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F08637-80-G-0010

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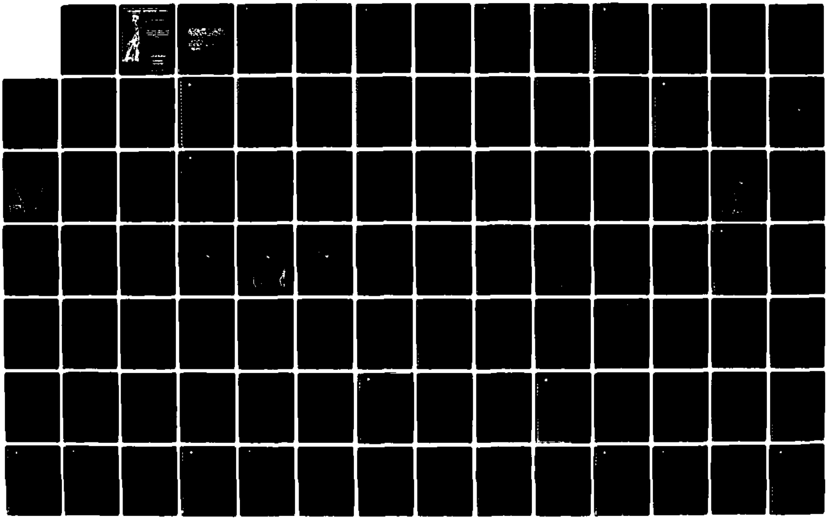

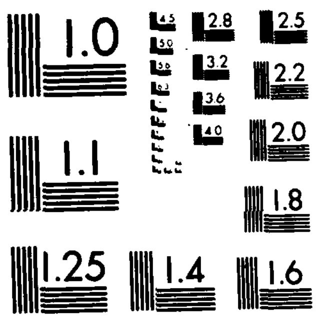

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Airport

INSTALLATION RESTORATION
PROGRAM RECORDS SEARCH

FOR

158 TACTICAL FIGHTER GROUP
VERMONT AIR NATIONAL GUARD
BURLINGTON INTERNATIONAL AIRPORT

Prepared for

AIR NATIONAL GUARD SUPPORT CENTER
ANDREWS AIR FORCE BASE, MARYLAND 20331

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Prepared by

CH2M HILL
7201 N.W. 11th Place
Gainesville, Florida

September 1983

Contract No. F08637-80-G0010-5000

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CONTENTS

CONTENTS--Continued

TABLES

FIGURES

EXECUTIVE SUMMARY

A. INTRODUCTION

1. CH2M HILL was retained on March 25, 1983, to conduct the Burlington Air National Guard (ANG) Installation records search under Contract No. F08637-80-G0010-5000, with funds provided by the National Guard Bureau (NGB).

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

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

4. The Burlington ANG Installation records search included a detailed review of pertinent installation records, contacts with 12 government organizations for documents relevant to the records search effort, and an onsite installation visit conducted by CH2M HILL during July 5 through 8, 1983. Activities conducted during the onsite installation visit included interviews with 19 past and present installation employees, ground tours of installation facilities, and a detailed search of installation records.

B. MAJOR FINDINGS

1. The major industrial shop operations at the Burlington ANG Installation include hydraulics corrosion control, aerospace ground equipment (AGE) maintenance, engine maintenance, and vehicle maintenance. These operations generate varying quantities of waste oils, recovered fuels, and spent solvents and cleaners.

2. The industrial activities are conducted by the 158th Tactical Fighter Group to maintain and operate eighteen F-4D Phantom aircraft and associated support equipment.

3. Two industrial shop operations have resulted in waste disposal at the Burlington ANG Installation. Between 1960 and 1980, all industrial wastes, with the exception of waste oils from the AGE and Motor Vehicle Shops, were disposed of during fire training activities or at the landfill adjacent to the fire training area. Waste oils from the AGE

and Motor Vehicle Shops were collected and recycled by a local company.

Since 1980, all wastes have been segregated for contract disposal through the Defense Property Disposal Office (DPDO) at Plattsburgh Air Force Base (AFB) in New York.

4. Interviews with base employees resulted in the identification of 2 past disposal sites at the Burlington ANG Installation and the approximate dates that each site was used.

C. CONCLUSIONS

1. Information obtained through interviews with 19 present installation personnel, installation records, and field observations indicate that Burlington ANG Installation property has been used for disposal of small quantities of hazardous wastes.

2. No evidence of environmental stress resulting from past disposal practices of hazardous waste was observed at the Burlington ANG Installation.

3. At Site No. 1, the Fire Department Training Area and Old Landfill, direct evidence of groundwater contamination was found in samples collected in April 1982 from monitoring wells installed in the area. During the installation visit, indirect evidence of groundwater contamination was found in the stream adjacent to the site in the form of discolored sediments and the presence of leachate. Based on the topography and geology of the site

and its proximity to the installation boundary, there is potential that the contamination has migrated off of the installation's property.

4. Table 1 presents the priority listing of the two rated sites and their overall scores. Site No. 1, the Fire Department Training Area and Old Landfill, exhibits the most significant potential for environmental impacts.

Table 1
PRIORITY LISTING OF DISPOSAL SITES

Site No.	Site Description	Overall Score
1	Fire Department Training Area and Old Landfill	82
2	"Construction Rubble" Landfill	48

5. Site No. 2, the "Construction Rubble" Landfill, is not considered to present significant potential for environmental impacts.

6. The potential for contaminant migration is high at both sites because soil permeability and hydraulic gradient are moderately high and the water table is close to the ground's surface (approximately 10 ft).

D. RECOMMENDATIONS

For Site No. 1, the Fire Department Training Area and Old Landfill and Site No. 2, the "Construction Rubble" Landfill, the following Phase II recommendations are made.

1. Six monitoring wells, installed to the base of the aquifer and screened from 5 feet above the water table through the full length of the saturated zone, should be installed in the following locations:

   a. One adjacent to existing monitoring well BP-6, the most downgradient well, and one upgradient of the site near the main entrance road.

   b. Two downgradient on each side of the creek.

2. Groundwater samples should be collected from the new and existing monitoring wells and analyzed for volatile organic compounds (VOC), oil and grease, phenols, and heavy metals (Pb, Cd, Zn, and Cr) to determine the extent of the contamination and to develop a historical trend of the plume's movement.

3. Surface-water samples should be collected from the creek upstream and downstream of the site and analyzed for VOC's, oil and grease, phenols, and heavy metals (Pb, Cd, Zn, and Cr).

4. Sediment samples should be collected from the creek bed upstream and downstream of the site and analyzed for heavy metals (Pb, Cd, Zn, and Cr).

5. The details of the monitoring well installation and procedures for collecting and analyzing samples will be finalized as part of the Phase II program.

6. At Site No. 2, the "Construction Rubble" Landfill, one upstream and one downstream surface-water sample should be collected from the small creek adjacent to the site and analyzed for VOC's and oil and grease.

   Also, one upstream and one downstream sediment sample should be collected from the small creek and analyzed for heavy metals (Pb, Cd, Zn, and Cr).

1. [illegible]

I. INTRODUCTION

A. BACKGROUND

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

The Department of Defense (DoD) developed the current Installation Restoration Program (IRP) to ensure compliance with these hazardous waste regulations. The DoD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5 dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination on DoD facilities and to control the migration of hazardous contamination that could endanger health and welfare from such facilities. The IRP will be the basis for remedial actions on ANG installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and Executive Order 12316.

To conduct the IRP Hazardous Materials Disposal Sites Records Search for the Burlington ANG Installation, CH2M HILL was retained on March 25, 1983 under Contract No. F08637-80-G0010-5000 with funds provided by the NGB.

The records search comprises Phase I of the DoD IRP and is intended to review installation records to identify possible hazardous waste-contaminated sites and to assess the potential for contaminant migration. Phase II (not part of this contract) would consist of follow-on field work to determine the extent and magnitude of contaminant migration. Phase III (not part of this contract) would consist of technology base development to support the development of project plans for controlling migration or restoring the installation. Phase IV (not part of this contract) would include those efforts which are required to control identified hazardous conditions.

B. AUTHORITY

The identification of hazardous contamination at Air Force installations was directed by Defense Environmental Quality Program Policy Memorandum 81-5 (DEQPPM 81-5) dated 11 December 1981, and implemented by Air Force message dated 21 January 1982, as a positive action to ensure compliance of Air Force installations with existing environmental regulations. The identification of hazardous contamination at Air National Guard Installations was directed to the Civil Engineering Division in a letter from the Air Directorate NGB/DE dated 19 August 1981.

C. PURPOSE OF THE RECORDS SEARCH

The purpose of the Phase I Records Search is to identify and evaluate suspected problems associated with past hazardous material disposal sites and spill sites on DoD facilities. The existence and potential for migration of hazardous material contaminants were evaluated at the Burlington ANG Installation by reviewing the existing information and conducting an analysis of installation records. Pertinent information includes the history of operations, the geological and hydrogeological conditions which may contribute to the migration of contaminants, and the ecological settings which indicate environmentally sensitive habitats or evidence of environmental stress.

D. SCOPE

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

The pre-performance meeting was held at CH2M HILL's office in Reston, Virginia on March 23, 1983. Attendees at this meeting included representatives of the Air Force Engineering and Services Center (AFESC), United States Air Force (USAF), Air National Guard Support Center (ANGSC), Vermont Air National Guard (ANG), and CH2M HILL. The purpose of the pre-performance meeting was to provide detailed project instructions, to provide clarification and technical guidance by AFESC, and to define the responsibilities of all parties participating in the Burlington ANG Installation records search.

The onsite installation visit was conducted by CH2M HILL from July 5 through 8, 1983. Activities performed during the onsite visit included a detailed search of installation records, ground tours of the installation, and interviews with past and present installation personnel. At the conclusion of the onsite visit, the installation commander was briefed on the preliminary findings. The following individuals comprised the CH2M HILL records search team:

1. Mr. Michael Thompson, Project Manager (M.S. Civil Engineering , 1972)

2. Mr. J. Kendall Cable, Environmental Engineer/Ecologist (M.E. Civil Engineering, 1980)

3. Mr. Gary Eichler, Hydrogeologist (M.S. Geology with a minor in Civil Engineering, 1974)

Resumes of these team members are included in Appendix A.

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

Individuals from the Air Force and the Air National Guard who assisted in the Burlington ANG Installation records search include the following:

1. Mr. Harry Lindenhofen, ANGSC, Air National Guard Program Coordinator for IRP

2. Major William Klyszeiko, Vermont ANG, Technical Advisor

3. Captain David L. Bombard, Vermont ANG, Unit Environmental Coordinator

4. Mr. Bernard Lindenberg, AFESC, Air Force Engineering Program Coordinator for IRP

E. METHODOLOGY

The methodology utilized in the Burlington ANG Installation records search is shown graphically on Figure 1. First, a review of past and present industrial operations was conducted at the installation. Information was obtained from available records such as shop files and real property files, as well as interviews with 19 past and present employees from the various operating areas of the installation. The information obtained from interviewees on past activities was based on their best recollection. Their areas of knowledge and years at the installation are presented in Appendix C.

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

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

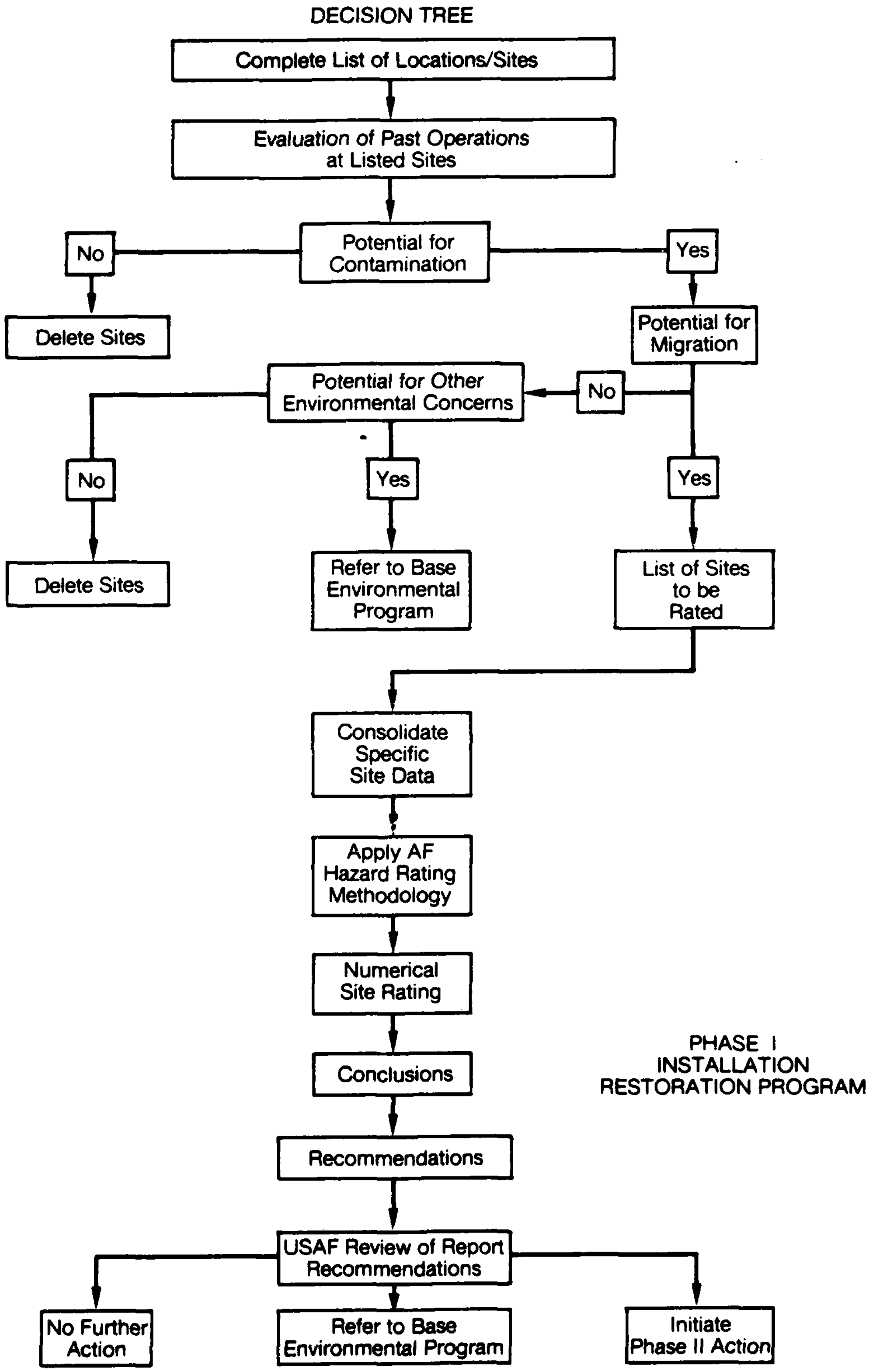

FIGURE 1.
Records Search Methodology.

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A decision was then made, based on all of the above information, as to whether a potential exists for hazardous material contamination from any of the identified sites. If not, the site was deleted from further consideration.

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

The site rating indicates the relative potential for environmental impact at each site. For those sites showing a significant potential, recommendations were made to quantify the potential contaminant migration problem under Phase II of the Installation Restoration Program.

II. INSTALLATION DESCRIPTION

A. LOCATION

The Burlington ANG Installation is located at the Burlington International Airport in the eastern portion of Chittenden County, Vermont. The installation encompasses approximately 240 acres and is located approximately 4 miles from downtown Burlington, Vermont. The location map of the Burlington ANG Installation is shown on Figure 2, and the site plan of the installation is shown on Figure 3.

B. ORGANIZATION AND HISTORY

The Vermont ANG was organized at the Burlington Airport on July 1, 1946 and was federally recognized on August 14, 1946. Initially, the Vermont Air Guard was the 530th Fighter Squadron, 311th Fighter Group, which had a distinguished battle record in the Pacific theatre during World War II. The unit was then re-designated as the 134th Fighter Squadron and assigned to the 101st Fighter Group, 67th Fighter Wing.

The unit's primary aircraft was the P-47 Thunderbolt until the mid-1950's, when the unit transitioned into the F-51 Mustang aircraft.

In January 1951, the unit was activated and assigned to the Eastern Air Defense Command. Many members of the 134th Fighter Squadron served with distinction in the Korean Conflict. The unit was released from Active Duty in October 1951 and returned to its air defense mission with the F-51 aircraft.

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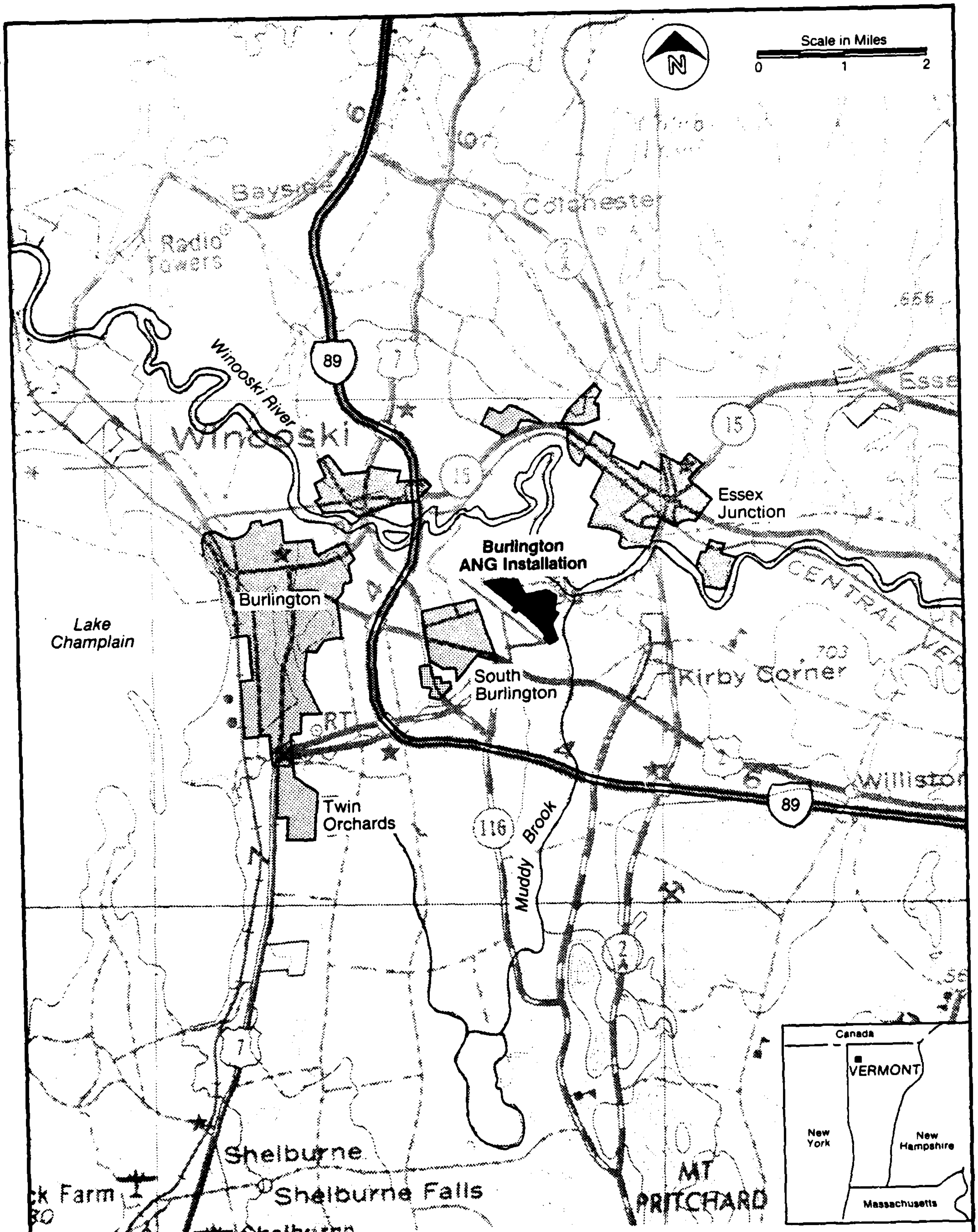

Source: USGS

FIGURE 2.
Location Map of the Burlington ANG Installation.

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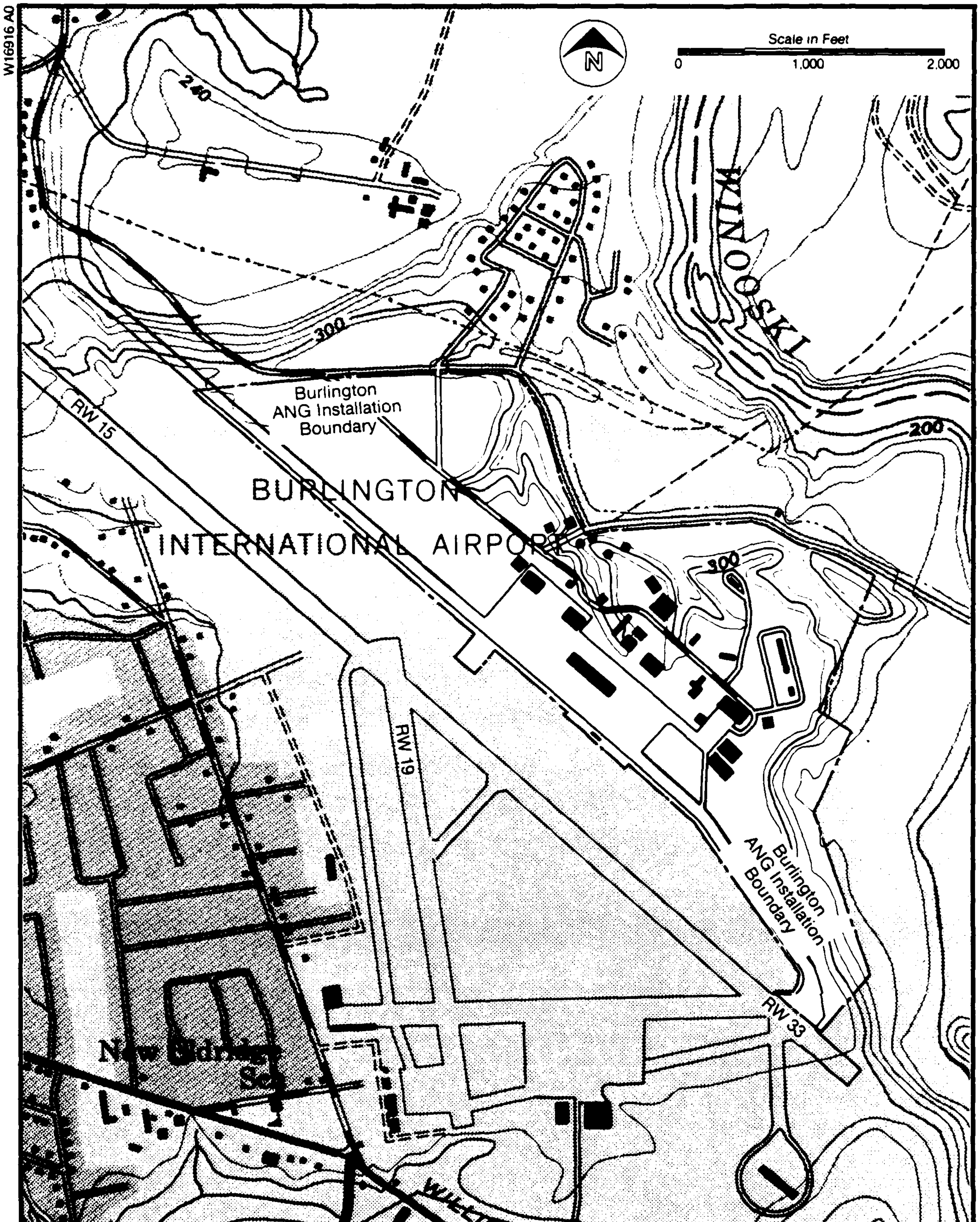

Source: USGS

FIGURE 3.
Site Map of the Burlington ANG Installation.

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The group was assigned its first jet aircraft, the F-94, in April 1954. With the new aircraft came a new crew position, the radar observer, and the squadron strength increased to 440 airmen and 60 officers. Later that year a Tactical Fighter Group Headquarters was assigned to the Vermont Air Guard.

In 1958, the F-94 aircraft was replaced with the F-89J Scorpion aircraft, which also required a radar observer.

In early 1960, a new dimension, Runway Alert, was added to the Vermont Air Guard Mission. The unit became part of the Air Defense Network by assuming the runway alert posture from sunset to sunrise. The alert force was made up of two aircraft and two combat crews. During that year the 134th Fighter Squadron was reorganized to become the 158th Fighter Group and was placed under the supervision of the Air Defense Command. The biggest change of the year for the Vermont Air National Guard was the Department of Defense decision to de-activate the Ethan Allen Air Force Base. As the Air Force moved out, the Vermont Air National Guard moved in and took over all the flight line facilities and buildings. With this move the concept of runway alert changed from a sunset to sunrise operation to a full-time, 24-hour alert day, 7 days a week.

On August 12, 1965, the first of 17 F-102 "Delta Daggers" aircraft arrived.

In 1970, the major portion of the new operations building on the north side of the runway was completed. Within the next few years, the Combat Support Squadron and the Supply Squadron also moved to the north side of the field, thus bringing all of the Air National Guard facilities into one location.

In early 1974, word was received that the Vermont Air National Guard was going to receive another mission change. The new aircraft was to be the EB-57 aircraft equipped with electronic countermeasures and chaff emitting equipment. The new mission involved evaluating defense systems radar both in the air and on the ground.

In December 1981, the EB-57 aircraft were replaced by F-4D Phantom aircraft. In January 1982, the unit became the 158th Tactical Fighter Group. This unit continues today to be the major mission at the installation and is responsible for 18 F-4D Phantom aircraft.

A more detailed description of the base history and its mission are presented in Appendix D.

III. ENVIRONMENTAL SETTING

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A. METEOROLOGY

The northerly latitude of the Burlington area gives it a typical New England climate, characterized by moderately warm summers and cold winters. Coldest temperatures in winter months are caused by high pressure systems which move rapidly down from central Canada or Hudson Bay. Average monthly temperatures range from 16.8°F in January to 69.8°F in July, as indicated in Table 2. Due to shielding by the Adirondack Mountains to the west and the Green Mountains to the east, the Champlain Valley receives somewhat less precipitation than surrounding areas. Mean annual precipitation is approximately 33 inches per year (in/yr), with the heaviest rainfall occurring in the summer months. Average monthly precipitation ranges from 1.68 inches in February to 3.72 inches in August. Thunderstorms occur an average of 25 times annually and are most common in the summer. The mean annual lake evaporation rate, commonly used to estimate the mean annual evapotranspiration rate, for the region is 24 inches. Evapotranspiration over land areas may be greater or less than this depending on vegetative cover type. Therefore, the annual net precipitation (mean annual precipitation minus mean annual evapotranspiration) for the Burlington ANG Installation area is approximately 9 in/yr.

Most winds are northerly or southerly, due to the orientation of the Champlain Valley between mountain ranges. The prevailing direction most of the year is from the south, and the mean annual wind speed is 8.8 mph.

Table 2

METEOROLOGICAL DATA SUMMARY FOR THE BURLINGTON ANG INSTALLATION

Month (a)	Temperature °F: Daily Max.	Temperature °F: Daily Min.	Temperature °F: Mon.	Precipitation Water Equivalent (in): Nor.	Max. Mon. 38	Year	Max. Mon. 38	Year	Max. in 24 Hrs. 38	Year	Wind: Mean Speed (mph) 38	Wind: Prevailing Direction 20	% of Possible Sunshine 38	Mean Sky Cover, Tenths, Sunrise to Sunset 38	Precipitation .01 Inch or More 38	Thunderstorms 38	Mean Number of Days, Temperature (°F), Max.: 90° and Above 17	Max.: 32° and Below 17	Min.: 32° and Below 17	Min.: 0° and Below 17
J	25.9	7.6	16.8	1.74	4.69	1978	0.49	1981	1.53	1978	9.5	S	42	7.6	14	*	0	23	30	11
F	28.2	8.9	18.6	1.68	5.38	1981	0.21	1978	1.93	1981	9.3	S	48	7.3	12	n	0	19	27	9
M	38.0	20.1	29.1	1.93	3.58	1972	0.38	1965	1.62	1971	9.3	N	51	7.2	13	*	0	10	26	2
A	53.3	32.6	43.0	2.62	4.27	1954	0.93	1966	2.16	1968	9.3	S	50	7.1	12	1	*	1	17	0
M	66.1	43.5	54.8	3.01	5.90	1945	0.29	1977	2.26	1955	8.8	S	56	6.9	13	2	1	0	3	0
J	76.5	53.9	65.2	3.46	7.69	1973	1.09	1949	2.83	1972	8.3	S	59	6.8	12	6	1	0	0	0
J	81.0	58.5	69.8	3.54	6.12	1972	1.23	1979	2.43	1945	7.8	S	64	6.4	12	7	3	0	0	0
A	78.3	56.4	67.4	3.72	11.54	1955	0.72	1957	3.59	1955	7.4	S	60	6.4	12	6	1	0	0	0
S	70.0	48.6	59.3	3.05	8.18	1945	0.87	1948	2.48	1960	8.1	S	53	6.5	12	2	*	0	1	0
O	58.7	38.8	48.8	2.74	6.22	1959	0.50	1963	1.69	1951	8.7	S	48	6.9	11	1	0	*	9	0
N	44.3	29.7	37.0	2.86	5.17	1949	0.63	1952	1.80	1959	9.5	S	30	8.3	14	*	0	5	19	0
D	30.3	14.8	22.6	2.19	5.95	1973	0.62	1960	2.60	1950	9.7	S	33	8.1	15	*	0	18	28	5
YRLY AVG.	54.2	34.5	44.4	32.54																

Source: Local Climatological Data, Burlington Vermont, 1981 Annual Summary.

(a)Length of record, years, through the current year unless otherwise noted, based on January data.

Notes:

1. Means and extremes above are from existing and comparable exposures.

2. Mon. = Monthly; Max. = Maximum; Nor. = Normal.

3. NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.

B. GEOLOGY

The Burlington ANG Installation is located within the Champlain Lowlands physiographic province. In the Burlington area, this province is actually a river delta built up by sediments transported from mountainous areas to the west by the Winooski River and its tributaries. The delta lowlands occur at the eastern edge of Lake Champlain and are bounded on the east by the Green Mountains. Although this physiographic province is referred to as a lake plain, its surface is quite irregular. The irregularities in topography include hills and low mountains, many of which are erosional remnants of former ridges caused by faulting.

The principal physiographic features at the Burlington ANG Installation are the flat, lowland plain and the Winsooski River and its tributaries, Muddy and Allen Brooks, which flow north along the east side of the site. Elevations at the installation range from 310 to 280 feet mean sea level (msl).

Soil associations occurring at the Burlington ANG Installation (Figure 4) consist primarily of excessively drained sandy soils. The predominant soil association at the installation is referred to as Adams and Windsor Loamy Sands and is described by the U.S.D.A. Soil Conservation Service as follows:

The Windsor soil is predominant in this mapping unit, but an area may consist of either the Adams soil, the Windsor soil, or of a mixture of the two. These soils occupy irregularly shaped terraces 2 to 200 acres in size. The irregular shape is due to the many gullies dissecting the sand plains.

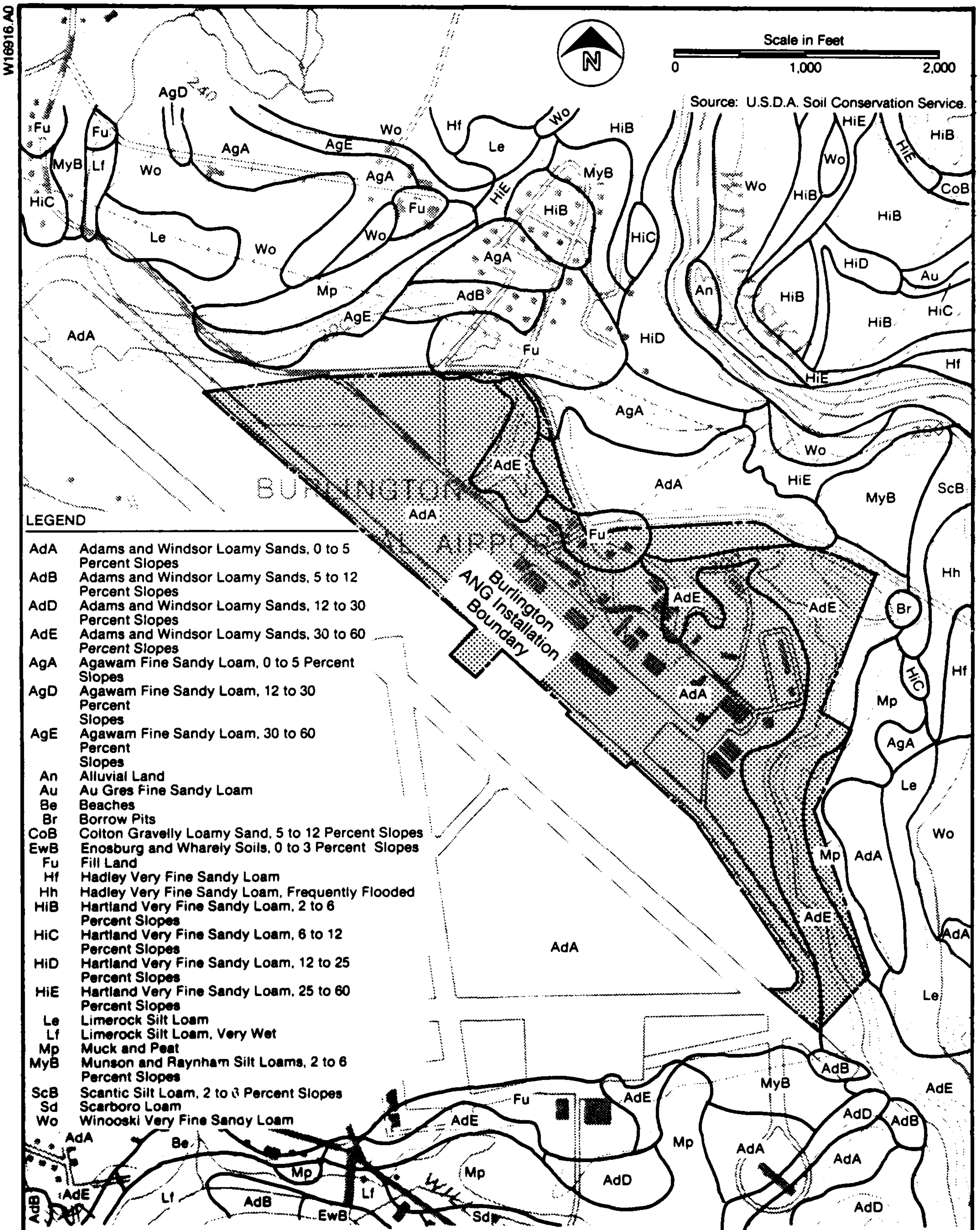

FIGURE 4.
Soils Map.

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Included with these soils in mapping are some areas of Adams and Windsor soils that have a thin surface layer where soil blowing has taken place. These areas are roughly circular in shape and less than 100 feet in diameter. Also included are areas of soil in which the content, by volume, of gravel, cobblestones, and stones averages more than 15 percent between depths of 10 and 40 inches. Some of the areas mapped contain areas of Deerfield soils and Colton soils. Areas that have stones and cobblestones on the surface are also included. In a few areas, the surface layer is sand or fine sand. In many areas this mapping unit is slightly acid or neutral throughout.

These soils are used for truck gardening, intertilled farm crops, hay, and pasture. They have few limitations for many nonfarm uses such as housing developments. A large part of this mapping unit is woodland or idle.

Surface runoff is very slow. The ground should be kept well covered by vegetation to prevent soil blowing. On these soils the hazard of water erosion is very slight, even in unvegetated areas.

A typical soil profile of the Adams-Windsor Association is as follows:

- A--1 to 7 inches, light brownish-gray loamy sand; single grain; loose; many roots; very strongly acid; clear, wavy boundary.

- B--7 to 9 inches, dark reddish-brown loamy fine sand; weak, medium, granular structure and single grain; very friable; many roots; very strongly acid; clear, wavy boundary.

- B--9 to 15 inches, dark yellowish-brown loamy fine sand; weak medium, granular structure and single grain; loose; common roots; strongly acid; gradual, wavy boundary.

- B--15 to 30 inches, yellowish-brown loamy fine sand; single grain; loose; few roots; medium acid; gradual, wavy boundary.

- C--30 to 45 inches, grayish-grown loamy fine sand; single grain; loose; few roots; medium acid.

Permeability of this soil type ranges from 1.4×10^{-2} to 4.4×10^{-3} cm/sec, which is in the moderate range.

A typical geologic sequence in the vicinity of the Burlington ANG Installation consists of either sand of marine origin (30 to 60 feet thick), Lacustraine clay (lake deposit, 30 to 50 feet), and Bedrock consisting of limestone and/or dolomitic marble; or sand (30 to 60 feet), Glacial till (30 to 50 feet), and bedrock. The materials occurring above the bedrock in the vicinity of the installation are saturated with groundwater below a depth of approximately 20 feet. The sequence of geologic materials referred to as bedrock, although somewhat variable through the Champlain Valley, can generally be described as listed in Table 3. A geologic map is presented on Figure 5.

Table 3
GEOLOGIC FORMATIONS IN THE BURLINGTON AREA

Formation	General Lithology	Average Thickness (ft)
ORDOVICIAN--CHAMPLAIN SERIES		
Trenton Group		
Iberville formation	Noncalcareous black shale interbedded with dolomite.	1000
Stony point formation	Predominantly calcareous black shale that grades upward into argillaceous limestone and rare dolomite beds.	1000
Cumberland head formation	Interbedded calcareous black shale and fine-grained homogenous, dark-gray limestone.	1000
Hortonville formation	Black, carbonaceous and pyritic slate and phyllite, locally sandy; brown weathered limy beds are common near installation.	500
Black River Group		
Orwell limestone	Smooth ledged, sublithographic and lithographic, dove-gray weathered limestone commonly cut by veins of white calcite; beds filled with fossil shell fragments are characteristic.	200
Chazy Group		
Middlebury & Chazy limestone, undifferentiated	Dark blue-gray, somewhat modular and granular limestone with buff dolomite and shaly interbeds a fraction of an inch thick and 2 to 4 inches apart. The Middlebury, which is east of Champlain and Orwell thrusts, and the Youngman, which is east of Highgate Springs thrust, are, due partly to deformation, more slaty in appearance than the Chazy, which is west of the major thrusts.	600
ORDOVICIAN--CANADIAN SERIES		
Beekmantown Group		
Chipman, Bridport, Beldens formation	Bridport dolomite member: buff to brown weathered, sharply defined and laterally persistent beds chiefly of medium bedded to massive, scored dolomite; variously designated Bridport formation and Providence Island dolomite in northwestern Vermont. Beldens member: interbedded buff to brown heavily scored dolomite and white to blue-gray marble and limestone; designated Beldens formation east of Highgate Springs thrust.	400
Bascom formation	Interbedded dolomite, limestone or marble, calcareous sandstone, quartzite, and limestone breccia; irregular dolomitic layers, thin sandy laminae, and slaty or phyllitic partings characterize limestone and marble of lower, middle, and upper parts of the Bascom, respectively; south of West Rutland it includes some of Chipman formation.	100
Cutting dolomite	Typical Cutting is a massive, gray weathered, nondescript dolomite with a finely laminated calcareous sandstone at base.	440

Table 3--Continued

Formation	General Lithology	Average Thickness (ft)
Shelburne, Whitehall, and Strites pond formation	The Shelburne is chiefly a white marble or gray limestone characterized by raised reticulate lines of gray dolomite on the weathered surface; includes Sutherland Falls marble, intermediate dolomite and Columbian marble of the marble quarries. Interbedded massive dolomite increases westward and predominates in the Whitehall formation, west of Champlain and Orwell thrusts. The Strites Pond, which is identical to the Shelburne, is east of the Philipsburg thrust.	210
CAMBRIAN--CROIXIAN SERIES		
Ticonderoga dolomite	Fairly uniform, massive, smooth weathered gray dolomite characterized by numerous geodes and knots of white quartz; quartz sandstone and irregular masses of chert are near the top. Called the Ticondergoa west of Orwell and Champlain thrusts and the Rock River east of Philipsburg thrust. The Gorge is a partly conglomeratic facies on west limb of the St. Albans synclinorium.	200-300
CAMBRIAN--WAUCOBAN SERIES:		
Winooski dolostone	Light-colored, sandy dolostone.	
Monkton quartzite	Red, thin- to medium-bedded quartzite and thick-bedded, massive, light-colored quartzites; yellowish-orange and pinkish dolostones in lower part of formation with light colored quartzites.	
Dunham dolostone	Massively bedded, buff- and yellowish-orange-weathering, locally sandy.	

Source: Vermont Geological Survey.

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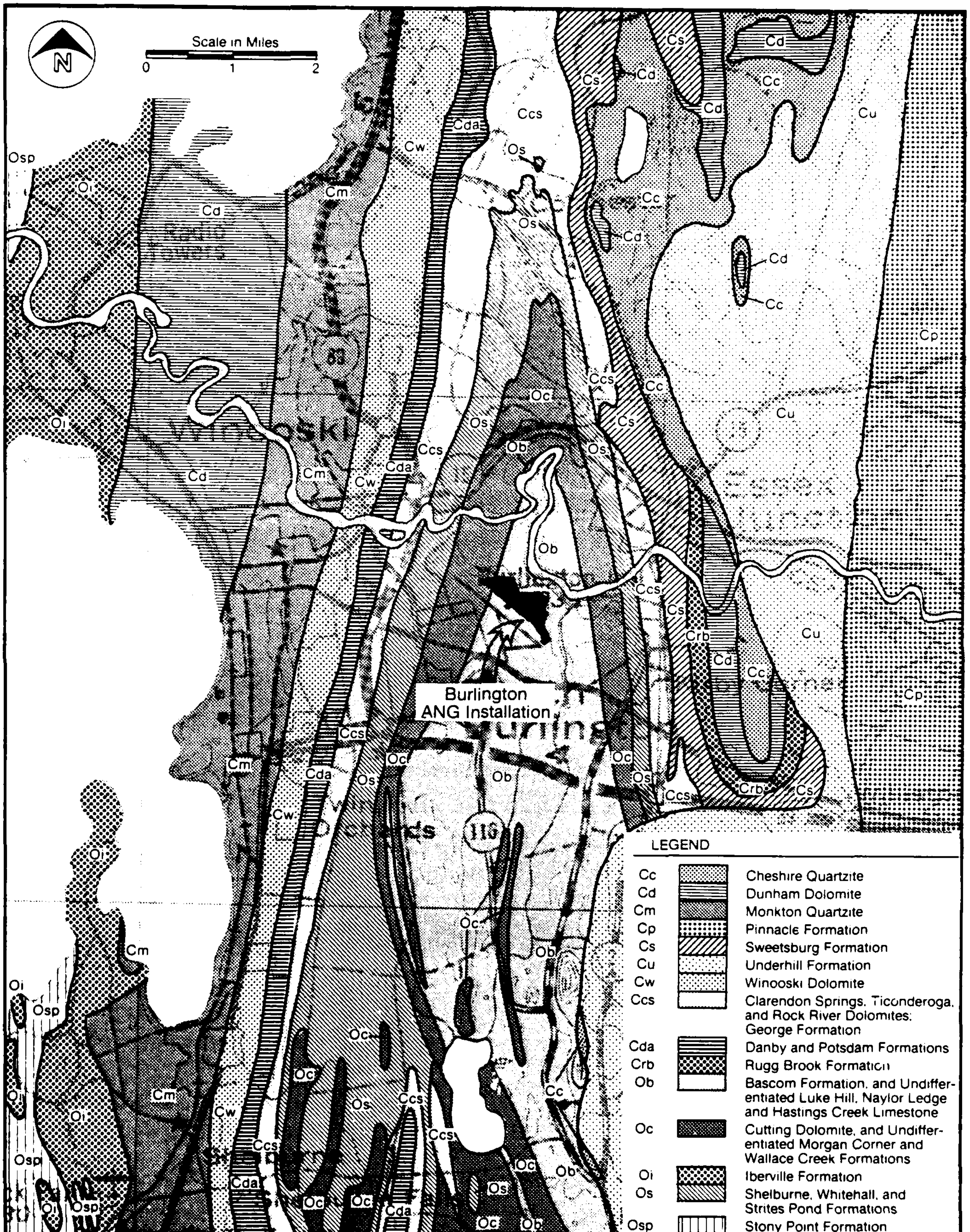

Source: Vermont Geologic Survey.

FIGURE 5.
Geologic Map.

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The surfacial materials at the Burlington ANG Installation below the immediate soil horizons consist of a pebbly, marine sand deposited during an interglacial period when sea level was much higher than today. The materials below the marine sediments consist of either Lacustrine clay or Glacial till overlying bedrock. The clays in the Burlington ANG Installation vicinity were deposited within Lake Vermont which is the name given to the body of water which occurred generally where Lake Champlain occurs today but covering a much larger area. The Glacial till, which in places occurs where the Lacustrine clays are absent, consists of pebbly, sandy clayey deposits of unsorted debris left behind by past glacial activity.

Bedrock occurring below the younger sediments described above consists of interbedded limestone, dolomitic marble, shale, and siltstone. Table 3 includes descriptions of the geologic materials, consisting of sand, clay, and till and the uppermost sections of Bedrock, which are of significance to this study.

C. HYDROLOGY

The site is located within the basin of the Winooski River, which drains the western slopes of the Green Mountains and discharges into Lake Champlain just north of Burlington. Drainage from the installation, and from the northwest side of the Burlington International Airport, leaves the site by way of tributaries of the Winooski River (see Figure 6). These drainage features are actually deep, erosional cuts occurring at the edge or escarpment of the lowland plain originally created by the meandering Winooski River. The drainage from the installation actually discharges to Muddy Brook, which in turn discharges to Allen Brook and then to the Winooski River.

Source: USGS and ANG

FIGURE 6.
Topography and Drainage Map.

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The State of Vermont has classified the Winooski River from Lake Champlain to a point approximately 2 miles east (upstream) of the installation as Class C waters. Allen Brook is currently classified as Class C but is proposed to change to Class B. Muddy Brook is classified as Class B. Table 4 lists the State of Vermont criteria for stream classification. Figure 7 illustrates the major rivers and streams which drain the installation.

Groundwater occurs in the vicinity of the installation under unconfined (water table) conditions within the sands and glacial till. Groundwater also occurs under confined (artesian) conditions within the carbonate solution features, faults, and fractures within the shales, and joints within the metamorphic rock occurring below the unconsolidated surfacial materials.

Figure 8 illustrates the potential for groundwater development in the Burlington area. This map illustrates the relative potential for groundwater development since there is not enough data to quantify the resource in this area. To date, little use is made of groundwater in this area. Figure 9 shows the locations of wells constructed in the vicinity of the installation since 1966. For the most part these wells are low yield and were installed for non-potable use. One well, not illustrated on Figure 9, was reportedly drilled at the Burlington International Airport in 1952 for potable use. However, this well was abandoned and paved over during runway expansion some time prior to 1966. No information was available concerning closure of the well.

Table 4
CRITERIA FOR STREAM CLASSIFICATION IN THE STATE OF VERMONT

Classification	Criteria
A	These waters are suitable for a public water supply with disinfection when necessary. The character is uniformly excellent.
B	These waters are suitable for bathing and recreation, irrigation, and agricultural uses. They are good fish habitats and are acceptable for public water supply with filtration and disinfection.
C	These waters are suitable for recreational boating and irrigation of crops. They are not used for consumption without boiling. They are good habitat for wildlife and common food and game fishes indigenous to the region. Industrial uses which are consistent with other class uses are acceptable.

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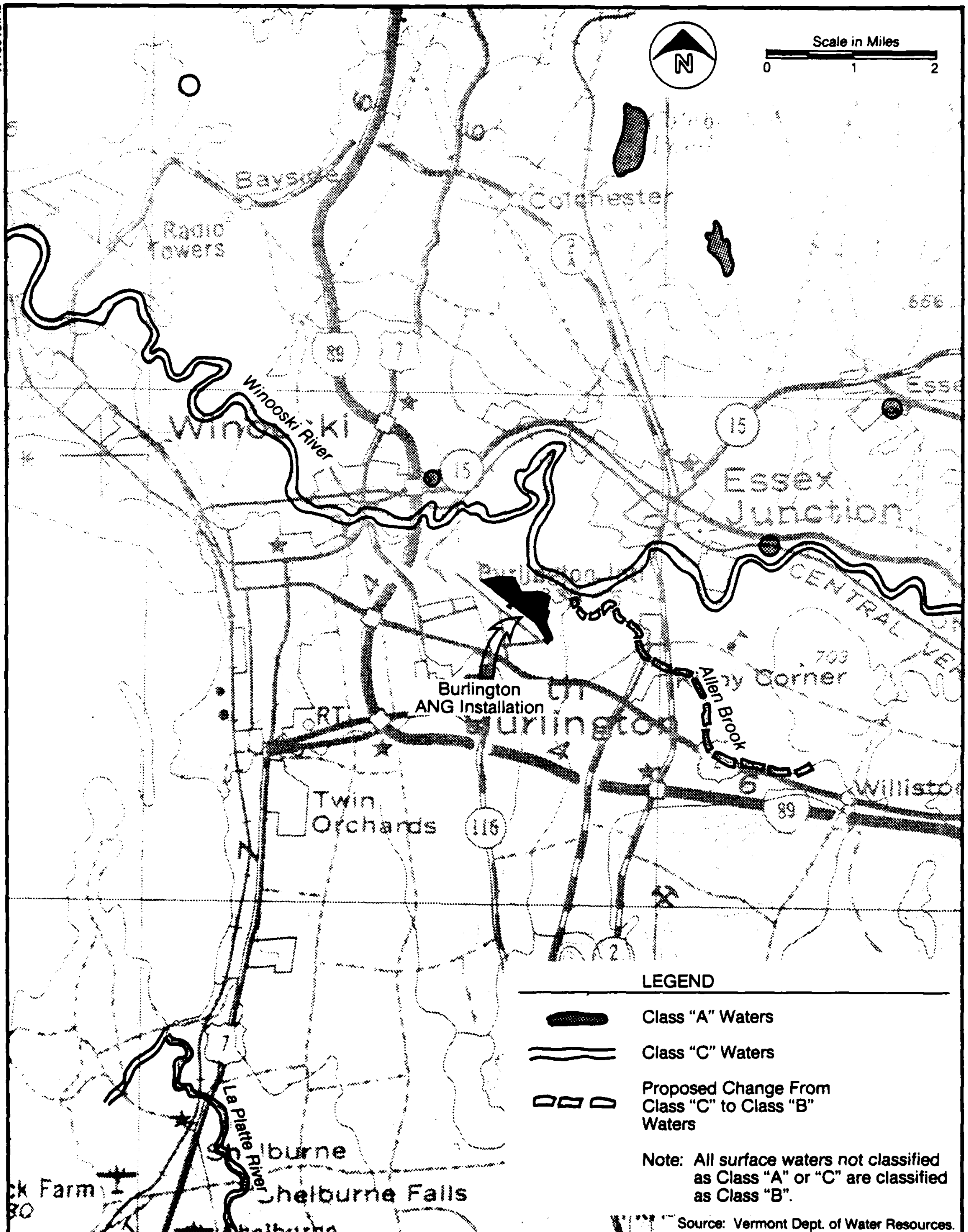

FIGURE 7.
Surface-Water Classification Map.

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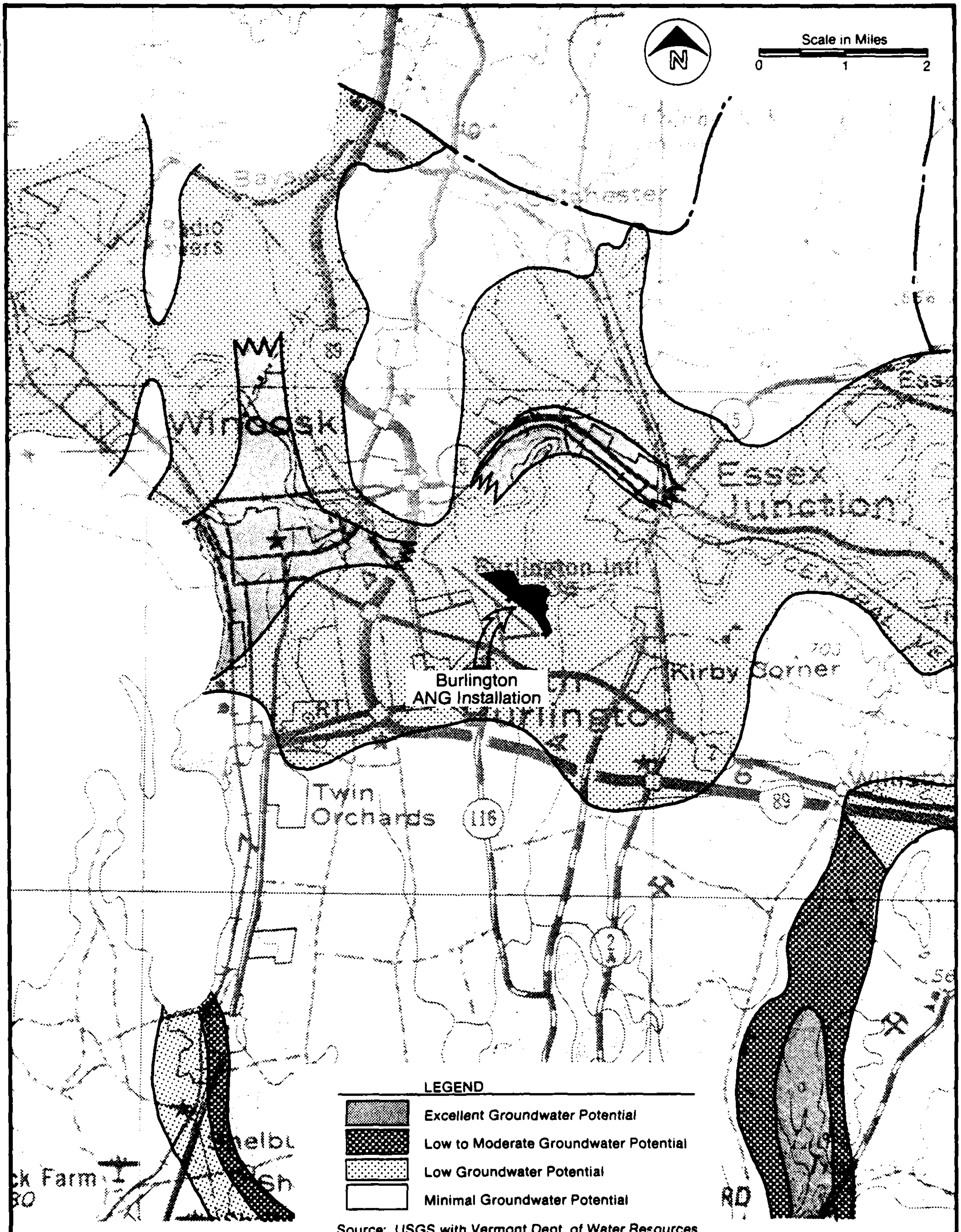

FIGURE 8.
Groundwater Favorability Map.

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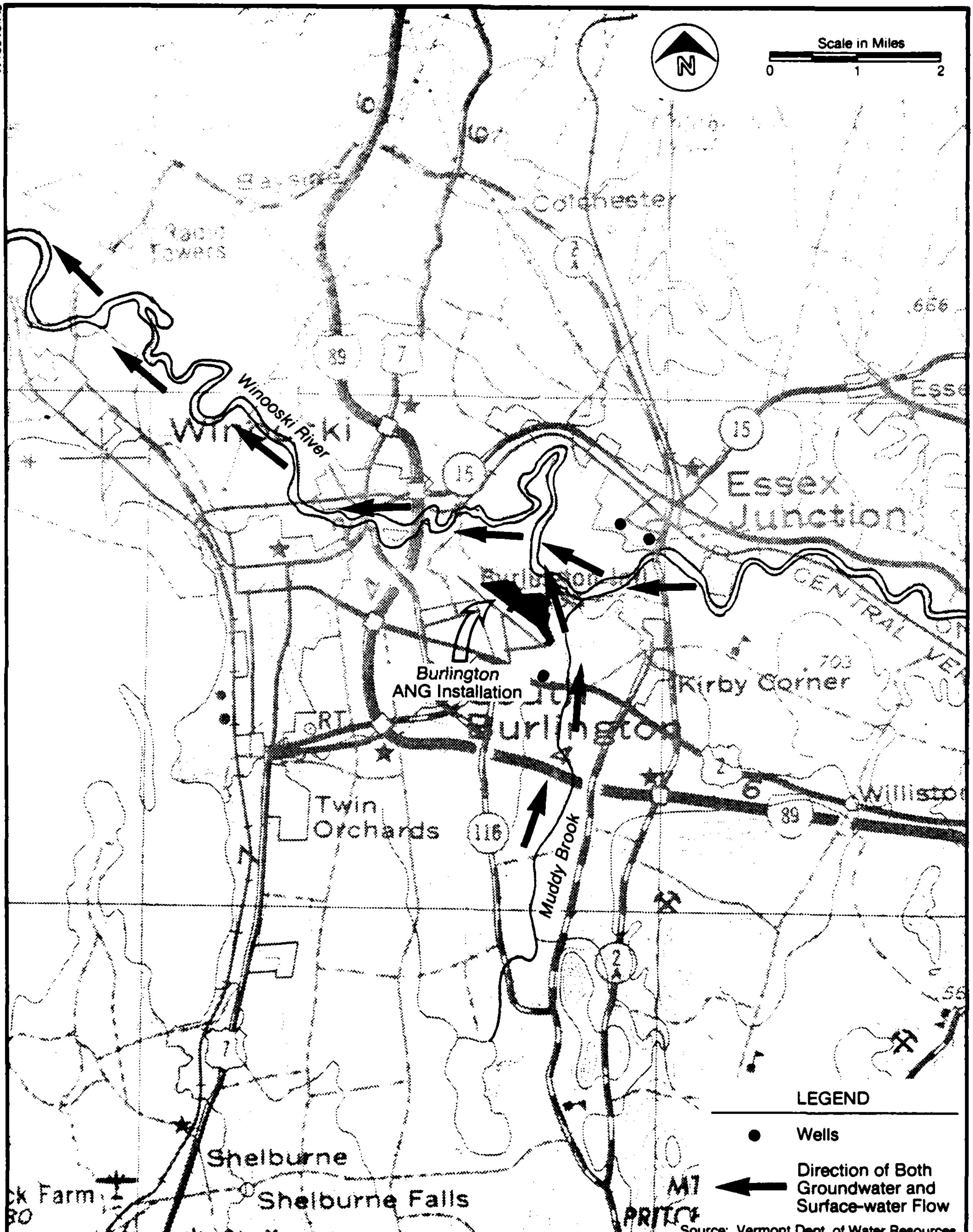

FIGURE 9.
Well Location Map—
Burlington International Airport Vicinity.

The ANG facility and the immediately surrounding area are served by the City of Burlington, which obtains potable water from Lake Champlain. The intake points for potable water are located approximately one-quarter mile offshore at a depth of 50 feet below the water surface.

Groundwater information with regard to regional flow conditions, potentiometric maps, etc., is believed to be nonexistent due to the limited use made of this source. Of significance with regard to contaminant migration would be the upper unconfined water table aquifer developed within the sands and glacial tills. This aquifer is isolated from the deeper water-bearing strata developed within the Bedrock formations by clay and is not used as a source of water.

Although no site-specific data exist, the configuration of the water table aquifer potentiometric surface can be approximated by careful review of the topographic contours. The shallow aquifer water surface or potentiometric surface would be a subdued replica of the ground surface, rising under hills and depressed somewhat under valleys. The hills represent potentiometric highs or recharge areas while the lows are discharge areas. In cases where the land surface intersects the potentiometric surface, groundwater becomes surface water.

Although regional groundwater data are unavailable, some information has been compiled at the Burlington ANG Installation at the site of suspected contamination from past fire department training/disposal activities. (This site is described in detail in Section IV-B, page IV-11.) Data collected at this site together with well logs obtained from the Vermont Department of Water Resources and publications of the Vermont Geological Survey can be used to construct a reasonably accurate hydrogeologic setting for the site. Hydrogeologic conditions at this site are expected to be typical for the Burlington ANG Installation.

The site for which data exist is located at the northeast corner of the installation and is immediately adjacent to a drainage tributary of Muddy Brook.

This site was used for fire department training and waste (liquid and solid) disposal in the past (more details with regard to waste disposal practices are presented in Section IV-B, page IV-14). The site is located on approximately 7 acres and occurs at an elevation of approximately 315 feet msl. During previous investigations, monitoring wells were installed to approximately 5 feet below the groundwater table at the site and samples were analyzed for organic contaminants. Well elevations were surveyed and referenced to a temporary benchmark at an elevation of approximately 315 feet msl. For purposes of the survey, the benchmark was designated elevation 100.00, and all wells were referenced to this elevation. Depth to water level measurements were made as well as a rough profile of the creek, all referenced to elevation 100.00 feet. Table 5 lists the water level elevations referenced to this benchmark, and Figure 10 illustrates a potentiometric map constructed from these data. Figure 11 illustrates a geologic cross section taken in an east-west direction through the site. It is determined from these two figures that groundwater flow at the site is toward the creek and is discharging to the creek. This condition was observed in the field during the installation visit. Therefore, as illustrated by Figures 10 and 11, a contaminant placed on the surface could move vertically downward to the water table and then,

Table 5
GROUNDWATER ELEVATIONS AT THE MONITORING WELLS

Well No.	1983 Water Level[a] Elevation (ft-D)
BP-2	91.01
BP-3	89.87
BP-4	88.35
BP-6	89.06
BP-7	88.30
BP-8	87.39
BP-12	77.25
BP-13	80.66
BP-14	79.75
BP-18	84.41

[a]Reference to datum designated as 100.00'.

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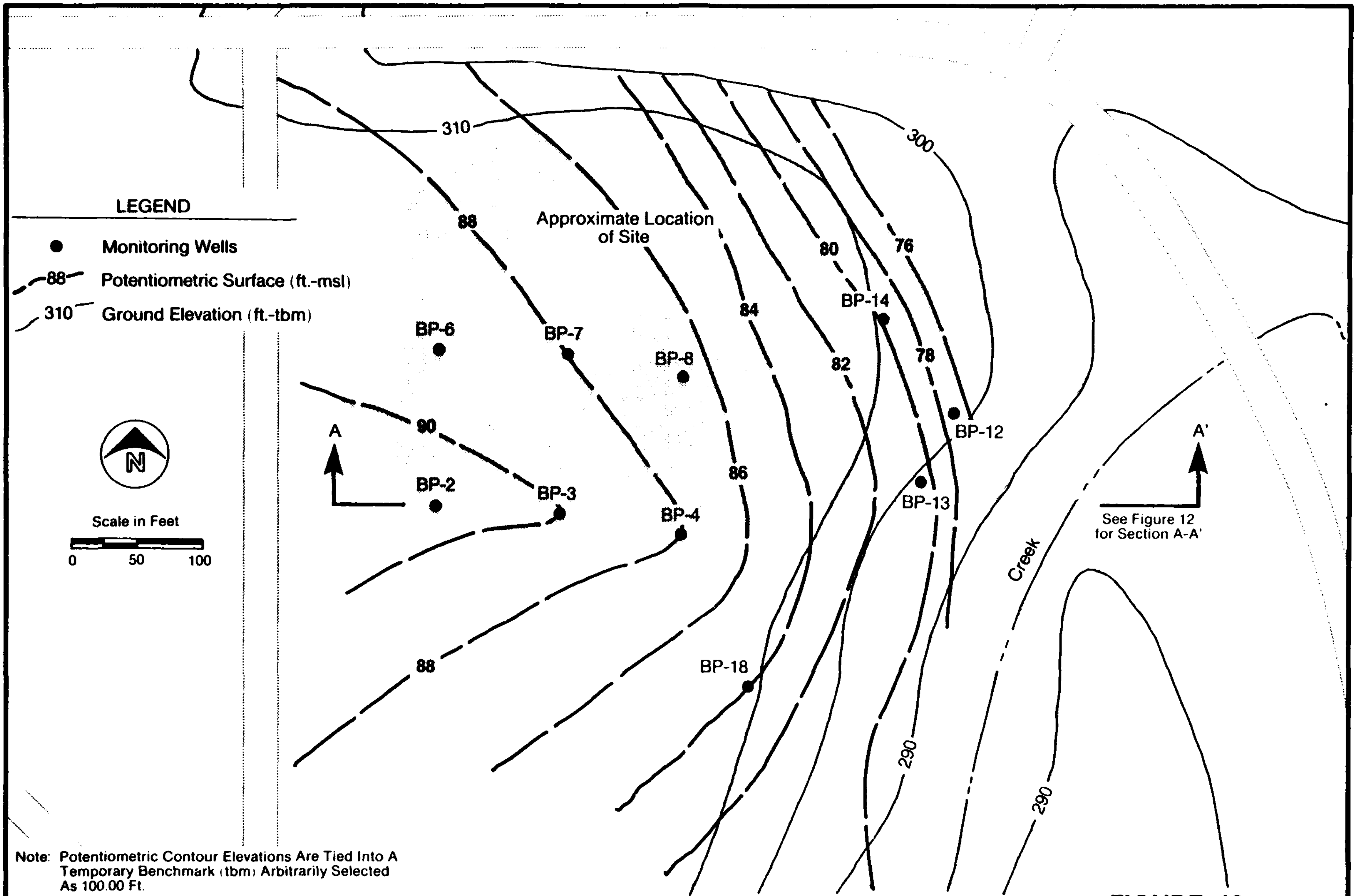

FIGURE 10.
Potentiometric Map for Site No. 1, Fire Department Training Area and Old Landfill.

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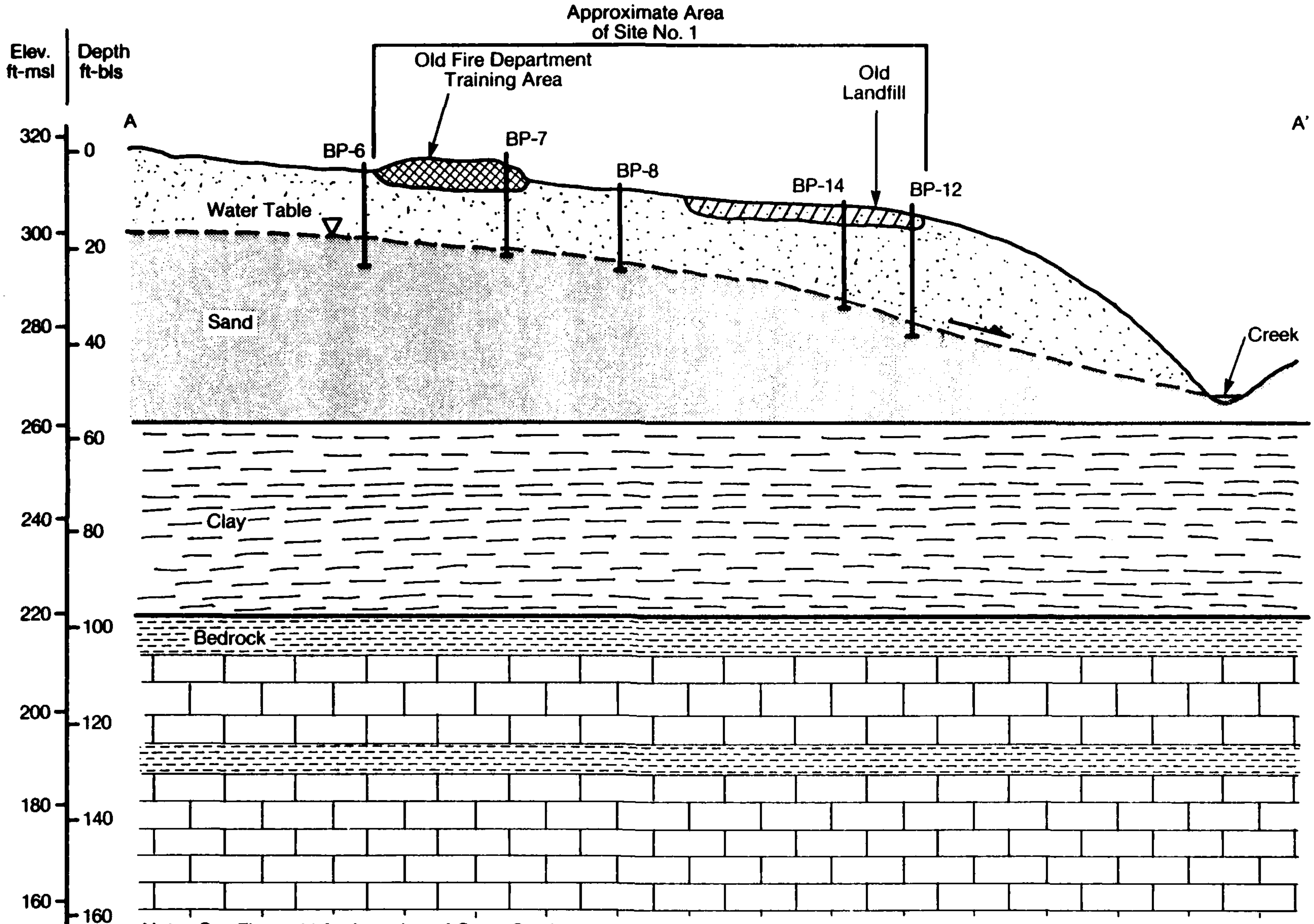

Note: See Figure 11 for Location of Cross Section.

FIGURE 11.
Geologic Cross Section A-A'.

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depending on the density of the substance, would travel along the bottom or top of the water table aquifer toward the creek, discharging eventually to the Winooski River. This mechanism would apply to most of the Burlington ANG Installation.

D. ECOLOGY

1. Vegetation and Wildlife

About half of the installation's 240 acres are undeveloped and consist of fields and wooded areas. Although no systematic inventory of wildlife has been undertaken, species reportedly sighted on the installation include deer, snowbirds, and seagulls. The type of habitat found in the area may be expected to also support a variety of other species including small mammals, such as raccoon and rabbits, birds, and other wildlife.

2. Threatened and Endangered Species

Animals designated as endangered by the State of Vermont are the Lake Sturgeon, Southern Bald Eagle, American Osprey, American Peregrine Falcon, Indiana Bat, Pine Marten, Eastern Cougar, and Canada Lynx. Lake Sturgeon, which occurs in Lake Champlain, could potentially be affected by operations at the Air National Guard Installation, although the installation influences only a very small portion of the lake's drainage area.

IV. FINDINGS

IV. FINDINGS

A. ACTIVITY REVIEW

1. Summary of Waste Disposal Practices

The major industrial shop operations at the Burlington ANG Installation include hydraulics, corrosion control, engine maintenance, aerospace ground equipment (AGE) maintenance, and vehicle maintenance. These shop operations generate varying quantities of waste oils, recovered fuels, and spent solvents and cleaners.

The total quantity of waste oils, recovered fuels, and spent solvents and cleaners generated at the Burlington ANG Installation is approximately 16,000 gallons per year (gpy), based on information obtained during the site visit.

Standard procedures for past and present industrial waste disposal practices at the Burlington ANG Installation, based on reports and interviewee information, are as follows:

- 1960 to 1980--Recovered JP-4 was collected in an above-ground storage tank adjacent to the fire department training area for disposal during fire department training exercises. Spent solvents and cleaners were placed in drums for periodic disposal in the fire department training pit. Waste oils from the Motor Vehicle and AGE Shops were collected in underground storage tanks and periodically pumped out for disposal by a local company. After 1973, all synthetic oil was segregated and recycled.

The sewer which led to a septic tank and drainfield prior to 1973 and which led to the City of Burlington's Wastewater Treatment Plant (WWTP) after 1973 was used for disposal of small quantities of wastes and all washwaters.

To provide pretreatment of industrial wastewaters prior to discharging to the storm sewer, oil/water separators were constructed at Facility No. 330, the Engine Shop, in 1959; at Facilities No. 350, the AGE Shop, and 365, the Aircraft Washrack, in 1969; and at Facility No. 110, the Vehicle Maintenance Shop, in 1972 .

- 1980 to Present--All fire department training activities at the Burlington ANG Installation were curtailed, and fire department training activities for the Burlington ANG personnel began to be conducted at Plattsburgh AFB in New York. Waste oils, recovered fuels, and spent solvents and cleaners are now segregated and stored in drums behind Facility No. 330, the Engine Shop, prior to contract disposal on a monthly basis through the Defense Property Disposal Office (DPDO) at Plattsburgh AFB. An oil/water separator was installed at Facility No. 385 in 1982.

2. Industrial Operations

Industrial operations at the Burlington ANG Installation have been primarily involved with routine maintenance of assigned aircraft and associated ground support equipment. A review of installation records and interviews with installation employees resulted in the identification of the industrial operations in which the majority of industrial chemicals are handled and hazardous wastes are generated. Table 6 summarizes the major industrial operations, estimates the quantities of wastes currently being generated, and describes the past and present disposition of these wastes, i.e., treatment, storage, and disposal. Appendix E contains a master list of industrial operations and provides information on the locations of each. Descriptions of the major industrial activities are included in the following paragraphs.

a. Hydraulic Shop

The Hydraulic Shop is located in Facility No. 150. This shop services and repairs all aircraft pneumatic and hydraulic equipment. Wastes generated from this area include PD-680 (75 gal/mo) and hydraulic fluid (20 gal/mo).

b. Corrosion Control

The Corrosion Control Shop is located in Facility No. 385. Corrosion control activities include cleaning, sanding, wiping, priming, repainting, and stenciling aircraft and ground support equipment. Wastes generated in this shop include toluene (6 gal/mo), methyl isobutyl ketone (MIBK) (3 gal/mo), and paint thinner (30 gal/mo).

c. Flightline

General aircraft maintenance is conducted on the flightline. Wastes generated from this area include PD-680 (75 gal/mo), recovered JP-4 (125 gal/mo), hydraulic fluid (7 gal/mo), and waste oil (25 gal/mo).

Table 6
MAJOR INDUSTRIAL OPERATIONS SUMMARY

Shop Name	Present Location (Bldg. No.)	Waste Material	Current Estimated Quantity	Treatment/Storage/Disposal Methods 1960 1970 1980
Hydraulic Shop	150	PD-680 Hydraulic Fluid	75 gal/mo 20 gal/mo	Fire Training Exercises (1960–1980); DPDO Disposal (1980–)
Corrosion Control	385	Toluene Paint Thinners MIBK	6 gal/mo 30 gal/mo 3 gal/mo	Fire Training Exercises (1960–1980); DPDO Disposal (1980–)
Flight Line	--	PD-680 JP-4 Hydraulic Fluid Waste Oil	75 gal/mo 125 gal/mo 7 gal/mo 25 gal/mo	Fire Training Exercises (1960–1980); DPDO Disposal (1980–)
Engine Shop	330	PD-680 Waste Oil Synthetic Oil JP-4	75 gal/mo 30 gal/mo 8 gal/mo 1 gal/mo	Fire Training Exercises (1960–1980); DPDO Disposal (1980–)
Tire Repair and Reclamation	150	PD-680 Paint Remover	7 gal/mo 10 gal/mo	Fire Training Exercises (1960–1980); DPDO Disposal (1980–)
Fuel System Shop	385	MEK PD-680 Paint Remover JP-4	10 gal/mo 75 gal/mo 3 gal/mo 125 gal/mo	Fire Training Exercises (1960–1980); DPDO Disposal (1980–)

Table 6--Continued

Shop Name	Present Location (Bldg. No.)	Waste Material	Current Estimated Quantity	Treatment/Storage/Disposal Methods 1960 1970 1980
NDI	110	Penetrant Emulsifier Developer Waste Oil Waste Oil and MIBK	5 gal/mo 5 gal/mo 10 gal/mo 1 gal/mo 5 gal/mo	Fire Training Exercises (1960–1980) → DPDO Disposal
AGE	350	PD-680 JP-4	75 gal/mo 125 gal/mo	Fire Training Exercises (1960–1980) → DPDO Disposal
		Hydraulic Fluid Engine Oil Aircraft Oil	7 gal/mo 60 gal/mo 25 gal/mo	Local Recycling (1960–1980) → DPDO Disposal
Motor Vehicle	110	PD-680 Paint Thinner JP-4	75 gal/mo 7 gal/mo 125 gal/mo	Fire Training Activities (1960–1980) → DPDO Disposal
		Engine Oil	60 gal/mo	Local Recycling (1960–1980) → DPDO Disposal
		Battery Acid	2 gal/mo	Neutralized (1960–1980) →

Note: TCE was replaced by PD-680 in the mid 1970's
MIBK = Methyl Isobutyl Ketone
MEK = Methyl Ethyl Ketone

d. Engine Shop

The Engine Shop is located in Facility No. 330. This shop generates PD-680 (75 gal/mo), waste oil (30 gal/mo), synthetic oil (8 gal/mo), and JP-4 (1 gal/mo).

e. Tire Repair and Reclamation

The Tire Repair and Reclamation Shop is located in Facility No. 150. Waste materials generated from this shop include PD-680 (7 gal/mo) and paint remover (10 gal/mo).

f. Fuel System Shop

The Fuel System Shop is located in Facility No. 385. This shop generates methyl ethyl ketone (MEK) (10 gal/mo), PD-680 (75 gal/mo), paint remover (3 gal/mo), and waste JP-4 (125 gal/mo).

g. Non-Destructive Inspection (NDI) Laboratory

The NDI Laboratory is located in Facility No. 110. Non-destructive testing methods, including x-ray, magnaflux, and ultrasound, are performed to determine material defects of aircraft structures, component parts, and related ground equipment. Wastes generated from this area include penetrant (5 gal/mo), emulsifier (5 gal/mo), developer (10 gal/mo), waste oil (1 gal/mo), and commingled waste oil and MIBK (5 gal/mo).

h. Aerospace Ground Equipment (AGE) Maintenance Shop

The AGE Shop is located in Facility No. 350. This shop is responsible for repair, maintenance, and periodic inspection of all aerospace ground equipment. Wastes generated from this area include PD-680 (75 gal/mo), JP-4 (125 gal/mo), hydraulic fluid (7 gal/mo), engine oil (60 gal/mo), and aircraft oil (25 gal/mo).

i. Motor Vehicle Shop

The Motor Vehicle Shop is located in Facility No. 110. Wastes generated during the repair and maintenance of motor vehicles include PD-680 (75 gal/mo), paint thinner (7 gal/mo), JP-4 (125 gal/mo), engine oil (60 gal/mo), and battery acid (2 gal/mo).

3. Fuels

The major fuel storage areas at the Burlington ANG Installation are Facilities No. 200, 201, 202, and 203. In these areas, JP-4 is stored in four above ground tanks with capacities of 110,000 gallons, 210,000 gallons, 420,000 gallons, and 210,000 gallons. Fuel oil, MOGAS, and diesel fuel are stored at various locations on the installation in below ground tanks. A complete listing of major POL storage tanks, including facility number, type of POL stored, capacity, and type of tank, is included in Appendix F.

All fuel spills noted during the interview process were small, except for one (in 1967) in which approximately 2000 gallons of JP-4 was spilled through the off loading headers. The JP-4 drained down the stormwater drainage ditches to the sheetpile dam constructed to retain spills. No actions were taken to clean the spill up.

The major POL storage tanks are cleaned approximately every 5 years. The sludge which is removed consists mainly of water, rust, dirt, and fuel. Final disposal of the sludge is the responsibility of the cleaning contractor. These tanks are visually checked on a daily basis. Every month, the below ground tanks are leak-tested.

4. Fire Department Training Exercises

Fire department training activities are conducted at ANG installations to provide experience in fighting fires. Normally, flammable materials are poured into the fire department's training pit and ignited. The fire fighting team then enters the burning area to extinguish the fire. In the past, fire department training activities have provided a good opportunity for disposal of waste materials generated during shop operations. Fire department training activities were conducted from 1960 to 1980 in one area located near the entrance of the installation. From 1960 to 1973, fire department training activities were conducted once per month and daily during the two-week summer camp using approximately 2,000 gallons of new and waste JP-4 for each session. From 1973 to 1980, fire department training activities were conducted once per month using approximately 300 gallons of waste JP-4 each time.

The standard procedure for conducting fire training activities was to pre-saturate the area prior to dumping the JP-4 and starting the fire. However, this area was also used to dump waste oils and spent solvents and cleaners without the control of the fire department.

From 1979 to 1980, available fuels for fire department training activities became scarce, so waste fuels and solvents from the Burlington community were collected and used. During this period, approximately 1,500 gallons of commingled MEK, acetone, propyl alcohol, cyclohexanone, and methanol waste paint pigments were used. This practice was discontinued in 1980, and all fire department training activities were moved to Plattsburgh AFB. In September 1980, during closure of the site, the upper 3 feet of contaminated soils in the fire department training area were removed for disposal offsite.

5. Polychlorinated Biphenyls

Typical sources of polychlorinated biphenyls (PCBs) at the Burlington ANG Installation are electrical transformers and capacitors. In 1975, 30 transformers at the Burlington ANG Installation were replaced with new non-PCB transformers. The inactive transformers were tested for PCB, and five were found to be contaminated with PCB, ranging in concentrations from approximately 70 to 400 parts per million (ppm). The 25 uncontaminated transformers were collected by an electrical contractor for offsite disposal. The five contaminated transformers are presently stored near Facility No. 100 and are awaiting pickup for disposal by a DPDO contractor.

6. Pesticides

Pesticides are selectively used at the Burlington ANG Installation to control insects, rodents, and undesirable weeds. All of these activities are conducted by a state-licensed contractor.

7. Wastewater Treatment

The Burlington ANG Installation's sanitary sewer system is connected to the Burlington WWTP. No analysis of the raw wastewater leaving the installation was available.

Prior to 1973, all sanitary wastewater was treated in a septic tank located at the installation. The system was abandoned when the connection to the Burlington WWTP was completed in 1973. At that time, the septic tank sludge was pumped out for offsite disposal, and the empty tank was filled with sand.

There are five oil/water separators on the installation, which provide pretreatment of the industrial wastewater discharged from the shops. These oil/water separators are located at Facilities No. 110, 330, 350, 365, and 385. The effluent from the oil/water separators is discharged to the stormwater drainage ditches, which eventually drain to the Winooski River. The oil phase is collected for disposal by a private contractor. Appendix G lists the facility number and location, date of installation, and point of discharge for each of the oil/water separators.

8. Available Water Quality Data

All potable water for the Burlington ANG Installation is purchased from the City of Burlington. No water quality data were available at the installation.

The stormwater drainage system at the Burlington ANG Installation is composed of ditches and storm sewers. There are two sheetpile dams located downstream of the installation which were built to collect and retain any major spills. Stormwater exits the installation from the northeast boundary. No data was available concerning the analysis of the stormwater runoff.

9. Other Activities

The review of records and interview information produced no evidence of past or present storage, disposal, or handling of biological or chemical warfare agents at the Burlington ANG Installation. Also, no explosive ordnance disposal (EOD) has been conducted at the Burlington ANG Installation.

The records search indicated that, in the past, trichloroethylene (TCE) has been used in moderate quantities. In the mid-1970's, TCE was replaced by 1,1,1-trichloroethane and later PD-680 (Type I and Type II).

B. DISPOSAL SITE IDENTIFICATION AND EVALUATION

Interviews with 19 installation personnel (Appendix C) resulted in the identification of two disposal sites at the Burlington ANG Installation. The approximate locations of these sites are shown on Figure 12.

A preliminary screening was performed on the two identified past disposal sites based on the information obtained from the interviews and available records from the installation and outside agencies. These sites were evaluated using the decision tree process described in the "Methodology" section, page I-5. A detailed description of the HARM system is included in Appendix H. Copies of the completed rating forms are included in Appendix I. A summary of the overall hazard ratings is given in Table 7.

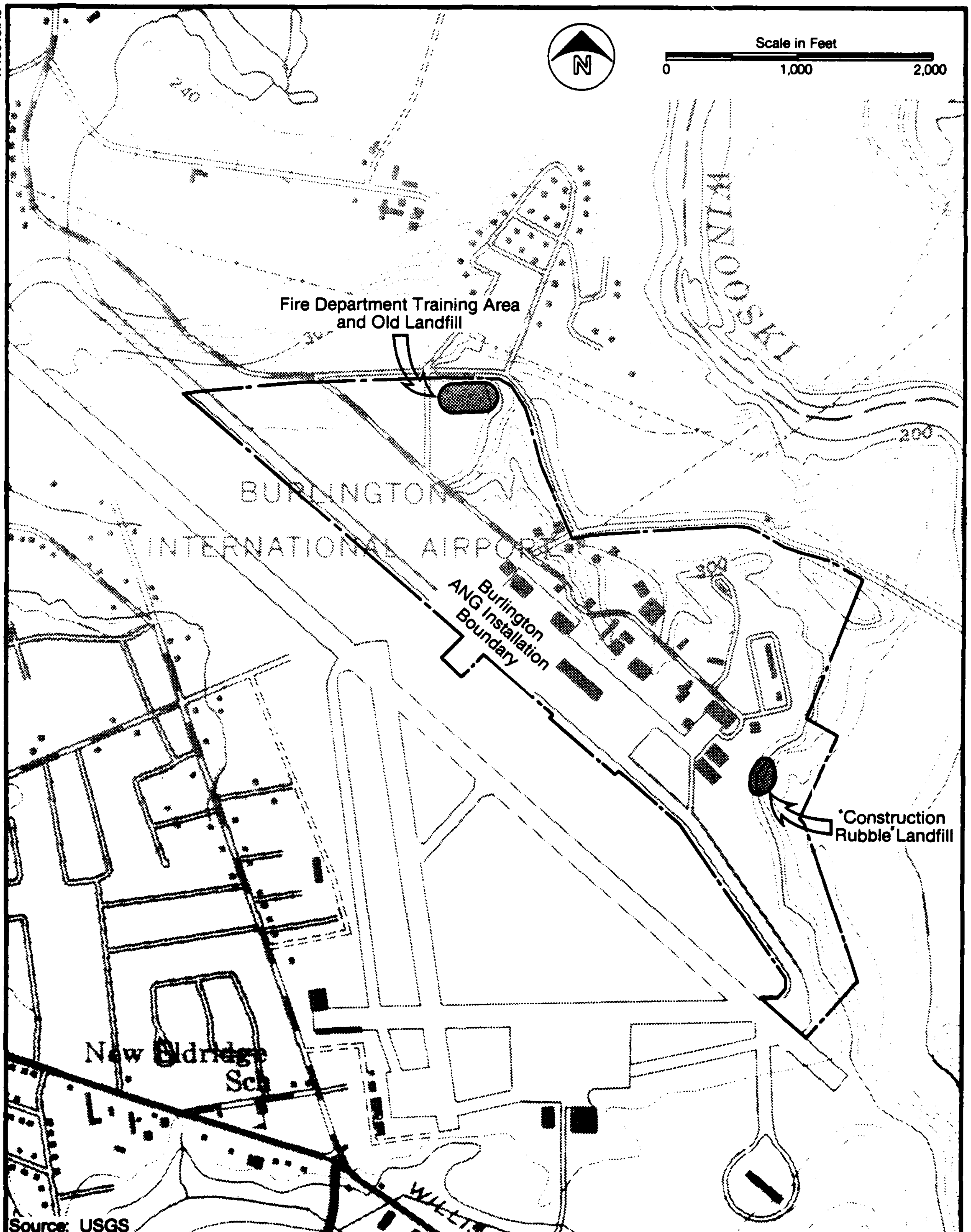

FIGURE 12.
Location of Identified Disposal Sites at the Burlington ANG Installation.

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Table 7
SUMMARY OF RESULTS OF SITE RATINGS

Site No.	Site Description	Subscore (% of Maximum Score of Each Category) Receptors	Pathways	Characteristics	Management Practices Factor	Overall Score	Page Reference Site Rating Form
1	Fire Department Training Area and Old Landfill	47	100	100	1.0	82	H-1
2	"Construction Rubble" *Landfill*	45	68	30	1.0	48	H-3

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

- Site No. 1 (Overall Score 82) is the area containing the Fire Department Training Area and Old Landfill. These two locations were combined because of their close proximity to one another. The Fire Department Training Area was used for fire department training exercises from 1960 to 1980. From 1960 to 1973, fire department training activities were conducted 26 times per year using approximately 2,000 gallons of clean and recovered JP-4 per burn. From 1973 to 1980, fire department training activities were conducted 12 times per year using approximately 300 gallons per burn. Waste oils and spent solvents and cleaners were also dumped in this area. The area was closed in 1980, and all fire department training activities were moved to Plattsburgh AFB. In September 1980, the upper three feet of contaminated soils were excavated for offsite disposal.

  The Old Landfill was used from 1960 to 1980 for disposal of concrete rubble, old automobiles, appliances, and miscellaneous aircraft parts. Unknown quantities of waste oils and spent solvents and cleaners were also dumped in this area when fire department training activities were not scheduled.

  From February 23 to 25, 1982, 10 groundwater monitoring wells were constructed to approximately 5 feet below the water table in the vicinity of Site No. 1, the Fire Department Training Area and

Old Landfill. Groundwater samples were collected from the wells on February 26, 1982, and sent to USAF OEHL/SA, Brooks AFB for analysis. The results of the monitoring program indicate that organic contamination at parts per billion (ppb) levels is present in the area. A summary of the results obtained from a report sent to the Burlington ANG Installation dated June 30, 1982 is presented in Table 8. Total volatile organic compound (VOC) concentrations (in ppb) at each well are presented on Figure 13.

The major organic compounds present in the groundwater include trichloroethylene, 1,1,1-trichloroethane, 1,2-dichloroethylene, benzene, ethylbenzene, toluene, xylene, and MEK. Methylene chloride is found in low concentrations. Trichloroethylene, 1,1,1-trichloroethane and MEK are used as solvents in the shops. Benzene, toluene, and ethylbenzene are present in fuels. Toluene and xylene are present in lacquer thinners and paint removers. The organic compound, 1,2-dichloroethylene, is found in relatively high concentrations in the groundwater but was not known to be a chemical used in Burlington ANG industrial shop activities. These results indicate direct evidence of groundwater contamination.

A potentiometric map of the site is presented on Figure 11. The regional movement of groundwater is toward the Winooski River, while the local groundwater movement is toward the creek adjacent

Table 8

SUMMARY OF MONITORING WELL DATA[a]

Compound	Well Number and Concentration (ppb)									
	BP-2	BP-3	BP-4	BP-6	BP-7	BP-8	BP-12	BP-13	BP-14	BP-18
Methylene Chloride	ND[b]	1.0	1.2	ND	ND	ND	2.4	ND	2.6	ND
1,1,1-Trichloroethane	ND	44.4	ND	ND	ND	ND	584	58	ND	ND
Trichloroethylene	18.7	2.2	1.2	ND	ND	430	54	5.3	1,166	ND
1,2-Dichloroethylene	0.9	ND	735	4.4	2,265	ND	1,790	1,277	1,925	ND
Benzene	ND	173	104	ND	61	18.1	129	ND	20.6	ND
Ethylbenzene	ND	85	100	ND	10.6	51	142	ND	ND	ND
Toluene	ND	500	661	30	230	271	1,029	15.1	25.1	ND
O-xylene	ND	271	587	ND	61	1,005	523	ND	26.3	ND
m-xylene	ND	334	642	ND	54	1,067	660	ND	ND	ND
p-xylene	ND	110	236	ND	25	407	185	ND	ND	ND
Methyl Ethyl Ketone	ND	3,700	1,122	ND	2,030	932	3,152	358	1,494	ND
2,2-Tetrachlorethylene	0.6	ND	ND	ND	ND	150	ND	ND	ND	ND
TOTAL VOC's	200	5,221	4,189	34	4,737	4,331	8,250	1,713	4,660	ND

[a]Samples collected on February 26, 1982 and analyzed by USAF OEHL/SA, Brooks AFB, Texas. Data was submitted to the Burlington ANG Installation in a report dated June 30, 1982.

[b]ND = none detected.

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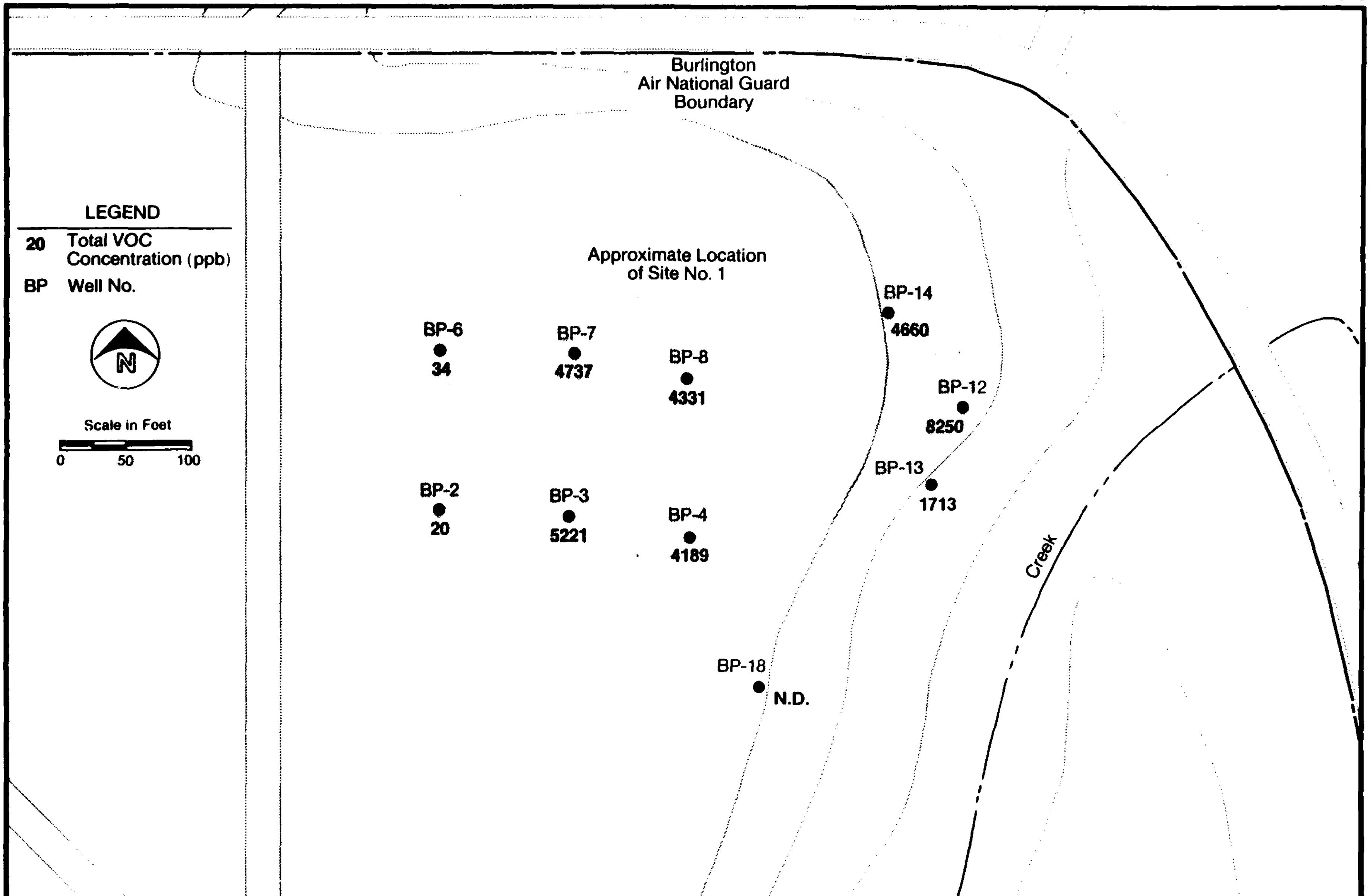

FIGURE 13.
Total VOC Concentrations Found in the Monitoring Wells at Site No. 1, Fire Department Training Area and Old Landfill.

CH2M HILL

to the site. The permeability of the soil in the area ranges from 10^{-3} to 10^{-4} cm/sec. The hydraulic gradient across the site averages approximately 0.04 feet per feet (ft/ft) and increases to approximately 0.10 ft/ft as the groundwater reaches the embankment. Because of the close proximity of the site to the installation's boundary, the degree of contamination in the groundwater, and the hydraulic gradient at the site, it is likely that the contamination has migrated off of the ANG's property.

The creek adjacent to the site intercepts the groundwater. From the creek, the water flows to the Winooski River, which eventually discharges to Lake Champlain approximately 8 miles downstream. The water intakes to the City of Burlington's WTP are located in Lake Champlain. No potable wells are known to be located within the general area of the site.

The data collected during the monitoring program indicates that a groundwater contamination problem exists at the site; however, because of limitations in the existing data, it is different to determine the full extent of groundwater contamination. Specific limitations in the data are as follows:

1. The location and extent of contamination of the base of the aquifer were not determined during the original monitoring program.

2. Criteria for well placement and details of well construction are not known.

3. No analytical results are available for surface-water samples collected from the creek adjacent to the site.

These areas of concern are part of the Phase II program.

The receptors subscore of 47 is due to four factors: the site is located less than 3,000 feet from the installation's boundary; there are between 26 and 100 people living within 1,000 feet of the site; the site is adjacent to a residential area; and surface waters are used as a source of potable water for more than 1,000 people within a 3-mile radius of the site.

The waste characteristics subscore is 100 because the site was used for disposal of a confirmed large quantity of high hazard. This material has a persistence factor of 1.0 since the site was used for disposal of halogenated compounds. The physical state multiplier is 1.0 since the majority of the materials were liquids.

The pathways subscore is 100 because there is direct evidence of hazardous contaminant migration. Samples from monitoring wells constructed in the area indicate elevated levels of 1,1,1-trichloroethane, trichloroethylene, 1,2-dichloroethylene, ethylbenzene, benzene, toluene, xylene, methyl ethyl ketone and 2,2-tetrachloroethylene. Trace concentrations of methylene chloride were found. The stream adjacent to the site was visually inspected during the installation visit, and discolored soils and the presence of leachate were noted.

The waste management practices factor is 1.0 since no containment was provided during site closure.

- Site No. 2, "Construction Rubble" Landfill (Overall Score 48), is located behind Hangar 5 and has been used since 1960 for disposal of construction rubble from the installation. According to the interviewees, this area was also used for disposal of small quantities of waste oils and spent solvents and cleaners. The site continues to be used today for construction rubble disposal.

  The receptors subscore of 45 is due to three factors: the land use zoning within a 1-mile radius of the site is residential; the distance to the installation boundary is less than 3,000 feet; and the population served by a surface-water supply within 3 miles downstream of the site is greater than 1,000.

  The waste characteristics subscore of 24 is due to the fact that this site was used for disposal of a suspected small quantity of waste material with a medium hazard rating. The persistence factor was 1.0 since the site was used for disposal of halogenated compounds. The physical state multiplier is 1.0 since the waste materials were liquids.

  The pathways subscore of 68 is due to four factors: the distance to the nearest surface water is less than 500 feet; the net precipitation is between +5 to +20 inches; the surface erosion is moderate, and the rainfall intensity is 2.1 to 3.0 inches.

The waste management practices factor is 1.0 since no containment has been provided at the site.

Two disposal sites were identified at the Burlington ANG Installation and rated using the HARM rating system.

C. ENVIRONMENTAL STRESS

No evidence of significant environmental stress resulting from past disposal of hazardous wastes was observed during the ground tour of the Burlington, Vermont, Air National Guard Installation. Areas of potential concern are those adjacent to Muddy Brook and the Winooski River, where natural woodland environments and flood plains are present.

V. CONCLUSIONS

A. Information obtained through interviews with 19 present installation personnel, installation records, and field observations indicate that Burlington ANG Installation property has been used for disposal of small quantities of hazardous wastes.

B. No evidence of environmental stress resulting from past disposal of hazardous wastes was observed at the Burlington ANG Installation.

C. At Site No. 1, the Fire Department Training Area and Old Landfill, direct evidence of groundwater contamination was found in samples collected in April 1983 from monitoring wells installed in the area. During the installation visit, indirect evidence was also found in the stream adjacent to the site in the form of discolored sediments and the presence of leachate. Based on the topography and geology of the site and its proximity to the installation boundary, there is a high potential for contaminant migration off of the installation's property. Further study to confirm this will be required as part of the Phase II program.

D. Table 9 presents the priority listing of the two rated sites and their overall scores. Site No. 1, the Fire Department Training Area and Old Landfill, exhibits the most significant potential for environmental impact.

E. Limited Phase II monitoring has been recommended at Site No. 2, the Construction Rubble Landfill.

F. The potential for contaminant migration is high at both sites because soil permeability and hydraulic gradient are moderately high and the water table is close to the ground's surface (approximately 10 feet).

Table 9
PRIORITY LISTING OF DISPOSAL SITES

Site No.	Site Description	Overall Score
1	Fire Department Training Area and Old Landfill	82
2	"Construction Rubble" Landfill	48

VI. RECOMMENDATIONS

A. PHASE II PROGRAM

A potential hazard has been determined to exist at the Burlington ANG Installation; therefore, based on the findings and conclusions, the priority for monitoring is considered high. An in-depth Phase II monitoring program is recommended to determine the extent and magnitude of migration of hazardous contaminants. The following Phase II recommendations are made for the Burlington ANG Installation:

1. In the area of Site No. 1, the Fire Department Training Area and Old Landfill, five monitoring wells, installed to the base of the aquifer and screened from 5 feet above the water table through the full length of the saturated zone, are recommended. The approximate locations of these wells are as follows:

    a. One adjacent to the existing monitoring well BP-6, the most downgradient well, and one upgradient of the site near the main entrance road.

    b. Two downgradient on each side of the creek.

    These wells will help to determine the full extent of the groundwater contamination.

2. Groundwater samples should be collected from the new and existing monitoring wells and analyzed for VOC's, oil and grease, phenols, and heavy metals (Pb, Cd, Zn, and Cr) to determine the extent of

the contamination and to develop a historical trend of the plume's movement.

3. Surface-water samples should be collected from the creek upstream and downstream of the site, and analyzed for VOC's, oil and grease, phenols, and heavy metals (Pb, Cd, Zn, and Cr).

4. Sediment samples should be collected from the creek bed upstream and downstream of the site and analyzed for heavy metals (Pb, Cd, Zn, and Cr).

5. At Site No. 2, the "Construction Rubble" Landfill, one upstream and one downstream surface-water sample should be collected from the small creek adjacent to the site and analyzed for VOC's and oil and grease. Also, one upstream and one downstream sediment sample should be collected from the creek and analyzed for heavy metals (Pb, Cd, Zn, and Cr).

6. The details of the monitoring well installation and procedures for collecting and analyzing samples will be finalized as part of the Phase II program.

Figure 14 illustrates locations of the recommended monitoring wells and surface-water sampling points for Site No. 1, the Fire Department Training Area and Old Landfill.

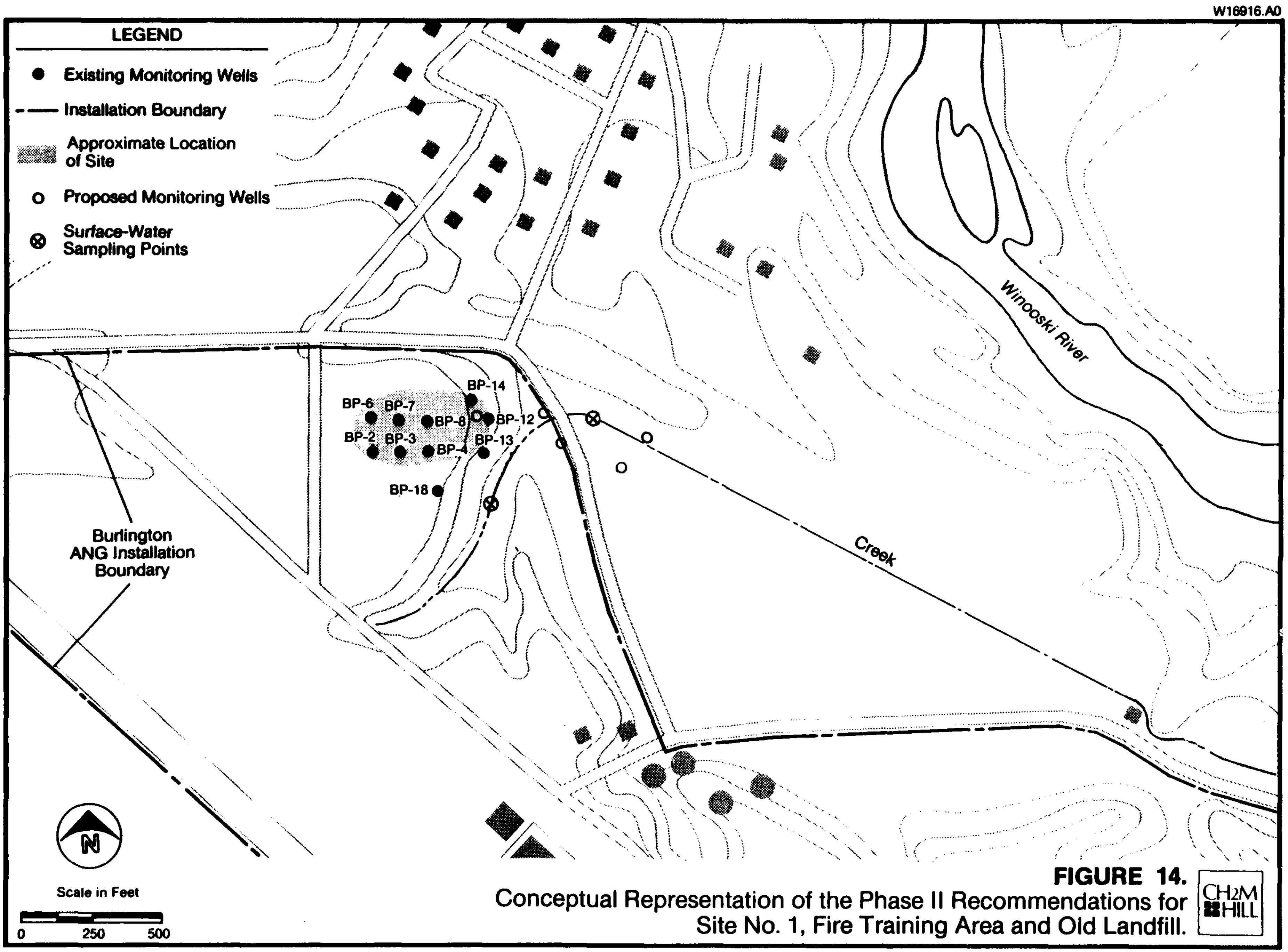

FIGURE 14.
Conceptual Representation of the Phase II Recommendations for Site No. 1, Fire Training Area and Old Landfill.

B. OTHER RECOMMENDATIONS

In addition to the Phase II monitoring program, the following recommendation is made:

1. Standard operating procedures for major spills which enter the stormwater drainage ditches and are collected by the downstream dams should include pumping the waste material out from behind the dam to prevent downstream contamination.

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

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

ADC	Air Defense Command
AFB	Air Force Base
AFCC	Air Force Communications Command
AFESC	Air Force Engineering and Services Center
AG	Above ground
AGE	Aerospace Ground Equipment
ANG	Air National Guard
ANGSC	Air National Guard Support Center
AVGAS	Aviation Gasoline
BG	Below ground
bls	Below Land Surface
CAMS	Consolidated Aircraft Maintenance Squadron
CE	Civil Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	Centimeter
cm/sec	Centimeters per second
COD	Chemical Oxygen Demand
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DoD	Department of Defense
DPDO	Defense Property Disposal Office
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
°F	Degrees Fahrenheit
ft/ft	feet per feet
gal/mo	gallons per month
gal/yr	gallons per year
HARM	Hazard Assessment Rating Methodology
IRP	Installation Restoration Program
JP	Jet Petroleum
MEK	Methyl Ethyl Ketone
MIBK	Methyl Isobutyl Ketone
MOGAS	Motor Gasoline

msl	Mean Sea Level
NDI	Non-Destructive Inspection
No.	Number
PCBs	Polychlorinated Biphenyls
POL	Petroleum, Oil, and Lubricants
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
R&R	Repair and Reclamation
tbm	Temporary Benchmark
TCE	Trichloroethylene
TFG	Tactical Fighter Group
TFW	Tactical Fighter Wing
USAF	United States Air Force
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

GLOSSARY OF TERMS

GLOSSARY OF TERMS

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

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

3. CONFINING STRATA - A strata of impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.

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

5. DEVELOPER - A chemical used to make images visible on exposed film; typically sodium hydroxide or sodium sulfite.

6. DISCHARGE - The process involved in the draining or seepage of water out of a ground-water aquifer.

7. DOWNGRADIENT - A direction that is hydraulically down slope; the direction in which ground water flows.

8. EMULSIFIER - A substance used to hold very fine oily or resinous liquid suspended in another liquid; in photography, a suspension of silver salt in gelatin used to coat plates and film.

9. EVAPOTRANSPIRATION - Evaporation from the ground surface and transpiration through vegetation.

10. FIXER - A solution containing silver used in photography to stabilize images on film.

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

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

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

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

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

14. LACUSTRINE - (A) Pertaining to, produced by, or formed in a lake or lakes, (B) Growing in or inhabiting lakes, (C) Said of a region characterized by lakes.

15. LOESS - An unconsolidated deposit of windblown dust of glacial age, usually calcareous and unstratified and consisting primarily of silt-sized particles.

16. METHYL ETHYL KETONE - An organic chemical used as a solvent in cements and adhesives.

17. METHYL ISOBUTYL KETONE - An organic chemical used as a solvent in paints, varnishes, and lacquers.

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

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

20. OIL/WATER SEPARATOR - A man-made facility designed to separate by gravity liquids of differing densities; typically to skim oil or grease from a water surface.

21. ORDNANCE - Any form of artillery, weapons, or ammunition used in warfare.

22. PCB (Polychlorinated Biphenyl) - A chemically and thermally stable toxic organic compound that, when introduced into the environment, persists for long periods of time, is not readily biodegradable, and is biologically accumulative.

23. PD 680 - A petroleum distillate used as a safety cleaning solvent. Two types of PD-680 solvent have been used; Type I, having a flashpoint of 100°F, and Type II, having a flashpoint of 140°F.

24. PENETRANT - A petroleum-based fluorescent dye.

25. PERCHED GROUND WATER - Unconfined ground water separated from an underlying regional ground-water table.

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

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

28. RECHARGE - The process involved in the addition or replenishment of water to a ground-water aquifer.

29. SEDIMENTARY ROCK - A rock resulting from the consolidation of loose sediment that has accumulated in layers; typical examples include sandstone, siltstone, limestone, and shale.

30. SOIL HORIZONS:

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

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

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

31. STRATA - Distinguishable horizontal layers separated vertically from other layers.

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

33. TILL - Unsorted and unstratified drift, generally unconsolidated, deposited directly by and underneath a glacier without subsequent reworking by water from the glacier, and consisting of a heterogeneous mixture of clay, sand, gravel, and boulders varying widely in size and shape.

34. UPGRADIENT - A direction that is hydraulically up slope.

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

36. WETLAND - An area subject to permanent or prolonged inundation or saturation which exhibits plant communities adapted to this environment.

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Appendix A

RESUMES OF TEAM MEMBERS

AD-A136 832 INSTALLATION RESTORATION PROGRAM RECORDS SEARCH FOR 158 TACTICAL FIGHTER..(U) CH2M HILL GAINESVILLE FL SEP 83 F08637-80-G-0010 2/2

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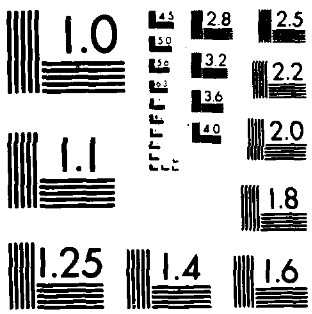

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

(7335-WDC)
MICHAEL S. THOMPSON

Education

M.S., Civil (Sanitary) Engineering, South Dakota State University, 1972
B.S., Civil Engineering, South Dakota State University, 1971

Experience

Mr. Thompson has extensive solid and hazardous waste technical experience in both the private and public sectors. Mr. Thompson has served as project technical consultant on various aspects of municipal and hazardous waste collection and disposal including waste characterization, landfill site selection and design, and RCRA permit application assistance. He has been involved in both short- and long-term investigations and studies as related to the requirements of the RCRA, TSCA, and CERCLA.

Mr. Thompson was assistant project manager for a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Part B Permit application for a storage facility at the U.S. Army Umatilla Depot Activity, Oregon. He also served as assistant project manager for RCRA Hazardous Waste Part B Permit applications for treatment, storage and disposal facilities at three U.S. Army installations in Texas: Red River Army Depot, Lone Star Army Ammunition Plant, and Longhorn Army Ammunition Plant.

Mr. Thompson served as project consultant and task manager for remedial response actions for an uncontrolled hazardous waste site at Winthrop, Maine, under the U.S. Environmental Protection Agency's Superfund I program.

Mr. Thompson was senior project consultant and field engineer for engineering assistance to the New York City Department of Environmental Protection for the contracting and cleanup of an abandoned hazardous waste site within the city.

As District Engineer in Waste Management, Inc.'s Midwest Region for 1-1/2 years, Mr. Thompson provided engineering field support to landfill operations and management personnel at waste disposal sites within the region. Support activities involved design and supervision of construction of monitoring well systems and leachate collection facilities, monitoring of site operations to ensure compliance with plans, investigations and analysis of prospective landfill sites, coordination with outside engineering consultants tasked for company projects, supervision of construction projects ongoing at the landfills, and coordination of

MICHAEL S. THOMPSON

landfill programs with Federal, state, and local regulatory agencies with regard to active and prospective sites.

Mr. Thompson was a project officer for 3 years at the U.S. Army Environmental Hygiene Agency in the Waste Disposal Engineering Division and the Army Pollution Abatement Program Support Division. During these periods he consulted with Army installation commanders on all aspects of hazardous waste management including identification, sampling, handling, treatment, storage, and disposal. He interacted constantly with Federal, state, and local regulatory personnel and interagency technical committees regarding environmental permit applications/requirements and project impacts on Army installations. Existing Army landfill sites and prospective sanitary landfill areas were evaluated under his supervision.

Mr. Thompson has served as a hazardous or solid waste consultant to the following: Defense Logistics Agency (DLA), U.S. Army Development and Readiness Command (DARCOM), the U.S. Army Forces Command (FORSCOM), the Army National Guard, the Okinawa (Japan) Prefecture Environmental Pollution Investigative Committee, and the Michigan Advisory Committee for the Development of the State Department of Natural Resources Landfill Design Guidelines.

Professional Registration

Professional Engineer: Illinois, Maryland

Membership in Professional Organizations

American Society for Testing and Materials (ASTM)
Chi Epsilon
National Society of Professional Engineers
Water Pollution Control Federation

Publications

Mr. Thompson has authored or coauthored 15 Federal Government publications.

(7333-GNV)
J. KENDALL CABLE
Environmental Engineer

Education

M.E., Civil Engineering, University of Tennessee
B.S., Civil Engineering, University of Tennessee

Experience

Mr. Cable's responsibilities at CH2M HILL involve projects dealing with hazardous and solid waste management and industrial waste treatment processes. He is also involved in municipal water and wastewater treatment projects.

Mr. Cable's hazardous waste experience includes hazardous materials records search for the United States Air Force, in which past hazardous material disposal sites were identified and suspected problems associated with the sites were evaluated. He also worked on a conceptual design and conducted pilot testing on a prototype packed tower aeration unit for removal of volatile organic compounds (VOC's) from groundwater in Port Malabar, Florida.

Mr. Cable's industrial wastewater experience includes a bench-scale treatability study and conceptual design for the American Hoechst Corporation in Mt. Holly, North Carolina; wastewaters generated at the facilities were a complex mixture of synthetic organic compounds. He also participated in a pilot plant treatability study and conceptual design for Hercules, Inc., in Brunswick, Georgia; wastewaters generated at the facilities resulted from the production of organic gum and wood chemicals, cellulose-based water-soluble polymers, and specialty organic chemicals.

Mr. Cable's municipal wastewater studies have included a wastewater master plan for Manatee County, Florida, an addendum to the West Pasco County Wastewater Facilities Plan--New Port Richey Service Area, and a cost-effective analysis of two types of package wastewater treatment plants. He also contributed to a study for the U.S. Army Corps of Engineers to develop functions for estimating the capital and O&M costs associated with surface-water intake systems. The cost functions were verified using cost data from projects previously designed by CH2M HILL. He conducted a sampling program and developed design flow and loads for the Ocean Springs Regional Land Treatment System. He helped to develop conceptual documents and design instructions for the Ocean Springs Regional Land Treatment System in Ocean Springs, Mississippi. The system included a 75-acre multicellular facultative lagoon, a 15.75-mgd pump station, and 415 acres of sprinkler irrigation with subsurface drainage. He evaluated the flows, loads, and operating efficiency of an existing facultative lagoon in Ridge Spring, South Carolina. From this information, he developed a conceptual design for an aerated lagoon for the town. He conducted a sampling program and evaluated the existing and future capacity of a 1.0-mgd activated sludge WWTP in Silver Springs Shores near Ocala, Florida. He also participated in development of a municipal sludge disposal plan for the Pascagoula/Moss Point Regional Wastewater Treatment Plant in Pascagoula, Mississippi. In this project, various sludge disposal options were evaluated, and land application on privately owned farmland was selected. Based on this information, a disposal plan and feasibility study were developed. He also evaluated the method of municipal sludge land application used by a WWTP located in Silver Springs Shore near Ocala, Forida.

Professional Registration

Engineer-In-Training, Tennessee

Membership in Professional Organizations

American Society of Civil Engineers
Water Pollution Control Federation
Chi Epsilon
Toastmasters

Publications

"An Evaluation of the Adsorption and Flotation of Nonpolar Organic Compounds in Clay Colloid Suspensions." Masters Thesis, University of Tennessee. 1980.

"Developing Cost Estimating Methods for Surface Water Intake Structures." Presented at ASCE National Specialty Conference entitled Water Supply--The Management Challenge in Conjunction with the U.S. Army Engineer Waterways Experiment Station, Tampa, Florida. March 1983.

(6179-GNV)
GARY E. EICHLER
Hydrogeologist

Education

M.S., Geology with Minor in Civil Engineering, University of Florida
B.S., Cum Laude, Construction and Geology, Utica College of Syracuse University

Experience

Mr. Eichler has been responsible for groundwater projects for both water supply and effluent disposal. Studies have included site selection, well design, construction services, monitoring and testing programs, determination of aquifer characteristics, and well field design. In addition, he has conducted numerous studies to determine pollution potential of toxic and hazardous wastes. Prior to joining CH2M HILL, Mr. Eichler was an engineering geologist with an environmental consulting firm. His responsibilities included project management, soils investigations, siting studies, groundwater and surface-water reports, and federal and state environmental impact studies.

Mr. Eichler has been responsible for exploration drilling, testing and design of well fields having a combined total installed capacity of over 75 mgd. Many of these well fields for potable water supply are located in the coastal aquifer in close proximity to saltwater.

His experience includes responsibility for the design and installation of shallow aquifer well fields in unconsolidated formations. Mr. Eichler has designed and installed screened wells, both natural and gravel packed, as well as open hole wells using both cable tool and rotary drilling methods.

Project responsibilities have included management and team participation on more than 20 hazardous waste disposal projects. The studies included initial site investigations, determination of pollutant travel time and direction, and evaluation of the potential for contaminant migration.

Mr. Eichler has been involved in geophysical logging and performance testing of deep disposal wells for both municipal effluent and hazardous waste.

He has conducted projects to determine saltwater intrusion potential and has been responsible for the design of monitoring programs to warn against intrusion.

GARY E. EICHLER

Mr. Eichler has conducted hydrogeological projects using aquifer computer modeling techniques to predict the effects of future large scale groundwater withdrawals.

Professional Registration

Certified Professional Geologist, Certificate No. 4544

Membership in Professional Organizations

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

Publications

With U. P. Singh, C. R. Sproul, and J. I. Garcia-Bengochea. "Aquifer Testing of the Boulder Zone of South Florida." ASCE Publication Preprint 82-030. 1982.

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Appendix B
OUTSIDE AGENCY CONTACT LIST

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   Burlington, Vermont
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3. Vermont Agency of Environmental Conservation
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   James W. Ashley
   802/828-2761

4. Vermont Agency of Environmental Conservation
   Department of Water Resources
   Montpelier, Vermont 056002
   David Butterfield
   802/828-2761

5. Chittenden County Regional Planning Commission
   58 Pearl Street
   Essex Junction, Vermont
   Art Hogen
   802/658-3004

6. Burlington Water Department
   City Hall
   Burlington, Vermont
   Andrew Colaceci
   802/864-7023

7. South Burlington Water Pollution Control Department
   1015 Airport Parkway
   South Burlington, Vermont
   Bill Szymanski
   802/862-6936

Appendix C
BURLINGTON ANG INSTALLATION
RECORDS SEARCH INTERVIEW LIST

Interviewee No.	Organization	Area of Knowledge	Years at Installation
1	ANG	Flightline	29
2	ANG	Aircraft Maintenance	25
3	ANG	Aircraft Maintenance	27
4	ANG	Fire Department	22
5	ANG	Fire Department	25
6	ANG	Motor Vehicle	10
7	ANG	Motor Vehicle	24
8	ANG	Security	33
9	ANG	Base Operations	32
10	ANG	Civil Engineering	10
11	ANG	Machine Shops	11
12	ANG	Field Maintenance	23
13	ANG	Engine Shop	17
14	ANG	Hydraulics	22
15	ANG	Environmental Systems	2
16	ANG	Tire Repair and Reclamation	24
17	ANG	Aerospace Ground Equipment	22
18	ANG	Fuels	9
19	ANG	NDI	2

Appendix D
INSTALLATION HISTORY AND MISSION

The Vermont Air Guard was organized at what was then the Burlington Municipal Airport on July 1, 1946, and was given federal recognition as the 134th Fighter Squadron. It was the first air unit in Vermont and one of the first Air National Guard units in the country organized after the end of World War II. The forerunner of the Vermont Air Guard, the 530th Fighter Squadron, 211th Fighter Group, was credited with battle participation in the India-Burma campaign and the China Offensive campaign.

The first aircraft in the VTANG inventory were the C47 Gooney Birds and two types of trainers, the L5 and AT6. The trainers were later replaced by the unit's first tactical aircraft, the P47 Thunderbolt.

The F51 Mustangs replaced the P47's in July 1950. The Mustang was widely used in both the European and Asian theaters of World War II. By the end of 1950, the unit reached its full assigned strength of 300 members.

The Korean War was an important milestone for the unit. On January 9, 1951, the Vermont ANG was alerted and entered active military service on February 1. The Fighter Squadron was assigned to the Eastern Air Defense Commander for the 21 months of its activation and several members of the unit served in Korea and other parts of the world. On October 31, 1952, the squadron was released from active duty and returned to state control.

In April 1954, the Vermont ANG began an important transition to its first jet aircraft--the F94 Starfire. The 134th was reorganized as a jet all-weather fighter interceptor squadron. The squadron was rated as a Category "A" combat-ready unit in July 1957 with special commendations.

April 1958 brought another change in aircraft. The F94s were replaced by the twin engine F89D Scorpions. A year later, the Chief of the National Guard Bureau presented the unit with the Flying Safety Award for its excellent safety record.

The Vermont ANG became part of the Air Defense Runway Alert program in January 1960 and was reorganized as the 158th Fighter Group under the USAF Air Defense Command. Alert hangars, previously owned by Ethan Allen AFB until its deactivation in 1960, were now manned by the Vermont Air National Guard. The unit went into a full-time, 24-hour seven day-a-week alert status.

In October 1962, the group received the Operational Readiness Award by the National Guard Bureau for having the highest degree of readiness of any F89 unit in the country.

In August 1965, the unit transitioned to F-102 Delta Dagger tactical jets. In August of the following year, the unit celebrated its 20th Anniversary and honored the charter members. Some 20,000 people were on hand for an air show presented by the USAF Thunderbirds and a sky-diving team. There was also a moment of reflection for the men who had died while flying for the Vermont ANG, and the Distinguished Flying Cross for heroism was awarded posthumously to Col. Robert P. Goyette, Commander of the fighter group, who had been killed in a crash the year before.

The early 1970s became a period of transition for the Air Guard. The operations building was completed and over the next several years Combat Support, Clinic, and Supply were moved from the airport side of the runway to their present locations. The first women entered the forces of the Air Guard and, in 1972, the first full-time recruiter was appointed.

During November 1974, the unit began its transition from F-102 aircraft to the EB-57 and became the Defense Systems Evaluation Group. With this mission came deployments to many parts of the world, including Iceland, Korea, Greenland, and Alaska.

In March 1976 the unit received the Air Force Outstanding Unit Award for exceptionally meritorious service in support of military operations from July 1, 1974 to June 30, 1975.

On July 1, 1979, the Vermont Air National Guard acquired a contingency mission. This unit is available for deployment to Europe whenever the President considers more support necessary. This mission requires that personnel be processed in a minimal amount of time.

In December 1981, the EB-57s were replaced by F-4D Phantoms. In January 1982, the unit became the 158th Tactical Fighter Group (TFG). The unit continues today to be the primary mission at the Burlington ANG Installation.

Appendix E

MASTER LIST OF INDUSTRIAL OPERATIONS

Appendix E
MASTER LIST OF INDUSTRIAL OPERATIONS

Organization/Shop Name	Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal Method
Fire Department	50			
Resources	100			
Comptroller	100			
Clinic	105			
Operations	140			
Parachute Shop	140			
NDI	110	X	X	Contract disposal through DPDO at Plattsburgh AFB, NY
Motor Vehicle	110	X	X	Contract disposal through DPDO at Plattsburgh AFB, NY
Environmental Systems	150	X	X	Contract disposal through DPDO at Plattsburgh AFB, NY
Hydraulic Shop	150	X	X	Contract disposal through DPDO at Plattsburgh AFB, NY
Tire Shop	150	X	X	Contract disposal through DPDO at Plattsburgh AFB, NY
Sheet Metal Shop	150			
Administration-Maintenance	150			
Battery Shop-Maintenance	150	X	X	Contract disposal through DPDO at Plattsburgh AFB, NY
Machine Shop	150			
CBPO	170			
Communications	170			
Security	170			
Photography Lab	170	X	X	Silver Recovery
Administration Base	170			
POL	220	X	X	Recycled to AGE
Gun Services	320	X	X	Recycled to AGE
Engine Shop	330	X	X	Recycled to AGE
Welding Shop Maintenance	330			
AGE	350	X	X	Recycled to AGE
Weapons Release	360	X	X	Recycled to AGE
Avionics	360			
Egress	360			
Engineering	380			
Corrosion Control	385	X	X	Contract disposal through DPDO at Plattsburgh AFB, NY
Fuel System Shop	385	X	X	Contract disposal through DPDO at Plattsburgh AFB, NY
Flightline		X	X	Contract disposal through DPDO at Plattsburgh AFB, NY

Appendix F--Continued

Organization/Shop Name	Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Waste	Current Treatment/Storage/Disposal Method
Flight Simulator	190 1978-Pres.	X	X	Contract disposal through DPDO at Offutt AFB
Flightline		X	X	Contract disposal through DPDO at Offutt AFB
POL Operations	215 1963-Pres.	X	X	Contract disposal through DPDO at Offutt AFB
Missile Maintenance	301 1966-Pres.	X	X	Contract disposal through DPDO at Offutt AFB
Phase Maintenance	100 1941-Pres.	X	X	Contract disposal through DPDO at Offutt AFB
Support Aircraft	100 1941-Pres.	X	X	Contract disposal through DPDO at Offutt AFB
Fabrication	230 1961-Pres.			

[a]Information for past or alternate locations was not available for all shops.

Appendix F

INVENTORY OF EXISTING POL STORAGE TANKS

Appendix F
INVENTORY OF EXISTING POL STORAGE TANKS

Facility/Location	Type POL	Capacity (gal)	Above Ground (AG) Below Ground (BG)
50	Fuel Oil	1,034	BG
	Fuel Oil	5,076	BG
100	Fuel Oil	11,907	BG
105	Fuel Oil	1,989	BG
110	Fuel Oil	10,329	BG
	MOGAS	10,000	BG
	MOGAS	1,000	BG
	Diesel	4,000	BG
	Waste POL	275	BG
115	JP-4	50,000	BG
	JP-4	50,000	BG
125	Fuel Oil	560	BG
	Fuel Oil	560	BG
140	Fuel Oil	15,000	BG
150	Fuel Oil	7,896	BG
170	Fuel Oil	4,011	BG
220	Fuel Oil	1,034	BG
310	Fuel Oil	5,076	BG
320	Fuel Oil	560	BG
330	Fuel Oil	6,016	BG
335	Fuel Oil	1,034	BG
350	Fuel Oil	1,034	BG
	JP-4	2,500	BG
	Used Oil	275	BG
360	Fuel Oil	19,976	BG
380	Fuel Oil	2,961	BG
385	Fuel Oil	7,896	BG
	Solvent	2,000	BG
	Solvent	1,000	BG
220	Fuel Oil	15,000	BG
	Fuel Oil	20,000	BG
	Fuel Oil	25,000	BG
	Fuel Oil	25,000	BG
201	JP-4	210,000	AG
200	JP-4	110,000	AG
203	JP-4	420,000	AG
202	JP-4	210,000	AG

[illegible]

[illegible] OF OIL/WATER SEPARATORS

Appendix G
INVENTORY OF OIL/WATER SEPARATORS

Facility No.	Facility Identification	Date of Facility Construction	Date of Separator Installation	Discharge
110	Vehicle Maintenance Shop	1947	1972	Storm sewer
330	Engine Shop	1959	1959	Storm sewer
350	AGE Shop	1953	1969	Storm sewer
365	Aircraft Washrack	1969	1969	Storm sewer
385	Corrosion Control	1982	1982	Storm sewer

Appendix [illegible]

HAZARD ASSESSMENT RATING METHODOLOGY

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

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

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

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

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

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

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

PURPOSE

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

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

DESCRIPTION OF MODEL

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

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

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

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

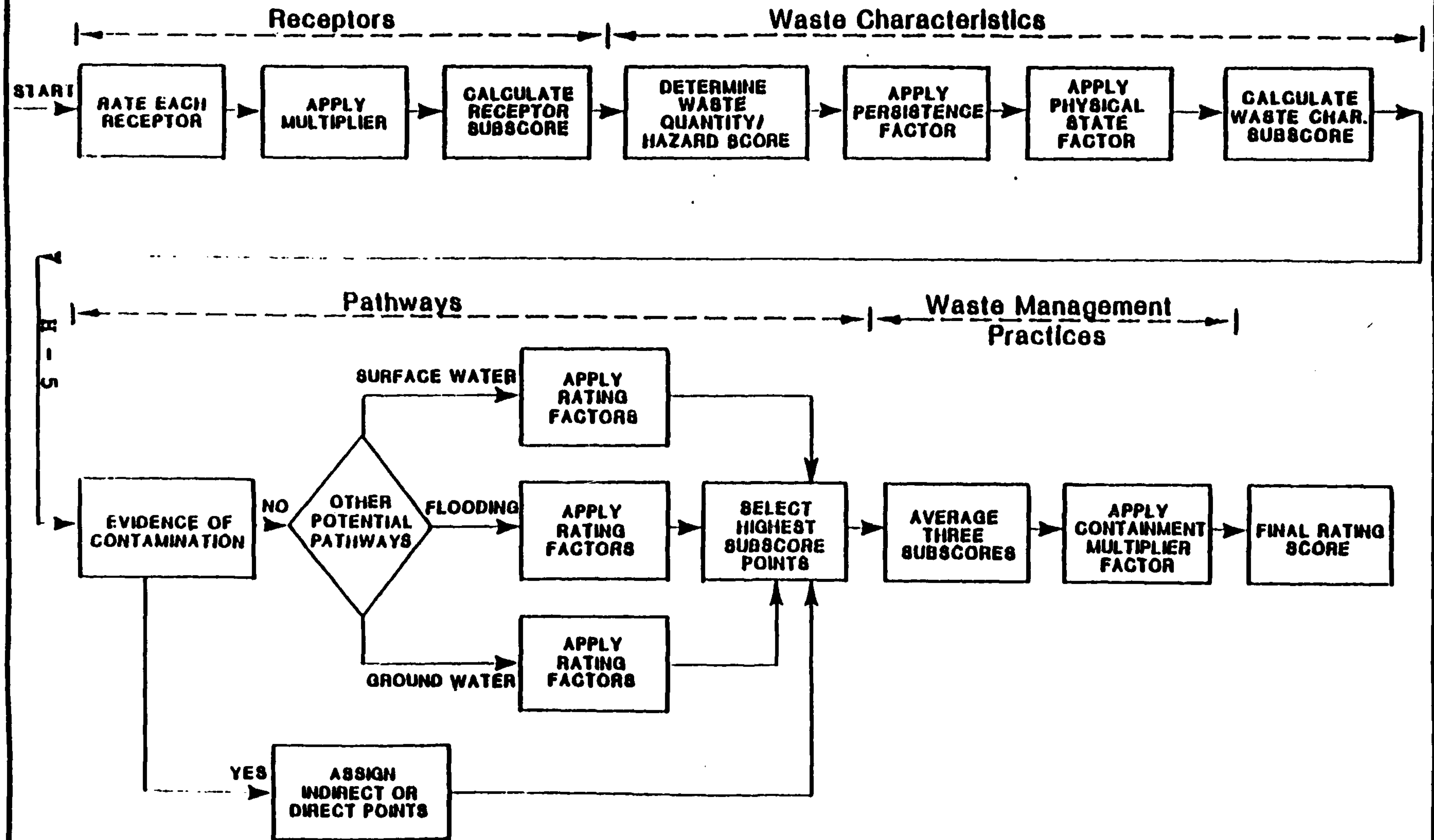
The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant, and adding the weighted scores to obtain a total category score.

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

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

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

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART



FIGURE

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE ____________________

LOCATION ____________________

DATE OF OPERATION OR OCCURRENCE ____________________

OWNER/OPERATOR ____________________

COMMENTS/DESCRIPTION ____________________

SITE RATED BY ____________________

I. RECEPTORS

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

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

II. WASTE CHARACTERISTICS

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

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

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

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

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

III. PATHWAYS

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

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

Subscore ______

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

1. Surface water migration

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

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

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

Subscore (100 x factor score/3) ______

3. Ground-water migration

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

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

C. Highest pathway subscore.

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

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

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

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

 x ______ = ☐

Table 1
HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

I. **RECEPTORS CATEGORY**

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

Table 1--Continued

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

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

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records
- o Knowledge of types and quantities of wastes generated by shops and other areas on base

S = Suspected confidence level

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

A-3 Hazard Rating

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

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

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

Table 1--Continued

II. WASTE CHARACTERISTICS--Continued

Waste Characteristics Matrix

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

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

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

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

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

B. Persistence Multiplier for Point Rating

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

C. Physical State Multiplier

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

Table 1--Continued

III. PATHWAYS CATEGORY

A. Evidence of Contamination

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

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

B-1 Potential for Surface Water Contamination

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

B-2 Potential for Flooding

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

B-3 Potential for Ground-Water Contamination

Rating Factors	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to + 20 inches	Greater than +20 inches	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8

Table 1--Continued

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

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

IV. WASTE MANAGEMENT PRACTICES CATEGORY

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

B. Waste Management Practices Factor

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

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

Guidelines for fully contained:

Landfills:

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

Surface Impoundments:

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

Spills:

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

Fire Protection Training Areas:

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

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

APPENDIX I

[illegible] RATING FORMS

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Fire Department Training Area and Original Landfill

LOCATION: Burlington ANG Installation

DATE OF OPERATION OR OCCURRENCE: 1960 to 1980

OWNER/OPERATOR: Burlington ANG

COMMENTS/DESCRIPTION: Fire Department Training and General Disposal

SITE RATED BY: K. Cable, G. Eichler

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	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	18
G.	Ground-water use of uppermost aquifer	0	9	0	27
H.	Population served by surface-water supply within 3 miles downstream of site	3	6	18	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	85	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) **47**

II. WASTE CHARACTERISTICS

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

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

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

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

100 x 1.0 = 100

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.0 = **100**

III. PATHWAYS

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

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	47
Waste Characteristics	100
Pathways	100
Total 247 divided by 3 =	82
	Gross Total Sc

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

82 x 1.0 = 82

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE: Construction Rubble Landfill

LOCATION: Burlington ANG Installation

DATE OF OPERATION OR OCCURRENCE: 1960 to Present

OWNER/OPERATOR: Burlington ANG

COMMENTS/DESCRIPTION: Primarily Construction Rubble

SITE RATED BY: K. Cable, G. Eichler

I. RECEPTORS

	Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A.	Population within 1,000 feet of site	1	4	4	12
B.	Distance to nearest well	1	10	10	30
C.	Land use/zoning within 1 mile radius	3	3	9	9
D.	Distance to reservation boundary	3	6	18	18
E.	Critical environments within 1 mile radius of site	1	10	10	30
F.	Water quality of nearest surface-water body	1	6	6	18
G.	Ground-water use of uppermost aquifer	0	9	0	18
H.	Population served by surface-water supply within 3 miles downstream of site	3	6	18	18
I.	Population served by ground-water supply within 3 miles of site	1	6	6	18
			Subtotals	81	180

Receptors subscore (100 x factor score subtotal/maximum subtotal) 45

II. WASTE CHARACTERISTICS

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

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

Factor Subscore A (from 20 to 100 based on factor score matrix) 30

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

300 x 1.0 = 30

C. Apply physical state multiplier

Subscore B x Physical State Multiplier = Waste Characteristics Subscore

1.0 x 1.0 = 30

III. PATHWAYS

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

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

Subscore 0

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

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
1. Surface-water migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	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
2. Flooding	1	1	1	3
	Subscore (100 x factor score/3)			33
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
		Subtotals	60	114
Subscore (100 x factor score subtotal/maximum score subtotal)				53

C. Highest pathway subscore

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

Pathways Subscore 68

IV. WASTE MANAGEMENT PRACTICES

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

Receptors	45
Waste Characteristics	30
Pathways	68
Total 143 divided by 3 =	48

Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score x Waste Management Practices Factor = Final Score

48 x 1.0 = 48

8