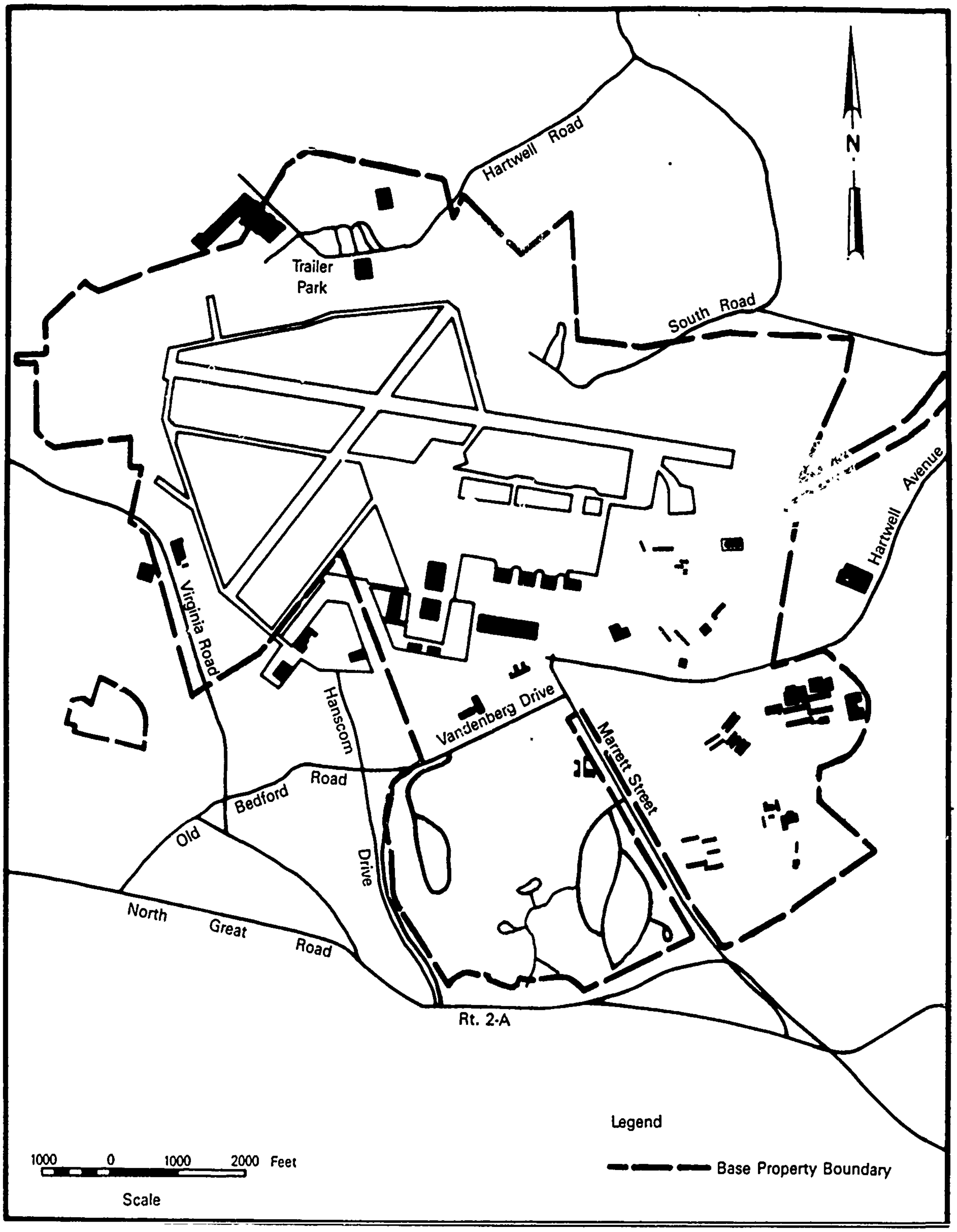


Figure 2-2. Area Occupied by Hanscom AFB in 1965.

TABLE 2-3

REAL ESTATE OCCUPIED BY
HANSCOM AFB IN 1965

Location	Acres
U.S. Government owned lands	981.54
Leased land from other parties	641.12
Easements	223.07
TOTAL	1,845.73

Source: Master Plan Hanscom AFB, 1965

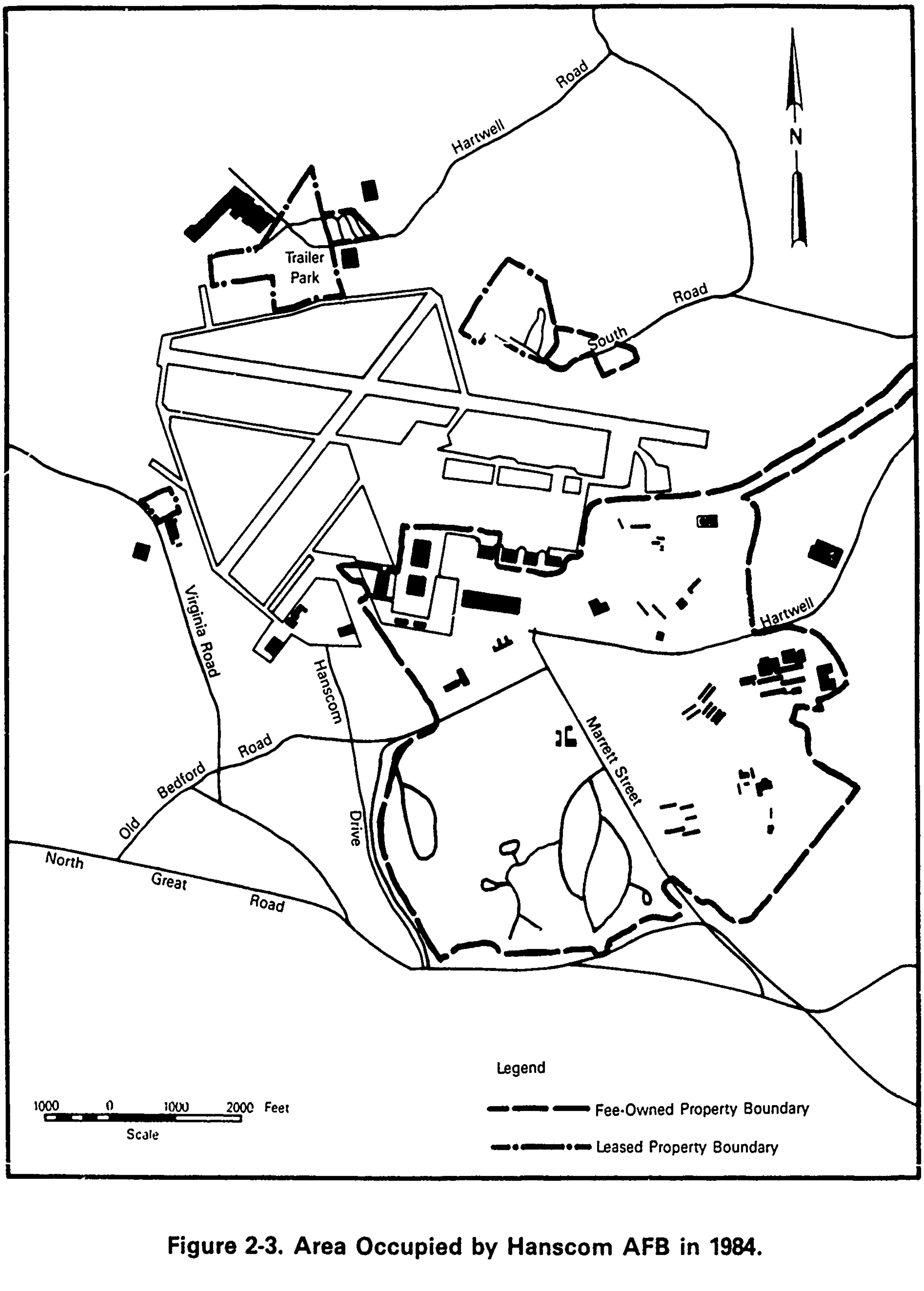


Figure 2-3. Area Occupied by Hanscom AFB in 1984.

TABLE 2-4

FEE-OWNED REAL ESTATE OCCUPIED BY HANSCOM AFB IN 1975

Function		Size (Acres)
Housing Areas		245
Maintenance and Production		164
Research Facilities		163
Supply Areas		16
Medical Facilities		11
Community Facilities		93
Utilities		6
Administration Facilities		44
Recreation Area		43
Base Trailer Court		6
Tenant Facilities		36
	TOTAL	826

Source: Annual Review Real Property Study Hanscom Air Force Base (Air Force Systems Command), 1978

MIT Lincoln Laboratory, RADC, and The MITRE Corporation all have personnel assigned to projects at Hanscom AFB. Table 2-5 provides an overview of the various missions and responsibilities assigned to each of the above organizations.

In addition to the seven off-base facilities, the JRB investigation team identified a U.S. Navy contractor-operated plating facility located northwest of Hanscom AFB. This facility was opened in the early 1950's by Raytheon to provide research and development services. Interviews with a former base employee revealed that unknown quantities of waste liquids were being taken from Raytheon's metal plating facility and disposed of in the paint waste disposal area (described in Section 4) from early 1960's through 1972. Because the Raytheon facility is under the jurisdiction of the Department of the Navy, investigation of this facility is beyond the scope of this project and no further discussion of the facility is provided in this report.

TABLE 2-5

MAJOR ORGANIZATIONS AT HANSCOM AFB

Organization	Description	Responsibilities	Primary Mission
Electronic System Division	Directly subordinate to Headquarters Air Force Systems Command. ESD Headquarters; 3245th Air Base Group; USAF Clinic HAFB	Responsible to HQ AFSC	To plan and manage the acquisition and development of command, control, communication, and intelligence electronic systems, sub-systems and equipment.
MIT Lincoln Laboratory	Federal Research Contract Center Operated by the Massachusetts Institute of Technology	To provide technical support to the USAF, Navy and Army	Major activities include: electonics, radar communications, digital signal processing.
MITRE Corporation	Federal Research Contract Center, working for the Air Force	To provide Systems Engineering support to the ESD	Major activities include: systems planning and engineering feasibility studies, cost economics, etc.
Air Force Geophysics Laboratory	Directly subordinate to the source Technology Center of the Space Division		Principal Space Division assigned with planning and executing USAF research and development programs in geophysics.
Rome Air Development Center	Component of the Electronics Systems Division	To provide Research and Development for Department of Defense Aircraft and associated electronic components	Major activities include: The testing of prototypical aircraft development of electronic devices for aircraft.

Source: Annual Review Real Property Study Hanscom Air Force Base (Air Force Systems Command) 1978

3.0 ENVIRONMENTAL SETTING

This section describes the environmental setting of Hanscom AFB and the seven off-base facilities that are under the control of Hanscom AFB. The off-base facilities, located throughout eastern Massachusetts, are: Prospect Hill Electronics Research Annex, Maynard Geophysics Research Annex, Sudbury Electronics Research Annex, Sagamore Hill Solar Radio Observatory, RADC Electromagnetic Test and Measurement Facility, Fourth Cliff Recreation Annex, and North Truro Air Force Station.

The focus of this section is the geologic, hydrologic, pedologic, and ecologic conditions that influence the movement of hazardous materials in the environment or may be adversely affected by the presence of hazardous materials.

3.1 GEOGRAPHY AND TOPOGRAPHY

3.1.1 Hanscom Air Force Base and Hanscom Field

Hanscom AFB is situated in the Eastern Plateau Physiographic Region (Figure 3-1). This is a low-lying and well-dissected region of eastern Massachusetts. The plateau slopes gently seaward and maximum elevations are generally less than 500 feet mean sea level (MSL). Primary drainage for this region is provided by the Merrimac, Parker, Rawley, Ipswich, Concord, Sudbury, Assabet, Charles, and Neponset Rivers (Motts and O'Brien, 1981).

There are common and large wetlands throughout the region that reflect the poorly integrated drainage due to disruption by glaciation. Much of the preglacial topography in this region was buried by deposits of stratified drift and marine sediments. Many of the wetlands are situated in depressions in the stratified drift and now cover much of the stratified drift.

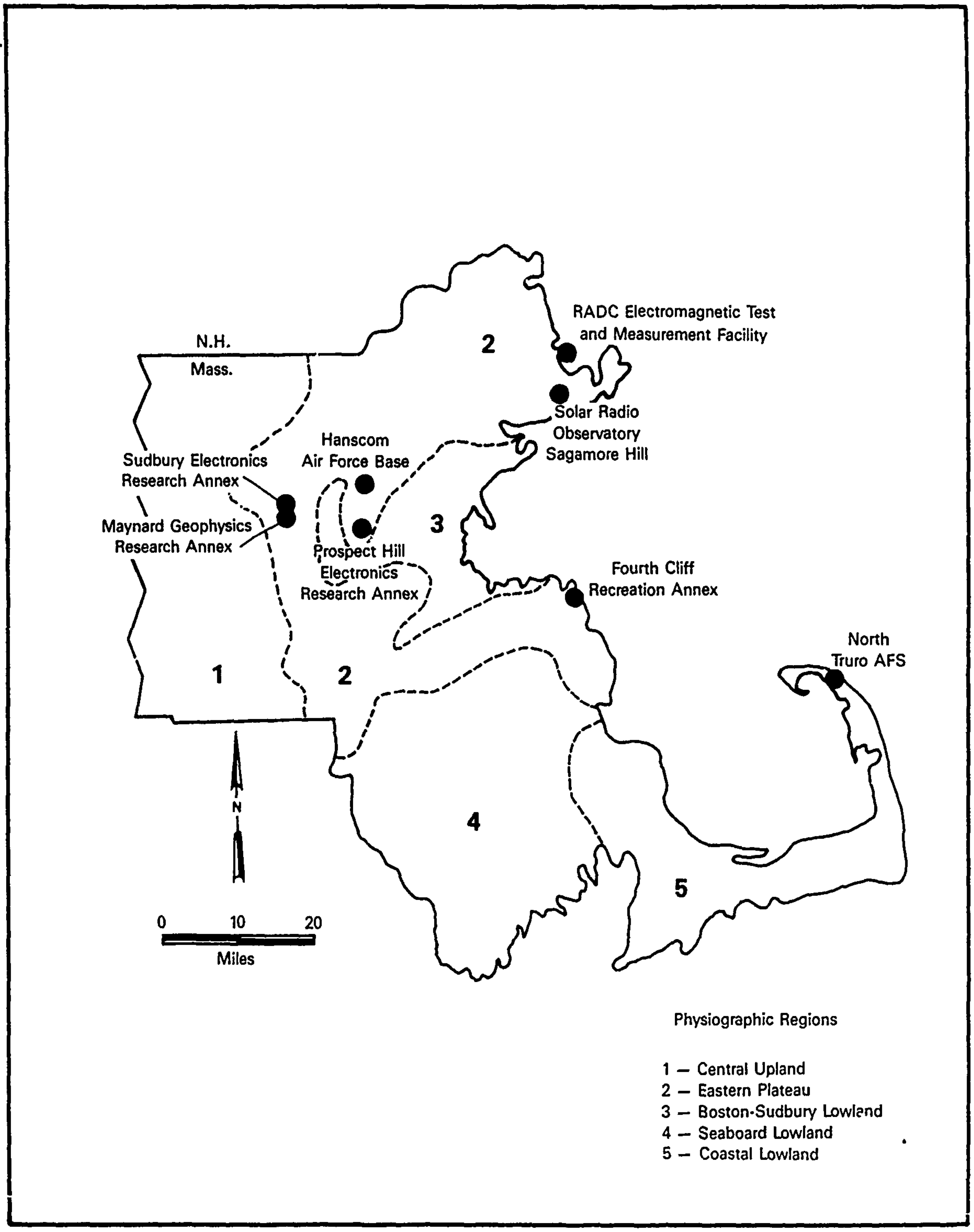


Figure 3-1. Physiographic Regions and Locations of Hanscom AFB and Off-Base Facilities.

The wetlands in this region commonly occur where sand and gravel deposits, such as outwash plains and kame terraces, abut against till and bedrock, lake bottom deposits, marine silts and clays, or other glaciofluvial sequences. The area that is now Hanscom AFB and Hanscom Field was once primarily low wetlands. However, activities associated with base construction have resulted in the filling of most of the wetlands within the base perimeter. The construction activities have also resulted in the alteration of much of the surface drainage at the base.

Elevations in the area of Hanscom AFB range from a high of approximately 300 feet MSL near the MIT Lincoln Laboratory to a low of approximately 118 feet MSL along Runway 29 (Figure 3-2). Although this indicates a fairly large degree of relief, the majority of the study area is at an average elevation of 125 to 130 feet MSL. The higher elevations within and outside the base boundary reflect the surficial expression of preglacial topography. Some areas within the base boundary are currently at higher elevations than the off-base surrounding areas. This is a result of filling of the lowlands during base construction.

The wetlands that now exist or once existed in this physiographic region of Massachusetts are usually underlain by stratified glacial drift. However, the wetlands in the area of Hanscom AFB are underlain by glaciofluvial deposits of ancient Concord Lake.

3.1.2 Prospect Hill Electronics Research Annex

The Prospect Hill Electronics Research Annex is also situated in the Eastern Plateau Physiographic Region (Figure 3-1). The facility is approximately 5 miles southeast of Hanscom AFB and is situated on an elongated ridge known as Prospect Hill. The topography of the facility is shown in Figure 3-3. A thin layer of glacial till covers preglacial topography as is evidenced by bedrock outcrops along the flanks of the hill. Elevations range from 350 feet MSL at the foot of Prospect Hill to 487 feet MSL at the facility. This relief is typical of the ridges and lowlands in the area.

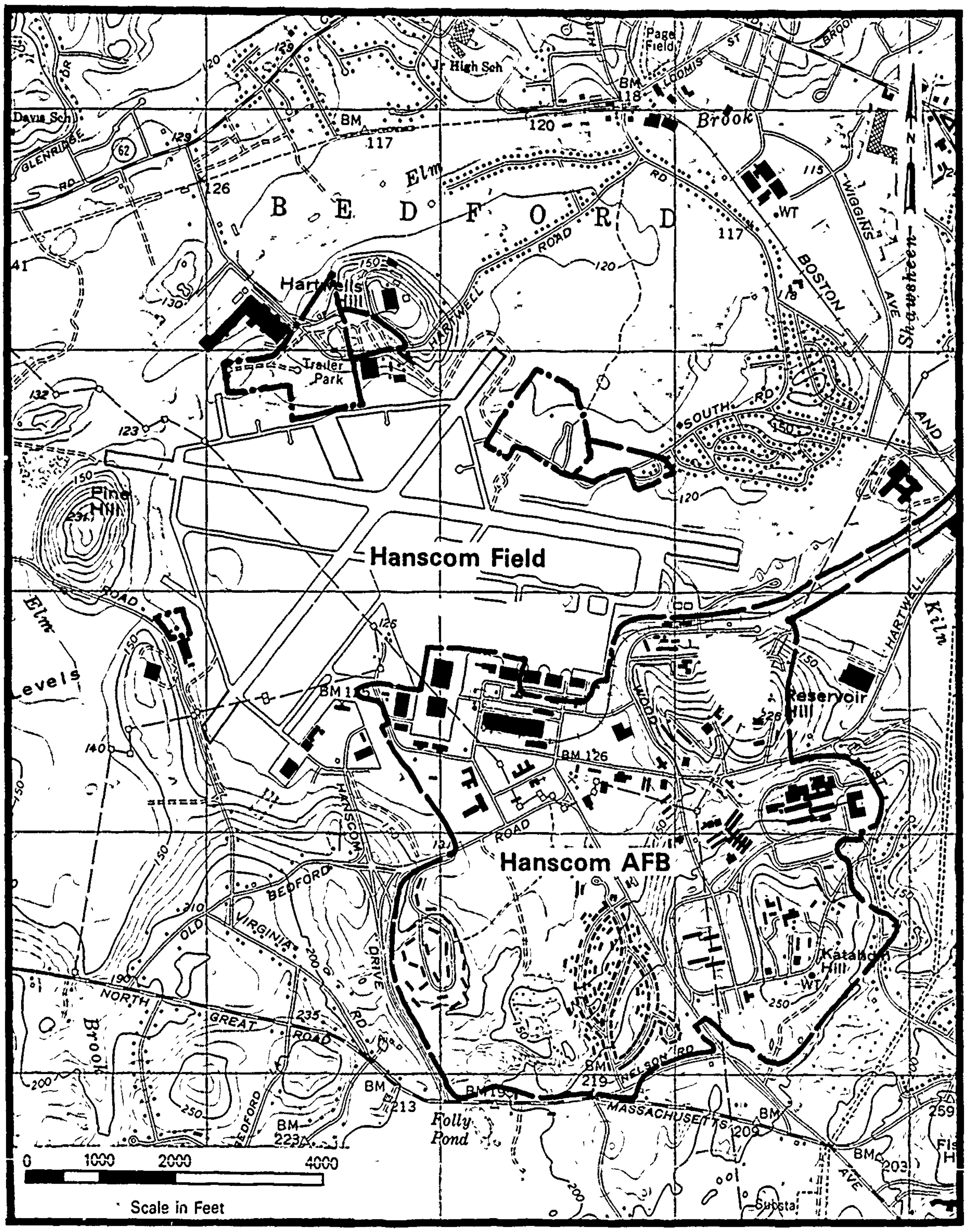


Figure 3-2. Topography of Hanscom AFB and Hanscom Field.

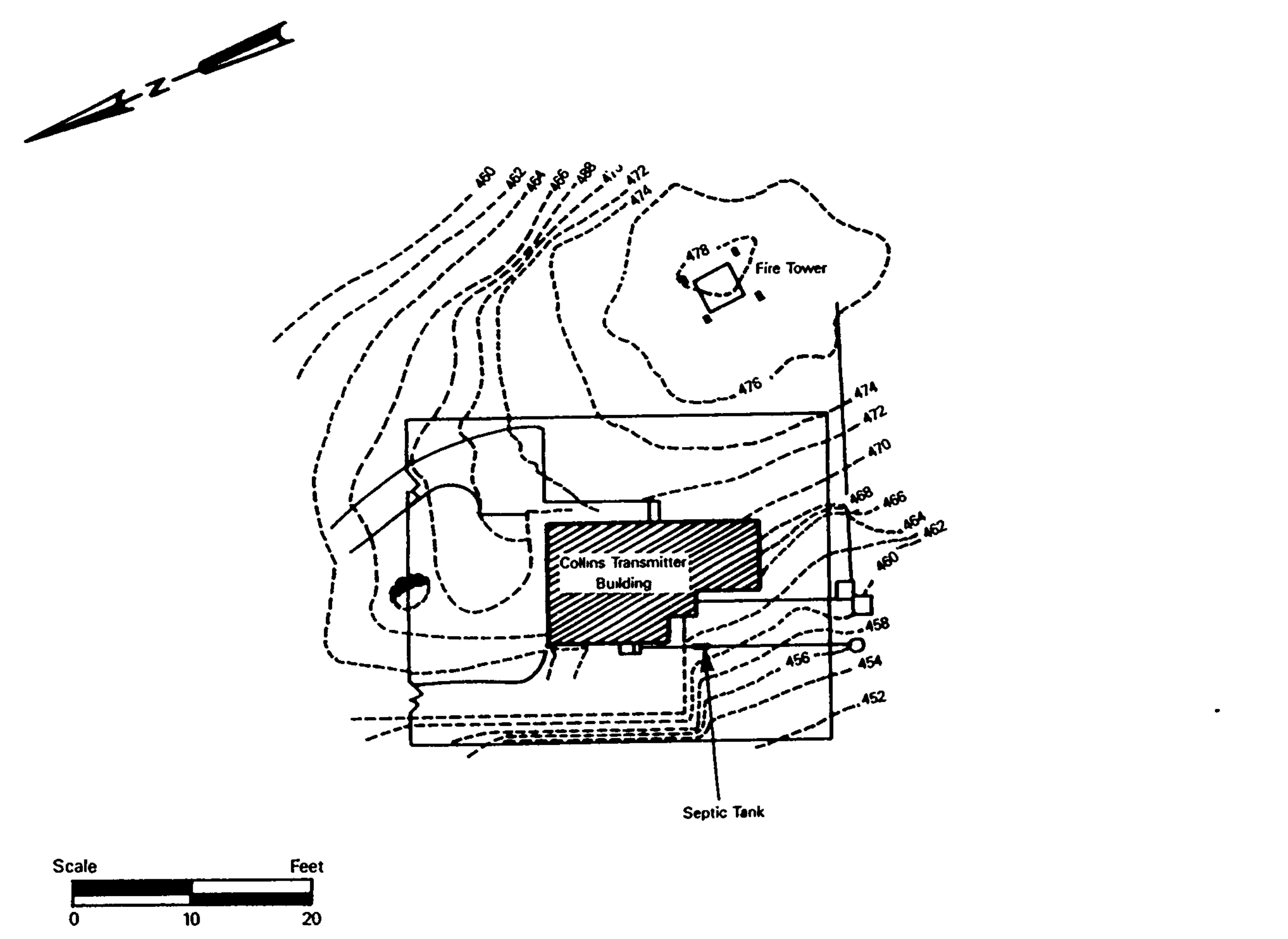


Figure 3-3. Topography of Prospect Hill Electronics Research Annex.

3.1.3 Maynard Geophysics and Sudbury Electronics Research Annexes

The Maynard Geophysics Research Annex and Sudbury Electronics Research Annex are also in the Eastern Plateau Physiographic Region. These facilities are approximately 15 miles southwest of Hanscom AFB situated on the U.S.-Army-owned Natick Laboratories Sudbury Annex. The topography of the area is shown in Figure 3-4. Like other areas in this physiographic region, the low-lying areas are swamps or wetlands with the groundwater table being close to the surface most of the year. The broad, flat lowlands are interrupted intermittently by steep-sloped hills. These hills are either surficial expression of preglacial topography (drumlins) or moraines created during glacial retreat.

A radio facility serving the annexes is located on a glacial deposit (ground moraine) having a maximum elevation of 310 feet MSL. The surrounding lowlands are predominantly outwash plains with elevations of less than 200 feet MSL. Numerous small lakes and ponds are found throughout the lowlands in the vicinity of the facilities.

3.1.4 Solar Radio Observatory at Sagamore Hill

The Solar Radio Observatory at Sagamore h.il is also situated in the Eastern Plateau Physiographic Region. This facility is located in the northeast section of Massachusetts and is also typical of New England areas that were glaciated. Low-lying areas are swampy and there is little relief in the general area. The site is situated on Sagamore Hill at an elevation of approximately 187 feet MSL. Surrounding lowlands are at elevations that are generally lower than 100 feet MSL. Sagamore Hill is a ground moraine deposited during the last glacial retreat. The main drainage for the area is by the Ipswich, Castle Neck, and Essex Rivers. These are northeast-flowing rivers that are fed by the many wetlands and swamps of this area of Massachusetts. The topographic setting is illustrated in Figure 3-5.

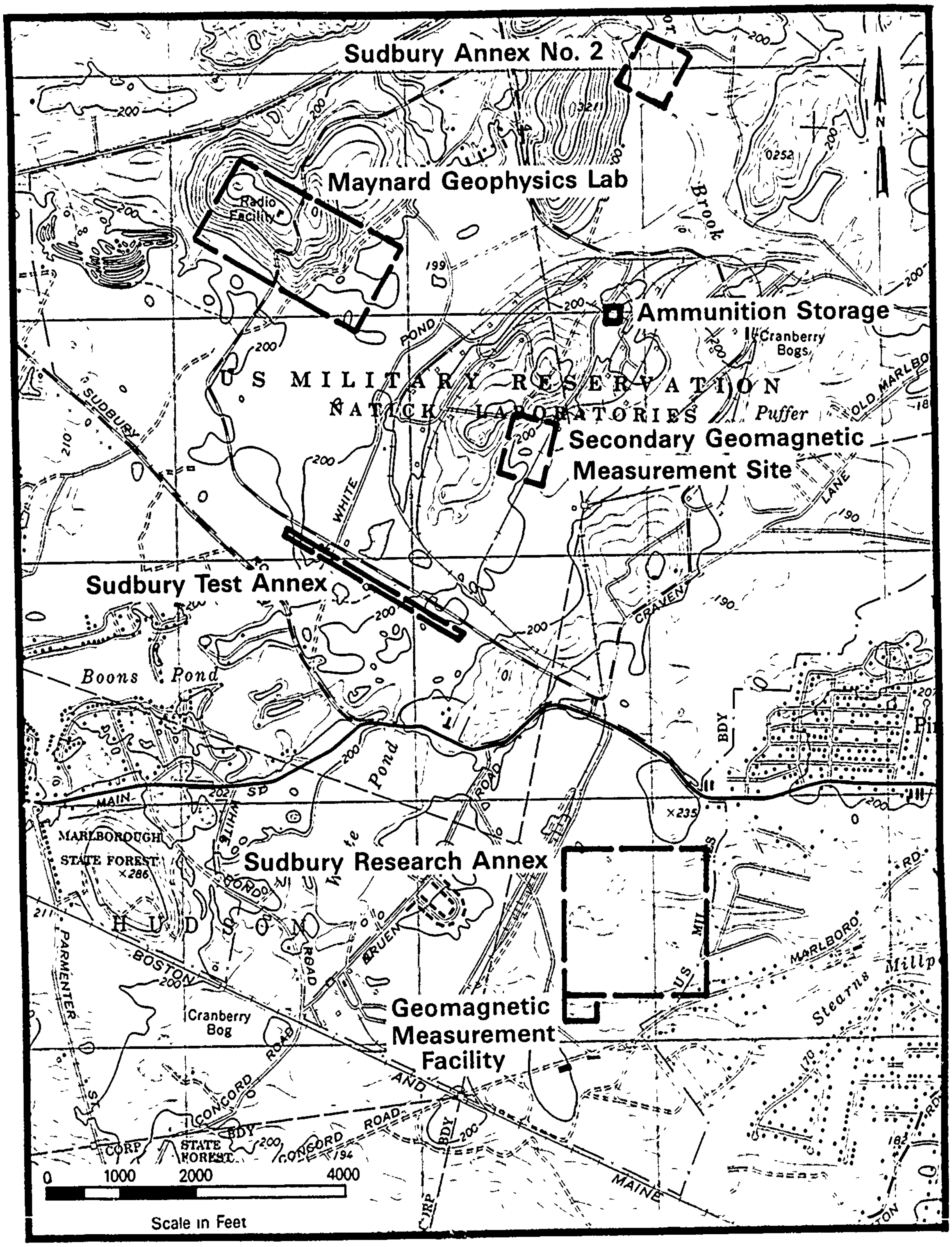


Figure 3-4. Topography of Maynard and Sudbury Research Annexes.

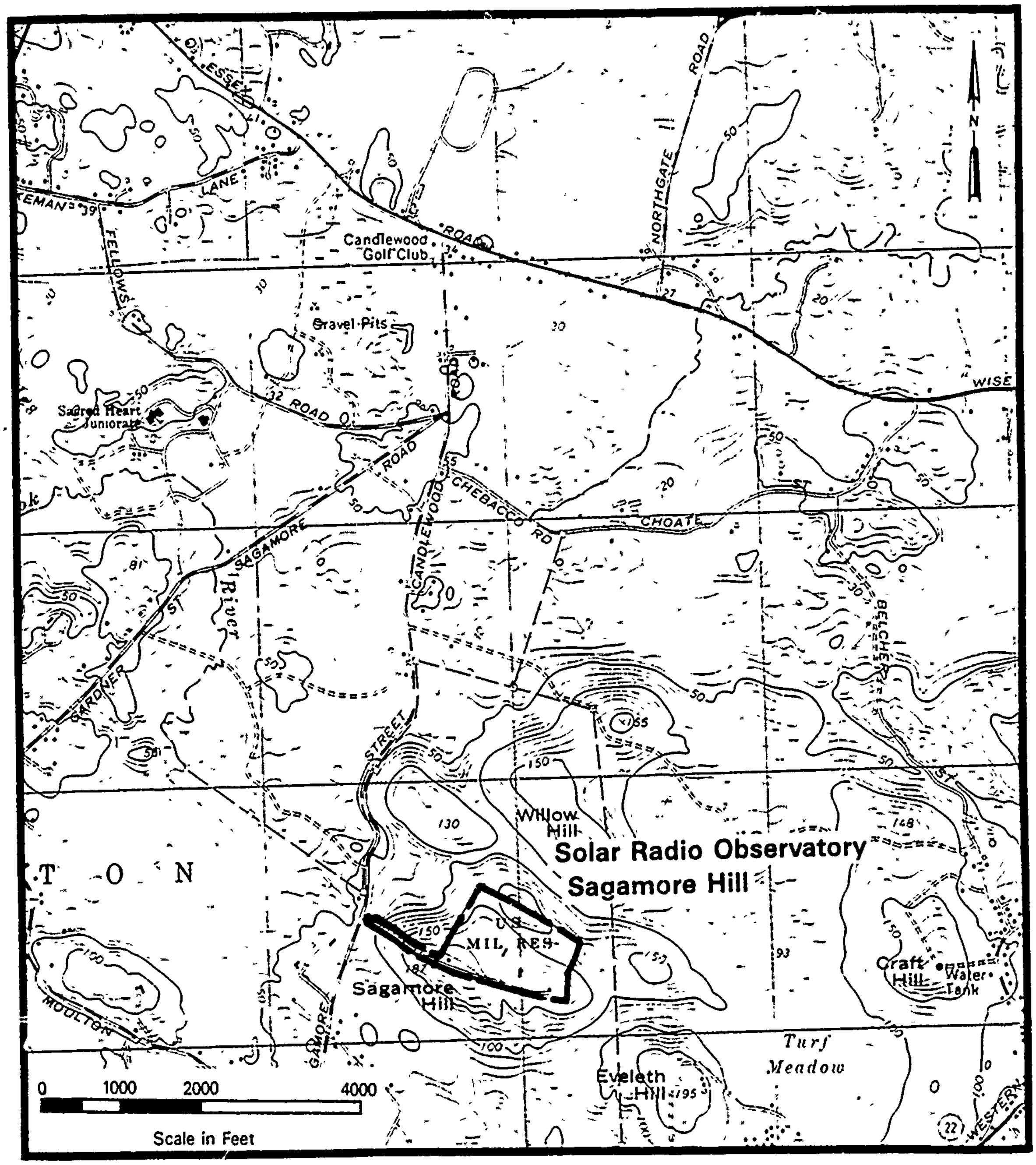


Figure 3-5. Topography of Solar Radio Observatory Sagamore Hill.

3.1.5 RADC Electromagnetic Test and Measurement Facility

The RADC Electromagnetic Test and Measurement Facility (EMTF) is located on Great Neck on an island situated in the Plum Island Sound at the mouth of the Ipswich and Eagle Hill Rivers. The facility is in the Eastern Plateau Physiographic Region. Located on the north ridge of Great Neck, the facility is at an elevation of approximately 123 feet MSL. The land slopes steeply to water level on all sides. Great Neck is surrounded on three sides by the above water bodies and to the southeast by a saltwater marsh. Figure 3-6 illustrates the topography of the site and the surrounding area.

3.1.6 Fourth Cliff Recreation Annex

The Fourth Cliff Recreation Annex is located in the Eastern Plateau Physiographic Region on a drumlin deposit on the Massachusetts Bay at the confluence of the North and South Rivers. The topography of the area is shown in Figure 3-7. Located at a maximum elevation of 62 feet MSL, the land surface drops off sharply on the seaward side. The southwest flank slopes more gently into soft marsh deposits near the mouth of the South River.

3.1.7 North Truro Air Force Station

North Truro Air Force Station (AFS) is located on Cape Cod, which is in the Coastal Lowland Physiographic Region. It is located in the southeast portion of lower Cape Cod and covers approximately 134 acres above Longnook Beach. The topography of the facility is shown in Figure 3-8. The maximum elevation at the site is approximately 160 feet MSL, and the land generally slopes gently to the west. Many depressions exist within the air station as a result of past glacial action. These depressions give a karst appearance to the landscape. To the east the land drops off almost vertically to the beach below. This cliff is a result of past and present wave action that continually erodes the land.

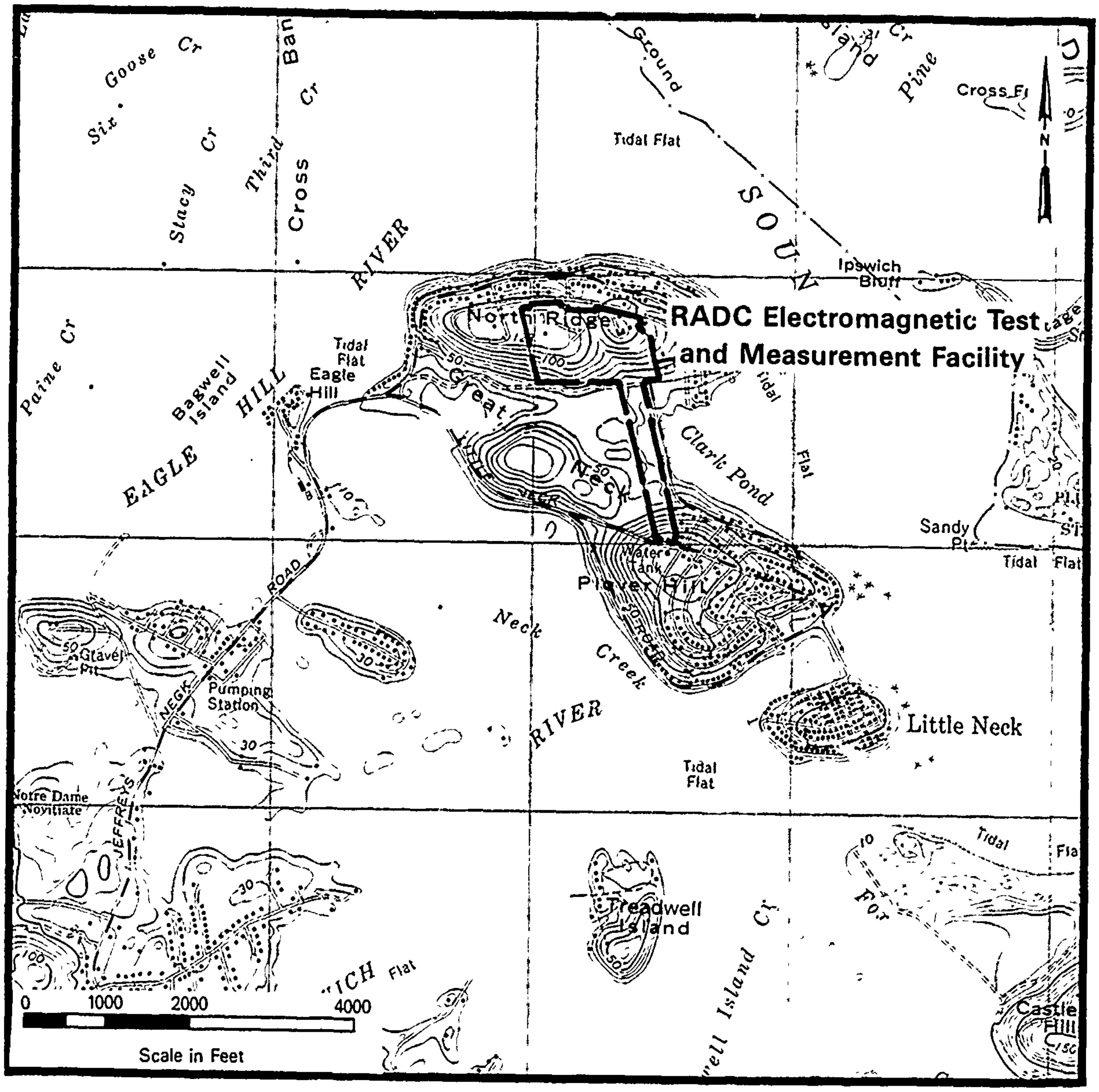


Figure 3-6. Topography of RADC Electromagnetic Test and Measurement Facility.

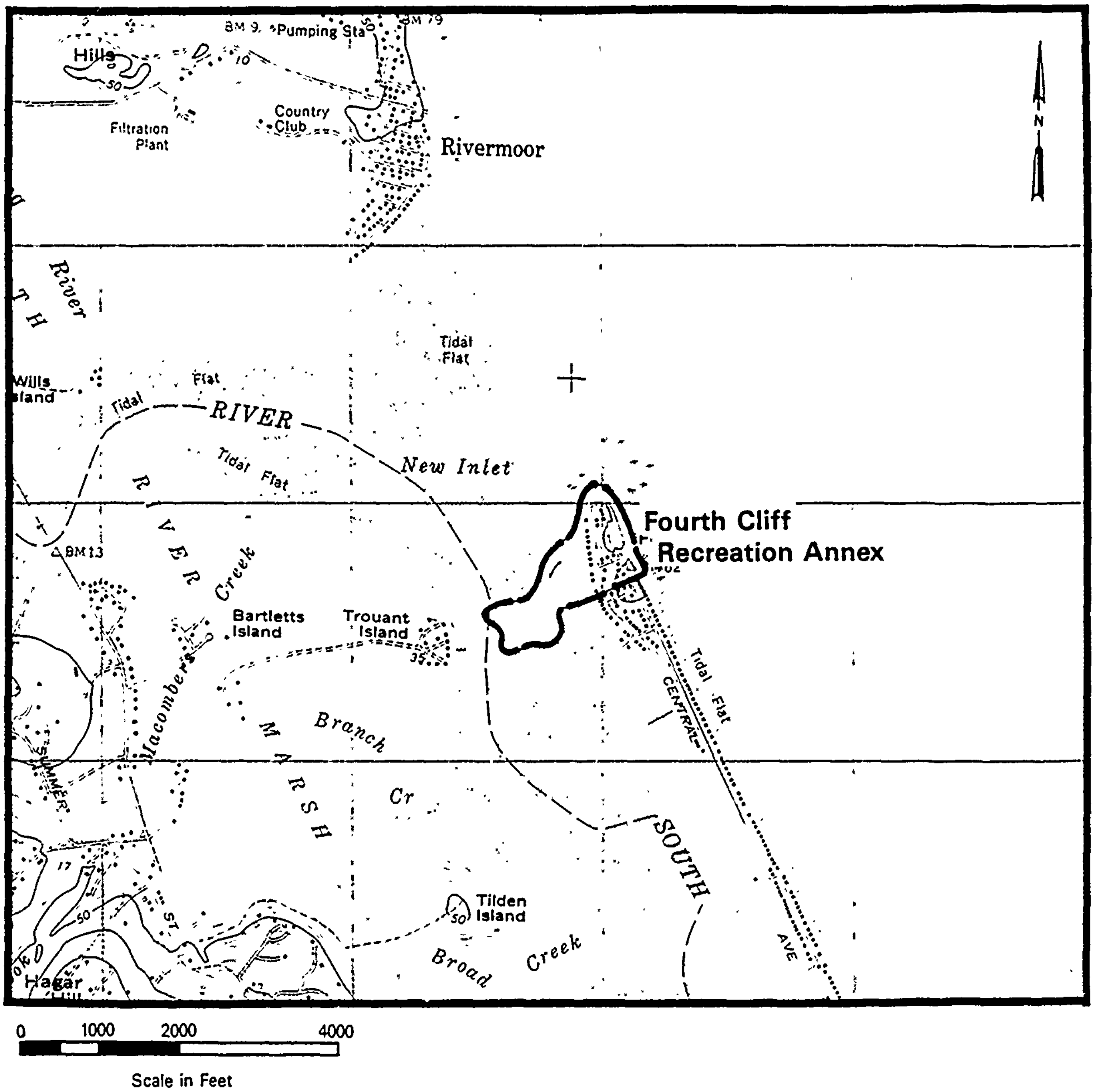


Figure 3-7. Topography of Fourth Cliff Recreation Annex.

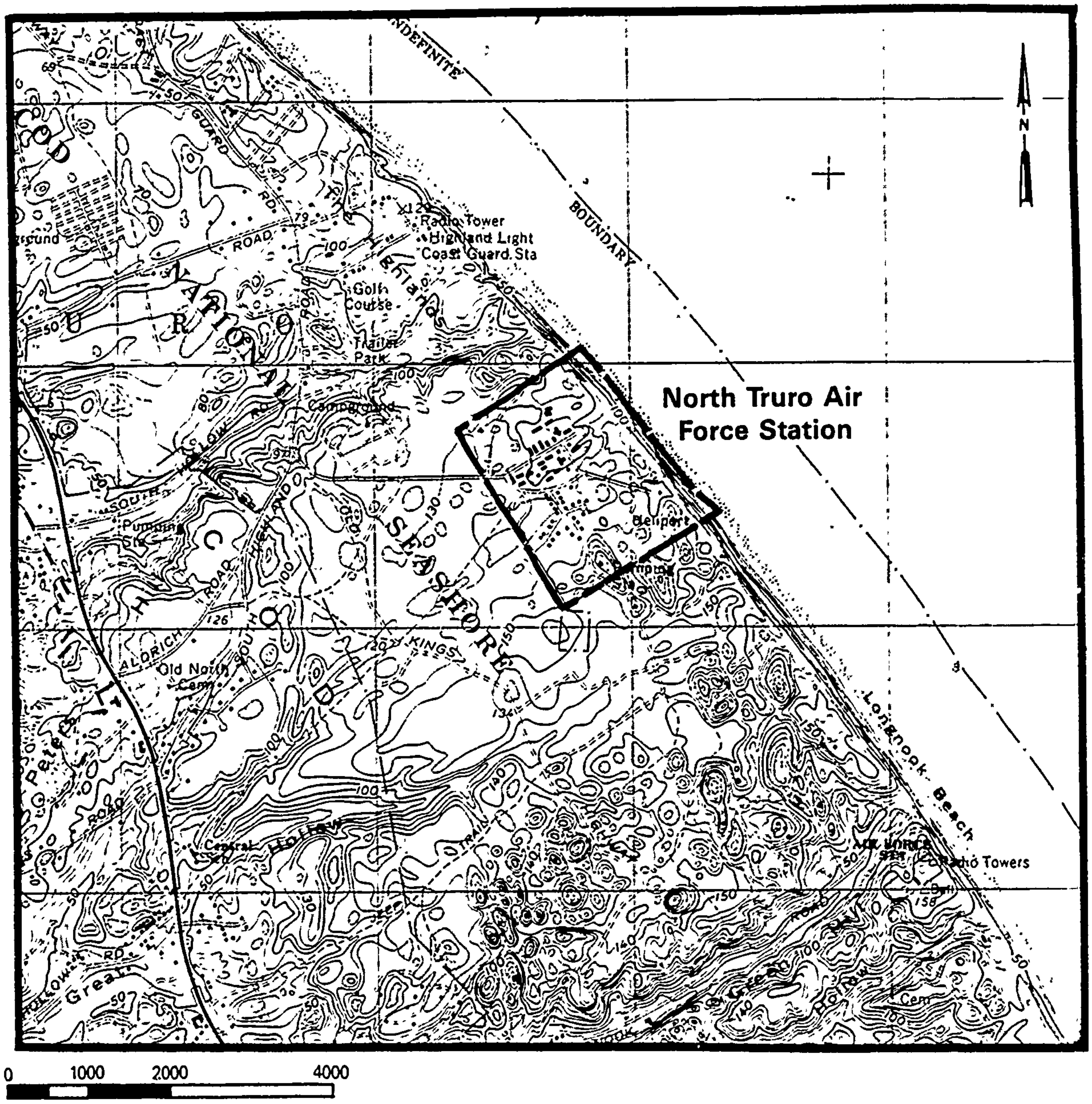


Figure 3-8. Topography of North Truro Air Force Station.

3.2 METEOROLOGY

General climatic conditions at Hanscom AFB are characterized by a continental climate, modified and somewhat buffered by the Atlantic Ocean to the east. Weather patterns vary daily and seasonally from year to year because of the prevailing northwesterly winds. A summary of temperatures and precipitation data for Hanscom AFB is given in Table 3-1. These data, recorded at Hanscom Field, show monthly maximum, minimum, and mean temperatures for a 20-year period from 1946 to 1966 and are representative of present-day conditions. The maximum 24-hour precipitation for this area in the 87 years of recordkeeping is 8.7 inches. The maximum 24-hour snowfall in 86 years of recordkeeping is 16.5 inches. Average annual precipitation is 44 inches and the average annual snowfall is 56.6 inches. Evapotranspiration ranges between 22 and 28 inches annually. The difference between precipitation and evapotransprination is the annual net precipitation, between 16 and 22 inches.

The climatic conditions at the off-base facilities are similar to those discussed above, with the exception of the sites situated along the Atlantic coast. These sites, RADC EMTF, Sagamore Hill, Fourth Cliff, and North Truro, are influenced to a greater extent by the buffering of the ocean than are the inland sites. Total precipitation along the coast is approximately the same, but the amount of snowfall is much less. The wind is generally from the sea in a northwesterly direction and moderates the effects of the colder Canadian air that influences inland areas.

3.3 SURFACE HYDROLOGY

3.3.1 Hanscom Air Force Base and Hanscom Field

Hanscom AFB is situated near the headwaters of the Shawsheen River. This river and Elm Brook, a tributary of the Shawsheen, provide the natural surface drainage for the base (see Figure 3-9). Elm Brook originates in a swampy area southwest of the base and flows north along the western edge of

TABLE 3-1

CLIMATOLOGICAL DATA FOR HANSCOM FIELD

Month	Temperature (°F)				Precipitation (inches)	
	Mean Daily Max.	Mean Daily Min.	Highest	Lowest	Mean Total	Snow Fall
January	35	17	71	-21	3.98	16.7
February	37	18	69	-23	3.25	14.6
March	45	27	85	- 9	4.11	11.9
April	57	36	89	14	4.01	2.4
May	69	46	95	28	3.89	0
June	78	55	99	34	2.88	0
July	83	60	101	38	3.04	0
August	81	58	103	40	3.93	0
September	74	51	101	28	3.44	0
October	64	41	89	18	3.15	.2
November	51	32	85	10	4.59	1.0
December	39	20	65	-11	3.79	10.7
Annual	60	39	103	-23	43.97	56.60

Source: U.S. Geological Survey

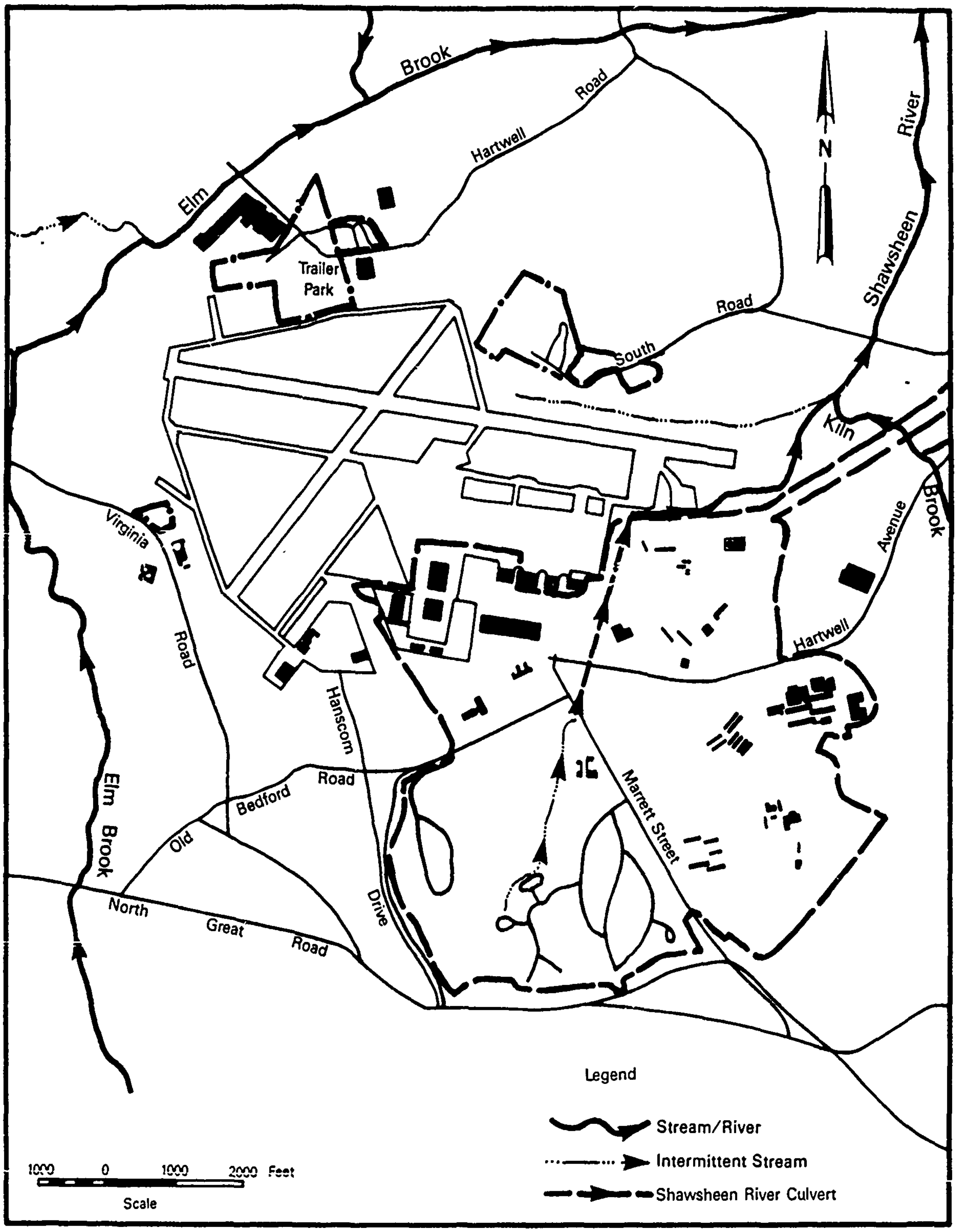


Figure 3-9. Surface Waters at Hanscom AFB and Hanscom Field.

the air field toward Pine Hill. At this point, the brook turns east, flows along the northern edge of Hanscom Field toward Bedford, and joins the Shawsheen River approximately 1 mile northeast of the air field. The Shawsheen River orginates in a swamp between the base housing areas and flows north through a culvert near the intersection of Marrett Street and Bedford Road. It surfaces again along the taxiways of Hanscom Field approximately 2800 feet to the north. It then flows northeast to the perimeter of the base where it is joined by Kiln Brook.

Because of the generally low degree of relief and glacial effects, there are numerous wetlands and swamps within the base and in surrounding areas. Much of the original wetlands and swamps have been filled to allow for base construction.

Figure 3-10 illustrates the trends of surface runoff to the receiving streams. Much of the surface drainage within the base is controlled by a network of drains and man-made swales that collect surface runoff from within the base and discharges into the natural waterways.

Surface runoff in the headwaters of the Shawsheen River varies considerably with the season. The trend is low winter flows followed by heavy spring runoff, which generally recedes rapidly in June (Motts and O'Brien, 1981). Flow data taken approximately 7.5 miles downstream from the base in the Shawsheen River indicate a lack of perennial storage for sustaining stream flow. Daily runoff per square mile of drainage area in the Shawsheen River basin ranges from a maximum of 0.17 inches to a minimum of 0.0043 inches, with an annual average of 17.24 inches (Motts and O'Brien, 1981). Sustained low flow in the Shawsheen River is probably attributable to groundwater discharge from shallow upper levels of groundwater, fed by the swamps and lowlands surrounding the base.

At the headwaters of the Shawsheen River the stream has graded into till barriers and intersects the shallow groundwater table. Following a rain, groundwater discharges rapidly to the streams from a shallow upper

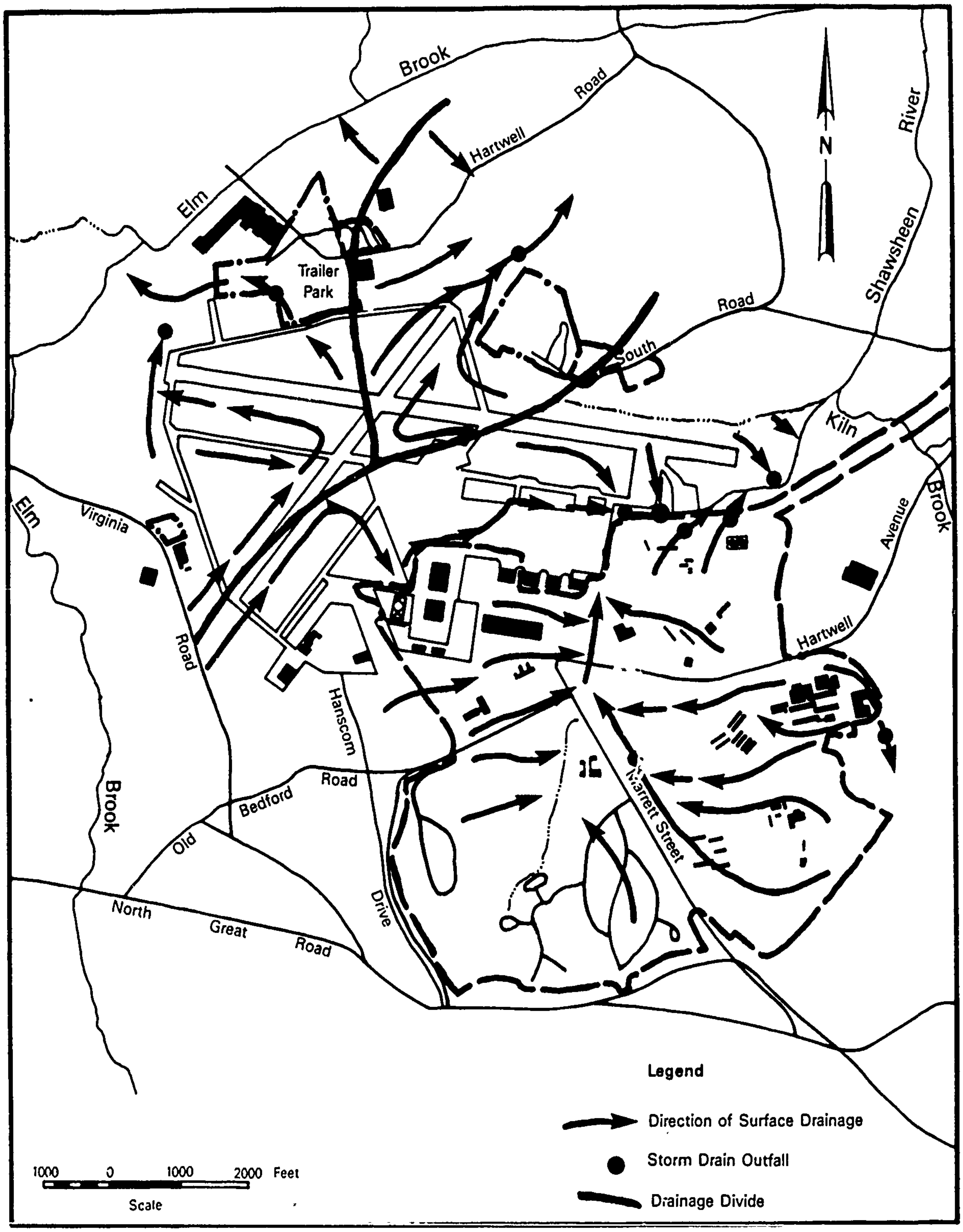


Figure 3-10. Drainage Patterns at Hanscom AFB and Hanscom Field.

aquifer. Normally discharge zones from aquifers are relatively small, but the wetlands represent an expanded discharge zone in the aquifer. This allows a rapid groundwater discharge within the wetlands and, therefore, into the Shawsheen River and Elm Brook. As groundwater discharges and evapotranspiration lower the water table from the spring high, the water table level drops to or below the level of the stream bottom. As a result, flow becomes minimal because the groundwater gradients approach zero. Thus, the shallow upper portion of the wetland groundwater body fluctuates rapidly, allowing relatively little perennial storage or moderation of rainfall events. Although most of the year the wetlands discharge to surface waters, it is possible that, during late summer dry periods, the wetlands recharge the regional groundwater body (Motts and O'Brien, 1981).

Much of the variation in flow of the Shawsheen River is a result of the river being the main collector for the storm runoff within the base. The normal range in flow depth is approximately 2 to 3 feet when the river reaches flood stage in the downstream towns of Bedford, Billerica, and Tewksbury. The Shawsheen has been reported to reach flow depths of 5 to 6 feet at Hanscom AFB, but no major flood damage has occurred at the base because the base facilities are situated at elevations higher than the recorded flood elevations. The severity of flooding is minimized by the location of Hanscom AFB in the upper reaches of the drainage basin.

Analyses of the surface water along the Shawsheen River upstream and downstream of the base were conducted in by base personel 1976. The locations of these sampling points are shown on Figure 3-11. These water quality data are shown in Table 3-2. Slight increases (downstream relative to upstream) in concentration were noted in certain parameters. However, the increases were not drastic and were, therefore, not indicative of the discharge of large quantities of hazardous material. The sampling effort focused on potential sources of contaminant release, as follow:

- Samples collected along Elm Brook upstream and downstream of the sanitary landfill (described in Section 4) revealed increases in concentrations of certain parameters (see Table 3-2) but general water quality did not seem to be impacted by the landfill.

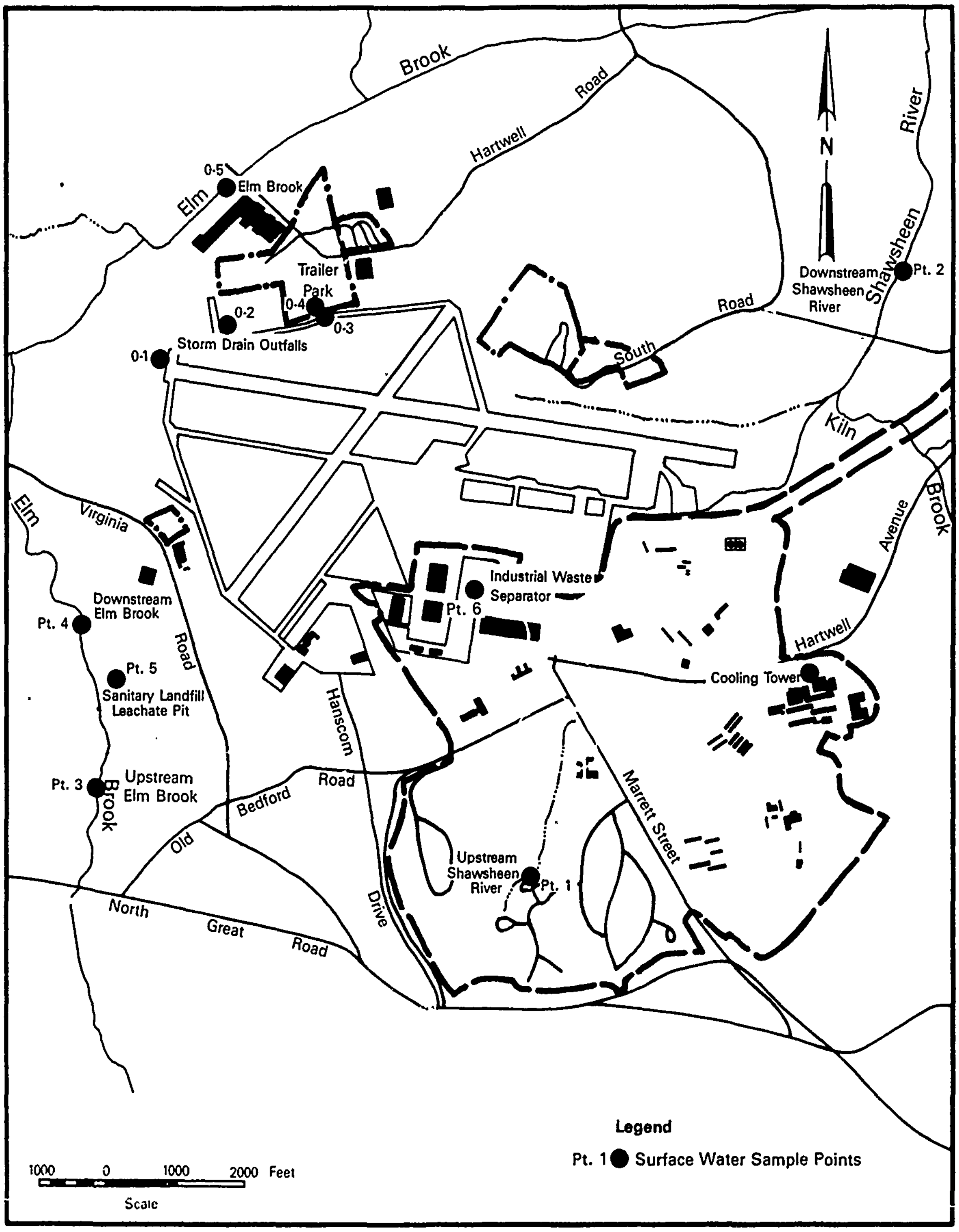


Figure 3-11. Surface Water Sampling Points at Hanscom AFB in 1976.

TABLE 3-2

SURFACE WATER ANALYSIS AT HANSCOM AFB IN 1976

Parameter (Units) \ Location	Shawsheen River Upstream Pt. 1	Shawsheen River Downstream Pt. 2	Elm Brook Upstream Pt. 3	Elm Brook Downstream Pt. 4	Leachate Pit of Sanitary Landfill Pt. 5	Industrial Waste Separator Pt. 6
Color (Units)	25	10	50	60	65	10
Turbidity (units)	3	4	3	4	320	6
Chemical Oxygen Demand (mg/l)	21	37	37	42	3120	11
Dissolved Solids (mg/l)	193	213	122	164	4928	94
Oils & Greases (mg/l)	0.4	0.6	1.4	.6	52	0.8
Surfactants (mg/l)	<.1	.1	.1	.1	1.0	0.1
Phenols (mg/l)	<.001	.001	.1	.001	4.25	.001
Chlorides (mg/l)	84	76	48	36	676	16
Fluorides (mg/l)	<0.1	.1	.1	.1	.1	.1
Nitrates (mg/l)	3.0	4.0	1.0	1.0	1.0	1.0
Phosphates (mg/l)	<.2	<.2	2.0	.3	0.4	0.3
Sulfates (mg/l)	21	33	17	24	18	9.0
Cadmium (mg/l)	<.01	<.01	<.01	<.01	<.01	<.01
Chromium (hexavalent) (mg/l)	<.01	<.01	<.01	<.01	<.01	<.01
Chromium (total) (mg/l)	<.05	<.05	<.05	<.05	<.05	<.05
Copper (mg.l)	<.02	<.02	<.02	<.02	<.02	<.02
Cyanides (mg/l)	<.01	<.01	<.01	<.01	0.10	<.01
Iron (mg/l)	2.77	2.25	1.12	1.25	91.94	1.04
Lead (mg/l)	<.05	<.05	<.05	<.05	.09	<.05
Manganese (mg/l)	<.05	<.15	<.05	<.05	15.0	<.05
Silver (mg/l)	<.01	<.01	<.01	<.01	<.01	<.01
Zinc (mg/l)	0.05	0.09	.06	.09	9.65	0.1
Mercury (mg/l)	<.005	<.005	<.005	<.005	<.005	<.005
Total Organic Carbon (mg/l)	6	18	11	15	1900	8
Nitrate Nitrogen (mg/l)	<.02	<.02	<.02	<.02	<.02	<.02
Ammonia Nitrogen (mg/l)	<.2	<.2	<.2	<.2	4.2	<.2

Source: Civil Engineering Records, Hanscom AFB.

- Samples of surface water taken at a storm drain outfall downstream of the industrial waste treatment plant (described in Section 4) showed the water quality to be acceptable and similar to that of the Shawsheen River (see Table 3-2 and Figure 3-11). (Discharged to the storm drainage system ceased in 1975).

- Samples from a leachate pit at the landfill (see Section 4), taken because of its potential effect on the surface water quality of the area, showed high concentrations of dissolved solids, oil, grease, phenols, chlorides, iron, manganese, zinc, total organic carbon, and ammonia nitrogen.

Water from the cooling towers of the central base heating plant prior to 1980 was discharged into Kiln Brook east of the base. Analysis data in Table 3-3 show the quality of the receiving water in October 1971. Kiln Brook was poor during the period of discharges, but no lasting impacts are thought to have resulted. Cooling water is not currently being discharged into Kiln Brook, but is directed into the sanitary sewer system.

Additional surface water sampling by Roy F. Weston, Inc., has been performed at various outfalls of the storm drainage system in the northwest area of the base. These points are shown on Figure 3-11 and analytical data are listed in Table 3-4. These data indicate the presence of various concentrating of four chlorinated organic compounds and two unidentified compounds. The source of these contaminants may be the groundwater, since the groundwater table intersects the storm drainage system during periods of high percipitation.

3.3.2 Prospect Hill Electronics Research Annex

This facility is situated on bedrock covered with a thin layer of glacial till on a topographic high point. The surface grading and the fine-textured soils limit infiltration. Surface water flows down-slope to surrounding lowlands.

3.3.3 Maynard Geophysics and Sudbury Electronics Research Annexes

These facilities are comprised of several parcels of land situated within the U.S. Army Natick Laboratories. These areas vary in topographic setting from hills to lowlands. Surface water flows with slope or is

TABLE 3-3

WATER QUALITY OF KILN BROOK DOWNSTREAM
OF COOLING TOWER DISCHARGE IN 1971

Parameter	Analysis (mg/l unless noted)
Color	
Total Volatile Solids	524
Chemical Oxygen Demand	356
Dissolved Solids	1447
Total Solids	1723
Total Suspended Solids	276
Phenols	0.016
Chlorides	298
Nitrates (as mg/l No_3^{-2})	1.0
Phosphates (total)	70
Cadmium	.01
Chromium (Total)	0.05
Copper	0.14
Iron	6.50
Lead	0.33
Manganese	0.29
Silver	.05
Zinc	0.24
PH	10.6 (units)
Ammonia (as N)	0.20
Mercury	.005
Phenolphthalein Alkalinity (as $CaCO_3$)	90
Total Alkalinity (as $CaCO_3$)	290
Total Kjeldahl Nitrogen (as N)	3.44
Nitrate (as N)	0.72

Source: Hanscom Air Force Base Records (OEHL Laboratory)

TABLE 3-4

ANALYSIS OF SURFACE WATER AT STORM DRAIN OUTFALLS IN 1983

	Parameter (ug/1)				
Sample Point	Trans-1,2 Dichloroethylene	Methylene Chloride	Trichloro-ethylene	1,2 Dichloro-ethane	Unidentified Peaks
(2 Dec. 1983)					
0-1	-	-	-	-	-
0-2	-	24	9	-	2
0-3	4	26	25	-	1
0-4	-	190	-	-	2
0-5	-	30	-	-	2
(7 Dec. 1983)					
0-1	-	10	-	2	2
0-2	-	-	-	-	-
0-3	3	56	20	1	1
0-4	-	12	-	-	-
0-5	-	6	-	-	2

Source: Weston, 1984

diverted by the man-made ditches to Lake Cochituate. Much of the lowlands surrounding these facilities are swamps or wetlands. These areas feed small streams and ponds which are tributaries to the Assabet River.

3.3.4 Solar Radio Observatory at Sagamore Hill

The Solar Radio facility is situated atop Sagamore Hill and ocupies approximately 32 acres. The geologic material on which the station is situated is tight compacted till. This relatively impermeable material causes most precipitation to become surface runoff. Surface runoff flows in all directions and is controlled primarily by surface grading and small ditches constructed to divert water away from facilities. The runoff flows into the surrounding lowland.

During the site visit and record search an area of stressed vegetation was noted to be present near the antenna. Apparently, excessive amounts of herbicides that have accumulated in the surface soil and are migrating down slope. The herbicides may be transported further down slope by surface runoff, although it is doubtful that significant quantities are being transported to down-slope surface waters.

3.3.5 RADC Electromagnetic Test and Measurement Facility

This facility is located on a peninsula in Plum Island Sound at the highest elevation on the peninsula. Surface water drainage within the facility is controlled by ditches and small drains. Surface water results from on-site precipitation only and the ditches and drains direct runoff off site. Surface water flows down-slope into the Sound or to the saltwater marshes east of the site. A small stream originates between North Ridge and Plover Hill approximately 80 feet below the elevation of the facility. The source of the stream is a small spring that discharges groundwater to the down-slope saltwater.

3.3.6 Fourth Cliff Recreation Annex

This facility is surrounded on three sides by salt water and is situated at the highest elevation on the spit-like landform. No surface water exists on the site other than direct precipitation. Runoff is controlled on the site by ditches, which discharge into the ocean and saltwater marshes.

In the past, a subsurface sanitary disposal system for the annex had saturated the soil and seeped effluent to the ground surface. The system was upgraded during May 1984 with the addition of septic tank capacity and two new leaching basins.

3.3.7 North Truro Air Force Station

This facility is situated along a cliff overlooking the Atlantic Ocean. Surface topography is undulating and many small depressions can be found outside the developed areas. These small depressions can serve as basins for surface runoff. However, because the soils are highly permeable, very little water collects or stands in these depressions. Surface runoff that does not collect in the depressions flows down slope to the east and eventually enters Cape Cod Bay. No streams flow through or near the station. A storm sewer system also provides control of surface water at the station.

3.4 SOILS

3.4.1 Hanscom Air Force Base and Hanscom Field

Native soils within the perimeter of Hanscom AFB have been drastically disrupted by construction and earth-moving activities associated with base construction. The Soil Conservation Service has classified most of the soils on the base as "made land." This is land that has been altered or disturbed by buildings, industrial areas, paved parking lots, roads, and yards. The existing soils are generally a mixture of native soils, and their physical and chemical properties resemble the undisturbed soils. The soils that surround the base are likely native and undisturbed; i.e., the same kind of soils that were present prior to base development. Fifteen soil series have been identified and mapped in the area surrounding Hanscom AFB. These soils are shown in Figure 3-12 and their properties are listed in Table 3-5.

Hydrologic soil groups are used in estimating runoff from precipitation and the influence that the soils have on the water budget. Soils are placed in one of four groups (A, B, C, or D) on the basis of the intake of water after the soils are saturated and have received precipitation from long-duration storms. Most of the soils at Hanscom AFB fall into Hydrologic Soils Group C, indicating a slow rate of water infiltration when the soils are thoroughly wetted.

Permeability refers to the ability of a soil to transmit water or air. The estimates of permeability given in Table 3-5 indicate the rate of downward movement of water when the soil is saturated. The permeability is based on soil characteristics observed in the field, particularly structure, porosity, and texture. The "limitations" indicated on Table 3-5 are related to the acceptability of the mapped soils to be used in various activities.

Some areas of the base are indicated on soils maps as "muck." This is not a generally recognized soil series, but is material that resembles peat in physical and chemical properties. These areas are not suited for development and are suitable only for wetland wildlife habitats. Soil series that have been classified as wetlands in northeastern Massachusetts near or within the base are Whitman, Scarboro, Pipestone, and Raynham.

3.4.2 Prospect Hill Electronics Research Annex

This facility is situated on a bedrock hill that has a thin glacial till surficial covering. The soil series is similar to the Hollis or

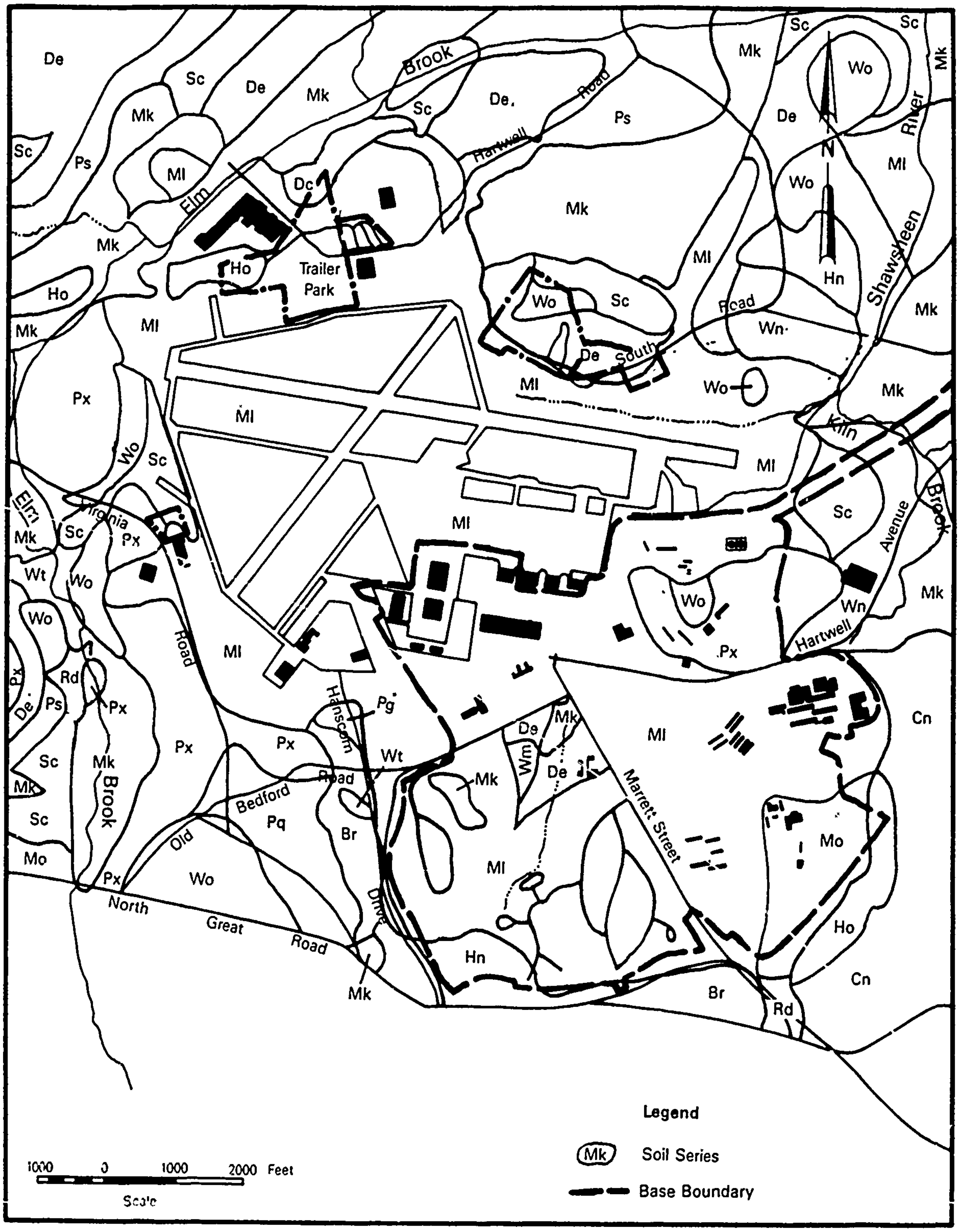


Figure 3-12. Soils in the Vicinity of Hanscom AFB and Hanscom Field.

TABLE 3-5

PROPERTIES OF SOILS IN THE VICINITY OF HANSCOM AFB AND HANSCOM FIELD

Properties					Limitations		
Soil Series Name and Symbol	Hydrologic Group	Depth to Bedrock (in)	Water Table (ft)	Permeability (in/hr)	Trench Sanitary Landfill	Area Sanitary Landfill	Daily Cover for Landfill
Birchwood (Br)	C	>60	1.5-3.5	2.0-20	severe/wetness	moderate/wetness	fair/small stones
Canton (Cn)	B	>60	>6.0	2.0-6.0	severe/seepage	severe/seepage	poor/seepage
Deerfield (De)	B	>60	1.5-3.0	6.0-20	severe/wetness	severe/wetness	poor/seepage
Hinckley (Hn)	A	>60	>6.0	6.0-20.0	severe seepage	severe/seepage	severe/seepage
Hollis (Ho)	C/D	10-20	>6.0	0.6-6.0	severe/seepage depth to bedrock	severe/bedrock seepage	poor/thin layer
Montauk (Mo)	C	>60	2-2.5	0.6-6.0	severe/slope	severe/slope	poor/seepage
Paxton (Px)	C	>60	1.5-2.5	2.0-6.0	moderate/wetness	moderate/wetness	fair/wetness
Pipestone (Ps)	A	>60	.5-1.5	6.0-20	severe/wetness	severe/wetness	severe/wetness
Poquonock (Pq)	C	>60	1.5-3.0	6.0-20	moderate/wetness	moderate/wetness	fair/wetness
Raynham (Rm)	C	>60	0.5-2.0	.06-2.0	severe/wetness	severe/wetness	poor/wetness
Ridgebury (Rd)	C	>60	0-1.5	<0.2-6.0	severe/wetness	severe/wetness	poor/wetness
Scarboro (Sc)	D	>60	+1-1.0	6.0-20.0	severe/seepage	severe/seepage	poor/seepage
Whitman (Wt)	D	>60	+1-0.5	<0.2-6.0	severe/ponding	severe/ponding sandy	poor/ponding poor/slope
Winsor (Wn)	A	>60	>6.0	>6.0	severe/slope, seepage, sandy	poor/slope, seepage	too sandy seepage
Woodbridge (Wo)	C	>60	1.5-3.0	<0.2-2.0	severe/wetness	moderate/wetness	fair/wetness
Made Land (Ml)	-	-	-	-	-	-	-
Muck (Mk)	-	-	-	-	-	-	-

Source: USDA Soil Conservation Service 1982

Canton. Permeability is moderately rapid (0.6 to 6.0 inches per hour) and soils are excessively well-drained. The soil textures vary from clays to large rock and gravel because of the nature of the parent material. These soils are poorly suited for most uses because of the limited depth to bedrock and steep slopes.

3.4.3 Maynard Geophysics and Sudbury Electronics Research Annexes

The soils within these two facilities are similar and are developed from glacial parent material. The topographically higher areas are glacial drumlins and the low wetlands are outwash plains.

Soils of these types of parent material are relatively deep (< 60 inches) and have a wide range of textures. The upland soils are similar to the Canton and Hollis series and are classified as sandy loams. Permeability is moderately rapid to rapid throughout the profile and the soils are limited for use primarily by slope and stoniness. The water table is usually deeper than 6 feet below the surface.

Soils in the low and wet areas of these facilities developed on glacial outwash plains. These soils are also deep (< 60 inches) and have developed in well-sorted sands and gravels. Textures reflect the sorting action of the glacial outwash and vary throughout the area. Permeabilities are moderate to rapid because of the sandy nature of the parent material. These soils are in Hydrologic Soils Groups B and C, depending on the level of the water table. Low swampy areas have a shallow water table most of the year while the topographically high soils have water tables that show seasonal fluctuations and generally are deeper. The uses of these soils are severely limited primarily because of wetness.

3.4.4 Solar Radio Observatory at Sagamore Hill

Soils within the area of the Sagamore Hill facility are developed in glacial till material. These soils will have a broad range in textures

Groundwater data for the Scott Circle area, roughly bounded by Hanscom Drive, Route 2-A, Marrett Street, Vandenberg Drive (see Figure 3-25), are insufficient to formulate an adequate groundwater flow net. However, the available data do show a decrease in groundwater elevations in a north-northeasterly direction. Based on water elevation data and evidence of topographic, surface drainage, and bedrock control over groundwater flow in the northwest portion of the base, it is reasonable to conclude that groundwater in this area flows north past the ridge and hills to the east in the same direction as the Shawsheen River.

The direction of groundwater flow within the outwash aquifer in the southwest portion of the base in the vicinity of the sanitary landfill site (shown in Figure 3-25 and described in Section 4) cannot be substantiated with available hydrogeologic data. However, this site is located in very close proximity to Elm Brook in a low area along the base of a ridge, and based on other evidence, groundwater is most certainly flowing in a northern direction along Elm Brook, bypassing the ridge formed by Pine Hill and Hartwell Hill to the east. Based on the same inferences, groundwater originating on the east side of this ridge probably flows northeast across the base, between the two bedrock subcrops to the east, and discharges to the Shawsheen River.

A complicating factor in the groundwater flow pattern at Hanscom AFB as noted by Weston in an investigation of Hanscom Field sites (Weston, 1983) is the storm drain network. The degree to which the storm drainage system around the airfield intercepts groundwater flow by controlling local hydrostatic head became evident when water level elevations in wells were compared with elevations of adjacent storm drains. One example described in Weston's report involves a 3-foot head difference between a well and a staff gauge located in a storm culvert. The two devices were only 50 feet from one another. It became apparent from this evidence that the storm drain system intercepts the water table and that there exists an opportunity for preferential groundwater flow within the storm drains. Contaminants that because of the variability of parent material. These upland soils have moderately rapid to rapid permeability throughout and are primarily limited by slope and stoniness. Soil depth is usually greater than 60 inches.

3.4.5 RADC Electromagnetic Test and Measurement Facility

This site is situated on an upland area and soils have developed in the ground moraine parent materials. The varied composition of this glacial material has resulted in soils having a wide range of textures. The upland position and moderately rapid to rapid permeability place these soils in Hydrologic Group B. When saturated, these soils have a moderate infiltration rate. The water table within these soils varies seasonally but is generally deeper than 60 inches. The soils on the steeper slopes are subject to erosion and are thus limited for many uses. The proximity of the site to the Atlantic Ocean indicates that these soils are also subject to wind erosion and deposition. Windblown sand may be deposited on the surface giving a sandier surface texture than that of similar soils further inland.

3.4.6 Fourth Cliff Recreation Annex

Fourth Cliff is situated on a spit-like structure of glacial origin. Drumlin deposits provide the parent material from which the majority of the soils at this site developed. The broad size range of parent material results in soils that are sandy textured and relatively deep. A hard pan usually exists in these soils between 18 and 24 inches deep, which restricts downward movement of infiltrating water. This results in a perched seasonally high water table and slow permeability (>2.0 in/hr) in the substrata. The topographic position and hard pan at this site result in seepage along the slopes. This water flows into the nearby salt marshes. These soils are in Hydrologic Group C and are limited for use primarily by seasonal wetness and slow permeability of the substrata.

The lowland area in the salt marsh consists of very poorly drained soils on the tidal flats. These soils are formed from partially decomposed organic material derived from salt-tolerant herbaceous plants. These areas are subject to flooding. The organic-rich upper layers have moderate to rapid permeabilities but the lower layers are severely limited for use because of flooding and a high water table.

3.4.7 North Truro Air Force Station

North Truro Air Force Station (AFS) is located in the southern portion of Lower Cape Cod and is situated on Well Fleet Plain deposits. These stratified glacial drift deposits provide the parent material from which the soil at the station developed. Surface layers are very sandy and contain large rocks and boulders. Lower layers are also dominated by sand and contain small percentages of clay, silt, and gravel. This layering is probably the result of glacial action rather than soil development. These soils have rapid permeability in the surface layers and very rapid permeability in the substrata. The rapid infiltration and high permeability result in water tables at depths greater than 6 feet.

3.5 GEOLOGY

3.5.1 Hanscom Air Force Base and Hanscom Field

Hanscom AFB and Hanscom Field are located in an area that was occupied by a Pleistocene-age lake known as Glacial Lake Concord (USGS, 1964). The lake was formed by glacial meltwaters during the recession of the great ice masses. Evidence of glacial activities and the presence of Lake Concord is seen in both the aerial topography and in existing geologic data. The series of rounded hills and valleys that exist in the area is the result of both bedrock structure and glacial erosion. Hanscom AFB is located in a portion of a north-trending valley and is underlain by lake sediments and glacial material deposited during different stages of glacier movement (Motts and O'Brien, 1981).

The surficial geology of the area in which Hanscom AFB and Hanscom Field are located is shown in Figure 3-13. The present extent of Glacial Lake Concord deposits outlines the lower elevated area in which the base is situated. The higher areas surrounding the base consist of older glacial deposits as do elevated points within the lake deposit area. Bedrock is exposed in a few locations on base, however, this outcropping is more frequently seen in the more highly elevated outlying areas.

To more clearly describe the structure and stratigraphic sequence of the subsurface materials at Hanscom AFB, logs from well-drilling and boring activities in the area were closely reviewed and five cross-sections were prepared. The locations of the cross-sections (see Figure 3-14) were selected based on the availability of subsurface data across the base area. Figure 3-14 shows the locations of the wells and borings used to devise the cross-sections. The majority of available subsurface information applies to those areas surrounding the air field.

The five cross-sections, shown in Figures 3-15, 3-16, and 3-17, illustrate the typical undulation of the bedrock surface, the result of glacial advancement and recession. The oldest sedimentary material was transported and deposited on granitic bedrock by glacial ice and is described as till. This material is typically a nonstratified mass of unsorted debris containing angular particles composed of a wide variety of rock types.

As the ice masses began to melt and recede northward, glaciofluvial material was deposited. These sediments, composed of poorly to well-sorted gravel, sand, and silt, were transported by moving water before their final deposition and acquired a degree of stratification not normally seen in tills. Glaciofluvial deposits are also distinguished from till in that they usually contain more rounded rock fragments and particles.

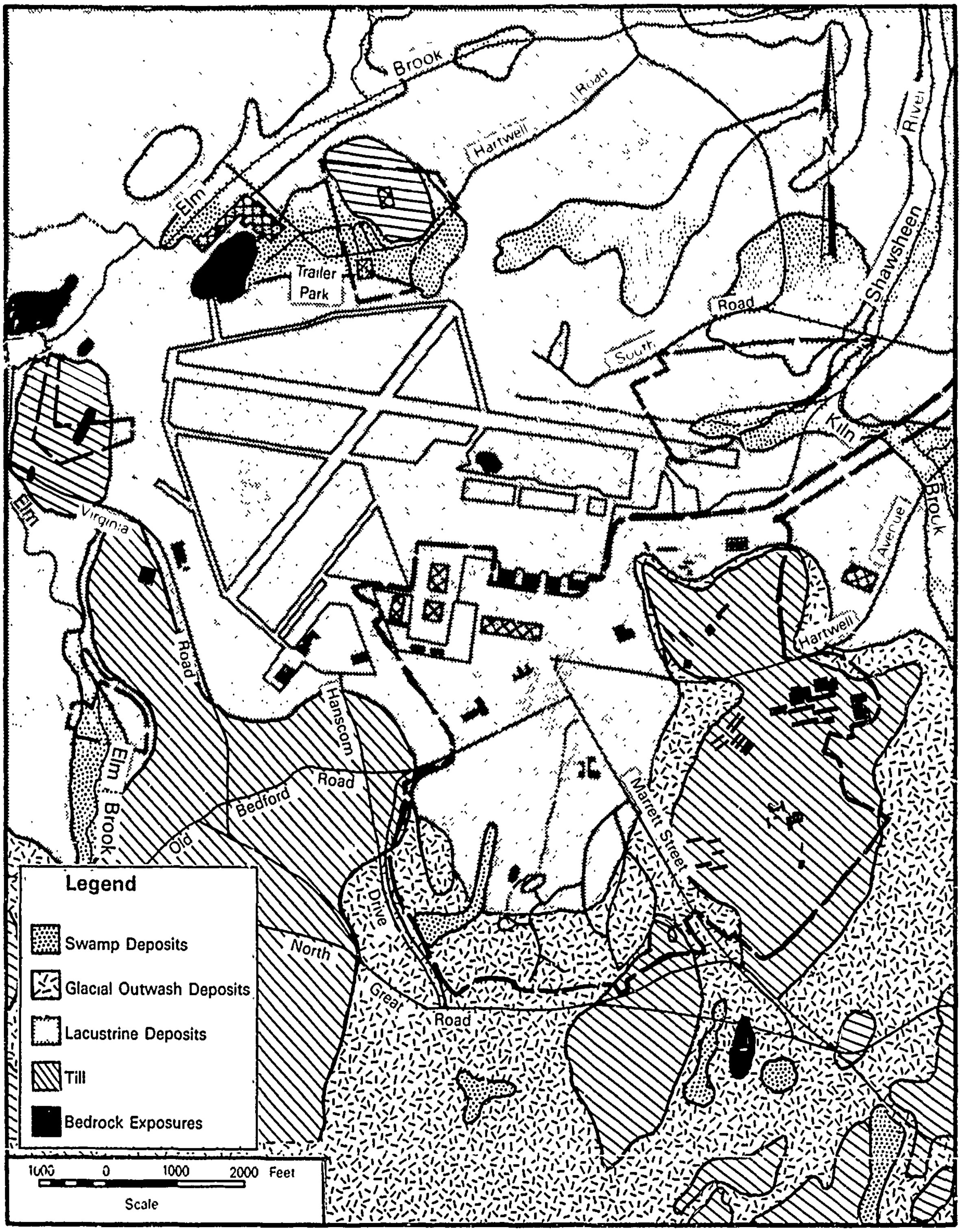


Figure 3-13. Surficial Geology of Hanscom AFB and Hanscom Field.

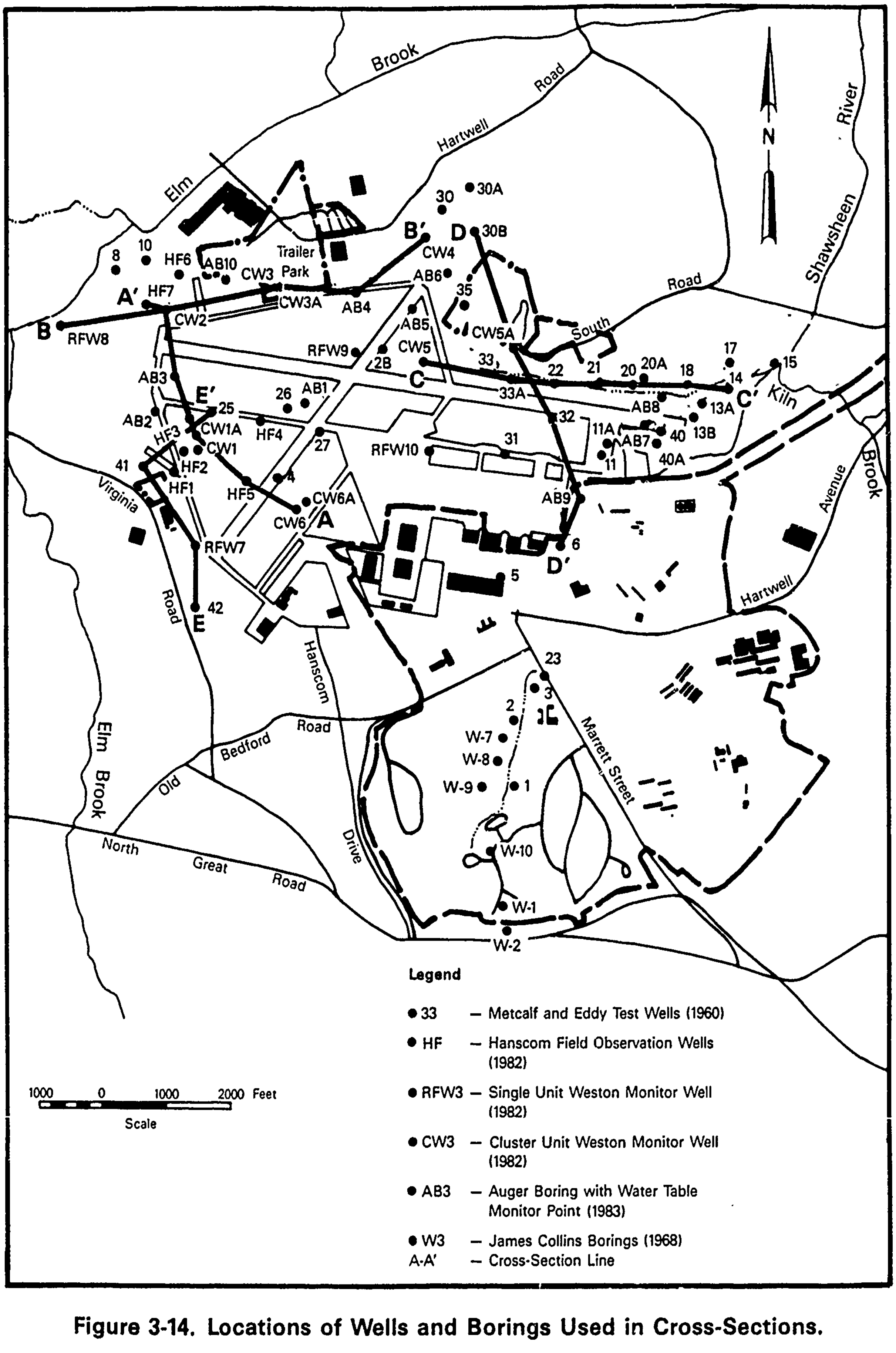


Figure 3-14. Locations of Wells and Borings Used in Cross-Sections.

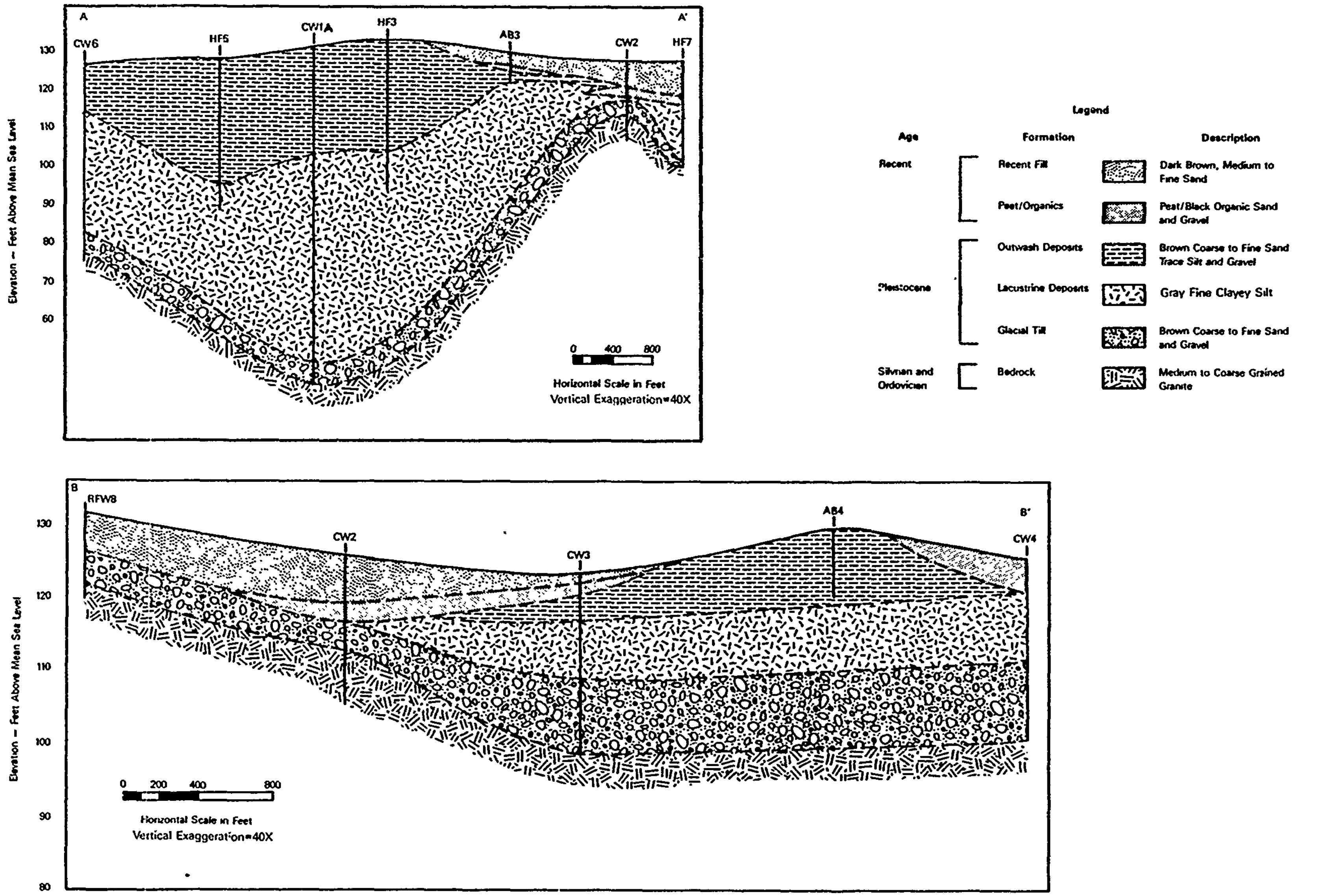


Figure 3-15. Geological Cross-Sections A-A′ and B-B′

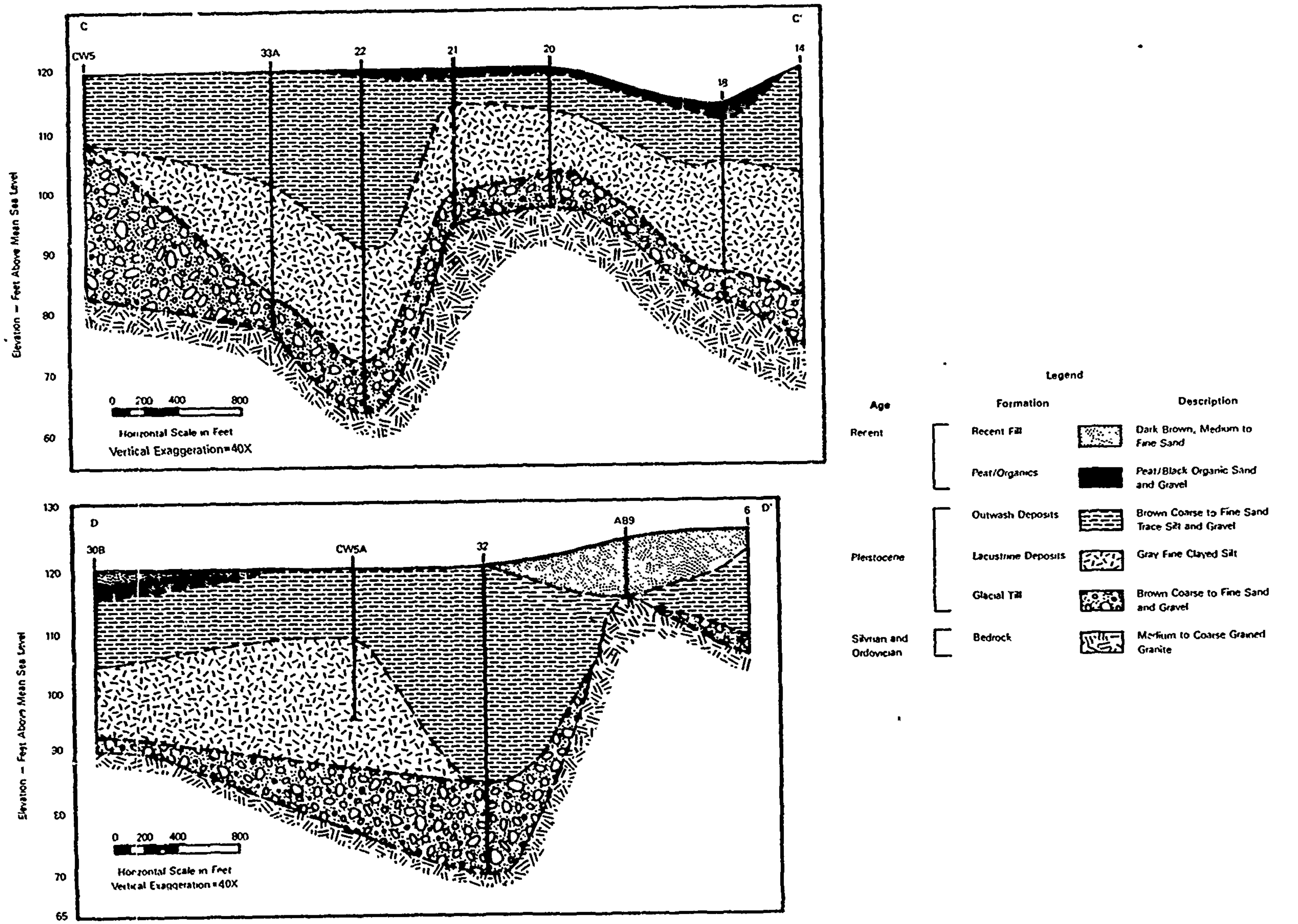


Figure 3-16. Geological Cross-Section C-C′ and D-D′.

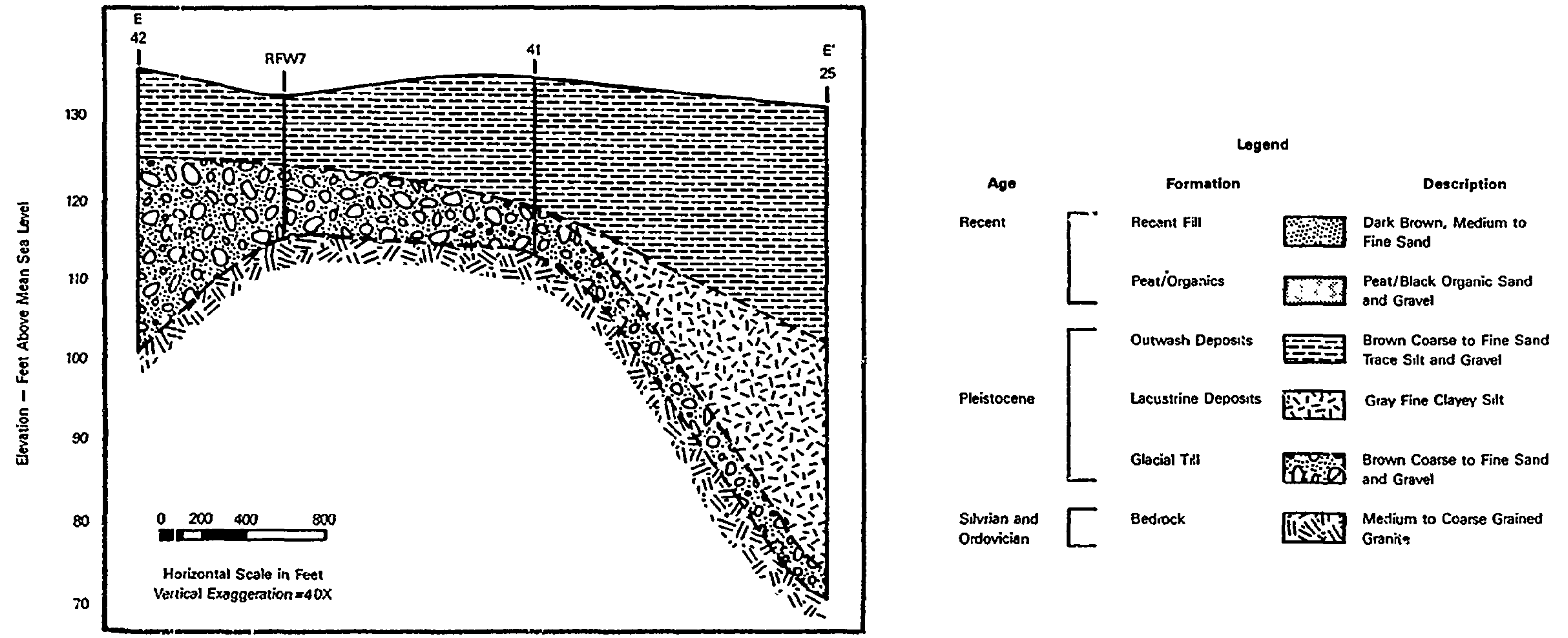


Figure 3-17. Geologic Cross-Section E-E'.

As the glacial mass continued to recede, its meltwaters formed what has become known as the glacial Lake Concord and, with the formation of this water body, lake bottom sediments were deposited. These glaciolacustrine sediments consist of fine- and medium-grained sand overlying silty clay and clay. These deposits have been further differentiated in the cross-sections included in Figures 3-15, 3-16, and 3-17. The silty clay and clay are described here as lacustrine deposits, and the overlying sands are designated as outwash material.

The glaciolacustine sediments continued to be deposited until the ice front had retreated far enough to allow the Shawsheen River valley to become free of ice and Lake Concord was drained completely to the northeast. Material deposited in the area following drainage of the lake consisted primarily of swamp deposits composed of muck, peat, silt, and sand. In addition to the naturally deposited swamp materials, extensive areas in the vicinity of the base are now filled in with artificial fill that was emplaced for construction purposes.

The following sub-sections described in detail each member of the aforementioned stratigraphic sequences based on researched information and findings of a hydrogeologic investigation of Hanscom Field (Weston, 1983). The existing geologic units are described here in order of increasing age.

3.5.1.1 Fill

The fill material present in the area of the base consists primarily of natural sand and silt relocated for purposes of filling in wet, swampy areas and/or leveling the land surface during construction activities. As reported in Weston's findings, 7 feet of sandy fill overlying topsoil and natural peat deposits were encountered at the west end of the air field, at boring locations in the vicinity of CW-2, AB-2 and AB-10 (see Figure 3-14). Similar conditions were revealed in the vicinity of Metcalf and Eddy's well 30-B, located east of Hartwell's Hill, where 3 feet of fill overlie swamp material. Well RFW-8, located north of Pine Hill, revealed 5 to 6 feet of sand and silt fill overlying glacial fill. Shallow bedrock areas have also been filled over and reworked, as indicated in the vicinity of boring AB-9 at the southeast corner of the air field, where 6 feet of fill directly overlie bedrock.

3.5.1.2 Swamp Deposits

Swamp deposits consisting of organic materials and sands were identified in Weston's borings CW-2, AB-3, AB-10, and Metcalf and Eddy's test well borings 1, 2, 3, 3A, 5, 11, 15, 17, 18, 20, 21, 22, and 35 (see Figure 3-14). These materials ranged from 0.5 to 3 feet in thickness. Borings CW-3, CW-4, 30-B, W-8, and W-10, which are located in what were originally swamp areas (see Figure 3-14), revealed between 2 and 7 feet of saturated peat. Peat deposits are laterally discontinuous across the base. In many cases, the peat has been overlain by clean earth fill.

3.5.1.3 Glacial Outwash Deposits

The uppermost water-bearing zones underlying most of the base are clean, medium- to fine-grained sands grading to coarse sand and then to fine sand. This unit usually occurs within 0 to 5 feet below the ground surface unless the area has been extensively filled. These deposits are present in a stratigraphic sequence that is typically described in boring and well logs as "gray-brown medium to fine sand, trace silt and gravel, saturated, loose to medium dense".

The thickness of the outwash deposits range from 0 to 35 feet in borings AB-9 and 32, respectively, as shown in cross-section D-D'. The average thickness, however, is between 10 to 15 feet in most locations. As indicated by cross-sections A-A' and B-B' (see Figures 3-15, 3-16, and 3-17), the outwash material is thin or absent along the northwest portion of the air field.

The outwash deposits constitute the principal and uppermost water-bearing deposits in the area of the base and constitute the zones of saturation most susceptible to any adverse affects created by former base operations.

3.5.1.4 Lacustrine Deposits

Lacustrine or lake bed deposits in the vicinity of the base consist of saturated fine sand and silts grading with depth to clayey silts. These deposits were encountered in most of the borings across the base. As shown in cross-sections A-A', B-B', and C-C' in Figures 3-15 and 3-16, these fine-grained, low-permeability deposits are thin or entirely absent where bedrock occurs at shallow depths.

It is also important to note that, although the Lacustrine deposits are saturated, they are not a viable water-producing unit as evidenced in a groundwater supply study (Metcalf and Eddy, 1960). Therefore, it is reasonable to conclude that, where the deposits occur, they probably act as a hydraulic barrier, inhibiting groundwater flow between the permeable outwash and till water-bearing units.

3.5.1.5 Glacial Till

Underlying the Lacustrine deposits and immediately overlying bedrock is a sandy glacial till. These nonstratified deposits, although variable in composition across the area of the base, are predominantly coarse, permeable and saturated. The deposits consist of either brown or gray, coarse to fine sand with some gravel and silt. As indicated in the five illustrated cross-sections (see Figures 3-15, 3-16, and 3-17), the till deposits mimic the bedrock surface, forming a veneer over the bedrock which averages about 5 feet in thickness. However, in the vicinity of borings CW-3, and CW-4, CW-5, and 31, the till unit is over 10 feet thick. The sandy, gravelly till material constitutes the deeper of two significant water-bearing zones in the area of base, and is separated from the uppermost water-bearing zone by the relatively impermeable lacustrine silty clays.

3.5.1.6 Bedrock

Bedrock beneath the base is known as Andover granite of Silurian and Ordovician age. The larger outcrops observed are metamorphic varieties of granitic rock. A typical description of this rock mass is "light to medium gray, foliated medium- to coarse-grained muscovite-biotite granite; pegmatite masses common".

Several outcrops in the vicinity of boring RFW-10 in the southeast corner of the air field consist of quartz-rich pegmatite injected through granitic gneiss and schist or otherwise described as migmatite. Shallow bedrock is also believed to occur in the vicinity of borings AB-9, CW-2 and RFW-8, based on refusal of the boring device. Mapped and field-checked bedrock exposures in the immediate area of the base occur in a road cut in Pine Hill, southeast of Hartwell's Hill, and due north of boring RFW-10 (see Figures 3-13 and 3-14).

The subsurface configuration of the bedrock surface is shown in Figure 3-18. It can be seen that bedrock topographic highs occur along the eastern side of the air field and between Pine Hill and Hartwell's Hill. These bedrock highs form subsurface barriers that divert and direct local groundwater flow. The deepest bedrock basin encountered at the base occurs beneath the confirmed disposal area on the west side of the air field.

3.5.2 Prospect Hill Electronics Research Annex

The Prospect Hill Electronics Research Annex, located approximately 5 miles south of Hanscom AFB, occupies an area with a geologic setting very similar to that of Hanscom AFB. Figure 3-19 shows the surficial geology in the vicinity of the facility. It can be seen that surficial deposits are quite thin if not entirely absent on the hill itself, exposing bedrock across much of the facility area. The bedrock, so extensively exposed, consists of a complex of diorite and gabbro, which is the predominant bedrock material in the area of the facility. Also present as bedrock material are subordinate metavolcanic rocks and intrusive granite and granodiorite (USGS, 1964).

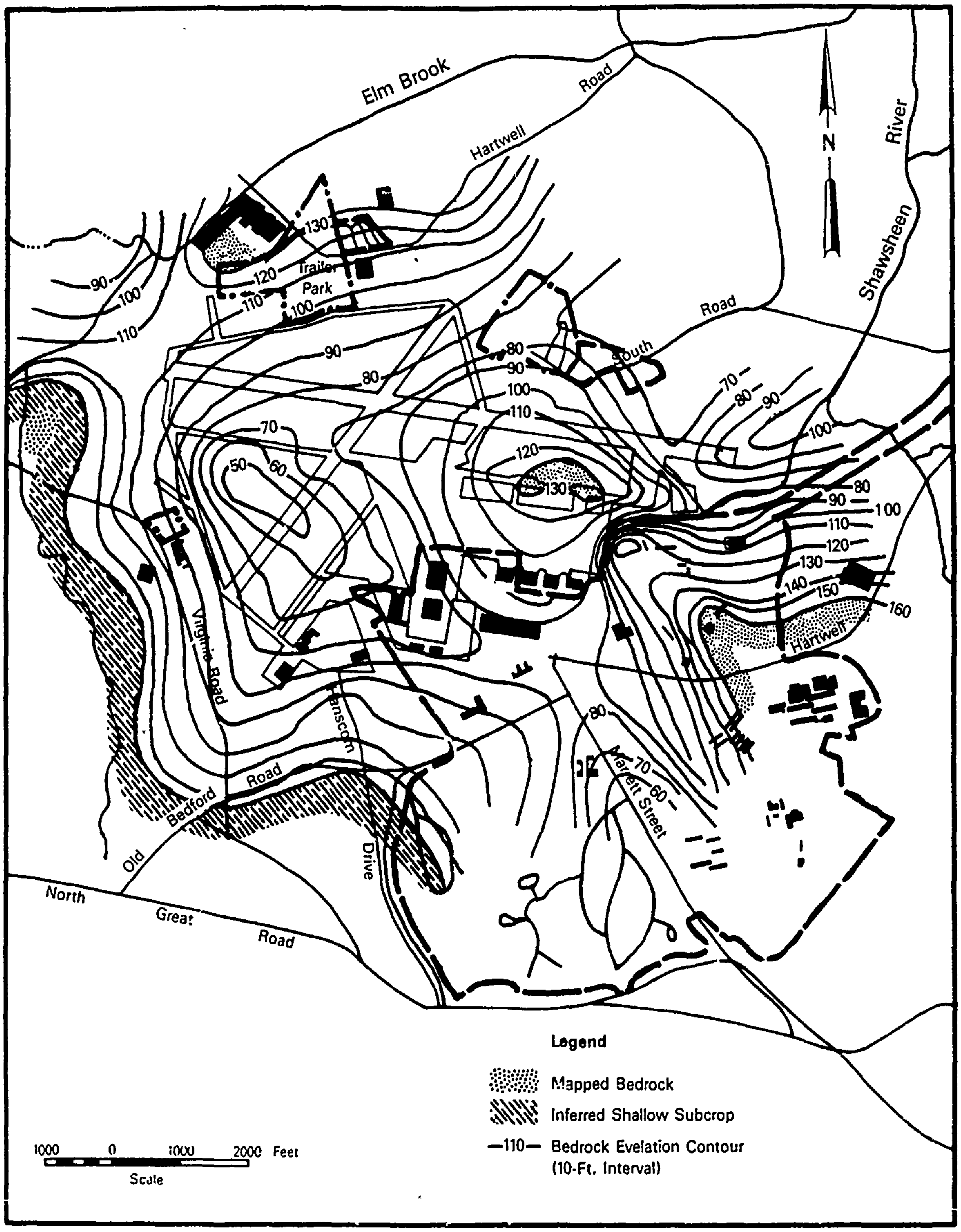


Figure 3-18. Contour Map of Bedrock Surface at Hanscom AFB and Hanscom Field.

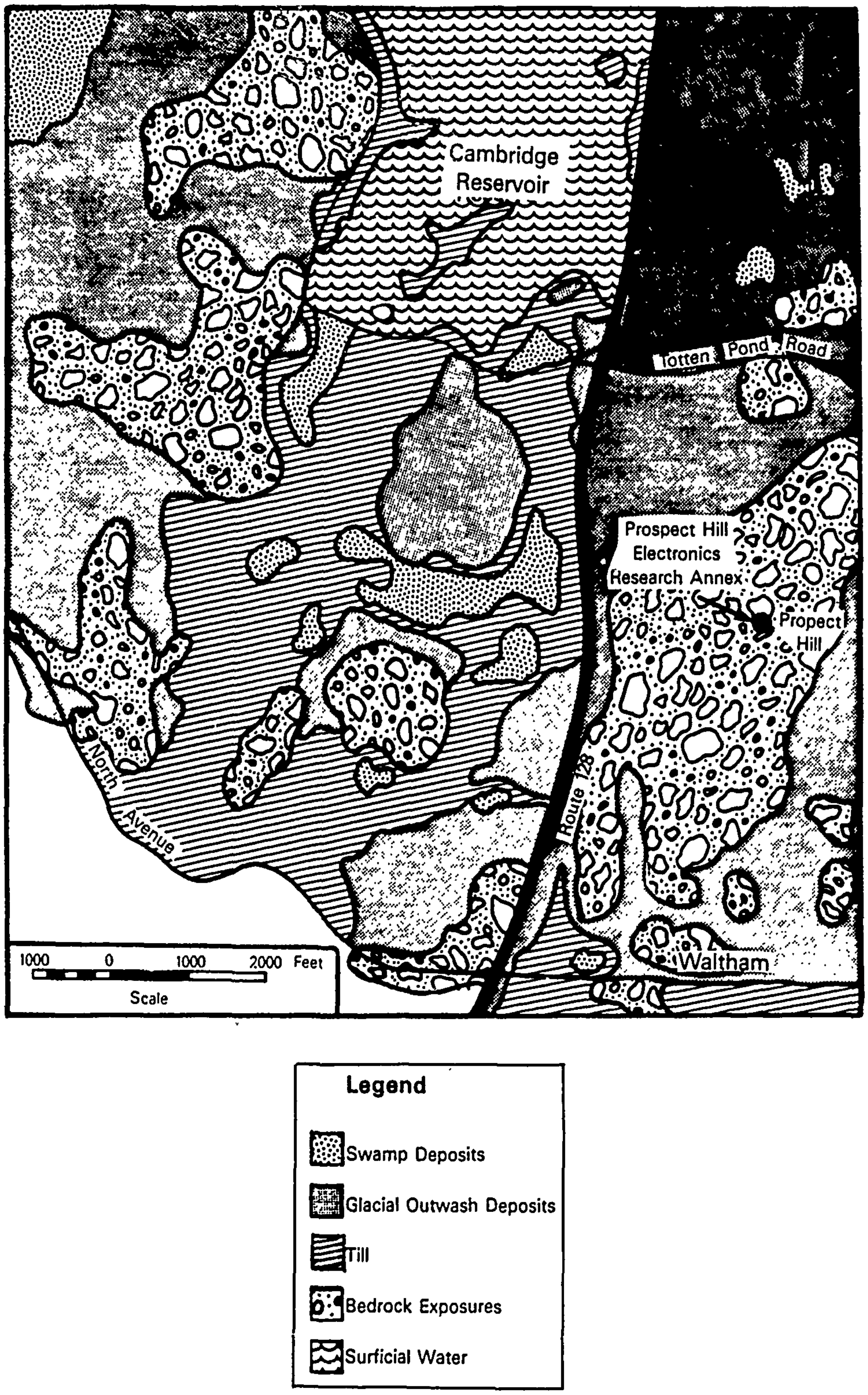


Figure 3-19. Surficial Geology of Prospect Hill Electronics Research Annex.

Prospect Hill represents one of the many bedrock "peaks" in the series of hills and valleys described in the previous section. In the lower elevated areas surrounding Prospect Hill, glacial till deposits similar in composition to the till found at Hanscom AFB are exposed at the surface. Directly west of the facility, where the land surface slopes more steeply than to the north, south, and east, later glaciofluvial outwash deposits are present. The outwash deposits in this area are not associated with lacustrine sediments as they are at Hanscom AFB. Based on the presence of the Cambridge Reservoir (northwest of Prospect Hill) within the outwash and till deposits, it is reasonable to conclude that the glacial outwash and till units, which are underlain by relatively impermeable plutonic rocks, constitute the primary water-bearing zones in the area.

3.5.3 Maynard Geophysics and Sudbury Electronics Research Annexes

The Maynard Geophysics Research Annex and the Sudbury Electronics Research Annex are located at the U.S. Army Natick Laboratories, approximately 15 miles west of Hanscom AFB. The geologic setting of the area also clearly reflects past glacial activities. However, the existing bedrock and deposits differ in age and composition from those of the Hanscom AFB area to the east.

The Maynard facility is located in the area generally known as Pig Hill at an elevation of approximately 300 feet MSL. The surrounding lowlands are characteristically swampy areas. The hill on which the site is located is a bedrock "peak" covered with a thin veneer of till deposits (see Figure 3-20). The bedrock material that underlies both the Maynard and Sudbury facilities is the Gospel Hill gneiss (Hansen, 1956). This moderately foliated granite gneiss is medium- to coarse-textured and is composed mostly of the minerals microcline, albite, quartz, and mica. Pegmatite is also abundant throughout the formation. Where it is well-exposed, as it is along the eastern slope of Pig Hill, the granite gneiss is pearly gray to almost white in color. When freshly exposed, it is pinkish or flesh-colored (Hansen, 1956).

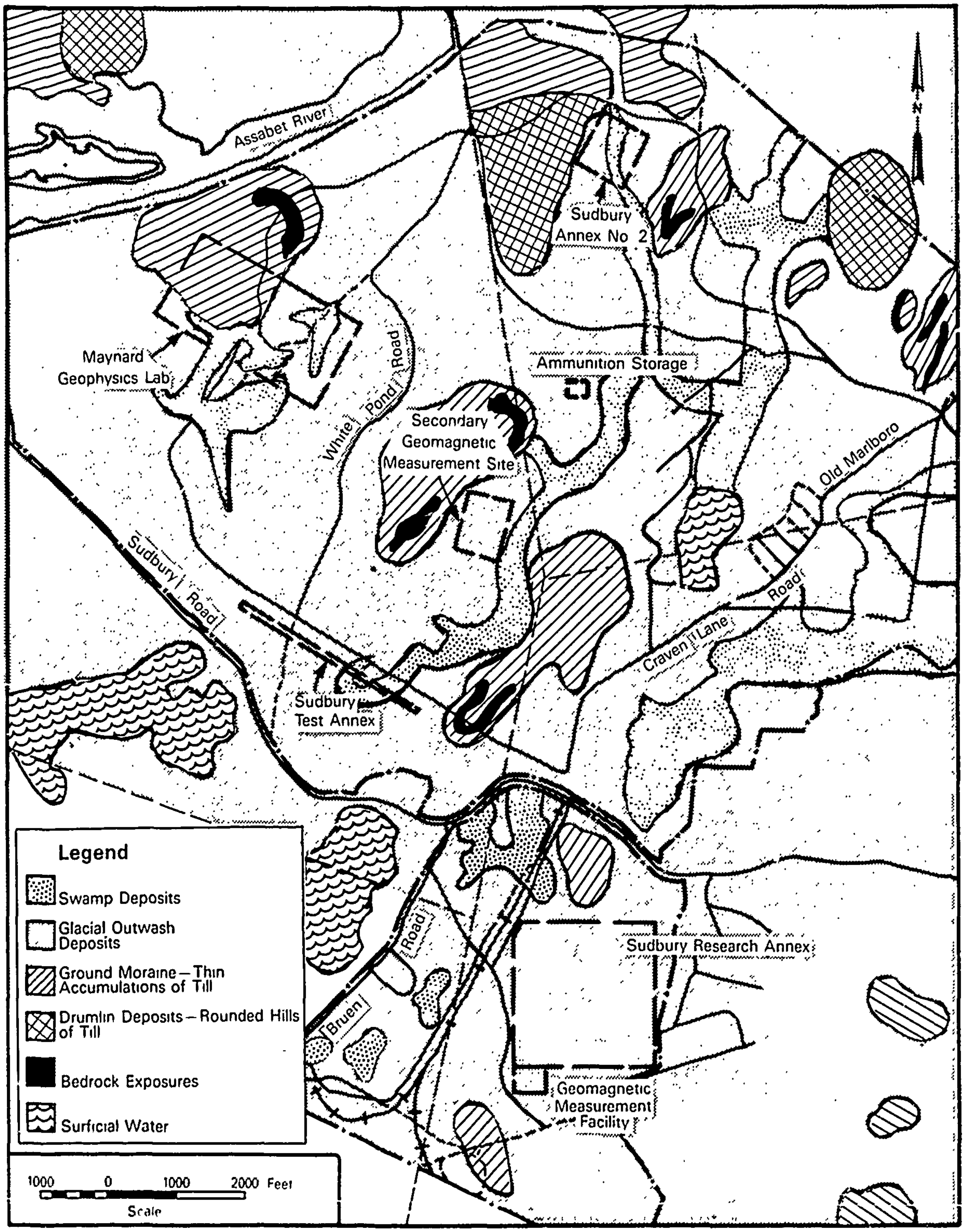


Figure 3-20. Surficial Geology of Maynard and Sudbury Research Annexes.

The thin accumulation of till covering bedrock in the vicinity of the Maynard facility is described by Hansen (1956) as ground moraine, composed of unsorted angular rock fragments of all sizes from minute particles to large boulders. Ground moraines are characterized as being broad, relatively thin till deposits with gentle undulatory relief that reflects the shape of underlying bedrock.

The Sudbury facility is located approximately 1 mile southeast of Pig Hill. The site area is transected by a bedrock "peak" covered with ground moraine appearing to be very similar to Pig Hill (Hansen, 1956). The surrounding lower elevated areas on which the facility is situated consist of outwash plains composed of well-stratified sand and gravel constructed by melt waters during the withdrawal of glacial ice. These plains now contain swamps and ponds. These depressions, described as kettles, were formed by buried ice blocks that were left behind by retreating ice and remained unmelted until after deposition of outwash had ceased.

3.5.4 Sagamore Hill Solar Radio Observatory

The Sagamore Hill facility is located 22 miles northeast of Hanscom AFB. The geology of the facility area is similar to that of the Maynard facility but is not identical (see Figure 3-21). The radio observatory is situated on a hill that has a core composed of alkalic granite and quartz syenite of the Cape Anne Complex (USGS, 1983). Overlying this bedrock material is ground moraine consisting of mostly dense clayey till at depths greater than 4 feet and only moderately dense sand and cobbles in the upper 3 to 4 feet (USGS, 1963). Based upon the literature, the till deposits here seem to be of greater thickness than those found in the Maynard area. Till material forms a veneer over many of the major hills in the Sagamore Hill area. Although the surface topography is reported to be essentially "constructed", there is evidence that the hills have cores of bedrock. Till thicknesses in this area's hills are known to reach up to 80 feet (USGS, 1963). Till deposits on Sagamore Hill are probably not among the thickest found in the Ipswich area due to bedrock exposures along the southwest slope, but they cannot be characterized as a thin veneer overlying a bedrock "peak" as described for the Maynard facility at Pig Hill.

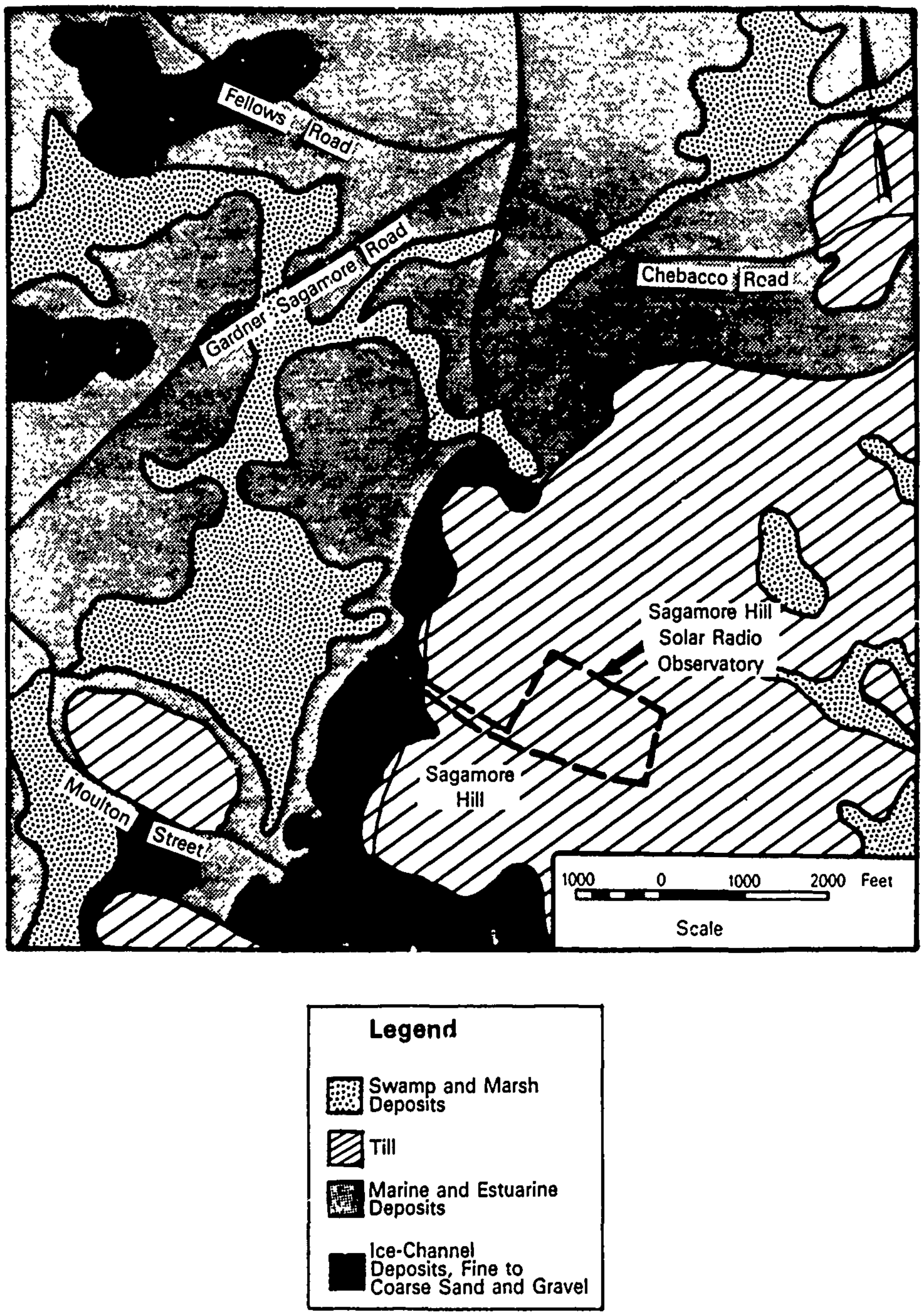


Figure 3-21. Surficial Geology of Sagamore Hill.

Surrounding Sagamore Hill are glaciofluvial, glaciomarine, and swamp deposits (see Figure 3-21). The glaciofluvial materials are terrace deposits laid down by meltwater streams flowing between a wasting ice mass and either a hill of till or bedrock. Grain sizes in these deposits range from fine silty sand to large cobbles. The average thickness is probably between 15 and 20 feet. Terrace deposits are well drained except in those portions that are confined by overlying marine clay (USGS, 1963).

The glaciomarine deposits consist of both marine and estuarine materials. These near-shore deposits are composed mostly of laminar silty clays that form a nearly continuous layer beneath saltwater marshes, and farther inland, a discontinuous layer that buries or partially buries deposits of glacial drift (USGS, 1963).

Swamp deposits consist of organic matter and include some alluvial sand and silt. They occur in most inland depressions and valleys where they conceal underlying outwash and ice-contact deposits. A layer of muck at the base of most swamp deposits generally impedes the downward percolation of water (USGS, 1963).

3.5.5 RADC Electromagnetic Test and Measurement Facility

The RADC ETMF is located about 25 miles northeast of Hanscom AFB and approximately 5.5 miles north of Sagamore Hill on a hill known as North Ridge. North Ridge is geologically very similar to Sagamore Hill, the difference being that there are no bedrock exposures at North Ridge (see Figure 3-22). The ridge or hill has a peak elevation of 123 feet MSL (USGS, 1963). The composition of North Ridge is ground moraine of a dense clayey till. The thickness of the till deposits is uncertain, although the core is most probably bedrock material. The bedrock underlying the ETMF is the same diorite and gabbro described at Prospect Hill (USGS, 1983). It is a complex of diorite and gabbro with subordinate metavolcanic rocks and intrusive granite and granodiorite.

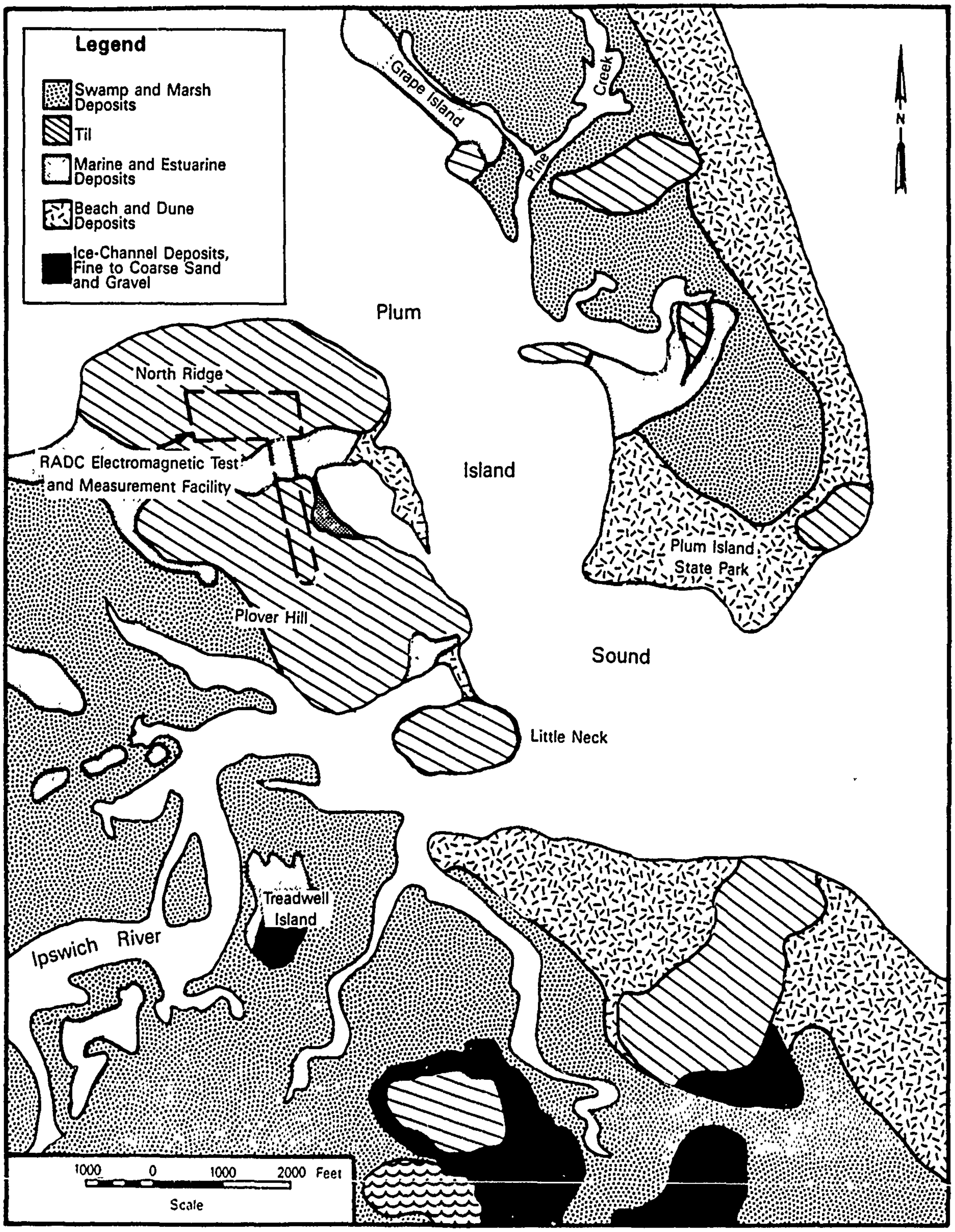


Figure 3-22. Surficial Geology of RADC Electromagnetic Test and Measurement Facility.

An extensive swampy area exists to the southwest of North Ridge, which consists of organic matter including some alluvial sand and silt. Separating North Ridge from these swamps and Plover Hill to the southeast are marine and estuarine deposits consisting of gravel, sand, silt, and clay with predominant gray to brown silty clay (USGS, 1963).

3.5.6 Fourth Cliff Recreation Annex

The Fourth Cliff facility, located 52 miles southeast of Hanscom AFB, occupies a streamlined hill composed mostly of till (see Figure 3-23). Because of its predominant till composition, the hill is referred to as a drumlin deposit (USGS, 1965). At the north end of the Fourth Cliff, brown oxidized till about 20 feet thick grades downward into incompletely oxidized till with remnants of unoxidized gray till that are plant remains. Two lenses of sand and gravel 10 to 15 feet thick, separated by about 10 feet of till, outcrop near the middle of Fourth Cliff. These lenses dip about 10 degrees south and appear to pinch out near the bottom of the cliff (USGS, 1965).

The underlying bedrock material is part of the Rhode Island Formation consisting of sandstone, graywacke, shale, conglomerate, and minor beds of meta-anthracite (USGS, 1983). The salt marsh area along Fourth Cliff's western boundary is composed of marine peat underlain by post-glacial silt and clay, glacial deposits, and coastal plain deposits (USGS, 1965).

3.5.7 North Truro Air Force Station

The North Truro facility is located along the eastern shore of Cape Cod in what is described in the literature as "Well Fleet outwash plain deposits" (USGS, 1967) (see Figure 3-24). These deposits, composed of stratified glacial drift, are predominantly sands but contain some clay, silt, and gravel. Sand, gravel, silt, and clay strata crop out along the sea cliffs, and these strata commonly dip gently to the west or southwest. Little is known of the distribution of material types below sea level, but

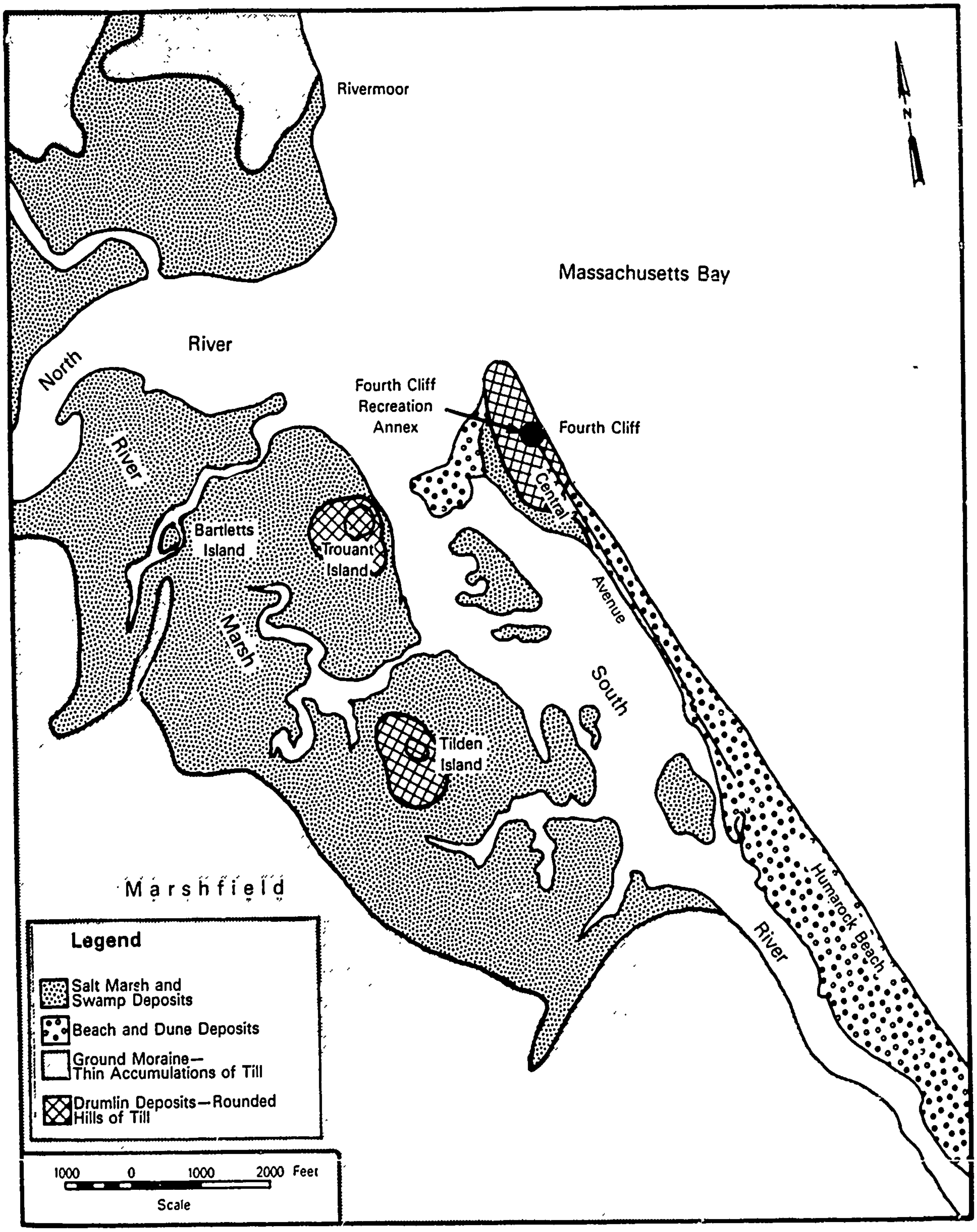


Figure 3-23. Surficial Geology of Fourth Cliff Recreation Annex.

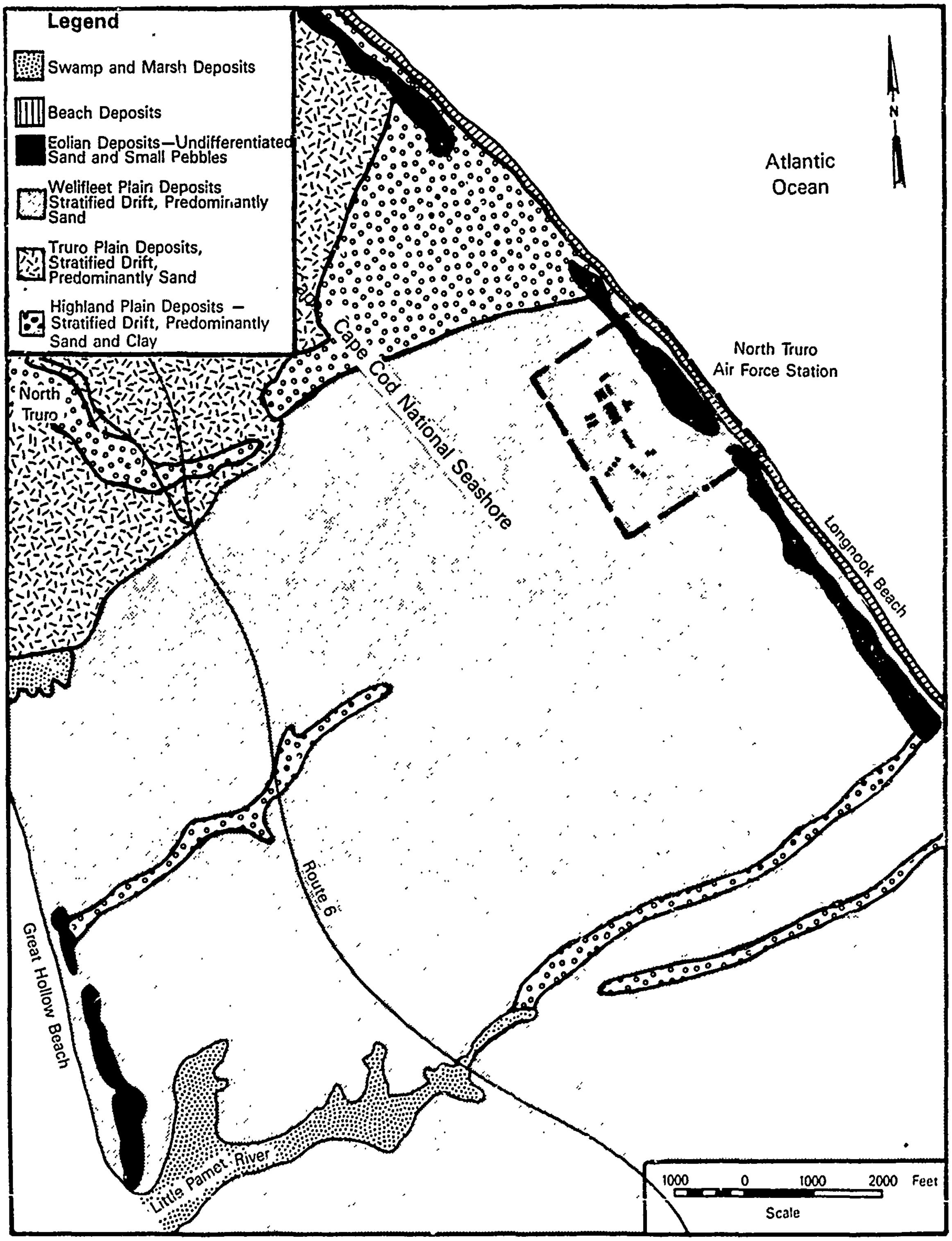


Figure 3-24. Surficial Geology of North Truro Air Force Station.

seismic surveys indicate that these deposits are at least 450 feet thick and that they are underlain by semi-consolidated or consolidated sediments that fill a large-scale depression in crystalline bedrock (Delaney and Cotton, 1972.) In addition to the glacial sand deposits, there are undifferentiated eolian or windblown deposits present along the most eastern portion of the site area. The eolian deposits consist of irregular sand to small pebbles and form climbing dunes and cliff-top dunes along the shore that rise as high as 160 feet MSL (USGS, 1967). Underlying the glacial and eolian sand deposits, as much as 900 feet below mean sea level, is crystalline bedrock consisting of undivided granite, gneiss, and schist (USGS, 1983). These materials are Proterozoic in age and have been extensively metamorphosed overtime. They may also include plutonic and volcanic rock of Paleozoic and later ages.

3.6 WATER SUPPLY

3.6.1 Hanscom Air Force Base and Hanscom Field

Hanscom AFB and Hanscom Field receive water under a contract with the Town of Lexington, which holds a contractual agreement with the Metropolitan District Commission. Through the Commission, water is piped into the Lexington area from the Quabbin Reservoir located in western Massachusetts near Amherst. The recipients of this water resource include all of Hanscom AFB and Hanscom Field, with the exception of the Air Force Mobile Home Park in the Town of Bedford, which receives water from the town's municipal wells.

3.6.2 Prospect Hill Electronics Research Annex

The Prospect Hill facility is supplied water for its operations by the City of Waltham. The water is pumped to the facility through a pipeline that runs from the city to the site. The water that is transported from Waltham is used only for facility operations, and bottled water is used for drinking purposes. The pipeline that runs from Waltham to the facility is corroded and the pumped water is undesirable for drinking because of discoloration caused by the iron content.

3.6.3 Maynard Geophysics Research Annex

The water source in the Maynard area is the glacial outwash material, which occurs over much of the area. The Maynard Annex has obtained its potable water from two artesian wells located at the south end of the peninsula since 1978. Prior to 1978, the annex obtained its well water from the Town and the resulting need for additional water, the Town requested that the military facility provide its own potable water. Groundwater is pumped and stored in a 151-cubic meter underground storage reservoir that is located adjacent to the pumping station. The pumping station houses two pumps each capable of delivering more than 1.5 cubic meters per minute (Installation Assessment of USANRDC, 5/80).

3.6.4 Sudbury Electronics Research Annex

The water source in the Sudbury area is also the glacial outwash material. The Sudbury Annex obtains its potable water from the Town of Maynard, for which the White Pond reservoir is the source, and from a number of wells located on facility property. Presently, only one well is active. Located adjacent to the facility pumping station is an outside storage tank with a capacity of 57 cubic meters (Installation Assessment of USANRDC, 5/80).

3.6.5 Solar Radio Observatory at Sagamore Hill

The Solar Radio Observatory receives water supplies from a single well located on site. The well draws from the granitic bedrock aquifer that underlies Sagamore Hill. Reaching a depth of 320 feet, the production well yields approximately 10 gallons per minute.

3.6.6 RADC Electromagnetic Test and Measurement Facility

The RADC ETMF presently uses bottled water for drinking and water from the Town of Ipswich for facility operations. The source for the Town supply is Dow's Brook reservoir and a number of municipal wells. This source has not been used for drinking at ETMF since about 1968. The reason for this is high chloroform counts found in samples collected by Air Force personnel. The Town's supply is found by the State to be of good quality and has continued to be used by area residents (Town of Ipswich, Water and Sewer Dept.; telephone communication with ETMF engineer).

3.6.7 Fourth Cliff Recreation Annex

The Fourth Cliff Recreation Annex receives its water from Scituate municipal supplies. There are no existing wells used for water production at Fourth Cliff due to its probable high salinity and the limited availability of the resource in the immediate area. Presently, there is one deep well in the area, which is located south of Fourth Cliff along Humarock Beach. This well was constructed for institutional use and is not presently used for water supply.

3.6.8 North Truro Air Force Station

The North Truro Air Force Station is supplied water from a well located at the station. The well penetrates to a depth of 145 feet below the land surface. The water supply system comprises a single 8-inch-diameter well, which was originally pump-tested at a rate of about 800,000 gallons per day. More recent analyses indicate that the well is estimated to be capable of producing 500,000 to 600,000 gallons per day continuously without intrusion of saltwater. The station consumes approximately 30,000 gallons per day with an increase of 10,000 gallons per day during the summer months.

The well is connected directly to the station's water storage tank via a 6-inch-diameter cast iron water pipe. The distribution system is comprised of an 8-inch-diameter water main network. The water storage tank has a holding capacity of 110,000 gallons and is connected to the water system at the highest site elevations (150 to 160 feet MSL).

3.7 GROUNDWATER HYDROLOGY

3.7.1 Hanscom Air Force Base and Hanscom Field

Groundwater at Hanscom AFB is present predominantly under the following three conditions:

- As unconfined groundwater within sandy outwash deposits that overlie silty lacustrine sediments
- As slow-moving interstitial water within the lacustrine strata
- As semi-confined groundwater contained in sandy glacial tills that overlie bedrock
- As semi-confined groundwater within bedrock.

The lateral and horizontal extent of each of these three units across the base is discontinuous due to the glacial environment in which they were deposited. The bedrock is undulatory and, where it forms knolls or hills, the associated sedimentary deposits described above tend to be much thinner and in some cases are non-existent. This is particularily the case in the lacustrine strata, which act as an aquitard between the outwash deposits above and the underlying glacial tills. Although bedrock structure affects the configuration of the existing sedimentary strata, it does not play a major role in the control of the overall or general groundwater flow direction in the study area. Surface topography and surface hydrology seem to have the greatest influence in this respect. Bedrock hills do, however, exert an influence on local groundwater flow, beyond which flow returns to its normal course toward the Shawsheen River or one of its tributaries. As previously described, Hanscom AFB occupies a low basin-like area that is bounded by small hills and ridges composed of bedrock and glacial till. Groundwater at Hanscom AFB, as evidenced from hydrogeologic data, flows around elevated bedrock subcrops and outcrops. However, the overall flow is toward discharge points, namely the Shawsheen River and its tributaries.

The following sections describe the hydraulic characteristics of each geologic unit present in the area of the base.

3.7.1.1 Unconfined Glacial Outwash Aquifer

The glacial outwash deposits occur across the base at depths between 0 and 5 feet. The average thickness of this water-bearing unit is 10 to 15 feet at which point the underlying lacustrine sediments are encountered. Survey elevation and water-level data for wells screened in the outwash aquifer and located in the vicinity of the base are shown in Table 3-6; well locations are shown in Figure 3-14. The data indicate that the outwash deposits exist under saturated conditions and that the the water table is within 5 feet of the ground surface.

Figure 3-25 shows water table elevations and flow directions within the outwash across the base area, based on both hydrogeologic data and postulation. Groundwater flow in the outwash aquifer is generally in a northeast direction, although the bedrock surface exerts considerable control over local flow direction. For example, in the northwest corner of Hanscom Field, groundwater flows in a northwesterly direction between two higher elevated bedrock subcrops toward Elm Brook (Weston, 1983). Reference is made in subsequent sections of this report to the area between these subcrops as the "northwest exit pathway."

Roy F. Weston, Inc., has estimated the flow in this direction to occur at a relatively low rate of approximately 20,000 gallons per day. In comparison, flow in the easterly and northeasterly directions has been computed by Weston to be 240,000 gallons per day and 1,720,000 gallons per day, respectively (Weston, 1984).

TABLE 3-6

SUMMARY OF SURVEY ELEVATION AND WATER LEVEL DATA
FOR WELLS IN THE OUTWASH AQUIFER

Well No.*	Top of Ground (Ft. MSL)	Water Level Elevation (Ft. MSL)		
		2/4/83	2/18/83	3/17/83
CW-1A	129.8	124.67	123.46	125.63
CW-3A	124.2	120.25	119.57	119.76
CW-5A	126.4	121.64	121.37	122.96
CW-6A	126.0	122.78	122.19	123.18
RFW-7	131.6	126.59	126.57	129.37
RFW-8	132-7	129.17	129.45	132.23
RFW-9	125.7	120.10	119.94	120.76
RFW-10	127.5	119.29	118.66	119.47

* See Figure 3-14 for well locations.

Source: Weston, 1983

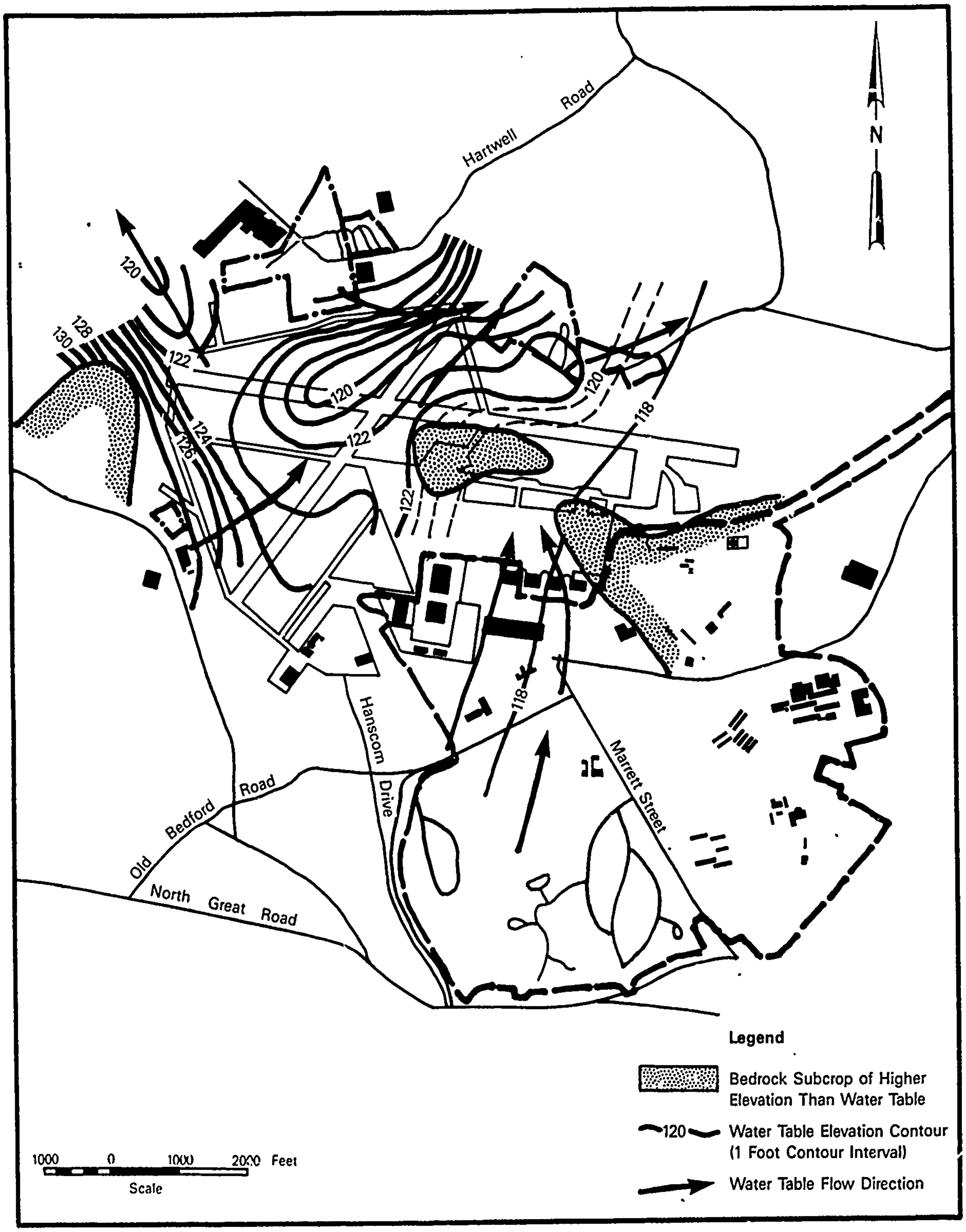


Figure 3-25. Potentiometric Surface Map and Flow Directions of Surficial Aquifer at Hanscom AFB and Hanscom Field.

may be present in the shallow groundwater would also be present in the storm drain system. The interception of shallow groundwater by storm drains is supported by Hanscom AFB water quality data, which is discussed in Section 3.3.

3.7.1.2 Lacustrine Aquitard

The lacustrine deposits underlying the outwash deposits occur over much of the base and exist under saturated conditions. The hydraulic conductivity of these deposits is assumed to be several orders of magnitude lower than the overlying outwash material due to their fine-grained nature. Typical hydraulic conductivity values for silt deposits such as those deposited in glacial Lake Concord range from 0.01 to 10 gal/day/ft^2, which is low compared to values associated with sands (100 to 100,000 gal/day/ft^2) (Freeze and Cherry, 1979). There are no piezometric data available for the aquitard that would give an indication of the direction of groundwater flow within this unit. However, overall flow beneath the base would seem to be preferentially oriented within the more permeable sands that overlie and underlie the lacustrine material and, therefore, it is assumed that flow within the aquitard is in this same preferred direction.

3.7.1.3 Semi-confined Glacial Till Aquifer

The sandy glacial till deposits form a blanket of saturated permeable material over bedrock. Groundwater within the till aquifer is believed to occur under semi-confined conditions where overlain by lacustrine silts. During Weston's investigation in the northwest portion of the base, piezometric heads were found to be nearly 1 foot higher than those within the shallow outwash deposits. This is evidence of a vertically upward hydraulic gradient of 0.1 or more within the flow system in this location.

In those areas where the till is not overlain by lacustrine deposits, the groundwater surface is unconfined. The piezometric surface of wells intersecting the till material in these areas is essentially the same as in the shallower wells within the outwash sediments. Therefore, the groundwater flow direction within the till is believed to be parallel to the flow within the outwash aquifer (Weston, 1983).

3.7.1.4 Bedrock

The water-bearing nature of the bedrock in the base area has not been determined. However, granitic material typically has low primary hydraulic conductivity values of between 10^{-7} to 10^{-3} gal/day/ft^2 (Freeze and Cherry, 1979). Secondary hydraulic conductivity values for granite, i.e., values that account for fracturing within the subject material, are higher (10^{-1} to 10^{3} gal/day/ft^2), but still are relatively low. These secondary values are comparable to those for the lacustrine deposits. Although it is not known whether the hydraulics of the bedrock material have an effect on the groundwater flow within the overlying units, the dramatic variation in the bedrock surface relief, as described previously, certainly influences the near-surface groundwater flow.

3.7.2 Prospect Hill Electronics Research Annex

Groundwater is present in the bedrock that comprises Prospect Hill, however, its occurrence is probably limited to fractures and other secondary openings. Groundwater at the facility is not a source of water for operations. In the lowland areas surrounding the facility, outwash deposits likely constitute the principal water-bearing unit, based on their relatively high permeability and continuity over the area.

The contour of the water table, as in other geologically similar areas, generally parallels the topography. In other words, its highest elevations are beneath hills and uplands and the lowest areas are beneath lowlands near streams or ponds.

Groundwater flow is in a southwest direction and moves toward surface discharge zones such as small streams and ponds. Data pertaining to the rate of groundwater flow in the vicinity of Prospect Hill are not available.

3.7.3 Maynard Geophysic and Sudbury Electronics Research Annexes

All three of the major geologic units that exist in this area and that are described in Section 3.5.3 contain groundwater (Perlmutter, 1962). The water in all is generally hydraulically continuous, but the till and bedrock have such low permeabilities that flow of water through them or between them and the overlying outwash is very slow. Water in the bedrock occurs only in limited quantities along fractures, and the till is so compact and has such low permeability that water cannot be pumped by wells in appreciable quantities. The outwash deposits are the most permeable, and also the most extensive deposits available for well development. Therefore, they constitute the principal aquifer and principal source of groundwater in the area.

Groundwater occurs mostly under water-table conditions, although locally there may be some degree of confinement or retardation of water movement owing to lenses of silt or sand of differing permeability. The shape of the water table generally parallels the topography. The groundwater table occurs at depths below the ground surfaces between 0 and 10 feet (Perlmutter, 1962). The swamp lands surrounding the site are indicative of the shallow water table in the area. However, in some areas and particularly during dry periods, the water table is found at depths as great as 20 feet.

High points on the bedrock surface act as obstacles to the movement of groundwater in the outwash unit and distort the pattern of flow locally. These bedrock peaks appear topographically as hills. The Maynard facility is located on one such hill and another hill transects the Sudbury facility. Groundwater flow, which is generally to the northeast toward major points of discharge such as the Assabet River, is diverted by the bedrock peaks such that flow is around these "obstacles."

3.7.4 Solar Radio Observatory at Sagamore Hill

Information concerning the groundwater hydrology at Sagamore Hill is limited. However, there are inferences that can be made based on the topographic setting of the facility and available well log data. Groundwater exists within an aquifer that consists of granitic bedrock material (Gay and Delarey, 1980). Since granite usually has a low primary hydraulic conductivity and low transmissivity, it is likely that, in this case, the material is weathered and fractured or in some other way altered such that water flows more readily. The outlying swampy areas are groundwater discharge zones. Groundwater flows in all directions away from Sagamore Hill toward the surrounding swamp discharge areas.

3.7.5 RADC Electromagnetic Test and Measurement Facility

From the evaluation of available geologic and topographic data, the RADC EMTF appears to be located in a groundwater recharge area. Precipitation infiltrates the elevated North Ridge area and replenishes the subsurface water supply that exists within the till deposits. The aquifer is probably similar to many coastal systems in that underlying the fresh water is a zone of salty water, and an interface of mixed, brackish water exists between the two zones. Groundwater flows toward Plum Island Sound to the north and east, the Ipswich River to the south, the Eagle Hill River to the northwest, and toward the swamp lands to the southwest.

3.7.6 Fourth Cliff Recreation Annex

Groundwater hydrologic data for the Fourth Cliff area are limited, however, several inferences can be made from the information that is available. Fourth Cliff, as the name implies, stands considerabley higher than the surrounding areas and is located at the north end of a spit-like structure of glacial origin. The water that exists within the glacial till that constitutes the cliff occurs at elevations at least as high as the levels of the surrounding water bodies and could occur at higher levels. Groundwater movement is in the direction of discharge, which is toward the outlying water bodies.

3.7.7 North Truro Air Force Station

Groundwater in the North Truro area exists in an unconfined aquifer consisting of outwash deposits. Subsurface water supplies in North Truro, as throughout Cape Cod, are derived and recharged solely from precipitation that has reached the water table. Due to the loose and sandy nature of the soils, there is very little overland runoff and most of the precipitation percolates directly to the water table. When overland flow does occur, such as over frozen ground, the water generally settles in some undrained depression and then infiltrates the ground. Groundwater discharge by subsurface outflow from the North Truro area is primarily directly to the ocean.

As in the case of most coastal aquifer systems, the fresh groundwater reservoir in North Truro is underlain by salty groundwater with a zone of mixed, brackish water at the interface between the two zones (Sterling, 1963). The depth to the top of the mixed zone or the amount of available fresh water will naturally fluctuate with seasonal variation in groundwater recharge and discharge. In addition to fluctuations due to changes in season, the availability of fresh groundwater depends on the amount withdrawn for use by the population and the rate of this withdrawal. In order to manage the groundwater resources in the area such that the fresh water resource is not depleted, a careful balance is kept between recharge and discharge/withdrawal.

3.8 GROUNDWATER QUALITY

3.8.1 Hanscom Air Force Base and Hanscom Field

3.8.1.1 Geochemistry

The groundwater quality throughout the Shawsheen River basin is generally good and chemically suitable for most uses. A summary of chemical analyses of groundwater is shown in Table 3-7. The wells from which the groundwater samples were drawn for these analyses are located throughout the

TABLE 3-7

CHEMICAL COMPOSITION OF GROUNDWATER IN THE SANDS AND GRAVELS IN THE SHAWSHEEN RIVER BASIN[1]

Constituent	Concentration (mg/l)		
	Maximum	Minimum	Median[2]
Silica (SiO_2)	16	10	13
Copper (Cu)	.40	.00	.03
Iron (Fe)	1.0	.00	.05
Manganese (Mn)	1.9	.01	.12
Calcium (Ca)	35.0	7.7	13.0
Magnesium (Mg)	9.0	1.5	3.2
Sodium (Na)	50.0	12.0	25.0
Potassium (K)	6.0	1.5	2.5
Bicarbonate (HCO_3)	86.6	20.7	26.8
Sulfate (SO_4)	45	13	20
Chloride (Cl)	79	23	40
Nitrate (N)	5.20	.05	1.10
Hardness (Ca + Mg as $CaCO_3$)	124	26	48
Alkalinity ($CaCO_3$)	71	15	22
pH (units)	8.4	6.0	6.4
Color (platinum-cobolt units)	35	0	5
Specific Conductance (micromhos per centimeter at 25°C)	480	140	250

1 Aquifer not specified; well log information not available.

2 Concentrations in mg/l unless otherwise noted.

Source: Gay and Delaney, 1981

basin. Analyses for nine representative wells located in the Bedford, Lincoln, and Lexington areas are given in Table 3-8. These wells were selected based on their proximity to the base. Their locations appear in Figure 3-26.

The hardness of the groundwater throughout the basin ranges from soft to moderately hard (0 to 120 mg/liter). Analyses from the nine wells closest to the base area do not indicate this large range, rather all of the available values are around 50 mg/liter, indicating that the water is soft.

At many places in the basin, groundwater contains dissolved iron and manganese concentrations that exceed the respective 0.3 mg/liter and 0.05 mg/liter limits for drinking water recommended by the National Academy of Sciences and the National Academy of Engineers (1974) (Gay and Delaney, 1981). High dissolved concentrations of these constituents in groundwater are common in swampy areas and water treatment is often required.

In summary, a review of the limited background geochemical data indi- [illegible] that the groundwater in the area of the base is generally of good q[illegible], with the one exception of having relatively high iron and manganese conc[illegible] All other constituents occur in normal concentrations as indicated by values given in Table 3-8.

3.8.1.2 Contamination

In response to concern expressed over the relationship between past waste disposal activities at Hanscom AFB and the detection of contaminants in the Town of Bedford's newly activated municipal well field, the Air Force implemented a series of hydrogeologic investigations, beginning during the summer of 1982, to identify potential sources of the contamination. The well field of concern consists of three wells, Nos. 10, 11 and 12 located north of Hartwell's Hill (see Figure 3-27). The wells draw from the upper outwash aquifer (see Section 3.7.1.1). These three wells are presently not being used for production due to unacceptable levels of various contaminants. Well Nos. 10 and 11 were taken off line early in 1984 due to

TABLE 3-8

CHEMICAL COMPOSITION OF GROUNDWATER IN THE BEDFORD, LINCOLN, AND LEXINGTON AREA

Well Number	Date of Sample	pH	Alkalinity as $CaCO_3$ (mg/l)	Hardness (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Potassium (mg/l)	Iron (mg/l)	Manganese (mg/l)	Silica (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Specific Conductance (micromhos)	Nitrate as N (mg/l)	Copper (mg/l)	Source of Data
W1*	5/9/74	--	20	50	7			23**	--	--	7	21	50	--	<2	--	1
W6*	12/23/74		12	45	6	--		12**	--	--	7	10	40	--	<2	--	1
W7*	12/23/74		40	51	13			40**	>.3	>.05	12	22	45	--	<2	--	1
W12+	12/23/74	6.7	31	49	14	3.4	27	4	.45	.55	13	22	39	235	1.4	.12	2
W23+	4/14/60	6.5	22	--	--	--	--	--	.06	--	--	--	8	--	.1	--	3
W69+	4/14/60	5.9	45	--	--	--	--	--	.30	.7	--	--	10	--	.1	--	3
W71+	4/25/60	6.1	26	--	--	--	--	--	.05	--	--	--	26	--	--	--	3
W72+	4/14/60	6.1	62	--	--	--	--	--	.08	--	--	--	15	--	6.0	--	3
W84+	4/25/60	5.0	17	--	--	--	--	--	.05	.4	--	--	28	--	--	--	3

* Well number designated by USGS.
\+ Well number designated by local town officials.
** Dissolved sodium plus potassium values.

Source of Data:
1. U.S. Geological Survey
2. State Health Department
3. Massachusetts Water Resources Commission.

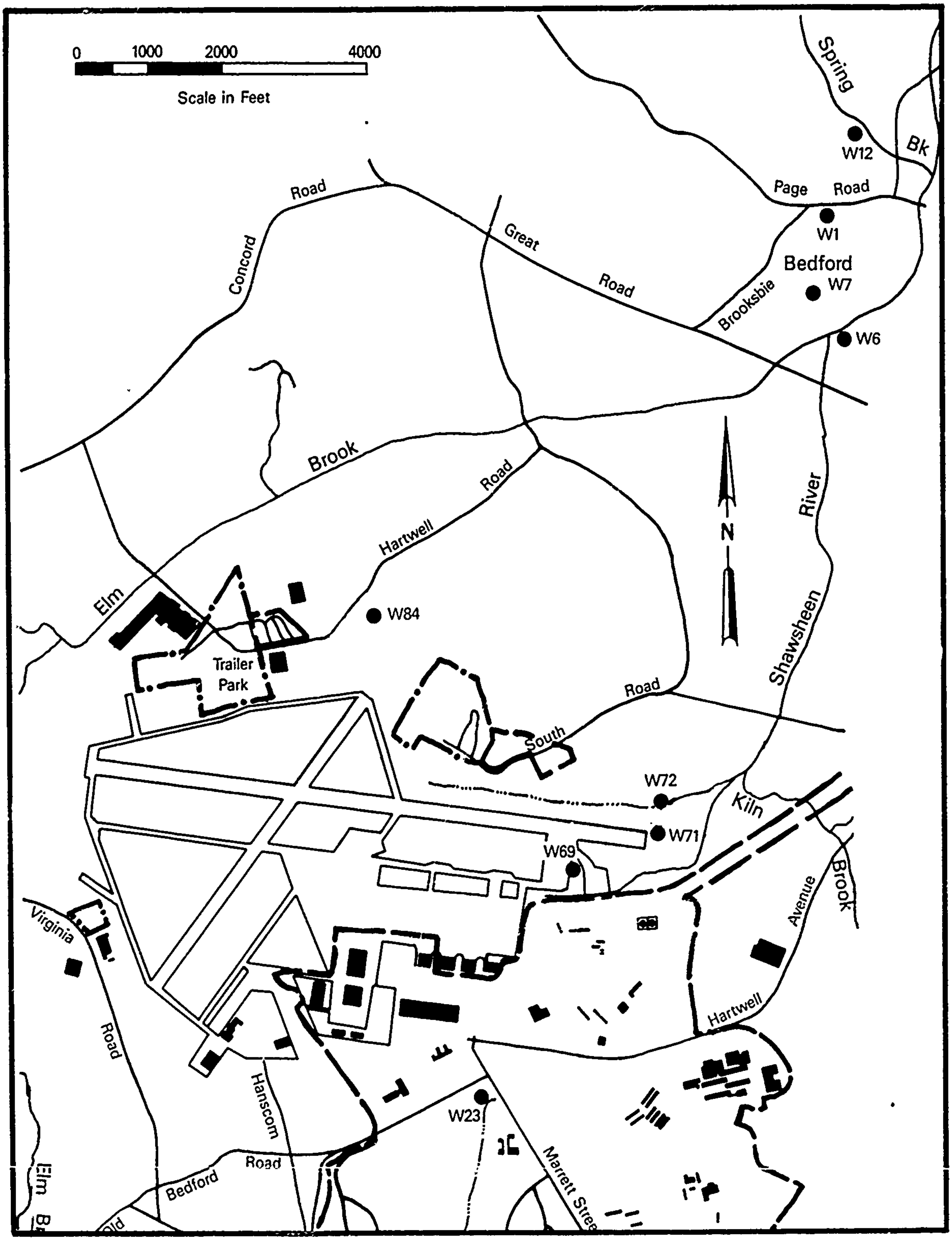


Figure 3-26. Locations of Nine Representative Wells in the Area of Hanscom AFB.

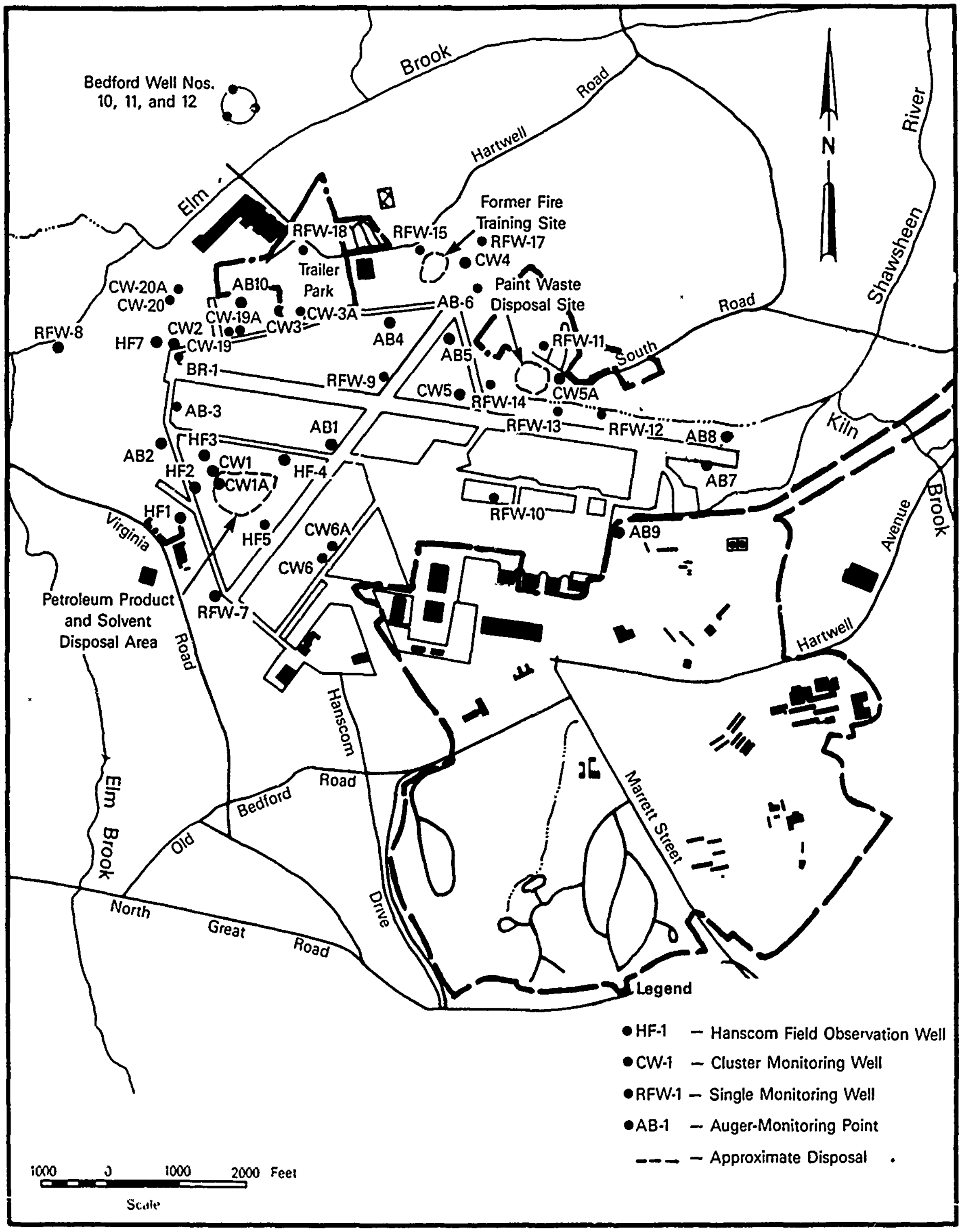


Figure 3-27. Locations of Monitoring Wells and Monitoring Points at Hanscom AFB and Hanscom Field.

unacceptable concentrations of iron and mangnese and trace concentrations of trichloroethane, toluene, dichloroethylene, and tetrachloroethylene. Well No. 13 was taken off line in April, 1984 when concentrations of benzene approached the maxinum recommended level of 6.6 ppb (The Sun, 3/84, 4/84, and 6/84).

The hydrogeologic investigations are discussed in the following sections as they were conducted in chronological stages:

- Initial Air Force investigation
- Initial Weston investigation
- Supplemental Weston investigation.

The investigations provided data that resulted in the following major conclusions:

- There exist at least three sources of groundwater contamination at Hanscom Field (see Figure 3-27)
  - Petroleum product and solvent disposal area
  - Former fire training area
  - Paint waste disposal site
- The Bedford well field is not likely to be affected by contaminants released from the Hanscom Field sources.

Initial Air Force Investigation

The area of concern during the initial stage of the hydrogeologic investigation was a reported petroleum product and solvent disposal site located on the west side of the airfield (see Figure 3-27). The site is described in Section 4. During the first phase of the investigation, in the summer of 1982, six observation wells, designated HF-1 through 5 and HF-7 and shown in Figure 3-27, were installed in the vicinity of the disposal site. Two sets of groundwater samples were collected by Air Force personnel from the six wells, and analyzed by the Air Force Occupational and Environmental Health Laboratory (OEHL) between August and October 1982. The samples were analyzed for volatile halocarbons, volatile aromatics, and metals. A summary of analytical results for those compounds detected in the samples is given in Table 3-9. These results confirmed the presence of a source of groundwater contamination in this area. Both TCE and 1,2-dichloroethylene (DCE) were found to be present in relatively high concentrations (291.0 ug/liter and 30.2 ug/liter, respectively) in the area of the suspected disposal site. Toluene was also found in concentrations at or slightly above the EPA-established quantitative limit. Chromium and lead were detected in HF-3 in concentrations that exceed the EPA limits; however, these metals were not detected in other samples.

Initial Weston Investigation

Following confirmation of the presence of a disposal site on the west end of the airfield and that it was a probable source of groundwater contamination by way of the northwest exit pathway, Roy F. Weston, Inc. was retained by the Air Force to assess the potential for the site to contribute to water quality degradation at the new Bedford well field. Weston installed 14 additional monitoring wells and 10 shallow auger-boring monitoring points (see Figure 3-27). Groundwater samples from these wells, as well as from the six monitoring wells constructed by the Air Force, were sampled and analyzed for the volatile organics fraction (VOA) of the EPA Priority Pollutants List. During this stage of the hydrogeologic investigation, two additional sources of groundwater contamination were confirmed to exist at Hanscom Field by water quality testing. These two areas, the former fire training site and the paint waste disposal area, are identified on Figure 3-27 and are described in Section 4. Table 3-10 contains the analytical data for the 20 samples analyzed.

From a review of the data in Table 3-10, it is seen that groundwater from wells CW-1A, CW-4, and CW-5A was heavily contaminated with a variety of VOA compounds. Samples from Air Force wells HF-2, HF-3, and HF-5 continued to contain contaminants but at much lower concentrations than the wells installed by Weston.

TABLE 3-9

RESULTS OF ANALYSIS OF GROUNDWATER FROM INITIAL AIR FORCE INVESTIGATION

Well No.	Carbon Tetrachloride Sampled 8/82	Carbon Tetrachloride Sampled 10/82	Chloroform 8/82	Chloroform 10/82	Trichloro-ethylene 8/82	Trichloro-ethylene 10/82	1,2-Dichloro-ethylene 8/82	1,2-Dichloro-ethylene 10/82	Toluene 8/82	Toluene 10/82	Arsenic 8/82	Arsenic 10/82	Chromium 8/82	Chromium 10/82	Lead 8/82	Lead 10/82
HF-1	<0.1 (ND)	--	<0.1 (ND)	--	<0.1 (ND)	--	<0.1 (ND)	--	4.5	--	--	--	--	--	--	--
HF-2	<0.1 (ND)	--	0.2	--	<0.1 (ND)	--	0.4	--	<3.0 (Trace)	--	--	--	--	--	--	--
HF-3	<0.2 (Trace)	--	<0.1 (ND)	--	<0.1 (ND)	--	6.0	--	<3.0 (Trace)	--	13.0 (Trace)	--	53.0	--	65.0	
HF-4	1.2	<0.1 (ND)	<0.1 (ND)	--	0.2	<0.1 (ND)	27.5	<0.1 (ND)	3.0	<3.0 (Trace)	--	<10.0 (ND)	--	<50.0 (ND)	--	<50.0 (ND)
HF-5	2.6	<0.1 (ND)	<0.1 (ND)	--	<0.1 (ND)	291.0	30.2	24.3	4.0	4.9	--	<10.[illegible] (N[illegible])	--	<50.0 (ND)	--	<50.0 (ND)
HF-7	<0.1 (ND)	< 0.1 (ND)	<0.1 (ND)	--	<0.1 (ND)	< 0.1 (ND)	0.3	<0.1 (ND)	3.0	<3.0 (Trace)	--	<10.0 (ND)	--	<50.0 (ND)	--	<50.0 (ND)

ND - None Detected, less than the detection limit.

Trace - Present but less than the quantitative limit. (ug/l)

All concentrations are in micrograms per liter.

(Source: Weston, 1983)

TABLE 3-10

RESULTS OF ANALYSIS OF GROUNDWATER FROM
INITIAL WESTON INVESTIGATION

Chemical Name	Well Number									
	CW-1A	CW-1	CW-2	CW-3A	CW-3	CW-4	CW-5A	CW-5	CW-6A	CW-6
Benzene	87	<1	<1	21	<1	<1	27	<1	<1	<1
Carbon Tetrachloride	<1	<1	TR	<1	<1	<1	<1	<1	<1	<1
Chloroform	235	<1	TR	TR(5)	<1	<1	130	<1	<1	<1
1,1-Dichloroethane	<1	22	TR	<1	<1	19	<1	<1	<1	<1
1,1-Dichloroethylene	<1	TR	<1	<1	<1	TR	89	<1	<1	<1
1,2-(Trans)Dichloroethylene	71	24	<1	<1	<1	1,400	31,000	<1	<1	<1
Ethyl Benzene	240	<1	<1	<1	<1	<1	180	<1	<1	<1
Methyl Chloride	<1	<1	38	<1	<1	<1	11	<1	<1	<1
Methylene Chloride	<1	<1	<1	<1	TR	<1	250	13	<1	16
Tetrachloroethylene	78	<1	<1	<1	<1	<1	21	<1	<1	<1
Toluene	1,700	14	<1	TR	TR	29	8,800*	<1	<1	<TR
1,1,1-Trichloroethane	<1	<1	24	<1	<1	124	740	<1	<1	<1
Trichloroethylene	10,950	TR(3)	<1	<1	<1	77	12,000	<1	<1	<1
Vinyl Chloride	<1	<1	<1	<1	<1	99	<1	<1	<1	<1

* Average of two samples.

TR = 1 < X < 10, TR(X) = Estimated.

TABLE 3-10 (continued)

RESULTS OF ANALYSIS OF GROUNDWATER FROM
INITIAL WESTON WESTON INVESTIGATION

Chemical Name	RFW-7	RFW-8	RFW-9	RFW-10	HF-1	HF-2	HF-3	HF-4	HF-5	HF-7
Benzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbon Tetrachloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	TR	<1
1,1-Dichloroethylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-(Trans)Dichloroethylene	<1	<1	<1	<1	<1	<1	<1	<1	20	<1
Ethyl Benzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methyl Chloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methylene Chloride	<1	33	<1	<1	TR	<1	<1	<1	<1	<1
Tetrachloroethylene	<1	<1	<1	<1	<1	<1	<1	<1	10	<1
Toluene	<1	<1	<1	<1	TR	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	<1	TR	<1	<1	<1	<1	<1	<1	40	<1
Trichloroethylene	<1	<1	TR	<1	TR	29	33	TR	240	TR
Vinyl Chloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

* Average of two samples.

TR = 1 <X <10, (TR(X) = Estimated.

Source: Weston, 1983

Shallow well CW-1A, located within the approximate boundaries of the previously confirmed disposal site, contained seven VOA compounds, with a total VOA hydrocarbon loading of about 13 mg/liter. Deep well CW-1, located immediately adjacent to CW-1A, contained only low levels of VOA compounds, which are believed to have leaked from the shallow aquifer during drilling. The Air Force wells surrounding the site contained only low levels of contaminants except for HF-5, indicating that contaminants from the disposal site had migrated at least a few hundred feet southeasterly in the shallow aquifer.

Deep well CW-4, located adjacent to the former fire training area, contained six VOA compounds, at a total VOA loading of less than 2 mg/liter. The mix of VOA compounds and their relative proportions found in samples from CW-4 were different from those found in wells near the petroleum product and solvent disposal area to the west. Based on this evidence, Weston concluded that the former fire training area was also a source of groundwater contamination.

Shallow well CW-5A was constructed within an area suspected to have been used for disposal of paint wastes and was the most heavily contaminated well. Eleven VOA compounds were detected, at a total VOA loading of 53 mg/liter. The mix and proportions of the compounds were different from those from wells near the petroleum product and solvent disposal area to the west, but were similar to those of samples taken near the former fire training area. Despite the similarity, the fire training area was believed to be a third and separate source of contamination based on reports from Air Force personnel. At that time, prior to the supplemental phase of the investigation, the lateral extent of the contamination was not known because no other shallow wells were located downgradient from well CW-5.

All other wells that were sampled and tested at Hanscom Field during the initial investigation activities were virtually free of all VOA compounds. It is possible that the few low levels detected in these remaining wells could have been the result of cross-contamination induced by drilling and well construction (Weston, 1983).

The potential for contaminant migration toward the Bedford well field, which was the immediate purpose of implementing the above-described investigation, does exist. However, Weston concluded that the potential was relatively low, based on data collected during the investigation, and that the well field was neither highly vulnerable nor susceptible to contaminant migration from former disposal sites at the air field (Weston, 1983; 1984).

Supplemental Weston Investigation

Following the completion of Weston's initial 1983 investigation, a supplemental investigation was begun in late 1983 to respond fully to the environmental issues raised by the initial findings. Twelve additional groundwater monitoring wells were installed at Hanscom Field during the supplemental field activities (see Figure 3-27). Eleven of these wells were installed in unconsolidated deposits and one well was installed in bedrock.

Two cluster wells, CW19/CW-19A and CW-20/CW-20A, were installed in the northwest exit to better define the potential mass flux of water through this pathway toward the Bedfore well field. Bedrock well BR-1 was drilled adjacent to CW-2 to assess the groundwater quality within the fractured bedrock in the vicinity of the northwest exit. Well RFW-18 was installed on the west flank of Hartwell's Hill, between and north of CW-3 and CW-4. Wells RFW-15 and RFW-17 were installed west and northeast of CW-4, respectively, in the vicinity of the former fire training area. Finally, four additional wells (RFW-11, RFW-12, RFW-13, and RFW-14) were installed in the vicinity of the paint waste disposal area and around existing well CW-5A to aid in delineating the areal extent and migration pattern of contaminated groundwater in this area.

During the supplemental investigation, the three most heavily contaminated monitoring wells (CW-1A, CW-4, and CW-5A) were sampled and analyzed for all priority pollutants, and five existing wells and the twelve new wells were sampled and analyzed for volatile organics mples were collected and analyzed in January and February of 1984. from the laboratory analyses are given in Tables 3-11 and 3-12. The first set of analyses of groundwater samples collected from wells in the vicinity of the northwest exit exhibited high levels of methylene chloride which were attributed to laboratory handling. Other than methylene chloride, only low levels of priority pollutant volatiles were detected in the January 1984 samples.

A January sample from BR-1 did not contain the 1,2- and 1,3-dichlorobenzene reported in Table 3-12. February samples showed no volatile priority pollutants except methylene chloride in BR-1, again though to have resulted from laboratory contamination. In conclusion, there was no significant organic contamination observed migrating towards the Bedford well field through the northwest exit.

Groundwater sampling and analysis from wells in the vicinity of the former fire training area indicated significant contamination downgradient of the site. However, analysis of water from well RFW-15, which is located upgradient, between the site and the Bedford wellfield, indicated that no contaminants (with the exception of methylene chloride) were present.

Sampling results from wells located in the paint waste disposal area indicated severe contamination. The absence of contaminants in RFW-14 indicated that contaminants from this area probably had not migrated northward toward the well field. Levels of contamination in CW-12 and CW-13 suggested that the contaminant plume was moving in easterly and southerly directions.

Resampling of monitoring well CW-1A in the vicinity of the petroleum product and solvent disposal area showed that volatiles, particularly trichloriethylene, were the major contaminants. Other priority pollutants were not detected at significant levels.

TABLE 3-11

RESULTS OF NON-VOLATILE ORGANIC ANALYSIS OF GROUNDWATER FROM SUPPLEMENTAL WESTON INVESTIGATION

Priority Pollutants Detected	Well No.*		
	CW-4	CW-5A	CW-1A
Di-N-Butyl Phthalate	58	ND	29
Diethyl Phthalate	ND	18	51
Phenol	ND	36	ND
Arsenic	ND	10.2	16.1
Lead	ND	66.8	ND

All results in ug/l.

All other priority pollutant acid & base neutrals, metals, and CN not detected.

ND - Not detected

* See Figure 3-14 for well locations.

Source: Weston, 3/1984

TABLE 3-12

RESULTS OF VOLATILE ORGANIC ANALYSIS OF
GROUNDWATER FROM SUPPLEMENTAL WESTON INVESTIGATION

Volatile Priority Pollutants Detected	Detec. Limits	CW-2 Jan	CW-2 Feb	BR-1 Jan	BR-1 Feb	CW-3 Jan	CW-3 Feb	CW-3A Jan	CW-3A Feb	RFW-8 Jan	RFW-8 Feb	HF-7 Jan	HF-7 Feb	RFW-18 Jan	RFW-18 Feb	CW-19 Jan	CW-19 Feb	CW-19A Jan	CW-19A Feb	CW-20 Jan	CW-20 Feb	CW-20A Jan	CW-20A Feb
Bromoform	0.20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	0.52	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	0.07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	0.13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--
Trans-1,2-Dichloroethylene	0.10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	0.25	59	24	66[D]	36	74	--	7	--	91	--	75	--	9	--	51	--	9	--	94	--	8	--
Tetrachloroethylene	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethylene	0.12	--	--	3.7[D]	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoethane	1.18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	0.15	--	--	--	--	--	--	--	--	--	--	1.2	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	0.32	--	--	--	--	--	--	--	--	--	--	1.5	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	0.18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unidentified Peaks	None	2	--	2	--	6	--	2	--	4	--	2	--	--	--	3	--	--	--	6	--	--	--

D = Duplicate

-- = Not detected at detection limit; see Figure 3-14 for well locations

All results in ug/l

TABLE 3-12 (continued)

RESULTS OF VOLATILE ORGANIC ANALYSIS OF
GROUNDWATER FROM SUPPLEMENTAL WESTON INVESTIGATION

Volatile Priority Pollutants Detected	Detect. Limits	Wells In FFTA			Wells In Paint Waste and Infield Areas					
		CW-4 Jan	RFW-15 Jan	RFW-17 Jan	CW-5A Jan	RFW-11 Jan	RFW-12 Jan	RFW-13 Jan	RFW-14 Jan	CW-1A Jan
Bromoform	0.20	--	--	--	1.2[D]	--	--	--	--	--
Chloroethane	0.52	--	--	--	1.8[D]	--	--	--	--	--
Chloroform	0.05	--	--	1	--	--	97	107	--	15
1,1-Dichloroethane	0.07	533	--	--	17.7	--	--	--	--	--
1,1-Dichloroethylene	0.13	189	--	--	1,211	--	178	868	--	--
Trans-1,2-Dichloroethylene	0.10	70,048	--	--	71,310	3,146	6,335	75,121	--	200
Methylene Chloride	0.25	263	100	99	751	5	701	890	94	8.5
Tetrachloroethylene	0.03	3.4	--	--	26		--	--	--	--
Trichloroethylene	0.12	3,299	--	20	51,381	545	5,752	191,524	--	2,400
1,1,1-Trichloroethane	0.03	1,737	--	--	3,216	1	669	3,224	--	--
1,2-Dichloroethane	0.03	30	--	--	--	--	--	--	--	--
Bromoethane	1.18	--	--	--	176[D]	--	--	--	--	--
1,2-Dichlorobenzene	0.15	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	0.32	--	--	--	--	--	--	--	--	-
Vinyl Chloride	0.18	652,922	--	--	--	--	--	--	--	--
Unidentified Peaks	None	--	--	--	--	1	--	--	--	5

D = Duplicate

-- = Not detected at detection limit

All results in ug/l

Source: Weston, 3/1984

In addition to better defining the extent of contamination at Hanscom Field, results from the supplemental investigation activities were used to corroborate the assessments made regarding the volume and flow of groundwater in the Hanscom Field area. The cross-sectional area of groundwater flow through the northwest exit to Elm Brook has been re-estimated to be 16,000 sq[illegible] feet, an increase from the original estimate of 400 square feet. This change was made based on the finding that a bedrock subcrop, believed to exist near the northwest outlet, does not exist. This conclusion was based on the presence of saturated conditions above bedrock in RFW-18. However, RFW-18 also indicates a strong hydraulic gradient from Hartwell's Hill toward Hanscom Field. Thus, contaminant migration is hydraulically restricted from passing through the northwest exit from Hanscom Field to the Bedford well field.

Hydraulic conductivity values calculated using data from the new wells were lower than estimates made in the 1983 report. Also, the seepage velocities and corresponding flow rates presented in the 1983 report were in error because effective porosity was not accounted for. The reassessment of results gave flow velocities in unconsolidated deposits that range from less than 0.3 feet to less than 3 feet per day. These estimates are lower than an earlier estimate of 3 feet per day. The resulting estimated groundwater flow rate through the northwest exit was the same as originally estimated in the 1983 report, 20,000 gallons per day.

The analytical and hydrologic data collected during the supplemental investigation supported the findings of the initial April 1983 study. Most importantly, the supplemental study confirmed that the groundwater and stormwater quality exiting Hanscom Field by the northwest pathway is not contaminated with volatile organic compounds (Weston, 1984).

3.8.2 Prospect Hill Electronics Research Annex

Information pertaining to groundwater quality at Prospect Hill is not available. The groundwater supply in the outlying areas is assumed to be of generally good quality based on its extensive use. There have been no reports of groundwater contamination at the site.

3.8.3 Maynard Geophysics and Sudbury Electronics Research Annexes

Chemical analyses of water within the outwash aquifer indicate that the water is soft, with hardness values ranging from 10 to 58 ppm. The pH values are 7.0 or lower. The concentrations of most of the chemical constituents are within the limits recommended by the U.S. Public Health Service (1946) for drinking water (Perlmutter, 1962). However, the concentrations of iron and manganese have been found to be three times as high as the generally accepted standards of 0.3 ppm and 0.05 ppm, respectively. High iron and manganese concentrations are commonly found in groundwater in swampy areas.

The water in bedrock generally differs from the outwash water in its relatively high pH (7.9) and bicarbonate content (83 ppm) (Perlmutter, 1962). There have been no reports of groundwater contamination at the Maynard and Sudbury annexes, however, potential sources of contamination do exist on the facilities, such as: (1) salt water intrusion, (2) station-operated sewage treatment plant, (3) underground fuel tanks, and (4) shop operations (i.e., generation of waste oils, solvents and dielectric fluids).

3.8.4 Solar Radio Observatory at Sagamore Hill

Groundwater quality in the Sagamore Hill area is generally good, and the water is suitable for most uses. The hardness of the water is predominantly moderate with values around 110 mg/liter. The pH levels reported indicate acidic conditions. Analysis results of samples collected from the well at the site showed a sodium content of 26.0 mg/liter and 26.2 mg/liter in 1963 and 1973, respectively (Gay and Delaney, 1980). These values exceed the levels recommended by the State of Massachusetts Drinking Water Regulations. In addition, dissolved manganese concentrations in the past have exceeded the 0.05 mg/liter limit for drinking water recommended by the National Academy of Sciences and the National Academy of Engineering (1973) (Gay and Delaney, 1980). The manganese problem is common for wells located in or near swamp lands, as in the case of the Sagamore Hill well. The high sodium concentrations are not explained in the literature. Results from chemical analyses of groundwater at Sagamore Hill in August 1963 are shown in Table 3-13.

There have been no reports of groundwater contamination problems at this site other than the high constituent levels described above. The pesticides and herbicides described in Section 3.3.4 as being present in the soil downslope from the antenna do not present a potential for groundwater contamination due to the low permeability of the subsoil, the probable small quantity of the substances that remain, and the dilution and dispersion that will occur over time.

3.8.5 RADC Electromagnetic Test and Measurement Facility

The groundwater supply in the Ipswich area is generally of good quality. However, it is known for its high concentrations of iron and manganese, and occasional high chloroform content. Although the ETMF has resigned from using the local water supply for drinking, the State finds no problems with the water quality and the water is provided to area residents.

3.8.6 Fourth Cliff Recreation Annex

Groundwater quality data for Fourth Cliff are not available. However, based on the location of the site, the water probably has a high saline content and cannot be used for most purposes without treatment. No specific chemical or analytical background groundwater data were available for review.

There has been one report concerning potential contamination of groundwater at Fourth Cliff. This involved a sewage release from the subsurface sewage disposal leach field in September 1982. The Bioenvironmental Engineering Services (BES) Office at Hanscom AFB was notified and

TABLE 3-13

CHEMICAL ANALYSIS OF GROUNDWATER AT SAGAMORE HILL

Constituent	Concentration (mg/1)
Calcium	31.0
Magnesium	7.9
Sodium	26.0
Iron	0.03
Manganese	0.08
Silica	24.0
Sulfate	13.0
Chloride	6.2
Specific Conductance (mhos)	320.0
Ph	7.8
Alkalinity as $CaCo_3$ (mg/1)	143.0
Hardness	110

Source: Gay and Delaney, 1980

subsequently Air Force personnel performed a visual survey and sampled the suspected sewage water for fecal coliform analysis. The visual survey revealed a liquid seeping from the ground in the leach field area that had the odor and grayish color of sewage. Analysis of the samples indicated the presence of fecal coliforms confirming a seepage of sewage. Because groundwater is not used for drinking water at Fourth Cliff, the primary concern was for the coastal waters.

3.8.7 North Truro Air Force Station

The quality of groundwater at the North Truro AFS is potentially suitable for domestic, agricultural, and commercial uses. The water is soft, with hardness usually ranging from 21 to 27 parts per million. The pH of the water is slightly acidic, usually varying between 6.2 and 7.0. Water analysis results typical of samples taken from the station supply well are shown in Table 3-14.

Typically, analytical results indicate that the groundwater meets the accepted standard for a drinking water source. All of the physical and chemical values are within normal and acceptable limits, with no indication of any unusual tendency to corrosiveness (Sterling, 1963).

No pollution incidents were found to have occurred at the station. The only potential source of groundwater contamination at this facility has been saltwater encroachment, which could result in high chloride concentrations in the fresh groundwater supply. There was, however, a groundwater contamination problem in the North Truro area caused by a gasoline leak from a gasoline station near Provincetown. The leak had an effect on the groundwater in the Provincetown area and, due to the good quality and large supply of groundwater at the North Truro Air Force Station, the Town of Provincetown, in its actions to mitigate the contamination problem, requested and received use of the station's surplus water supply.

TABLE 3-14

TYPICAL GROUNDWATER ANALYSIS AT
NORTH TRURO AIR FORCE STATION

Constituent	Concentration (mg/1)
Calcium	4.9
Magnesium	3.7
Sodium	19.2
Potassium	1.0
Bicarbonate	11.0
Carbonate	0.0
Sulfate	7.0
Chloride	37.0
Fluoride	0.1
Manganese	0.00
Iron	0.01
pH	6.5
Specific Conductance (mhos @ 25°C)	120.0
Dissolved Solids (calculated)	96.0
Hardness as $CaCO_3$	25.0
Alkalinity	15.0

Source: Commonwealth of Massachusetts, Water Resources Commission, 1975

3.9 BIOTIC ENVIRONMENT

3.9.1 Hanscom Air Force Base and Hanscom Field

The land area within a two-mile radius of Hanscom AFB and Hanscom Field includes the Great Meadows National Wildlife Refuge. The refuge, located northwest of the base, is the habitat of several current and historical rare plant and animal species. This wildlife presently exists under the protection of the national refuge (see Appendix E) (MNHP, 1984). There are no rare species on the base or in the nearby surrounding area.

3.9.2 Prospect Hill Electronics Research Annex

The area surrounding the Prospect Hill facility consists of dry, open woods. Unusual plant species occur to the east and south on the more open ledges within a one-mile radius of the summit on which the radio facility is situated. None of these species are currently considered rare (MNHP, 1984).

3.9.3 Maynard Geophysics and Sudbury Electronics Research Annexes

The biotic environment within a one-mile radius of the Maynard-Sudbury facility consists of wooded swamps and moist woods. This area is the home of one rare species, the blue-spotted Salamander, Ambystoma laterale. The salamander is rare throughout the state and is particularly vulnerable during the early spring breeding season (MNHP, 1984).

3.9.4 Solar Radio Observatory at Sagamore Hill

There are no reported occurrences of rare plants or animals within a one-mile radius of Sagamore Hill (MNHP, 1984).

3.9.5 RADC Electromagnetic Test and Measurement Facility

There are no reported occurrences of rare plants and animals within a one-mile radius of the RADC ETMF (MNHP, 1984).

3.9.6 Fourth Cliff Recreation Annex

The immediate area surrounding the Fourth Cliff Recreation Annex is the home of a Tern colony that includes two rare bird species, the Least Tern (Sterna antillarum) and the Piping Plover (Charadrius melodius). Both are rare throughout the state. In addition, Fourth Cliff is a major migration stopover for the rare bird species, the Red Knot (Calidrus canutus). The area is a critical feeding habitat for the Red Knot. The birds stop in the Fourth Cliff area prior to their nonstop migratory flight to South America (MNHP, 1984).

3.9.7 North Truro Air Force Station

Within a one-mile radius of the North Truro Station there are several rare wildlife species. The Prickly Pear plant species, Opuntia humifusa is rare in the vicinity of the facility and throughout the state. Another rare plant species is the Broom Crowberry, Corema conradii. The one rare animal species that exists in the area of the facility is the Hoary Bat, Lasiurus cinereus (MNHP, 1984).

3.10 ENVIRONMENTAL SUMMARY

3.10.1 Hanscom Air Force Base and Hanscom Field

- A dual aquifer system exists at Hanscom AFB and comprises an upper unconfined aquifer consisting of outwash deposits and a lower semi-confined aquifer consisting of tills. These two units are separated by low-permeability lacustrine deposits.
- The bedrock surface exerts considerable control over local groundwater flow; however, the overall groundwater flow system is controlled by topography and surface hydrology.
- Groundwater flow is generally in the north or northeast direction.
- The outwash and till aquifers are not used as sources of water at the base due to low production rates. The water supply for the base, with the exception of the Air Force Trailer Home Park which uses Bedford well water, is the Quabbin Reservoir in western Massachusetts, provided by the Metropolitan District Commission.

- All three wells located in Bedford's new well field north of the Hartwell's Hill have been taken off line due to the detection of trace levels of TCE, and iron and manganese concentrations.

- Water from monitoring wells at Hanscom Field contains varying concentrations of TCE, DCE, toluene, and other volatile organic compounds.

- Surface water drainage is primarily controlled by the storm sewers throughout the base.

- The storm sewer system discnarges into the Shawsheen River and Elm Brook.

- Soils within the base area have been drastically disturbed by construction activities. These soils, however, reflect the properties of native soils existing prior to construction of the base. Hence, soils are similar to the native soils present outside the base perimeter.

- Most of the soils severely limit land use because of saturation.

3.10.2 Prospect Hill Electronics Research Annex

- Groundwater exists within bedrock beneath the facility, but probably only along fractures or other secondary openings.

- Groundwater does not exist in appreciable quantities in the Prospect Hill bedrock.

- Groundwater flow is in a southwesterly direction.

- Water is supplied to the site by the City of Waltham through a pump and pipeline system.

- There have been no reports of groundwater contamination at the facility.

- Shallow, well-drained soils are present at the facility, and major soil limitations are the depth to bedrock and the slope.

3.10.3 Maynard Geophysics and Sudbury Electronics Research Annexes

- The principal aquifer in the Maynard-Sudbury area is comprised of glacial outwash deposits.

- Water is supplied to the facilities from the Town of Maynard for which the source is the White Pond Reservoir, and from a number of wells located on site.

- Groundwater flow is generally in the northeast direction; however, the bedrock surface locally distorts the flow pattern.

- The outwash aquifer is used as the primary source of water in the area.

- Groundwater from the principal aquifer is generally of good quality. There have been no reports of groundwater contamination at the facilities.

- Surface water drains from the facilities to surrounding wetlands and eventually into the Assabet River.

- Because of the shallow water table in the lowlands and swamps, communication between the surface and groundwater is common.

- Soils within this area reflect the properties of the glaci[illegible] parent material. The lowlands are severely limited for poten[illegible] use because of saturation. The upland soils are limited by slo[illegible]

3.10.4 Solar Radio Obseratory at Sagamore Hill

- Groundwater occurs in a bedrock aquifer, which is used as the source of water at the facility. The granitic bedrock material is likely weathered and fractured, inducing a high hydraulic conductivity relative to unweathered and unfractured granite.

- Groundwater probably flows in all directions away from Sagamore Hill and toward the swamp land discharge zones.

- Water quality is generally good except for high sodium and manganese concentrations.

- Surface water is minimal and is directed off site by ditches and natural surface contours.

- Soils are highly permeable, thus having the potential to transmit liquid contaminants into the upper groundwater aquifer.

3.10.5 RADC Electromagnetic Test and Measurement Facility

- Groundwater probably is present within a glacial till aquifer.

- Water for facility operations is supplied by the Town of Ipswich. Bottled water is used for drinking.

- North Ridge is a groundwater recharge area.

- Groundwater flows in all directions away from North Ridge.

- Soils at the facility are of glacial origin and are usually deeper than 5 feet. The upland position of the facility results in the water table being deeper than 5 feet most of the year.

3.10.6 Fourth Cliff Recreation Annex

- Fourth Cliff is comprised of glacial till deposits under which lies bedrock consisting of sandstone, graywacke, shale, and conglomerate materials.

- Groundwater occurs at elevations at least as high as the surrounding water bodies, but could exist at higher elevations.

- Groundwater flows in the direction of discharge, i.e., toward the outlying surface water bodies.

- Groundwater is not the source of drinking water in the Fourth Cliff area, probably due to potential high saline content.

- The only reported potential source of contamination at the facility was seepage from the existing underground sewage disposal leach field.

3.10.7 North Truro Air Force Station

- Groundwater is present in a coastal aquifer consisting of sandy outwash deposits.

- Fresh groundwater is underlain by a salty water zone. The interface between the fresh water and salty water is a zone of mixed, brackish water.

- The coastal aquifer is used as the source of drinking water at the station and contains water of good quality.

- There have been no reports of groundwater contamination at the facility. The Town of Provincetown used the station's water supply after a local gasoline spill contaminated the Town's supply.

- Surface water is of limited extent and is not adversley impacted by the facility activities.

- High infiltration rates of the soils and deep aquifer preclude the presence of swamps and wetlands.

4.0 FINDINGS

This investigation focused on all hazardous material and waste management activities relevant to Hanscom AFB and the seven off-base support facilities under Air Force jurisdiction. Information regarding the storage, treatment, and disposal of hazardous wastes and materials was obtained from the following sources:

- A visit and tour of Hanscom AFB
- Available Hanscom AFB records
- Interviews with present and former Hanscom AFB employees conducted in person and by telephone
- Aerial reconnaissance of off-base facilities
- Contacts with Federal, State, and local environmental agencies and public works departments.

This section presents a summary of the following activities:

- Waste management plans
- Past waste management practices
- Hazardous material storage
- Fuel storage
- Spills and leaks
- On-site land disposal
- Fire training.

Information relating these activities over time is presented in Figure 4-1.

4.1 REVIEW OF PAST BASE ACTIVITY

4.1.1 Waste Management Plans

On February 23, 1973, Hanscom AFB adopted its first formal plan for the management of hazardous substances: The Oil and Hazardous Materials

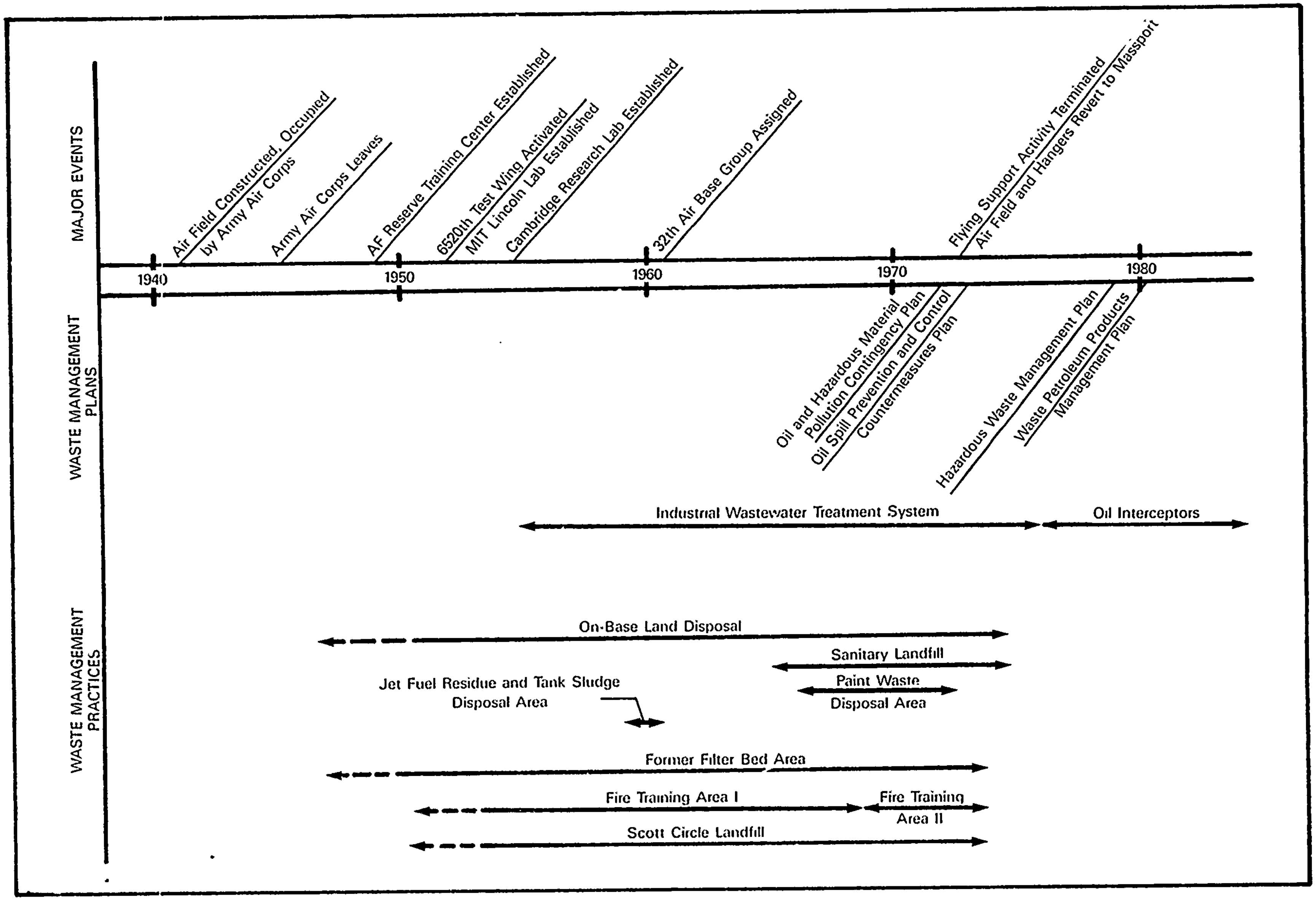


Figure 4-1. Summary of Major Events and Waste Management Practices at Hanscom AFB.

Pollution Contingency Plan. This plan was formulated in response to Paragraph 101 of the EPA Region I Environmental Plan, dated January 1972. The objectives of the Hanscom AFB plan were to:

- Assign duties and responsibilities
- Establish and identify emergency task forces
- Develop a system of notification, surveillance, and reporting
- Provide a schedule of dispersants, sorbents, and other chemicals to treat oil spills
- Establish enforcement and investigative procedures
- Provide direction on public information releases
- Outline instructions covering on-scene coordination.

Although the Contingency Plan of 1973 contains most of the necessary items for a Spill Prevention Control and Countermeasures Plan (SPCC), it did not include actions to be taken to prevent spills, as required by Part 112, Title 40 CFR. On June 23, 1974, the Civil Engineering Squadron drafted the Hanscom AFB Oil Spill Prevention Control and Countermeasures Plan. This SPCC Plan amended the 1973 Contingency Plan to include a comprehensive inspection and maintenance program to preclude tank failures.

In 1980, the Base Civil Engineering Squadron issued a Hazardous Waste Management Plan to comply with the EPA Hazardous Waste and Consolidated Permit Regulations, which were promulgated May 19, 1980. The plan, which was revised on November 15, 1982, provides for:

- Assignment of duties and responsibilities
- A system of notification, reporting, and recordkeeping
- Proper means of disposal or treatment of hazardous waste.

The Hazardous Waste Management Plan is applicable to all organizations generating hazardous wastes, including all tenants within the geographic boundaries of Hanscom AFB, except MIT Lincoln Laboratory. Seven on-base organizations were identified including AFGL, ABG/LG, ESD/SG, RADC/ET, ABG/DE, 2014th CS, and ESD/IM. Each of these organizations has a Hazardous Waste Coordinator and an alternate who are responsible for the organizations' compliance with the objectives and policies set forth in the Hazardous Waste Management Plan.

The Environmental Planning Office is the Office of Primary Responsibility (OPR) for implementing the Hazardous Waste Management Plan. The OPR's duties include keeping abreast of all aspects of hazardous waste regulations development and informing the coordinators of such, acting as the liaison for the coordinators' contract disposal activities, and preparing the annual report of hazardous waste activities. The Environmental Health Services Office and the Safety Office review hazardous waste management practices and generating activities with respect to safeguarding the health and welfare of base personnel. In addition, the Bioenvironmental Engineering Service (SGPB) performs field inspections, testing of waste materials (to determine whether they are hazardous), and training of base personnel in the proper techniques for handling hazardous materials. Other offices involved in the transport and handling of hazardous materials are Base Supply and Base Transportation. Base Supply coordinates with the SGPB when hazardous materials are received at the base. Base Transportation Coordinators handle all matters concerning proper packaging, marking, and labeling of hazardous materials according to DOT regulations and are responsible for the safe transport of hazardous materials to Fort Devens.

The Civil Engineering Squadron prepared the Plan for the Management of Waste Petroleum Products in October 1981. The purpose of this plan was to establish policies, assign responsibilities, and provide guidance for collection, storage, and deposition of waste petroleum products in an environmentally acceptable manner. This plan is applicable to all personnel within the base, including tenants and contractors that generate contaminated, used, or waste petroleum products.

4.1.2 Generation of Hazardous Waste

The generation of hazardous waste at Hanscom AFB has occured in a variety of Air Force shops and installations and by various non-Air Force organizations, such as the Army Air Corps, civilian agencies, DOD contractural agencies, the Civil Aeronautics Authority, and Commonwealth of Massachusetts, that have shared the base and/or airport facilities. Table 4-1 provides a summary of typical hazardous substances that have been generated from shops and installations that support flying activities. Although many of these shops remained after the flight line was terminated in 1973, their activity and subsequent generation of hazardous wastes was curtailed. Since 1974, hazardous wastes of a recurring nature are generated in only two areas on the base: the Protection Coating Shop (Building 1812) and the Motor Pool (Building 1642). In 1981, the Protection Coating Shop generated approximately four, 55-gallon drums of waste paint, lacquer, and thinner. The Motor Pool has a parts solvent bath that generated approximately 40 gallons of contaminated PD-680 solvent in 1981. The balance of hazardous wastes generated at Hanscom AFB is generally one-time wastes created by expiration of shelf-life dates or changes in laboratory practices or mission, resulting in surplus of chemicals.

Waste oil is also generated by a variety of organizations at Hanscom AFB. Table 4-2 provides a summary of waste-oil-generating organizations, quantities and storage locations in 1981. This inventory was prepared as part of the Plan for the Management of Waste Petroleum Products.

Table 4-3 presents a summary of quantities of waste oil and hazardous materials that were generated at Hanscom AFB and disposed of off-base from 1980 to 1983. Table 4-4 provides a list of waste chemicals that were generated on-base and removed by a hazardous waste contractor during 1981.

TABLE 4-1

TYPICAL HAZARDOUS SUBSTANCES GENERATED FROM SUPPORT OF FLYING ACTIVITIES

Support Shops & Installations	Typical Hazardous Materials Generated
1. Aero repair	
Inflight Refueling	Solvents, gasoline, jet fuel, methyl ethyl ketone, ethylene dichloride, petrol naptha
Hydraulic	Solvents, alcohol, hydraulic fluid
Electrical	Solvents
Instrument and Office Machine Repair	Solvents, lubricants, ammonia, alcohol
Pneudraulics (Pneumatic systems)	Solvents
Fuel System Repair	Solvents, gasoline, jet fuel, tetraethyl lead
Aircraft Repair and Reclamation	Solvents, gasoline, toluene, acetone, ethyl alcohol, ethyl acetate, caustic cleaners, greases, carbon monoxide
Pre-dock (Aircraft Washing)	Kerosene
Motorized and Ground Equipment Repair	Rust preventive compounds, gasoline, solvents, kerosene
2. Power Plant	
Engine Conditioning (Engine change, Engine Build Up, Engine Tear Down, Power Pack Repair, Propeller, Jet Engine Overhaul)	Gasoline, solvents, jet fuel, greases, tetraethyl lead lead oxides
Battery Shop	Sulfuric acid, sulfur dioxide, lead
3. Woodworking	Wood dust, glue,

TABLE 4-1 (continued)

TYPICAL HAZARDOUS SUBSTANCES GENERATED
FROM SUPPORT OF FLYING ACTIVITIES

	Support Shops & Installations	Typical Hazardous Materials Generated
4.	Machine Shop	Cutting oils, synthetic resins
5.	Welding	Decomposition products of welding rods, fluorides, lead oxides
6.	Paint Shop	Benzol, toluene, acetone, ethyl alcohol, petro, naptha, kerosene, turpentine, metallic paint pigments, lead mineral spirits, xylene, synthetic paint pigments
7.	Parachute, Leather, Rubber and Textile	Solvents, caustic cleaners, naptha, methyl ethyl ketone, toluene, ethylene dichloride
8.	Sheet Metal	
9.	Electroplating	Sodium cyanide, cadmium oxide
10.	Plumbing Shop	Lead, solder, greases
11.	Entymology	Insecticides, rodenticides, solvents, kerosene
12.	Body Shop (Motor vehicles)	Lead, solder, solvents
13.	Water Plant	Chlorine gas, lime, soda ash, fluorides
14.	Sewage Plant	Chlorine, H_2S
15.	Aviation Petrol Products Distribution	Gasoline, jet fuel, tetraethyl lead
16.	Fire Protection and Crash Rescue	Fire extinguishants-CB, Carbon Tetrachloride-, thermal decomposition products of extinguishants

TABLE 4-2

SUMMARY OF WASTE OIL GENERATION AT HANSCOM AFB IN 1981

Organization	Type of Waste Oil	Estimated Quantity (Gal)	Location of Storage Area	Remarks
Auto Hobby Shop ABG/SSR	90 wt oil, Engine Oil, Hydraulic Fluid	2,200	Near Bldg 1830	2,000 gal UG tank
Motor Pool ABG/LGTV	Lube Oil, Grease, Hydraulic Fluid	720	Bldg 1642	550 gal UG tank
Electric Power Production Shop ABG/DEMP	10-40, 10-30 Lube Oil, Diesel Fuel	1,500	Bldg 1817	750 gal above-ground tank
Refrigeration and Air Conditioning ABG/DEMMR	Refrigerating Oils	50-100	Bldg 1812	55 gal drum
Pavements and Grounds ABG/DEMG	Lube Oil	50	Bldg 1824	55 gal drum
Sheet Metal ABG/DEMSM	Water Soluble Cut-off Saw Oil	4	Near Bldg 1830	Generally recycled; occasional oil changes
Heat Shop ABG/DEMMH	Cutting Oils	0	--	Strained & reused
Base Service Station ABG/SVE	Lube Oil, Grease Hydraulic Fluid	1,500-2,000	Bldg 1639	500 gal UG tank use their own contractor for WPP sales

TABLE 4-2 (continued)

SUMMARY OF WASTE OIL GENERATION AT HANSCOM AFB IN 1981

Organization	Type of Waste Oil	Estimated Quantity (Gal)	Location of Storage Area	Remarks
MIT/LL, all units	Machine Oil, Vacuum Oil, Engine Oil	1,000	5 gal-Bldg E receiving platform 5 gal Transportation Garage	Bldg E - 55 gal drum Transp. Garage - 500 gal UG tank; Reserve option to use own contractor.
Army Reserve Center	Lube Oil	600	Bldg 1608	55 gal drums
Rome Air Development Center	Pump Oil	5	Bldg 1128	55 gal drum
Aero Club ABG/SSYA	Aircraft Lube Oil	200-500	Bldg 1722	2-55 gal drums will use base plan if DEMMF will pick up drums
Air Force Geophysics Laboratory, all units	Pump Oil	110	Bldg 1104C	55 gal drum
2014th Communications Squadron	90 wt Oil	30	Bldg 1600, Room 109	5 gal container, Turn-in to Motor Pool
Precision Measurement Equipment Laboratory	Vacuum Oil	0.5	Bldg 1726	2-Quart Container, generally evaporated

Source: Hanscom AFB Waste Oil Inventory (1981)

TABLE 4-3

WASTE OIL AND HAZARDOUS MATERIALS REMOVED FROM HANSCOM AFB FROM 1980 to 1983

Waste Materials	1983	1982	1981	1980
Waste Oil	8.7 tons	7.3 tons	17.8 tons(2)	6.4 tons
Waste Paint Sludge	N.R.	1.1 tons	0.8 tons	N.R.
1,1,1-Trichloroethane	N.R.	686 lbs	400 lbs	N.R.
Sodium Arsenate	N.R.	270 lbs	250 lbs	N.R.
PD680 Solvent	N.R.	350 lbs	440 lbs	N.R.
Waste Flammable Liquid N.O.S.	N.R.	577 lbs	(1)	N.R.
Ferric Chloride	N.R.	165 lbs	175 lbs	N.R.
Waste Corrosive Liquid N.O.S.	700 lbs	295 lbs	(1)	N.R.
Waste Solids (from oil separator)	7.8 tons	6.5 tons	N.R.	N.R.
Petroleum Oil/Water (from oil separator)	10.8 tons	3.5 tons	N.R.	N.R.
Lithium Batteries	10 lbs	N.R.	N.R.	N.R.
Misc. Hazardous Materials	N.R	N.R.	800 lbs(1)	N.R.
TOTAL	27.7 tons	19.6 tons	19.6 tons	6.4 tons(3)

(1) See Table 4-7 for individual chemicals.
(2) Yearly generation rate is estimated based on a 15-month reporting period
(3) Additional information needed concerning hazardous materials other than waste oil.
N.R. No amount reported.
Source: Generators Annual Report

TABLE 4-4

HAZARDOUS MATERIALS REMOVED FROM HANSCOM AFB IN 1981

Chemical	Size	Quantity	Location	EPA I.D.	Remarks
Butyl Carbitol	5 gal	2	B-1104C		
Methanol Iodine	1 qt	1	"		1/2 full
Stop Bath	1 qt	1	"		1/4 full
Methanol	1 gal	1	"	U154	1/2 full
Nitric Acid	1 pt	12	"	D002	
Acetic Acid	5 lb	1	"	P058	
Sulphuric Acid	1 gal	1	"	P115	
Hydrofluoric Acid	1 lb	3	"	U134	
Perchloric Acid	8 lb	1	"	D002	
Phosphoric Acid	1 pt	2	"	U145	
Phosphoric acid	1 qt	4	"	U145	
Dichrol (Acid Dichromate)	5 pt	1	"	D002	
Potassium Cyanide	1 lb	1	"	P098	
Sodium Cyanide	1 lb	2	"	P106	
Sodium Iodide	1 lb	1	"		
Dimethylmagnesium Heptane	1 gal	1	"		
Sodium Hydroxide	5 lb	10	"	D002	
Alconox Wetting Agent	3 lb	1	"		
Sodium Persulphate	1 lb	1	"		dry crystal
Photo Resist	1 gal	16	"	U239	contains Xylene
Enamel Reducer	1 gal	1	"		Dupont
Hysol Dissolver	1 gal	1	"		

TABLE 4-4 (continued)

HAZARDOUS MATERIALS REMOVED FROM HANSCOM AFB IN 1981

Chemical	Size	Quantity	Location	EPA I.D.	Remarks
Hysol	1 gal	2	B1104C		
Hysol	1 pt	1	"		
Velvet Coating Paint	1 gal	1	"	D001	
Hysol Hardener	1 pt	1	"		
Moisture and Fungus Proof Varnish	12 3/4 oz	9	"	D001	Spraytech
White Reflectance Paint	1 pt	2	"	D001	Eastman
Encapsulating Resin Kits	1 lb	1	"	D001	
Glyptal Insulating Paint	1 qt	2	"	D001	
Hysol Resin	1 qt	3	"		
Stycast	1 qt	1	"		
Protective Varnish	16 oz	2	"	D001	
Spray Photo Resist	12.5 oz	3	"	U239	Contains Xylene
Photo Developer	16 oz	1	"		
Lignator Solvent & Thiner	1 pt	1	"	D001	
Q-Dope	1 pt	1	"	D001	
Kepro Tinning Solution	1 pt	24	"	D002	
Ferric Chloride	5 gal	1	"		
Liquid Epoxy Potting Resin	13.4 oz	9	"		
Liquid Epoxy Potting Resin	3.4 oz	9	"		

TABLE 4-4 (continued)

HAZARDOUS MATERIALS REMOVED FROM HANSCOM AFB IN 1981

Chemical	Size	Quantity	Location	EPA I.D.	Remarks
Bostik 2402 Adhesive	8 oz	8	B1104C	D001	
Curing Agent D10	2 oz	8	"		
Benzene	8 pt	1	"	U019	1/3 full
Trichloroethylene	1 gal	1	"	U228	
Low Sodium MOS	1 gal	3	"		
Benzene Tech	1 gal	1	B-1704	U019	3/4 full
Acetone	1 gal	1	"	U002	
Acetone Tech	1/2 pt	1	"	U002	
Acetyl Acetone	1 pt	1	"	U002	
Ammonium Nitrate	1 lb	1	"	U002	
Petroleum Naptha	1 pt	1	"	U165	
Chlorophenal Red-D	4 oz	5	"		
Bromethymal Blue-D	2 oz	7	"		
Lead Base Paint	1/4 pt	1	"	D008	
10% Sodium Dichromate 25% Zinc Sulphate (65% water)	55 gal	1	B-1124	D006	Approx. 30 gal

Source: Hanscom AFB Hazardous Waste Turned into DPDO in 1981

4.1.3 Storage of Hazardous Materials

Storage activities at Hanscom AFB are classified according to the nature of the materials stored, in accordance with the following general categories:

- Storage of oils, cleaning solvents, pesticides, herbicides, and other chemicals for use by Civil Engineering services to support maintenance operations
- Storage of laboratory reagents and chemicals used by operations such as MIT Lincoln Laboratory, RADC, and AFGL in support of their research activities
- Bulk storage of raw materials such as paints, solvents, solder materials, photographic chemicals, clinical supplies, gas cylinders, etc., used by base industrial shops to support construction and maintenance operations
- Waste storage prior to treatment or disposal.

A large number of hazardous materials are stored at Hanscom AFB at a variety of locations. Fifteen such locations having the potential to release hazardous substances to the environment were identified in the Phase I investigation. Figure 4-2 illustrates the locations and Table 4-5 provides a guide to the figure.

Additional information from the 1980 Hanscom AFB Chemical Inventory regarding the types and amounts of materials stored at the locations is provided in Appendix F.

Several relatively minor spill incidents have been documented in conjunction with hazardous materials storage facilities at Hanscom AFB. The incidents include:

Date	Incident
March 10, 1977	An oil spill at the Petroleum, Oils, and Lubrication (POL) Storage Area.
March 8, 1976	A two-gallon methanol spill occurred at the Base Supply (Bldg. 1614).

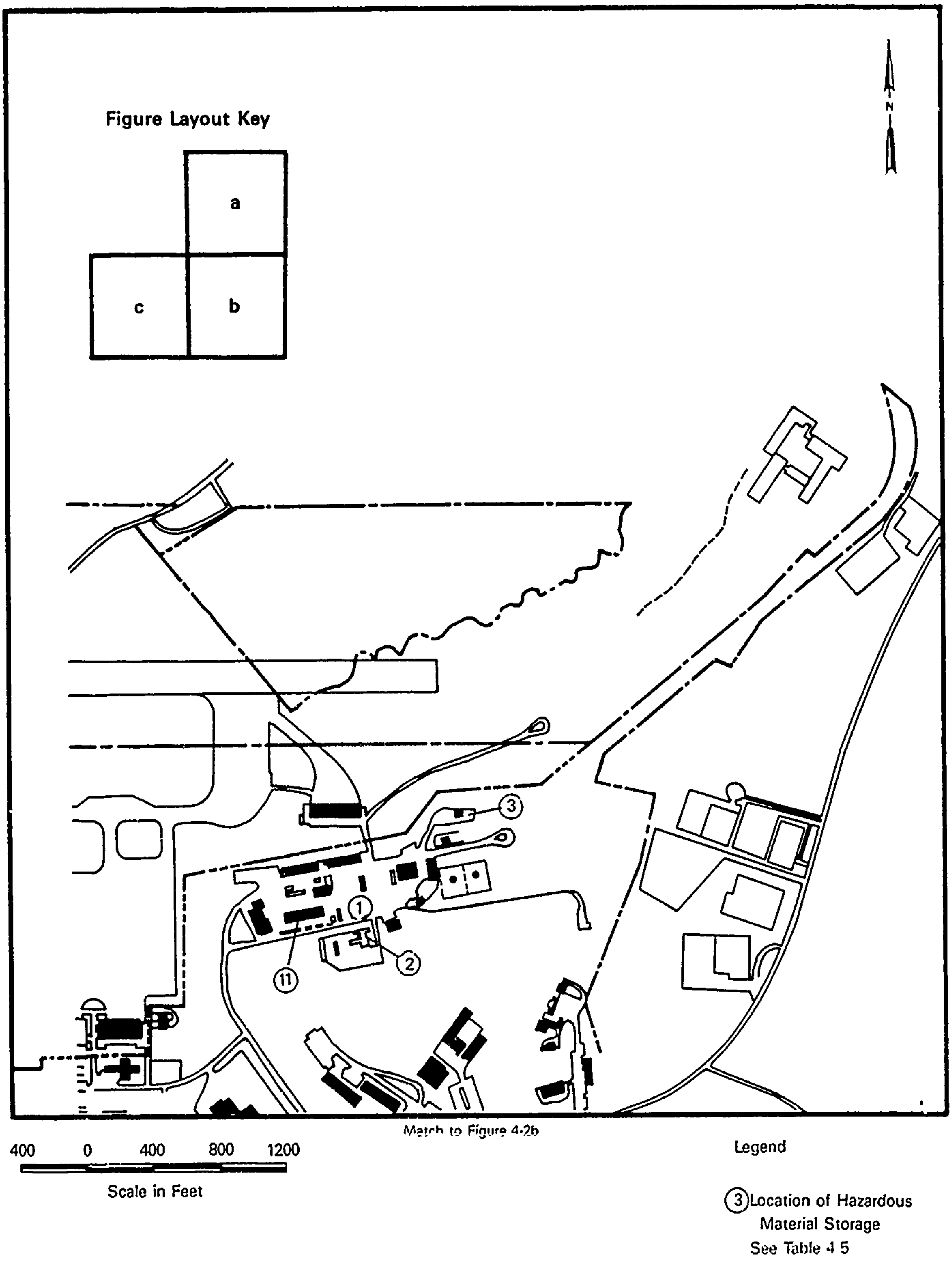


Figure 4-2a. Locations of Hazardous Material Storage at Hanscom AFB.

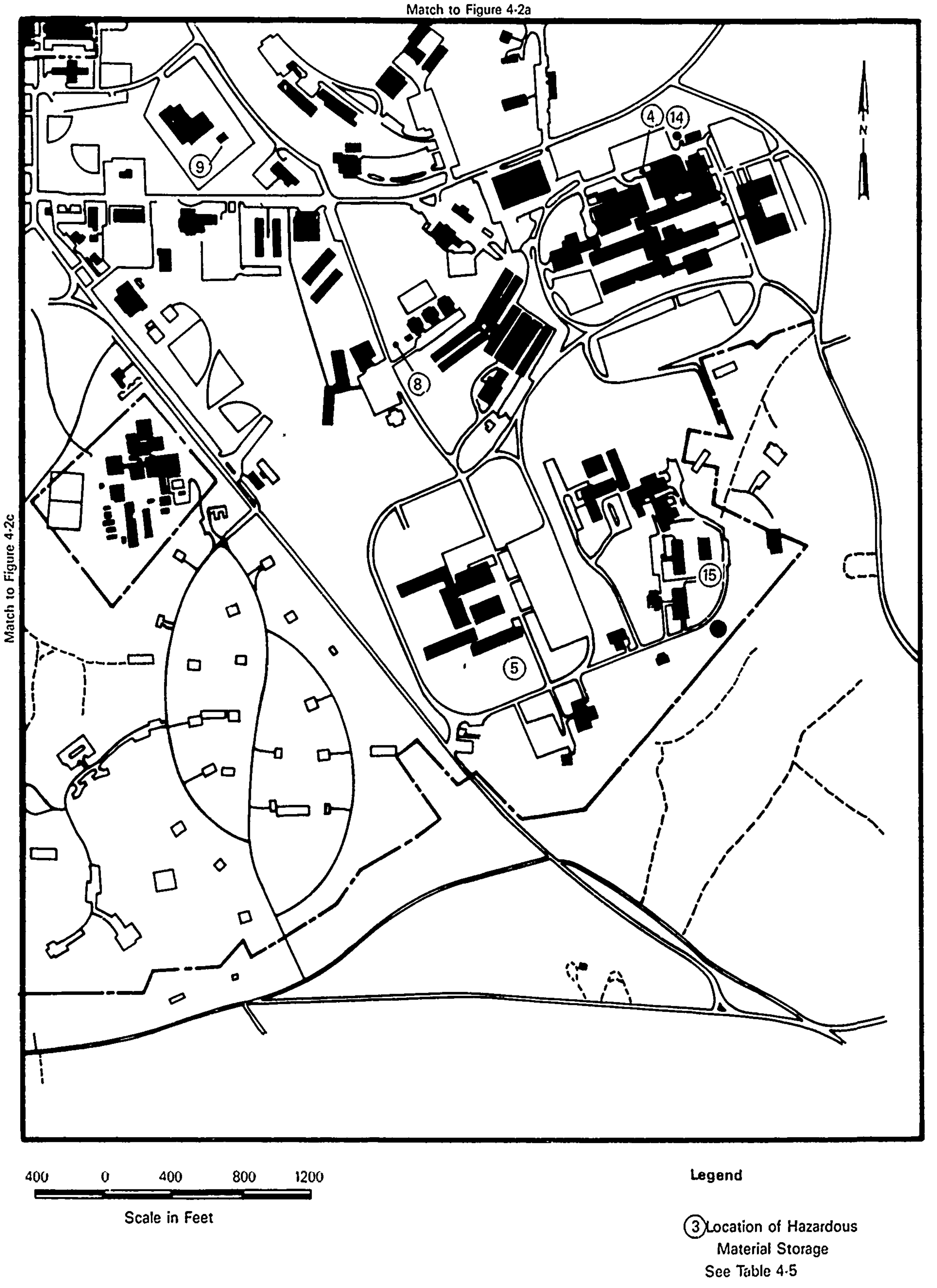


Figure 4-2b. Locations of Hazardous Material Storage at Hanscom AFB.

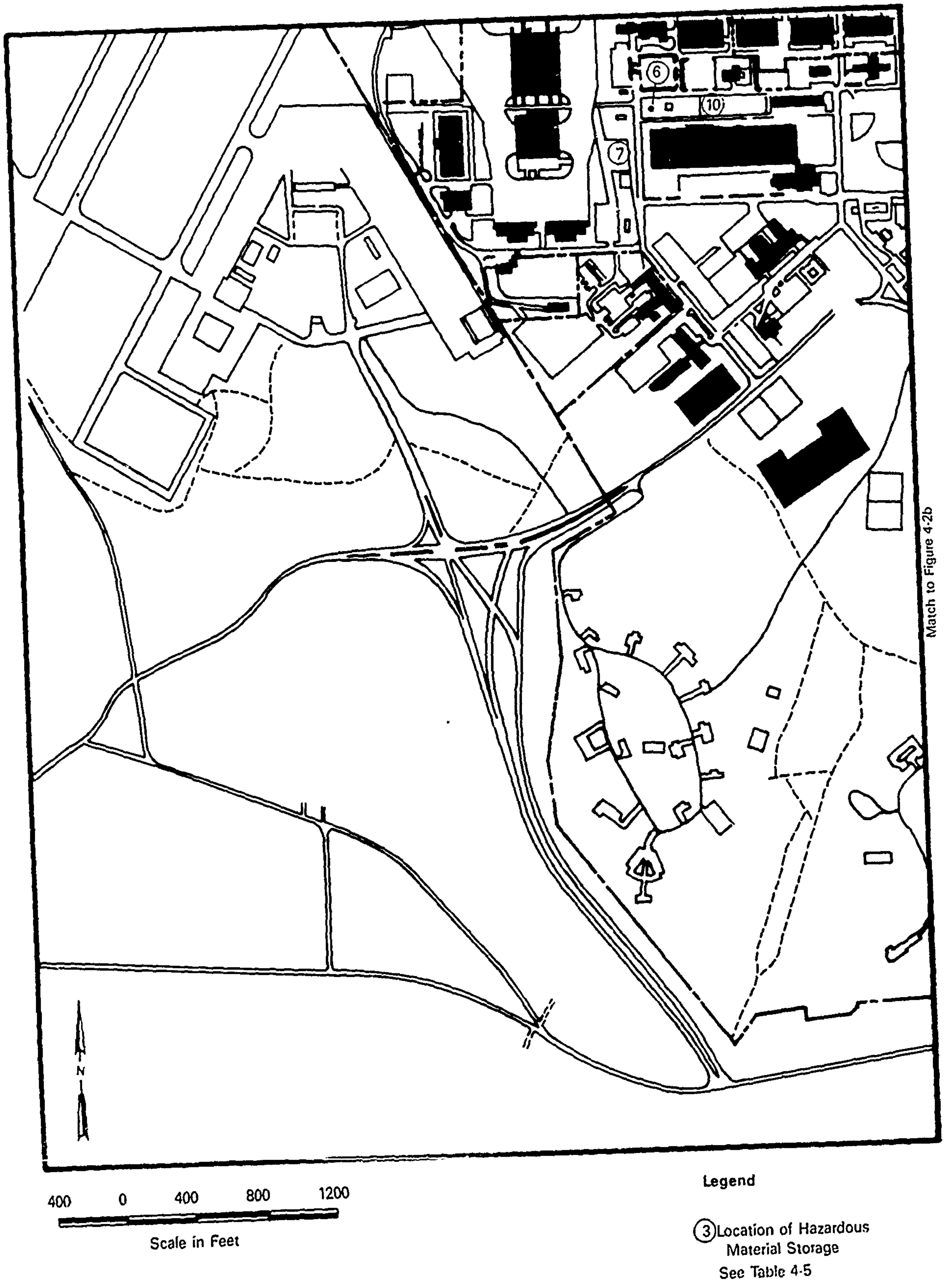


Figure 4-2c. Locations of Hazardous Material Storage at Hanscom AFB.

TABLE 4-5

LOCATIONS OF HAZARDOUS MATERIAL STORAGE AT HANSCOM AFB

	Location*	Description	Figure 4-2
1.	PCB Storage (Bldg 1808)	Fenced in secure hardtop area	b
2.	Former Property Storage	Area used to store excess furniture, clothing, and equipment, PCB transformers were reported to have been stored here	b
3.	P.O.L. Storage Yard	Storage area for petroleum, lubricants and oils	b
4.	MIT Lincoln Lab Chemical Storage	Secure supply room used to store hazardous and non-hazardous chemicals	a
5.	AFGL Chemical Storage (Bldg. 1104C)	Secure supply room used to store hazardous and non-hazardous chemicals	a
6.	Flammable Compressed Gas Storage (Bldg 1615)	Secure storage area	c
7.	Compressed Gas Storage (Bldg. 1717)	Secure storage area	c
8.	Chemical Storage (Bldg. 1208)	Secure supply room used to store hazardous and non-hazardous chemicals	a
9.	Motor Pool Chemical Storage (Bldg. 1642)	Supply room used to store automotive solvents and chemicals	a
10.	Base Supply Storage Area (Bldg. 1614)	Storage area used to store empty cylinders prior to disposal	c

TABLE 4-5 (continued)

LOCATIONS OF HAZARDOUS MATERIALS STORAGE AT HANSCOM AFB

Location*	Description	Figure 4-2
Paint Shop Storage Area (Bldg 1812)	Storage area used to store paints, thinners and solvents	b
Pesticide Storage (Bldg. T-421)	Tank used to store pesticides	b
Hazardous Material Storage (Bldg 1729)		b
MIT Lincoln Lab Waste Chemical Storage	Holding area for chemical wastes prior to disposal by private contractor	a
Radioactive Storage (Bldg 1124)		a

* Numbers keyed to locations shown on Figure 4-2

June 25, 1975	Five 110-lb. drums of calcium hypochlorite were discovered leaking due to corroded drums.
No record of date	A leak in a hydrogen cylinder at Building 1717.

Incidents of spillage and leakage from on-base storage facilities are discussed further in Section 4.1.5.

4.1.4 Storage of Fuel

Fuel storage activities at Hanscom AFB involve underground and above-ground storage of No. 2 fuel oil, No. 6 fuel oil, diesel fuel, gasoline, waste oil, and kerosene. Above-ground fuel storage tanks range in size from 55 to 500,000 gallons. Underground or basement storage tanks range in size from 55 to 33,000 gallons, with 1,000-gallon No. 2 fuel oil tanks accounting for over 25 percent of all underground storage tanks.

The major fuel storage areas on the base include four underground storage locations and one above-ground location. All tanks at these locations are reported to be in good or excellent physical condition, posing little or no threat to the environment by way of leaks or possible rupture. Table 4-6 summarizes fuels storage at these five locations.

In addition to the major fuel storage areas, smaller underground and above-ground storage tanks containing automotive fuel, heating fuel, and waste oil are located throughout the base. Tables 4-7 and 4-8 present summaries of underground and above-ground fuel storage facilities, respectively, identified in the Hanscom AFB Spill Prevention and Countermeasures Plan of February 1981. Figures 4-3 and 4-4 illustrate the locations of underground and above-ground fuel storage, respectively, at Hanscom AFB. Tables 4-9 and 4-10 provide a guides to Figures 4-3 and 4-4, respectively.

Six of the seven off-base facilities also maintain fuel storage areas, summarized in Table 4-11.

TABLE 4-6

SUMMARY OF MAJOR FUEL STORAGE AT HANSCOM AFB

Fuel	Building Location	Disposal	Tank Capacity (Gallons)	Physical Condition
No. 6 Fuel Oil	1201	Underground fuel storage	3 @ 33,000	Good
Gasoline	1801	Underground fuel storage	2 @ 25,000	Good
No. 2 Fuel Oil	13007 & 13009	Above-ground fuel storage	2 @ 500,000	Good
Mogas	1639	Underground fuel storage	1 @ 12,000 2 @ 10,000	Excellent
Mogas	1642	Underground fuel storage	3 @ 10,000	Excellent

Source: Hanscom AFB Spill Prevention Control and Countermeasures Plan, 1981

TABLE 4-7

SUMMARY OF UNDERGROUND FUEL STORAGE AT HANSCOM AFB

Fuel	No. of Tanks	Capacity
No. 2 Fuel Oil	1	200 gal
	7	500 gal
	1	550 gal
	20	1,000 gal
	4	1,500 gal
	2	2,000 gal
	1	2,500 gal
	3	3,000 gal
	1	8,000 gal
	1	6,000 gal
	1	10,000 gal
	1	12,500 gal
Diesel Generator	1	275 gal
	5	500 gal
	2	750 gal
	1	2,000 gal
Diesel	3	500 gal
	1	10,000 gal
Heating Oil	3	33,000 gal
Gasoline	2	2,000 gal
	1	4,000 gal
	2	10,000 gal
	2	25,000 gal
Waste Oil	1	400 gal
	1	500 gal
	1	600 gal
	1	800 gal
	1	1,000 gal
	1	2,000 gal

Source: Hanscom AFB Spill Prevention Control and Countermeasures Plan Draft, 1984

TABLE 4-8

SUMMARY OF ABOVE-GROUND FUEL STORAGE AT HANSCOM AFB

Fuel	No. of Tanks	Capacity
No. 2 Fuel Oil	37	275 gal
	1	500 gal
	2	1,000 gal
	2	500,000 gal
Kerosene	1	275 gal
Oil	1	275 gal
Diesel Fuel	1	275 gal
	1	500 gal
Diesel Generator	1	8 gal
	3	10 gal
	1	13 gal
	1	20 gal
	1	60 gal
	7	100 gal
	1	275 gal
	3	500 gal
Diesel Compressor	1	15 gal

Source: Hanscom AFB Spill Prevention Control and Countermeasures Plan 1984 (Revised Edition)

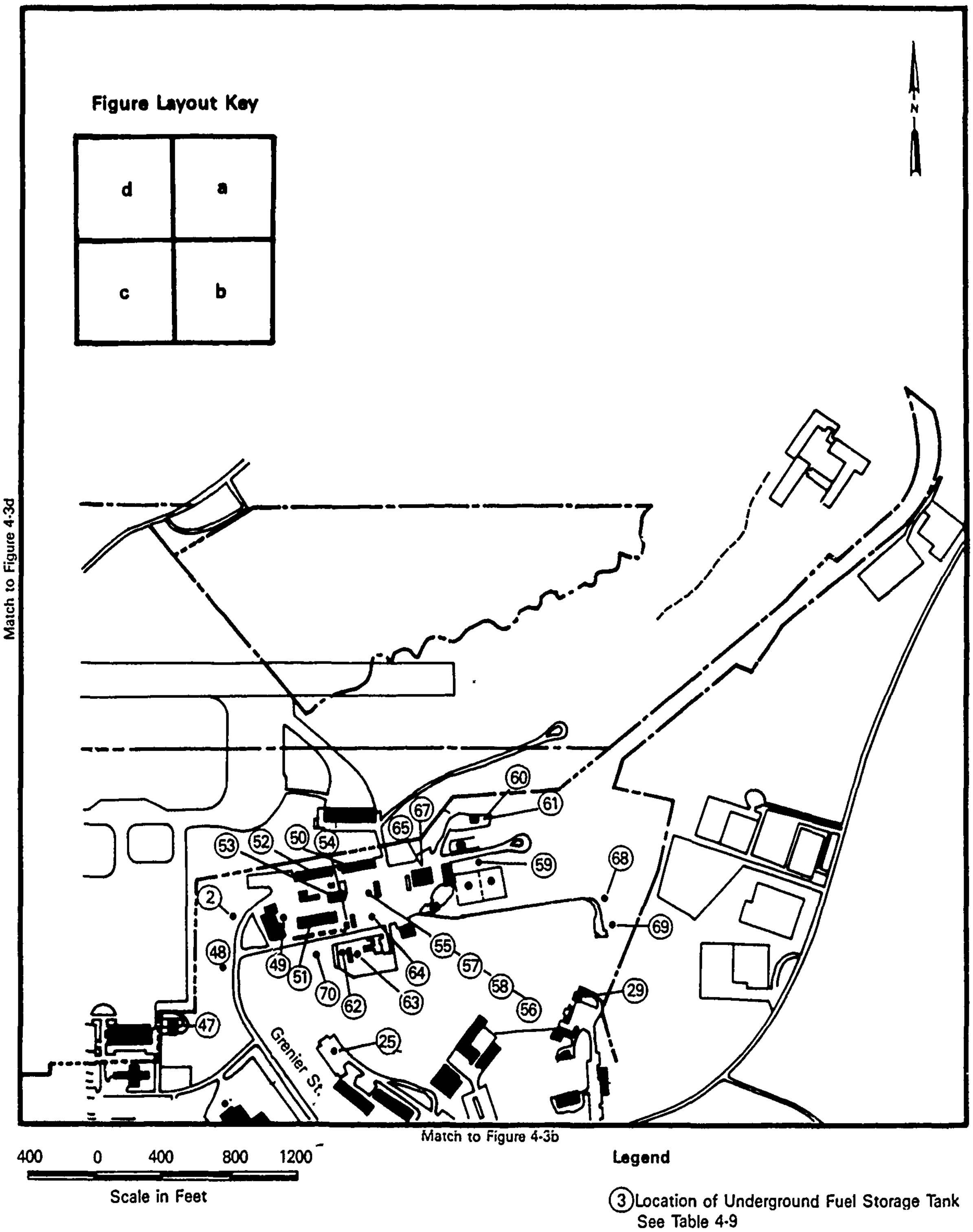


Figure 4-3a. Locations of Underground Fuel Storage Tanks at Hanscom AFB.

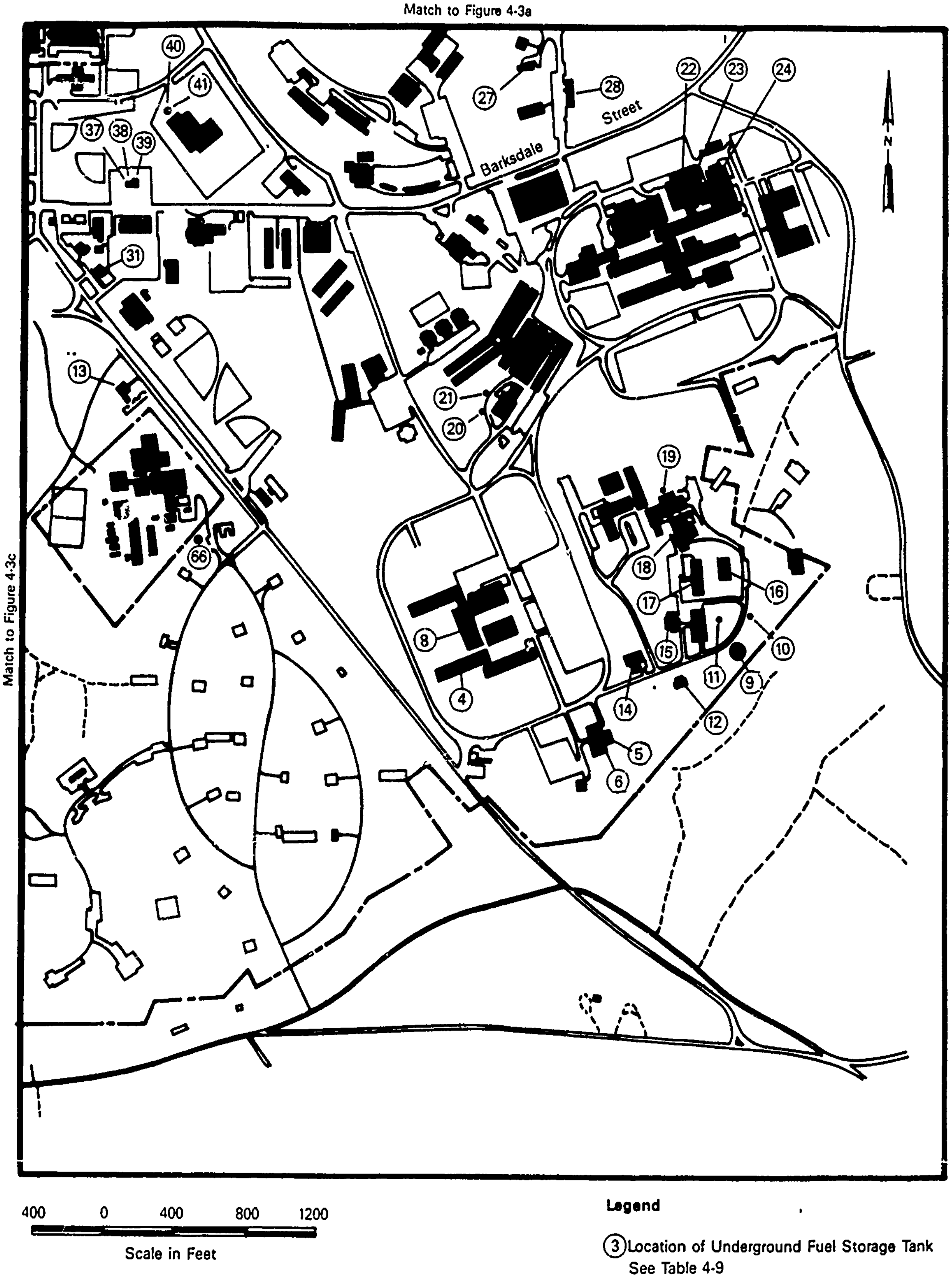


Figure 4-3b. Locations of Underground Fuel Storage Tanks at Hanscom AFB.

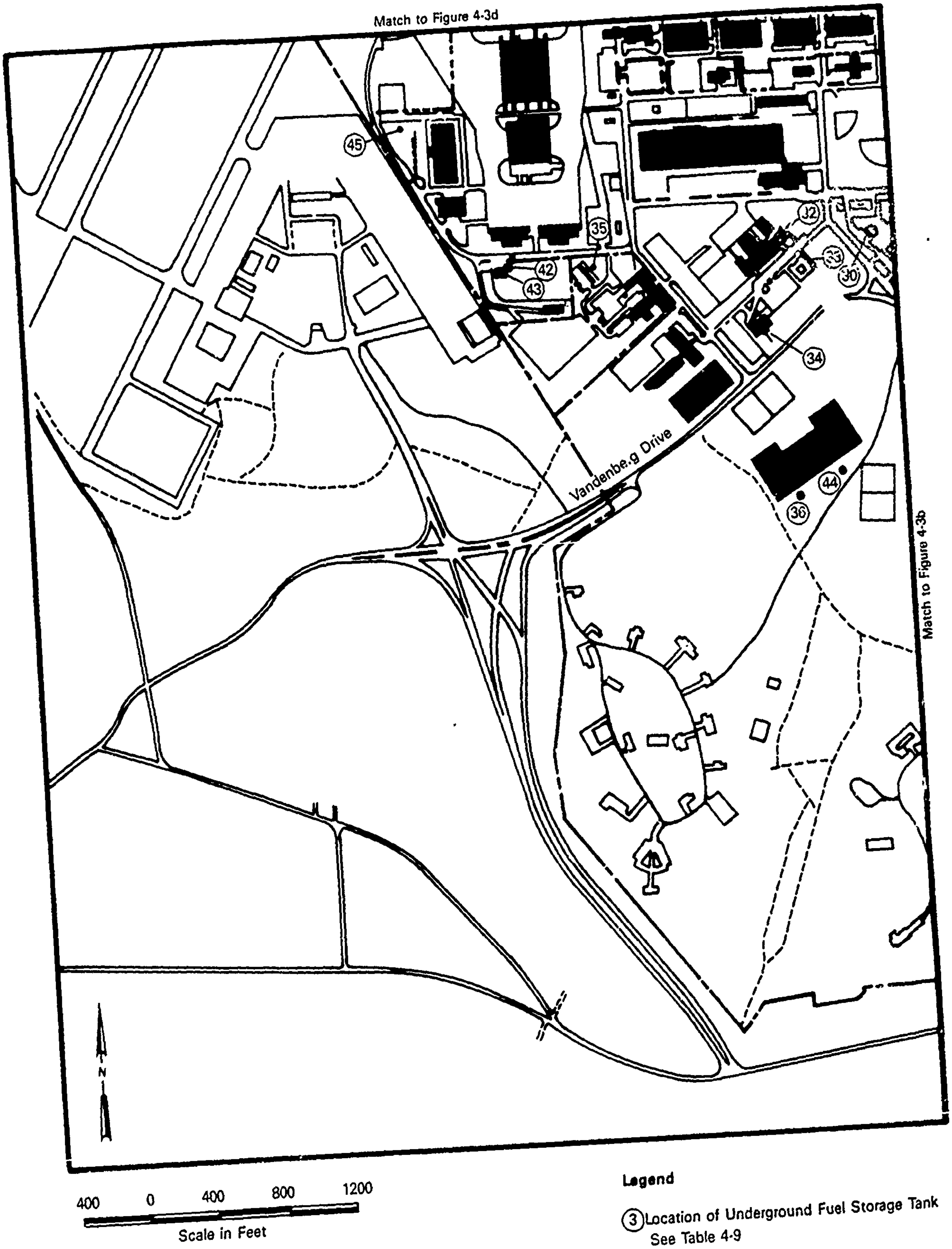
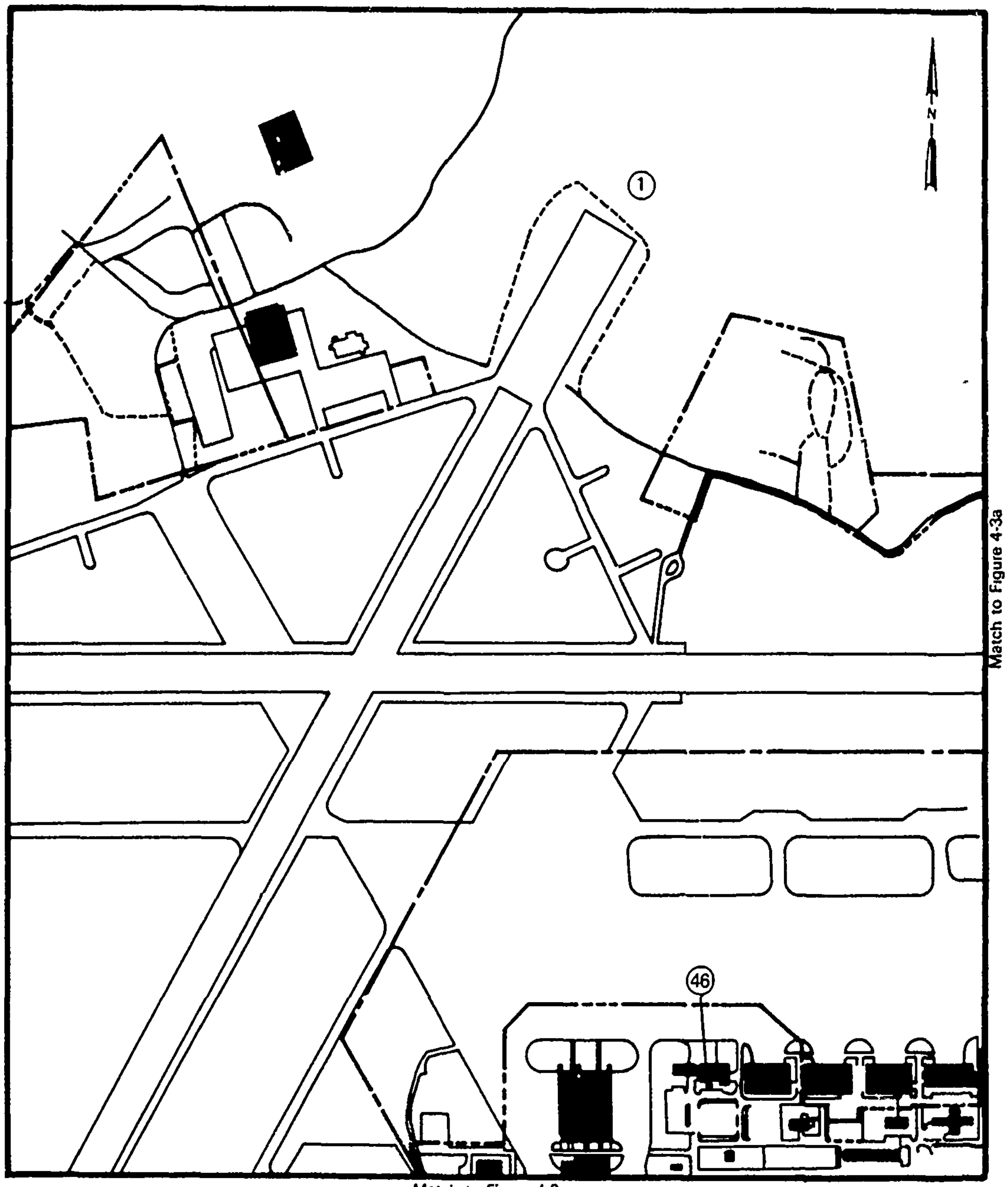


Figure 4-3c. Locations of Underground Fuel Storage Tanks at Hanscom AFB.



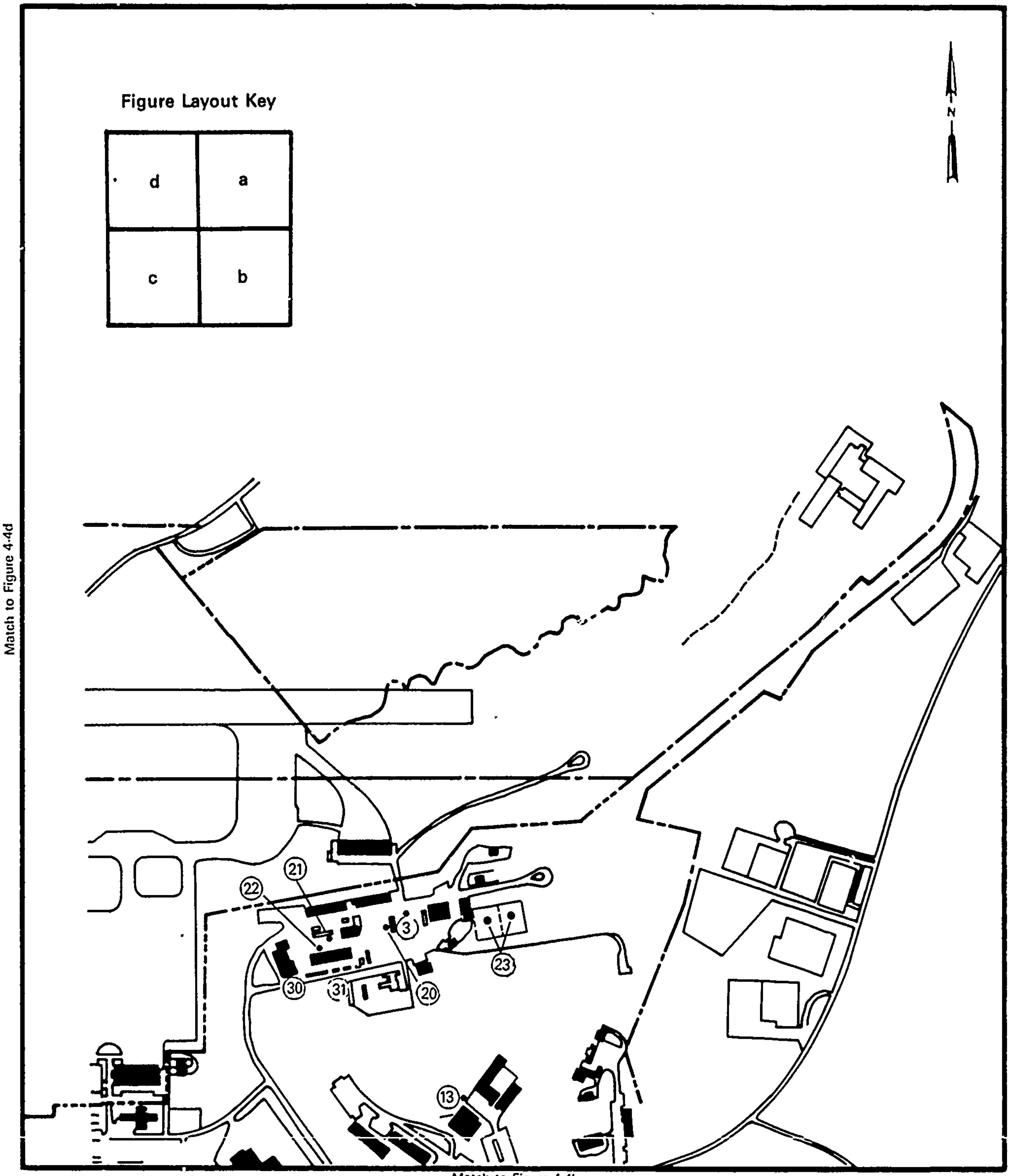
400 0 400 800 1200

Scale in Feet

Legend

(3) Location of Underground Fuel Storage Tank
See Table 4-9

Figure 4-3d. Locations of Underground Fuel Storage Tanks at Hanscom AFB.



400 0 400 800 1200

Scale in Feet

Legend

(3) Location of Above-Ground Fuel Storage Tank
See Table 4-10

Figure 4-4a. Locations of Above-Ground Fuel Storage Tanks at Hansom AFB.

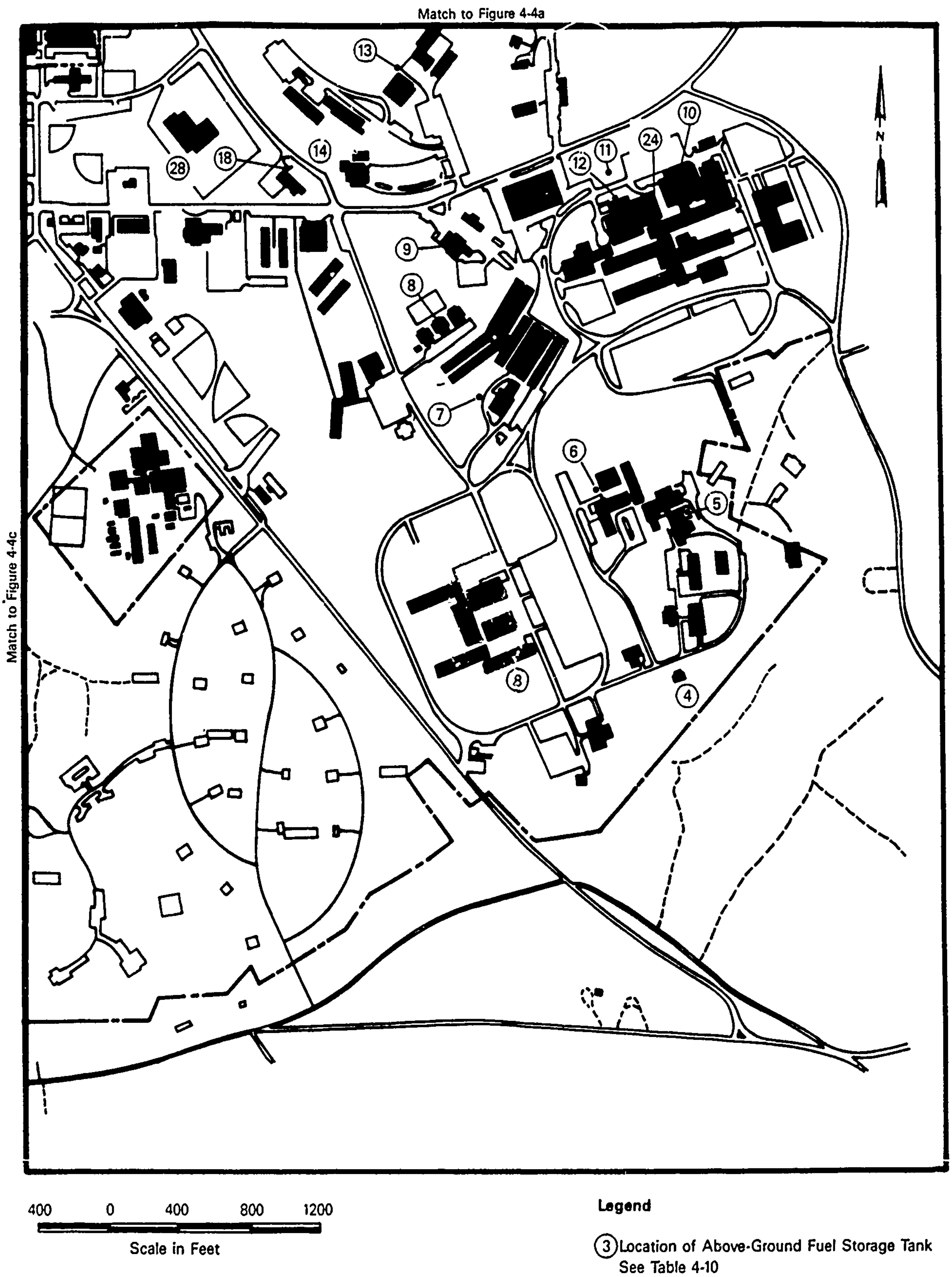
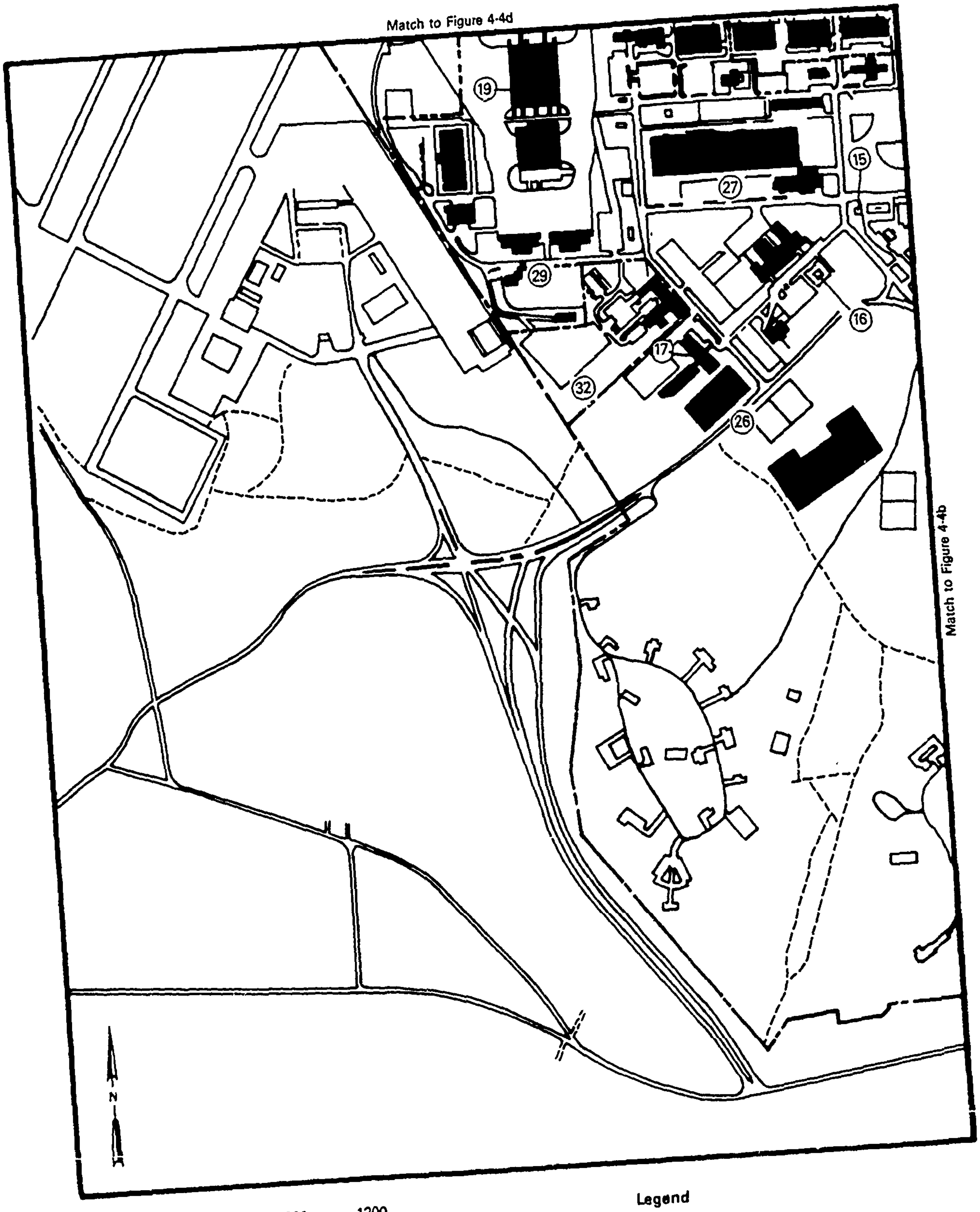


Figure 4-4b. Locations of Above-Ground Fuel Storage Tanks at Hansom AFB.



400 0 400 800 1200

Scale in Feet

Legend

(3) Location of Above-Ground Fuel Storage Tank
See Table 4-10

Figure 4-4c. Locations of Above-Ground Fuel Storage Tanks at Hansom AFB.

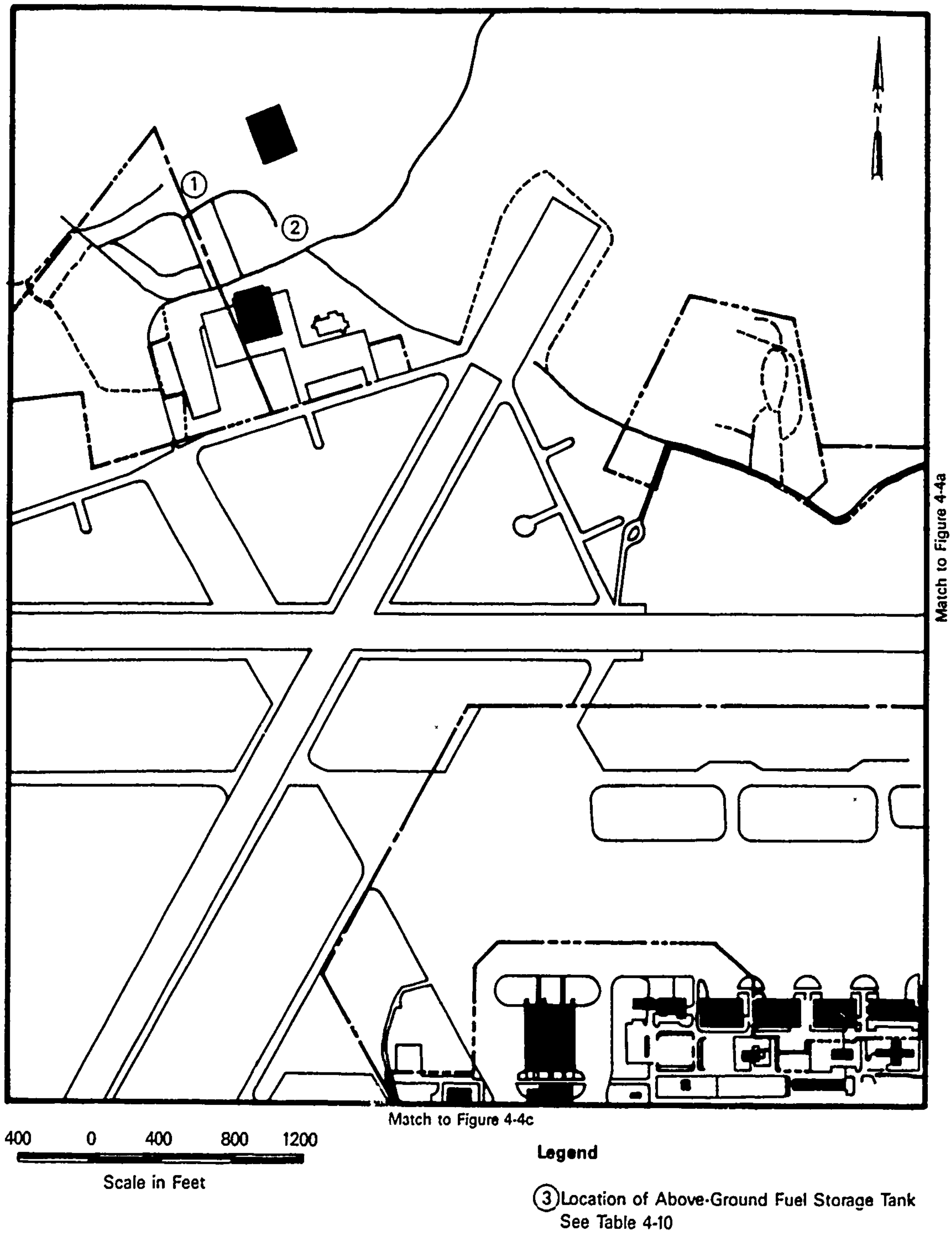


Figure 4-4d. Locations of Above-Ground Fuel Storage Tanks at Hansom AFB.

TABLE 4-9

LOCATIONS OF UNDERGROUND FUEL STORAGE TANKS AT HANSCOM AFB

	Location*	Quantity	Description	Figure 4-3
1.	Bldg. T214	1	550-Gal Fuel Oil Tank	d
2.	Bldg. T860	1	12,500-Gal No. 2 Fuel Oil Tank	a
3.	Bldg. 1101	1	1,500-Gal No. 2 Fuel Oil Tank	b
4.	Bldg. 1102E	1	500-Gal Diesel Generator	b
5.	Bldg. 1103-T1	1	6,000-Gal No. 2 Fuel Oil Tank	b
6.	Bldg. 1103-T2	1	500-Gal Diesel Fuel Oil Tank	b
7.	Bldg. 1105-B	1	500-Gal Diesel Generator	b
8.	Bldg. 1107	2	750-Gal Diesel Generator	b
9.	Bldg. 1114	1	500-Gal Diesel Fuel Oil Tank	b
10.	Bldg. 1115	1	500-Gal No. 2 Fuel Oil Tank	b
11.	Bldg. 1118	1	1000-Gal No. 2 Fuel Oil Tank	b
12.	Bldg. 1119-T1	1	1000-Gal No. 2 Fuel Oil Tank	b
13.	Bldg. 1900	1	2000-Gal Diesel Generator	b
14.	Bldg. 1120	1	1000-Gal No. 2 Fuel Oil Tank	b
15.	Bldg. 1121	1	500-Gal No. 2 Fuel Oil Tank	b
16.	Bldg. 1122	1	2000-Gal No. 2 Fuel Oil Tank	b
17.	Bldg. 1124	1	3000-Gal No. 2 Fuel Oil Tank	b
18.	Bldg. 1126-T1	1	200-Gal No. 2 Fuel Oil Tank	b
19.	Bldg. 1128	1	275-Gal Diesel Generator	b
20.	Bldg. 1201-T1,2,3	3	33,000-Gal No. 6 Heating Oil Tank	b
21.	Bldg. 1201-T5	1	500-Gal Diesel Generator	b
22.	Bldg. 1302E-T1	1	500-Gal Waste Oil Tank	b
23.	Bldg. 1302E-T3	1	4000-Gal Gasoline Tank	b
24.	Bldg. 1302-T4	1	2000-Gal Gasoline Tank	b
25.	Bldg. 1420-T1	1	1000-Gal No. 2 Fuel Oil Tank	a
26.	Bldg. 1429	1	1000-Gal No. 2 Fuel Oil Tank	a
27.	Bldg. 1431	1	1000-Gal No. 2 Fuel Oil Tank	b
28.	Bldg. 1436	1	1000-Gal No. 2 Fuel Oil Tank	b

TABLE 4-9 (continued)

LOCATIONS OF UNDERGROUND FUEL STORAGE TANKS AT HANSCOM AFB

	Location*	Quantity	Description	Figure 4-3
29.	Bldg. 1440	1	1000-Gal No. 2 Fuel Oil Tank	a
30.	Bldg. 1542	1	500-Gal No. 2 Fuel Oil Tank	c
31.	Bldg. 1543	1	550-Gal No. 2 Fuel Oil Tank	b
32.	Bldg. 1600	1	500-Gal Diesel Generator	c
33.	Bldg. 1603	1	3000-Gal No. 2 Fuel Oil Tank	c
34.	Bldg. 1605-T1	1	1500-Gal No. 2 Fuel Oil Tank	c
35.	Bldg. 1608	1	2500-Gal No. 2 Fuel Oil Tank	c
36.	Bldg. 1900	1	10,000-Gal No. 2 Fuel Oil Tank	c
37.	Bldg. 1639-T1	1	800-Gal Waste Oil Tank	b
38.	Bldg. 1639-T2	2	12,000-Gal Mogas Fuel Tank	b
39.	Bldg. 1639-T3,4	2	10,000-Gal Mogas Fuel Tank	b
40.	Bldg. 1644-T1	1	10,000-Gal Diesel Fuel Oil Tank	b
41.	Bldg. 1644-T2,3	2	10,000-Gal Waste Oil Tank	b
42.	Bldg. 1700	1	1000-Gal Waste Oil Tank	c
43.	Bldg. 1700,T2	1	1000-Gal No. 2 Fuel Oil Tank	c
44.	Bldg. 1900	1	2000-Gal Diesel Generator	c
45.	Bldg. 1712	1	500-Gal No. 2 Fuel Oil Tank	c
46.	Bldg. 1721	1	500-Gal diesel Generator	d
47.	Bldg. 1729	1	1000-Gal No. 2 Fuel Oil Tank	a
48.	Bldg. 1801	2	25,000-Gal Gasoline Tanks	a
49.	Bldg. 1810	1	1500-Gal No. Fuel Oil Tank	a
50.	Bldg. 1811	1	1000-Gal No. 2 fuel Oil Tank	a
51.	Bldg. 1812	1	3000-Gal No. 2 Fuel Oil Tank	a
52.	Bldg. 1813	1	1000-Gal No. 2 fuel Oil Tank	a
53.	Bldg. 1814	1	1000-Gal No. 2 Fuel Oil Tank	a
54.	Bldg. 1816	1	500-Gal No. 2 Fuel Oil Tank	a
55.	Bldg. 1817-T3	1	500-Gal Diesel Fuel Oil Tank	a
56.	Bldg. 1817-T3	1	600-Gal Waste Oil Tank	a

TABLE 4-9 (continued)

LOCATIONS OF UNDERGROUND FUEL STORAGE TANKS AT HANSCOM AFB

	Location*	Quantity	Description	Figure 4-3
57.	Bldg. 1817-T4	1	1000 Gal No. 2 Fuel Oil Tank	a
58.	Bldg. 1817-T5	1	2000-Gal Gasoline Tank	a
59.	Bldg. 1819	1	1000-Gal No. 2 Fuel Oil Tank	a
60.	Bldg. 1823-T1	1	400-Gal Waste Oil Tank	a
61.	Bldg. 1823-T2	1	500-Gal No. 2 fuel Oil Tank	a
62.	Bldg. 1824	1	500-Gal No. 2 fuel Oil Tank	a
63.	Bldg. 1825	1	1000-Gal No. 2 Fuel Oil Tank	a
64.	Bldg. 1826	1	1000-Gal No. 2 Fuel Oil Tank	a
65.	Bldg. 1830-T1		5000-Gal No. 2 Fuel Oil Tank	a
66.	Bldg. 1998	1	1000-Gal No. 2 Fuel Oil Tank	b
67.	Bldg. 1830-T2	1	2000-Gal Waste Oil Tank	a
68.	Bldg. 1851	1	1500-Gal No. 2 Fuel Oil Tank	a
69.	Bldg. 1855	1	1000-Gal No. 2 Fuel Oil Tank	a
70.	Bldg. 1880	1	1000-Gal No. 2 Fuel Oil Tank	a
71.	Bldg. 1993	1	2000-Gal No. 2 Fuel Oil Tank	b

* Numbers keyed to locations shown on Figure 4-3

TABLE 4-10

LOCATIONS OF ABOVE-GROUND FUEL STORAGE TANKS AT HANSCOM AFB

	Location*	Quantity	Description	Figure 4-4
1.	Trailer Court	29	275-Gal No. 2 Fuel Oil Tanks	d
2.	Trailer Court	2	275-Gal No. 2 Fuel Oil Tanks (T-207)	d
3.	Bldg. 421	1	275-Gal No. 2 Fuel Oil Tank	a
4.	Bldg. 1129	1	500-Gal Diesel Generator	b
5.	Bldg. 1126	1	275-Gal Diesel Generator	b
6.	Bld. 1139	1	275-Gal Diesel Fuel Tank	b
7.	Bldg. 1201 (Tank 4)	1	275-Gal Oil Tank	b
8.	Bldg. 1102-C	1	500-Gal Diesel Generator	b
9.	Bldg. 1217	1	275-Gal Diesel Generator	b
10.	Bldg. 1302-E2	1	500-Gal Diesel Fuel Oil Tanks	b
11.	Bldg. 1306	1	100-Gal Diesel Generator	b
12.	Bldg. 1308	1	1000-Gal No. 2 Fuel Oil Tank	b
13.	Bldg. 1428	2	275-Gal No. 2 Fuel Oil Tank	a
14.	Bldg. 1515	1	275-Gal Diesel Generator	b
15.	Bldg. 1539	1	500-Gal Diesel Generator	c
16.	Bldg. 1605-T2	1	275-Gal Diesel Generator	c
17.	Bldg. 1606	1	275-Gal Diesel Generator	c
18.	Bldg. 1646	1	275-Gal Diesel Generator	b
19.	Bldg. 1715	2	275-Gal No. 2 Fuel Oil Tanks	c
20.	Bldg. 1806	1	500-Gal No. 2 Fuel Oil Tank	a
21.	Bldg. 1809	1	275-Gal No. 2 Fuel Oil Tank	a
22.	Bldg. 1817-T2	1	275-Gal Kerosene Tank	a
23.	Fuel Tanks 13007, 13009	2	500,000-Gal No. 2 Heating Oil Tank	a

TABLE 4-10 (continued)

LOCATIONS OF ABOVE-GROUND FUEL STORAGE TANKS AT HANSCOM AFB

	Location*	Quantity	Description	Figure 4-4
24.	Bldg. 1302-F	1	8-Gal Diesel Generator	b
25.	Bldg. 1305	1	60-Gal Diesel Generator	b
26.	Bldg. 1612	1	275-Gal Diesel Generator	c
27.	Bldg. 1614	1	13-Gal Diesel Generator	c
28.	Bldg. 1642	1	10-Gal Diesel Generator	b
29.	Bldg. 1700	2	10-Gal Diesel Generator	c
30.	Bldg. 1810	1	20-Gal Diesel Generator	a
31.	Bldg. 1880	1	15-Gal Diesel Compressor	a
32.	Bldg. 1701	1	1000-Gal No. 2 Fuel Oil Tank	c

* Numbers keyed to locations shown on Figure 4-2

TABLE 4-11

SUMMARY OF FUEL STORAGE AT OFF-BASE FACILITIES

Facility Location	Fuel	No. of Tanks	Type	Capacity
RADC Electromagnetic Test and Measurements Facility	Diesel	1	A/G	275 gal
	No. 2 Heating Oil	1	U/G	1000 gal
	No. 2 Heating Oil	2	Cellar Tanks	275 gal
	No. 2 Heating Oil	3	U/G	500 gal
	No. 2 Heating Oil	1	U/G	1500 gal
North Truro AFS	Heatig Fuel Oil	1		50,000 gal
	Diesel Fuel	1		2708 BL
	Mogas	1		131 BL
	Diesel	1		4000 gal
Fourth Cliff Recreation Annex	Diesel	2	U/G	3800 gal
	No. 2 Heating Oil	3	A/G	275 gal
Sagamore Hill	Diesel Generator	1	A/G	275 gal
	Diesel Fuel	1	U/G	500 gal
	No. 2 Heating Oil	1	U/G	500 gal
	No. 2 Heating Oil	1	U/G	1000 gal
Prospect Hill Electronics Research Annex	Diesel Generator	1	A/G	275 gal
	Diesel Fuel Tank	1	U/G	500 gal
	No. 2 Heating Oil	2	Cellar Tank	275 gal
	No. 2 Heating Oil	1	U/G	1000 gal
Maynard Research Annexes	Diesel	1	U/G	500 gal
	Diesel	1	A/G	500 gal
	Diesel	1	A/G	275 gal
	No. 2 Heating Oil	1	A/G	500 gal

Source: USAF Real Property Inventory Detail List, December 1983

Three incidents of fuel spillage or leakage have occurred at Hanscom AFB, and two spill incidents have occurred at off-base facilities. These incidents include:

Date	Incident
December 4, 1981	An unleaded gasoline spill from a leaking fuel storage tank at the base motor pool (Building 1642) was reported. The quantity of fuel spilled is not known.
February 4, 1981	A 3000-gallon gasoline spill from leaking underground fuel storage tanks at the base service station (Building 1639) was detected.
No record date	A 30- to 40-gallon spill of fuel oil from a storage tank at Hanscom AFB. Tank ruptured due to fire damage. The location of the spill is not known.
No record of date	A spill from a 500-gallon underground heating oil tank that was ruptured at the RADC Electromagnetic Test and Measurement Facility by a contractor during construction of a new building at the facility. The contractor subsequently covered over the spilled fuel oil with a layer of soil and erected a building over the spill area.
No record of date	The failure of an emergency generation fuel system, at the Solar Radio Observatory at Sagamore Hill resulted in three separate discharges of an unknown quantity of diesel fuel.

Incidents of spillage and leakage from on-base fuel storage locations are discussed further in Section 4.1.5.

4.1.5 Spills and Leaks

Interviews and records searches conducted at Hanscom AFB revealed a variety of past spill incidents. These spills range in size from 1 pint of PCB fluid to 5,000 gallons of JP-4 jet fuel. Information concerning a total of 15 spills occurring at the base has been collected. Figure 4-5 illustrates the locations of these spills. A guide to Figure 4-5 is provided in Table 4-12.

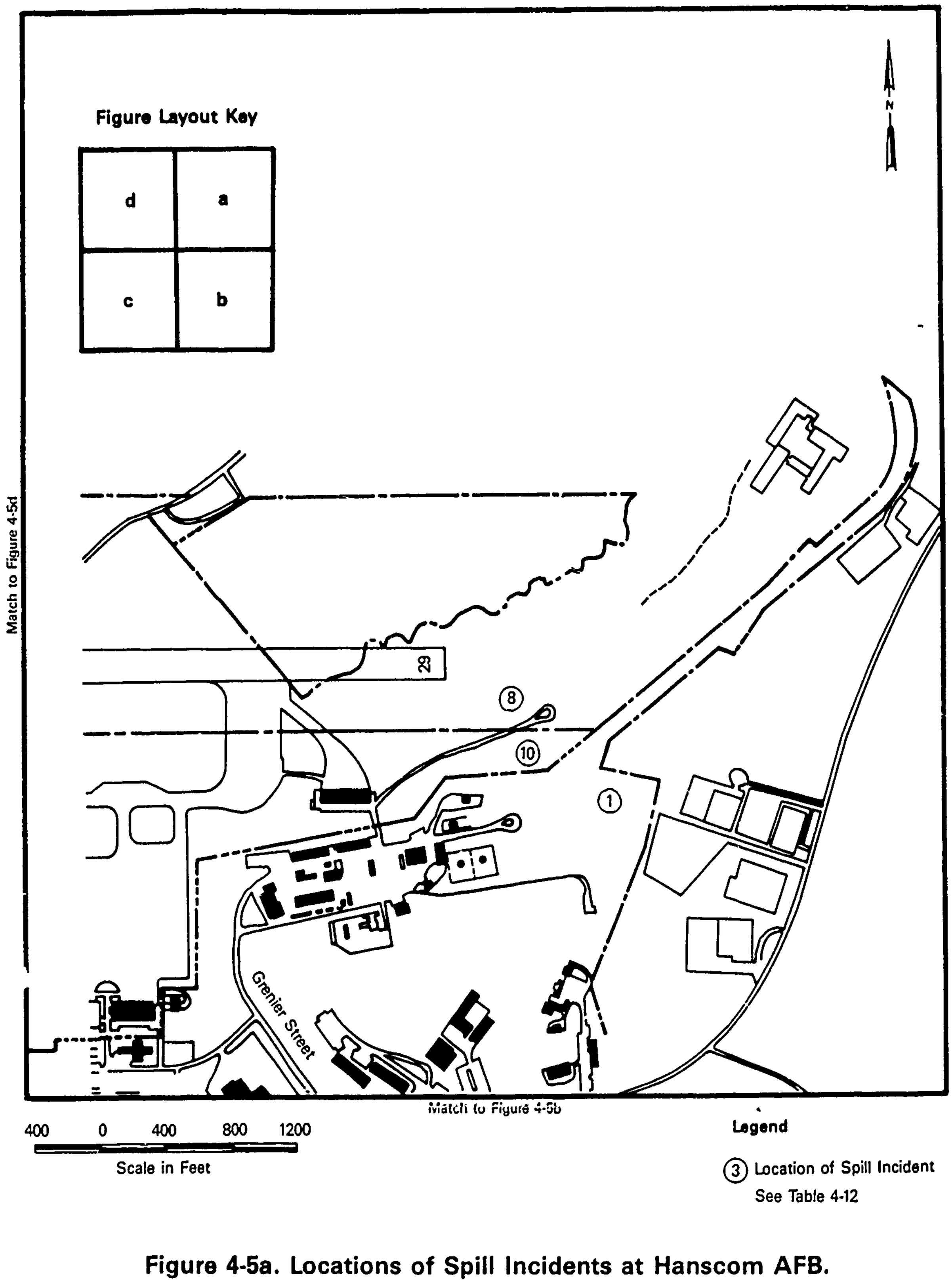


Figure 4-5a. Locations of Spill Incidents at Hanscom AFB.

Match to Figure 4-5a

Match to Figure 4-5c

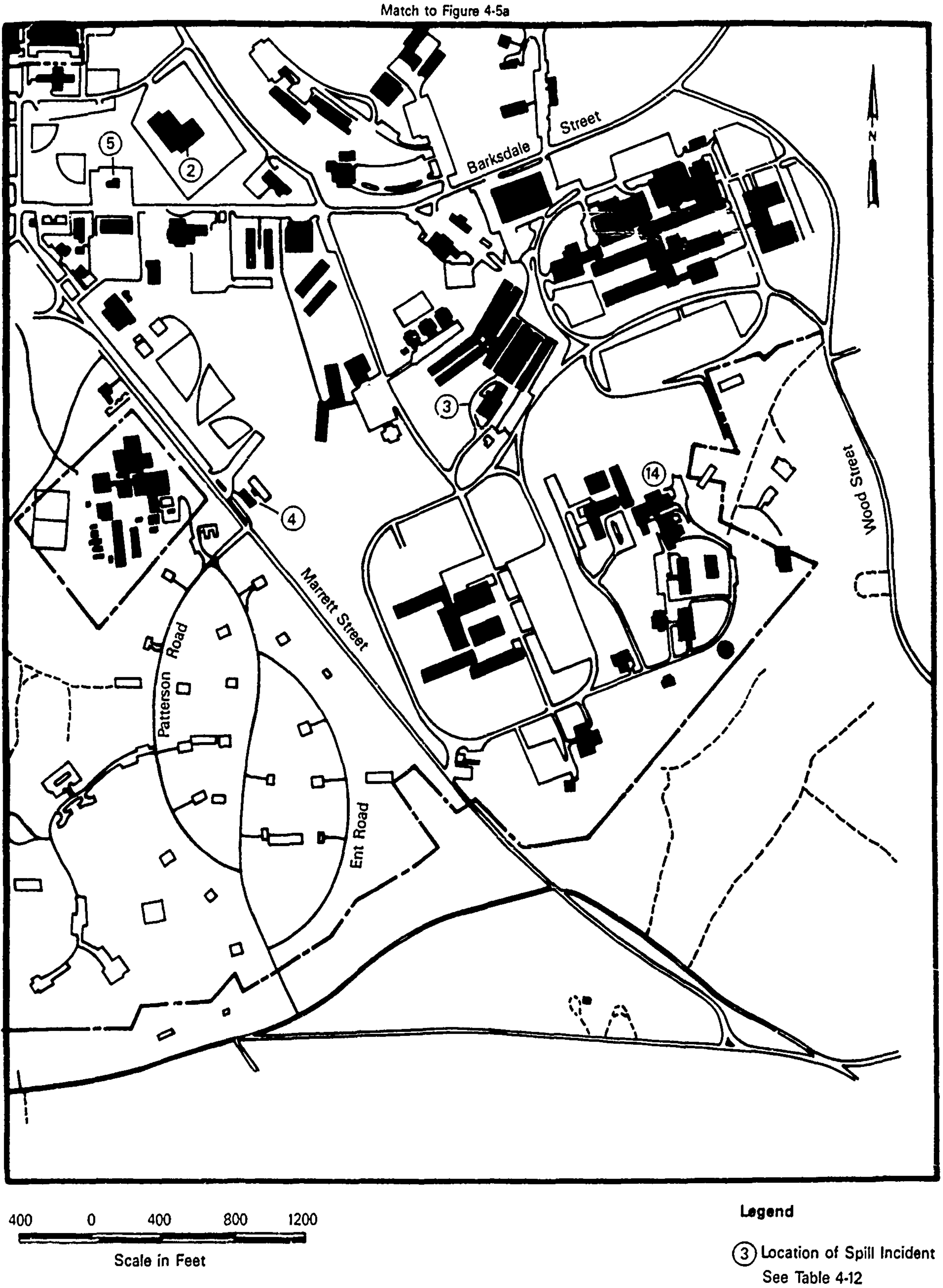
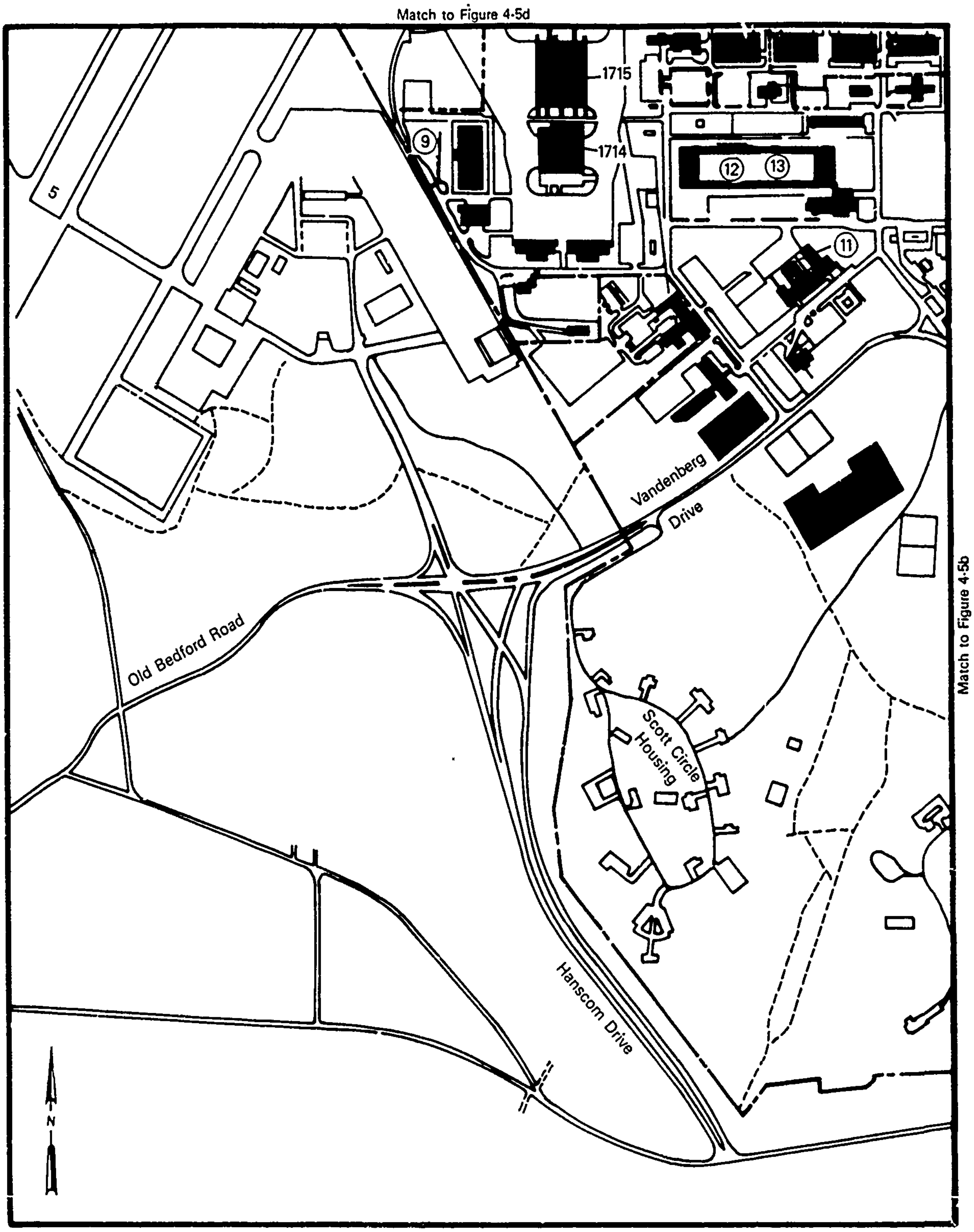


Figure 4-5b. Locations of Spill Incidents at Hanscom AFB.



400 0 400 800 1200

Scale in Feet

Legend

(3) Location of Spill Incident
See Table 4-12

Figure 4-5c. Locations of Spill Incidents at Hanscom AFB.

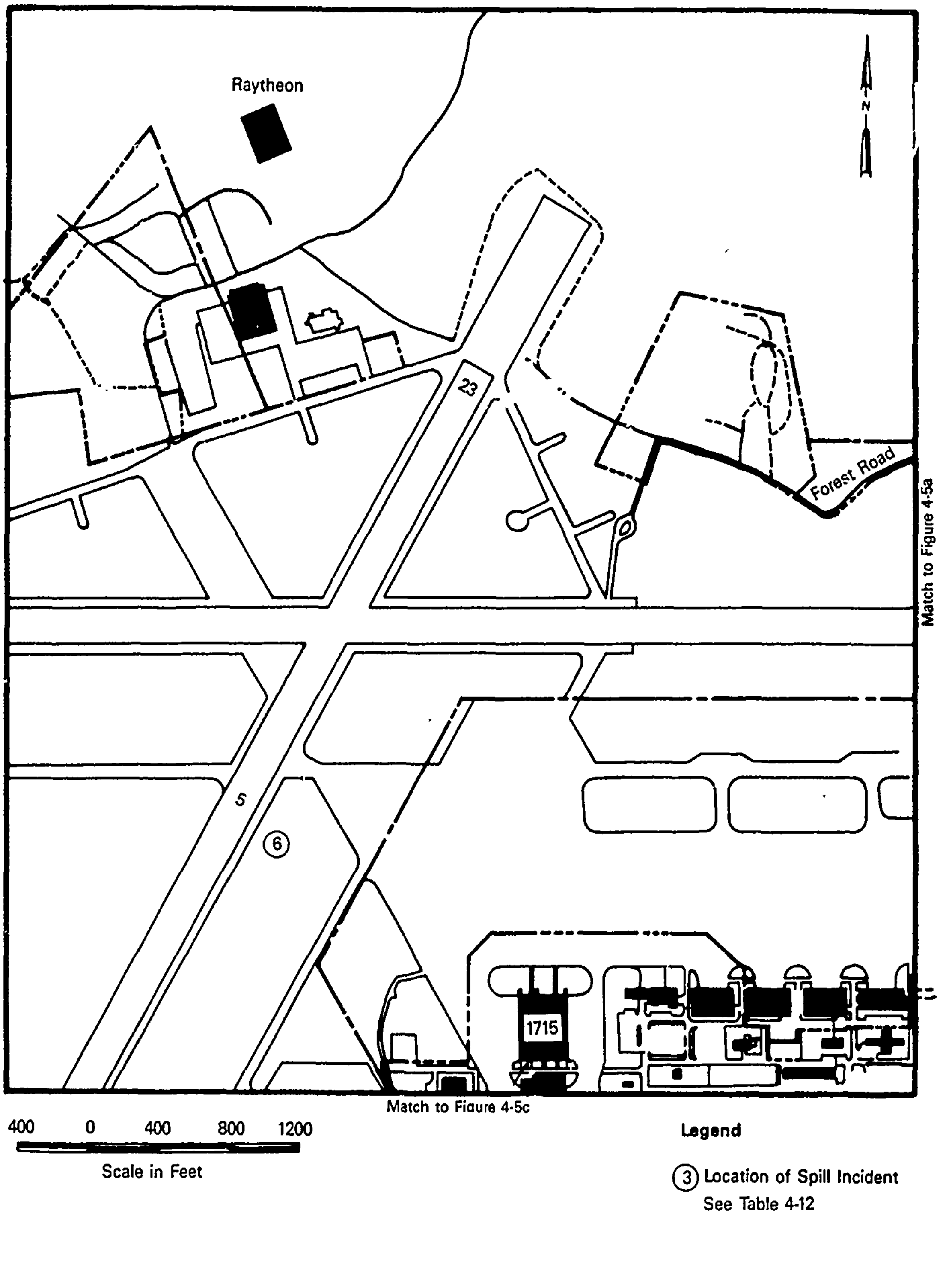


Figure 4-5d. Locations of Spill Incidents at Hanscom AFB.

TABLE 4-12

LOCATIONS OF SPILL INCIDENTS AT HANSCOM AFB

	Location*	Description	Figure 4-5
1.	Former Filter Bed	Bar Kleen Spill	a
2.	Motor Pool	Gasoline Spill	b
3.	Building 1201	PCB Leak	b
4.	Building 1550	Chlorine Release	b
5.	AAFES Base Service Station	Gasoline Tank Leak	b
6.	Runway No. 5	Jet Fuel Spill	d
7.	Deleted		
8.	Runway 29	Jet Fuel Spill	a
9.	Building 1704	Hydraulic Oil Spill	c
10.	P.O.L. Storage Yard	Oil Spill	a
11.	Administration Building	Jet Fuel Spill	c
12.	Base Supply (Bldg. 1614)	Methanol Spill	c
13.	Base Supply (Bldg. 1614)	HTH Spill	c
14.	Building 1128	Mercury Spill	b

*Numbers keyed to locations shown on Figure 4-5

Former Filter Beds

On April 4, 1983, an unauthorized intentional release of 110 gallons of "Bar Kleen" and 80 gallons of "Inhibitor N-101" occurred in the filter bed area behind the POL storage yard. These substances are boiler water treatment chemicals with the following chemical composition:

- Bar Kleen
  - phosphoric acid
  - nitrilotriacetic acid
- Inhibitor N-101
  - sodium nitrate
  - sodium borate
  - 1,2,3-benzotrialzole

Civil Engineering Services responded quickly to the spill, and cleanup was completed within 8 hours. The cleanup procedure consisted of pumping the free liquid into drums and collecting the contaminated soil. An emergency contractor specializing in hazardous material cleanup was used for the response action. Approximately 30 cubic yards of contaminated soil was collected and placed temporarily in a polyethylene-lined holding lagoon in the filter bed area. The contaminated soil was covered with a plastic tarp it was subsequently determined not to be classified as hazardous.

Motor Pool Spill

Hanscom AFB correspondence references a December 4, 1981 leak in an underground tank containing unleaded gasoline located at the base Motor Pool (Building 1642). The leak was discovered when a 5,000-gallon tank failed a routine vacuum test. The gasoline tank was not refilled after the leak was identified. The tank is situated within 300 feet of the culvert that carries the Shawsheen River under Hanscom AFB. The quantity of gasoline discharged into the soil and groundwater is not known.

In response to a request from the Massachusetts Department of Environmental Quality Engineering, base personnel dug an observation hole adjacent to the leaking fueld tank to assess the degree of groundwater contamination. The removed soil was reported to have a strong gasoline odor. The gasoline-contaminated soil was thoroughly aerated on a plastic liner within a diked area near the former filter beds. A Scavenger recovery unit was in operation during the entire fuel tank replacement operation. The unit recovered 5 gallons of fuel.

The leaking tank was located with three other 5,000-gallon tanks at the site, including two containing leaded gasoline and one containing diesel fuel. The top of the tanks were approximately 3 feet below the asphalt and concrete pavement and were surrounded with sand and native soil. The maintenance records indicated that the tanks were about 35 years old at the time of the incident and had undergone no repairs since their installation.

Although the other three fuel tanks passed the vacuum test, all four tanks were replaced in compliance with Massachusetts State law. Cleanup of the groundwater continued in the recovery well until the Scavenger unit could extract no more contaminated fuel from the groundwater.

Building 1201 PCB Leak

On August 31, 1981, during a routine inspection of operational equipment in the Central Heat Plant (Building 1201), a Wagner 500-kilovolt transformer was observed to be leaking a PCB fluid from a worn gasket located on the side of the transformer. It was estimated that less than 1 quart of the PCB fluid "no-flamol" was spilled on the transformer and the adjacent concrete floor. The spill was contained using an unknown absorbent material. The released PCB fluids were placed in DOT-approved containers and sent off site to a licensed disposal firm. A contractor repaired the transformer by replacing all seals and gaskets. The National Response Center and the EPA Region I office were notified of the incident.

Building 1550 Chlorine Release

On June 12, 1981, during a routine change of the chlorine tanks at the base swimming pool (Building 1550), chlorine gas was accidentally released into the air. A faulty brass fitting located between the chlorine tank and the chlorinator caused the indicator gauge on the tank to read empty even though a small amount of gas still remained in the tank. An estimated 5 pounds of chlorine gas was discharged into the atomosphere. No remedial cleanup activity was deemed necessary. The two workers installing the tanks reported feeling nauseated following the incident.

AAFES Service Station Gasoline Tank Leak

On February 4, 1981, the results of a vacuum test indicated that a 12,000-gallon gasoline underground storage tank at the base Service Station (Building 1639) was leaking. A contractor who was hired to replace the tank estimated that about 3,000 gallons of fuel had leaked into the surrounding soil. Approximately 2,500 gallons of gasoline were pumped from the site after the tank was removed on May 4. During the replacement of the leaking tank, two other 10,000 gallon tanks were also discovered to be defective and were replaced.

In accordance with Massachusetts State law, a gasoline recovery system and observation wells were installed on May 8. The recovery system collected an additional 200 gallons of gasoline from the site. The recovery system operated until no more gasoline could be recovered from the depressed groundwater table (at 2 months total time). Also, about 60 cubic yards of contaminated soil were excavated and stored at Building 1639 for aeration prior to off-site disposal at a contract landfill.

Runway 5 Jet Fuel Spill

A spill of approximately 300 gallons of jet fuel on the runway near Building 1715 in the 1960's was reported by a base employee. The Fire Department reportedly hosed the spilled fuel into the storm drain system.

Runway 29 Jet Fuel Spill

On June 13, 1973, during a heavy rainstorm, a T-39 aircraft hydroplaned off of the east end of Runway 11-29 discharging an estimated 300 gallons of JR-4 jet fuel into an adjacent storm drain and into the Shawsheen River. Base personnel reported sighting small patches of fuel on the surface of the river approximately 2 hours after the accident. Due to the inclement weather conditions at the time of the accident, no preventive action by Air Force personnel could be taken to prevent the spill from entering into the stream channel. In addition, no subsequent cleanup activities were attempted.

Hydraulic Oil Spill

On August 23, 1978, a hydraulic oil spill (3 to 5 gallon) caused by a burst fuel line in the power steering mechanism of a K-loader vehicle occurred on a concrete ramp near the west side of Building 1704. The base environmental coordinator dispatched an emergency response team from the roads and grounds unit. A combination of sand and Speedy Dry absorbent was applied to an area of approximately 20 square yards. The spill area was closed off from all vehicular traffic for a period of 24 hours. On August 24, the contaminated sand and absorbent material were removed from the site in approved containers and stored by the environmental coordinator prior to off-site disposal by a licensed contractor.

POL Storage Yard Oil Spill

On March 10, 1977, an oil spill estimated to be at least 60 gallons occurred behind the POL Storage Yard (Building 1827). Although the spill was contained with absorbents within the POL Storage Yard area, the oil and cleanup materials were not immediately removed from the site. After receiving advice from the Massachusetts Resource Division of the Environmental Management Department, Air Force personnel scraped up the oil-contaminated soil and absorbent material, placed them into barrels, and sent the barrels to Building 1104C for temporary storage prior to disposal by a contractor.

Administration Building Jet Fuel Spill

Former base personnel recalled that a 5,000-gallon spill of JP-4 jet fuel oil occurred in 1954, directly northwest of the area presently occupied by the base Administration Building (Building 1600). The incident occurred when a tank trailer containing JP-4 jet fuel was ruptured by a tractor while base personnel were attempting to secure the trailer to its hitch. An emergency situation was declared and the entire half-acre site was encircled with a soil berm to contain the spill. Approximately 24 hours after this action, the base Fire Department was called in to burn off the remaining jet fuel residue. The amount of fuel that entered the groundwater is unknown, but should be considered substantial because of the elapsed time between spillage and burning.

Base Supply Building Methanol Spill

On March 8, 1976, two gallons of methanol were spilled at the base supply (Building 1614) receiving dock. The spilled methanol was absorbed and disposed according to the Air Force Headquarters Waste Management Guidelines.

HTH Spill at Base Supply

Sixteen 110-pound corroded drums of HTH (65 percent calcium hypochlorite) were discovered leaking at base supply on June 26, 1975. The spill was quickly contained and the material was stored in plastic bags until it could be redrummed.

Building 1128 Mercury Spill

In 1975, an unknown quantity of elemental mercury was released from a waste holding tank into the sanitary sewer system. The mercury was sighted in two manholes near Building 1128. A former base employee reported the source of the mercury to be the radiation laboratory located in a nearby

RADC building. Typical quantities of mercury kept on hand at the laboratory ranged from 50 to 75 pounds. The cause of the spill is not known. Base personnel have suggested two possible explanations: 1) the waste holding tank, located in an underground vaulted storage building behind Building 1128, overflowed, or 2) the tank corroded and failed due to a faulty sump pump.

Building 1717 Hydrochloric Acid Compressed Gas Leak

In September of 1982, one of four hydrogen chloride (HCl) cylinders being stored in Building 1717 developed a leak. Prompt action was taken by emergency response personnel from the Fire Department to immerse the leaking cylinder in a drum of water so that the escaping HCl would be dissolved into the water. The resulting aqueous HCl was then neutralized with sodium hy' oxide. The other three cylinders were tested and found to be empty.

Building 1118 Chemical Spill

On January 17, 1984, approximately 2 gallons of suspected paint thinner/stripper were poured down a storm drain near Building 1118. No analysis was performed, but the substance was reported to be gray in color and to have an aromatic odor. In response to this spill, sediment located on the bottom of the storm drain was removed and placed in an approved container. Nevt, an empty 30-gallon container was positioned downstream along with a pump in an attempt to remove any excess residual that may have migrated downstream.

4.2 TREATMENT AND DISPOSAL METHODS

4.2.1 Overview of Practices

The date of earliest available information concerning the treatment and disposal of hazardous waste at Hanscom AFB in 1951. Interviews with Air Force and civilian personnel who worked at the base revealed that, from 1951 to 1974, containers with varying amounts of hazardous substances or contaminated materials were routinely mixed with general refuse, which was placed in on-base land disposal areas. Another common practice during this time was the collection of petroleum-based wastes in 55-gallon drums that were either buried on-site in land disposal areas or burned in fire training exercises. Land disposal sites and fire training areas are discussed further in Sections 4.2.2 and 4.2.3, respectively.

The on-site disposal of hazardous materials was curtailed in the early 1970's following the promulgation of Federal and State guidelines concerning the proper treatment and disposal of solid wastes. With the closure of the sanitary landfill in December 1974, all waste disposal for Hanscom AFB was performed by either the Defense Property Disposal Office (DPDO) or private contract disposal firms.

Beginning in 1975, the DPDO unit at Ft. Devens assumed the responsibility of providing regular pickups of waste oil and paint thinners temporarily stored at Hanscom AFB. In addition, the Ft. Devens DPDO has accepted certain chemicals for resale on a case-by-case basis since 1980 and disposal of other chemicals by hazardous waste contractors if no resale market exists. More recently, DPDO has obtained a hazardous waste removal contract to be used on an as-needed basis during the fiscal year.

From 1955 to 1976, an industrial wastewater treatment plant was operated in Building 1717. The plant was designed to neutralize oily wastes, and wastewaters generated by the bases's industrial support shops prior to plant was replaced in 1976 with three oil interceptors. These oil interceptors were installed to remove oil-based substances from wastewaters generated at the base motor pool, hanger, fire station, and auto hobby shops. A detailed discussion of the wastewater treatment system is provided in Section 4.2.1.

An incinerator, installed at Hanscom AFB in 1965, was used to burn general refuse such as paper, rags, cardboard, etc. No documentation has been found to indicate that hazardous waste was incinerated. Interviews with the principal incinerator operator revealed that the incinerator was operated approximately 4 hours per day over a 10-year period. The incinerator required hand feeding, which would have facilitated identification and removal of any potentially hazardous materials that otherwise would have been incinerated. The operation of the incinerator was discontinued in 1975.

4.2.2 Industrial Wastewater Treatment

In 1955, an industrial wastewater treatment plant was established in Building 1717 to remove oily wastes and neutralize plan wash water and wastewaters from support shops prior to discharge. Hanscom AFB operated this industrial waste treatment system for approximately 21 years. As a replacement for the industrial waste system, three oil interceptors were installed in 1976 at Buildings 1721/1722, 1642, and 1830. The locations of these and other oil interceptors and the former treatment plant are shown in Figure 4-6. Table 4-13 provides additional information and a guide to the figure.

During its operation, the industrial wastewater treatment system handled the effluent from ten buildings (Nos. 1642, 1701, 1702, 1715, 1716, 1721, 1722, 1724, 1727, and 1730), which generated wastes that were considered to be undesirable for discharge into the sanitary sewer system. The treatment system consisted primarily of an F.S. Gibbs Flotation Unit complete with chemical feed systems for alum and soda ash addition. Sludge removed from the treatment system was deposited into the filter beds for drying; the dewatered sludge was subsequently placed in the adjacent landfill site referred to as the tank sludge disposal area (see Section 4.2.2). The treated effluent was discharged into the storm drain system (located on land now owned by the Massachusetts Port Authority), which discharges into the Shawsheen River.

A review of base documents revealed that the industrial wastewater treatment system had a history of leaks, particulary along the east end of Chennault Street. Furthermore, it is conceivable that the leaked material made its way into the storm drainage system. In March 1976 the base abandoned the industrial wastewater system (including all pits and Building 1717) due to

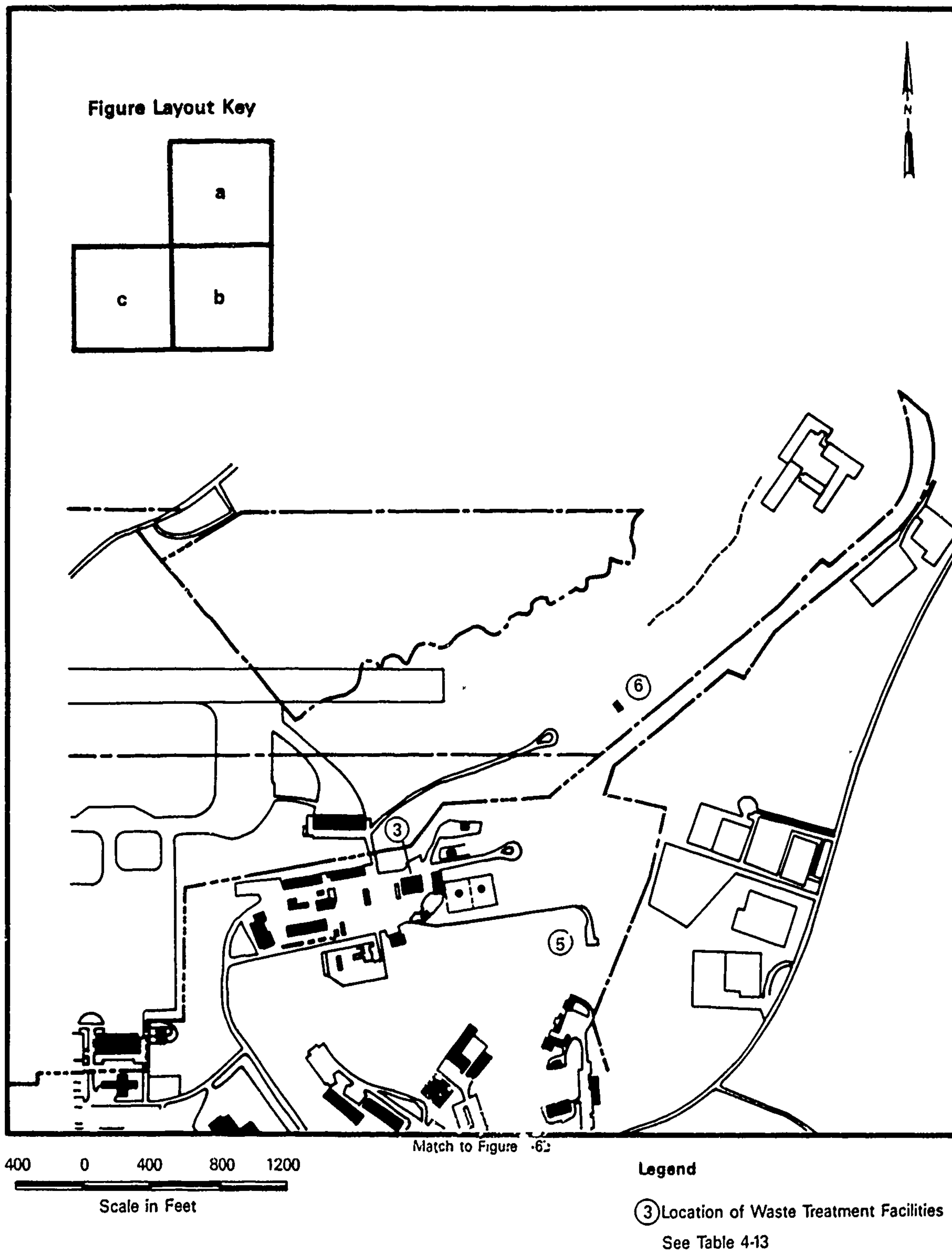


Figure 4-6a. Locations of Waste Treatment Facilities at Hanscom AFB.

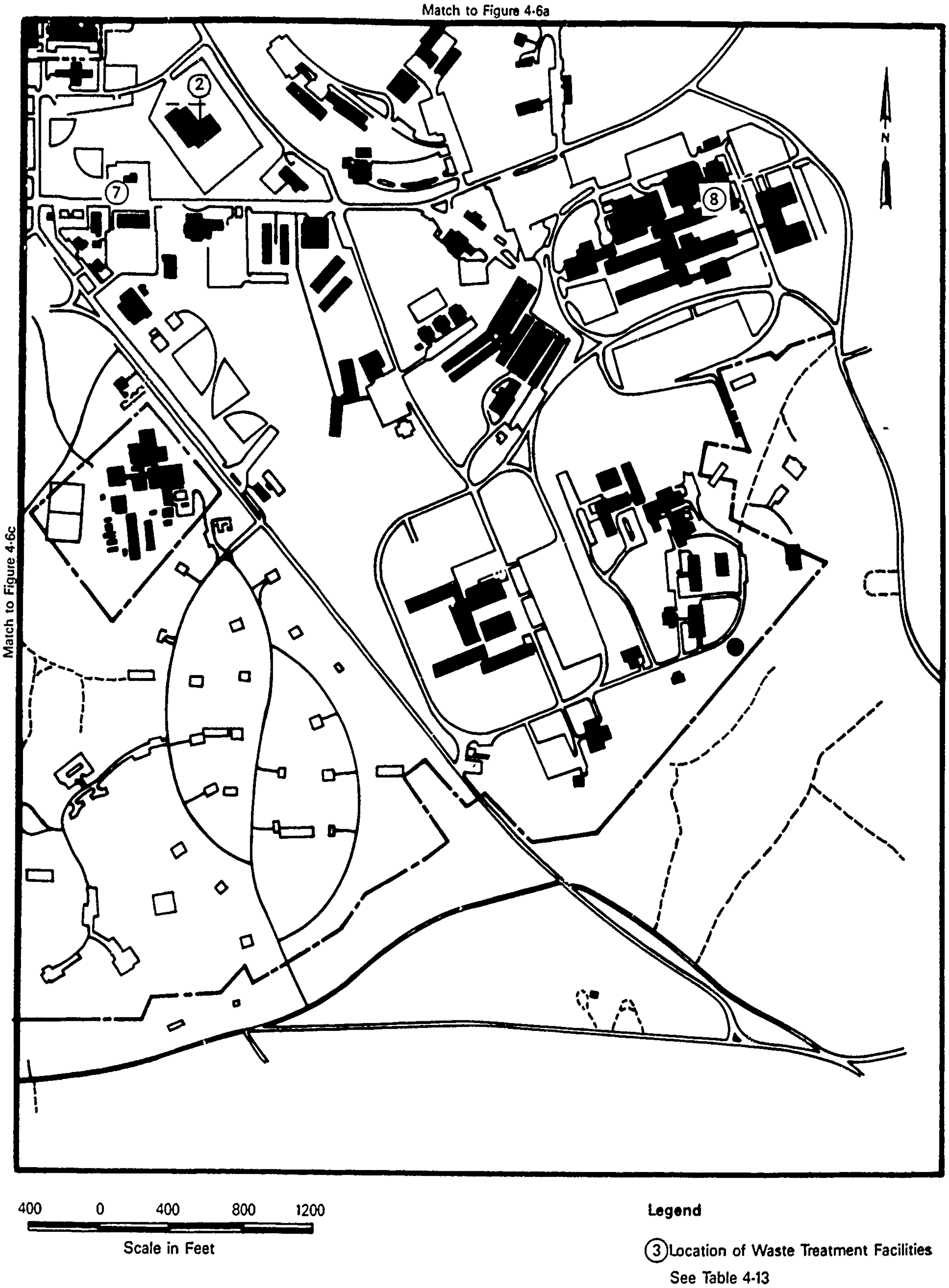
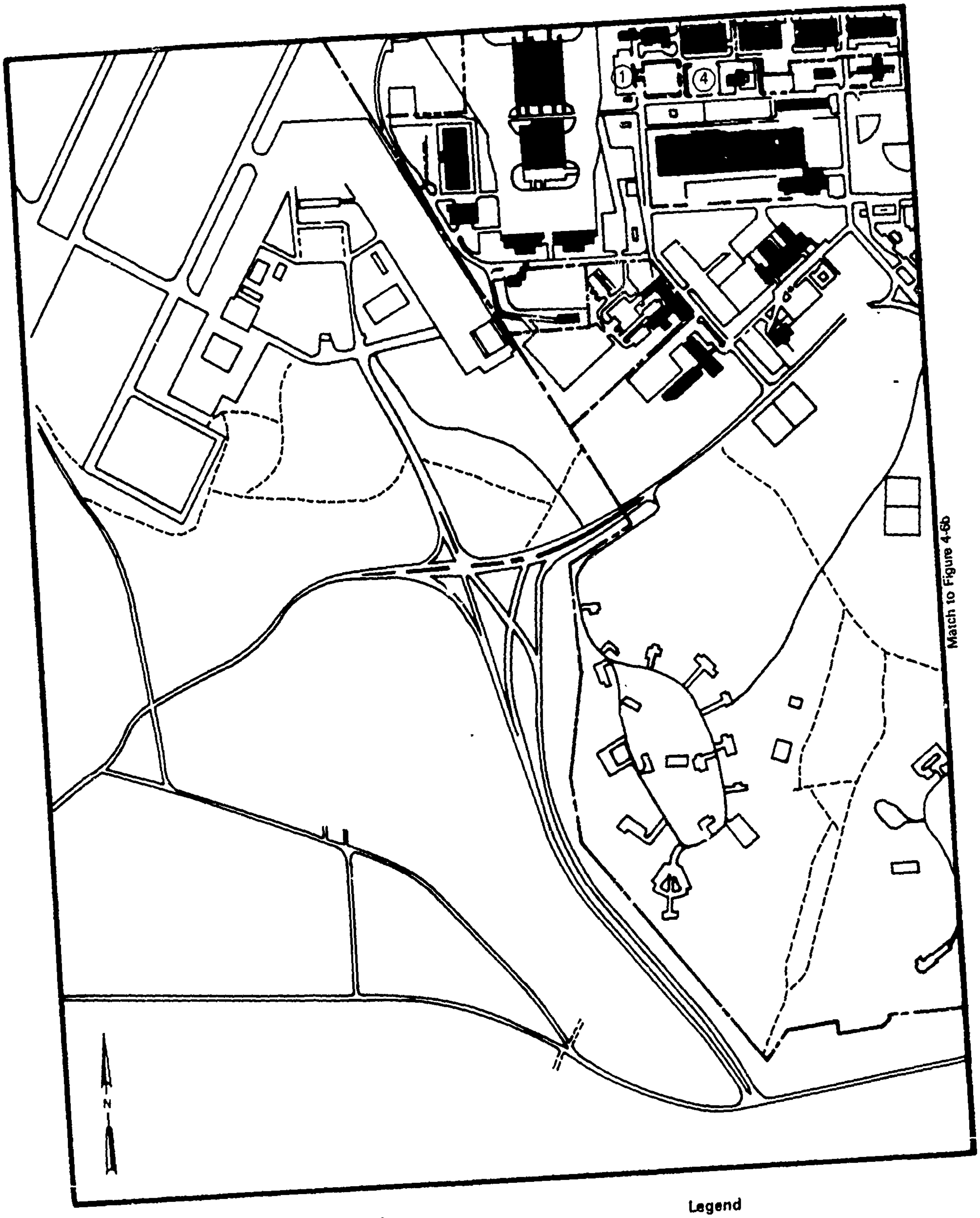


Figure 4-6b. Locations of Waste Treatment Facilities at Hanscom AFB.



Legend

(3) Location of Waste Treatment Facilities
See Table 4-13

Figure 4-6c. Locations of Waste Treatment Facilities at Hanscom AFB.

TABLE 4-13

LOCATIONS OF WASTE TREATMENT FACILITIES AT HANSCOM AFB

	Location*	Description	Interceptor Capacity (Gallons) Total	Interceptor Capacity (Gallons) Oil	Figure
1.	Building 1717	Industrial Waste Treatment Plant	-	-	c
2.	Building 1642	Oil Interceptor at Motor Pool	2070	202	b
3.	Building 1830	Oil Interceptor at Automotive Shop	305	34	a
4.	Building 1772	Oil Interceptor at Former Hanger Wash Rack	NA	NA	c
5.	Dallis Boom	Floating Oil Interceptor	-	-	a
6.	Building 1639	Oil Interceptor at Base Service Station	396	216	b
7.	Building 1302 E	Lincoln Laboratory Oil Interceptor	396	216	b
8.	Building 1721 and 1722	Oil Interceptor at Hanger	1388	154	b

* Numbers keyed to locations shown on Figure 4-6

NA = Information not available

\- = Does not apply

the high cost of operation and inherent leaks in the system. The lines were capped and abandonned in place, and the oil interceptors were put into service. The purpose of the oil interceptors is to remove oil-based substances from the wash areas and repair stations. The interceptors are tied into the sanitary sewer system, eliminating direct discharge into storm drains. Collected oil and solids are periodically recovered from the interceptors and disposed of off base by a contractor.

In addition to the oil interceptors, a floating oil boom called "Dalli's Dam" was installed on the Shawsheen River just north of the POL Storage Yard and the former filter beds (see Figure 4-5). The purpose of this oil boom was to collect oil from accidental spills from the POL Storage Yard area or from fuel spills on the runway. A recent inspection of Dalli's Dam showed it to be inoperable. Hanscom AFB no longer owns this land and Massport has not maintained the boom.

4.2.3 Land Disposal Sites

The Phase I investigation of Hanscom AFB revealed five distinct land disposal areas. Sufficient documentation exists to confirm the presence of hazardous substances in the following disposal sites:

- Sanitary landfill
- Paint waste disposal area
- Tank sludge/jet fuel residue disposal area
- Former filter bed area
- Scott Circle landfill
- Roof tar dispoal area.

The sizes and periods of operation of these disposal sites vary. The locations of the sites are illustrated in Figure 4-7. These sites are discussed further in the following sections.

No information was encountered to indicate that hazardous wastes or hazardous materials were disposed on land at the seven off-base facilities.

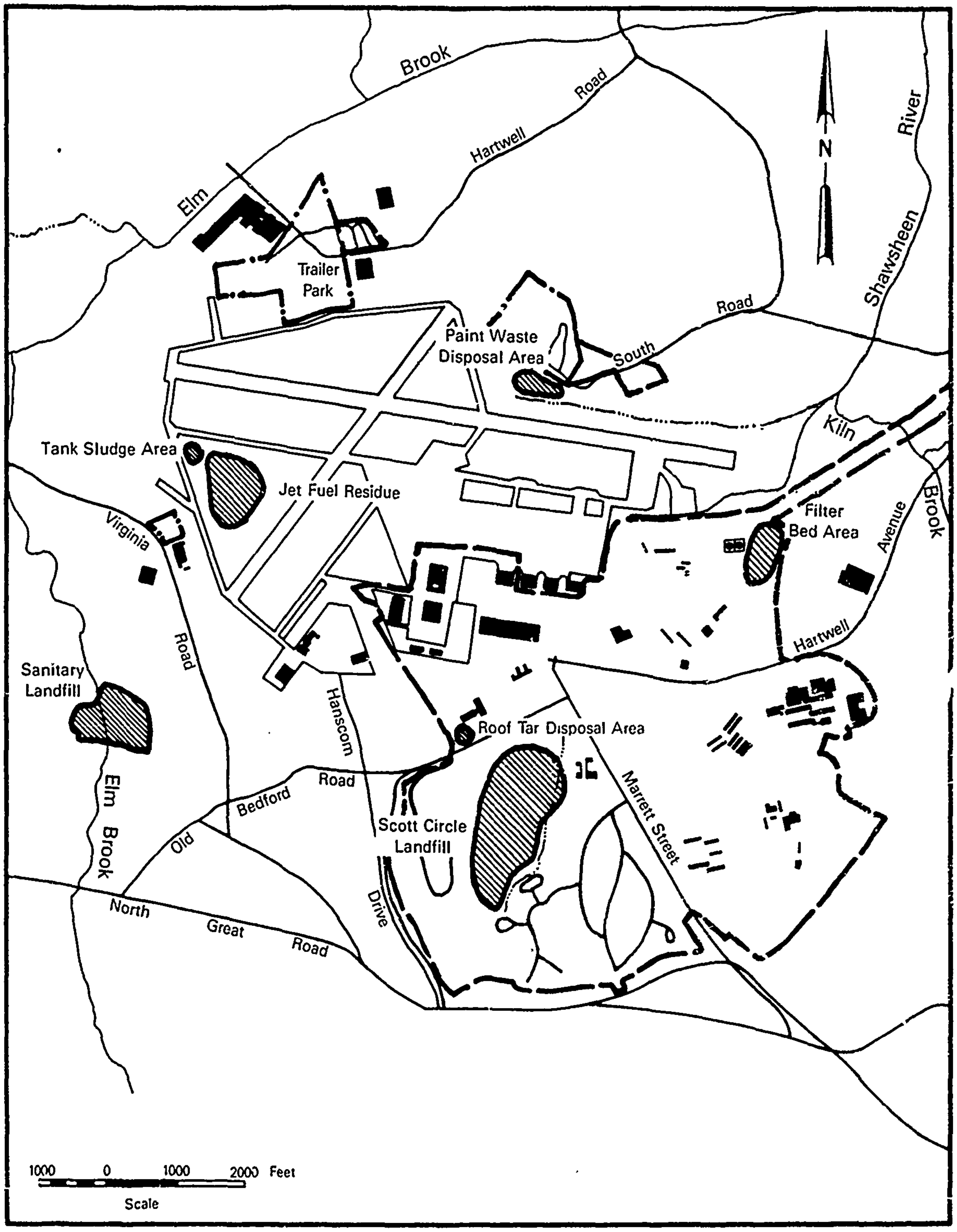


Figure 4-7. Locations of Land Disposal Sites at Hanscom AFB.

Sanitary Landfill

The Hanscom AFB sanitary landfill is no longer in operation. The site covers 10.5 acres and is located approximately 1,800 feet southeast of the approach end of Runway 5-23. The landfill ranges from 10 to 15 feet deep and is estimated to have a volume of 210,000 cubic yards. The site is located on gently sloping terrain contiguous to a wetlands area, which drains into Elm Brook. The landfill is situated predominantly in the town of Lincoln, with a small portion protruding into the bordering town of Concord. The landfill was operational from December 1964 until December 1974. Pre-1964 topographic maps of the area indicate that the site was a wetland area, suggesting that waste was placed in surface water and that the bottom of the landfill is below the current water table. During its active life, the landfill was intended to be primarily for the disposal of solid waste.

Interviews with base personnel confirm that dumpsters containing waste from all shops and research laboratories were emptied into the sanitary landfill during its 10-year operation. No attempt was made to segregrate hazardous materials from nonhazardous materials during the 1960's and early 1970's. A review of the 1980 chemical inventory and waste management practices of Hanscom AFB shops and resident research facilities (i.e., RADC, AFGL) revealed that the following types of compounds and associated empty containers were routinely discarded into dumpsters:

- Battery acid
- Bonding compounds
- Fuels
- Medical wastes
- Inks and paints
- Mercury
- Photographic chemicals (developers, fixers, toners)
- Solvents
- Spent acids (HF, H_2SO_4, HCl, HNO_3)
- Trichloroethylene and other cleaning solvents.

Following the landfill's closure in 1974, a leachate problem was identified at the site. An inspection was subsequently conducted by a sanitary engineer from EPA Region I, which revealed several violations of the Commonwealth of Massachusetts regulations regarding the disposal of solid waste in sanitary landfills. To comply with these regulations, a formal closure plan was adopted in 1975, which involved:

- Development of a final grading plan incorporating requirements for cover material, berms, seeding, and drainage
- Complete surveillance of the site for 12 months following placement of final cover
- Implementation of a rodent-control program
- Water quality testing of Elm Brook upstream and downstream of the landfill
- Development of a master utilization plan for the site
- Performance of a land survey to determine the extent and grades of the landfill and depth of cover material (minimum of 2 feet specified).

A routine inspection of the sanitary landfill area by Air Force Environmental Health personnel in April 1977 resulted in the identification of a severe erosion problem that was evident at the far west end of the site bordering on Elm Brook.

The JRB Phase I team inspected the landfill, which is now the site of a softball field. The site is bordered on all sides by swampy low-lying land with fair to good vegetative cover. Seepage and water runoff (exhibiting reddish discoloration and a blue/green sheen) were observed to be flowing from the west end of the site. Patches of refuse were exposed in this area and around the perimeter of the site. Refuse (cans, paper, and miscellaneous residues), standing water, and rusted empty drums were evident along the west end of the site.

Paint Waste Disposal Area

This former disposal site for waste solvents and paint is located just north of Runway 29-11 and east of Runway 5-23. This land is currently owned by the Massachusetts Port Authority. The area is the same elevation as the runway but above the nearby marshy area. It is devoid of most vegetation, possibly because of the sand cap placed over the site. No odors were detected at the site.

Interviews with base personnel reveal that from 1966 to 1972 paint wastes and other toxic materials were buried in this area. A Field Investigation Team report completed by NUS Corporation described many corroded leaking drums releasing wastes to the surrounding marsh area and groundwater. Water samples analyzed by Roy F. Weston, Inc., show 11 VOA compounds detected, with total loading of 53 ppm. This site is being monitored by the Air Force and is a priority site scheduled for possible future cleanup.

Jet Fuel Residue Area/Tank Sludge Area

Several hundred drums of waste oils and paint wastes were buried at the Jet Fuel Residue Area during 1959 and 1960. Because of the long time period that has elapsed since this activity, the two witnesses who reported this disposal have not been able to pinpoint the extent of the site. However, drums are believed to be buried on the infield south of Taxiway "Whiskey", east of Taxiway "Mike", and west of Runway 5-23.

A notification to EPA of hazardous waste disposal activities filed by Hanscom AFB in April 1982 stated that this site contains at least 200, 55-gallon drums, which contain waste airplane fuel, oils, and paint waste. The disposal activities involved excavating parallel trenches 8 to 10 feet deep, filling them with drums, and then backfilling the trenches. Several drums were reported to have been leaking after being pushed into the trenches, resulting in odors that made the workers feel nauseated.

A heavy-equipment operator at Hanscom AFB reported the burial of ten to fifty 55-gallon drums. Disposal at this site, referred to as the tank sludge area, occurred on a routine basis during the early 1960's over at least a 2-year period. The employee did not know the contents of the drums. Because of the close proximity of these sites, they are discussed and evaluated as one in this report.

Former Filter Bed Area

This site comprises the filter beds formerly used to dewater sewage sludge from Imhoff tanks and an adjacent tank sludge disposal area and landfill. The combined size of these areas is approximately 20 acres. The filter beds are bounded on the west by the fuel storage facility fence line, on the east by the base property line, a railroad spur leading toward Itek on the north, and the service road to the site on the south. The 12-acre filter bed area is relatively level. A rusting sign in the southeast corner of the filter bed area reads "Leaded tank sludge buried here, do not excavate."

The adjacent landfill area consists of 8 acres of hillside located south of the filter beds. This area is graded into several terraces at 160- to 180-foot MSL elevations. The landfill site extends eastward to the Air Force property line and includes the incinerator and service road, which leads up the hill to the site. Because of the close proximity of the filter bed area landfill, and tank sludge disposal area, these sites are addressed as one disposal area in this report.

The JRB site investigation team observed that the filter bed site is situated in a low-lying area cut into a hill bordered by boulders, rock debris, and sandy soil. At the north edge of the site was a diked area (30 feet by 15 feet) containing two truck loads of No. 2 fuel oil-soaked soil being dried on polyethylene sheets. Across from the fenced area, there was evidence of rusting drums and bulk waste material. Also in evidence were 10 to 15 empty drums labeled as foaming grease. One of these drums was on its side and leaking a rust-colored liquid, most probably rain water discolored by the rusted drums. Also in evidence was a concrete slab, on which rested powerline insulators, sod piles, and construction debris. This is the sole remaining pit that was associated with the filter bed area when it was active.

In the late 1940's, approximately 200 canisters of DDT were buried in the area of the former filter beds. Most of these canisters were excavated in the early 1970's and transferred to the Hingham Naval Facility for final disposal. About one-fourth of the canisters were so deteriorated that they could not be removed. Interviews with base employees revealed that these remaining canisters and their contents were reburied in the filter bed area.

Scott Circle Landfill

The Scott Circle Landfill is located just south of the Base Clinic and Elementary School and is bounded on three sides by military housing complexes. Site inspection confirmed landfill activities as far south as the skating rink, and excavation for Building 1900 (Base Clinic) revealed that the landfill extends north to the athletic fields. This site is estimated by the JRB site visit team to occupy approximately 40 acres and thus is the largest land area of all the disposal sites identified. Landfilling activities began in the early 1950's and continued through 1973.

During its operation, the fill was characterized as principally receiving construction materials and debris. However, interviews with base personnel have confirmed the disposal of hazardous substances at this site during the 1960's. Examples of hazardous substances placed in this landfill area include paint, paint thinner, solvents, waste oils, and laboratory chemicals. Also, several sources verified the burial of aircraft and automobiles at this site.

Roof Tar Disposal Area

The Roof Tar Disposal Area is located just north of the Scott Circle Landfill behind Building 1606. The site was discovered during the construction of a parking lot for the Systems Management Engineering Facility (SMEF). Neither the date of the site discovery nor the period of the construction activity could be determined in the records search. The site consisted of an area 20 feet by 30 feet and was located in the western portion of the parking lot. Interviews with base personnel revealed that approximately 20 to 50 buckets (volume not known) of tar pitch asphalt and assorted debris were present at the site. A contract was issued by the Department of the Army on April 18, 1980 calling for the removal and off-site disposal of any refuse, debris, concrete, wood poles, and asphalt cans that were unearthed during the excavation of this area.

4.2.4 Fire Training

Fire Training Area I

The original fire training area (Fire Training Area I, called former fire training area by Weston and in Section 2) consisted of a large pit located to the south of Runway 29-11 and west of Runway 5-23 (Figure 4-8). From the early 1950's through the 1960's, this site was used by the base Fire Department for training exercises. These training exercises consisted of emptying drummed solvents, contaminated fuels, and spent laboratory chemicals into the fire training pit, igniting the contents, and extinguishing the flames using state-of-the-art techniques. Up to 60 to 80 barrels of materials were dumped into the pit during weekend training exercises in order to simulate the desired fire hazard.

Fire Training Area II

In the late 1960's, following extensive modification of the nearby runway, the fire training area was relocated to an area northwest of Runway 5-23 (Figure 4-8). From the late 1960's through 1973, this site (herein called Fire Training Area II) was used by the base Fire Department at least twice a week, and occasionally by the Arthur D. Little consulting firm to conduct research on pyrokinetic materials. During these fire training sessions, drums of degreasing chemicals, paint thinners, solvents, and waste soils were dumped into a large pit (15 feet by 20 feet) to achieve the desired conditions for training simulations. On several occasions the remains from aircraft wrecks and burned fuselages were burned in the pit. Fire training activities continued at the site until the termination of all flying activities at Hanscom AFB in 1973.

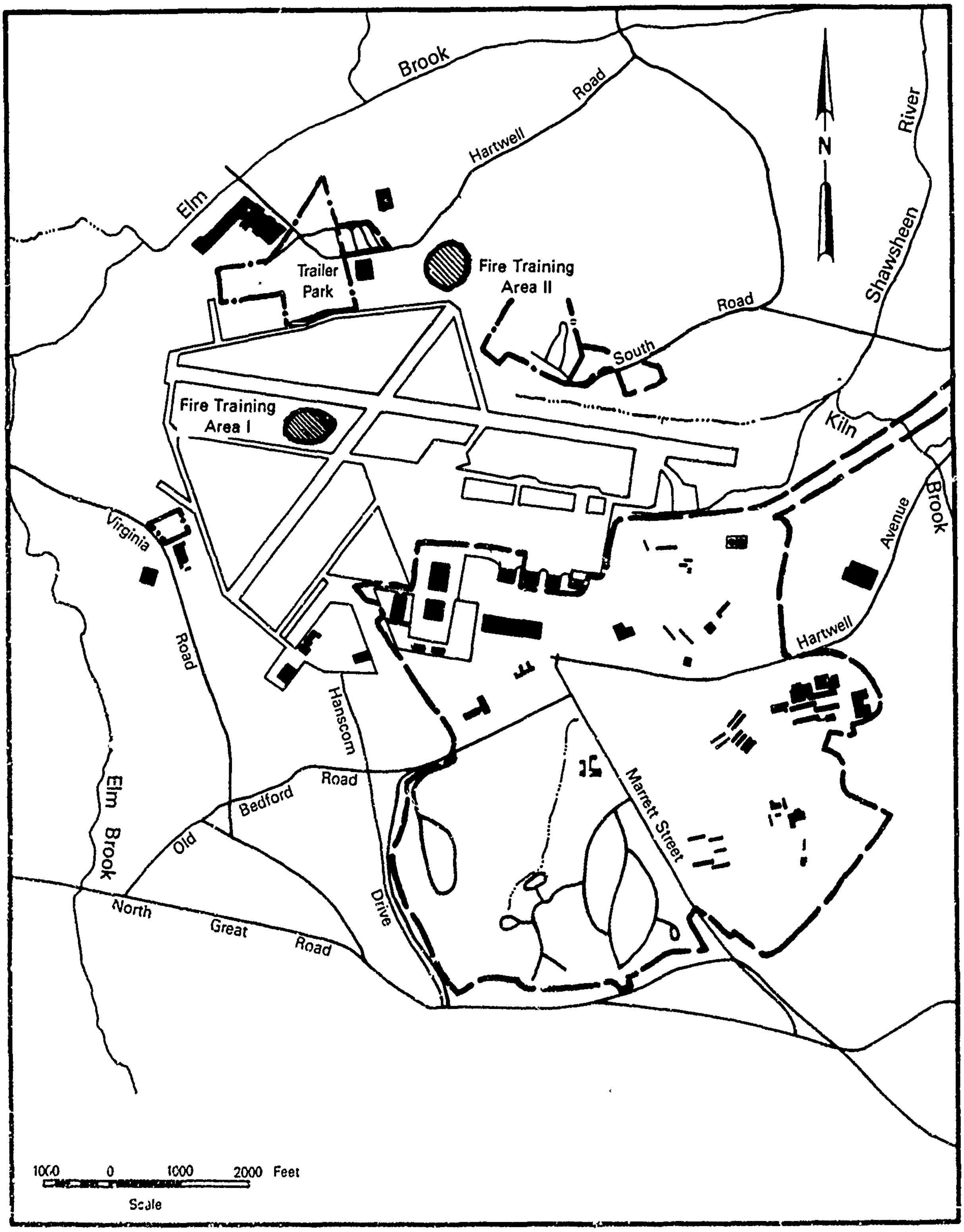


Figure 4-8. Locations of Fire Training Areas at Hanscom AFB.

Fire Training Area II is estimated to occupy an area of 3 acres. It is situated in a plateaued natural low-lying area, with local standing water. The area exhibits signs of burned and charred soil residue with small trees and bushes located around the southern limits. Rusted-out tanks, remains of drums, and an aircraft fuselage are readily visible around the site.

4.3 EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

The review of past operation and maintenance functions, waste management practices, and spill occurrences at Hanscom AFB resulted in the identification of 22 sites that were initially considered to be areas of concern and may have the potential to contaminate the environment. These sites were evaluated using the Phase I Methodology shown in Figure 1-1. Sites that were considered as not having a potential for contamination were eliminated from further consideration. Sites considered to have potential for contaminant generation and migration were further evaluated using the Hazard Assessment rating Methodology (HARM), provided in Appendix H. The HARM system is designed to indicate the relative need for follow-on action and takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices.

Table 4-14 summarizes the decisions made for each of the sites of initial concern. Based on the Phase I Methodology, 6 of the 22 sites originally reviewed did not warrant evaluation under the HARM. The rationale for not scoring these sites using HARM evaluation is discussed below.

The PCB leak in Building 1201 does present a potential for contamination. However, the small quantity of PCB that was actually spilled and the prompt and acceptable cleanup operation eliminated the potential for contaminant migration and other environmental concerns.

The chlorine gas leak in Building 1550 presented only a temporary danger to health. The rapid control and dissipation of the chlorine eliminated any lasting environmental concerns.

TABLE 4-14

SUMMARY OF DECISICN TREE LOGIC FOR AREAS OF INITIAL ENVIRONMENTAL CONCERN AT HANSCOM AFB

Site Description	Potentail for Contamination	Potential Contaminant Migration	Potential for Other Environmental Concerns	Harm Rating
Filter Bed Spill	Yes	Yes	No	*Yes
Motor Pool Spill	Yes	Yes	Yes	Yes
Building 1201 PCB Leak	Yes	No	No	No
Building 1550 Chlorine Release	No	No	Yes	No
AAFES Service Station Gasoline Leak	Yes	Yes	Yes	Yes
Ruptured Fuel Tank Spill	Yes	Yes	No	**Yes
Runway 5 Jet Fuel Spill	Yes	Yes	No	**Yes
Hydraulic Oil Spill	Yes	Yes	No	**Yes
POL Storage Yard Oil Spill	Yes	No	No	No
Administration Building Jet Fuel Spill	Yes	Yes	Yes	Yes
HTH Spill at Base Supply	Yes	No	No	No
Building 1128 ›rcury Spill	Yes	Yes	Yes	Yes
Building 1717 HCl compressed Gas Leak	No	No	Yes	No
Building 1118 Chemical Spill	Yes	No	No	No
Sanitary Landfill	Yes	Yes	Yes	Yes
Paint Waste Disposal Area	Yes	Yes	Yes	Yes
Jet Fuel Residue/Tank Sludge Area	Yes	Yes	Yes	Yes
Former Filter Bed Area	Yes	Yes	Yes	Yes
Scott Circle Landfill	Yes	Yes	No	Yes
Fire Training Area #1	Yes	Yes	No	Yes
Fire Training Area #2	Yes	Yes	No	Yes
Industrial Waste Treatment System	Yes	Yes	No	Yes
Roof Tar Disposal Area	Yes	No	No	No

* Considered with Former Filter Bed for HARM rating.

** Combined for HARM evaluation and considered as single site.

TABLE 4-15

SUMMARY OF HARM SCORES OR POTENTIAL CONTAMINATION SOURCES AT HANSCOM AFB

Rank	Site Name	Receptor Subscore	Waste Characteristic Subscore	Pathways Subscore	Waste Management Factor	Overall Total Score
1	Fire Training Area II	59	100	100	1.00	86
2	Paint Waste Disposal Area	57	100	95	1.00	86
3	Jet Fuel Residue/Tank Sludge Area	54	100	100	1.00	85
4	Sanitary Landfill	46	100	95	1.00	80
5	Fire Training Area I	51	100	81	1.00	77
6	Former Filter Beds	51	70	71	1.00	71
7	Industrial Waste Treatment System	56	80	81	0.95	69
8	Scott Circle Landfill	58	50	88	1.00	65
9	Administration Building Jet Fuel Spill	48	64	74	0.95	59
10	Mercury Spill Building 1128	52	60	56	1.00	49
11	Various Fuel Spills on Runways and Taxiways	57	40	72	0.80	45
12	AAFES Service Station Gasoline Leak	51	64	100	0.95	6
13	Motor Pool Spill	51	40	90	0.95	6

The filter bed spill was taken into consideration in the rating of the entire filter bed disposal site. If rated separately, the spill would rate very low. It does, however, contribute to the overall hazard of the filter bed disposal area.

The oil spill at the POL Yard was eliminated from consideration under HARM because of the quick response by base personnel and the acceptable and complete cleanup. The spill was acceptably contained and all contaminated soil was disposed of properly.

The spill of HTH at Base Supply occurred inside a building, was quickly controlled and cleaned up, and has no present potential for environmental contamination.

The HCl compressed-gass leak in Building 1717 presents no environmental contamination problems. Quick response on the part of cleanup personnel limited the leak to a minor temporary problem.

The small quantitiy of chemicals spilled near Building 1118 creates no environmental dangers. Although the chemicals were poured into the storm sewer system, quick and complete cleanup prevented their release into surface water. There is no present environmental danger from this occurrence.

Various spills of petroleum products have occurred on the runways or taxiways of the airfield and ranged in quantity from 5 to 300 gallons. Cleanup operations varied from none to acceptable; for rating purposes, these three incidents were evaluated under HARM as one site.

HARM scores and ranking of sites considered to have potential for contaminant generation and migration are shown in Table 4-15. The HARM scores are intended to aid in the assessment of priorities for further evaluation of problems identified at Hanscom AFB. The HARM rating forms for the scored sites are provided in Appendix D.

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5.0 CONCLUSIONS

One objective of the IRP Phase I investigations is to identify sites where there is a potential for environmental contamination resulting from past activities associated with the Air Force base's mission. It is also an objective of this study to assess the potential for contaminate migration from these sites. The conclusions discussed herein are based on field inspections; a review of records and files; an evaluation of the environmental setting; and interviews with base personnel, past employees, and State, local, and Federal officials.

Table 5-1 contains a list of the sites identified at Hanscom AFB that present a potential for contamination and a summary of their HARM scores. The complete HARM rating forms are included in Appendix D. Conclusions specific to each site are presented in the following sections.

Seven off-base facilities under the command and control of Hanscom AFB were also investigated under this study. Activities at six of the facilities presently show no potential for significant environmental contamination. Five of the facilities are research annexes and should not create future environmental problems. Fourth Cliff is a recreation annex and presents little potential for generation of hazardous wastes.

North Truro AFS is a small station having some of the facilities associated with a larger base, although the facilities are on a much smaller scale. In addition, many of the services necessary for the operation of this facility are provided by Hanscom AFB. Investigation showed that there are a small number of in-ground fuel and waste oil/solvent storage tanks present at this station. The station has also operated its own sewage treatment plant for a number of years. Interviews with base personnel and record searches showed no history of spills or leaks from the tanks and that the sewage treatment plant has operated within perscribed limits throughout its lifetime. There also has been no contamination reported in the two water supply wells at the station. Because no direct or indirect evidence of environmental contamination was found concerning this station, it was eliminated from further consideration.

TABLE 5-1

HANSCOM AFB SITES EVALUATED USING THE HARM METHODOLOGY

Rank	Site Name	Dates of Operation of Occurrence	Overall HARM Score
1	Fire Training Area II	Late 1960-1973	86
2	Paint Waste Disposal Area	1966-1972	86
3	Jet Fuel Residue/Tank Sludge Area	1959-1963	85
4	Sanitary Landfill	1964-1974	80
5	Fire Training Area I	1950-1960	77
6	Former Filter Beds	1940's-1984	71
7	Industiral Wastewater Treatment System	1955-1974	69
8	Scott Circle Landfill	1950's-1973	65
9	Administration Bldg. Jet Fuel Spill	1954	59
10	Mercury Spill Bldg. 1128	1975	48
11	Various Fuel Spills on Runways and Taxiways	1960's-1973	45
12	AAFES Service Station Gasoline Leak	February 1981	6
13	Motor Pool Spill	December 1981	6

Fire Training Area II

This site is on land formerly leased by the Air Force and now owned by Massport. The site is currently undergoing an IRP-Phase-II-type investigation by Roy F. Weston, Inc. It has a high potential for creating groundwater contamination because of the management practices employed in the past, low-lying topographic position, shallow groundwater table, and the nature of contaminants present at the site.

The site received a HARM score of 86, primarily because of information available from the confirmation study conducted by Weston and documented evidence of the use of hazardous materials used in fire training exercises.

Paint Waste Disposal Area

This site is on land formerly leased by the Air Force and now owned by Massport and is also currently under confirmatory investigation by Roy F. Weston, Inc. The documented presence of hazardous materials as well as the site's proximity to surface water and groundwater present a serious ·ential for environmental contamination. Sample analyses performed by We. indicated the presence of 11 VOA compounds having a total concentration of 53 ppm. These factors combined to give this site a HARM score of 86. Additional monitoring wells have been installed around the site for determination of groundwater contamination levels and the rate and direction of plume migration.

Jet Fuel Residue/Tank Sludge Area

These areas are in close proximity to one another and are considered to be one site for the purposes of this study. In addition, the lack of areal delineation of individual sites precludes separate discussion. The site is a disposal area, and the name "jet fuel residue/tank sludge residue area" is a misnomer. However, base personnel are familiar with this name and it is used herein for consistency.

The site was used for the disposal of hundreds of drums of waste during the late 1950's and early 1960's. It is located in the infield south of Taxiway "Whiskey," east of Taxiway "Mike," and west of Runway 5/23 on Hanscom Field.

The proximity of the site to the groundwater table and the confirmed presence of hazardous materials contribute to a HARM score of 85 for the site.

Sanitary Landfill

The sanitary landfill is on land formerly leased by the Air Force and now owned by Massport. It is a potential source of contamination of surface water and the shallow groundwater aquifer at Hanscom AFB. Historic maps suggest that waste was placed in marsh areas and that the bottom of the landfill is below the water table. It is probable that the landfill received the majority of the chemical wastes generated at Hanscom AFB between 1964 and 1974, including paint, fuels, acids, mercury, photographic chemicals, solvents, and medical wastes. In addition, erosion of soil cover and vegetation encourages continuing infiltration of precipitation, exposure of waste material, and generation and migration of leachate. These site conditions contribute to a HARM score of 80 for the site.

Fire Training Area I

Fire Training Area I, also on land formerly leased by the Air Force and now owned by Massport, is a potential source of contamination of the shallow groundwater aquifer. Materials dumped into and burned in the pit included solvents, contaminated fuels, and laboratory chemicals. Up to 60 to 80 drums at a time over the period from 1950's through 1960 may have been released in the area. The portion of this waste that may have infiltrated through or absorbed to soils is not known. Further, the surface of the site and any subsurface waste are in close proximity to the shallow groundwater table. These site conditions contribute to the HARM score of 77.

Former Filter Beds

The area of the former filter beds is a potential source of contamination of groundwater. The Phase I study revealed the presence of DDT, tetraethyl lead, and reportedly various unidentified wastes in the area. The possible presence of radioactive materials was reported but could not be confirmed. The groundwater table beneath the filter bed area is shallow and the Shawsheen River borders the site to the north. These conditions contribute to a HARM score of 71 for the site.

Industrial Wastewater Treatment System

The Industrial Wastewater Treatment System may have been a source of groundwater contamination prior to 1976, when it was abandoned and sealed. The pipe network, which connected 11 buildings to the treatment facility, was reported to have leaked at various points, particularly along the east end of Chennault Street. Liquids that may have leaked (grease, oils, solvents) would have been released to the surrounding soil and possibly to groundwater. These conditions contribute to a HARM score of 69 for the system.

Scott Circle Landfill

The Scott Circle Landfill is a potentially significant source of contamination of groundwater at Hanscom AFB. The site reportedly received hazardous substances during the 1960's, including paint, paint thinner, solvents, waste oils, and laboratory chemicals. The site and presumably hazardous substances are in close proximity to both groundwater and surface water, although the areal and vertical limits of the site are not known. These conditions combine to result in a HARM score of 65 for the site.

Administration Building Jet Fuel Spill

This site has significant potential for contamination of groundwater. It was reported by former base personnel that a 5,000-gallon spill of jet fuel occurred in 1954, over 1/2 acre directly northwest of the present location of Building 1600. The spill area was encircled with soil for containment, and fuel remaining on the ground surface after 24 hours was burned in place. The passage of time and construction activities have eliminated any visual evidence of the spill.

The spilled fuel having remained in contact with soil for 24 hours inevitably resulted in a large, but unknown quantity of fuel having percolated and absorbed into the soil. Fuel may have migrated to groundwater and, even after 30 years, traces of fuel may remain in the soil and groundwater. The large quantity of fuel involved and the shallow depth to groundwater strengthen this possibility. These conditions combine to give a HARM score of 59 for the site.

Building 1128 Mercury Spill

During an undetermined period of time, a large quantity of elemental mercury was stored in a radioactive waste storage building. The failure of a sump pump reportedly caused mercury overflow into the sanitary sewer system. It has been reported by past employees of the base that the elemental mercury was visible at various manholes along the sewer system. Mercury may remain in deposits in the sanitary sewer, and the sewer may be a continuing source of mercury being released to the sanitary collection and treatment system.

The sanitary sewer system is designed to minimize infiltration and exfiltration, and there should be minimal contact between sewage and the surrounding soil and groundwater. The sanitary sewer system is routed through a sewage treatment plant prior to discharge to the surface water, and elemental mercury should be removed in the treatment processes. The treatment should ensure that the quality of the receiving surface water is not adversely affected by the mercury spill. These conditions combined to give a HARM score of 48 for the spill.

Various Fuel Spills on Taxiways and Runways

Various spills of fuel and oil have been reported during the period of runway operations by the Air Force at Hanscom AFB. The quantities of the spills ranged from 5 to more than 300 gallons. In most cases the spills were adequately contained and effectively cleaned up.

These spill incidents rated together yielded a HARM score of 45 and do not present any substantial danger to the environment. This low score is a result of generally prompt and effective cleanup and the lack of any potential residual material remaining at the sites of the spills. Fuel that entered the surface water would now be completely transported downstream, and residuals are not likely to remain.

Motor Pool Gasoline Leak

This site has a very low potential to cause groundwater contamination. In December 1981, a leak in a 5,000-gallon underground storage tank containing unleaded gasoline was discovered. Once the leak was detected, the tank was taken out of service and eventually replaced. Records do not indicate the quantity of gasoline that was lost.

During the time the tanks were being replaced, a scavenger recovery system was installed and operated until gasoline could not be detected. The system resulted in approximately 5 gallons of gasoline being removed.

The site is situated in close proximity to the Shawsheen River culvert and any gasoline which was not recovered by the scavenger system probably discharged to the Shawsheen River. These factors combined to result in a HARM score of 6 for the site.

AAFES Service Station Gasoline Tank Leak

The release of gasoline from the three tanks at the AAFES service station probably caused some contamination of groundwater prior to the discovery and subsequent cleanup. However, the thorough cleanup required by the State probably recovered most of the gasoline from the groundwater in the immediate vicinity of the leak. The drawdown well created a gradient toward the scavenger system which was operated until no gasoline was detected. As a result, only small quantities of gasoline were likely to have remained in the groundwater, and the HARM score for the release is 6.

6.0 RECOMMENDATIONS

Thirteen sites have been identified at Hanscom AFB and Hanscom Field that have the potential for environmental contamination. These sites have been evaluated using the HARM to assess their relative potential for environmental contamination. Ten of the sites have sufficient potential for releasing contaminants to warrant further investigation. Additional data are necessary to clearly ascertain whether or to what extent these sites are contributing to environmental contamination, and recommendations have been developed for obtaining the data. Studies similar to IRP Phase II confirmatory studies are currently in progress at three of the rated sites, and the recommendations take into account the work in progress to avoid redundant effort.

The recommendations generally entail one-time sampling programs to determine sources and/or extent of contamination at the identified sites. If contamination is identified at a given site, the monitoring program may need to be expanded to further define the extent of contamination or to more definitively identify the types of contaminants present. The recommended Phase II program is described on the following subsections and is summarized in Table 6-1. Locations of recommended monitoring points are shown on Figure 6-1.

Groundwater monitoring wells installed under Phase II should be Schedule 80 PVC and a minimum of 2-inch nominal diameter. Depths of well will vary; however, all wells should fully penetrate the water zone to be monitored, and be screened through the entire saturated interval.

The three sites that are undergoing studies similar to IRP Phase II are:

- Fire Training Area II
- Paint Waste Disposal Area
- Jet Fuel Residue/Tank Sludge Area

TABLE 6-1

RECOMMENDED MONITORING PROGRAM FOR IRP PHASE II AT HANSCOM AFB

Ranking Number	Site Name	Harm Score	Recommended Monitoring	Sampling Analysis List	Comments
1	Fire Training Area II	86	Sample existing wells and surface water points. Install 3 additional wells downgradient from the site to determine plume size.	B	Use data to delineate the areal extent of the plume.
2	Paint Waste Disposal Area	86	Sample existing wells and surface water points Install 3 additional wells downgradient from the site to determine plume size.	B	Currently under Phase II investigations by Roy F. Weston, Inc. Evaluate data and determine whether additional monitoring is required.
3	Jet Fuel Residue Tank Sludge Area	85	Sample existing wells and surface water points Install 3 additional wells downgradient from the site to determine plume size.	B	Currently under Phase II investigation by Roy F. Weston, Inc. Evaluate data and determine whether additional monitoring is required.
4	Sanitary Landfill	80	Install and monitor 1 upgradient and 3 downgradient wells; sample Elm Brook water and sediments up and down stream from the site. Sample leachate seeps, if present.	A	Continue monitoring if sampling indicates contamination. If confining layer is found to be present, additional deeper wells may be installed to monitor till aquifer.
5	Fire Training Area I	77	Install and sample two additional well pairs around the site to supplement existing wells. Well pairs should be designed to monitor both aquifers.	A	Continue monitoring if sampling indicates contamination is originating from this site.
6	Former Filter Bed	71	Install and sample 1 upgradient well and 3 downgradient well pairs. Well pairs should be designed to monitor the upper and lower aquifers. The upgradient well will monitor only one aquifer.	C	Continue to monitor if sampling indicates contamination to be present. A GC/MS scan should be run to identify contaminants.
7	Industrial Waste Treatment System	69	Seal and smoke test the system to identify leaks. Install wells at locations where leaks are evident.	B	Continue to monitor if contamination is shown to be present. A GC/MS scan should be run to identify contaminants.
8	Scott Circle Landfill	65	Conduct geophysical survey. Install and sample 1 upgradient well and 3 downgradient well pairs. Sample and analyze sediment and surface water samples up and down stream from the site.	B	Continue to monitor if sampling indicates contamination to be present. GC/MS scan should be run to identify specific contaminants.
9	Administrative Building Jet Fuel Spill	59	Install and sample one well point near center of site. Sample water in storm sewer near the site.	D	Additional well points may be installed to delineate extent of contamination if contamination is detected.

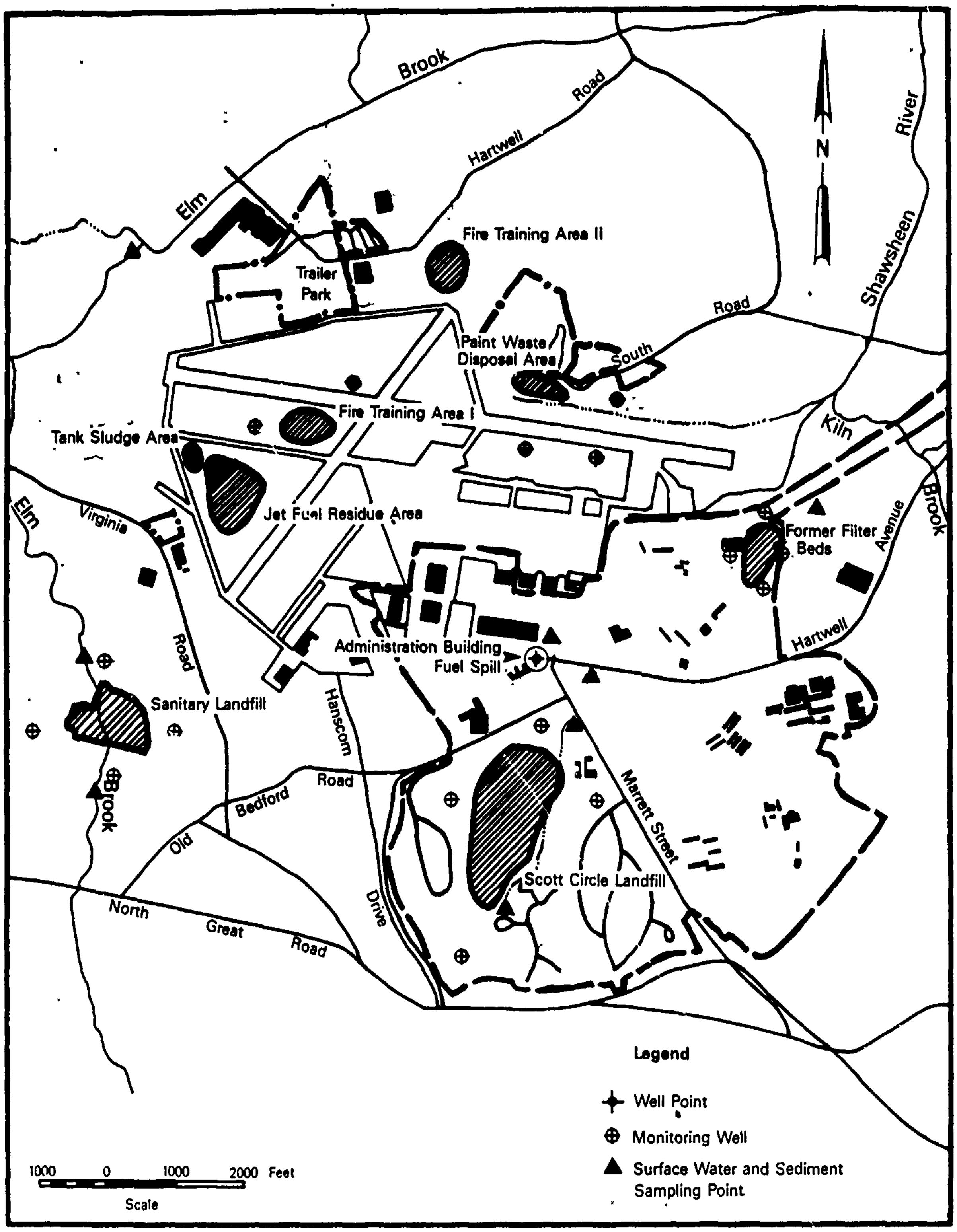

Figure 6-1. Recommended Locations for Monitoring Wells, Well Points, and Surface Water and Sediment Sampling.

These sites have been shown to be releasing contaminants to shallow groundwater. Studies to determine whether contamination is present in the bedrock aquifer have recently been completed and an additional monitoring well has been installed into bedrock. This and other wells provide information about the bedrock elevation and the rate of flow through the bedrock between Hartwell's and Pine Hills.

In addition, the storm sewers in the area of these sites have been investigated to determine whether there are interconnections between the shallow groundwater aquifer and surface water. This study showed that chlorinated organic compounds in groundwater are discharing into Elm Brook through the storm drainage system. Dilution and/or volatilization are thought to account for the absence of chlorinated organics downstream in Elm Brook.

Fire Training Area II

Fire Training Area II has been investigated by Roy F. Weston, Inc., and analyses indicated the presence of VOA contaminants. Additional investigations have also been conducted to determine the type and direction of the contaminant movement. This information provides background information for further Phase II investigations. Geophysical investigations should be performed in the area of this site to provide a more accurate delineation of the contaminant plume. Geophysical methods which may be used include resistivity magnetometry, and/or ground-penetrating radar. Data from these investigations can be used for selecting locations of additional monitoring wells along the apparent furthest extent of the plume.

Wells that are installed should be screened through the entire saturated interval of the shallow aquifer. Samples collected should be analyzed for parameters in List B of Table 6-2. During this sampling effort, existing wells CW-4, RFW-9, RFW-15, RFW-17, and RFW-18 should be resampled and analyzed for the same parameters.

TABLE 6-2

LIST OF RECOMMENDED ANALYTICAL PARAMETERS

LIST A

pH
Specific Conductivity
Temperature
Oil and Grease
Total Organic Carbon
Volatile Organic Compound

LIST B

pH
Specific Conductivity
Temperature
EPA Priority Pollutant Scan
Radioactivity

LIST C

pH
Specific Conductivity
Temperature
Oil and Grease
Total Organic Carbon
Volatile Organic Compounds
DDT
Heavy Metals

Paint Waste Disposal Area

The paint waste disposal area has also been investigated and contamination determined to be present. Geophysical investigations should be performed to determine the areal extent of the contamination. Geophysical methods that may be employed include resistivity and/or magnetometry. Data from these investigations should be used to select locations for 3 additional monitoring wells downgradient from the site, along the leading edge of the plume. Well pairs should be installed where necessary to allow monitoring of the upper and lower aquifer zones. Analyses to be performed on samples taken from the new wells and the existing wells should include those shown on Table 6-2, List B.

Jet Fuel Residue/Tank Sludge Area

The jet fuel residue/tank sludge area and has also recently been evaluated for the presence of contamination. Analyses indicated that VOA's are present in groundwater in the vicinity of the site. Geophysical investigations (electromagnetometry and resistivity) should be conducted to determine the areal extent of the site as well as the extent of the contaminant plume. These data should be used in selecting locations for additional monitoring wells downgradient from site. Wells that are installed should be screened through the entire saturated interval of the aquifer. Where necessary, paired wells should be installed to allow monitoring of the upper and lower aquifers. Samples should be collected from the new wells and existing wells and analyzed for parameters in List B of Table 6-2.

To determine whether contaminates are migrating between Pine Hill and Hartwell's Hill (the "northwest exit pathway"), samples should be collected from wells CW-20, CW-20A, CW-19, CW-19A, RF-7, RFW-18, RFW-8, and CW-2. Samples should be analyzed for the parameters specified in List B of Table 6-2. Surface water samples should be collected at storm sewer outfalls and at least one point downstream along Elm Brook. These samples should be analyzed for the parameters on List B in Table 6-2. Where available, sediment samples should be collected at points where surface water samples are obtained. Analyses should include the parameters in List B of Table 6-2.

Sanitary Landfill

At least four groundwater monitoring wells should be installed around the sanitary landfill to determine whether contaminants are being released from the site to the groundwater. The wells should be located such that one is upgradient and a sufficient distance from the site to be removed from a contaminant plume, if existing. Three additional wells should be installed generally downgradient from and around the site. Recommended locations for the wells are shown in Figure 6-1. All-terrain equipment may be required for access to these points because of marshy conditions.

The monitoring wells should fully penetrate the shallow aquifer. Preliminary estimates of well depths are constrained by the lack of site-specific data. However, projections of nearby boring data indicate an average well depth of approximately 30 feet. The wells should be screened through the full saturated thickness of the aquifer.

Surface water and sediments should also be sampled at a minimum of two points on Elm Brook: one upstream and one downstream from the landfill. Preferably, the surface water samples should be taken during a period of known leachate discharge. For example, leachate was visually evident at the base of the landfill in late winter 1984 following a snow melt. Leachate should also be sampled from surface seeps, if possible.

All samples should be analyzed for the parameters specified in List B of Table 6-2.

Fire Training Area I

Groundwater monitoring wells installed in the vicinity of Fire Training Area II as part of an ongoing study by Weston (involving Fire Training Area II, the Paint Waste Disposal Area, and the Jet Fuel Residue/Tank Sludge Area) should be supplemented by two additional wells to be located north and west of the site. The recommended locations of these wells are shown in Figure 6-1.

Although this site was not part of the Weston study, monitoring of nearby wells revealed contaminants present in both the deep and the shallow aquifer zones, suggesting communication between these aquifers. Accordingly, the two proposed wells should be installed to allow monitoring of both aquifers.

Groundwater samples taken from the vicinity of the site should be analyzed for parameters in List B of Table 6-2.

Former Filter Bed Area

Groundwater monitoring wells should be installed at four locations around the site of the former filter ds to establish the local groundwater gradient and to determine whether contamination of groundwater has occurred. Figure 6-1 shows the proposed locations. The upgradient point should be located along the north-facing slope of Reservoir Hill. Lateral points should be located to the east and west of the site, and a downgradient point should be located near the Shawsheen River to the north of the site.

The well depths will vary considerably because of the geologic facies change beneath the site. Two wells should be installed at the downgradient points, one to monitor the upper surficial aquifer and one to monitor the lower till aquifer. The deeper well should be drilled approximately 35 feet deep and screened over the entire saturated interval below the lake deposits. The well drilled into the upper aquifer should be approximately 15 to 20 feet deep and should also be screened through the saturated thickness.

The upgradient location should consist of a single well, approximately 25 feet deep. The lateral well locations should consist of both deep and shallow wells if both the deep and shallow aquifers exist at these points and are encountered in the drilling. The depths of the shallow and deep wells should be approximately 15 to 35 feet, respectively.

Groundwater samples taken from the vicinity of the site should be analyzed for the parameters included in List C of Table 6-2.

Industrial Waste Treatment System

In order to identify those points in the industrial waste treatment system that are the most likely to have leaked contaminants to the soil and groundwater, a smoke test of the system should be conducted. The system should be checked to ensure that all openings to the system are sealed and smoke should be introduced for a time sufficient to allow diffusion of the smoke through the entire system. Test borings should be conducted and groundwater monitoring wells should be installed at those points where smoke is released from the piping system and observed venting through the ground surface to the atmosphere. The number of wells required will depend on the number of leaks observed. If numerous points of leakage are observed, monitoring wells should be installed at points of highest leakage as evidenced by the greatest release of smoke. The wells should penetrate the full depth of the shallow aquifer, estimated to be 20 to 25 feet deep, and should be screened through the saturated interval.

Soil and groundwater samples that are obtained should be analyzed for the parameters included in List A of Table 6-2.

Scott Circle Landfill

A study of the areal limits the Scott Circle Landfill should first be conducted. Geophysical remote-sensing techniques, such as resistivity or magnetometry, may be employed for this purpose, although their effectiveness should be tested over natural ground in the vicinity of the site before attempts are made to delineate the limits of the landfill. If the remote-sensing techniques prove to be ineffective, backhoe observation pits should be dug at selected points around the suspected site boundary.

Once the limits of the landfill have been established, four groundwater monitoring wells should be installed. Proposed locations for the wells are shown in Figure 6-1; the locations may need to be adjusted as the landfill limit is identified.

The southern-most upgradient wells should be located near the headwaters of the Shawsheen River and outside of the expected extent of glacial lake deposits. These wells should be installed to allow discrete sampling of the lower and upper portions of the aquifer. Rather than screen the full saturated interval, separate well casings are required as follows:

- The deeper casing should be screened over the lowest 10 feet of the aquifer above bedrock
- The upper casing should be screened over the upper 15 feet of the saturated zone.

The downgradient wells should be similarly installed to allow discrete sampling of the shallow and deep aquifers. Installation of shallow and deep casings should be accomplished by making separate borings for each casing. The use of separate borings is preferred to minimize the possibility of communication between the aquifers. With this method, the potential for cross-contamination between the levels being monitored is minimized.

In addition, sediment and surface water samples should be collected from the Shawsheen River upstream and downstream of the site, shown in Figure 6-1. The downstream sampling point should be upstream of the outfalls of the storm sewers which drain the portions of the base to the east and west of the site.

Groundwater, surface water, and sediment samples should be analyzed for the parameters included in List B of Table 6-2. If contaminants are detected, GC/MS scans should be conducted on the suspect samples to identify specific contaminants.

Administration Building Jet Fuel Spill

To determine the presence or absence of contaminants from the spill site, one well point should be pneumatically driven at a point near the center of the site (Figure 6-1). The well point will serve as a sampling point to determine if the site is a source of contamination. Depths of the well point should be 8 to 10 feet and the screened interval should extend from water table 3 to 5 feet into the aquifer. If analysis shows contaminants to be present, the additional well points should be installed downgradient from the source of contamination.

In addition, water samples should be collected from the storm drains that run north and west of the site to determine whether contaminants from the site are entering surface water. Samples should be analyzed for the parameters on List B of Table 6-2.

Mercury Spill Building 1128

The location of the spill in the sanitary sewer system effectively isolates the contaminants from the environment and no monitoring is recommended.

AAFES Service Station Gasoline Tank Leak

The reported effectiveness of the scavenger equipment installed after the discovery of the leak essentially eliminates this site as a source of contamination and no additional monitoring is recommeded.

Motor Pool Gasoline Leak

The scavenger system installed to clean up the spill was reported to be effective and no additional monitoring is recommended.

APPENDIX A

MEMORANDUM OF UNDERSTANDING BETWEEN DOD AND EPA

APPENDIX IV

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE DEPARTMENT OF DEFENSE
AND
THE ENVIRONMENTAL PROTECTION AGENCY
FOR THE
IMPLEMENTATION OF P.L. 96-510
THE COMPREHENSIVE ENVIRONMENTAL RESPONSE,
COMPENSATION, AND LIABILITY ACT OF 1980 (CERCLA)

1. PURPOSE

The Department of Defense (DOD) and the Environmental Protection Agency (EPA) are entering into this agreement to clarify each Agency's responsibilities and commitments for conducting and financing response actions authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and specifically delegated by Executive Order 12316.

This agreement does not redelegate any responsibilities set out in Executive Order 12316. Rather, it seeks to clarify respective operational roles, responsibilities, and procedures. This agreement does not create any substantive or procedural rights in other parties, does not affect enforcement rights and remedies with regard to any party, and is intended only for Federal administrative purposes of EPA and DOD.

These responsibilities and procedures are guided by the following:

- DOD facilities are defined as government-owned, government-operated facilities controlled by DOD; and government-owned land controlled by DOD that are either contractor-operated or leased to other parties.
- DOD is generally responsible for financing actions taken in response to releases from DOD facilities, or assuring that another party finances such actions.
- DOD and EPA will conduct response actions consistent with response procedures established by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).
- At DOD's request and in its discretion, EPA will provide DOD with technical assistance to support the response actions conducted by DOD.
- Civil works activities of the Department of Army Corps of Engineers are not subject to the terms of this agreement.

DOD will consult with EPA concerning the best techniques and methods available for the prevention, control, and abatement of environmental pollution.

2. BASIS OF AGREEMENT

CERCLA provides a comprehensive framework for response to the release or potential release of hazardous substances, pollutants, and contaminants.

Section 104 of CERCLA and Executive Order 12316 place authority for responding to releases from DOD facilities with the Secretary of Defense. These response actions must be conducted in accordance with the NCP as amended by EPA under section 105 of CERCLA.

3. RESPONSIBILITIES AND RESPONSE PROCEDURES

For purposes of this agreement, releases of hazardous substances are divided into three categories:

- Releases from current DOD facilities;
- Releases from former DOD facilities; and
- Other releases for which DOD is a responsible party.

For each category, section 3 describes procedures to be followed by DOD and EPA in determining which Agency will conduct and/or finance the response action consistent with CERCLA, the requirements of Executive Order 12316, and the NCP. At DOD's request and in its discretion, EPA will provide technical assistance or serve in an advisory role when DOD conducts a response.

3.1 Releases from Current DOD Facilities

a. DOD facilities with on-facility contamination and no off-facility contamination

When there is contamination on a DOD facility and no off-facility contamination, DOD will conduct and finance the response action or assure that another party does so. At DOD's request, EPA will provide technical assistance or serve in an advisory role. This section does not apply to releases for which DOD is not a responsible party under section 107(b) of CERCLA (e.g., "midnight dumping").

b. DOD facilities with off-facility contamination

When there is off-facility contamination and clear evidence that a DOD facility is the sole source, DOD will conduct and finance the response action or assure that another party does so. At DOD's request, EPA will provide technical assistance to DOD.

When there is off-facility contamination and no clear evidence that a DOD facility is the sole source, EPA will finance and conduct investigations and studies off-facility to determine the source and extent of the contamination and recommended response action. DOD will finance and conduct investigations and studies on the DOD facility to determine the source and extent of the contamination and the recommended response action. DOD and EPA will coordinate these efforts and resulting decisions to minimize costs and duplication of activities, and will exchange all reports, studies, and other relevant site information.

If after DOD and EPA review these investigations, it is determined that the DOD facility is the sole source of the contamination, DOD will conduct and finance the response action or assure that another party does so and will reimburse EPA for costs EPA expended at the site.

If after DOD and EPA review these investigations, it is determined that the DOD facility is one of two or more sources of the contamination, EPA and DOD will jointly determine the most appropriate response and financing methods.

3.2 Releases from Former DOD Facilities

a. Releases from former DOD facilities, when DOD is the sole responsible party

If EPA, in consultation with DOD, determines that a former DOD facility is the sole source of the contamination, DOD will finance any response action, including off-facility response actions or will assure that another party does so. If EPA agrees, DOD may choose to conduct the response action. If EPA conducts the response action, DOD will reimburse the Hazardous Substance Response Trust Fund (Fund) for the action. EPA concurrence is required before DOD conducts a response action.

In cases where DOD disagrees with the determination of responsibility, proposed action, or its cost, DOD may use the dispute resolution section of this agreement.

b. Releases from former DOD facilities, when DOD is one of two or more responsible parties

If EPA, in consultation with DOD, determines that DOD is one of two or more parties responsible for the contamination, EPA will conduct and finance the response action and EPA, in consultation with DOD, will determine the appropriate response costs. DOD will reimburse EPA that amount.

If EPA agrees, DOD may choose to conduct the response action. If EPA conducts the response action, DOD will reimburse the Hazardous Substance Response Trust Fund (Fund) for the action. EPA concurrence is required before DOD conducts a response action.

In cases where DOD disagrees with the determination of responsibility, proposed action, or its cost, DOD may use the dispute resolution section of this agreement.

3.3 Other Releases for Which DOD is a Responsible Party

When there is a release for which DOD is a responsible party, and does not involve a current or former DOD facility, EPA will investigate the need for a response action, and the extent of responsibility of different parties for the release, including DOD's responsibility. EPA, in consultation with DOD, will determine the appropriate response costs and DOD will reimburse EPA that amount. If EPA agrees, DOD may choose to conduct the response action for the portion of the release for which it is responsible. EPA concurrence is required before DOD conducts a response action.

For releases from DOD vessels, including vessels owned or bareboat chartered and operated, DOD and EPA will jointly determine the most appropriate response.

In cases where DOD disagrees with the determination of responsibility, proposed action, or its cost, DOD may use the dispute resolution section of this agreement.

4. FUNDING OF RESPONSE

DOD will request sufficient funds in its budget to pay for response actions programmed by the Department under this agreement. DOD will ensure that projects in this budget program are listed in the same manner as other environmental projects under OMB Circular A-106.

When EPA undertakes a response for which DOD is responsible under CERCLA, DOD will reimburse the Fund for its share. Where funds are not immediately available for reimbursement, DOD's next fiscal year budget request will include a request for Fund reimbursement. Provisions of this agreement for payment by DOD shall not be construed as affecting the particular source of appropriations for payment by the government, including special appropriations or 31 U.S.C. 724a.

Any commitment of funds is subject to the availability of appropriations.

Each Agency will maintain records of all costs incurred which may involve payments to or from the Fund and will provide documentation of these costs at the other Agency's request.

5. COMMUNITY RELATIONS

When EPA undertakes a response action, EPA will be responsible for establishing a community relations program for the site, as specified in the Guidance for Implementing the Superfund Program (Part III, Section 4).

When DOD undertakes a response action, DOD will be responsible for providing information to the local community.

For EPA and DOD actions at the same site, EPA and DOD will conduct a joint community relations program.

6. EXCHANGE OF INFORMATION

DOD and EPA will exchange information on a regular basis. EPA and DOD will inform each other at the earliest possible stage of any evidence of contamination, types of contamination, and potential actions. EPA and DOD will keep each other informed regarding the type and availability of data or information. Such data or information will be made available upon request, subject to Agency technical or peer review. Upon request and following Agency technical or peer review, DOD and EPA will submit drafts of specific technical reports to each other for review. Review comments will be addressed in final reports.

Agency technical or peer review will be expedited when information is requested. All requests for data or information will be responded to within ten working days of the request.

EPA and DOD will notify each other prior to providing the other Agency's information or data to another party. All confidential business information exchanged under this agreement is subject to procedures set forth at 40 CFR Part 2.

This section applies to information related to all releases under section 3 of this agreement, including releases under section 3.1.

7. RESOLUTION OF INTERAGENCY CONFLICTS

Any conflict arising under this agreement will be resolved at successive levels of Agency decisionmaking until agreement is reached. The EPA Regional Administrator and the Commanding Officer of the Defense Component Major Command in question will first attempt to resolve any disputes. Failing resolution, the EPA Assistant Administrator for Solid Waste and Emergency Response and the appropriate Military Department Assistant Secretary will attempt to reach agreement. If this is unsuccessful, the matter will be referred to the EPA Administrator and the Secretary of Defense.

The dispute resolution process is not a substitute for necessary and timely removal actions, and each Agency reserves rights otherwise provided by law to pursue any response or enforcement actions.

8. MULTIPARTY AGREEMENTS

Where appropriate, EPA Regional Offices and DOD installations may enter into agreements with State and local authorities regarding response actions. Such agreements must be consistent with this agreement, except that dispute resolution sections of such agreements may supersede section 7 of this MOU.

9. AMENDMENTS

This agreement may be amended at any time by mutual agreement of EPA and DOD. Amendments will be in writing, and will be signed by appropriate DOD and EPA officials.

10. PERIOD OF AGREEMENT

Unless ended or extended by mutual agreement, this MOU will continue in effect until December 1, 1985. This agreement may be terminated upon notification by either DOD or EPA to the other party. A minimum of ninety days' advance written notice of termination is required.

11. EFFECTIVE DATE

This agreement will become effective upon signature of both parties.

LAWRENCE J. KORB Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics)	/S/ LEE M. THOMAS Assistant Administrator Office of Solid Waste and Emergency Response
Date: August 9, 1983	Date: AUGUST 12, 1983

APPENDIX B

RESUMES OF PHASE I INVESTIGATION TEAM

KEVIN R. BOYER, P.E.

EDUCATION

Virginia Polytechnic Institute and State University: B.S., Civil Engineering (1974)

SUMMARY

Mr. Boyer has practiced civil and environmental engineering related to solid and hazardous waste management since the mid-1970's. His experience includes design, management, and technical research and writing ranging from design of site development plans to assisting in the 'evelopment of the USEPA's National Priorities List of Uncontrolled Hazardous Waste Sites.

EXPERIENCE

Mr. Boyer is currently contributing to JRB's research effort on Improved Techniques for Removal of Hazardous Material-Contaminated Sediments for the USEPA and the U.S. Coast Guard. He is researching and writing a report section on the state-of-the-art of contaminated sediment dredging technology. He is also documenting cases of contaminated sediment remediation and will evaluate the actions taken and identify research needs for advancement of dredging technology.

For the U.S. Air Force Mr. Boyer is managing an initial assessment of the potential for groundwater contamination resulting from past waste management practices at an active New England Air Force base. The effort includes record searches, personal interviews, on-site inspections, evaluation of present conditions, prediction of future impacts, and recomendations for in-field site characterization.

Mr. Boyer has assumed management, design, and study responsibilities for other consulting engineering firms and for the City of Richmond, Virginia. Much of his experience has dealt with the hazards associated with land disposal of solid and hazardous waste. He has evaluated potential fire and explosion hazards resulting from landfill-generated methane gas at over twenty landfill sites. This work has included field evaluation of the problem through drilling and monitoring probe installation, gas sampling, evaluating alternative gas control methods, and design and construction monitoring of gas control systems. Mr. Boyer's work has been used as a basis for sites complying with regulatory enforcement orders and for settlement of court actions.

Mr. Boyer has also conducted studies and designs relating to the recovery of landfill gas as fuel. This work has included field test pumping of gas, projection of long-term gas recoverability, recovery system design, construction cost estimating, and preparation of bid documents.

Verified for accuracy by: Kevin R. Boyer Date: 1/11/84

While working under the USEPA's Field Investigation Team (FIT) program, Mr. Boyer was part of a quality assurance (QA) team which audited work conducted by the states and regions in associating a numerical degree of hazard with candidate uncontrolled hazardous waste sites under Superfund. This work was instrumental in EPA's publication and subsequent defense of the National Priority List of Hazardous Waste Sites. Mr. Boyer continues to serve on the QA team on a consulting basis after leaving the FIT program, as EPA periodically updates the list.

Also while working under the FIT program, Mr. Boyer prepared a Methodology and Estimated Costs for Hazard Ranking System Data Collection for EPA's Superfund office. This document provides a process and data for preparing budgetary estimates of costs of gathering data needed to characterize a hazardous waste site. The document has been used by EPA in developing costs and in preparing other cost-estimating guides.

Mr. Boyer was project manager and a major contributor to a study and report effort for HUD on the effects of uncontrolled hazardous waste disposal on the programs of the Department. The effort resulted in the recommendation of site-screening procedures, regulatory revisions, and interagency coordinating procedures which would assist the Department and its program recipients with the social, regulatory, and physical impacts of improper hazardous waste management.

For private and municipal clients, Mr. Boyer has prepared plans relating to various aspects of sanitary landfill design, operation, and closure. He evaluated the day-to-day operation of a Virginia County-owned landfill, recommending modifications in traffic and loading patterns, surface drainage, excavation for slope stability, vegetation and erosion control, and littering control. In support of a land condemnation case in California, he evaluated alternative landfill configuration scenarios directed toward maximizing the capacity of a planned landfill, proposed to receive several hundred million tons of refuse over several decades. Mr. Boyer also prepared the erosion and sedimentation control portion of a closure plan for a privately owned landfill in New Jersey which had been filled nearly to the site property boundary. This condition was a significant design constraint and required considerable coordination with the regulatory authority in order to meet its design standards. For the USEPA Mr. Boyer participated in the preparation of the agency's RCRA guidance manual for "Closing and Upgrading Open Dumps" by writing the chapter for monitoring and control of landfill gas.

Mr. Boyer has also served as project manager or project engineer on a variety of civil engineering projects. These include site development, recreation projects, sanitary sewer design and rehabilitation, storm drainage and erosion control design, land surveying, and preparation of easement and land acquisition plans. He has supervised draftsmen and field inspectors on many of these projects, and has been responsible for the preparation of construction plans, supporting specifications, and cost estimates.

Verified for accuracy by: Kevin R. Boyer Date: 1/11/84

PROFESSIONAL REGISTRATION

Virginia, Professional Engineer (1979)
Maryland, Professional Engineer (1982)

AFFILATIONS

National Society of Professional Engineers
Virginia Society of Professional Engineers

PUBLICATIONS, PRESENTATIONS, AND REPORTS

"Landfill Gas Control Study-Ridge Road Landfill"; for Pasco County, New Port Richey, Florida; July 1983.

"Control and Recovery of Methane Gas at Sanitary Landfills"; National Solid Waste Management Association International Waste Equipment and Technology Exposition, San Francisco, California, May 10, 1983.

"Landfill Gas Field Testing Report-East Pennsboro Township Landfill," for East Pennsboro Township, Enola, Pennsylvania; February 1983.

"Phase I Landfill Gas Field Testing Report-Granger Landfill No. 1"; for Granger Land Development Co., Lansing, Michigan; December 1982.

"Methodology and Estimated Costs for Hazard Ranking System Data Collection" (Draft Report); for U.S. Environmental Protection Agency Office of Emergency and Remedial Response; Washington, D.C.; April 1982.

"Hazardous Waste Site Response Management," (co-authored with Roger J. Gray); Proceedings of National Conference on Risk Decision Analysis for Hazardous Waste Disposal, Hazardous Material Control Research Institute; August 24, 1981.

"Effects of Hazardous Wastes on Housing and Urban Development and Mitigation of Impacts," (co-authored with E. T. Conrad, et.al.); for Department of Housing and Urban Development, Washington, D.C.; March 26, 1980.

"Evaluation of the Operation of the Loudoun County Sanitary Landfill," (co-authored with E. T. Conrad); for County of Loudoun, Virginia, Leesburg, Virginia; January 21, 1980.

"A study of Lake Anne's Sedimentation Problems and Solutions," (co-authored with E. T. Conrad); for Reston Home Owners Association, Reston, Virginia; August 1979.

"Report Summarizing the Landfill Gas Control Program of the City of Richmond, Virginia," National Association of Counties' Technical Assitance Seminar, Denver, Colorado; September 27, 1977.

Verified for accuracy by: Kevin R. Boyer Date: 1/11/84

CLAUDIA A. FURMAN

EDUCATION

Franklin and Marshall College, B.A., Geology (1981)

EXPERIENCE

Claudia Furman is a Geologist with JRB's Waste Management Division and has been involved in numerous and varied projects since joining the JRB staff.

Ms. Furman is presently one of several investigators for a project that involves a nationwide survey of completed remedial actions at uncontrolled hazardous waste facilities. From this survey, twelve sites have been selected for detailed case study analysis. Each site analysis involves the different technologies used, their effectiveness, design, implementation, and cost. The end product of this effort will be a document containing twelve detailed technical case study reports intended for use as guidance on remedial action selection and implementation. Also recently, Ms. Furman was involved in the development of a remedial action screening methodology. The process uses site, waste and technology characteristics for the purpose of eliminating alternatives for particular site situations.

Ms. Furman recently acted as one of several geologists supervising the drilling and installation of groundwater monitoring wells and well points at a Superfund site in New Jersey. The purpose of the monitoring program implemented at the site is to monitor the effectiveness of the remedial measures that were taken to control the movement of contaminated groundwater. During the well installation program, Ms. Furman shared the responsibility of overseeing the auger drill rig operations; collecting and characterizing core samples and the writing up of daily logs.

Ms. Furman was involved in a groundwater monitoring and sampling program at a site in Warminster, Pennsylvania, for the Naval Air Development Center. She participated in the sampling of 14 wells that were installed by JRB around several areas of suspected hazardous waste disposal.

Ms. Furman was involved in developing a technical handbook for EPA, Cincinnati, Ohio, on the design, construction, and performance evaluation of slurry trench cut-off walls used as pollutant migration control barriers. Her tasks include an extensive literature search, information compilation, data review, and contributing to the final writing of the manual.

Under JRB's Chlorinated Organics Industry Study, Ms. Furman managed the preliminary investigation and assessment of 12 chlorinated organic manufacturing facilities. This task involved the compilation and organization

Verified for accuracy by: Claudia Furman Date: 7/1/83 of site-specific environmental and waste-type data, information and data review, criteria evaluation and site assessment. In addition to the above task, Ms. Furman reviewed groundwater model literature and cost-benefit analysis methods, compiled bibliographies, and prepared the information in tabular and report formats. This information constitutes the preliminary basis for reviewing groundwater models potentially useful for assessing chlorinated organic facilities and a cost-benefit analysis method for determining regulatory impact on the industry.

Ms. Furman made significant contributions to a project requiring the characterization and evaluation of 100 surface impoundments in Northern Virginia. Her responsibilities include literature compilation, data review, criteria evaluation, and site investigation to determine compliance or noncompliance with the "Criteria for Classification of Solid Waste Disposal Facilities and Practices." Subsequent to this study, she wrote several sections of the final report "An Assessment of the Hazard Potential of 100 Surface Impoundments in Virginia."

Ms. Furman was involved in the research and writing of the "Emergency Drum Handling Practices at Abandoned Dump Sites" manual prepared for EPA's Municipal Environmental Research Laboratory in Edison, New Jersey. Her responsibilities included a literature search, information review, and the writing of several sections of the manual.

Ms. Furman participated in study involving the investigation and rating of 15 hazardous waste disposal sites in the State of Maryland. Her task included an extensive literature search for environmental data, information and data review, on-site field investigations, and the writing of final site investigation and assessment reports.

She was involved in the research and writing of the "Technical Reference Manual on Hazardous Waste Facility Siting," prepared for EPA Region III. In addition, she participated in the preparation of a hazardous waste disposal facility siting presentation, presented before the West Virginia Subcommittee on Hazardous Wastes.

PUBLICATIONS

R. Cochran, M. Kaplan, P. Rogoshewski, and C.A. Furman, "Survey and Case Study Investigation of Remedial Actions at Uncontrolled Hazardous Waste Sites," 3rd National Conference on the Management of Uncontrolled Hazardous Waste Sites, Washington, D.C., November 29 - December 1, 1982.

R. Cochran, C.A. Furman and P. Rogoshewski, "Alternatives for Ground Water Containment and Cleanup at Hazardous Waste Disposal Sites," Northeast Conference on the Impact of Waste Storage and Disposal on Groundwater Resources in Ithaca, N.Y., July 1982.

Verified for accuracy by: Claudia Furman Date: 7/1/83

JOHN P. MEADE

EDUCATION

Manhattan College: B.C.E., Civil Sanitary Engineering (1955)

SUMMARY

Mr. Meade has 25 years of experience in sanitary, industrial hygiene, and bioenvironmental engineering, and is certified as an Associate Public Health Engineer in State of New York. He is a Senior Project Manager at JRB, working as a senior technical reviewer for a multi-task contract for remedial actions on uncontrolled hazardous waste sites. He joined JRB as the Project Manager of two Department of Labor (DOL) contracts to provide OSHA with on-site consultation services to assist small business in Pennsylvania. Prior to joining JRB, Mr. Meade spent 24 years on active duty in the U.S. Air Force (USAF). His last post there was Vice Commander of the USAF Occupational and Environmental Health Laboraoty (OEHL). In that position, he assisted the Commander in the direction and monitoring of OEHL's daily efforts and was also involved in the preparation of an annual budget in excess of $4 million for OEHL operation. His other Air Force experience includes serving as Chief of the Consultant Services Division, USAF OEHL, and as Director for Categorical Programs for the Department of Defense. This last position included serving as the DOD representative on the Federal Task Force for Hazardous Materials Management.

Experience

December 1980 to present: JRB Associates

Mr. Meade, under the terms of an EPA contract addressing the investigation of remedial actions of uncontrolled hazardous waste sites, has functioned as one of JRB's senior technical reviewers. One of his assigned tasks is to review the majority of twenty detailed case study analyses selected from an inventory of nationwide remedial actions. The sites were selected based upon their overall priority and the remedial actions were evaluated from both their effectiveness in meeting the objectives of the site action and also from a cost standpoint.

Mr. Meade is presently functioning as the Deputy to the Senior Vice President for the Waste Management Department and shares in the responsibility for monitoring and administering a $4 million EPA R & D mission contract that has 29 tasks. He also manages two additional tasks that address the design and monitoring of protective covers for hazardous waste lagoons, and design of decontamination equipment and procedures for use at hazardous waste sites. Mr. Meade is the Program Manager for JRB's Basic Ordering Agreement with Tyndall AFB to perform Phase 1, 3, and 4 Installation Restoration Program tasks at Military installations throughout the country. In addition, he has responsibility for performing Quality Assurance/Quality Control and functions as Senior Health and Safety advisor at many of JRB's field efforts, such as the #1 rated Superfund site in Glosgow, New Jersey.

Verified for accuracy by: John P. Meade Date: 12/2/83

This is a two year effort to determine the effectiveness of a slurry wall and cap in containing pollutant migration off-site.

Mr. Meade is presently the Task Manager for an EPA TMS III project to evaluate the effect of various chemicals that may be found in spills and in hazardous waste disposal sites on chlorinated polyethylene (CPE) protective clothing. The clothing is intended for use by EPA's Environmental Response Teams.

April 1978 to December 1980: U.S. Air Force Occupational and Environmental Health Laboratory

As Vice Commander of the USAF OEHL, Mr. Meade directed and monitored the daily efforts of 150 professional and support personnel, including assisting the AIHA-certified laboratory to ensure compliance with applicable Federal, state and local standards. He was also responsible for preparing portions of an annual budget in excess of $4 million for the operation of the USAF OEHL. In this effort, he was assisted by four Division Chiefs.

For 2 years, Mr. Meade was the Chief of the Consultant Services Division of the OEHL. In this position, he managed and supervised 60 professionals, including 12 industrial hygienists. 7 air and 8 water pollution abatement engineers and scientists, with a budget of $913,000. He had responsibility for managing almost fifty environmental projects within the Division. The Division had integrated conventional safety, hazards monitoring, and safety and health control functions. Mr. Meade also provided technical, industrial hygiene, and engineering oversight and direction of U.S. Air Force hazard abatement efforts, conducted occupational safety and health training of managers and employees, and developed programs to monitor and control exposure of employees to occupational safety and health hazards inherent in Air Force Operations. He was responsible for developing a computerized industrial hygiene information system that will be part of an overall occupational health information system and will be used Air Force wide. He also administered four technical contracts with a 3-year program of more than $16 million.

July 1973 to April 1978: U.S. Department of Defense

For the U.S. Department of Defense (DOD), office of the Assistant Secretary for Energy, Environment, and Safety, Mr. Meade was the Director of Categorical Programs for 5 years. In this position, he provided special technical expertise to the Deputy Assistance Secretary of Defense in the areas of hearing conservation and noise abatement, management of toxic and hazardous materials, and military construction programs to comply with applicable Environmental Protection Agency (EPA) and DOL legislative mandates. During this time, he also represented DOD on the Federal Task Force for Hazardous Materials Management and the Executive Steering Committee sponsored by EPA Region IX. As the DOD representative, he was responsible for conducting a regional inventory of DOD hazardous wastes; exploring, developing, and recommending courses of action to safely manage DOD hazardous materials;

Verified for accuracy by: John P. Meade Date: 12/2/83

identifying, developing, and disseminating recommended plans of action for environmentally safe management (transportation, storage, resale, recycling, reuse, modification, and ultimate disposal) of these materials; coordinating interagency actions relating to hazardous waste management; coordinating final disposition actions relating to hazardous waste management; and coordinating final disposition actions with appropriate state agencies. The primary objective of the Task Force was to provide a mechanism for technology and information transfer to all regional agencies concerned with hazardous waste management. Additionally, he served as the DOD focal point for the control of PCBs. He was lead member on several DOD-EPA working groups to develop guidelines for the appropriate disposal methodology for PCBs and to identify a safe transition to the use of less toxic materials. He also served as a key DOD member in the disposal actions of both DDT and Agent Orange. From 1975-1977, Mr. Meade was the DOD subcommittee Chairman for the management of hazardous wastes for the Interagency Committee on Resource Recovery.

Mr. Meade's other accomplishments included coordinating more than $1 billion for air and water pollution abatement programs in 4 years; developing policy for the control of toxic substances; initiating an expanded safety and occupational health program, including new procedures to implement the Occupational Safety and Health (OSH) Act; developing plans for occupational health and industrial hygiene programs; initiating procedures and mechanisms for early review and evaluation of proposed National Institute for Occupational Safety and Health (NOISH) criteria documents and proposed Department of Labor Standards; recommending goals for the occupational health program, and coordinating budget requests to allocate resources within fiscal constraints.

He worked very closely with the Military Departments in th mulation of SPCC programs to ensure that contingencies were developed controll of potential spills of potentially hazardous materials. In additi n, Mr. Meade was responsible for the acceptance by EPA of DOD's Pesticide Applicator Certification program. This program included training, monitoring, application of restricted use pesticides, and post-application clean-up and disposal of waste pesticides.

PROFESSIONAL AFFILIATIONS

American Industrial Hygiene Association
American Conference of Governmental Industrial Hygienists
Aerospace Medical Association
Conference of Federal Environmental Engineers

Verified for accuracy by: John P. Meade Date: 12/2/83

ROBERT M. SCARBERRY

EDUCATION

University of Pittsburgh: B.S., Chemical Engineering (1977)
West Virginia University: A.B., Biology (1975)

EXPERIENCE

Mr. Scarberry is a Chemical Engineer in JRB's Hazardous Waste Management Group. He has experience in pollution control and treatment as well as chemical process analysis.

Mr. Scarberry is presently a task manager for a program which assesses wastes and waste disposal practices with respect to the organic chemical industry. As part of this program, Mr. Scarberry is performing site visits and is involved with the design and costing of treatment alternatives, as well as data base management. This research will provide support to EPA for the development of industry-specific guidelines for hazardous waste disposal and hazardous waste listing activities under the Resource Conservation and Recovery Act (RCRA).

Mr. Scarberry is also serving as Task Manager for a program which is preparing a technical handbook for the evaluation and selection of sorbents for the removal of spills and other releases of hazardous substances. The manual is being designed for personnel directly involved in the cleanup of hazardous substance releases such as on-scene coordinators, spill cleanup contractors and fire departments. The handbook covers over 30 types of sorbents including natural organic and inorganic substances as well as synthetic and modified natural substances. In addition, the handbook addresses all liquid hazardous substances present on the CERCLA (Superfund) List. While most of the data are being gathered from the open literature, the program includes testing of sorbent performance to obtain missing data such as sorbent capacity, sorbent/hazardous liquid compatibility, and hazardous liquid/water preference indices.

Prior to working at JRB, Mr. Scarberry served as Task Leader of a program for EPA's Office of Solid Waste to perform engineering process analyses on 32 product/process segments of the organic chemical manufacturing industry. These analyses involved the preparation of detailed process descriptions, characterization of waste streams, and identification of waste management practices. Information for this program was gathered from the literature, industry questionnaires and site visits, and sampling and analysis. The purpose of this program was to provide the technical basis for determining the hazardous nature of wastes and to ascertain the processing factors which affect hazardous waste production.

Verified for accuracy by: Robert M Scarberry Date: 6/30/83

As Project Director for a program sponsored by EPA, Mr. Scarberry provided technical support to develop multimedia discharge regulations for the fuel alcohol industry. His responsibilities included data collection and management of the data base; compilation of an industry profile; sampling and analysis of air, wastewater, and solid waste streams from eight ethanol plants; assessment of waste stream treatability and participation in pilot unit treatability studies, design and costing of model plant pollution control and treatment technologies, and completion of a conceptual design of a commercial-size fuel alcohol facility.

As Technical Investigator of a program funded by the Department of Energy, Mr. Scarberry examined the potential processing, environmental, and health and safety consequences of utilizing shale oil and coal liquids in petroleum refineries. Various utilization scenarios were analyzed and options for mitigating problems ensuing from synthetic liquid refining were asssessed based on a comparison of the physical, chemical, and toxicological properties of selected synthetic feedstocks and conventional crude oils.

In the Chemicals Division of Texaco's Port Arthur Research and Development Center, Mr. Scarberry was primarily concerned with process and product development work on additives used in diesel, gas, and marine engine oils. This involved bench-scale studies and subsequent scale-up to pilot unit and commerical facilities. This work led to a patent on an overbased calcium alkylphenolate additive which shows improved performance in oxidative stability, corrosion control, and reserve alkalinity. His responsibilities at Texaco also included the maintenance and modification of pilot units as well as providing tec' al assistance to commercial production of chemicals at the adjacent r :y.

PUBLICATIONS

Propylene Oxide; Epichlorohydrin; Glycerin; Acrolein, Acrylic Acid, Acrylic Esters; Ethylamines; Acetic Acid; Caprolactam; Terephthalic Acid, Dimerthyl Terephthalate; Hexamethylene Diamine, Adiponitrile; Phenol, Acetone; Cumene; Bisphenol-A; Oxo-Alcohols; Acrylamides. Interim Draft Engineering Process Analyses prepared for U.S. EPA, Office of Solid Waste, Washington, D.C. August 1982.

Multimedia Technical Support Document: Proposed Effluent Guidelines for the Fuel Alcohol Point Source Category. Prepared for U.S. EPA Effluent Guidelines Division, Washington, D.C. October 1981.

Fuel Alcohol Pollution Control Technology Cost Manual. Prepared for U.S. EPA, Effluent Guidelines Division, October 1981.

Verified for accuracy by: Robert M Scarberry Date: 6/30/83

"Environmental Aspects of Fuel Alcohol Production." Presented at the National Gasohol Commission Conference, Myrtle Beach, South Carolina, December 1980.

"Industrial Ethanol Production" and "Environmental Regulations and Control Technology for Ethanol Production." Presented at the EPA Seminar in Kansas City, Missouri, October 1980.

Scarberry, R.M. Source Test and Evaluation: Alcohol Facility for Gasohol Production. Prepared for U.S. EPA, Industrial Energy Research Laboratory, Cincinnati, Ohio, February 1980.

"Shale Oil Refining, Storage, Handling, and Combustion" from Pollution Control Guidance Document for the Oil Shale Industry. Prepared for U.S. EPA, Industrial Energy Research Laboratory, Cincinnati, Ohio, March 1979.

Scarberry, R.M.; Papai, M.P. Implications of a Synthetic Liquids Utilization Program. Prepared for U.S. DOE, Office of Policy and Evaluation, Washington, D.C., June 1979.

Verified for accuracy by: Robert M Scarberry Date: 6/30/83

ROBERT A. SMITH

EDUCATION

Pennsylvania State University: B.S., Recreation and Parks (1980)

EXPERIENCE

Mr. smith is a Regulatory Analyst in JRB's Hazardous Waste Management Division. In conjunction with the Industry Studies waste management assessment program, Mr. Smith has primary reponsibilities in the following areas:

- The development of waste management profiles for the chlorinated organic and pestice manufacturing industries. These profiles examine the engineering practices and waste management economics which affect chlorinated organic and pesticide chemical production.

- Coordination of RCRA 3007 Questionnaire engineering reviews for the chlorinated organic, industrial organic, and pesticide industries. These reviews examine and analyse waste management practices, production processes and waste generation rates for all industry studies facilities.

- Coordination of an analysis of alternative waste treatment processes to aid in the development of industry specific guidelines for hazardous waste disposal under the Resource Conservation and Recovery Act (RCRA).

- Management of the Industry Studies RCRA 3007 Questionnaire clarification task. The purpose of this task is to analyze, interpret and clarify industry specific waste management and generation rate data prior to entry into the industry studies data base survey.

Verified for Accuracy by: Robert A. Smith Date: 12/5/83

ALFRED N. WICKLINE

EDUCATION

West Virginia University: M.S. Agronomy/Soil Science (1978)
West Virginia University: B.S. Agriculture Animal Science (1975)

EXPERIENCE

Mr. Wickline is a Senior Soil Scientist with JRB's Waste Management Department. He has a wide range of experience in field activities related to site investigations, monitoring and sampling well installation, and evaluation and assessment of pedologic, geologic, and hydrologic data.

Mr. Wickline is currently involved in a project for the EPA dealing with the evaluation of state-of-the-art technologies used in identifying, dredging and disposing of contaminated sediments.

He recently served as the field supervisor on a project under the Air Force Installation Restoration Program (IRP). He successfully supervised the installation of ten (10) monitoring well on an Air Force base in New York. This program was designed to assess the potential of leechate, from abandoned waste disposal sites, to contaminate the groundwater, surface water and sediments. Physical tests were also performed on the wells to establish the transmissivity and permeability of the surface aquifer which may be subject to contamination. Mr. Wickline was also responsible for the adherence to stringent health and safety requirements by all field personnel. Data generated during the field activities was used by Mr. Wickline in the formulation of geologic logs, cross sections, and potentiometric maps. This information was used in the assessment of the potential for soil, surface, and groundwater contamination within the Air Force Base. Recommendation were made concerning the need for containment of potential contaminants.

Mr. Wickline also served as the field supervisor for the installation of 19 monitoring wells at the Lipari Waste Disposal site in New Jersey (a superfund site). He was responsible for all drilling and health and safety activities during the field activities. This field program required special drilling techniques to prevent contamination from entering a confined aquifer below the disposal site. He also participated in the sampling of the wells for the EPA priority pollutants. This part of the program involved following extremely strict quality assurance/quality control and health and safety procedures. Mr. Wickline was also extensively involved in the preliminary geotechnical assessment of the Lipari site.

Verified for accuracy by: Alfred N. Wickline Date: 12/5/83

Prior to his involvement at Lipari, Mr. Wickline served as the field supervisor for the installation of 21 monitoring wells on an Army Ammunition Plant in Tennessee. This project involved the drilling and installation of monitoring well into three separate aquifers. This activity involved two different drilling techniques to successfully complete the installation of the wells.

Mr. Wickline also served as a supervisory geologist during the installation of monitoring wells at Love Canal, New York. This activitiy involved the supervision of drilling activities, logging of the well and insuring all personnel adhered to health and safety requirements..

Mr. Wickline also has extensive experience in the coal mining industry and dealing with drastically disturbed lands. Prior to transfering to JRB, Mr. Wickline managed and supervised field investigations and geotechnical evaluations of over 150 surface and underground mining operations in five appalachian coal mining states. These evaluations involved field data aquisition, and hydrologic geologic and pedologic assessments of the environmental impact of these operations. These investigations involved surface and subsurface geologic mapping, geologic log interpretation, stratigraphic correlating structural and hydrologic interpretations and monitoring well siting. He was also responsible for site investigations and technical writing of forty (40) soils and vegetative assessments for coai mining permits in Virginia, West Virginia, Pennsylvania, and Kentucky. These reports required site visits, soil mapping and evaluations as to the requirements for reclamation and revegetation.

Mr. Wickline also has extensive experience in overburden analysis. These analyses involved sample collection, preparation and evaluation of laboratory data. These evaluations were directed toward the prevention of surface and groundwater pollution and the establishment of acceptable vegetation after reclamation.

Mr. Wickline also has provided technical assistance to mining operators for site specific problems concerning water quality and revegetation problems. He also provided technical input and support for Environmental Characterization Information Reports for Eastern underground and surface mining operations and western surface mining operations. These reports detailed all enviromental aspects of the mining operation from exploration to reclamation. He also assisted in monitoring, coring, and logging of gas wells in New York, Pennsylvania, and Ohio.

Verified for accuracy by: Alfred N. Wickline Date: 12/5/83

APPENDIX C

LIST OF PERSONNEL INTERVIEWED

APPENDIX C

LIST OF PERSONNEL INTERVIEWED

Present/Past Position	Period of Involvement with Hanscom AFB
RADC/AFGL Environmental Manager	NR
RADC/AFGL Employee	30 years, period NR
RADC/AFGL Supervisor	1956 to present
RADC/AFGL Employee	NR
RADC/AFGL Sheet Metal Welder	1952 to present
RADC/AFGL Machinist	32 years, period NR
RADC/AFGL Employee	NR
Flight Line/Motor Pool Employee	1952 to 1973
Purchasing Agent	1973 to 1983
Motor Pool Mechanic	1952 to 1982
Motor Pool Mechanic	1969 to present
Motor Pool Employee	1958 to present
Heavy Equipment Operator	1966 to present
Exterior Electrician	1952 to present
Security Policeman	1959 to 1962
P.O.L. Employee	1943 to 1977
Industrial Equipment Operator	1970 to present
Plumber	1944 to 1972
Superintendent of Roads & Grounds	1966 to present
Prospect Hill Employee	NR
Sagamore Hill Employee	NR
North Truro Air Station Employee	NR
North Truro Air Station Employee	NR
North Truro Air Station Employee	NR
Hanscom Field Fire Department Crew Chief	1956 and 1966 to present
Hanscom Field Assistant Fire Chief	1972 to present
Massport Employee	NR
RADC Electromagnetic Test and Measurements Facility Employee	NR
Prospect Hill Electronic Engineer	1968 to present
Prospect Hill Employee	NR
Prospect Hill Employee	NR
Sudbury/Chief of Ground Base Sensing	1962 to present
Raytheon-Bedford Employee	NR
Raytheon-Bedford Employee	NR
Building Maintenance	NR
Deputy Chief of Building Maintenance	1946 to 1982
Exterminator	1952 to 1983

APPENDIX C

LIST OF PERSONNEL INTERVIEWED (continued)

Present/Past Position	Period of Involvement with Hanscom AFB
Contractor	NR
Hanscom AFB Environmental Engineer	1977 to 80
U.S. Army Corps of Engineers Employee	NR
ESD Employee	NR
Base Civil Engineers	NR
Air Force Police Officers	1960 to 1963 and 1982 to present
Airman 1st Class	1959
Major/Bioenvironmental Engineer	1971 to 1974
CM Sargent/Bioenvironmental Engineer	NR

NR - Not Reported

APPENDIX D

HAZARD ASSESSMENT RATING METHODOLOGY FORMS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Fire Training Area #2

LOCATION Northwest of Runway 23

DATE OF OPERATION OR OCCURRENCE 1960's - 1973

OWNER/OPERATOR USAF/Mass Port

COMMENTS/DESCRIPTION Degreasing chemicals, paint thinner, solvents and waste oils dumped into pit

SITE RATED BY A. Wickline & C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			106	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 58.8

II. WASTE CHARACTERISTICS

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

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

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

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

100 x 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 x 1 = 100

III. PATHWAYS

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

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

Subscore 100

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
		Subtotals	66	108

Subscore (100 X factor score subtotal/maximum score subtotal) 61.1

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

Subscore (100 x factor score/3) 33.3

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	2	8	16	24
Direct access to ground water	3	8	24	24
		Subtotals	92	114

Subscore (100 x factor score subtotal/maximum score subtotal) 80.7

C. Highest pathway subscore.

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

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	58.8
Waste Characteristics	100.00
Pathways	100

Total 258.8 divided by 3 = 86.3 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

86.3 X 1 = 86.3

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Paint Waste Disposal Site

LOCATION North of Runway 29/11 and east of Runway 5/23

DATE OF OPERATION OR OCCURRENCE 1966 - 1972

OWNER/OPERATOR USAF /Mass Port

COMMENTS/DESCRIPTION Waste oil, paints and other toxic materials disposed of here

SITE RATED BY A. Wickline and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	102	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 56.6

II. WASTE CHARACTERISTICS

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

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

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

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

100 x 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 x 1 = 100

III. PATHWAYS

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

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

Subscore 100

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
Subtotals			60	108

Subscore (100 X factor score subtotal/maximum score subtotal) 55.5

2. Flooding

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

Subscore (100 x factor score/3) 33.3

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	3	8	24	24
Subsurface flows	3	8	24	24
Direct access to ground water	3	8	24	24
Subtotals			108	114

Subscore (100 x factor score subtotal/maximum score subtotal) 94.7

C. Highest pathway subscore.

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

Pathways Subscore 94.7

IV. WASTE MANAGEMENT PRACTICES.

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

Receptors	56.6
Waste Characteristics	100
Pathways	100

Total 256.6 divided by 3 = 85.5
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

85.5 x 1 = 85.5

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Jet Fuel Residue Area/Tank Sludge Area

LOCATION Near intersection of taxiway M and F

DATE OF OPERATION OR OCCURRENCE 1959 to 1960

OWNER/OPERATOR USAF/Mass Port

COMMENTS/DESCRIPTION Disposal of several hundred drums of waste oils and paint wastes

SITE RATED BY A. Wickline & C. Furman

I. RECEPTORS

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

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 54.4

II. WASTE CHARACTERISTICS

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

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

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

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

100 x 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 x 1 = 100

III. PATHWAYS

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

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

Subscore 100

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
Subtotals			60	108

Subscore (100 X factor score subtotal/maximum score subtotal) 55.5

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

Subscore (100 x factor score/3) 33.3

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	3	8	24	24
Subsurface flows	3	8	24	24
Direct access to ground water	3	8	24	24
Subtotals			108	114

Subscore (100 x factor score subtotal/maximum score subtotal) 94.7

C. Highest pathway subscore.

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

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	54.4
Waste Characteristics	100
Pathways	100

Total 254.4 divided by 3 = 84.8 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

84.8 x 1 = 84.8

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Sanitary Landfill

LOCATION 1,800 feet from departure end of Runway 5-23

DATE OF OPERATION OR OCCURRENCE 12/1964 - 12/1974

OWNER/OPERATOR USAF

COMMENTS/DESCRIPTION 10.5 acres for disposal of primarily solid waste

SITE RATED BY A. Wickline and C. Furman

I. RECEPTORS

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

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 45.5

II. WASTE CHARACTERISTICS

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

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

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

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

100 x 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 x 1 = 100

III. PATHWAYS

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

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

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
		Subtotals	60	108

Subscore (100 X factor score subtotal/maximum score subtotal) 55.5

2. Flooding

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

Subscore (100 x factor score/3) 33.3

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	3	8	24	24
Subsurface flows	3	8	24	24
Direct access to ground water	3	8	24	24
		Subtotals	108	114

Subscore (100 x factor score subtotal/maximum score subtotal) 94.7

C. Highest pathway subscore.

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

Pathways Subscore 94.7

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	45.5
Waste Characteristics	100
Pathways	94.7

Total 240.2 divided by 3 = 80.1
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

80.1 X 1 = 80.1

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE Original Fire Training Area #1

LOCATION South of Runway 29-11 and west Runway 5-23

DATE OF OPERATION OR OCCURRENCE 1950's through 1960's

OWNER/OPERATOR USAF/Mass Port

COMMENTS/DESCRIPTION Emptied drummed solvents contaminated fuel, and spent laboratory chemicals into pit for training sessions

SITE RATED BY A. Wickline & C. Furman

I. RECEPTORS

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

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 51.1

II. WASTE CHARACTERISTICS

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

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

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

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

100 x 1 = 100

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

100 x 1 = 100

III. PATHWAYS

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

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

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			66	108

Subscore (100 X factor score subtotal/maximum score subtotal) 61.1

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

Subscore (100 x factor score/3) 33.3

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	2	8	16	24
Direct access to ground water	3	8	24	24
Subtotals			92	114

Subscore (100 x factor score subtotal/maximum score subtotal) 80.7

C. Highest pathway subscore.

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

Pathways Subscore 80.7

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51.1
Waste Characteristics	100
Pathways	80.7

Total 231.8 divided by 3 = 77.3 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

77.3 x 1 = 77.3

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Former Filter Beds

LOCATION: Around Building T504

DATE OF OPERATION OR OCCURRENCE:

OWNER/OPERATOR: United States Air Force

COMMENTS/DESCRIPTION: Past use as filter beds for STP

SITE RATED BY: C. Furman & A. Wickline

I. RECEPTORS

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

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 51.1

II. WASTE CHARACTERISTICS

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

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

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

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

70 x 1 = 70

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

70 x 1 = 70

III. PATHWAYS

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	3	6	18	18
Surface erosion	2	8	16	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
Subtotals			72	108
Subscore (100 X factor score subtotal/maximum score subtotal)				66.7
2. Flooding	0	1	0	0
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	3	8	24	24
Subsurface flows	2	8	16	24
Direct access to ground water	3	8	24	24
Subtotals			106	114
Subscore (100 x factor score subtotal/maximum score subtotal)				93

C. Highest pathway subscore.

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

Pathways Subscore 93

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51.1
Waste Characteristics	70.0
Pathways	93.0

Total 214.1 divided by 3 = 71.4
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

71.4 x 1 = 71.4

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Industrial Waste Treatment System

LOCATION: Building 1717

DATE OF OPERATION OR OCCURRENCE: 1949 - 1974

OWNER/OPERATOR: USAF

COMMENTS/DESCRIPTION: System had a history of leaks

SITE RATED BY: A. Wickline & C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	10	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			100	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55.6

II. WASTE CHARACTERISTICS

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

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

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

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

80 x 1 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1 = 80

III. PATHWAYS

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

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

Subscore 0

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
Subtotals			52	108

Subscore (100 X factor score subtotal/maximum score subtotal) 48.1

2. Flooding

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

Subscore (100 x factor score/3) 33.3

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	3	8	24	24
Subsurface flows	1	8	8	24
Direct access to ground water	3	8	24	24
Subtotals			92	114

Subscore (100 x factor score subtotal/maximum score subtotal) 80.7

C. Highest pathway subscore.

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

Pathways Subscore 80.7

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	55.6
Waste Characteristics	80.0
Pathways	80.7

Total 216.3 divided by 3 = 72.1 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

72.1 x .95 = 68.5

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Scott Circle Landfill

LOCATION: South of Base Clinic and Elementary School, bounded on 3 sides by military housing

DATE OF OPERATION OR OCCURRENCE: 1950's - 1973

OWNER/OPERATOR: USAF

COMMENTS/DESCRIPTION: Largest land area of the disposal sites; confirmed disposal of hazardous substances

SITE RATED BY: A. Wickline & C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			204	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 57.7

II. WASTE CHARACTERISTICS

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

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

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

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

50 x 1 = 50

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

50 x 1 = 50

III. PATHWAYS

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

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

Subscore 0

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	2	8	16	24
Surface permeability	1	6	6	18
Rainfall intensity	2	8	16	24
Subtotals			74	108

Subscore (100 X factor score subtotal/maximum score subtotal) 68.5

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

Subscore (100 x factor score/3) 33.3

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	3	8	24	24
Direct access to ground water	3	8	24	24
Subtotals			100	114

Subscore (100 x factor score subtotal/maximum score subtotal) 87.7

C. Highest pathway subscore.

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

Pathways Subscore 87.7

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	57.7
Waste Characteristics	50.0
Pathways	87.7

Total 195.4 divided by 3 = 65.1
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

65.1 X 1 = 65.1

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Administration Building Jet Fuel Spill

LOCATION: Directly NW of Building 1600

DATE OF OPERATION OR OCCURRENCE: 1954

OWNER/OPERATOR: U.S. Air Force

COMMENTS/DESCRIPTION: 500 gallon spill of JP-4 jet fuel oil

SITE RATED BY: A. Wickline & C. Furman

I. RECEPTORS

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

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 47.7

II. WASTE CHARACTERISTICS

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

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

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

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

80 x .8 = 64

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

64 x 1 = 64

III. PATHWAYS

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

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

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
Subtotals			52	108

Subscore (100 X factor score subtotal/maximum score subtotal) 48.1

2. Flooding

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

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to ground water	3	8	24	24
Subtotals			84	114

Subscore (100 x factor score subtotal/maximum score subtotal) 73.6

C. Highest pathway subscore.

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

Pathways Subscore 73.6

IV. WASTE MANAGEMENT PRACTICES.

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

Receptors	47.7
Waste Characteristics	64.0
Pathways	73.6

Total 185.3 divided by 3 = 61.7
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

61.7 x .95 = 58.6

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Building 1128 Mercury Spill

LOCATION: Behind Building 1128

DATE OF OPERATION OR OCCURRENCE: 1975

OWNER/OPERATOR: USAF

COMMENTS/DESCRIPTION: Unknown quantity of elemental mercury spilled into two manholes

SITE RATED BY: A. Wickline and C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			93	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal): 51.6

II. WASTE CHARACTERISTICS

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

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

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

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

60 x 1 = 60

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

60 x 1 = 60

III. PATHWAYS

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

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

Subscore 0

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	1	8	8	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	0	6	0	18
Rainfall intensity	2	8	16	24
Subtotals			44	108

Subscore (100 X factor score subtotal/maximum score subtotal) 40.7

2. Flooding

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

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	1	8	8	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			28	114

Subscore (100 x factor score subtotal/maximum score subtotal) 24.6

C. Highest pathway subscore.

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

Pathways Subscore 40.7

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51.6
Waste Characteristics	60
Pathways	40.7

Total 152.3 divided by 3 = 50.8
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

50.8 x .95 = 48.3

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Air Field Spills

LOCATION: Apron and Runways of Hanscom Field

DATE OF OPERATION OR OCCURRENCE: 1960's, 1973 & 1979 - 3 spills

OWNER/OPERATOR: USAF/Mass Port

COMMENTS/DESCRIPTION: Three spills in area all treated similarly

SITE RATED BY: A. Wickline & C. Furman

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
		Subtotals	102	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) **56.7**

II. WASTE CHARACTERISTICS

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

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

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

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

50 x .8 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 x 1 = 40

III. PATHWAYS

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

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

Subscore 100

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	18	24
Net precipitation	3	6	18	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			78	108

Subscore (100 X factor score subtotal/maximum score subtotal) 72.2

2. Flooding

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

Subscore (100 x factor score/3) 33

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	3	8	24	24
Subsurface flows	0	8	0	24
Direct access to ground water	2	8	16	24
Subtotals			82	118

Subscore (100 x factor score subtotal/maximum score subtotal) 69.5

C. Highest pathway subscore.

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

Pathways Subscore 72.2

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	56.7
Waste Characteristics	40
Pathways	72.2

Total 168.9 divided by 3 = 56.3 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

56.3 x .8 = 45.04

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Service Station Gasoline Tank Leak

LOCATION: Building 1639

DATE OF OPERATION OR OCCURRENCE: 2/4/1981

OWNER/OPERATOR: Army Air Force Exchange Service

COMMENTS/DESCRIPTION: 3000 gal + gasoline leaked into ground was recovered by Scovenger System

SITE RATED BY: A. Wickline & C. Furman

I. RECEPTORS

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

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 51.1

II. WASTE CHARACTERISTICS

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

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

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

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

50 x .8 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 x 1 = 40

III. PATHWAYS

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

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

Subscore 100

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	3	6	18	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			84	118

Subscore (100 X factor score subtotal/maximum score subtotal) 77.8

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

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	3	8	24	24
Subsurface flows	3	8	24	24
Direct access to ground water	3	8	24	24
Subtotals			118	118

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

C. Highest pathway subscore.

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

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51.1
Waste Characteristics	40
Pathways	100

Total 191.1 divided by 3 = 63.7 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

63.7 x .1 = 6.4

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE: Motor Pool Spill

LOCATION: Building 1642

DATE OF OPERATION OR OCCURRENCE: 12/4/81

OWNER/OPERATOR: USAF

COMMENTS/DESCRIPTION: Leak located within 300 feet of culvert carrying Shawsheen River

SITE RATED BY: A. Wickline & C. Furman

I. RECEPTORS

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

Receptors subscore (100 X factor score subtotal/maximum score subtotal): 51.1

II. WASTE CHARACTERISTICS

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

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

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

B. Apply persistence factor

Factor Subscore A X Persistence Factor = Subscore B

50 x .8 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 x 1 = 40

III. PATHWAYS

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

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

Subscore 80

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

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	3	6	18	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	84	108

Subscore (100 X factor score subtotal/maximum score subtotal) 77.8

2. Flooding

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

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	3	6	18	18
Soil permeability	3	8	24	24
Subsurface flows	2	8	16	24
Direct access to ground water	3	8	24	24
		Subtotals	106	118

Subscore (100 x factor score subtotal/maximum score subtotal) 89.8

C. Highest pathway subscore.

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

Pathways Subscore 89.8

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	51.1
Waste Characteristics	40
Pathways	89.3

Total 180.4 divided by 3 = 60.1 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

60.1 x .1 = 6.0

APPENDIX E

BIOTIC ENVIRONMENTAL DATA PROVIDED BY MASSACHUSETTS NATURAL HERITAGE PROGRAM

Massachusetts
Natural Heritage
Program

April 2, 1984

Claudia Furman
J.R.B. Associates
8400 West Park Drive
McLean, VA 22102

Re: Rare species review of
Mass. DOD properties

Dear Ms. Furman:

As you requested, the Massachusetts Natural Heritage Program has reviewed the vicinities of seven Department of Defense properties in Massachusetts, which you described by telephone last week. We would like to inform you of the following occurrences of rare plant or animal species populations or significant natural communities within the specified radii from each site:

Site/Radius/Map quadrangle	Occurrences of Rare Plants & Animals	Comments
Hanscom Field, within two miles, Concord.	Several current or historical rare plant and animal species within Great Meadows National Wildlife Refuge.	Already protected
Prospect Hill Radio Facility in Waltham, within one mile, Concord.	Dry open woods habitat; unusual plant species occur east and south of summit on more open ledges. None currently considered rare.	Keep activities within fenced area, stay away from ledges. Habitat may be getting overgrown.
Great Neck Hill Air Force Cambridge Research Labs, within one mile, Ipswich.	No known occurrences.	

(more)

Division of Fisheries & Wildlife 100 Cambridge Street, Boston, Mass. 02202 (617) 727 -3160

Sagamore Hill U.S. Military Reservation, within one mile, Ipswich.	No known occurrences	
U.S. Military Reservation Natick Lab in Maryland, within one mile of perimeter road, Concord.	Historical rare amphibian species record Blue-spotted Salamander, 1964: <u>Ambystoma laterale</u>.	Inhabits wooded swamps and moist woods. Rare in state and vulnerable during early spring breeding season.
Fourth Cliff USAF Reservation, within one mile, Scituate.	Current Tern Colony with two rare bird species:	
	Least Tern <u>Sterna antillarum</u>	55 breeding pairs at this site in 1983. Threatened in state.
	Piping Plover <u>Charadrius melodius</u>	2 breeding pairs at this site in 1983. Endangered in state.
	Major migration stopover in Mass. for rare bird species: Red Knot <u>Calidrus canutus</u>	A species of special concern. Critical feeding habitat for depositing fat reserves prior to nonstop flight to S. America.
North Truro Air Force Station, within one mile, North Truro.	Current occurrence of rare Prickly Pear plant species: <u>Opuntia humifusa</u>	Threatened in state.
	Historical rare plant species record Broom Crowberry, 1904: <u>Corema conradii</u>	Sandy pine barrens, sand hills, siliceous rocks. Threatened in state.
	Historical rare animal species record. Hoary Bat, 1891: <u>Lasiurus cinereus</u>	Threatened in state. Breeds in old-growth forests, may frequent open spaces during migration

Please note that locations of current rare species populations should not be publicized to prevent inadvertent damage to their habitats through collecting or visiting. Further data on these areas may become available as our inventory expands through ongoing research and fieldwork.

Thank you for consulting the MNHP. I hope this information is useful in your assessment of these areas and that you will call us with any questions. For future similar data requests, we ask that you send a brief summary of the proposed actions and a copy of the appropriate sections of the USGS quad(s) with the areas of concern outlined. Please allow two weeks for our response. A User's Guide is enclosed with further details about the Program.

Yours sincerely,

Alison Sanders-Fleming

Alison Sanders-Fleming
Environmental Reviewer

ASF:phb
Enc.

APPENDIX F

HAZARDOUS MATERIALS INVENTORY FOR SHOPS, SUPPORT SERVICES, AND RESEARCH L^BORATORIES

Operation Type Support Services and Maintenance

Shop Or Activity	Location/ Building No.	Hazardous Materials Used	Quantity On Hand (Range)	Disposal Practice: Used Up	Evaporation	Adheres to Surface	Sanitary Sewer	Trash Can/Off-Site Disposal	Reclamation	Other
Heat Shop	1201	Cleaners, cutting oil, epoxy cements, lacquers	1 gallon - 100 gallons	X				X		
Hazardous Chemical Storage	1208	Acetone, alcohols, lacquer, lube oils, paints, thinner, toluenes, TCE	1 pint - 140 gallons	X		X				
Base Clinical Laboratory	1217 (Pharmacy, nursing services, veterinary services)	Alcohols, drugs, infectious wastes, needles and syringes, photographic chemicals	1 pint - 40 gallons, plus < 100 doses < 20 cubic ft infectious waste	X			X	X		Autoclave
Base Dental Clinic	1218	Alcohols, drugs, infections wastes, needles and syringes, photographic chemicals, mercury	1 pint - 3 gallons 13 cubic ft infectious waste	X			X	X		Autoclave
Base Photo Lab	1508	Photographic chemicals (developers, activators, toners)	unknown	X		X	X			
Air Force Systems Support Operations	1521	Cleaners, photographic chemicals, solvents	1 pint - 5 gallons	X			X	X		
Administration	1600 (RM: 109)	Cleaners, lubricants, sealants			X	X	X			

Operation Type Support Services and Maintenance

Shop Or Activity	Location/ Building No.	Hazardous Materials Used	Quantity On Hand (Range)	Disposal Practice						
				Used Up	Evaporation	Adheres to Surface	Sanitary Sewer	Trash Can/Off-Site Disposal	Reclamation	Other
Security Police	1605	Cleaners, lubricants	1 quart - 11 gallons	X				X		
Base Supply (Packing & Crating)	1614	Cleaners, lubricants, paints	1 quart - 5 gallons	X		X				
Motor Pool	1642	Acids, alcohols, antifreeze, cleaners, paint, solvents, TCE	1 gallon - 110 gallons	X	X	X	X	X		
Environmental Health Clinic	1704	Acids, infectious wastes, mercury, radioactive materials	2-3 pints 1.5-2.5 cubic feet infectious materials					X		Autoclaved
Compressed Gas Storage Facility	1717	Hcl, arsine, chlorine, carbon monoxide, acetylene, nitrous oxide, sulfur hexafluoride	Varying quantities of cylinders	X						
Base Fire Department	1721	Butyl carbatol, fluoroaliphatic compounds (foams), organic surfactants	unknown quantities	X						
PMEL (Precision Measurement Equipment Lab)	1726	Alcohols, cleaning liquids, lube oils, paint, solder, toluene, TCE, thinner	4 ounces - 10 gallons	X						
Hazardous Storage Area	1729 (RMS: 7D,7E)	Acids, alcohols, antifreeze, caustics, cleaners, developers, lube oils, photographic chemicals, paint, TCE	1 quart - 150 gallons	X		X				

Operation Type Support Services and Maintenance

Shop Or Activity	Location/ Building No.	Hazardous Materials Used	Quantity On Hand (Range)	Disposal Practice: Used Up	Evaporation	Adheres to Surface	Sanitary Sewer	Trash Can/Off-Site Disposal	Reclamation	Other
Heating Plant	1811	Antifreeze, lubricants, refrigerants	50 gallons - 300 gallons	X						
Print Shop	1812	Creosote, lacquer, paint, thinner, toluene, varnish	1 gallon - 240 gallons	X		X		X		
Print Shop	1812	Acids, cleaners, inks, photographic chemicals, printing chemicals	1 quart - 5 gallons	X		X	X			
Air Conditioning & Refrigeration Shop	1812	Lube oil, lacquer, paint, refrigerants	1 gallon - 25 gallons	X				X		
Plumbing Shop	1812	Cleaners (drain & floor), lead blocks	3-6 gallons				X		X	
Sheet Metal Shop	1812	Alcohols, cleaners, cutting fluids, lubricants, paint, solder, thinner	1 pint - 2 gallons	X				X	X	
Carpentry Shop	1812	Adhesive, cleaners, glazing compounds, contact cement, thinner, wood preservatives	1-5 gallons	X		X		X		
Masonary Shop	1812	Adhesive, antifreeze, drain cleaner, enamel paint, lead/tin solder, flux, PCB cleaners, sulfuric acid, thinner	1 tube - 1 case	X			X			
Interior Electric Shop	1816	Adhesive, antifreeze, drain cleaner, enamel paint, lead/tin solder, flux, PCB cleaners, sulfuric acid, thinner		X			X			

Operation Type Support Services and Maintenance

Shop Or Activity	Location/ Building No.	Hazardous Materials Used	Quantity On Hand (Range)	Disposal Practice: Used Up	Evaporation	Adheres to Surface	Sanitary Sewer	Trash Can/Off-Site Disposal	Reclamation	Other
Exterior Electric Shop	1817	Degreasing compounds, lacquer, wire pulling compounds, transformers, TCE, sulfuric acid, cleaning compounds	1 quart - 55 gallons	X				X		
Civil Engineer Fuel Storage Shop	1823	Waste grease, paint, hydraulic fluid, heating oil	30 gallons 500 gallons						X	
Pavements and Grounds	1820, 1824, 1826	Antifreeze, adhesive, cleaners, diesel fuel, fertilizer, grease, herbicides, lubricants, paints (enamel, alkyd), thinners, transmission fluid	8 ounces - 500 pounds	X		X		X	X	
Auto Hobby Shop	1830	Antifreeze, degreasers, paint, transmission fluid, waste oil	1 gallon - 110 gallons	X					X	
USAF Clinic	1900	Drugs, infectious wastes, needles and syringes, X-ray photographic chemicals	2 quarts to 20 ft^3	X			X	X	X	Autoclaved
Entomology	T241	Alcohols, cleaning solvents, bird repellants, herbicides, insecticides, pesticides, rodenticides	1 quart - 20 quarts	X				X		
Environmental Support	T421	Algacides, ammonia, calcium hypochlorite, chlorine, hydrofluorosilicic acid, sodium hydroxide	unknown	X						

Operation Type RADC

Shop Or Activity	Location/ Building No.	Hazardous Materials Used	Quantity On Hand (Range)	Disposal Practice: Used Up	Evaporation	Adheres to Surface	Sanitary Sewer	Trash Can/Off-Site Disposal	Reclamation	Other
Sheet Metal/ Welding/ Carpentry	1118	Bonding agents, cleaning agents, cutting oils, epoxy, lacquer, lubricant, paint, propane, solder flux, thinner	1 quart - 3 gallons	X	X	X				
Paint Shop	1120	Alcohol (isopropyl), bond adhesive, cleaner, dope, lacquer, paint	2 ounces - 9 gallons		X	X				
Laboratories	1122	Cleaners, dope, lacquer, paint, varnish	2 ounces - 2 quarts	X		X	X	X		
Laboratories	1124	Adhesives, lacquers, paints, stains, thinners, varnish	1 pint - 6 gallons	X						
Laboratories	1126	Acetone, freon, methanol, paint, TCE, toluene, thinner	1 gallon - 5 gallons		X	X	X			
Laboratories	1127 (RM: 5)	Acids, acetone, alcohols, adhesives, bromine, cleaning chemicals, dope, hydrogen peroxide, potassium hydroxide	1 ounce - 1 gallon	X			X			
Laboratories	1128 (RMS: 33,34,38,39, 41,43,45,238)	Acids, alcohol, bromine, carbon disulfide, carbon tetrachloride, caustics, cleaners, EDC, hydrogen peroxide, lacquer, misc. lab reagents, pump oil, paint, TCE, toluene, xylene	2 ounces - 20 gallons		X	X	X	X		

Operation Type RADC

Shop Or Activity	Location/ Building No.	Hazardous Materials Used	Quantity On Hand (Range)	Disposal Practice: Used Up	Evaporation	Adheres to Surface	Sanitary Sewer	Trash Can/Off-Site Disposal	Reclamation	Other
Laboratories	1138 (RMS: 102A,104C, 106A+B, 212)	Acids, acetone, alcohols, bromine, caustics, cleaners, coatings, hydrogen peroxide, lacquer, propane fuel, sealants, TCE, toluenes	8 ounces - 11 gallons	X	X	X		X		
Machine Shops/ Chemical Storage	1140 (RMS: 204,206)	Acids, acetone, alcohols, cleaners, dope, lacquer, lubricating oil, propane fuel, misc. lab reagents, thinner, toluenes, TCE	8 ounces - 5 gallons	X	X		X			
Laboratories	1140A (RMS: 109,111,201, 203,207)	Acids, acetone, alcohols, bromine, carbon tetrachloride, coatings, EDC, heavy metals, hydrogen peroxide, lubricating oil, misc. chemical reagents, paint, photographic chemicals, propane fuel, sealants, TCE, thinners, toluenes, xylene	2 grams - 36 gallons	X	X	X	X	X		
Laboratories	1141 (RMS: 201B,202,204, 205,205A,206,208, 210,216,217,241)	Acids, acetone, alcohols, bonding compounds, caustics, developers, EDC, fluorides, heavy metals, hydrogen peroxide, lacquer, lubricating oil, misc. chemical reagents, photographic chemicals, thinner, toluenes, TCE	20 grams - 11 gallons	X	X	X	X	X		Acid Pit
Laboratories	H1141 (RMS: 102b)	Acetone, methanol, photographic chemicals	1 quart - 2 gallons	X						
Laboratories	1142 (RMS: 104,107)	Acids, acetone, alcohols, bromine, caustics, lubricating oils, misc. chemical reagents, paint, pump oil, selenium, sodium hydroxide, thinners, toluenes	4 ounces - 5 gallons	X		X	X	X		

Operation Type AFGL

Shop Or Activity	Location/ Building No.	Hazardous Materials Used	Quantity On Hand (Range)	Disposal Practice: Used Up	Evaporation	Adheres to Surface	Sanitary Sewer	Trash Can/Off-Site Disposal	Reclamation	Other
Laboratories	1102 (RMS: 134,134B,206)	Acetone, freon, pet ether, paint, lacquer, alcohol, hexane, benzene, EDC, dope, cleaning compounds, lubricating and penetrating oils, bonding agents, NaOH	1 pint - 5 gallons	X	X	X		X	X	
Laboratories	1102C (RMS: 128,129A,141, 147,318,346)	Acetone, alcohols, adhesives, bonding agents, coatings, cleaning solutions, EDC, ethers, Hcl, lubricants, nitric acid, paint, penetrants, pet ether, propane, pump oils, photographic chemicals, potassium bromide, sealants, solder flux, sodium hydroxide, sodium dichromate, TCE, toluene, thinners	1 ounce - 10 gallons	X	X	X	X	X	X	X
Laboratories/ Machine Shop	1102F (RMS: 5,8,1G6,118, 130,144,222,304,346)	Acetone, alcohols, bonding agents, cleaning solutions, carbonyl sulfide, coatings, compressed gas cylinders, freon, lacquer, lubricants, paints, penetrants, photographic chemicals, sealants, sodium hydroxide, solder, solvents, sulfur hexafloride, TCE, thinner, toluenes, xylene	2 ounces - 5 gallons	X	X	X	X	X	X	X
Laboratories	1105B (RMS: 106,121,121B, 142,210,252,253, 262)	Acids, acetone, alcohols, carbon tetrachloride, catalysts, caustics, cleaners, coatings, lacquers, lubricants, misc. lab chemicals and reagents, paint, pump oil, TCE, toluene, xylene	2 ounces - 5 gallons	X	X	X	X	X		X
Photo Laboratory	1106	Acetic acids, cleaners, developers, misc. photographic chemicals, toners	1 gallon - 160 gallons				X	X	X	

APPENDIX G

SUPPLEMENTAL ENVIRONMENTAL DATA

G-1

Well Logs and Groundwater Analysis Reports for Monitoring Wells Installed at Hanscom Field (Weston, 1983)

WESTON DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. CW-1

PROJECT: Preliminary Groundwater Evaluation								SHEET NO 1 OF 2
CLIENT: U.S. Air Force Hanscom Field								JOB NO. 06220513
BORING CONTRACTOR: D.L. Maher								ELEVATION 130.0
GROUND WATER:					CAS.	SAMP.	CORE	TUBE	DATE STARTED 12/[illegible]
DATE	TIME	WATER EL.	SCREEN	TYPE	HS	S.S	—		DATE FINISHED [illegible]
12/22	9:30	7.9	10'-.020	DIA.	8"	1 3/8	—		DRILLER W. [illegible]
12/23	8:20	7.9	SCH 80 PVC	WT	—	30"	—		INSPECTOR D. [illegible]
				FALL	—	140	—		

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
CEMENT; 3'-4' [illegible]; BACKFILL	0				OUTWASH DEPOSITS: Gray-brown medium to fine SAND, trace silt, occasional layer of coarse to fine sand	Bailer sample 0-18' Conductivity = 100 µmhos Temp. = 13°C hNu = 3 ppm
	5	1	SS	3-5 / 6-8		Moist: hNu = 0 Medium dense
	10	2	SS	1-1 / 2-2		Saturated: hNu = 0 Loose
		3	SS	1-1 / 2-8		Saturated Loose
	15				18.0	
8" HOLE		4	SS	1-3 / 4-6	LACUSTRINE DEPOSITS Laminated gray fine SAND and SILT, micaceous zones to 2 mm thick, grading finer to	Added drill water after 18'. Material is dilatant.
	20					
SAND-CEMENT 20:1 MIX 6% BENTONITE	25	5	SS	6-11 / 17-22	28.0	
	30	6	SS	2-5 / 7-7	Gray clayey SILT with [illegible] layers of green clay 1/8"-1/4" thick, laminae of micaceous fine sand	Stiff to very stiff
2" SCH 80 PVC	35	7	SS	5-6 / 6-9		12/22/82. Pumped 9:30-10:30. No drawdown on CW-1A. Water samples from pump @ 1030 hNu = 12 PPM 3 PPM
	40	8	SS	4-6 / 11-19		Pumped until 1330 no drawdown hNu: ?PPM Conductivity = 180 µmhos T-12°C
	45	9	SS	6-7 / 10-10		

WESTON DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. CW-1

PROJECT: PRELIMINARY GROUNDWATER EVAL. - HANSCOM FIELD

CLIENT: USAF

SHEET NO. 2 OF 2

JOB NO. 062 80513

DEPTH IN FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
45–50	10	SS	7-11 / 13-16	Gray clayey SILT with lenses and layers of green clay 1/2"-1" thick, little fine sand, changing to	Very stiff
55	11	SS	5-11 / 11-14		Very stiff
60	12	SS	6-11 / 11-14	Interbedded gray clayey SILT and green CLAY, spaced 3", layers 1/2" - 1.5" thick grading to	Very stiff
65	13	SS	4-8 / 8-13		Very stiff
68.0					
70	14	SS	4-5 / 6-15	Gray SILT, trace fine sand, layers of green clay 1/2"-1" thick spaced 4"-9" apart, micaceous fine sand partings. grading to	Medium dense
75	15	SS	4-5 / 7-12		Medium dense
78.0					
80	16	SS	3-4 / 6-10	Stratified gray fine SAND, medium to fine SAND, and coarse to fine sand	Medium dense
84.0					
85	17	SS	2-16 / 51-63	GLACIAL TILL: Rust-brown c/f SAND and GRAVEL grading to gray medium to fine SAND, little silt and gravel	Very dense
89	18	SS	75		
90–95				Refusal @ 89'	Vol Sand = [illegible] - [illegible] 4.36 - 1.38 = 3.48 cf; 3.48 cf = 26 gals H_2O

WELL CONSTRUCTION:

- 3" [illegible] HOLE
- 2" [illegible] SCH 80
- GROUT
- 2.[illegible] MIX WITH 6% BENTONITE
- [illegible] SAND
- 78'
- #2 GRAVEL
- 88'
- 89'
- 10' SLOTTED SCREEN, .020 SCH 80

WESTON
DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. CW-1A

PROJECT : Preliminary Groundwater Evaluation	SHEET NO 1 OF 1
CLIENT : US Air Force Hanscom Field	JOB NO. 062 8-75-13
BORING CONTRACTOR : D.L. MAHER	ELEVATION 17.7
	DATE STARTED 12/21/82
	DATE FINISHED 12/21/82
	DRILLER W. CANTY
	INSPECTOR D. WOODHOUSE

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
12/22	9:30	7.9	10' - .020	TYPE				
"			SCH 80	DIA.		Same		
				WT.				
12/23	8:30	7.9		FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
5'-4" HI-WALL CAS. 5; CEMENT; NATIVE SAND BACKFILL	0				OUTWASH DEPOSITS: Gray-brown medium to fine SAND, trace silt, occasional layer of coarse to fine sand	Pumped 12/23/82 @ 8:20. Sampled 18 ppm with HNu Strong odor
4.5; 5.5; BENTONITE PELLETS	5					
10' SLOTTED .020 PVC	10					
#2 GRAVEL	15					
17.5; 18.0					18.0	
8" hole	20					Vol. Sand = 5.06 − 1.4 = 3.7; 3.7 x 7.5 = 27 gals H_2O
	25					
	30					
	35					
	40					
	45					

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TEST BORING LOG

BORING NO. CW 2

PROJECT : Preliminary Groundwater Evaluation	SHEET NO 1 OF 1
CLIENT : U.S. Air Force - Hanscom Field	JOB NO. 06280513
BORING CONTRACTOR : D.L. Maher	ELEVATION 126.8
	DATE STARTED 12/29/82
	DATE FINISHED 12/29/82
	DRILLER W. Canty
	INSPECTOR D Woodhouse

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
12/29	11:00	8.0	10'-20'	TYPE				
			Slotted Sch	DIA.				
			80 PVC.	WT				
				FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
5'-4" THINWALL	0				FILL Dark-brown medium to fine SAND grading coarse to fine SAND, little silt, trace gravel	medium dense moist
GROUT	5	1	SS	3-5 7-16	7.0	
					ORGANICS Black organic SAND and Gravel 10.0	auger sample
OTTAWA SAND	10	2	SS	13-18 14-17	GLACIAL TILL Orange-brown to brown coarse to fine SAND and GRAVEL, little silt 13.5	Saturated Dense
#2 GRAVEL		3 3A	SS	19-14 20/4"	9" Decomposed Bedrock	
	15				Roller Drilled 14.5'-21.5' Chlorite Schist and Granite?	Described from cuttings
21.5	20					
					Bottom of hole @ 21.5'	
	25					Vol of water: 3.1 cf x 7.5 = 23 gals 1120
	30					
	35					
	40					
	45					

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TEST BORING LOG

BORING NO. GW-3

PROJECT: Preliminary Groundwater Evaluation	SHEET NO 1 OF 1
CLIENT: US AIR FORCE - HANSCOM FIELD	JOB NO. 062 805 13
BORING CONTRACTOR:	ELEVATION 123.4
	DATE STARTED 12/22/82
	DATE FINISHED 12/22/82
	DRILLER W. Canty
	INSPECTOR D. Woodhouse

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN
12/24		5.5	.020" SCH 80 PVC

	CAS.	SAMP.	CORE	TUBE
TYPE				
DIA.				
WT.				
FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
5'-4" Thinwall Casing	0				TOPSOIL 1.0	
					PEAT 3.0	
SCH 80 PVC	5	1	SS	4-5 4-7	OUTWASH DEPOSITS Rust-brown medium to fine SAND, trace silt, gravel 6.8	Strongly oxidized WET
GROUT	10	2	SS	2-3 5-5	LACUSTRINE DEPOSITS Gray clayey SILT, 1/2" layers of brown medium to fine sand spaced 6" apart	Soft to medium stiff Bailed water sample to 18' hnu = 0
14 BENTONITE		3	SS	1-2 2-2	15'	
#2 GRAVEL	15–20	4	SS	3-6 9-11	GLACIAL TILL Gray coarse to fine SAND and clayey SILT, little gravel changing to brown medium to fine SAND, some silt, little gravel, layer of sand	Saturated hnu = 12 ppm
24		5	SS	14-28 53		
25.5 8" hole	25				Refusal @ 25.5'	Vol = 3.1 CF 17.5 = 23 gals
	30					
	35					
	40					
	45					

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TEST BORING LOG

BORING NO. CW 3A

PROJECT :	Preliminary Groundwater Evaluation
CLIENT :	US Air Force - Hanscom Field
BORING CONTRACTOR :	DL Maher

SHEET NO.	1 OF 1
JOB NO.	06280513
ELEVATION	124.2
DATE STARTED	12/24/82
DATE FINISHED	12/24/82
DRILLER	W. [illegible]
INSPECTOR	D. Woodhouse

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
12/30	10.00	5.5	5' - .020	TYPE				
			SCH 80 PVC	DIA.	Same			
				WT.				
				FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
Riser; BENTONITE; 2.0	0				PEAT	
#2 GRAVEL					3.0	
	5				OUTWASH SANDS Rust-brown medium to fine SAND, trace silt, gravel	Vol = 11.5 gals 1.55 CF
7.0					Bottom of hole @ 7'	
	10					
	15					
	20					
	25					
	30					
	35					
	40					
	45					

WESTON DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. CW 4

PROJECT : Preliminary Groundwater Evaluation	SHEET NO 1 OF 1
CLIENT : U.S. Air Force - Hanscom Field	JOB NO. 6628-05-13
BORING CONTRACTOR : D.L. Maher	ELEVATION 125.6
GROUND WATER :	DATE STARTED 12/21/82
	DATE FINISHED 12/21/82
	DRILLER W. Carty
	INSPECTOR D. Wackhouse

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
12/21	3:00	7.3	.020-SCH 80	TYPE				
12/24	9 a	5.2	PVC	DIA.		[illegible]		
				WT.				
				FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
5'-4" THINWALL CASING	0				PEAT	
	4.6				LACUSTRINE DEPOSITS	
	5	1	SS	4-5 / 6-8	Mottled yellow-brown and blue clayey SILT with clay laminae	Stiff
GROUT	10.0	2	SS	3-10 / 12-11	Brown stratified medium to fine SAND and fine SAND, trace silt, gravel	Saturated; Added water while augering 12-15'
	14.0	3	SS	3-16 / 62-27	GLACIAL TILL	Very dense ABLATION TILL
OTTAWA SAND (15.0)	15				Rust-brown coarse to fine SAND, some gravel	
#2 GRAVEL	18	4	SS	19-46 / 83	trace silt changing to gray medium to fine SAND, some silt, trace gravel, boulders	Very dense; BASAL TILL
SCREEN		5	SS	61- / 37/2"		Very dense
25.0	25	6	SS	50/2"		
8" hole					Refusal @ 25.7'	Vol: 3.1 CF = 23 gals

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TEST BORING LOG

BORING NO. CW 5

PROJECT:	Preliminary Ground Water Evaluation
CLIENT:	US Air Force - Hanscom Field
BORING CONTRACTOR:	D. L. Maher
SHEET NO.	1 OF 1
JOB NO.	06290513
ELEVATION	126.5
DATE STARTED	12/24/82
DATE FINISHED	12/24/82
DRILLER	W. Canty
INSPECTOR	D. Woodhouse

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN
12/24	8:30	12.5	10'-.020
12/28	9:15	4.9	SCH 80 PVC

	CAS.	SAMP.	CORE	TUBE
TYPE				
DIA.				
WT.				
FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
5'4" THINWALL	0				OUTWASH DEPOSITS Gray-brown coarse to fine SAND, trace silt	hnu = 0 moist
	5	1	SS	2-4 5-6	8'	
GROUT	10	2	SS	11-14 19-25	GLACIAL TILL Gray medium to fine SAND, some clayey silt, little gravel; very sandy zones dispersed in till; contains cobbles and boulders	moist
15.0 OTTAWA SAND	15	3	SS	11-39 19-23		Saturated
		4	SS	21-35 41		Bailed sample of water to 18.5'. hnu = 10 PPM
#2 GRAVEL	20					Drill water added after sample 4
25.0	25	5	SS	19-76 100	Top of Rock 25.4	Vol. 3.1 cf. 23 gals
	30				Roller bitted 25.4-31.2 Granite Type (?) Bedrock	
					Bottom of hole @ 31.2'	
	35					
	40					
	45					

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TEST BORING LOG

BORING NO. CW-5A

PROJECT: Preliminary Ground Water Evaluation	SHEET NO 1 OF 1
CLIENT: U.S. Air Force - Hanscom Field	JOB NO. 0328051?
BORING CONTRACTOR: D.L. Maher	ELEVATION 120.?
	DATE STARTED 12/23/82
	DATE FINISHED 12/23/82
	DRILLER W. CANTY
	INSPECTOR D. WOODHOUSE

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN
12/23	9:00	5.0	10' - .020
12/24	1000	5.0	SCH 80 PVC

	CAS.	SAMP.	CORE	TUBE
TYPE				
DIA.				
WT				
FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
6'-4" Thin wall; SCH 80 PVC; GROUT	0–10				OUTWASH DEPOSITS Black, contaminated medium to fine SAND, trace gravel	
	5	1	SS	1-1 3-4	(paint solvent, sludge etc)	Saturated hnu = 100ppm
	10	2	SS	2-4 7-12	10' Gray coarse to fine SAND, trace gravel - contaminated	hnu = 100ppm
13.0	12	3	SS	3-5 7-12	12' LACUSTRINE DEPOSITS Stratified fine SAND, micaceous layers, clayey silt lenses	hnu = 200ppm
#2 GRAVEL	19	4 4A	SS	2-6 9-10	Gray fine SAND, 2" silt layer at bottom	hnu = 25 ppm
	20	5	SS	9-23 29-58	21.5	hnu = 50ppm
23.0	21.5				LACUSTRINE DEPOSITS Gray SILT	hnu = 30ppm
25.0	24	6	SS	15-19 15-15		
8" HOLE	25				Bottom of hole @ 25'	Vol = 3.1 c.f. 23 gals

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TEST BORING LOG
BORING NO. CW 6

PROJECT :	Preliminary Groundwater Evaluation
CLIENT :	U.S. Air Force - Hanscom Field
BORING CONTRACTOR :	D. L. Maher
SHEET NO	1 OF 2
JOB NO.	05280513
ELEVATION	126.0
DATE STARTED	[illegible]
DATE FINISHED	[illegible]
DRILLER	W. [illegible]
INSPECTOR	R. [illegible]

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
				TYPE				
			5' - .020	DIA.	Same			
			Sch 80 PVC	WT.				
				FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
Cement / Bentonite	0				TOPSOIL 1.0	
					OUTWASH SANDS	
	5	1	SS	3-4 / 5-6	Gray coarse to fine SAND, trace silt	saturated
	10	2	SS	4-7 / 9-10	13'	saturated
		3	SS	6-8 / 7-8	LACUSTRINE DEPOSITS	
	15				Gray fine SAND and Silt with [illegible] and laminae of green clay up to 1/2" thick and spaced 3"-4" apart.	
		4	SS	3-6 / 8-11	Grades finer with depth to SILT. [illegible]	
	20					
		5	SS	6-10 / 12-13		
	25					
		6	SS	7-9 / 12-11		
	30					
		7	SS	4-7 / 12-12		
	35					
Bentonite	40	8	SS	2-8 / 10-12		
Ottawa Sand 44.5		9	SS	4-5 / 6-14	44'	
5' Screen	45				[illegible] TILL	

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TEST BORING LOG	
BORING NO.	CW-6
SHEET NO. 2 OF 2	
JOB NO.	[illegible] 2513

PROJECT:

CLIENT:

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	SAMPLE BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
#2 GRAVEL	45				Gray coarse to medium SAND, little gravel	hNu = 1.5 ppm
		10	SS	19-63		
49.5 8" HOLE	50				Refusal on auger @ 49.5	
	55					
	60					
	65					
	70					
	75					
	80					
	85					
	90					
	95					

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TEST BORING LOG

BORING NO. GW-6A

PROJECT : PRELIMINARY GROUNDWATER EVALUATION	SHEET NO 1 OF 1
CLIENT : US AIR FORCE - HANSCOM FIELD	JOB NO. [illegible] 0513
BORING CONTRACTOR : D. L. MAHER	ELEVATION [illegible]

GROUND WATER:					CAS.	SAMP.	CORE	TUBE
DATE	TIME	WATER EL.	SCREEN	TYPE				
			[illegible]	DIA.	[illegible]			
			[illegible] PVC	WT.				
				FALL				

DATE STARTED [illegible]
DATE FINISHED [illegible]
DRILLER [illegible]
INSPECTOR [illegible]

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
Bentonite	0–5				OUTWASH SANDS	
#2 Gravel	5–13					
10' Screen	13–15				LACUSTRINE DEPOSITS	
8" Hole	15				Bottom of well @ 15'	
	20					
	25					
	30					
	35					
	40					
	45					

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TEST BORING LOG

BORING NO. RFW 7

PROJECT: PRELIMINARY GROUND WATER EVALUATION	SHEET NO 1 OF 1
CLIENT: US AIR FORCE - HANSCOM FIELD	JOB NO. 062 [illegible]
BORING CONTRACTOR: D.L. MAHER	ELEVATION [illegible]
	DATE STARTED 12/30/[illegible]
	DATE FINISHED 12/30/[illegible]
	DRILLER W. CANTY
	INSPECTOR D. WOODHOUSE

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN
12/30	2 30	10.6	10 - .020
12/31	8 00	7.6	SCH 80 PVC

	CAS.	SAMP.	CORE	TUBE
TYPE				
DIA.	[illegible]			
WT.				
FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
ONKRETE	0				OUTWASH DEPOSITS	
BENTONITE					Gray-brown fine SAND grading to medium to fine SAND, trace silt	MOIST
	5	1	SS	4-5 / 6-6		
7.3					8.5	
#2 GRAVEL	10	2	SS	9-39	GLACIAL TILL Gray-brown coarse to fine SAND, some silt, little gravel, boulders	WET Very dense
		3	SS	12-37 / 20-19		
	15					
					Refusal @ 17.3'	Vol = 3.1 cf = 23 gals
	20					
	25					
	30					
	35					
	40					
	45					

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TEST BORING LOG
BORING NO. RFW 8

PROJECT: PRELIMINARY GROUND WATER EVALUATION	SHEET NO 1 OF 1
CLIENT: U.S. AIR FORCE - HANSCOM FIELD	JOB NO. 062 8C513
BORING CONTRACTOR: D.L. MAHER	ELEVATION 132.7
	DATE STARTED 12/29/82
	DATE FINISHED 12/29/82
	DRILLER W. CA??
	INSPECTOR D. WOODHOUSE

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
12/29	2:30	2.7	5' - .020	TYPE				
12/30	10:00	7.6	Slotted Sch	DIA.		SAME		
			20 PVC	WT				
				FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
5" THINWALL; SAKRETE; BENTONITE	0				FILL Medium to fine SAND	
	5	1		5-13	5'±	
#2 GRAVEL; 7.2		1A	SS	15-19	Brown SILT 6'	
					GLACIAL TILL Brown coarse to fine SAND, some gravel, little silt	
	10	2	SS	9-58	11.1	Saturated
12.3; 8" HOLE				34/2"	BEDROCK: Very hard GRANITE Bottom of hole @ 12.3'	Refusal @ 11.1 on split spoon. Augered to 11.4. Roller bitted 11.4 - 12.3.
	15					
	20					Vol = 1.55 cf = 11.5 gals
	25					
	30					
	35					
	40					
	45					

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TEST BORING LOG

BORING NO. RFW 7
SHEET NO 1 OF 1
JOB NO. 2262-05-13
ELEVATION 125.7
DATE STARTED 12/30/82
DATE FINISHED 12/30/82
DRILLER W. CANTO
INSPECTOR D. WOODWORTH

PROJECT: Preliminary Groundwater Evaluation
CLIENT: US AIR FORCE - HANSCOM FIELD
BORING CONTRACTOR: D.L. MAHER

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN
			10' - .020
			SCH 80 PVC

	CAS.	SAMP.	CORE	TUBE
TYPE				
DIA.		3"		
WT.				
FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
SAKRETE; BENTONITE	0				OUTWASH DEPOSITS Gray-brown to rust-brown medium to fine SAND	
	5	1	SS	1-1 / 2-3		Saturated Loose
10' #2 GRAVEL	10	2	SS	1-2 / 4-5		Saturated Loose
	15	3	SS	1-1 / 5-6		Saturated Loose
	17.0				LACUSTRINE DEPOSITS Gray clayey SILT with green clay lenses	Drill water added after S2
20'	20	4	SS	6-8 / 10-10	Bottom of hole @ 20'	
	25					Vol: 3.1 CF = 23 GALS
	30					
	35					
	40					
	45					

THIS WALL CASTING (margin note)

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TEST BORING LOG

BORING NO. RFW10

PROJECT : Preliminary Groundwater Evaluation	SHEET NO 1 OF 1
CLIENT : US AIR FORCE - HANSCOM FIELD	JOB NO. 0628 05 13
BORING CONTRACTOR : D. L. MAHER	ELEVATION 127.5
GROUND WATER :	DATE STARTED 12/30/82
	DATE FINISHED 12/30/82
	DRILLER W. CANTY
	INSPECTOR D WOODHOUSE

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
12/30	12 00	7.7	5' .020	TYPE				
12/31	5 00	7.7	SCH 80 PVC	DIA.		SAME		
				WT				
				FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
1' SAKRETE; BENTONITE SEAL	0				Sand Fill	
	5				5.0	
		1	SS	3-4	LOAMY SAND 6.0	
# 2 GRAVEL		1A		9-11	OUTWASH DEPOSITS Rust-brown changing to gray medium to fine SAND, trace silt	MOIST
	10	2	SS	3-3 / 6-7		SATURATED
14'		3	SS	3-3 / 5-6	14' LACUSTRINE DEPOSITS Gray SILT	Vol = 1.55 CF. 11.5 GALS
	15				Bottom of hole @ 15'	
	20					
	25					
	30					
	35					
	40					
	45					

3 ft 4"; 70

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TEST BORING LOG

BORING NO. AB-1

SHEET NO 1 OF 1

PROJECT : PRELIMINARY GROUNDWATER EVALUATION

CLIENT : US AIR FORCE - HANSCOM FIELD

BORING CONTRACTOR : AIR FORCE

JOB NO. 062 80513

ELEVATION 126.1

DATE STARTED 11/1/83

DATE FINISHED 11/1/83

DRILLER AIR FORCE

INSPECTOR D. WOODHILL

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN
			1.5" O.D
			VYON
			1' LONG

	CAS.	SAMP.	CORE	TUBE
TYPE	Auger	—	—	—
DIA.	12"	—	—	—
WT.	—	—	—	-
FALL	—	—	—	

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
NATIVE SAND BACKFILL	0–10				OUTWASH DEPOSITS Brown medium to fine SAND grading to coarse to fine SAND	
12" hole	10				Bottom of hole @ 10'	

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TEST BORING LOG

BORING NO. AB-1

PROJECT : Preliminary Groundwater Evaluation	SHEET NO. OF
CLIENT : U.S. AIR FORCE - HANSCOM FIELD	JOB NO. [illegible] C513
BORING CONTRACTOR : AIR FORCE	ELEVATION 127.2

GROUND WATER :

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
				TYPE	[illegible]			
			[illegible] O.D.	DIA.	12"			
			[illegible]	WT.				
			[illegible] LONG	FALL				

DATE STARTED [illegible]
DATE FINISHED [illegible]
DRILLER AIR FORCE
INSPECTOR D. [illegible]

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
	0				TOPSOIL	
					GRAY SAND FILL	
					OUTWASH DEPOSITS	
	5				Brown medium to fine SAND	
	10				Bottom of hole @ 9.5'	
	15					
	20					
	25					
	30					
	35					
	40					
	45					

WESTON
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TEST BORING LOG

BORING NO. AB-3

PROJECT: Preliminary Groundwater Evaluation	SHEET NO 1 OF 1
CLIENT: U.S. AIR FORCE - HANSCOM FIELD	JOB NO. 0328051.3
BORING CONTRACTOR: AIR FORCE	ELEVATION 127.8

GROUND WATER:					CAS.	SAMP.	CORE	TUBE	
DATE	TIME	WATER EL.	SCREEN	TYPE	Auger				DATE STARTED 1/14/83
			1.5" O.D.	DIA.	12"				DATE FINISHED 1/14/83
			VYON	WT.					DRILLER AIR FORCE
			1' LONG	FALL					INSPECTOR D. WOODHOUSE

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
NATIVE BACKFILL	0				LOAM	
					FILL medium to fine SAND	Approximate changes
					PEAT	
	5				Gray fine SAND	
#2 GRAVEL					Gray SILT	
12" hole	10				Bottom of hole @ 9.5'	
	15					
	20					
	25					
	30					
	35					
	40					
	45					

WESTON
DESIGNERS CONSULTANTS

TEST BORING LOG	
BORING NO.	4B-4
SHEET NO.	1 OF 1
JOB NO.	06282513
ELEVATION	130.0
DATE STARTED	1/14/83
DATE FINISHED	1/14/83
DRILLER	AIR FORCE
INSPECTOR	D WOODHOUSE

PROJECT: Preliminary Groundwater Evaluation
CLIENT: U.S. Air Force - Hanscom Field
BORING CONTRACTOR: AIR FORCE
GROUND WATER:

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
				TYPE	Auger			
			1.5" O.D	DIA.	12"			
			VYON	WT.				
			1' LONG	FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
NATIVE SAND BACKFILL	0–10				OUTWASH DEPOSITS Brown medium to fine SAND grading to coarse to fine sand	
12" HOLE	10				Bottom of hole @ 10'	

WESTON
DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. AB-5

PROJECT: Preliminary Ground Water Evaluation	SHEET NO 1 OF 1
CLIENT: US Air Force - Hanscom Field	JOB NO. [illegible] 0513
BORING CONTRACTOR: Air Force	ELEVATION 126.6
GROUND WATER:	DATE STARTED [illegible]
	DATE FINISHED [illegible]
	DRILLER Air Force
	INSPECTOR [illegible]

DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
				TYPE	Auger			
			1.5" S.D.	DIA.	12"			
			Vyon	WT.				
			1Ft Long	FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
NATIVE SAND BACKFILL	0–9				OUTWASH DEPOSITS Brown medium to fine SAND	
12" hole	9				Bottom of hole @ 9'	

WESTON DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. HB-6

PROJECT: Preliminary GROUND WATER EVALUATION	SHEET NO 1 OF 1
CLIENT: U.S. AIR FORCE - HANSCOM FIELD	JOB NO. 062 10513
BORING CONTRACTOR: AIR FORCE	ELEVATION 120.2
	DATE STARTED 1/12/83
	DATE FINISHED 1/14/83
	DRILLER AIR FORCE
	INSPECTOR D. WOODHOUSE

GROUND WATER: DATE	TIME	WATER EL.	SCREEN		CAS.	SAMP.	CORE	TUBE
			1.5" O.D.	TYPE	Auger			
			VYON	DIA.	12"			
			15 ft Long	WT				
				FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
NATIVE BACKFILL	0				PEAT	
#2 GRAVEL	5				LACUSTRINE DEPOSITS Gray SILT and fine Sand	Approximate Change
12" HOLE	10				Bottom of hole @ 9.5'	
	15					
	20					
	25					
	30					
	35					
	40					
	45					

WESTON DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. HB-6

PROJECT : Preliminary GROUND WATER EVALUATION	SHEET NO 1 OF 1
CLIENT : U.S. AIR FORCE - HANSCOM FIELD	JOB NO. 062 10513
BORING CONTRACTOR : AIR FORCE	ELEVATION 120.2

GROUND WATER:					CAS.	SAMP.	CORE	TUBE
DATE	TIME	WATER EL.	SCREEN	TYPE	Auger			
			1.5" O.D.	DIA.	12"			
			VYON	WT.				
			1 Ft Long	FALL				

DATE STARTED 1/13/83
DATE FINISHED 1/14/83
DRILLER AIR FORCE
INSPECTOR D. WOODHOUSE

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
NATIVE BACKFILL	0				PEAT	
#2 GRAVEL	5				LACUSTRINE DEPOSITS Gray SILT and fine sand	Approximate Change
12" HOLE	10				Bottom of hole @ 9.5'	
	15					
	20					
	25					
	30					
	35					
	40					
	45					

WESTON

DESIGNERS CONSULTANTS

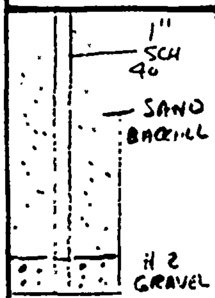
TEST BORING LOG

BORING NO. AB-7

PROJECT : Preliminary Ground Water Evaluation	SHEET NO. 1 OF 1
CLIENT : U.S. AIR FORCE - HANSCOM FIELD	JOB NO. 06280513
BORING CONTRACTOR : [illegible]	ELEVATION 120.3

GROUND WATER:					CAS.	SAMP.	CORE	TUBE
DATE	TIME	WATER EL.	SCREEN	TYPE	[illegible]R			
			1.5" O.D.	DIA.				
			V.Y.N	WT.				
			1 ft. LONG	FALL				

DATE STARTED	[illegible]
DATE FINISHED	1/5/85
DRILLER	AIR FORCE
INSPECTOR	[illegible]

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
	0–9				OUTWASH DEPOSITS Brown medium to fine SAND, trace cobbles	
18" hole	10				Bottom of hole @ 9'	
	15					
	20					
	25					
	30					
	35					
	40					
	45					

WESTON
DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. AB-3

SHEET NO. 1 OF [illegible]

JOB NO. [illegible] 0513

ELEVATION 119.9

DATE STARTED [illegible]

DATE FINISHED [illegible]

DRILLER [illegible]

INSPECTOR [illegible]

PROJECT : Preliminary Groundwater Evaluation

CLIENT : U.S. AIR FORCE - HANSCOM FIELD

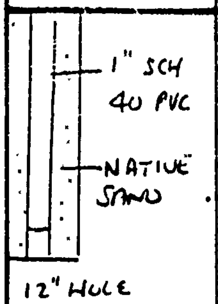
BORING CONTRACTOR : [illegible]

GROUND WATER :

DATE	TIME	WATER EL.	SCREEN
1/12	.	5.0	[illegible]
			[illegible]
			[illegible]

	CAS.	SAMP.	CORE	TUBE
TYPE	[illegible]			
DIA.	2"			
WT.				
FALL				

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
1" SCH 40 PVC; NATIVE SAND	0–8				OUTWASH DEPOSITS Brown medium to fine SAND grading to coarse to fine sand, trace gravel.	
12" HOLE					Bottom of hole @ 8'	



Depth scale (feet): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45

WESTON

DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. AB-9

PROJECT: Preliminary Groundwater Evaluation	SHEET NO. 1 OF 1
CLIENT: US AIR FORCE - HANSCOM FIELD	JOB NO. 232 80513
BORING CONTRACTOR: AIR FORCE	ELEVATION 125.0

GROUND WATER:					CAS.	SAMP.	CORE	TUBE
DATE	TIME	WATER EL.	SCREEN	TYPE	[illegible]			
			1.5" I.D	DIA.	12"			
			NYON	WT.				
			1 Ft Long	FALL				

DATE STARTED 1/14/83

DATE FINISHED 1/14/83

DRILLER Air Force

INSPECTOR D. Woodhouse

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
Backfill; #2 GRAVEL; 12" HOLE	0–5				FILL Loamy SAND with Cobbles, boulders	3 previous attempts in immediate area. Refusal at 4', 6.5', 6.0'
	6				Refusal @ 6'	

WESTON DESIGNERS CONSULTANTS

TEST BORING LOG

BORING NO. AB-10

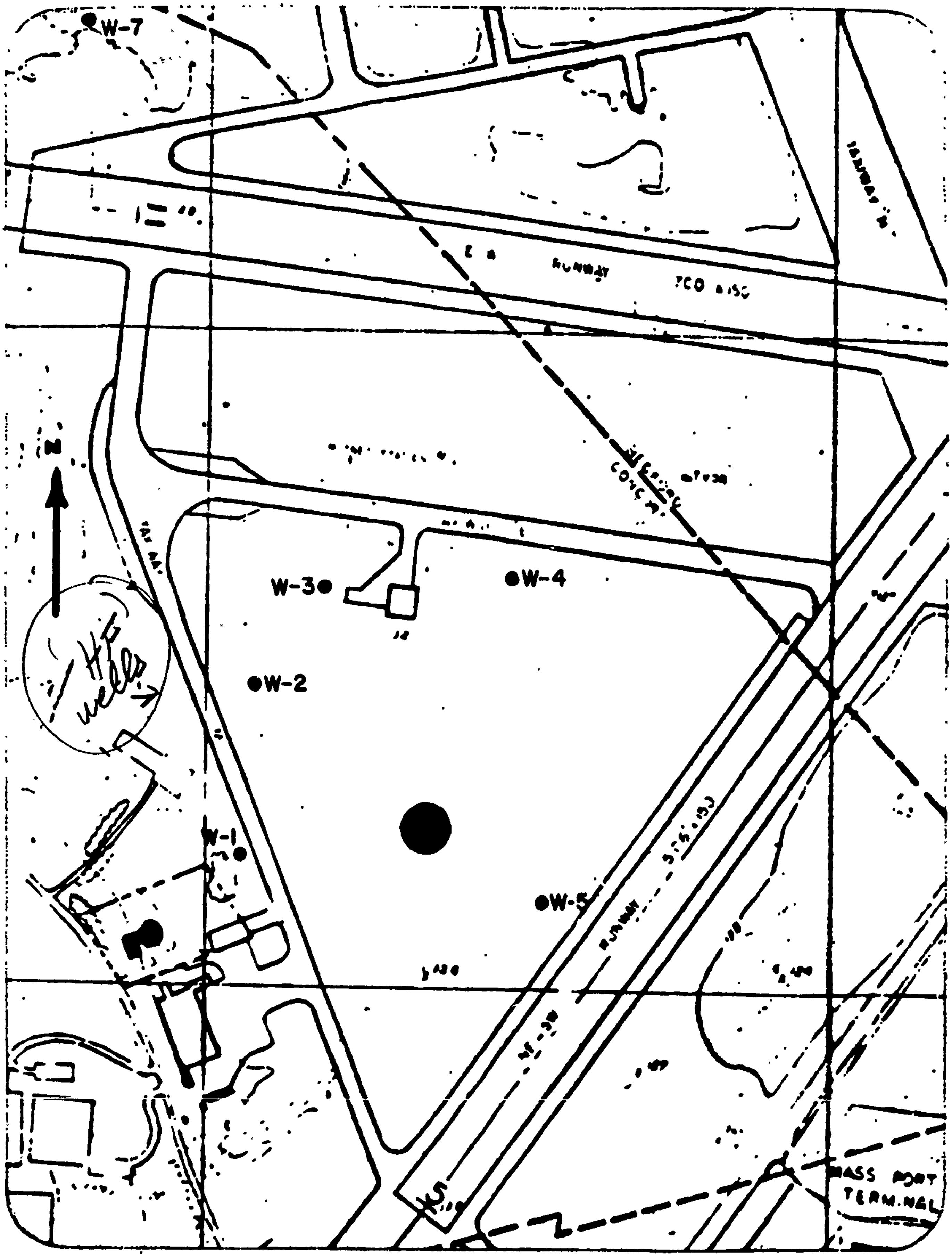
PROJECT : Preliminary Groundwater Evaluation	SHEET NO 1 OF 1
CLIENT : US AIR FORCE - HANSCOM FIELD	JOB NO. 062 805/3
BORING CONTRACTOR : AIR FORCE	ELEVATION 125.7

GROUND WATER:					CAS.	SAMP.	CORE	TUBE
DATE	TIME	WATER EL.	SCREEN	TYPE	AUGER			
			1.5" O.D	DIA.	12"			
			VYON	WT.				
			1' LONG	FALL				

DATE STARTED 1/13/83
DATE FINISHED 1/13/83
DRILLER AIR FORCE
INSPECTOR D. WOODHOUSE

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	SAMPLE TYPE	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS
NATIVE SAND	0				FILL Brown medium to fine SAND	
#2 GRAVEL 12" hole	5				PEAT Gray medium to fine SAND	Approximate change.
	10				Bottom of hole @ 8.8	
	15					
	20					
	25					
	30					
	35					
	40					
	45					

ANALYTICAL RESULTS OF OBSERVATION WELL WATER SAMPLES



W-7
W-3
W-4
W-2
W-1
W-5
N
HP wells
MASS PORT TERMINAL

LABORATORY ANALYSIS REPORT AND RECORD (General)

30 Aug 82

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY: Water (Observation Wells Sampling Results)

DATE RECEIVED: 20 Aug 82

SAMPLE FROM:

LAB CONTROL NR:

TEST FOR: Volatile Halocarbons

Methodology: EPA Method 601	W1	W2	W3	W4	W5
OEHL NO	35576	35577	35578	35579	35580
BASE NO	GP820163	GP820164	GP820165	GP820166	GP820167
Bromoform	ND <0.2	ND <0.2	ND <0.2	ND <0.2	ND <0.2
Bromodichloromethane	ND <0.1	ND <0.1	ND <0.1	ND <0.1	ND <0.1
Carbon Tetrachloride	ND <0.1	ND <0.1	TRACE <0.2	1.2	2..
Chloroethane					
Chloroform	ND <0.1	0.2	ND <0.1	ND <0.1	ND <0.1
Chloromethane					
Dibromochloromethane	ND <0.1	ND <0.1	ND <0.1	ND <0.1	ND <0.1
1,1-Dichloroethane					
1,2-Dichloroethane	ND <0.2	ND <0.2	ND <0.2	ND <0.2	ND <0.2
1,2-Dichloropropane					
cis-1,3-Dichloropropene					
Methylene Chloride	ND <0.2	ND <0.2	ND <0.2	ND <0.2	ND <0.2
1,1,2,2-Tetrachloroethane					
1,1,2,2-Tetrachloroethylene	ND <0.1	ND <0.1	ND <0.1	ND <0.1	ND <0.1
1,1,1-Trichloroethane	ND <0.1	ND <0.1	ND <0.1	ND <0.1	ND <0.1
1,1,2-Trichloroethane					
Trichloroethylene	ND <0.1	ND <0.1	ND <0.1	0.2	ND <0.1
1,2-Dichloroethylene	ND <0.1	0.4	6.0	27.5	30.2

Results in Micrograms per Liter

LEOPOLDO L. RODRIGUEZ, Chemist
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

REQUESTING AGENCY (Mailing Address)

ESD/SGPM
Hanscom AFB MA 01731

N.D. None Detected, Less Than The Detection Limit.

TRACE. Present but less than the quantitative limit.

1 of 2

OEHL FORM DEC 78 7 PREVIOUS EDITION WILL BE USED

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
Water (Observation Wells Sampling Results)

DATE RECEIVED

SAMPLE FROM

LAB CONTROL NR

TEST FOR
Volatile Halocarbons

Methodology: EPA Method 601 W 7 Between wells and observ wells

OEHL NO	35581				
BASE NO	GP820168				
Bromoform	ND <0.2				
Bromodichloromethane	ND <0.1				
Carbon Tetrachloride	ND <0.1				
Chloroethane					
Chloroform	ND <0.1				
Chloromethane					
Dibromochloromethane	ND <0.1				
1,1-Dichloroethane					
1,2-Dichloroethane	ND <0.2				
1,2-Dichloropropane					
cis-1,3-Dichloropropene					
Methylene Chloride	ND <0.2				
1,1,2,2-Tetrachloroethane					
1,1,2,2-Tetrachloroethylene	ND <0.1				
1,1,1-Trichloroethane	ND <0.1				
1,1,2-Trichloroethane					
Trichloroethylene	ND <0.1				

1,2-Dichloroethylene 0.3
Results in Micrograms per Liter

LEOPOLDO L. RODRIGUEZ, Chemist
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

REQUESTING AGENCY (Mailing Address)

N.D. None Detected, Less Than The Detection Limit.

TRACE Present but less than the quantitative limit.

OEHL FORM 7 DEC 79 PREVIOUS EDITION WILL BE USED

LABORATORY ANALYSIS REPORT AND RECORD (General)

DATE	30 Aug 82
TO:	
FROM:	USAF OEHL/SA Brooks AFB TX 78235
SAMPLE IDENTITY:	Water (Observation Wells Sampling Results)
DATE RECEIVED	20 Aug 82
SAMPLE FROM	
LAB CONTROL NR	35570-35575
TEST FOR	Volatile Aromatics

Methodology: EPA Method 503.1

	W1	W2	W3	W4	W5
OEHL No.	35570	35571	35572	35573	35574
Base No.	GP820157	GP820158	GP820159	GP820160	GP820161
Benzene	ND <1.0	ND <1.0	ND <1.0	ND <1.0	ND <1.0
Chlorobenzene	ND <1.0	ND <1.0	ND <1.0	ND <1.0	ND <1.0
1,2-dichlorobenzene					
1,3-dichlorobenzene					
1,4-dichlorobenzene					
Ethylbenzene	ND <1.0	ND <1.0	ND <1.0	ND <1.0	ND <1.0
*Toluene	4.5	TRACE <3.0	TRACE <3.0	3.0	4.0
o-Xylene	ND <1.0	ND <1.0	ND <1.0	ND <1.0	ND <1.0
m-Xylene	ND <1.0	ND <1.0	ND <1.0	ND <1.0	ND <1.0
p-Xylene	ND <1.0	ND <1.0	ND <1.0	ND <1.0	ND <1.0

Results in micrograms per liter

LEOPOLDO L. RODRIGUEZ, GS-12
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, GS-9, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

REQUESTING AGENCY (Mailing Address)

ESD/SGPM
Hanscom AFB MA 01731

AMD FORM DEC 78 641 REPLACES OEHL FORM 7 DEC 78, WHICH IS OBSOLETE

LABORATORY ANALYSIS REPORT AND RECORD (General)	DATE
TO: / FROM:	
SAMPLE IDENTITY: Water (Observation Wells Sampling Results)	DATE RECEIVED
SAMPLE FROM	LAB CONTROL NR

TEST FOR
Volatile Aromatics

Methodology: EPA Method 503.1

OEHL No.	W7 35575
Base No.	GP820162
Benzene	ND <1.0
Chlorobenzene	ND <1.0
1,2-dichlorobenzene	
1,3-dichlorobenzene	
1,4-dichlorobenzene	
Ethylbenzene	ND <1.0
X Toluene	3.0
o-Xylene	ND <1.0
m-Xylene	ND <1.0
p-Xylene	ND <1.0

Results in micrograms per liter

LEOPOLDO L. RODRIGUEZ, GS-12
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, GS-9, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

REQUESTING AGENCY (Mailing Address)

AMD FORM DEC 78 641 REPLACES OEHL FORM 7 DEC 78, WHICH IS OBSOLETE

Mitoka

0742

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NUMBER
OEHL	35597 - 598	GP820155

SAMPLE COLLECTION INFORMATION

			5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
7. SITE DESCRIPTION: Well #3 (Observation well 3)			26 Aug. 82	26 Aug. 82
8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	ON-SITE ANALYTICAL RESULTS: 16. WATER TEMP 000 10 °C; 17. PH 00400 UNITS; 18. DISS O_2	
11. COLLECTION DATE/PERIOD		12. NAME OF COLLECTOR	19. RESULTS OF OTHER ON-SITE ANALYSES	
13. SAMPLING TECHNIQUE		14. PHONE NUMBER		
15. REASON FOR SAMPLE SUBMISSION				

ANALYSES REQUESTED AND RESULTS

A. PRIMARY DRINKING WATER STANDARDS (40CFR 141)

598 PRESERVATION GROUP F (532) | 597 PRESERVATION GROUP C (238)

PARAMETER	TOTAL	µG/L	MAX LEV ALLWD	PARAMETER	TOTAL	MG/L	MAX LEV ALL
ARSENIC X	01002	13.	50 µG/L	NITRATE AS N (Cadmium Reduction Method)	00620	4.8	10 MG/L
BARIUM	01007	<1000.	1000 µG/L	**PRESERVATION GROUP G**			
				PARAMETER	TOTAL	MG/L	MAX LEV ALL
CADMIUM	01027	<10.	10. µG/L	FLUORIDE	00951	.	See table in AFR 161-44
CHROMIUM X	[illegible]	53.	50 µG/L	TURBIDITY	00076	Units	1 Unit
LEAD X	[illegible]	65.	50 µG/L				
MERCURY	71900	<2.	2 µG/L				
SELENIUM	01147	<10.	10 µG/L				
SILVER	01077	<10.	50 µG/L				

B. OTHER ANALYSES

PRESERVATION GROUP F PARAMETER	TOTAL	µG/L	PRESERVATION GROUP G PARAMETER	TOTAL	MG/L	PARAMETER	TOTAL	MG/L
COPPER	01042	.	Acidity, Mineral As $CaCO_3$	00436	.	Sulfate As SO_4	00945	.
IRON	01045	.	Acidity, Total, As $CaCO_3$	00435	.	Surfactants MBAS As LAS	38260	.
MANGANESE	01055	.	Alkalin, Phenolth As $CaCO_3$	00415	.			
ZINC	01092	.	Alkalinity, Total, As $CaCO_3$	00410	.			
CALCIUM As Ca	00916	. mg/l	Chloride	00940	.			
MAGNESIUM as Mg	00927	. mg/l	Hardness As $CaCO_3$	00900	.	PRESERVATION GROUP J		
POTASSIUM	00937	. mg/l	Residue, Filtrable (TDS)	00515	.	PARAMETER		
SODIUM	00929	. mg/l	Residue, Non-Filtrable (SS)	00530	.			
Chromium Total		53	Residue	00500	.			
			Specific Conductance	00095	µmhos			

1. ORGANIZATION REQUESTING ANALYSIS	
Lead Analysis ran twice.	CHEMIST: [illegible]
	REVIEWED BY
ESD/SGPM Hanscom AFB MA 01731	APPROVED BY: [signature]

OEHL FORM 2 — POTABLE WATER ANALYSIS

SUMMARY OF COMPOUNDS DETECTED IN THE OBSERVATION WELLS

COMPOUND	MAXIMUM CONCENTRATION DETECTED (MICROGRAMS/LITER)	CURRENT CONCENTRATION LIMITS (MICROGRAMS/LITER)
CARBON TETRACHLORIDE	2.6	
CHLOROFORM	0.2	100 (EPA, REG.)
TRICHLOROETHYLENE	0.2	
1,2-DICHLOROETHYLENE	30.2	?
TOLUENE	4.5	
ARSENIC	13.0	50 (EPA, REG.)
CHROMIUM	53.0	50 (EPA, REG.)
LEAD	65.0	50 (EPA, REG.)

RESULTS OF OBSERVATION WELL REPEAT SAMPLES

Samples Collected On 12 Oct. 1982 — Results Received By Telephone On 21 Oct 1982

Sample No.	Description of Sample	Carbon Tetrachloride	Trichloro-ethylene	1,2-Dichloro-ethylene	Toluene
		Concentration (micrograms/liter)			
GN 82 0179	Well #4 surface before pumping	ND	ND	ND	—
180	" " " " "	—	—	—	ND
181	Well #5 surface before pumping	ND	23.4	1.4	—
182	" " " " "	—	—	—	Trace
183	Well #7 surface before pumping	ND	ND	ND	—
184	" " " " "	—	—	—	ND
185	Well #4 surface after pumping	ND	ND	ND	—
186	" " " " "	—	—	—	ND
187	Well #4 after pumping (entire vol)	ND	ND	ND	—
188	" " " " " "	—	—	—	Trace
189	Well #5 surface after pumping	ND	291.0	24.3	—
190	" " " " "	—	—	—	4.9
191	Well #5 after pumping (entire vol)	ND	215.0	8.6	—
192	" " " " " "	—	—	—	4.6
193	Well #7 surface after pumping	ND	ND	ND	—
194	" " " " "	—	—	—	ND
195	Well #7 after pumping (entire vol)	ND	ND	ND	—
196	" " " " " "	—	—	—	Trace

ND = None Detected, Less Than The Detection Limit

Trace = Present But Less Than Quantitative Limit

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
Water

Surface before stripping

DATE RECEIVED
14 Oct 1982

SAMPLE FROM

LAB CONTROL NR

TEST FOR
Volatile Halocarbons

#5

Methodology: EPA Method 601

OEHL NO	43514	43517	43520	43522	43526
BASE NO	GN820179	GN820181	GN820183	GN820185	GN820187
Bromoform					
Bromodichloromethane					
Carbon Tetrachloride	ND<0.1	ND<0.1	ND<0.1	ND<0.1	ND<0.1
Chloroethane					
Chloroform					
Chloromethane					
Dibromochloromethane					
1,1-Dichloroethane					
1,2-Dichloroethane					
1,2-Dichloropropane					
cis-1,3-Dichloropropene					
Methylene Chloride					
1,1,2,2-Tetrachloroethane					
1,1,2,2-Tetrachloroethylene					
1,1,1-Trichloroethane					
1,1,2-Trichloroethane					
Trichloroethylene	ND<0.1	23.4	ND<0.1	ND<0.1	ND<0.1
cis -1,2-Dichloroethylene	ND<0.1	1.4	ND<0.1	ND<0.1	ND<0.1

Results in Micrograms per Liter

LEOPOLDO L. RODRIGUEZ, Chemist
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

REQUESTING AGENCY (Mailing Address)

ESD/SGPB
Hanscom AFB MA 01731

N.D. None Detected, Less Than The Detection Limit.

TRACE. Present but less than the quantitative limit.

OEHL FORM 7 DEC 78 PREVIOUS EDITION WILL BE USED

LABORATORY ANALYSIS REPORT AND RECORD *(General)*

20 Oct 1982

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
Water

DATE RECEIVED
14 Oct 1982

SAMPLE FROM

LAB CONTROL NR

TEST FOR
Volatile Halocarbons

Methodology: EPA Method 601

OEHL NO	43529	43532	43535	43537	
BASE NO	GN820189	GN820191	GN820193	GN820195	
Bromoform					
Bromodichloromethane					
Carbon Tetrachloride	ND<0.1	ND<0.1	ND<0.1	ND<0.1	
Chloroethane					
Chloroform					
Chloromethane					
Dibromochloromethane					
1,1-Dichloroethane					
1,2-Dichloroethane					
1,2-Dichloropropane					
cis-1,3-Dichloropropene					
Methylene Chloride					
1,1,2,2-Tetrachloroethane					
1,1,2,2-Tetrachloroethylene					
1,1,1-Trichloroethane					
1,1,2-Trichloroethane					
Trichloroethylene	291	215	ND<0.1	ND<0.1	
cis-1,2-Dichloroethylene	24.3	8.6	ND<0.1	ND<0.1	

Results in Micrograms per Liter

LEOPOLDO L. RODRIGUEZ, Chemist
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

REQUESTING AGENCY *(Mailing Address)*

ESD/SGPB
Hanscom AFB MA 01731

N.D. None Detected, Less Than The Detection Limit.

TRACE. Present but less than the quantitative limit.

OEHL FORM 7 DEC 78 PREVIOUS EDITION WILL BE USED

LABORATORY ANALYSIS REPORT AND RECORD *(General)*

DATE: 20 Oct 1982

TO:

FROM: USAF OEHL/SA
~~Brooks AFB TX 78235~~

SAMPLE IDENTITY

DATE RECEIVED: 14 Oct 1982

SAMPLE FROM

LAB CONTROL NR

TEST FOR

Toluene

OEHL NO	BASE NO	µg/L
43515	GN820180	ND<1.0
43518	GN820182	Trace<2.0
43521	GN820184	Trace<2.0
43524	GN820186	ND<1.0
43527	GN820188	Trace<2.0
43530	GN820190	4.9
43533	GN820192	4.6
43536	GN820194	ND<1.0
43539	GN820196	Trace<2.0

µg/L - Micrograms per litre

Trace - Present but less than the quantitative limit.

ND - None Detected, less than the detection limit.

LEOPOLDO L. RODRIGUEZ, GS-12
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, GS-9, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

REQUESTING AGENCY *(Mailing Address)*

ESD/SGPB
Hanscom AFB MA 01731

AMD FORM SEP 82 641 REPLACES OEHL FORM 7, DEC 78, WHICH IS OBSOLETE.

0712

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OEHL	43545 00008	GN820202 00028

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION			5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
Well #4 (After Pumping)			14 Oct 82	25 Oct 82

ON-SITE ANALYTICAL RESULTS

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L

11. COLLECTION DATE/PERIOD	12. COLLECTORS NAME	19. RESULTS OF OTHER ON-SITE ANALYSES
13. SAMPLING TECHNIQUE	**14. PHONE NUMBER**	

15. REASON FOR SAMPLE SUBMISSION

NPDES #

ANALYSES REQUESTED AND RESULTS (298)

PRESERVATION GROUP A

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	.
Total Organic CARBON as C	00680	.
		.

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	.

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	.
NITRATE as N Cd Reduct. Method	00620	.
NITRITE as N	00615	.
TOTAL KJELDAHL NITROGEN as N	00625	.
PHOSPHORUS Ortho PO4 as P	70507	.
PHOSPHORUS as P	00665	.

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	.
CYANIDE Free, Amenable to Cl_2	00722	.

PRESERVATION GROUP E

PARAMETER	TOTAL	µG/L
PHENOLS	32730	.

PRESERVATION GROUP F

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	.
BARIUM	01005	01007	.
CADMIUM	01025	01027	.
CHROMIUM	01030	01034	.
CHROMIUM Hexavalent		01032	.
COPPER	01040	01042	.
IRON	01046	01045	.
LEAD	01049	01051	.
MANGANESE	01056	01055	.
MERCURY	71890	71900	.
NICKEL	01065	01067	.
SELENIUM	01145	01147	.
SILVER	01075	01077	.
ZINC	01090	01092	.
CALCIUM as Ca	00915	00916	. mg/l
MAGNESIUM as Mg	00925	00927	. mg/l
POTASSIUM	00935	00937	. mg/l
SODIUM	00930	00929	. mg/l

545 **PRESERVATION GROUP G**

PARAMETER	TOTAL	MG/L
BORON	01022	. µg/l
BORON, Dissolved	01020	. µg/l
CHLORIDE	00940	.
COLOR	00080	Units
FLUORIDE	00951	.
Residue Filterable (TDS)	00515	211.
Residue Non Filt (SS)	00530	167.
Residue	00500	378.
Residue Volatile	00505	96.
Specific Conductance	00095	* [illegible] µmhos
SULFATE as SO_4	00945	.
SURFACTANTS MBAS as LAS	38260	.
TURBIDITY	00076	Units
acidity, Total		39
alkalinity, "		15
" Bicarbonate		15
Residue, Settable		<1 ml/l
* Specific Conductance		210 µmhos

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS	CHEMIST
ESD/SGPB Hanscom AFB MA 01731	[signature]
	REVIEWED BY
	APPROVED BY [signature]

OEHL FORM NOV 76 1 — NON-POTABLE WATER ANALYSIS

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OEHL	43544 00008	GN820201 00025

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
Well #4 (After Pumping)	14 Oct 82	25 Oct 82

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L

11. COLLECTION DATE/PERIOD	12. COLLECTORS NAME

13. SAMPLING TECHNIQUE	14. PHONE NUMBER

15. REASON FOR SAMPLE SUBMISSION
NPDES #

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	
Total Organic CARBON as C	00680	

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00620	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	
CYANIDE Free, Amenable to Cl_2	00722	

PRESERVATION GROUP E

PARAMETER	TOTAL	µG/L
PHENOLS	32730	

544 **RESERVATION GROUP** 298

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	(01002)	<10
BARIUM	01005	01007	
CADMIUM	01025	01027	
CHROMIUM	01030	(01034)	<50
CHROMIUM Hexavalent		(01032)	<50
COPPER	01040	(01042)	224
IRON	01046	(01045)	3563
LEAD	01049	(01051)	<50
MANGANESE	01056	(01055)	835
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	
ZINC	01090	(01092)	69
CALCIUM as Ca	00915	00916	20.7 mg/l
MAGNESIUM as Mg	00925	(00927)	6.5 mg/l
POTASSIUM	00935	00937	mg/l
SODIUM	00930	00929	mg/l
Hardness (as mg/l $CaCO_3$)			78

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
BORON	01022	µg/l
BORON, Dissolved	01020	µg/l
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS
Hanscom AFB

CHEMIST: Lyy wt. SB

REVIEWED BY

APPROVED BY: [signature]

07,12

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OEHL	43543 00008	GW820200 00029

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION: Well #5 (AFTer pumping)

5. DATE RECEIVED BY LAB: 14 Oct, 82

6. DATE ANALYSIS COMPLETED: 25 Oct, 82

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O₂ 00300 MG/L

11. COLLECTION DATE/PERIOD	12. COLLECTOR'S NAME
13. SAMPLING TECHNIQUE	14. PHONE NUMBER

15. REASON FOR SAMPLE SUBMISSION

NPDES #

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS (298)

PRESERVATION GROUP A		
PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	
Total Organic CARBON as C	00680	

PRESERVATION GROUP B		
PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	

PRESERVATION GROUP C		
PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00620	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	

PRESERVATION GROUP D		
PARAMETER	TOTAL	MG/L
CYANIDE	00720	
CYANIDE Free, Amenable to Cl_2	00722	

PRESERVATION GROUP E		
PARAMETER	TOTAL	µG/L
PHENOLS	32730	

PRESERVATION GROUP F			
PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	
BARIUM	01005	01007	
CADMIUM	01025	01027	
CHROMIUM	01030	01034	
CHROMIUM Hexavalent		01032	
COPPER	01040	01042	
IRON	01046	01045	
LEAD	01049	01051	
MANGANESE	01056	01055	
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	
ZINC	01090	01092	
CALCIUM as Ca	00915	00916	mg/l
MAGNESIUM as Mg	00925	00927	mg/l
POTASSIUM	00935	00937	mg/l
SODIUM	00930	00929	mg/l

543 PRESERVATION GROUP G		
PARAMETER	TOTAL	MG/L
BORON	01022	µg/l
BORON, Dissolved	01020	µg/l
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	81.
Residue Non Filt (SS)	00530	40.
Residue	00500	121.
Residue Volatile	00505	44.
Specific Conductance	00095	* [redacted] µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units
Acidity, Total		14
Alkalinity, "		28
" Bicarbonate		28
Residue, Settable		<1 ml/l
* Specific Conductance		120 µmhos

PRESERVATION GROUP J		
PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

Hanscom AFB

CHEMIST: DJB REL [illegible]

REVIEWED BY

APPROVED BY [signature]

OEHL FORM NOV 76 1 — NON-POTABLE WATER ANALYSIS

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER 00008	4. REQUESTOR SAMPLE NO 00029
OEHL	43542	GN820199

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION: Well #5 (After Pumping)

5. DATE RECEIVED BY LAB: 14 Oct. 82

6. DATE ANALYSIS COMPLETED: 25 Oct. 82

ON-SITE ANALYTICAL RESULTS

8. SITE LOCATION NO	9. FLOWRATE AT SITE 00059 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L

11. COLLECTION DATE/PERIOD

12. COLLECTORS NAME

19. RESULTS OF OTHER ON-SITE ANALYSES

13. SAMPLING TECHNIQUE

14. PHONE NUMBER

15. REASON FOR SAMPLE SUBMISSION

NPDES #

ANALYSES REQUESTED AND RESULTS

542

PRESERVATION GROUP A		
PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	
Total Organic CARBON as C	00680	
PRESERVATION GROUP B		
PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	
PRESERVATION GROUP C		
PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00620	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	
PRESERVATION GROUP D		
PARAMETER	TOTAL	MG/L
CYANIDE	00720	
CYANIDE Free, Amenable to Cl_2	00722	
PRESERVATION GROUP E		
PARAMETER	TOTAL	µG/L
PHENOLS	32730	

PRESERVATION GROUP F (298)			
PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	<10
BARIUM	01005	01007	
CADMIUM	01025	01027	
CHROMIUM	01030	01034	<50
CHROMIUM Hexavalent		01032	<50
COPPER	01040	01042	158
IRON	01046	01045	3789
LEAD	01049	01051	<50
MANGANESE	01056	01055	343
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	
ZINC	01090	01092	56
CALCIUM as Ca	00915	00916	7.7 mg/l
MAGNESIUM as Mg	00925	00927	4.0 mg/l
POTASSIUM	00935	00937	mg/l
SODIUM	00930	00929	mg/l
hardness	(as mg/l CaCO3)		36

PRESERVATION GROUP G		
PARAMETER	TOTAL	MG/L
BORON	01022	µg/l
BORON, Dissolved	01020	µg/l
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units
PRESERVATION GROUP J		
PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

Hanscom AFB

CHEMIST: DDB Lyy WH

REVIEWED BY

APPROVED BY: [signature]

OEHL FORM 1 NOV 76

NON-POTABLE WATER ANALYSIS

0712

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER 00008	4. REQUESTOR SAMPLE NO 00029
OEHL	43541	GN820198

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION: Well #7 (after Pumping)

5. DATE RECEIVED BY LAB: 14 05.82
6. DATE ANALYSIS COMPLETED: 25 05.82

8. SITE LOCATION NO
9. FLOWRATE AT SITE 00058 GAL/MIN
10. WEATHER 00041

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C
17. PH 00400 UNITS
18. DISS O_2 00300 MG/L

11. COLLECTION DATE/PERIOD
12. COLLECTORS NAME
13. SAMPLING TECHNIQUE
14. PHONE NUMBER
15. REASON FOR SAMPLE SUBMISSION
NPDES #
19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS (293)

PRESERVATION GROUP A		
PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	
Total Organic CARBON as C	00680	
PRESERVATION GROUP B		
PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	
PRESERVATION GROUP C		
PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00620	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	
PRESERVATION GROUP D		
PARAMETER	TOTAL	MG/L
CYANIDE	00720	
CYANIDE Free, Amenable to Cl_2	00722	
PRESERVATION GROUP E		
PARAMETER	TOTAL	µG/L
PHENOLS	32730	

PRESERVATION GROUP F			
PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	
BARIUM	01005	01007	
CADMIUM	01025	01027	
CHROMIUM	01030	01034	
CHROMIUM Hexavalent		01032	
COPPER	01040	01042	
IRON	01046	01045	
LEAD	01049	01051	
MANGANESE	01056	01055	
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	
ZINC	01090	01092	
CALCIUM as Ca	00915	00916	mg/l
MAGNESIUM as Mg	00925	00927	mg/l
POTASSIUM	00935	00937	mg/l
SODIUM	00930	00929	mg/l

541

PRESERVATION GROUP G		
PARAMETER	TOTAL	MG/L
BORON	01022	µg/l
BORON, Dissolved	01020	µg/l
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	189.
Residue Non Filt (SS)	00530	49.
Residue	00500	238.
Residue Volatile	00505	116.
Specific Conductance	00095	~~[illegible]~~ µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units
acidity, Total		30
alkalinity, "		57
" Bicarbonate		57
Residue, Settable		<1 ml/l
Specific Conductance		230 umhos
PRESERVATION GROUP J		
PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS: Hanscom AFB

CHEMIST: RG BDB mw
REVIEWED BY
APPROVED BY: [signature]

OEHL FORM NOV 76 1

NON-POTABLE WATER ANALYSIS

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER	4. REQUESTOR SAMPLE NO
OEHL	43540 00048	GN 820197 00029

SAMPLE COLLECTION INFORMATION

7. SITE DESCRIPTION	Well #7 (after Pumping)
5. DATE RECEIVED BY LAB	14 Oct 82
6. DATE ANALYSIS COMPLETED	25 Oct 82
8. SITE LOCATION NO	
9. FLOWRATE AT SITE 00058 GAL/MIN	
10. WEATHER 00041	
11. COLLECTION DATE/PERIOD	
12. COLLECTORS NAME	
13. SAMPLING TECHNIQUE	
14. PHONE NUMBER	
15. REASON FOR SAMPLE SUBMISSION	NPDES #

ON-SITE ANALYTICAL RESULTS

16. WATER TEMP 00010 °C	17. PH 00400 UNITS	18. DISS O2 00300 MG/L

19. RESULTS OF OTHER ON-SITE ANALYSES

ANALYSES REQUESTED AND RESULTS 298

PRESERVATION GROUP A

PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340	
Total Organic CARBON as C	00680	

PRESERVATION GROUP B

PARAMETER	TOTAL	MG/L
OIL & GREASE FREON-IR Method	00560	

PRESERVATION GROUP C

PARAMETER	TOTAL	MG/L
AMMONIA as N	00610	
NITRATE as N Cd Reduct. Method	00620	
NITRITE as N	00615	
TOTAL KJELDAHL NITROGEN as N	00625	
PHOSPHORUS Ortho PO4 as P	70507	
PHOSPHORUS as P	00665	

PRESERVATION GROUP D

PARAMETER	TOTAL	MG/L
CYANIDE	00720	
CYANIDE Free, Amenable to Cl_2	00722	

PRESERVATION GROUP E

PARAMETER	TOTAL	µG/L
PHENOLS	32730	

540 **PRESERVATION GROUP F** 298

PARAMETER	DISS	TOTAL	µG/L
ARSENIC	01000	01002	<10
BARIUM	01005	01007	
CADMIUM	01025	01027	
CHROMIUM	01030	01034	<50
CHROMIUM Hexavalent		01032	<50
COPPER	01040	01042	187
IRON	01046	01045	12550
LEAD	01049	01051	<50
MANGANESE	01056	01055	356
MERCURY	71890	71900	
NICKEL	01065	01067	
SELENIUM	01145	01147	
SILVER	01075	01077	
ZINC	01090	01092	63
CALCIUM as Ca	00915	00916	13.5 mg/l
MAGNESIUM as Mg	00925	00927	8.4 mg/l
POTASSIUM	00935	00937	mg/l
SODIUM	00930	00929	mg/l
hardness	(as mg/L $CaCO_3$)		68

PRESERVATION GROUP G

PARAMETER	TOTAL	MG/L
BORON	01022	µg/l
BORON, Dissolved	01020	µg/l
CHLORIDE	00940	
COLOR	00080	Units
FLUORIDE	00951	
Residue Filterable (TDS)	00515	
Residue Non Filt (SS)	00530	
Residue	00500	
Residue Volatile	00505	
Specific Conductance	00095	µmhos
SULFATE as SO_4	00945	
SURFACTANTS MBAS as LAS	38260	
TURBIDITY	00076	Units

PRESERVATION GROUP J

PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS

Hanscom, AFB

CHEMIST [signature]

REVIEWED BY

APPROVED BY [signature]

OEHL FORM NOV 78 1 NON-POTABLE WATER ANALYSIS

-1

24 AUG 1982

D. L. MAHER CO.
LOG OF TEST WELL

Return to [illegible]

Log of Well for Electronic Systems Div. Test No. 82-1

Address Hanscom A.F.B.

Well located at Airfield in Middlesex County, State of Mass

Date Drilling started Aug 9 - 82 Date Test Hole Completed Aug 12 - 82

Total depth to bottom of Well 20' Diameter Test Hole 2½" PVC Flush Th.

Water stands when not pumping 3 feet 6 inches from the surface of the ground.

	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM
	0-1	Topsoil
Plugs to 6'	1-2	Sand Fine Red
	2-5	Sand Coarse w/ Fine Brn
2-6-6-10	5-7	Sand Coarse Brn Top
		Sand Coarse Gray
		Sand V. Fine Gray Brn.
4-7-11-9	10-12	Sand Silty Fine Gray
		w/ Clay Seams
3-8-10-12	14-16	Clay Gray w/ Silts
6-8-8-8	18-20	Clay Gray w/ Silts
	20	Stopped

Did Well Clear Up? Materials Used

How Long? 1 10' DID

Time Pumped? 1 5' DID

Drawdown Ft. In. 1 5' Riser

Capacity 5 Bags # 2

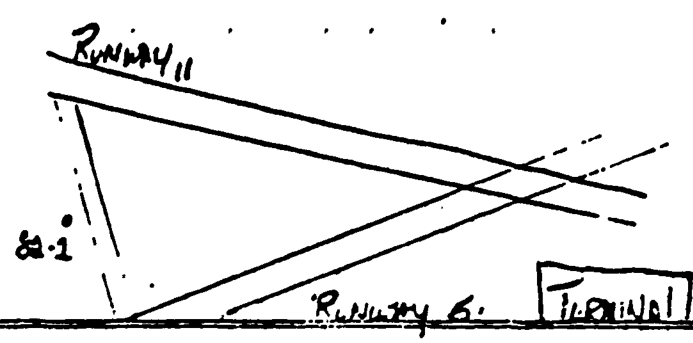
Time Required for Recovery? 1 Bag Cement

Was Well Pulled? 1 Cap

Observation What Depth? 1 End Plug

Was Observation Well Pulled?

Map of Location



Remarks and opinion of Test

Driller William J. Canty

Helper P. McManus

D. L. MAHER CO.

LOG OF TEST WELL

Log of Well for Electronic Systems Div. Test No. 82-2

Address Hanscom AFB.

Well located at AirField in Middlesex County, State of Mass

Date Drilling started Aug 9 - 82 Date Test Hole Completed Aug 12 - 82

Total depth to bottom of Well 37'. Diameter Test Hole 2½" PVC.

Water stands when not pumping @ 4' feet inches from the surface of the ground.

Tow Count	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM
	0 - 1	Topsoil
	1 - 5	Sand Med/Coarse Brn.
4-8-9-10	5'-7'	Sand Med. Brn.
6-7-11-9	10'-12'	Sand Coarse Brn
		w/ Sm. To Med. Round Gravel
3-5-5-8	14'-16'	Sand Coarse Brn.
5-11-17-22	18-20	Sand Med/Coarse Brn.
		Sand Med/Coarse Gray
		Sand Fine Gray
5-8-11-14	23-25	Clay Silty Gray
7-12-13-18	28-30	Clay Silty Gray w/ Gravel
		Sand Med. Gray
		Clay Silty Gray w/ Med Sand
5-8-15-19	33-35	Sand Coarse Gray
	37'	Till Gray Auger Refusal
	37'	Stopped

Did Well Clear Up? Materials Used

How Long? 1 20' 010

Time Pumped? 1 10' 010

Drawdown Ft. In. 1 2' 010

Capacity 1 5' Tube

Time Required for Recovery? 1 CAP

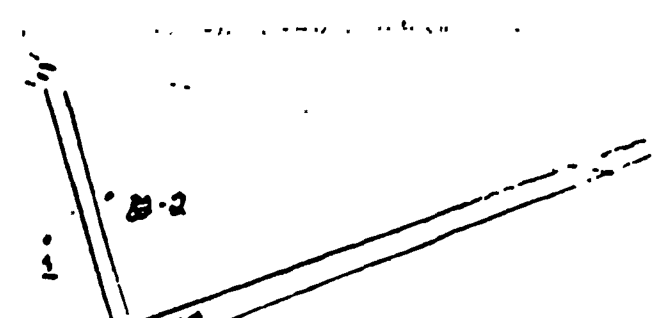
Was Well Pulled? 1 Bld Plug

Observation What Depth? 11 Bags #2

Bag Cement

Was Observation Well Pulled?

Map of Location



Remarks and opinion of Test Attempted Drilling At 34' to 37' Caused Large diameter Hole, Screen Tricky to Set Gravel Starts At 28'

Driller William J. Canty

Helpers P. McNamara

D. L. MAHER CO.

LOG OF TEST WELL

Log of Well for Electronic Systems Div. Test No. 82-3

Address HANSCOM A.F.B.

Well located at AIRFIELD in MIDDLESEX County, State of MASS

Date Drilling started Aug 9-82 Date Test Hole Completed Aug 12-82

Total depth to bottom of Well 40' Diameter Test Hole 2½" PVC

Water stands when not pumping @ 9' feet inches from the surface of the ground.

Blow Count	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM
	0-2	Topsoil
—	2-5	SAND MED BRN.
3-4-4-7	5-7	SAND MED. BRN.
3-6-8	10-12	SAND COARSE BRN
		w/ Sm. To Lg Round Gravel
3-4-5	14-16	SAND FINE GRAY
3-4-4-6	18-20	SAND FINE GRAY
		SAND FINE RED
1-5-5-7	23-25	SAND FINE GRAY
3-3-4-5	28-30	SAND FINE GRAY
		To Silty Fine Gray
8-8-10-16	33-35	SAND Silty GRAY
		w/ Small Clay Seams
6-7-7-8	38-40	SAND Silty GRAY
		w/ Sm. Clay Seams
	40'	Stopped

Did Well Clear Up? Materials Used

How Long? 1 20' 010

Time Pumped? 1 10' 010

Drawdown Ft. In. 1 5' 010

Capacity 1 2' 010

Time Required for Recovery? 1 5' Riser

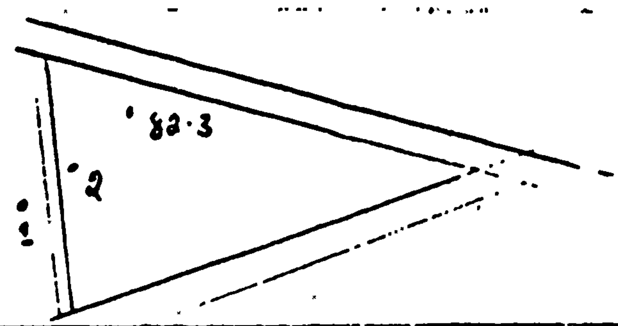
Was Well Pulled? 1 Cap

Observation What Depth? 1 end Plug

10 Bags #2

Was Observation Well Pulled? 1 Bag Cement

Map of Location



Remarks and opinion of Test

Driller William J. Canty

Helper P. McNamee

D. L. MAHER CO.

LOG OF TEST WELL

Log of Well for Electronic Systems Div. Test No. 82-4

Address Hanscom A.F.B.

Well located at Airfield in Middlesex County, State of Mass

Date Drilling started Aug-9 '82 Date Test Hole Completed Aug 12 '82

Total depth to bottom of Well 40' Diameter Test Hole 2½" PVC

Water stands when not pumping @ 5' feet inches from the surface of the ground.

Blow Count	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM
	0-3	Topsoil
	3-5	Sand Med. Red
4-8-9-11	5-7	Sand Med/Coarse Brn.
		w/ Sm. To Med. Round Gravel
Auger Sample	8'	Sand Dark Brn.
3-5-5-5	9-11	Sand Fine Gray
3-4-4-5	14-16	Sand Med./Fine Gray
3-5-7-7	18-20	Sand Fine Gray
		Sand Fine Brn.
6-8-11-11	23-25	Sand Fine Brn
		Sand Fine Gray
3-5-5-6	28-30	Sand Silty Fine Gray
		w/ Small Clay Seams
5-7-8-9	33-35	Sand Silty Gray
4-6-9-9	38-40	Sand Silty Gray
		w/ Small Clay Seams
	40'	Stopped

Did Well Clear Up? Materials Used

How Long? 1 20' OID

Time Pumped? 1 10' OID

Drawdown Ft. In. 1 5' OID

Capacity 1 2' OID

Time Required for Recovery? 1 5' Riser

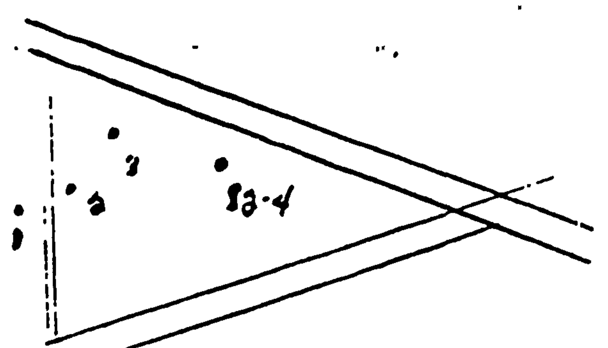
Was Well Pulled? 1 End Plug

Observation What Depth? 1 Cap

2 Bags #2

Was Observation Well Pulled 1 Bag Cement

Map of Location



Remarks and opinion of Test

Driller William J. Canty

Helpers R. McManus

D. L. MAHER CO.

LOG OF TEST WELL

Log of Well for Electronic Systems Div. Test No. 82-5

Address Hanscom AFB

Well located at Airfield in Middlesex County, State of Mass

Date Drilling started Aug 9 - 82 Date Test Hole Completed Aug 13 - 82

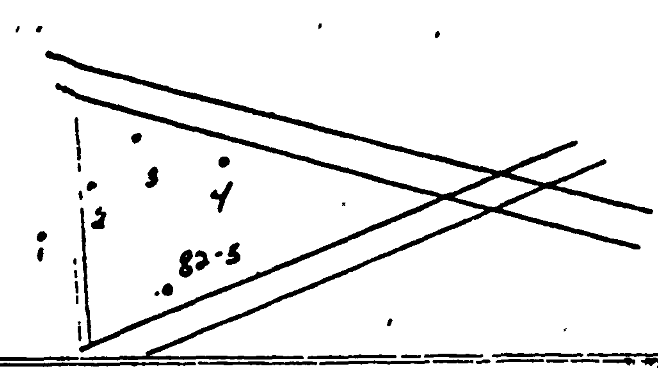
Total depth to bottom of Well 40' Diameter Test Hole 8½" PVC

Water stands when not pumping @ 6' feet inches from the surface of the ground.

Blow Count	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM
	0-1	Topsoil
	1-3	Sand Med. Brn.
	3-5	Sand Med/Coarse Brn.
3-4-4-5	5-7	Sand Med/Coarse Brn.
		w/ Sm. Tr. Round Gravel
3-3-5-7	10-12	Sand Coarse Brn w/ Gravel
		Sand Coarse Red
		Sand Fine/Med Gray w/ Fine Gravel
		Sand Fine Gray
5-11-14-13	14-16	Sand Fine Gray
1-2-2-1	18-21	Sand Fine Gray loose
7-12-11-15	23-25	Sand Fine Gray
3-3-5-4	28-30	Sand Fine Gray
8-11-16	33-35	Sand Fine Gray
		w/ Sm. Clay Seams
6-7-11-14	38-40	Sand Silty Gray
		w/ Sm. Clay Seams
	40'	Stopped

Did Well Clear Up?	Materials Used
How Long?	1 20' o10
Time Pumped?	1 10' o10
Drawdown Ft. In.	1 5' o10
Capacity	1 2' o10
Time Required for Recovery?	1 5' Riser
Was Well Pulled?	1 Cap
Observation What Depth?	1 End Plug
	10 Bags #2
Was Observation Well Pulled?	1 Bag Cement

Map of Location



Remarks and opinion of Test

Driller [signature]

Helper P. [signature]

D. L. MAHER CO.
LOG OF TEST WELL

Log of Well for Electronic Systems Div. Test No. 82-6

Address Hanscom A.F.B.

Well located at Airfield in Middlesex County, State of Mass.

Date Drilling started Aug 9 - 82 Date Test Hole Completed Aug 12 - 82

Total depth to bottom of Well 17' Diameter Test Hole 8" H.S.A.

Water stands when not pumping 0.5' feet inches from the surface of the ground.

Blow Count	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM
—	0-1	Topsoil
[illegible]	1-3	Black Soil
	3-5	Sand Med Red
1/18 9-23	5-7	Sand Med/Coarse Brn.
—		w/ Sm. To Lg. Round Gravel
15-17-28	10-12	Sand Fine Gray
—		To Fine Brn w/ Trace
—		of Clay & Med. Gravel
[illegible]	14-16	Sand Med/Coarse Gray
—		Till w/ Broken Gravel
—	17'	Till Auger Refusal
—	17'	Stopped
—		Hole Abandoned
—		by Engineer

Did Well Clear Up?

How Long?

Time Pumped?

Drawdown Ft. In.

Capacity

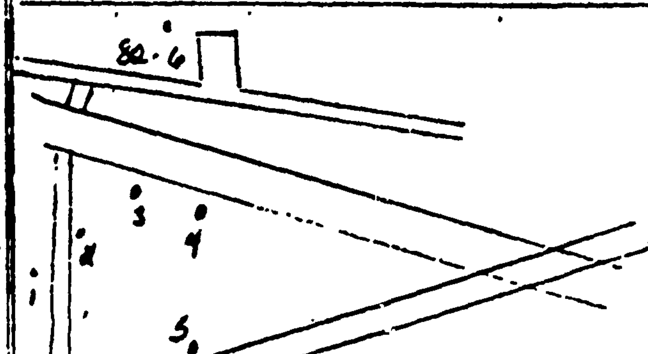
Time Required for Recovery?

Was Well Pulled?

Observation What Depth?

Was Observation Well Pulled?

Map of Location



Remarks and opinion of Test

Driller William J. Canty

Helpers D. McNamee

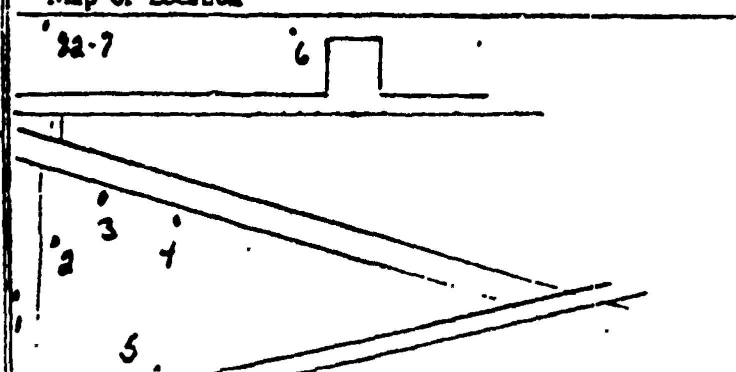
D. L. MAHER CO.
LOG OF TEST WELL

Log of Well for Electronic Systems Div. Test No. 82-7
Address Hanscom A.F.B.
Well located at Air Field in Middlesex County, State of Mass
Date Drilling started Aug 9 - 82 Date Test Hole Completed Aug 12 - 82
Total depth to bottom of Well 25' Diameter Test Hole 8 1/2" PVC
Water stands when not pumping 0 8 feet inches from the surface of the ground.

Blow Count	DEPTH OF STRATA	FORMATION FOUND EACH STRATUM
	0-1	Topsoil
	1-3	Sand Med Brn
	3-5	Sand Black Organic
[illegible] 10-14	5-7	Sand Black
		Sand/Clay Gray/Brn
		Mottled (Fill) Soft
1-1-2	10-12	Peat
1-6-7-11	14-16	Sand Med/Coarse Gray
		w/ Sm. To Lg. Gravel
		Sand Med/Coarse Brn
		w/ Sm. To Lg. Gravel
12-13-18-24	18-20	Sand Silty Fine Gray
		w/ Seams of Clay
[illegible] 19-22	23-25	Sand Fine To Coarse Brn
	25'	Stopped

Did Well Clear Up?	Materials Used
How Long?	1 10' 010
Time Pumped?	1 5' 010
Drawdown Ft. In.	1 2' 010
Capacity	1 5' Riser
Time Required for Recovery?	5 Bags #2
Was Well Pulled?	1 Bag Cement
Observation What Depth?	1 Cap
	1 End Plug
Was Observation Well Pulled?	

Map of Location



Remarks and opinion of Test Bentonite Seal 20' to 23'

Driller [signature]
Helper [signature]

G-2

Well Logs for Wells Installed in the Scott Circle Area (J.P. Collins and Associated Inc., 1968)

TEST BORING REPORT

RAYMOND

CONCRETE PILE DIVISION

BOSTON

To JAMES P. COLLINS & ASSOCIATES INC. Date JULY 25 19 68 Job No. 14566

Location of Borings HANSCOM FIELD BEDFORD MASSACHUSETTS

All borings are plotted to a scale of 1" = 8 ft. using GROUND SURFACE as a fixed datum.

No. 1

Strata	Blows	Depth
		0'
FIRM MEDIUM TO FINE SAND	8-12-13	4' WL
LOOSE BROWN MED. TO FINE SAND TRACE OF GRAVEL	3-3-3	8'
SEE NOTE A	7-8-9	12'
LOOSE BROWN COARSE TO FINE SAND TRACE OF GRAVEL	3-3-3 2-3-4	20' 6"

WATER LEVEL NOTED AT 3'6" ONE HALF HOUR AFTER COMPLETION.

15' OF 2.5" CASING USED.

NOTE A-FIRM BROWN COARSE TO FINE SAND TRACE OF GRAVEL

FOREMAN NOTED HE LOST SAMPLES AT 16'6" AND AT 20'6"

FOREMAN NOTED HE INSTALLED A 15' WATER OBSERVATION WELL.

7-17-68

GEORGE PULSIFER

No. 2

Strata	Blows	Depth
		0'
LOOSE BROWN MED. TO FINE SAND	1-3-5	WL 5'
LOOSE BROWN FINE SAND	LOOSE	7'
FIRM BROWN MED. TO FINE SAND	7-9-12	12'
LOOSE BROWN COARSE TO FINE SAND TRACE OF FINE GRAVEL	3-8-5	18'
SEE NOTE A	10-18-21	21' 6"

WATER LEVEL NOTED AT 3' ONE HALF HOUR AFTER COMPLETION.

20' OF 2.5" CASING USED.

FOREMAN NOTED A TRACE OF GRAVEL IN STRATA FROM 0' TO 5'

NOTE A-HARD BROWN COARSE TO FINE SAND TRACE OF FINE GRAVEL

7-16-68

GEORGE PULSIFER

No. 3

Strata	Blows	Depth
		0' WL
SEE NOTE A	8-15-19	3'
LOOSE BROWN MEDIUM TO FINE SAND	8-3-2 3-3-3	15'
SEE NOTE B	10-15 48	16'
VERY HARD BROWN SAND AND GRAVEL TRACE SILT (TILL)	21-23-31	20' 6"

WATER LEVEL NOTED AT 1' ONE HALF HOUR AFTER COMPLETION.

19' OF 2.5" CASING USED.

NOTE A-FIRM BROWN COARSE TO MEDIUM SAND TRACE OF CLAY AND SILT

NOTE B- HARD BROWN COARSE TO MEDIUM SAND AND GRAVEL TRACE OF SILT

7-17-68

GEORGE PULSIFER

No. 4

Strata	Blows	Depth
		0'
HARD COARSE BROWN SAND GRAVEL AND BOULDERS	38/12 12-11-5	WL 10'
FIRM COARSE BROWN SAND AND GRAVEL	6-6-6 6-8-11 13	18'
SEE NOTE A	13-17-21	21' 6"

WATER LEVEL NOTED AT 8' ON COMPLETION.

NOTE A-HARD COARSE BROWN SAND GRAVEL AND STONES

20' OF 2.5" CASING USED.

FOREMAN NOTED HE INSTALLED 20' WATER OBSERVATION WELL.

7-15-68

PHILIP MCGRATH

Used 15' of 2.5" Casing Used 20' of 2.5" Casing Used 19' of 2.5" Casing Used 20' of 2.5" Casing

Total Footage 84' 0"

Foreman GEORGE PULSIFER

Classification by FOREMAN

Sheet 3 of 6

Figures in right hand column indicate number of blows required to drive sampling pipe SIX INCHES using 140 lb. weight falling 30 inches.

TEST BORING REPORT

RAYMOND

CONCRETE PILE DIVISION

BOSTON

To JAMES P. COLLINS & ASSOCIATES Date JULY 25 1968 Job No. 14566

Location of Borings HANSCOM FIELD BEDFORD MASSACHUSETTS

All borings are plotted to a scale of 1" = 8 ft. using GROUND SURFACE as a fixed datum.

No. 5

Depth	Description	Blows
0' – 4'	LOOSE BROWN MED TO FINE SAND	3-6-10
4' – 7' 6"	SILT AND PEAT	3-1-4
7' 6" (WL) – 14'	LOOSE COARSE SAND AND FINE GRAVEL	5-6-5
14' – 18'	SEE NOTE A	3-3-3
18' – 20' 6"	SEE NOTE B	2-3-4

WATER LEVEL NOTED AT 6' ONE HALF HOUR AFTER COMPLETION.

19' OF 2.5" CASING USED.

NOTE A—LOOSE BROWN COARSE TO FINE SAND AND MEDIUM TO FINE GRAVEL.

NOTE B—FIRM BROWN COARSE TO FINE SAND AND MEDIUM TO FINE GRAVEL.

7-16-68
GEORGE PULSIFER

No. 6

Depth	Description	Blows
0' – 5'	FIRM BROWN FINE SAND TRACE OF SILT	4-12-16
5' – 9'	LOOSE BROWN VERY FINE SAND	5-7-9
9' – 14' (WL)	FIRM BROWN VERY FINE SAND AND SILT	8-10-11
14' – 18'	LOOSE BROWN COARSE TO FINE SAND	6-7-8
18' –	FIRM BROWN COARSE TO FINE SAND	13 10-11-

WATER LEVEL NOTED AT 12' ONE QUARTER HOUR AFTER COMPLETION.

15' OF 2.5" CASING USED.

7-22-68
GEORGE PULSIFER

No. 7

Depth	Description	Blows
0' – 8' (WL)	LOOSE SAND GRAVEL SILT LOAM AND PEAT (FILL)	3-5-8 3-6-9
8' – 17'	STIFF GRAY SILT TRACE OF SAND	4-6-9
17' – 20' 6"	MEDIUM GRAY SILT TRACE OF SAND	5-7-8 4-4-4

WATER LEVEL NOTED AT 8' ONE QUARTER HOUR AFTER COMPLETION.

15' OF 2.5" CASING USED.

7-24-68
GEORGE PULSIFER

No. 8

Depth	Description	Blows
0' – 3'	LOOSE BROWN FINE SAND	2-4-6
3' – 8' 6" (WL)	HARD BROWN FINE SAND TRACE OF SILT	12-15-21
8' 6" – 15'	STIFF GRAY SILT TRACE OF FINE SAND (COBBLE AT 14'6")	4-5-4 150
15' – 20'	VERY STIFF YELLOW CLAY TRACE OF SAND	14-15-13

WATER LEVEL NOTED AT 4'6" ONE QUARTER HOUR AFTER COMPLETION.

15' OF 2.5" CASING USED.

FOREMAN NOTED HE INSTALLED WATER OBSERVATION WELL AT 17'

FOREMAN ALSO NOTED HE LOST SAMPLE AT 15'

7-18-68
GEORGE PULSIFER

Used 19' of 2.5" Casing — Used 15' of 2.5" Casing — Used 15' of 2.5" Casing — Used 15' of 2.5" Casing

Total Footage 81' 0"
Foreman GEORGE PULSIFER
Classification by FOREMAN
Sheet 4 of 6

Figures in right hand column indicate number of blows required to drive sampling pipe SIX INCHES using 140 lb. weight falling 30 inches.

TEST BORING REPORT

RAYMOND

CONCRETE PILE DIVISION

BOSTON

To JAMES P. COLLINS & ASSOCIATES INC. Date JULY 25 1968 Job No. 14566

Location of Borings HANSCOM FIELD BEDFORD MASSACHUSETTS

All borings are plotted to a scale of 1" 8 ft. using GROUND SURFACE as a fixed datum.

No. 9

Depth	Description	Blows
0'		
	LOOSE BROWN FINE SAND	3-4-5
4'		
	HARD BROWN VERY FINE SAND TRACE OF SILT	12-12-12
9'		
	LOOSE BROWN MED TO FINE SAND	4-7-9
13' WL		
	LOOSE BROWN FINE SAND TRACE OF GRAVEL	5-4-6
17'		
	SEE NOTE A	9-5-3
21'		

WATER LEVEL NOTED AT 12'6" ONE QUARTER HOUR AFTER COMPLETION.

19' OF 2.5" CASING USED.

NOTE A—LOOSE BROWN COARSE TO FINE SAND TRACE OF FINE GRAVEL

7-18-68
GEORGE PULSIFER

No. 10

Depth	Description	Blows
0'		
	SEE NOTE A	1-2-12
1' 6"		
	VERY STIFF GRAY STSILT	9-9-18
9'		
	HARD GRAY FINE SAND TRACE OF SILT	19-21-21
WL		11-18-22
		18-24-25
19' 6"		

WATER LEVEL NOTED AT 12'6" ONE QUARTER HOUR AFTER COMPLETION.

NOTE A—LOOSE BROWN MEDIUM TO FINE SAND TRACE OF SILT

18' OF 2.5" CASING USED.

7-18-68
GEORGE PULSIFER

GENERAL NOTES

BORINGS LOCATED IN THE FIELD BY THE CLIENT, JAMES P. COLLINS & ASSOCIATES INC.

ALL WORK PERFORMED UNDER THE DIRECTION OF CLIENTS INSPECTOR ON THE JOB SITE AT ALL TIMES.

WATER LEVELS INDICATED ARE THOSE OBSERVED WHEN THE BORINGS WERE MADE OR AS NOTED. POROSITY OF THE SOIL STRATA, VARIATIONS OF RAINFALL, SITE TOPOGRAPHY ETC. MAY CAUSE CHANGES IN THESE LEVELS.

ALL CLASSIFICATIONS CONTAINED IN THIS REPORT WERE MADE FROM VISUAL INSPECTION BY OUR FOREMAN.

FIGURES SHOWN AS FRACTIONS INDICATE

NUMERATOR / DENOMINATOR = NUMBER OF BLOWS / PENETRATION IN INCHES

EXAMPLES 50/12 34/6 57/4 ETC.

Used 19' of 2.5" Casing Used 18' of 2.5" Casing

Figures in right hand column indicate number of blows required to drive sampling pipe SIX INCHES using 140 lbs. weight falling 30 inches.

Total Footage 40' 6"
Foreman GEORGE PULSIFER
Classification by FOREMAN
Sheet 5 of 6

TEST BORING REPORT

RAYMOND

CONCRETE PILE DIVISION

BOSTON

LAND PROBES — LAND PROBES

To JAMES P. COLLINS & ASSOCIATES INC. Date 25 JULY 1968 Job No. 14566

Location of Borings HANSCOM FIELD---BEDFORD MASSACHUSETTS

All borings are plotted to a scale of 1" = 8 ft. using GROUND SURFACE as a fixed datum.

No. 3 (0' – 5')

SAND (140 LB. WEIGHT AND OPEN-END 1A ROD)	8, 15, 11, 15, 11

WL. WATER LEVEL AT 1'6"

7-18-68

No. 4 (0' – 6')

SAND (140 LB. WEIGHT AND SPOON)	6, 12, 35, 46, 53

WL. WATER LEVEL AT 2"

7-18-68

No. 7 (0' – 10')

SAND (140 LB. WEIGHT AND OPEN-END 1A' ROD) 28	18, 23, 31, 31, 28, 14, 12, 8, 9, 17

WL. WATER LEVEL AT 7'

7-18-68

No. 10 (0' – 10')

SAND	7, 6, 4	3'
PEAT	2, 5, 2	6'
SAND (140 LB. WEIGHT & OPEN-END 1A' ROD)	5, 11, 8, 17	10'

WL. WATER LEVEL AT 4'6"

7-23-68

No. 2 (0' – 5')

SAND (140 LB. WEIGHT AND OPEN-END 1A'ROD)	6, 11, 12, 14, 26

WL. WATER LEVEL AT 10"

7-18-68

No. 5 (0' – 7' 6")

SAND (140 LB WEIGHT AND OPEN-END 1A' ROD)	13, 8, 15, 28, 27, 15, 21, 10

WL. WATER LEVEL AT 3'6"

7-18-68

No. 8 (0' – 10')

SAND (140 LB. WEIGHT AND OPEN-END 1A' ROD)	13, 19, 28, 28, 26, 20, 16, 14, 17, 16

WL. WATER LEVEL AT 4'6"

7-18-68

No. 11 (0' – 8')

SAND (140 LB. WEIGHT AND 1.5" SPOON)	8, 10, 8, 11, 29, 15, 20, 28

WL. WATER LEVEL AT 5'

7-23-68

No. 1 (0' – 5')

SAND (140 LB. WEIGHT AND OPEN-END 1A' ROD)	7, 18, 30, 51, 37

WL. WATER LEVEL AT 6"

7-18-68

No. 6 (0' – 7' 6")

SAND	7	1'
PEAT	2, 18	2' 6"
SAND (140 LB. WEIGHT AND OPEN-END 1A' ROD)	32, 23, 9, 9, 10	7' 6"

WL. WATER LEVEL AT 2'6"

7-18-68

No. 9 (0' – 7')

SAND (140 LB. WEIGHT AND OPEN-END 1A' ROD)	18, 17, 13, 12, 22, 30, 29

WL. WATER LEVEL AT 4'10"

7-18-68

No. 12 (0' – 8')

SAND AND WOOD FILL	8, 8, 6, 4, 3	5'
SAND	9, 15, 17	8'

WL. WATER LEVEL AT 4'

USED 140 LB. WEIGHT AND 1.5" SPOON.

7-23-68

Figures ... indicate number of blows required to drive A 1.5" pipe OR OPEN-END 1A' ROD ... weight falling 30 inches.

Total Footage 89' 0"

Foreman GEORGE B. PULSIEER

Classification by FOREMAN

Sheet 6 of 6

G-3

Well Logs for Groundwater Supply Development Wells Installed at Hanscom Field (Metcalf and Eddy Engineers, 1960)

PAGE A-1

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CLIENT USAF Hanscom Field

DRILLER R.E. Chapman Co.

HOLE NO 1

DATE DRILLED 11 April - 12 April 1960

STATIC WATER LEVEL

CASING

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN: First 22-in. Pipe Perforated

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES Used 1" diameter Wash Pipe Open End.

Casing 2-1/2" Diameter first 22" perforated

Removed Casing

Coordinates

N	E
530 485	659 013

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	1'
	Yellowish brown fine to medium sand, some gravel, subangular; trace of silt SP	5'
		6'
	Gray silty fine sand, subangular SM	10'
		15'
18'		18'
	Gray Clay CL	20'
		25'
		30'
		33'
	Gray Clay Some Med. Sand Subangular	34'
	Gray Clay CL	35'
11 April '60 38'		
		40'
		45'
		50'

INSPECTOR J.E. Moon

22101-2 64282

PAGE A-2
CONT. LOG

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Gray Clay CL	
12 April		
		55'
	11 April -	58'
	Gray silty med. sand angular, some clay SP - SM	
		60'
12 April	12 April	62.3'
	Rock	
		65'

CLIENT USAF Hanscom Field

DRILLER R.E. Chapman Co.

HOLE NO 1

DATE DRILLED 11 April -

STATIC WATER LEVEL

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE

SCREEN: 22-in. Pipe Perforated

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES 11 April 1960 - Water Level at 2' below grd. surf at end of day 15 min. after work had stopped.

12 April '60 - Water level at start of work at top of casing +0.5' above ground.

12 April - Hole to 62.3' - tried to hand pump. Very hard pumping. Water pumped indicated poor circulation carried silt and clay and hard pumping indicated only small flow.

Drove casing to refusal at 62.3'

Removed casing.

Hole complet at 62.3'

ordinates

N	E
530 485	659 013

INSPECTOR J.E. Moon

22101-2-64282

PAGE A-3

METCALF & EDDY
ENGINEERS
BOSTON, MASS
WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat	1'
	Yellowish brown fine sand, some silt. Grain's subangular SP	4'
	Gray Clay	5'
		10'
		15'
		20'
13 April		
		25'
		30'
		35'
		40'
		45'
		50'

CLIENT USAF Hanscom Field

DRILLER Chapman (J.Ward & Son)

HOLE NO 2

DATE DRILLED 13 April 1960

STATIC WATER LEVEL

CASING

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M

DRAW-DOWN

HOURS

VACUUM

NOTES

No Circulation

Coordinates

N E

531 411 [illegible]29 219

INSPECTOR J. E. Moon

PAGE A-4

CONT LOG

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Gray Clay	
		55'
		60'
		64.8'
	Refusal	
		65'
		70'

CLIENT USAF Hanscom Field

DRILLER Chapman (J. Ward & Son)

HOLE NO 2

DATE DRILLED 13 April 1960

STATIC WATER LEVEL

CASING

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Ex. Strength

SCREEN

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES

Hole cased to 24.0'. Rest of hole thru clay. Some coarse sand above rock but this material mostly clay.

Did not try to pump hole. Hole completed at 64.8'.

Removed Casing

Coordinates

N	E
531 411	659 219

INSPECTOR J. E. Moon

PAGE A-5

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	2'
	Gray medium sand, subangular	5', 9'
	Gray Clay CL	15', 20', 25', 30', 35', 40', 45', 47'
	Brownish Gray med. to coarse sand SP	

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward) Rig. #1

HOLE NO 3

DATE DRILLED 14-15 April

STATIC WATER LEVEL 2.1'above surface

CASING

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Ex. Strength

SCREEN: First 24" Casing Perforated

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST

DATE

PUMP USED. 3" Centrifugal

G.P.M

DRAW-DOWN

HOURS

VACUUM

NOTES 14 April - Pulled casing to 58' below surface. 24" perforated casing at end of casing. Pumped 75 gpm. Set 12 ft. of screen. 20 gpm.

Left 58' of casing in place

Pumping test

Pumped 9-3/4 hr.
Drawdown 6'-1"
Pumping 60+ gpm.

Coordinates

N	E
531 701	659 563

INSPECTOR J. E. Moon

PAGE A-6
CONT. LOG

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Brownish gray med. to coarse sand	50'
		55'
		60'
	SP	62.5
	Gray fine sand SP	
14 April		65'
	Refusal	

CLIENT USAF Hanscom Field
DRILLER Chapman (Ward) Rig. #1
HOLE NO 3
DATE DRILLED 14-15 April
STATIC WATER LEVEL 2.1' above surface
CASING:
METAL Wrought Iron DIA 2-1/2"
SCHEDULE Ex. Strength

SCREEN:
MAKE ______ METAL ______
SIZE ______ LENGTH ______
SLOTS ______
FITTINGS ______
PUMPING TEST:
DATE ______
PUMP USED ______
G.P.M ______
DRAW-DOWN ______
HOURS ______
VACUUM ______
NOTES: On Page #1

Coordinates

N	E
531 701	659 569

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	2'
	Gray medium to fine sand SP	9'
	Gray Clay CL	47'
	Brownish gray med. to coarse sand SP	58'
	Refusal	60'

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO 3 A
DATE DRILLED 19 April 1960
STATIC WATER LEVEL +2.1'
CASING:
METAL Wrought Iron DIA. 2-1/2"
SCHEDULE Ex. Strength

SCREEN:
MAKE METAL
SIZE LENGTH
SLOTS
FITTINGS

PUMPING TEST:
DATE
PUMP USED
G.P.M.
DRAW-DOWN
HOURS
VACUUM

NOTES Observation Hole,
Removed Casing

Coordinates

N	E
531 598	659 571

INSPECTOR J. E.

METCALF & EDDY
ENGINEERS
BOSTON, MASS

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Loam, sandy OL	1'
	Gray fine sand some silt SP-SM	5', 8'
	Gray clayey silt ML	10', 15', 20', 25', 26'
	Gray clay some silt CL	30', 35', 40', 45', 50'

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward)

HOLE NO 4

DATE DRILLED 15-18 April 1960

STATIC WATER LEVEL 8.8'

CASING

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN

MAKE ______ METAL

SIZE ______ LENGTH

SLOTS ______

FITTINGS ______

PUMPING TEST:

DATE ______

PUMP USED

G.P.M ______

DRAW-DOWN ______

HOURS ______

VACUUM ______

NOTES

Poor circulation

Removed Casing

Coordinates

N 534 056   E [illegible]

INSPECTOR J. E. Moon

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Gray med. to coarse angular sand, some fine gravel, trace of silt	50'
		55'
		60'
	SP	63'
	Refusal	

PAGE A-9

CONT. LOG

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward)

HOLE NO 4

DATE DRILLED 15-18 April 1960

STATIC WATER LEVEL 8.8'

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE ______ METAL ______

SIZE ______ LENGTH ______

SLOTS ______

FITTINGS ______

PUMPING TEST:

DATE ______

PUMP USED ______

G.P.M. ______

DRAW-DOWN ______

HOURS ______

VACUUM ______

NOTES:

Poor circulation

Coordinates

N	E
534 056	655 73

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	1'
	Yellowish brown fine sand, some silt. Sand subangular SP	5'
		10'
	Gray clay CL	15'
		20'
		25'
	Gray sandy clay. Sand med. grain and subangular SC	30'
		35'
		40'
	Gray med. to coarse sand and med. gravel subangular SP	42'
13 April	Refusal	43'
		45'

CLIENT USAF Hanscom Field

DRILLER Chapman (Wiles) Rig. #2

HOLE NO 5

DATE DRILLED 13 April - 14 April

STATIC WATER LEVEL --

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE ______ METAL ______

SIZE ______ LENGTH ______

SLOTS ______

FITTINGS ______

PUMPING TEST:

DATE ______

PUMP USED ______

G.P.M ______

DRAW-DOWN ______

HOURS ______

VACUUM ______

NOTES:

No pumping applied to this hole, only 1 ft. of sandy material above depth of refusal.

Refusal at 43'

Removed Casing

Coordinates

N	E
533 006	659 044

INSPECTOR J.E. Moon

3:191-2-00282

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Yellowish brown sandy gravel. Gravel coarse, sand med. to fine. Subangular GP	3'
	Yellowish brown fine sand, subangular SP	16'
	Yellowish brown fine sand, med. to fine grains subangular SP	20'
14 April	Yellowish brown-silty coarse sand and fine gravel. Subangular SP	21'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile) Rig. #2

HOLE NO 6

DATE DRILLED 14 April 1960

STATIC WATER LEVEL 10.9'

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE Johnson METAL

SIZE #20 LENGTH 10

SLOTS

FITTINGS

PUMPING TEST

DATE 14 April 1960

PUMP USED 3" Centrifugal

G.P.M. 10

DRAW-DOWN

HOURS

VACUUM

NOTES: Refusal at 21'.
Install Johnson #20 screen
10 ft. length. Casing raised
9 ft. Pumped approx. 10 gpm.

Removed Casing and Screen

Coordinates

N	E
533 548	660 037

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat	
	OL	5'
	Dark gray med. to coarse sand, some fine gravel	6'
		10'
	SP	14'
	Gray soft silty clay	15'
		20'
	CL	24'
	Gray silt, some med. to coarse sand	
		30'
	ML	34'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER R.E. Chapman (Ward)

HOLE NO 8

DATE DRILLED 22 April 1960

STATIC WATER LEVEL 1' below surface

CASING:

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M

DRAW-DOWN

HOURS

VACUUM

NOTES

No circulation

Removed Casing

Coordinates

N	E
537 691	55[illegible] 203

INSPECTOR J. E. Moon

PAGE A-13

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	1'
	Brownish gray med. sand and fine gravel SP	5', 9'
	Gray Clay CL	10', 15', 18'
	Yellowish brown and gray med. to coarse sand and fine gravel SP	20', 22'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile)

HOLE NO 10

DATE DRILLED 20 April 1960

STATIC WATER LEVEL 9'

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES:

No circulation

Removed Casing

Coordinates

N	E
537 813	653 810

INSPECTOR J. E. Moon

22101-2-64282

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Brown to light brown med. sand, occasional gray lumps of clay SP	5'
	Peat OL	7'
	Brown med. to fine sand SP	10' / 13'
	Gray clay CL	15' / 20'
	Yellowish brown coarse sand to fine gravel SP	30'
	Gray clay and gravel GC	36'
	Packed coarse sand and gravel SP	37'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wiles)

HOLE NO 11

DATE DRILLED 15 April 1960

STATIC WATER LEVEL 4.9' below surface

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE Johnson METAL

SIZE #20 LENGTH 10 ft.

SLOTS

FITTINGS

PUMPING TEST:

DATE 15 April 1960

PUMP USED 3" Cent.

G.P.M. 40

DRAW-DOWN

HOURS

VACUUM

NOTES:

Exposed 9 ft. of screen. Casing pulled back to 21'. Pumped 40 gpm.

10' Screen 21' 2-1/2"

Casing Left in Place

Rem. Screen & Casing

Coordinates

N	E
534 874	660 726

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Brown med. to fine sand. SP	0'–9'
	Brown med. sand SP	9'–20'
	Gray fine to med. sand SP	20'–25'
	Gray clay CL	25'–39'
	Gray med. gravel Sharp tightly packed GP	39'–43'
	Refusal	43'

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO 11A Observation for Hole #11 (8")
DATE DRILLED 20 May 1960
STATIC WATER LEVEL --
CASING:
METAL Wrought Iron DIA. 2-1/2"
SCHEDULE Ex. Strength
SCREEN:
MAKE Johnson METAL
SIZE #20 LENGTH 5'
SLOTS
FITTINGS
PUMPING TEST:
DATE 20 May 1960
PUMP USED 3" Cent.
G.P.M. 5
DRAW-DOWN --
HOURS --
VACUUM --
NOTES:
Exposed 3' No. 20 screen
Pumped 5 gpm. Poor circulation

40' Casing 5' Screen
Left in Place

Coordinates
N E
534 930 660 820

INSPECTOR J. E. Moon

2210F-2-68282

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Grayish brown fine sand, some gravel and silt SP	2'
	Brown med. to fine sand SP	5' / 10'
	Gray clay CL	15' / 20' / 25' / 30' / 31'
14 April '60	Gray coarse sand some sharp fine gravel SP	34'
	Refusal	

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METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CLIENT USAF Hanscom Field

DRILLER Chapman (Wiles) Rig. #2

HOLE NO 12

DATE DRILLED 14 April 1960

STATIC WATER LEVEL 8' below surface

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE ______ METAL ______

SIZE ______ LENGTH ______

SLOTS ______

FITTINGS ______

PUMPING TEST:

DATE ______

PUMP USED ______

G.P.M. ______

DRAW-DOWN ______

HOURS ______

VACUUM ______

NOTES:

No water

Removed Casing

Coordinates

N	E
534 846	661 732

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Fill Material Gravel, Sand, Clay Lumps and Peat Lumps	5'
	Grayish Brown Med. Sand SP	6' – 12'
	Yellowish Brown Med. to Fine Sand SP	12' – 16'
	Gray Clay, Trace of Med. Sand CL	16' – 30'
	Brown fine sand SP	30' – 35'
	Brown Med. to coarse sand and gravel (fine) SP	35' – 42'
	Brown Coarse Sand and Med. to fine gravel SP	42' – 44'
	Refusal	45'

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO 13
DATE DRILLED 23 April 1960
STATIC WATER LEVEL 5.8' Below Surface
CASING:
METAL Wrought Iron DIA. 2-1/2"
SCHEDULE Ex. Strength

SCREEN:
MAKE Johnson METAL
SIZE #20 LENGTH 10'
SLOTS
FITTINGS

PUMPING TEST:
DATE 23 April 1960
PUMP USED 3" Cent.
G.P.M. 45
DRAW-DOWN
HOURS
VACUUM

NOTES: Hole pumped approx. 45 gpm. Placed observation hole within 2' of original hole for drawdown observations during pumping test.

Pulled casing back to 36' below surface. Exposed 8' of #20 screen. Screen to 44'.

6 May 1960 Removed Screen & Casing

Coordinates

N	E
535 261	661 829

22101-2-64282

METCALF & EDDY
ENGINEERS
BOSTON, MASS.
WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Fill Material Gravel, Sand, Clay Lumps & Peat Lumps	5'
	Grayish Brown Medium Sand	6' – 10'
	Yellowish Brown Med. to Fine Sand	15'
	Gray Clay. Trace of Med. Sand	16' – 20' – 25'
	Brown Fine Sand	30'
	Brown Med. to Coarse Sand & Fine Gravel	35' – 40'
	Brown Coarse Sand & Med. to Fine Gravel	42'
	Refusal	44' – 45'

CLIENT USAF Hanscom Field

DRILLER R.E. Chapman Co. (Wile)

HOLE NO 13A

DATE DRILLED 23 April 1960

STATIC WATER LEVEL

CASING:

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE Johnson METAL

SIZE #20 LENGTH 10'

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES: To Be Used as Observation Well for 8" Test Well

36' Casing & 10' Screen Left in Place

Coordinates

N	E
535 261	661 828

INSPECTOR J. E. Moon

METCALF & EDDY ENGINEERS BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Fill Material Sand, Gravel Cobbles	5'
		7'
	Brown Medium Sand	10'
	SP	14'
	Gray Clay	15'
		20'
		25'
		30'
		35'
	CL	39'
	Gray Fine Sand Some Silt	40'
		45'
	SP	48'
	Gray Silty Gravel Sharp, Tightly packed (Not to Scale)	53'

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile)

HOLE NO 13B (Observation for #13(8)

DATE DRILLED 23 May 1960

STATIC WATER LEVEL

CASING:

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Ex. Strength

SCREEN:

MAKE Johnson METAL

SIZE #20 LENGTH 5'

SLOTS

FITTINGS

PUMPING TEST:

DATE 23 May 1960

PUMP USED 3" Cent.

G.P.M. 5

DRAW-DOWN --

HOURS --

VACUUM --

NOTES:

Expose 3' of #20 Screen. Pumped approx. 5 gpm. Circulation poor

50' Pipe in Place

5' Screen in Place

Coordinates

N	E
535 145	661 757

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Grayish brown fine to med. sand, some gravel & silt SP	5'
		9'
	Grayish brown medium sand SP	10'
		15'
		17'
	Gray Clay CL	37'
	Brown fine silty sand SP-SM	39'
	Brown med. sand SP	40'
		45'
15 April	Grayish brown med. to coarse sand and fine gravel SP	47'
	Refusal	

CLIENT USAF Hanscom Field
DRILLER Chapman (Wiles)
HOLE NO 14
DATE DRILLED 15 April 1960
STATIC WATER LEVEL 8' below surface

CASING
METAL Wrought Iron DIA 2-1/2"
SCHEDULE Extra Strength

SCREEN
MAKE Johnson METAL
SIZE #30 LENGTH 10'
SLOTS
FITTINGS

PUMPING TEST
DATE
PUMP USED
G.P.M
DRAW-DOWN
HOURS
VACUUM

NOTES Exposed 8' of #30 screen. Bottom of screen at 45'. Pumped approx. 40 gpm. Water tastes of iron.

Water samples taken to M&E lab.

Removed Casing & Screen

Coordinates

N	E
535 545	562 341

INSPECTOR J. E. Moon

PAGE A-21

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	2'
	Gray fine to med. sand, some gravel SP	5' 6'
	Gray clayey medium sand SC	10' 15' 20' 23'
	Gray fine sand some angular gravel, some silt SP	25' 29'
	Refusal	30'

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward)

HOLE NO #15

DATE DRILLED 20 April 1960

STATIC WATER LEVEL ---

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Ex. Strength

SCREEN

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES No circulation

Removed Casing

Coordinates

N	E
535 810	662 744

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS		DEPTH FROM SURFACE
	Peat	OL	0.5
	Brown med. to fine sand some fine gravel	SP	5' 7'
	Gray clay soft, trace of fine sand	CL	10' 15' 19'
	Brown fine to med. sand, some fine gravel	SP	20' 21'
	Gray fine to med. sand and some gravel angular. Material hard packed		25' 28'
	Refusal		35' 40' 45' 50'

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward)

HOLE NO #17

DATE DRILLED 21 April 1960

STATIC WATER LEVEL 2' below surface

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE ______ METAL ______

SIZE ______ LENGTH ______

SLOTS ______

FITTINGS ______

PUMPING TEST:

DATE ______

PUMP USED ______

G.P.M. ______

DRAW-DOWN ______

HOURS ______

VACUUM ______

NOTES: No circulation

Removed Casing

Coordinates

N	E
535 937	662 744

INSPECTOR J. E. Moon

22101-2-64-87

PAGE A-23

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	3'
	Gray medium to fine sand SP	5', 9'
	Gray Clay CL	10', 15', 20', 25', 28'
	Brown medium sand and fine gravel SP	30', 33'
	Refusal	35'

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO 18
DATE DRILLED 19 April 1960
STATIC WATER LEVEL 2'
CASING.
METAL Wrought Iron DIA 2-1/2"
SCHEDULE Extra Strength

SCREEN First 22-in. Pipe Perforated
MAKE METAL
SIZE LENGTH
SLOTS
FITTINGS
PUMPING TEST
DATE
PUMP USED
G.P.M
DRAW-DOWN
HOURS
VACUUM
NOTES
No Circulation

Removed Casing

Coordinates

N	E
535 731	661 729

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS		DEPTH FROM SURFACE
	Peat	OL	0.5'
	Brownish gray med. to coarse sand	SP	5' / 6'
	Gray clay	CL	10' / 15'
	Medium to coarse gravel	GP	20'
	Refusal		

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO 20
DATE DRILLED 19 April 1960
STATIC WATER LEVEL 2' below surface
CASING:
METAL Wrought Iron DIA 2-1/2"
SCHEDULE Extra Strength

SCREEN:
MAKE METAL
SIZE LENGTH
SLOTS
FITTINGS
PUMPING TEST:
DATE
PUMP USED
G.P.M
DRAW-DOWN
HOURS
VACUUM
NOTES

Removed Casing

Coordinates

N	E
535 808	660 713

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	0.5'
	Brownish gray med. to coarse sand SP	5' / 7'
	Yellowish gray clay CL	10' / 15' / 17'
	Brown coarse sand & fine to medium gravel SP	20' / 23'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wiles)

HOLE NO 20A

DATE DRILLED 19 April 1960

STATIC WATER LEVEL 2' below surface

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE Johnson METAL

SIZE #30 LENGTH 4'

SLOTS

FITTINGS

PUMPING TEST

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES: Tried to pump. Exposed 4' of screen #30, bottom of screen at 23'. Pumped approx. 5 gpm.

Hole located 25' east of hole #20. This hole drilled to verify depth to refusal of hole #20.

Removed Casing & Screen

Coordinates

N	E
535 802	660 748

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat, OL	0.5'
	Yellowish brown med. to fine sand SP	6'
	Gray Clay CL	20'
	Gray med. to fine sandy gravel GP	25'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile)

HOLE NO 21

DATE DRILLED 20 April 1960

STATIC WATER LEVEL 2'

CASING

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST

DATE

PUMP USED

G.P.M

DRAW-DOWN

HOURS

VACUUM

NOTES

No circulation

Removed Casing

Coordinates

N 535 914

E 660 174

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	1'
	Brown medium sand SP	8'
	Gray Fine Sand SP	30'
	Gray Clay CL	48'
	Medium to coarse sand SP	56'
	Med. to coarse gravel, some sand GP	57'
	Refusal	

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO 22
DATE DRILLED 18 April 1960
STATIC WATER LEVEL 2' below surface
CASING:
METAL Wrought Iron DIA 2-1/2"
SCHEDULE Extra Strength

SCREEN:
MAKE Johnson METAL
SIZE #30 LENGTH 10'
SLOTS
FITTINGS
PUMPING TEST:
DATE 18 April 1960
PUMP USED 3" Cent.
G.P.M. 25
DRAW-DOWN
HOURS
VACUUM
NOTES Exposed 8' of screen #30 slot, bottom of screen at 57'. Pumped approx. 25 gpm. Water tastes & field testing indicates high iron (4 ppm. ±).

Removed screen & casing

Coordinates

N	E
535 921	659 696

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Brown fine sand (SP)	9'
	Gray silty clay Some Sand (CL)	28'
	Gray clay trace sand (CL)	60'
	Gray fine to med. sand, some silt, trace of clay (SP)	67.3
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward)

HOLE NO 23

DATE DRILLED 25 April 1960

STATIC WATER LEVEL 2.5'

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE ______ METAL ______

SIZE ______ LENGTH ______

SLOTS ______

FITTINGS ______

PUMPING TEST:

DATE ______

PUMP USED ______

G.P.M. ______

DRAW-DOWN ______

HOURS ______

VACUUM ______

NOTES Casing pulled back to 64 ft. Left casing in place.

Coordinates

N	E
531 746	659 711

INSPECTOR J. E. Moon

32101-2-68282

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Top Soil	1'
	Brown fine to medium sand SP	29'
	Gray silty clay CL	58'
	Gray fine to med. sand, some clay, and fine gravel. Tightly packed. SP	61'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward)

HOLE NO 25

DATE DRILLED 26 April 1960

STATIC WATER LEVEL 9.3'

CASING

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES: No Circulation

Removed casing

Coordinates

N	E
535 254	654 553

INSPECTOR J. E. Moon

22101-2-6##22

PAGE A-30

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Top Soil	0.75
	Gray fine to med. sand SP	18'
	Gray Clay CL	40'
	Gray coarse sand, some fine to med. gravel. Tightly packed. SP	43'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile)

HOLE NO #26

DATE DRILLED 26 April 1960

STATIC WATER LEVEL

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES:

Removed Casing

Coordinates

N	E
535 737	656 010

INSPECTOR J. E. Moon

3212 2-64282

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Top Soil	1'
	Brown medium to coarse silty sand, some fine gravel. SP	19'
	Gray clay some sand and fine gravel CL	49'
	Gray silty clay little sand & fine gravel CL	53'
	Refusal	

CLIENT USAF Hanscom Field
DRILLER Chapman (Ward)
HOLE NO 27
DATE DRILLED 27 April 1960
STATIC WATER LEVEL 6.5'
CASING:
METAL Wrought Iron DIA. 2-1/2"
SCHEDULE Extra Strength

SCREEN:
MAKE METAL
SIZE LENGTH
SLOTS
FITTINGS
PUMPING TEST:
DATE
PUMP USED
G.P.M.
DRAW-DOWN
HOURS
VACUUM
NOTES: No circulation
Removed casing

Coordinates

N	E
534 996	656 362

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Top Soil OL	1'
	Gray coarse to medium sand SP	11'
	Gray silty clay CL	28'
	Gray silty coarse sand SP	29'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile)

HOLE NO 28

DATE DRILLED 27 April 1960

STATIC WATER LEVEL --

CASING:

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES No circulation

Removed Casing

Coordinates

N	E
536 336	657 439

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Grayish fine to coarse sand some medium gravel and clay. Tightly packed, hardpan. SP	17'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile)

HOLE NO 29

DATE DRILLED 27 April 1960

STATIC WATER LEVEL

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M.

DRAW-DOWN

HOURS

VACUUM

NOTES: No circulation

Removed Casing

Coordinates

N	E
537 724	656 688

INSPECTOR J. E. Moon

22101-2-64282

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METCALF & EDDY
ENGINEERS
BOSTON, MASS.
WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Brown clayey silt, some fine sand and fine gravel. SM	
		5.0'
	Brown medium to coarse sandy gravel GP	
		17'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile)

HOLE NO 30

DATE DRILLED 26 April 1960

STATIC WATER LEVEL 2.0'

CASING:

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE Johnson METAL

SIZE #20 LENGTH 10'

SLOTS

FITTINGS

PUMPING TEST:

DATE 26 April 1960

PUMP USED 3" cent

G.P.M. 75

DRAW-DOWN

HOURS

VACUUM

NOTES: This hole pumped 75 gpm. Other wells to be placed in immediate vicinity in order to attempt to find greater depth. See 30A & 30B.

Removed Casing & Screen

Coordinates

N	E
538 147	657 883

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Brown medium sand (SP)	5'
	Gray Clay (CL)	12'
	Brown fine to medium gravel (GP)	28'
	Refusal	

CLIENT: USAF Hanscom Field
DRILLER: Chapman (Wile)
HOLE NO: 30A
DATE DRILLED: 28 April 1960
STATIC WATER LEVEL: + 1.0'

CASING:
METAL: Wrought Iron DIA. 2-1/2"
SCHEDULE: Extra Strength

SCREEN:
MAKE: Johnson METAL:
SIZE: #30 LENGTH: 10
SLOTS:
FITTINGS:

PUMPING TEST:
DATE:
PUMP USED:
G.P.M:
DRAW-DOWN:
HOURS:
VACUUM:

NOTES: Pump for 2 hrs. 35 gpm.
Drawdown 66.0 ft. away, 2 ft.
Drawdown 128.0 ft. away, 1 ft.
Drawdown measured on two existing holes (2-1/2" cased).
There was no information available on these holes.

Removed Casing

Coordinates

N	E
538 145	658 253

INSPECTOR: J. E. Moon

12101-2 08-82

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METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Fill Material. Sand & gravel. SP	3'
	Peat OL	5'
	Grayish brown medium to coarse sand. SP	16'
	Bluish Gray Clay CL	28'
	Gray fine to med. sand SP	29'
	Gray coarse sand to med. gravel GP	30'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Wile)

HOLE NO 30B

DATE DRILLED 28 April 1960

STATIC WATER LEVEL -

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M

DRAW-DOWN

HOURS

VACUUM

NOTES: No circulation

Removed Casing

Coordinates

N E

537 945 658 478

INSPECTOR J. E. Moon

22101 Z-64282

PAGE A-37

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Topsoil	1'
	Brownish gray medium sand, some organic material SP	15'
	Brown silty fine sand, some fine gravel, occasional lumps of brown clay. Tightly packed. SP	37'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward)

HOLE NO #31

DATE DRILLED 28 April 1960

STATIC WATER LEVEL 8.3'

CASING:

METAL Wrought Iron DIA 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M

DRAW-DOWN

HOURS

VACUUM

NOTES: Poor circulation

Removed Casing

Coordinates

N E.

534 741 659 383

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Topsoil	1'
	Reddish Brown fine sand	
	SP	17'
	Brown medium to fine sand. Tightly packed.	
	SP	34'
	Gray fine sand, some sharp fine gravel.	
	SP	48'
	Refusal	

CLIENT USAF Hanscom Field
DRILLER Chapman (Ward)
HOLE NO 32
DATE DRILLED 28 April 1960
STATIC WATER LEVEL 1.4'
CASING:
METAL Wrought Iron DIA. 2-1/2"
SCHEDULE Extra Strength

SCREEN:
MAKE ______ METAL ______
SIZE ______ LENGTH ______
SLOTS ______
FITTINGS ______
PUMPING TEST:
DATE ______
PUMP USED ______
G.P.M. ______
DRAW-DOWN ______
HOURS ______
VACUUM ______
NOTES: No circulation

Removed Casing

Coordinates

N	E
535 389	559 558

INSPECTOR J. E. Moon

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METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Brown coarse sand SP	5'
	Yellowish gray sandy clay CL	7'
	Brown medium to coarse sand SP	14'
	Refusal	

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO 33
DATE DRILLED 28 April 1960
STATIC WATER LEVEL
CASING:
METAL Wrought Iron DIA. 2-1/2"
SCHEDULE Extra Strength

SCREEN:
MAKE METAL
SIZE LENGTH
SLOTS
FITTINGS

PUMPING TEST:
DATE
PUMP USED
G.P.M.
DRAW-DOWN
HOURS
VACUUM

NOTES: Moved to #33A
100' east of #33.

Removed Casing

Coordinates
N E
536 025 658 963

INSPECTOR J. E. Moon

22101-2-04282

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Brown coarse sand SP	7'
	Brownish gray fine sand SP	16'
	Brown silty medium gravel, some coarse sand GP	18'
	Gray clay CL	38'
	Coarse sand, some fine gravel SP	42'
	Refusal	

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO #33A
DATE DRILLED 28 April 1960
STATIC WATER LEVEL 1.5'
CASING:
METAL Wrought Iron DIA 2-1/2"
SCHEDULE Extra Strength

SCREEN:
MAKE ______ METAL ______
SIZE ______ LENGTH ______
SLOTS ______
FITTINGS ______

PUMPING TEST:
DATE ______
PUMP USED ______
G.P.M. ______
DRAW-DOWN ______
HOURS ______
VACUUM ______

NOTES: Poor circulation

Removed Casing

Coordinates
N E
536 014 659 078

INSPECTOR J. E. Moon

22701-2-10172

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METCALF & EDDY ENGINEERS BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Peat OL	2'
	Grayish brown fine to medium sand. SP	14'
	Gray clay, some fine sand CL	36'
	Gray silty coarse sand, some fine gravel SP	38'
	Gray medium sandy gravel GP	40'
	Refusal	

CLIENT: USAF Hanscom Field

DRILLER: Chapman (Wile)

HOLE NO: #35

DATE DRILLED: 27 April 1960

STATIC WATER LEVEL: 3.0'

CASING:

METAL: Wrought Iron DIA. 2-1/2"

SCHEDULE: Extra Strength

SCREEN:

MAKE: Johnson METAL:

SIZE: #30 LENGTH: 10 ft.

SLOTS:

FITTINGS:

PUMPING TEST:

DATE:

PUMP USED:

G.P.M.:

DRAW-DOWN:

HOURS:

VACUUM:

NOTES: Poor circulation

Removed Casing & Screen

Coordinates

N	E
536 974	658 441

INSPECTOR: J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Clay & gravel	5'
	Med. to coarse gravel	15'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER R.E. Chapman Co. (Wile)

HOLE NO 40

DATE DRILLED 29 April 1960

STATIC WATER LEVEL -

CASING:

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE ____ METAL ____

SIZE ____ LENGTH ____

SLOTS ____

FITTINGS ____

PUMPING TEST:

DATE ____

PUMP USED ____

G.P.M. ____

DRAW-DOWN ____

HOURS ____

VACUUM ____

NOTES:

Removed Casing

Coordinates

N	E
535 022	661 342

INSPECTOR J. E. Moon

22101-2-64282

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Fill, mixture of sand, gravel, lumps of clay.	5'
	Grayish brown medium to coarse gravel, some sand GP	17'
	Refusal	

PAGE A-4?

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CLIENT USAF Hanscom Field
DRILLER Chapman (Wile)
HOLE NO 40-A
DATE DRILLED 29 April 1960
STATIC WATER LEVEL
CASING:
METAL Wrought Iron DIA. 2-1/2"
SCHEDULE Extra Strength

SCREEN
MAKE METAL
SIZE LENGTH
SLOTS
FITTINGS
PUMPING TEST:
DATE
PUMP USED
G.P.M.
DRAW-DOWN
HOURS
VACUUM
NOTES:

Removed Casing

Coordinates

N	E
534 856	661 252

INSPECTOR J. E. Moon

22T01-Z-C-N2BZ

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METCALF & EDDY ENGINEERS BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Topsoil	2'
	Brown medium to coarse sand. SP	16'
	Brown fine to coarse sand, and fine to coarse gravel highly weathered material. SP	22'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman

HOLE NO 41 (Wile)

DATE DRILLED 29 April 1960

STATIC WATER LEVEL

CASING:

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE METAL

SIZE LENGTH

SLOTS

FITTINGS

PUMPING TEST:

DATE

PUMP USED

G.P.M

DRAW-DOWN

HOURS

VACUUM

NOTES: Very little water.

Circulation poor.

Removed Casing

Coordinates

N E

534 580 653 604

INSPECTOR J.E.Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Topsoil	1'
	Grayish brown fine sand SP	11'
	Brown medium to coarse silty sand, some fine gravel. Material tightly packed. SP	26'
	Gray fine silty sand, fine sharp gravel, tightly packed. SP	35'
	Refusal	

CLIENT USAF Hanscom Field
DRILLER Chapman (Ward)
HOLE NO 42
DATE DRILLED 29 April 1960
STATIC WATER LEVEL 0.3'
CASING
METAL Wrought Iron DIA. 2-1/2"
SCHEDULE Extra Strength

SCREEN
MAKE METAL
SIZE LENGTH
SLOTS
FITTINGS

PUMPING TEST:
DATE
PUMP USED
G.P.M
DRAW-DOWN
HOURS
VACUUM

NOTES Poor Circulation

Removed Casing

Coordinates

N	E
532 570	654 470

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Topsoil	1'
	Grayish brown fine sand SP	11'
	Brown medium to coarse silty sand, some fine gravel. Material tightly packed. SP	26'
	Gray fine silty sand, fine sharp gravel, tightly packed. SP	35'
	Refusal	

CLIENT USAF Hanscom Field

DRILLER Chapman (Ward)

HOLE NO 42

DATE DRILLED 29 April 1960

STATIC WATER LEVEL 0.3'

CASING:

METAL Wrought Iron DIA. 2-1/2"

SCHEDULE Extra Strength

SCREEN:

MAKE ______ METAL ______

SIZE ______ LENGTH ______

SLOTS ______

FITTINGS ______

PUMPING TEST:

DATE ______

PUMP USED ______

G.P.M ______

DRAW-DOWN ______

HOURS ______

VACUUM ______

NOTES: Poor Circulation

Removed Casing

Coordinates

N E

532 570 654 470

INSPECTOR J. E. Moon

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CLIENT USAF Hanscom Field
DRILLER R.E. Chapman Co.
HOLE NO 11
DATE DRILLED 17 May 1960
STATIC WATER LEVEL
CASING:
METAL W.I. DIA. 8"
SCHEDULE Ex. Strength

SCREEN:
MAKE Johnson METAL
SIZE #60 LENGTH 10 Ft.
SLOTS
FITTINGS

PUMPING TEST:
DATE 18 May 1960
PUMP USED Cent.
G.P.M. Unsteady
DRAW-DOWN 22 Ft.
HOURS Intermittent
VACUUM Varies

NOTES 5/18 Could Not Get Water To Flow Steadily Due To Capacity Of Pump. First Tried To Surge Well With Screen Bet. Bottom (42') And 32 Ft. Then Raised Casing & Screen 10 Ft. - Result Unsatisfactory Not Complete.

Coordinates

N	E
534 874	660 726

5/19 - Pulled screen and replaced with 10 ft. of #40; bottom set at 30'. Very little water. 5/20-Pump test unsuccessful, poor yield.

INSPECTOR J. E. Moon

Casing Setting	Formation Materials	Depth from Surface
	Dark Brown Med. Silty Sand--Organic	0'–10'
	Gray Sandy Clay	10'–20'
Casing to 22'	Reddish Brown Med. Sand & Gravel	20'–29'
Screen 22'–32'	Gray Coarse To Fine Sand. Med. to Coarse Gravel, silty	29'–36'
	Grayish Brown Med. Sand & Fine Gravel	36'–38'
	Grayish Brown Silty Sand & Gravel	38'–42'
42'	Refusal	42'

Depth scale: 5', 10', 15', 20', 25', 29', 30', 35', 36', 38', 40', 42'

METCALF & EDDY
ENGINEERS
BOSTON, MASS.

WELL LOG

CASING SETTING	FORMATION MATERIALS	DEPTH FROM SURFACE
	Sand & Clay Fill	0' – 6'
	Brown Medium Sand & Gravel	6' – 15'
	Grayish Brown Silty Clay Some Sand	15' – 37'
39'	Brown Med. to Fine Sand, Some Fine Gravel.	37' – 42'
SCREEN	Brown Med. Sand & Some Gravel, Trace of Clay in Small Lumps, Clay Probably Thin Seam.	42' – 46'
46'	Refusal	46'

CLIENT USAF Hanscom Field
DRILLER R.E. Chapman Co.
HOLE NO 13
DATE DRILLED 6 May 1960
STATIC WATER LEVEL --
CASING:
METAL W.I. DIA. 8"
SCHEDULE Ex. Strength

SCREEN:
MAKE Johnson METAL
SIZE #30 LENGTH 10 Ft.
SLOTS
FITTINGS

PUMPING TEST:
DATE 12 May 1960
PUMP USED Turbine
G.P.M. Not Measured
DRAW-DOWN Not Measured
HOURS Not Recorded
VACUUM Not Recorded

NOTES: 9 May 1960 Surge Pumping Could Not Get Rid of Fine Sand. 12 May 1960 Surge Pumping Resumed But Discontinued At Noon By Order of Authorities 5/18 Pumping test unsuccessful, poor yield.

Coordinates

N	E
535 261	661 829

INSPECTOR J. E. Moon

APPENDIX H

HAZARD ASSESSMENT RATING METHODOLOGY (HARM)

APPENDIX V

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

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

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

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

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

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

PURPOSE

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

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

DESCRIPTION OF MODEL

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

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

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

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

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

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

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

FIGURE 1

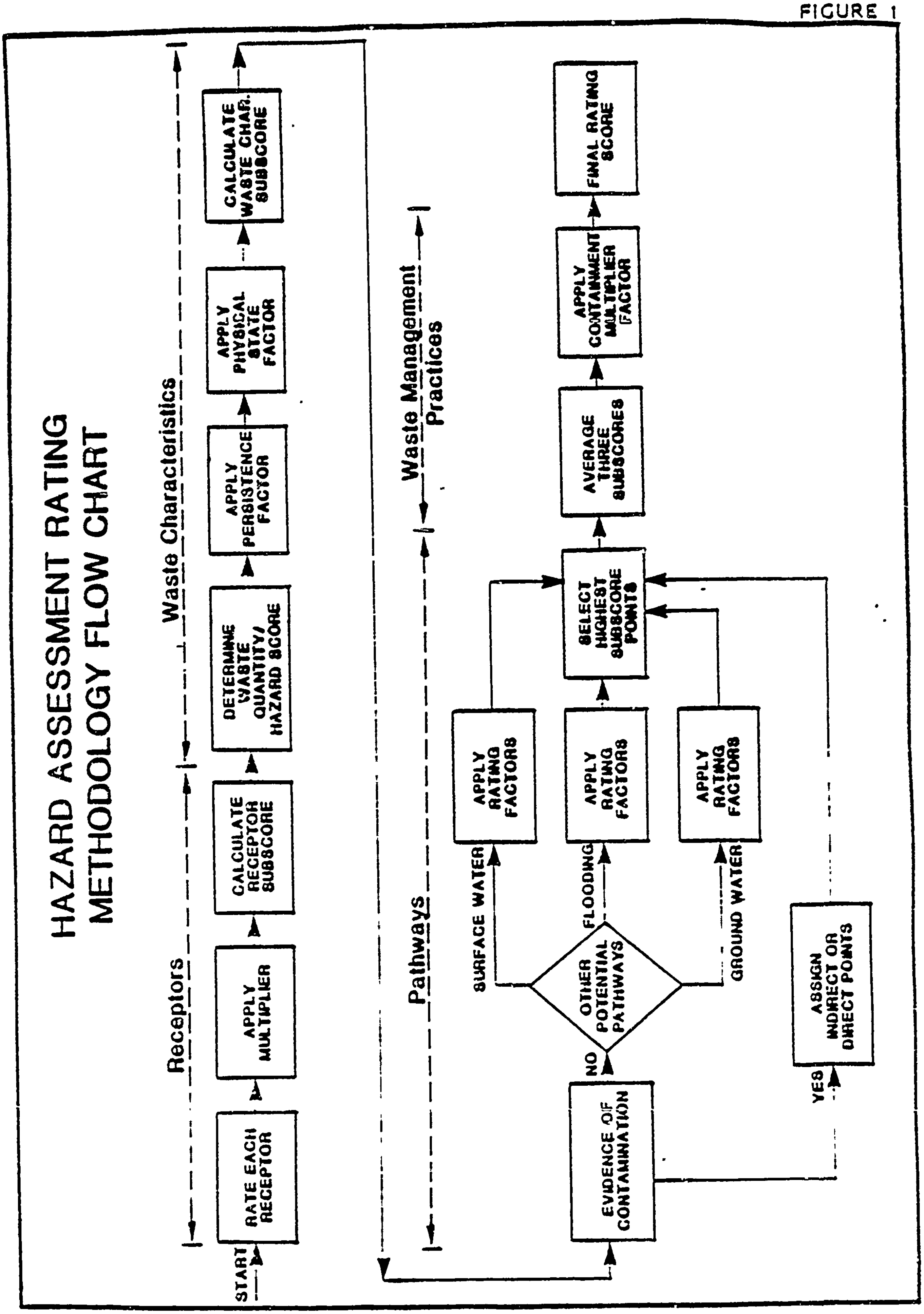
HAZARD ASSESSMENT RATING
METHODOLOGY FLOW CHART
Receptors
Waste Characteristics
START
RATE EACH RECEPTOR
APPLY MULTIPLIER
CALCULATE RECEPTOR SUBSCORE
DETERMINE WASTE QUANTITY/ HAZARD SCORE
APPLY PERSISTENCE FACTOR
APPLY PHYSICAL STATE FACTOR
CALCULATE WASTE CHAR. SUBSCORE
Pathways
Waste Management Practices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

FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ______________________________

LOCATION ______________________________

DATE OF OPERATION OR OCCURRENCE ______________________________

OWNER/OPERATOR ______________________________

COMMENTS/DESCRIPTION ______________________________

SITE RATED BY ______________________________

I. RECEPTORS

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

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

II. WASTE CHARACTERISTICS

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

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

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

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

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

III. PATHWAYS

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

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

Subscore ______

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

1. Surface water migration

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

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

2. Flooding

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

Subscore (100 x factor score/3) ______

3. Ground-water migration

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

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

C. Highest pathway subscore.

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

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

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

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ x ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

1. RECEPTORS CATEGORY

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

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

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

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

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

S = Suspected confidence level

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

A-3 Hazard Rating

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

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

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

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

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

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

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

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

B. Persistence Multiplier for Point Rating

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

C. Physical State Multiplier

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

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

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

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

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

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

B-2 POTENTIAL FOR FLOODING

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

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

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

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

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

B. WASTE MANAGEMENT PRACTICES FACTOR

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

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

Guidelines for fully contained:

Landfills:

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

Spills:

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

Surface Impoundments:

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

Fire Proection Training Areas:

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

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

APPENDIX I

GLOSSARY OF TERMS AND ABBREVIATIONS

GLOSSARY OF TERMINOLOGY

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

Aquitard: The less permeable bed(s) in a stratigraphic sequence, whose permeability is not sufficient to allow the completion of production wells within them.

Bedrock: The solid rock underlying auriferous gravel, sand, clay, etc.

Biotite: A mineral member of the mica group. A common rock-forming mineral.

Diorite: A plutonic rock composed essentially of sodic plagioclose and hornblende, biotite or pyroxene.

Drift: Any accumulation of glacial origin; glacial or fluvioglacial deposit.

Drumlin: A streamlined hill or ridge of glacial drift with the long axis paralleling direction of flow of the former glacier.

Eolian: Applies to deposits which are due to the transporting action of the wind.

Gabbro: A plutonic rock consisting of calcic plagioclose and clinopyroxene; loosely used to describe any coarse-grained dark igneous rock.

Glaciofluvial: Fluvioglacial. Pertaining to streams flowing from glaciers or to the deposits made by such streams.

Gneiss: A coarse-grained rock in which bands rich in granular minerals alternate with bands in which schistose minerals predominate.

Granite/Granitic: A plutonic rock consisting of alkalic feldspar and quartz.

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

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

Head (Hydraulic): The height above a datum (sea level) at which a column of fluid can be supported by the static pressure at that point.

Hydraulic Conductivity: The volume of water that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.

Karst: A limestone plateau marked by sinks or holes interspersed with abrupt ridges and irregular protuberant rocks.

Lacustrine: Of, or pertaining to, or formed in lakes.

Leachate: Contaminated liquid discharge from a waste disposal site to either surface or subsurface receptors. It is created by fluid percolation through and from waste materials.

Metamorphic Rock: Rock formed in the solid state in response to pronounced changes of temperature, pressure, and chemical environment.

Metavolcanic: Partially metamorphosed volcanic rocks.

Moraine: Glacial drift deposited by direct glacial action and having constructional topography independent of control by the surface on which the drift lies.

Muscovite: A mineral member of the mica group, the common white, green, red or light brown mica of granites, gneisses and schists.

Outwash: Drift deposited by melt water streams beyond active glacial ice.

Pegmatite: Coarse-grained igneous rocks most commonly found as dikes associated with a large mass of plutonic rock of finer grain size.

Permeability:	A rock's capacity for transmitting fluid. Depends upon the size and shape of the pores and their interconnections.
Piezometric:	Pertains to the surface formed by the hydraulic head in an aquifer. Provides indication of groundwater flow direction within the aquifer.
Plutonic:	Applies to a body of igneous rock that was formed beneath the surface of the earth by consolidation of magma.
Schist:	A medium- or coarse-grained metamorphic rock with subparallel orientation of the micaceous minerals which dominate its composition.
Spit:	A small point of land or narrow shoal projecting into a body of water from the shore.
Syenite:	A plutonic igneous rock consisting principally of alkalic feldspar usually with hornblende or biotite.
Terrace:	A relatively flat, horizontal or gently inclined surface which are bounded by a steeper ascending slope on one side and by a steeper descending slop on the opposite side. Step-like in character.
Till:	Nonsorted, nonstratified sediment carried or deposited by a glacier.
Transmissivity:	The rate of flow of water through a vertical strip of aquifer one unit wide extending the full saturated thickness of the aquifer under a unit hydraulic gradient.
Unconfined Groundwater:	Unconfined groundwater is water in an aquifer that has a water table.
Water Table:	An imaginary surface in an unconfined water body at which the water pressure is atmospheric. It is essentially the top of the saturated zone.

GLOSSARY OF ABBREVIATIONS

ABG/DE	Air Base Group/Civil Engineering
ABG/LG	Air Base Group/Logistics
ADSMO	Air Defense Systems Management Office
AFB	Air Force Base
AFESC	Air Force Engineering and Service Center
AFGL	Air Force Geophysical Laboratory
AFS	Air Force Station
AFSC	Air Force Systems Command
ASID	Air Systems Integration Division
BES	Bioenvironmental Engineering Services
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DCE	Dichloroethylene
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DOD	Department of Defense
DOT	Department of Transportation
DPDO	Defense Property Disposal Office
EPA	Environmental Protection Agency
ESD	Electronic Systems Division
ESD/IM	Electronic Systems Division/Management Services
ESD/SG	Electronic Systems Division/Office of the Surgeon
HARM	Hazard Assessment Rating Methodology
HTH	Tradename for calcium hypochlorite
HCl	Hydrochloric acid
IRP	Installation Restoration Program

mg/l	Miligrams per liter
MIT	Massachusetts Institute of Technology
MPA	Massachusetts Port Authority
MSL	Mean sea level
OPR	Office of Primary Responsibility
PCB	Polychlorinated biphenyls
POL	Petroleum, Oil, and Lubricants
ppm	Parts per million
RADC	Rome Air Development Center
RADC/ET	Rome Air Development Center/Electronic Technology Office
RCRA	Resource Conservation and Recovery Act
SPCC	Spill Prevention Control and Countermeasures
TCE	Trichloroethylene
USAF	United States Air Force

APPENDIX J

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REFERENCES

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