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FACILITY ASSESSMENT PRELIMINARY REVIEW DOCUMENT

For

MARINE CORPS BASE CAMP LEJEUNE, NORTH CAROLINA

VOLUME I

Prepared For

Naval Facilities Engineering Command
Atlantic Division
Norfolk, Virginia

Environmental and Safety Designs, Inc
Memphis, Tennessee

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SITE SUMMARY REPORT
FINAL

MARINE CORPS BASE
Camp Lejeune, North Carolina

Contract No. N62470-83-B-6101

Prepared For:

Naval Facilities Engineering Command
Atlantic Division

Prepared By:

ENVIRONMENTAL SCIENCE & ENGINEERING, INC.
Plymouth Meeting, Pennsylvania

ESE PROJECT NO. 49-02036

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LIST OF ACRONYMS

AOC	Area of Concern
AVGAS	Aviation gas
BLS	Below Land Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EOD	Explosive Ordnance Demolition
FMF	Fleet Marine Force
GW	Groundwater
HOLF	Helicopter Outlying Landing Field
HPIA	Hadnot Point Industrial Area
HTH	Calcium Hypochlorite
IAS	Initial Assessment Study
LANTDIV	Atlantic Division of the Naval Facilities Engineering Command
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCOLF	Marine Corps Outlying Landing Field
MSL	Mean Sea Level
NACIP	Navy Assessment and Control of Installation Pollutants
NRQ	Analysis not requested
O&G	Oil and grease
OLF	Outlying Landing Field
POL	Petroleum, oil and lubricants
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SE	Sediment
STP	Sewage Treatment Plant
SW	Surface water
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

The Atlantic Division of the Naval Facilities Engineering Command (LANTDIV) issued a modification to Contract No. N62470-83-B-6101 to Hunter/ESE to prepare a Interim Remedial Investigation (RI) report consolidating all documents produced to date concerning 22 potentially contaminated sites at Marine Corps Base (MCB) Camp Lejeune, North Carolina. The Interim RI will describe the contamination assessments performed at the areas of concern (AOC), indicate potential migration pathways, summarize all rounds of analytical data collected, and provide recommendations for further action.

The initial stage of the Navy Assessment and Control of Installation Pollutants (NACIP) Program was the Initial Assessment Study (IAS) conducted by Water and Air Research, Inc in 1983. Based on the results of the IAS, LANTDIV issued a contract to perform a Confirmation Study to Environmental Science and Engineering, Inc. in 1983. Efforts on this contract were initiated and data reports were generated in 1984 and 1987. At the Hadnot Point Industrial Area, a Characterization Step Report was prepared in 1988. To further characterize the groundwater quality of the Hadnot Point Industrial Area, a Contaminated Groundwater Study was conducted by O'Brien and Gere Engineers in December 1988.

This report presents a summary of the environmental data generated by the various field investigations conducted at 22 AOCs within Camp Lejeune since initiation of the Confirmation Study. All nomenclature from the Confirmation Study has been adapted to conform to United States Environmental Protection Agency (USEPA) guidance for conducting Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) investigations.

1.2 RI OBJECTIVES

The objectives of this report are to:

- Describe the geohydrologic setting at 22 AOCs currently included in the Remedial Investigation/Feasibility Study (RI/FS) at Camp Lejeune;

- Determine, to the extent possible using available data, the degree of environmental contamination in the groundwater, surface water, sediment, soils, and fish tissues;

- Determine the rate and direction of groundwater flow and consequent contaminant migration; and

- Identify data gaps in the existing data base and make recommendations regarding the required next steps to proceed efficiently through the RI/FS process.

1.3 SITE BACKGROUND

1.3.1 GENERAL

Marine Corps Base (MCB) Camp Lejeune is located in Onslow County, North Carolina (Figure 1). The facility currently covers approximately 170 square miles and is bisected by the New River. The Atlantic Ocean forms the southeastern boundary of the base. The western and northeastern boundaries are U.S. 17 and State Road 24, respectively.

There are five major areas of development at Camp Lejeune: Camp Geiger, Montford Point, Mainside, Courthouse Bay, and the Rifle Range area. Marine Corps Air Station (MCAS) New River, a helicopter base, is a separate command on the west side of the New River. Helicopter Outlying Landing Field (HOLF) Oak Grove, approximately 25 miles to the north, and Outlying Landing Field (OLF) Camp Davis, 10 miles to the southwest are also under the command of MCAS New River. HOLF Oak Grove is no longer active and is under caretaker status. The property has some camping facilities and occasionally is used for recreation by scouting groups. HOLF Oak Grove does not contain any

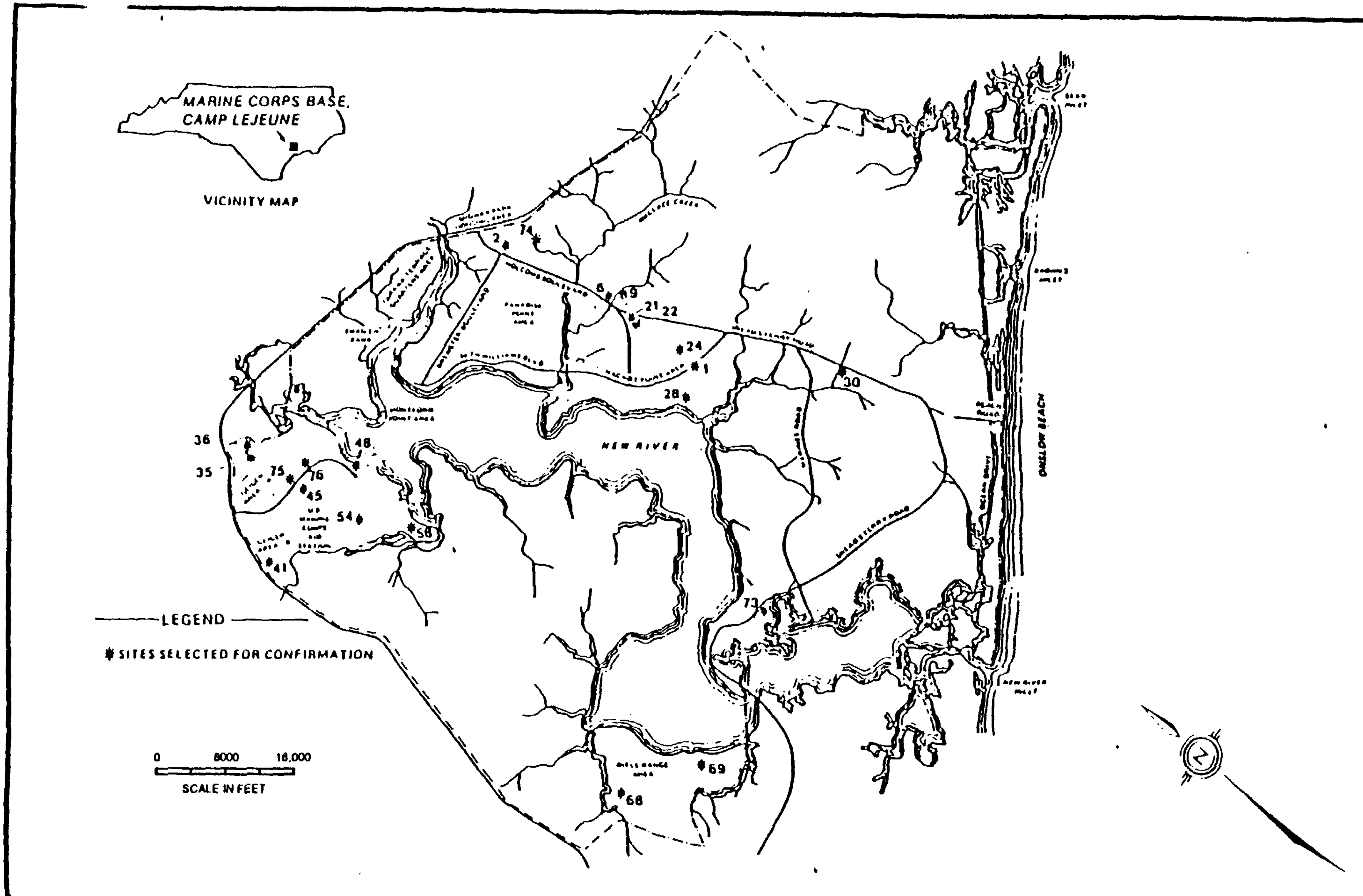

Figure 1
SITE LOCATION MAP
MARINE CORPS BASE, CAMP LEJEUNE

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1984.

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

significant sites. OLF Camp Davis is no longer considered part of MCB and is no longer the property of the U.S. Marine Corps. OLF Camp Davis is, however, included in a proposed property acquisition project.

Within 15 miles of Camp Lejeune are three large, publicly owned tracts of land; Croatan National Forest, Hofmann Forest, and Camp Davis Forest. In addition to the forested areas, the low elevations of the coastal plain have created vast acreage of inland and coastal wetlands.

1.3.2 SITE HISTORY

Construction of MCB Camp Lejeune began in 1941 at Hadnot Point where functions were centered. During construction, 9 million board feet of timber were harvested from the reservation. From 1944 to 1954, a sawmill was operated by base personnel.

During World War II, and the Korean and Vietnam conflicts, Camp Lejeune was used as a training area to prepare Marines for combat. The base serves as the home base for the Second Marine Division, and Fleet Marine Force (FMF) units have also been stationed as tenant commands.

Construction in the Montford Point, Camp Geiger, and Courthouse Bay areas was completed by 1945. Montford Point, originally developed for training of troops is now used for Marine Corps Service Support Schools. Courthouse Bay hosts amphibious training, while Paradise Point is the site of housing for commissioned personnel. Noncommissioned housing is provided at such locations as Tarawa Terrace I and II and Midway Park.

The U.S. Naval Hospital opened in 1943 and has served military personnel during World War II and the Korean War. In addition, the hospital provides medical services for all assigned military personnel and their dependents.

MCAS New River was set up as a separate command in 1951. At that time it was called Peterfield Point, but the name was changed to New River in 1968. In 1942 three new runways were added and the station came under the jurisdiction of MCAS Cherry Point. During this time PBJ squadron was based here and the facility was also used for glider training. During the Korean Conflict, it was used as a helicopter training base and for touch-and-go training for jet fighters.

In 1968, Marine Corps Outlying Landing Field (MCOLF) Oak Grove was placed under the jurisdiction of MCAS New River. The field was used as a helicopter base and renamed HOLF Oak Grove. During World War II, the field was under the command of MCAS Cherry Point. At the end of the war, all structures were destroyed with the exception of the runways.

1.3.3 PREVIOUS INVESTIGATIONS

An Initial Assessment Study was conducted by Water and Air Research, Inc. of Gainesville, Florida in 1983. The purpose of the report was to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous materials operations.

Based on information from historical records, aerial photographs, field operations, and personnel interviews, a total of 76 potentially contaminated sites were identified. The initial assessment evaluated each site with regard to contamination characteristics, migration pathways, and pollutant receptors.

The results of the study indicated that while none of the sites posed an immediate threat to human health or the environment, 21 areas warranted further investigation to assess long-term impacts. During the initial investigation at the 21 AOCs, an additional AOC (Site A at MCAS New River) was identified and included in the RI effort.

Based on the recommendations of the Initial Assessment Study, the RI/FS at

MCB, Camp Lejeune was begun in 1984. The first round of sample collection and analysis was conducted by Environmental Science and Engineering, Inc. beginning in July 1984. During the investigation, 55 shallow groundwater monitoring wells were installed and a total of 75 groundwater samples were collected for analyses. In addition to the groundwater samples, 56 soil samples, 7 surface water samples, 8 sediment samples, and 2 fish tissue samples were collected and chemically analyzed. An Evaluation Report presenting the data generated by this round of sample collection was prepared in January 1985. The report recommended additional monitoring for all of the investigated sites. Site 48, the MCAS New River Mercury Dump, was not recommended for additional monitoring, but was recommended for characterization.

An additional round of sample collection and analysis was conducted by Environmental Science and Engineering, Inc. in 1986/87. In this sampling episode, 29 additional monitoring wells were installed and a total of 113 new and existing monitoring wells were sampled. In addition, 54 soil samples, 44 surface water, and 41 sediment samples were collected and analyzed. An Evaluation Report was submitted to LANTDIV in July 1987 which documented the data generated during the second round of sampling.

In 1988, O'Brien and Gere Engineers was retained by LANTDIV under its Underground Storage Tank Program to provide necessary hydrogeologic services to investigate the hydrogeology and evaluate the extent of fuel leakage from the underground storage tanks and associated transfer lines at the Hadnot Point Fuel Farm (Site 22). The purpose of the investigation was to determine the presence of any product pool or soluble hydrocarbons in the groundwater in the vicinity of the fuel farm. The site investigation included the installation of monitoring wells, product thickness measurements, and groundwater sampling and analysis. The results of the Contaminated Groundwater Study were presented in report form to LANTDIV in December 1988.

None of the previous investigations at the AOCs have included activities to determine the site-specific values of aquifer parameters such as horizontal and vertical hydraulic conductivity, storage coefficient, transmissivity, and leakage. These parameters are required to quantify the rate of potential groundwater movement and contaminant transport. All future field efforts should include the determination of these parameters by the performance of slug tests and/or pumping tests.

1.4 REPORT ORGANIZATION

The RI report is organized into four sections. The purpose of this first section is to provide an overall description of the area under investigation and briefly describe previous activities undertaken to date.

Section 2.0 provides a description of the physical characteristics of the study area. This section provides a description for Camp Lejeune as a whole since there has been a limited amount of specific data generated with respect to hydrology, geology, or soils, in particular.

A summary of the sampling and analytical results of the 22 AOCs at Camp LeJeune are presented in Section 3.0. Site-specific geology along with groundwater contour information is presented for each AOC where monitoring wells were installed. Recommendations for further investigations are also included at the conclusion of each AOC discussion.

Section 4.0 summarizes the work accomplished to date and suggests where further efforts should be expended.

2.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

2.1 SURFACE FEATURES

The Camp Lejeune facility is located in the coastal plain of North Carolina. This coastal plain is characterized by generally flat topography. Specifically, the topography in Camp Lejeune varies from sea level to an elevation of 72 feet above mean sea level (msl), however, the average elevations lie between 20 and 40 feet msl. Along the coast lies a 200 to 500 foot barrier island complex. The dune field located on this barrier island range in elevation from 10 to 40 feet msl.

Approximately 70 percent of Camp Lejeune is located in the broad, flat interstream areas where drainage is poor and soils are often wet (Atlantic Division, Bureau of Yards and Docks, 1965).

2.2 SURFACE WATER HYDROLOGY

Approximately 70 percent of MCB Camp Lejeune is in the broad, flat interstream areas where drainage is poor and soil is often wet (Atlantic Division, Bureau of Yards and Docks, 1965).

The drainage at Camp Lejeune is predominantly toward the New River, although the coastal areas tend to drain directly into the Atlantic Ocean through the Intercoastal Waterway. The natural drainage has been changed in developed areas by drainage ditches, stormsewers, and extensive asphalt and concrete areas. Drainage sub-basins for the Hadnot Point area and MCAS New River are shown in Figures 2 and 3. Most of the study AOCs are in these two areas.

The dominant surface water feature at MCB Camp Lejeune is the New River which receives drainage from most of the base. The New River flows in a southerly direction and empties into the Atlantic Ocean through the New River Inlet. Several small coastal creeks drain the area of MCB Camp Lejuene that is not drained by the New River and its tributaries. These creeks flow into the Intercoastal Waterway, which is connected to the Atlantic Ocean by a series

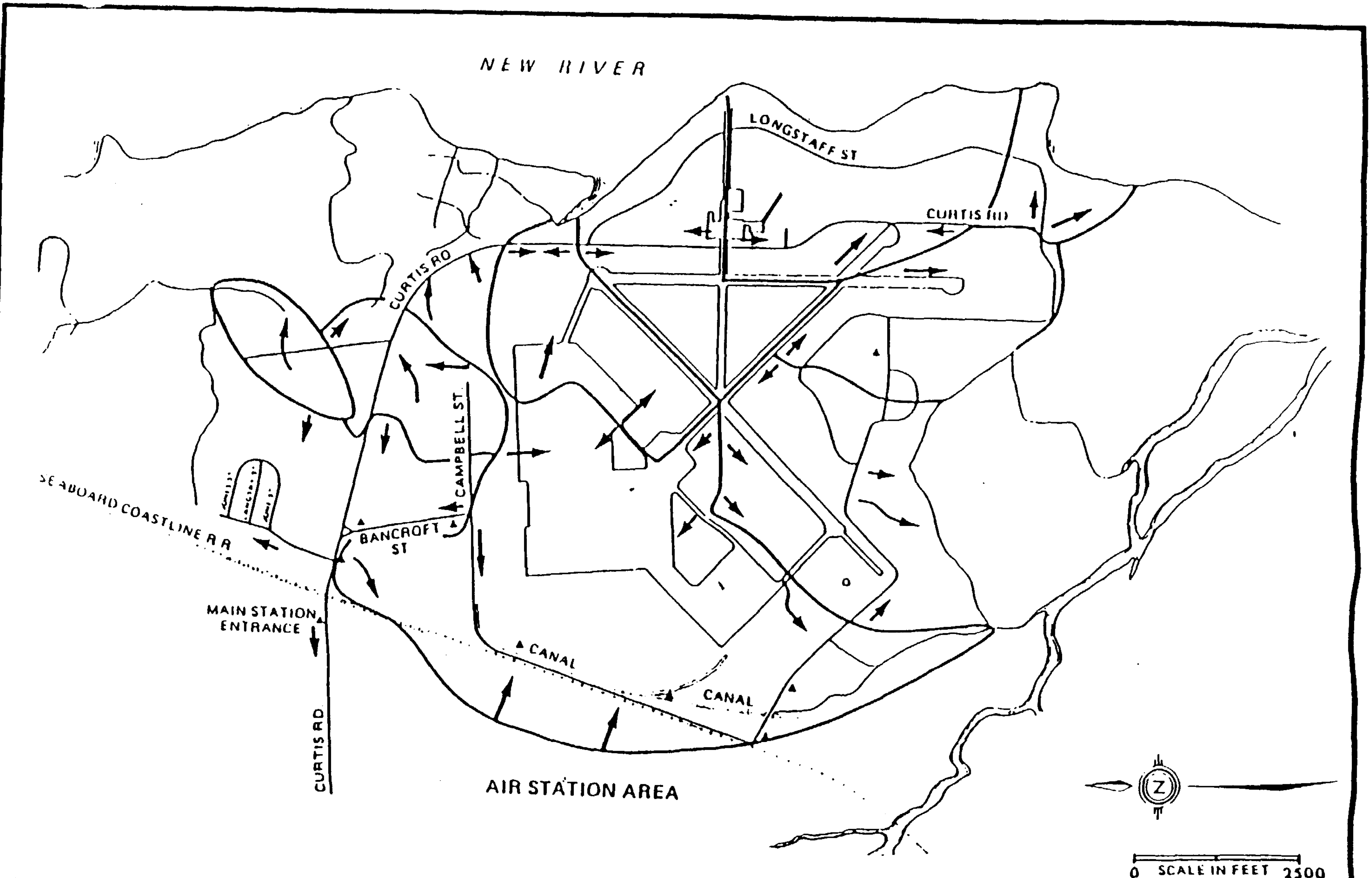

Figure 2
SURFACE WATER DRAINAGE SUB-BASIN AT MCAS NEW RIVER, MCB CAMP LEJEUNE

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1990.

MARINE CORPS BASE
CAMP LEJEUNE

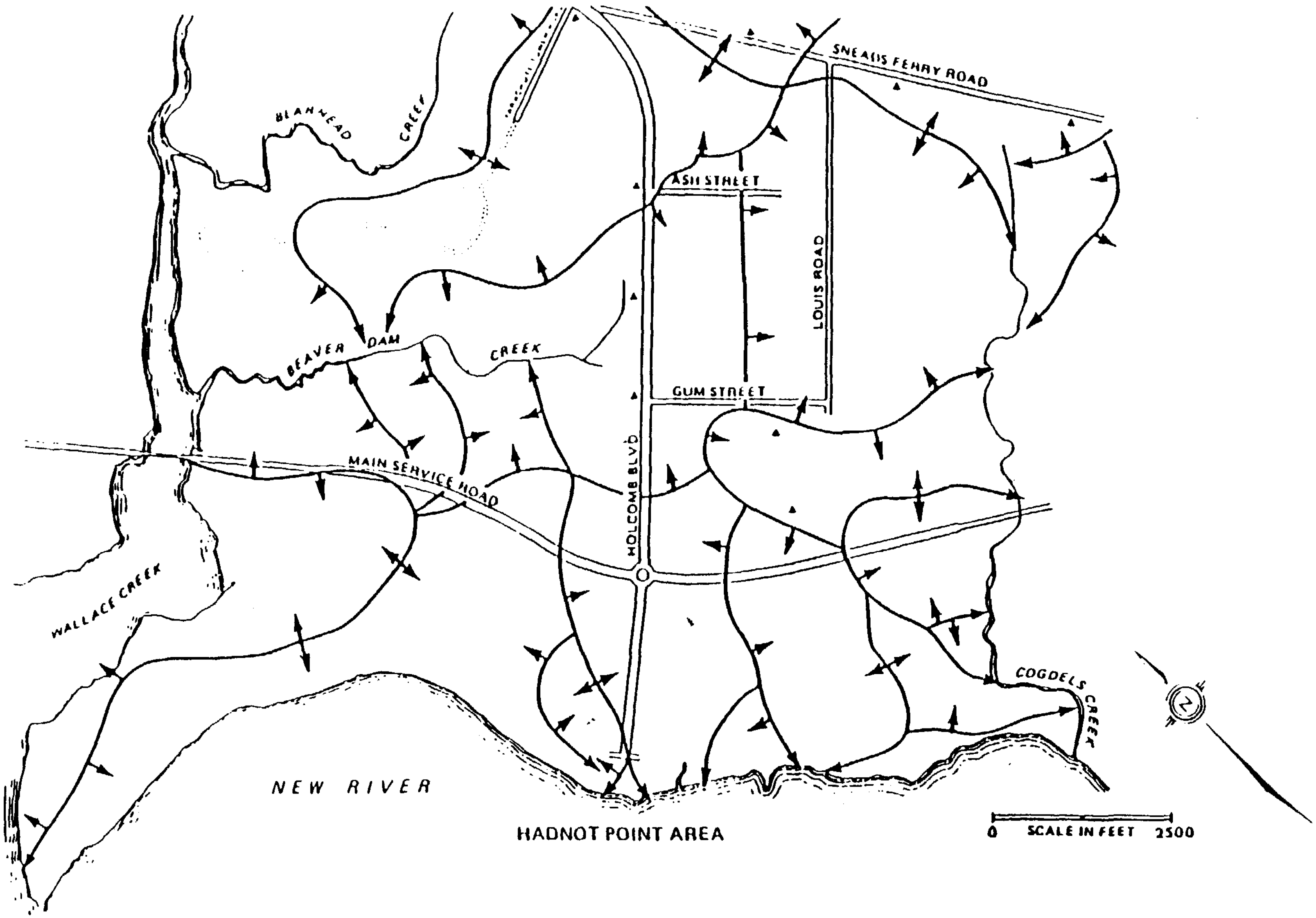

Figure 3
SURFACE WATER DRAINAGE SUB-BASINS AT HADNOT POINT, MCB CAMP LEJEUNE

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1990.

MARINE CORPS BASE
CAMP LEJEUNE

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of inlets. Stream flow in the New River in the area of MCB Camp Lejeune and the average annual runoff of the MCB Camp Lejeune area have not been determined. The water in the New River at MCB Camp Lejeune is brackish, shallow and warm.

Flooding is a potential problem for areas of the base within the 100-year floodplain. The U.S. Army Corps of Engineers has mapped the limits of the 100-year floodplain at Camp Lejeune at 7.0 feet msl in the upper reaches of the New River and increases to 11.0 feet msl on the open coast (Natural Resources Management Plan, 1975).

2.3 GEOLOGY

Camp Lejeune is located in the Atlantic Coastal Plain physiographic province. The Coastal Plain is underlain by unconsolidated deposits of sand, and clay with minor amounts of gravel. Also noted are minor amounts of marl shell rock. Regionally, these deposits are gently dipping to the southeast in a thickening wedge that overlies the bedrock (Todd, 1983). These shallow deposits constitute the unconfined aquifer (water table) of the coastal plain. Due to the permeable nature of these sediments, they are vulnerable to both saline encroachment and surface contaminants.

Beneath the area of Camp Lejeune, a sequence of unconsolidated sedimentary deposits approximately 1400 to 1700 feet thick exists. The following discussion involves only the uppermost 300 feet of the sequence which represents the source of fresh water for the base (NCDNR & CD, 1980; Water and Air Research, 1983).

At the top of the sequence, undifferentiated Pleistocene and Recent sands and clays form the seaward thickening band of sediments. These deposits can reach a thickness of 35 feet (NCDNR & CD, 1980; Water and Air Research, 1983).

MCB Camp Lejeune is underlain by seven sand and limestone aquifers separated by confining units of silt and clay (Harned et al, 1989). The seven aquifers are the surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and Upper and Lower Cape Fear. Less permeable clay and silt beds separate the aquifers and serve as confining or semi-confining units which impede the flow of groundwater from one aquifer to another.

Fresh water is present in the surficial and Castle Hayne aquifers at MCB Camp Lejeune. Fresh water extends to a depth of 300 feet (Harned et al, 1989). Brackish water is usually found deeper than 300 feet below msl (Shiver, 1982).

The surficial aquifer at MCB Camp Lejeune is composed of Quaternary and Miocene sand, silt, and clay. The aquifer ranges in thickness from 0 feet in the channels of the New River and its tributaries to 75 feet in the southwestern portion of Camp Lejeune (Harned, et al, 1989).

The Castle Hayne aquifer is composed of sand and limestone of Oligocene and Middle Eocene age. The upper portion of the aquifer is primarily unconsolidated sand. The lower portion is partially consolidated sand and limestone. Thin clay layers are found throughout the unit. The Castle Hayne aquifer thickens toward the southeast, from 175 feet in the northern portion of the base to 375 feet at the coast. The Castle Hayne aquifer is approximately 340 feet thick in the Hadnot Point Area (Harned et al, 1989).

2.4 HYDROGEOLOGY

Some of the formations in the Coastal Plain are permeable, can be defined as aquifers, and are of wide areal extent. Hydraulic connections between these aquifers are common through complex interbedding creating a complex hydrologic system, which is a common characteristic of Coastal Plain sediments. This complex system may include streams and lakes where the aquifers are at or near the land surface.

In general, the hydrologic system at Camp Lejeune consists of an unconfined (water table) aquifer and semi-confined aquifer. The unconfined aquifer extends from the water table to the first significant confining unit.

The water table at HPIA is found at depths ranging from 6.17 to 22.36 feet below land surface (bls) (ESE, May 1988). Water levels fluctuations in the area range from 1 to 4 feet and are attributed to seasonal variations (Harned et al, 1989).

In general, shallow groundwater flows toward the New River. The direction of flow actually ranges from south-southwest in the northern corner of HPIA to west-southwest in the southwest. Groundwater mounding appears to occur in the west-central and southeastern areas. This may be due to increased surface infiltration and a drainage ditch in the west-central and southern sections respectively (ESE, May 1988). The horizontal flow gradient over most of the area is approximately 0.003 feet/ft, but does increase to 0.02 feet/ft in the southwest corner of the site.

Water levels measured in deep and intermediate wells are similar to those observed in nearby shallow wells. Additional data is required before a potentiometric surface map can be generated for the deep aquifer, however, it is expected that deep groundwater flows to the east-southeast, towards the Atlantic Ocean (ESE, May 1988). Small-scale regional changes in groundwater flow may occur in the deep aquifer due to local pumping of water supply wells. The USGS (Harned et al, 1989) notes that flow gradients may range from 15 feet/mile (0.0028 feet/ft) in areas unaffected by pumping to 150-200 feet/mile (0.0284-0.0378 feet/ft) in areas near active water supply wells.

A 72 hour pumping test performed at HPIA by ESE in 1987 indicates average transmissivity and storage coefficient values of 9.6×10^{-3} gpd/ft and 8×10^{-4}, respectively for the limestone portion of the deep (Castle Hayne) aquifer. These values are in general agreement with those reported by the United States Geological Survey (USGS) (Harned et al, 1989). Hydraulic conductivity for the Castle Hayne is reported at an average of 35 ft/day with a range between 19-82 ft/day by the USGS (Harned et al, 1989).

Further analysis of the Hunter/ESE deep pumping test data indicates that the limestone portion of the deep aquifer is semi-confined. Recharge occurs through a clayey layer overlying the aquifer. Hydraulic conductivity for this layer is estimated at 4.6×10^{-3} ft/day, typical of silty sands and silty clays.

2.5 LAND USE

Within 15 miles of Camp Lejeune are three large, publically owned tracts of land; The Croatan National Forest, The Hofman Forest, and Camp Davis Forest. Because of the low elevations in the Coastal Plain the majority of the area is composed of wetlands. In addition these areas to some extent have been exploited by agriculture and silvaculture interests. There is a growing concern on a state and national level that these ecosystems, unique to the Coastal Plain, require a protected status to survive.

The remaining land use surrounding MCB Camp Lejeune is agricultural, with typical crops of soybean, small grains, and tobacco. Productive estuaries along the coast support commercial finfish and shellfish industries. Tourism and residential resort areas have stimulated the regional economy.

The MCB Camp Lejeune is predominently tree covered, with large amounts of softwood and substantial stands of hardwood species. Of MCB Camp Lejeune's 112,000 acres, more than 60,000 are under forestry management. Timber producing areas are under even-aged management with the exception of those areas along major streams and in swamps. These areas are managed to provide for both wildlife habitat and erosion control. Smaller areas are managed for the benefit of threatened or endangered wildlife species.

Some areas of the New River at MCB Camp Lejeune are classified under Title 15 of the North Carolina Admnistrative Code as Class SC, while others are classified as Class SA. Class SC waters are useable for fishing and secondary recreation, but not for primary recreation or shellfish marketing. Class SA waters are the highest estuarine classification, useable for shellfish marketing.

The ecosystems found at MCB Camp Lejeune include terrestrial (or upland), wetland, and aquatic communities. The terrestrial ecosystems contain four habitat types -- long leaf pine, loblolly pine, loblolly pine/hardwood, and oak/hickory. Loblolly pine is the main timber stand of the area. The wetlands ecosystems vary from those bordering freshwater streams to salt marshes along coastal estuaries. The aquatic ecosystems consist of small lakes, the New River estuary, numerous tributary creeks, and part of the Intracoastal waterway.

The wetland ecosystems on MCB Camp Lejeune include five habitat types -- pond pine or pocosin, sweet gum/water oak/cypress and tupelo, sweet bog/swamp black gum and red maple, tidal marshes, and coastal beaches. The tidal marsh at the mouth of the New River on MCB Camp Lejeune is one of the few remaining North Carolina coastal areas relatively free from filling or other man-made changes. Coastal beaches along the Outer Banks and the Intracoastal Waterway of MCB Camp Lejeune are used for recreation and to house a small military command unit on the beach. The Marines also conduct beach assault training maneuvers from company-size units to combined 2nd Division, Force Troops, and Marine Air Wing units. These exercises involve the use of heavy equipment; however, heavy tracked vehicles are permitted to cross the dunes only in restricted areas to protect the ecologically sensitive coastal barrier dunes.

The aquatic ecosystems on MCB Camp Lejeune are important as a freshwater and marine fisheries resource, as a habitat for local and migratory bird species, as a recreational resource for pleasure boating, and as a commercial resource for year-round barge traffic. The aquatic ecosystem contains a wide variety of fresh and salt water fish species, local shore bird species, and migratory bird species.

MCB Camp Lejeune, constructed in the 1940s, is used today for training exercises involving the use of large numbrs of tracked and wheeled vehicles and live ordnance. The use of these items are restricted and carefully controlled to protect human health and safety and the environment. Potable wells at the base are usually deep and heavy demands for water have been placed on these wells at times.

According to the most recent master plan (NAVFACENGCOM, 1975), there are two major corridors of developable land in the area of MCB Camp Lejeune. These extend south from New Bern along U.S. 17 and U.S. 58, and from Swansboro northwest to Jacksonville and Richlands along Routes 24 and 258. The principal economic base of the area is MCB Camp Lejeune and associated military activities. More than 46,000 military personnel are stationed at the base and more than 110,000 people are either employed or are eligible for support (NAVFACENGCOM, 1975).

3.0 NATURE AND EXTENT OF CONTAMINATION

3.1 SITE 1 - FRENCH CREEK LIQUIDS DISPOSAL AREA

3.1.1 SITE BACKGROUND

This AOC is located on both the north and south sides of Main Service Road at the western edge of the Gun Park Area and Force Troops Complex (PWDM Coordinates 11, C7/D7). The total area for the AOC is approximately 7 to 8 acres (Figure 1-1). Site 1 has been used by many different Marine organizations since the 1940's. Liquid wastes from vehicle maintenance activities were poured on the ground as part of routine operations. Batteries and used battery acid were also disposed of at this location. Suspected quantities of waste are estimated to be: 5,000 to 20,000 gallons of waste petroleum, oil, and lubricants (POL) and 1,000 to 10,000 gallons of battery acid.

The area is underlain by silty and clayey sand. Gravelly sand and a limestone marl were also encountered during previous drilling efforts. A geologic cross section (Figure 1-2) has been drawn on a north-south line (Figure 1-3). The surface of the shallow groundwater lies within the silty sand at a depth of 7 to 17 feet below land surface. Groundwater flow is generally to the west towards Cogdels Creek at a dip of approximately 1/2 degrees (Figure 1-4).

3.1.2 SITE INVESTIGATION

GROUNDWATER

Six shallow monitoring wells were installed to characterize the groundwater at this site (Figure 1-1); 5 of the wells were installed downgradient and one upgradient (1GW6). Groundwater from the six wells was sampled in July 1984 and again in November 1986. An onsite water supply well, 1GW7 (No. 636) was also sampled in July 1984. The groundwater samples were analyzed for the following analytes:

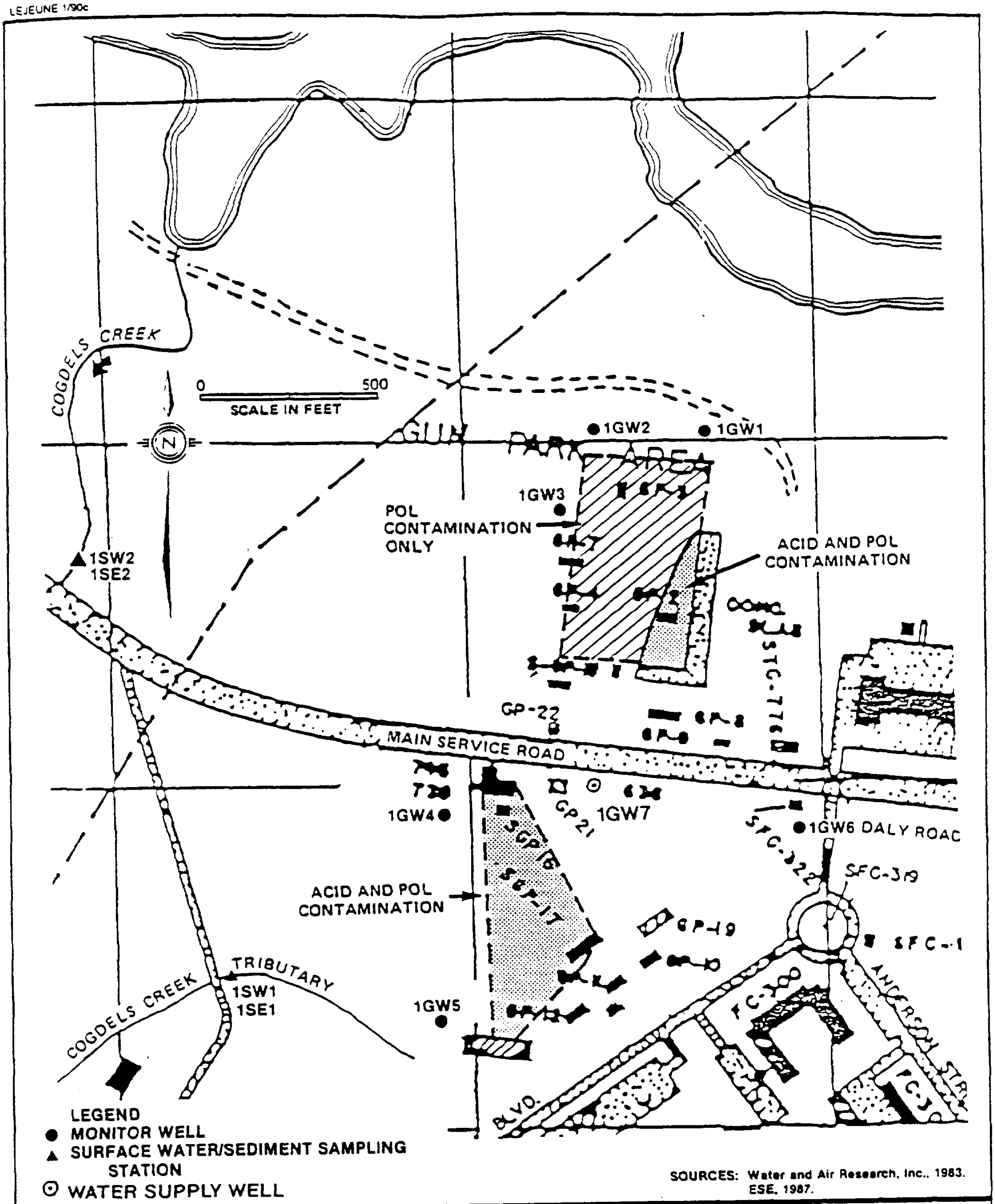
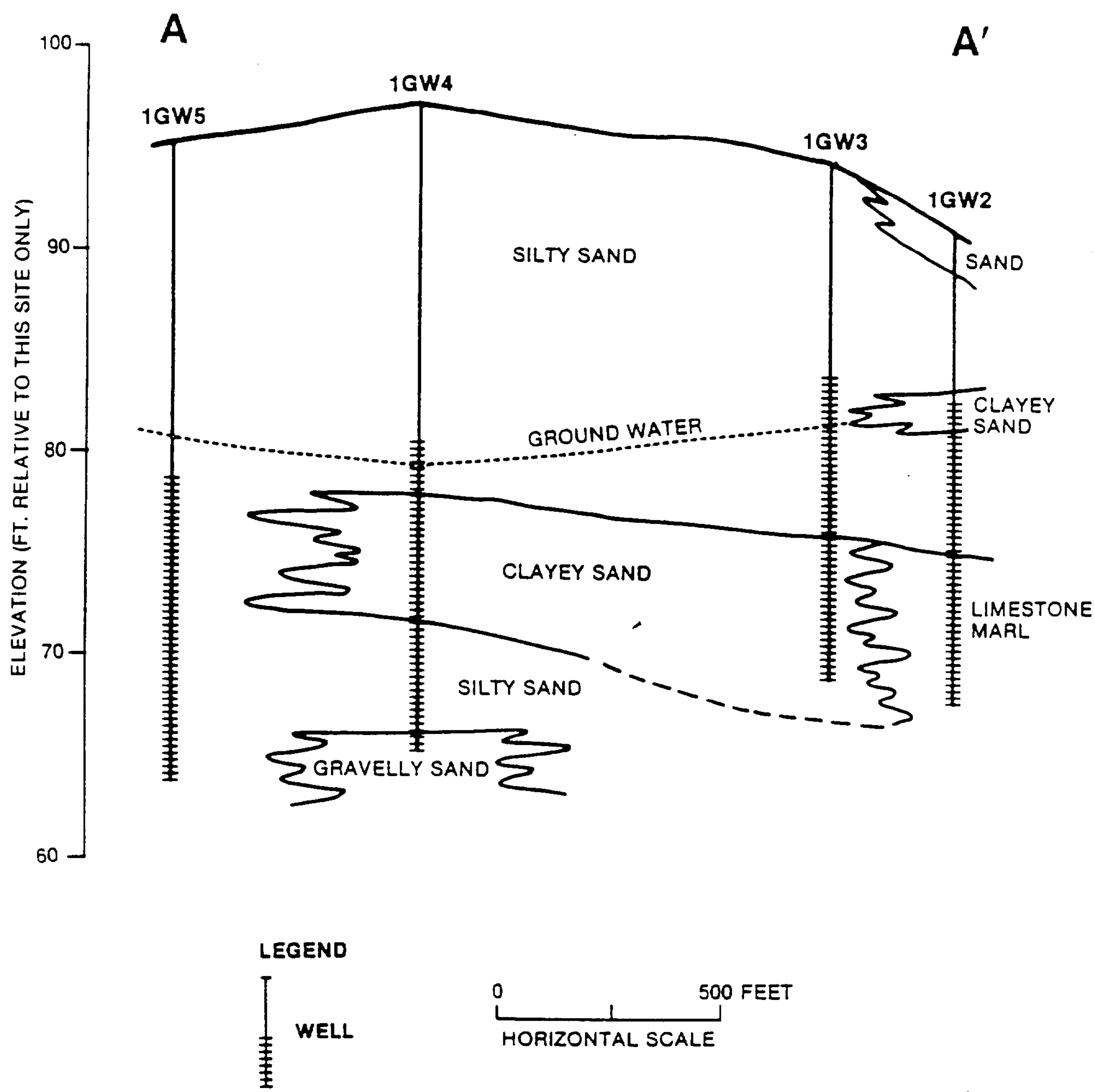


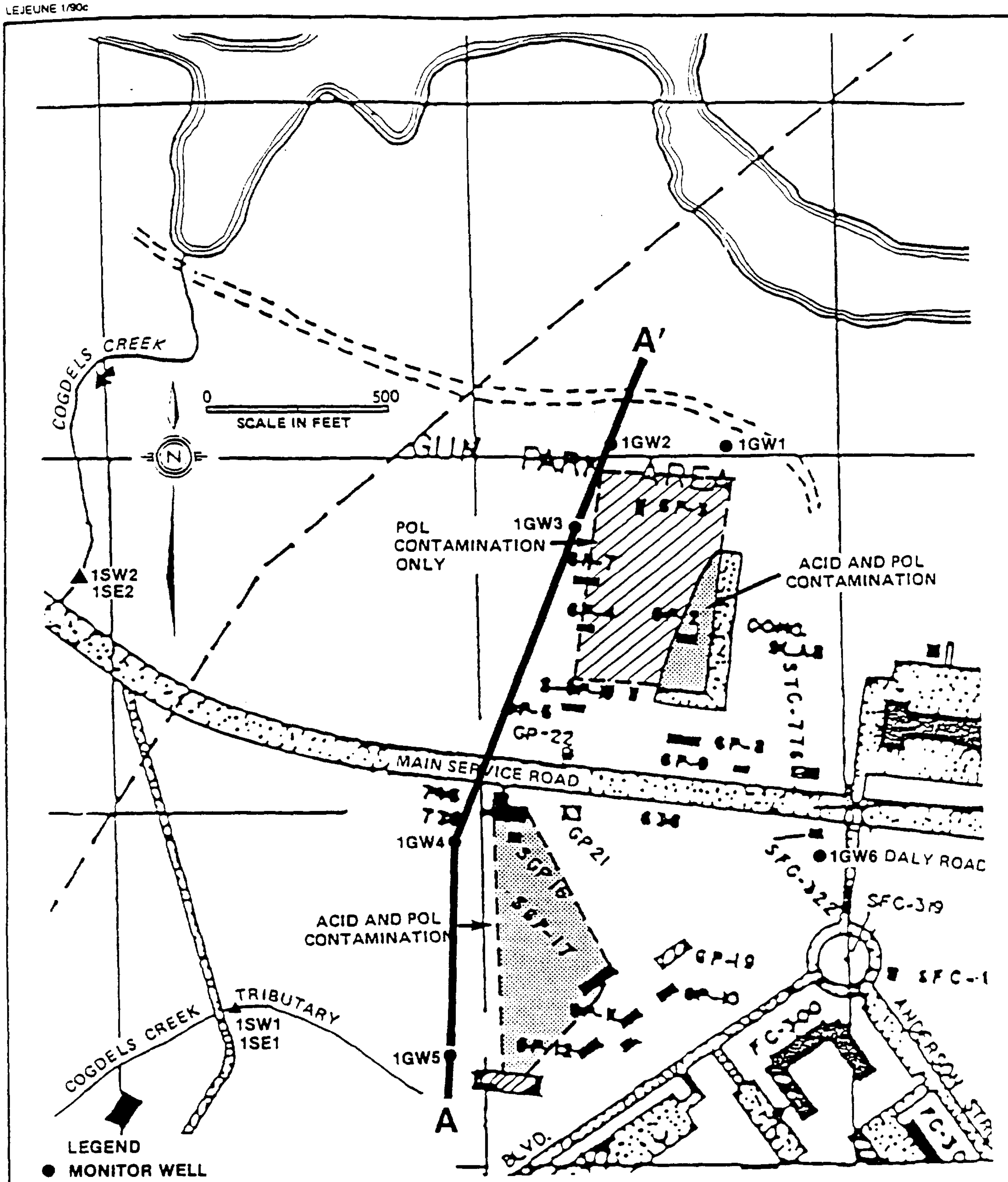
Figure 1-1
SAMPLING LOCATIONS, SITE 1—
FRENCH CREEK LIQUIDS DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE



igure 1-2
GEOLOGIC CROSS SECTION, SITE 1—
FRENCH CREEK LIQUIDS DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE



LEGEND
- ● MONITOR WELL
- ▲ SURFACE WATER/SEDIMENT SAMPLING STATION

SOURCES: Water and Air Research, Inc., 1983.
ESE. 1987.

Figure 1-3
GEOLOGIC CROSS SECTION LOCATION, SITE 1—
FRENCH CREEK LIQUIDS DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

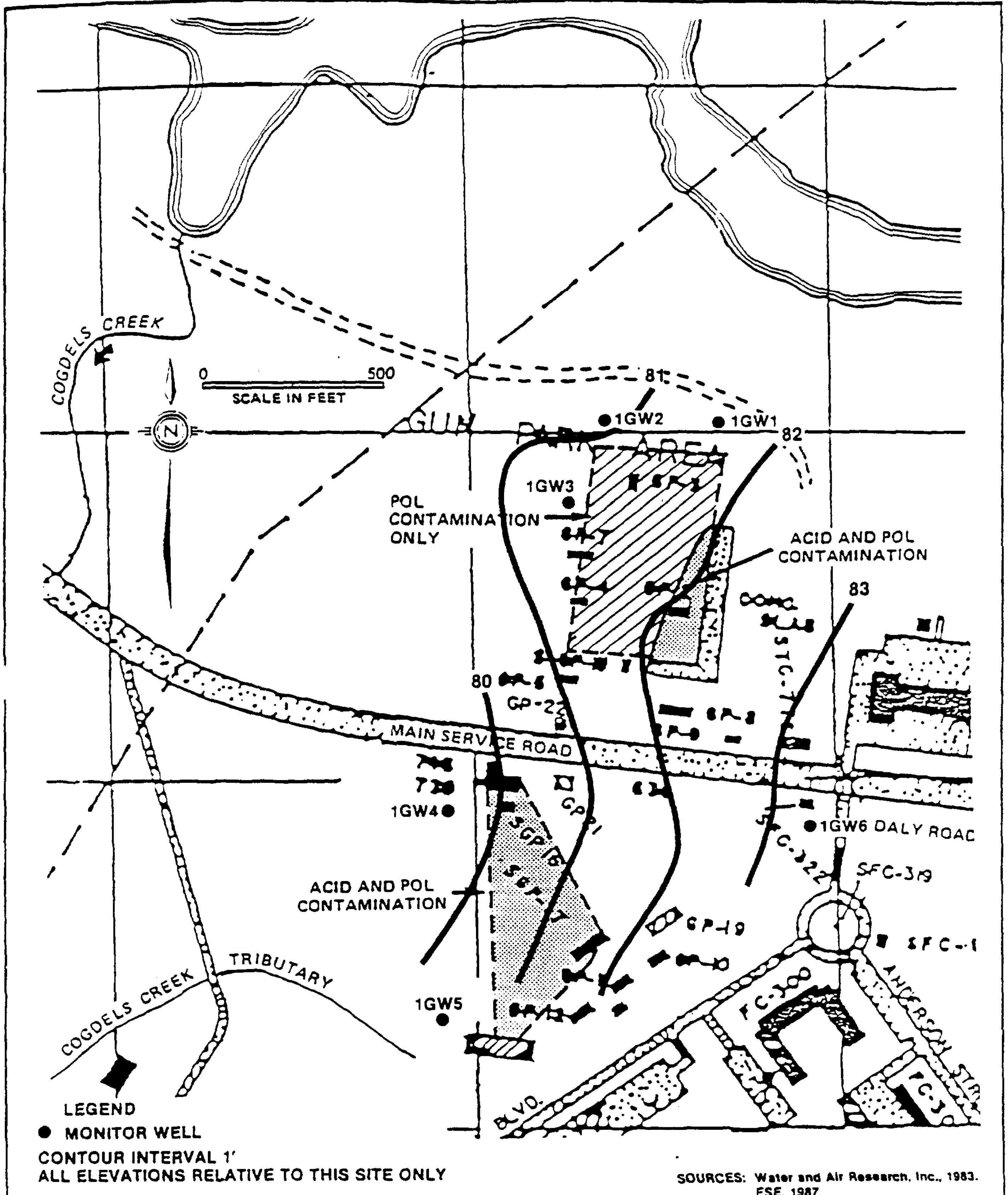


Figure 1-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 1—
FRENCH CREEK LIQUIDS DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

- Cadmium
- Chromium
- Hexavalent Chromium (1986 only)
- Lead
- Antimony
- Oil & Grease (O&G)
- Volatile organics (VOC)
- Total Phenols
- Xylene (1986 only)
- Methylethyl ketone (MEK) (1986 only)
- Methyl isobutyl ketone (MIBK) (1986 only)
- Ethylene dibromide (EDB) (1986 only)

Appendix A presents a complete listing of all target analytes and their abbreviations.

Table 1-1 presents the analytical data from both rounds of sampling. Only those target analytes that were detected above the method detection limit are reported on the table.

As shown in Table 1-1, several VOCs were detected in samples collected from Well 1GW5 during both rounds of sampling. This well is located on the southernmost portion (farthest downgradient) of the site. Wells 1GW1, 1GW2, and 1GW6 all had trace levels of VOCs, including phenols detected in samples collected in July 1984 and November 1986. Well 1GW6 is the "upgradient" well.

All of the groundwater samples from the six monitoring wells contained quantifiable amounts of cadmium, chromium and lead. The sample collected from the water supply well (1GW7) did not contain VOCs or metals above detection limits. Because all six monitor wells at Site 1 were found to contain similar quantities of contaminants, it appears that areas hydraulically upgradient were either subjected to the same disposal history as the pit(s) within Site 1 or an additional contaminant source of similar

TABLE 1-1. SITE 1 - FRENCH CREEK LIQUIDS DISPOSAL AREA

DETECTED TARGET ANALYTES

GROUNDWATER SAMPLES

	NC GW	1GW1	1GW1	1GW2	1GW2	1GW3	1GW3	1GW4	1GW4	1GW5	1GW5	1GW6	1GW6	1GW7
DATE	STANDARD	7/5/84	11/18/86	7/5/84	11/18/86	7/5/84	11/19/86	7/5/84	11/18/86	7/7/84	11/18/86	7/5/84	11/18/86	7/5/84
PARAMETER														
BENZENE	1	0.5	<4.4	<0.3	<4.4	<0.3	<1.0	<0.3	<4.4	<0.3	<4.4	<0.3	<4.4	<0.3
1,1-DICHLOROETHANE	NONE	<0.5	<4.7	<0.5	<4.7	<0.5	<4.7	<0.5	<4.7	2.7	6.7	<0.6	<4.7	<0.5
1,1-DICHLOROETHYLENE	7	<1.0	<2.8	<1.0	<2.8	<1.1	<2.8	<1.0	<2.8	1.1	2.8	<1.2	<2.8	<1.1
T-1,2-DICHLOROETHENE	70	1.0	3.4	<1.0	2.0	<1.0	<1.6	<1.0	<1.6	2.4	2.4	<1.2	<1.6	<1.0
1,1,2,2-TETRACHLORO														
ETHANE	NONE	<0.7	<4.1	<0.7	<4.1	<0.8	<4.1	<0.7	<4.1	4	<4.1	<0.8	<4.1	<0.8
TETRACHLOROETHENE	NONE	<1.5	<4.1	<1.5	<4.1	<1.5	<3.0	<1.5	<4.1	6.8	<4.1	<1.7	<4.1	<1.5
1,1,1-TRICHLOROETHANE	200	<1.0	<3.8	<1.0	<3.8	<1.0	<3.8	<1.0	<3.8	<1.0	<3.8	14	<3.8	<1.0
TRICHLOROETHENE	NONE	2	4.6	1.3	3.2	<1.2	<3.0	<1.1	<1.9	5.2	2.2	<1.3	<1.9	<1.2
TOLUENE	1000	<0.5	<6.0	<0.5	<6.0	0.6	<6.0	<0.5	<6.0	0.9	<6.0	<0.6	<6.0	<0.5
CADMIUM	5	<6.0	<6.0	7	<6.0	10	<6.0	7	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
CHROMIUM	50	94	23.6	160	110	29	26.6	49	54.3	7	<15	34	28.8	<6.0
LEAD	50	43	<36	136	49.1	55	48.7	<40	<36	<40	<36	51	<36	<40
OIL & GREASE	NONE	2	<0.2	2	<0.2	3	0.4	2	<0.2	<0.7	<0.2	<0.8	<0.2	<0.8
PHENOLS	NONE	2	4	<1	4	2	3	2	<2	2	6	<6	19	<5

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Note: Well 1GW6 is the upgradient well; Well 1GW7 is the supply well.

Source: ESE, 1990.

chemical character exists east of Site 1. In either case, the contaminants detected downgradient of Site 1 are consistent with the disposal history of Site 1, suggesting that the pits at Site 1 are/were a source of the detected contamination. However, additional pits or non-point sources of the detected contamination may also be present.

Oil & grease (O&G) was identified in samples collected from Wells 1GW1, 1GW2, 1GW3, and 1GW4. This target analyte was detected more often in the samples collect in July 1984 than in samples collected in November 1986. Well 1GW6 is the "upgradient" well.

SURFACE WATER/SEDIMENT

Two surface water and sediment samples were collected from Cogdels Creek and a tributary to the creek. These samples were collected only during the November 1986 round of sampling. The surface water samples were analyzed for the same parameters as the groundwater samples. Sediment samples were analyzed for the following:

- Cadmium
- Chromium
- Hexavalent Chromium
- Lead
- Antimony
- Oil & Grease (O&G)
- Total Phenols
- Ethylene dibromide (EDB)

Table 1-2 presents the analytes detected for the surface water samples. Detected target analytes in the sediment samples are presented in Table 1-3. All of the samples contained total chromium, phenols and O&G.

3.1.3 SUMMARY AND CONCLUSIONS

The groundwater contour map (Figure 1-4) indicates that flow in the shallow aquifer is from Site 1 toward Cogdels Creek. The measured gradient suggests that the site is characterized by low natural groundwater gradients. Based

TABLE 1-2. SITE 1 - FRENCH CREEK LIQUIDS DISPOSAL AREA
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

DATE PARAMETER	NC SW STANDARD	1SW1 11/18/86	1SW2 11/18/86
CHROMIUM	50	7.3	<5.4
OIL & GREASE	NONE	0.8	0.2
PHENOLS	1	13	3

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 1-3. SITE 1 - FRENCH CREEK LIQUIDS DISPOSAL AREA
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

DATE PARAMETER	1SE1 11/18/86	1SE2 11/18/86
CHROMIUM	20.8	3.69
OIL & GREASE	712	1460
PHENOLS	116	<90

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC sediment standards.

Source: ESE, 1990.

on site maps, it appears that the shallow aquifer eventually discharges into the New River. Organic contaminants and several metals were detected in samples collected from the shallow aquifer. These contaminants however were not noted in the deeper aquifer sample; thus the data suggest that vertical migration is not occurring.
The levels of cadmium found in the samples collected from Wells 1GW2 and 1GW4 (7 ug/l) and 1GW3 (10 ug/l) were above the North Carolina groundwater standard established for this metal (5 ug/l). The groundwater standard for chromium (50 ug/l) was exceeded in samples collected from Wells 1GW1 (94 ug/l), 1GW2 (160 ug/l), and 1GW4 (54.3 ug/l). Groundwater samples from Wells 1GW2 and 1GW3 were also above the established standard for lead (50 mg/l).

O&G has been found in all media sampled at this AOC. This is not surprising since waste petroleum, oil and lubricants (POL) were known to be disposed of at this location. The O&G identified in the surface water and sediment samples seem to be associated with the past activities at this site. These contaminants may be impacting Site 28 located further downstream on Cogdels Creek.

3.1.4 RECOMMENDATIONS

The existing monitor well network at Site 1 has identified low levels of VOCs and metals. Of special concern is the presence of tetrachloroethane (1GW5) at a concentration of 6.8 micrograms per liter (ug/l) which is in excess of the state standard of 0.7 ug/l. In addition, cadmium, chromium, and lead were detected at levels greater than the applicable state groundwater standards. It should be noted that all existing monitor wells are located on the downgradient edge of the suspected center of contamination. It is possible that greater concentrations of detected contamination are present within the former disposal features. Although contamination of the shallow aquifer has been documented, sampling of adjacent deep water supply wells indicate that this contamination has not migrated vertically.
In order to provide an adequate database for completion of the RI/FS at this AOC, additional groundwater quality characterization is required within the specific disposal features identified by the IAS effort. This

characterization may be difficult to accomplish because of the presence of a large building and concrete paving over most of the area. Additional data needs of the RI/FS include chemical characterization of any affected unsaturated soils. To date, no chemical sampling of the soils have been conducted. Following adequate characterization of the affected environmental media, a Risk Assessment should be conducted to determine if the detected contamination represents a unacceptable risk to health and the environment.

3.2 SITE 2 - FORMER NURSERY/DAY-CARE CENTER

3.2.1 SITE BACKGROUND

From 1945 to 1958 this building (PWDM Coordinates 5, K10) was used for the storing, handling, and dispensing of pesticides. The building at this location was later used as a children's day-care center. Chemicals known to have been used include: chlordane, DDT, diazinon, and 2,4-D. Chemicals known to have been stored onsite include dieldrin, lindane, malathion, silvex, and 2,4,5-T. Areas of suspected contamination are the fenced playground, the mixing pad, the wash pad, and railroad drainage ditch (Figure 2-1). Contamination is believed to have occurred as a result of small spills, washout and excess disposal. A preliminary soil sampling investigation conducted at this AOC in 1982 indicated the presence of DDE, DDD, DDT, and chlordane. Based on these results, the day care activities were moved to another location.

A geologic cross section (Figure 2-2) was drawn on a northwest-southeast line (Figure 2-3) and shows the site to be underlain by a sequence of clayey silt, silty sand, clay and clayey sand, and silty sand and sand. These units overlie a layer of clay found at a depth ranging from 24 to 28 ft. Depth to groundwater ranges from 7 to 20 ft below land surface. The groundwater contour map (Figure 2-4) shows the groundwater flow to be generally to the southeast with a gradient approximately 0.14 foot per foot (ft/ft).

3.2.2 SITE INVESTIGATION

GROUNDWATER

Five shallow monitoring wells were installed and sampled in July 1984, December 1986 and March 1987 to determine the presence or absence of contaminants in the shallow aquifer. In addition four water supply wells were sampled in July 1984 to characterize the deeper aquifer.

The shallow well locations are identified in Figure 2-1. The water supply wells are not identified in Figure 2-1 since they are on average 1000 ft north (Building 646), south (Building 616), east (Building 647), and west (Building 645) of the site. The monitoring and water supply wells were

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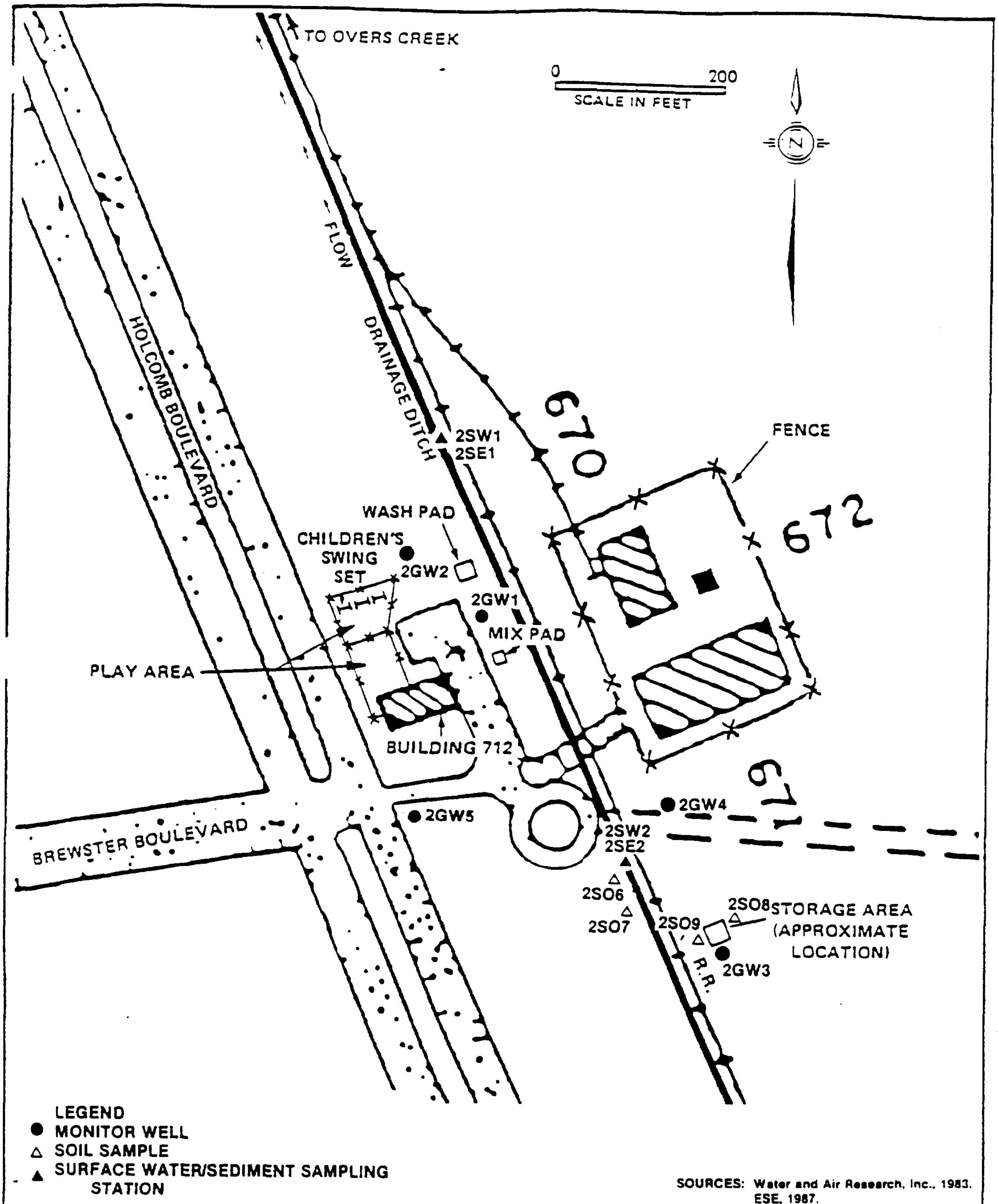


Figure 2-1
SAMPLING LOCATIONS, SITE 2–
FORMER NURSERY/DAY CARE CENTER

MARINE CORPS BASE
CAMP LEJEUNE

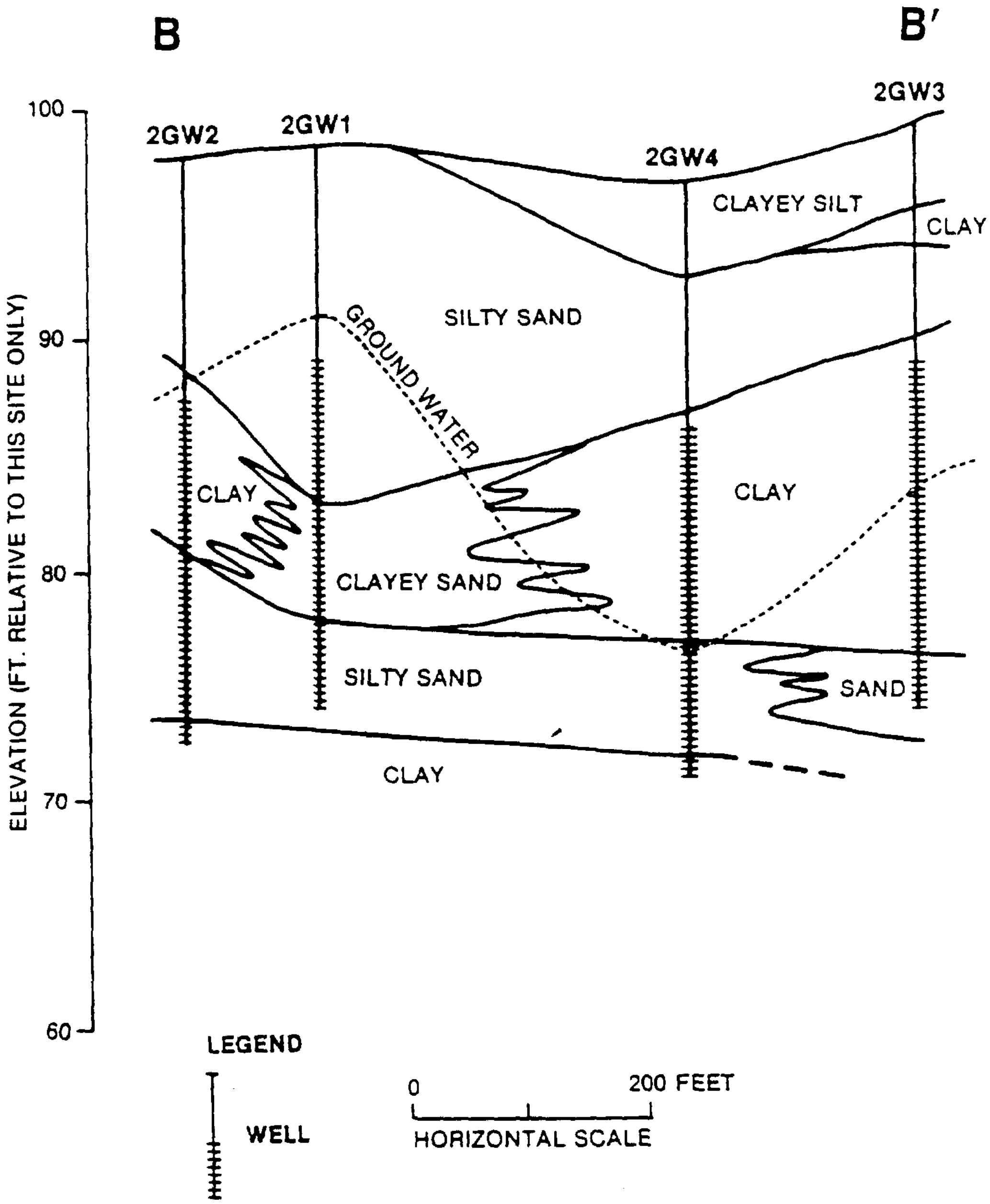
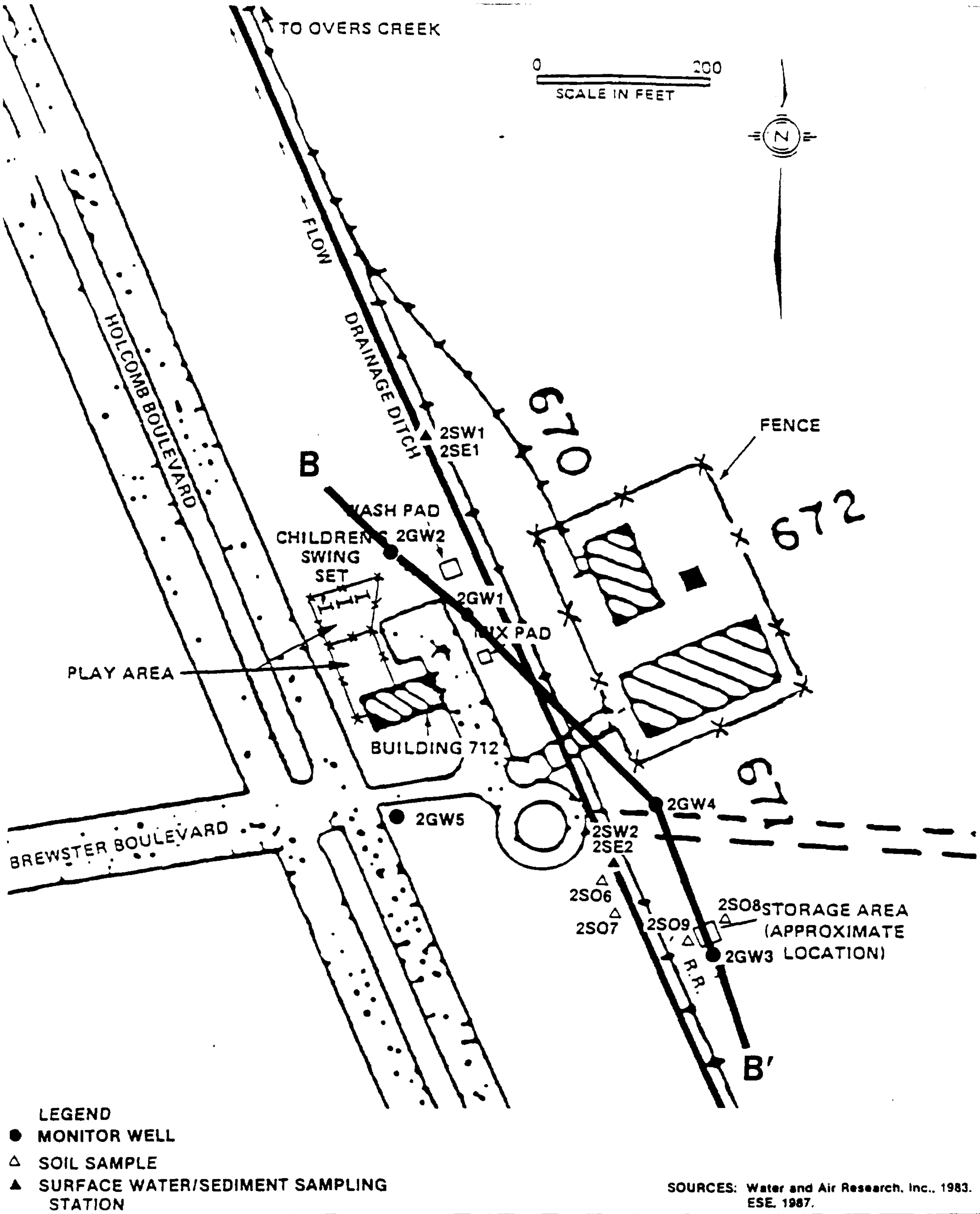


Figure 2-2
GEOLOGIC CROSS SECTION, SITE 2—
FORMER NURSERY/DAY CARE CENTER

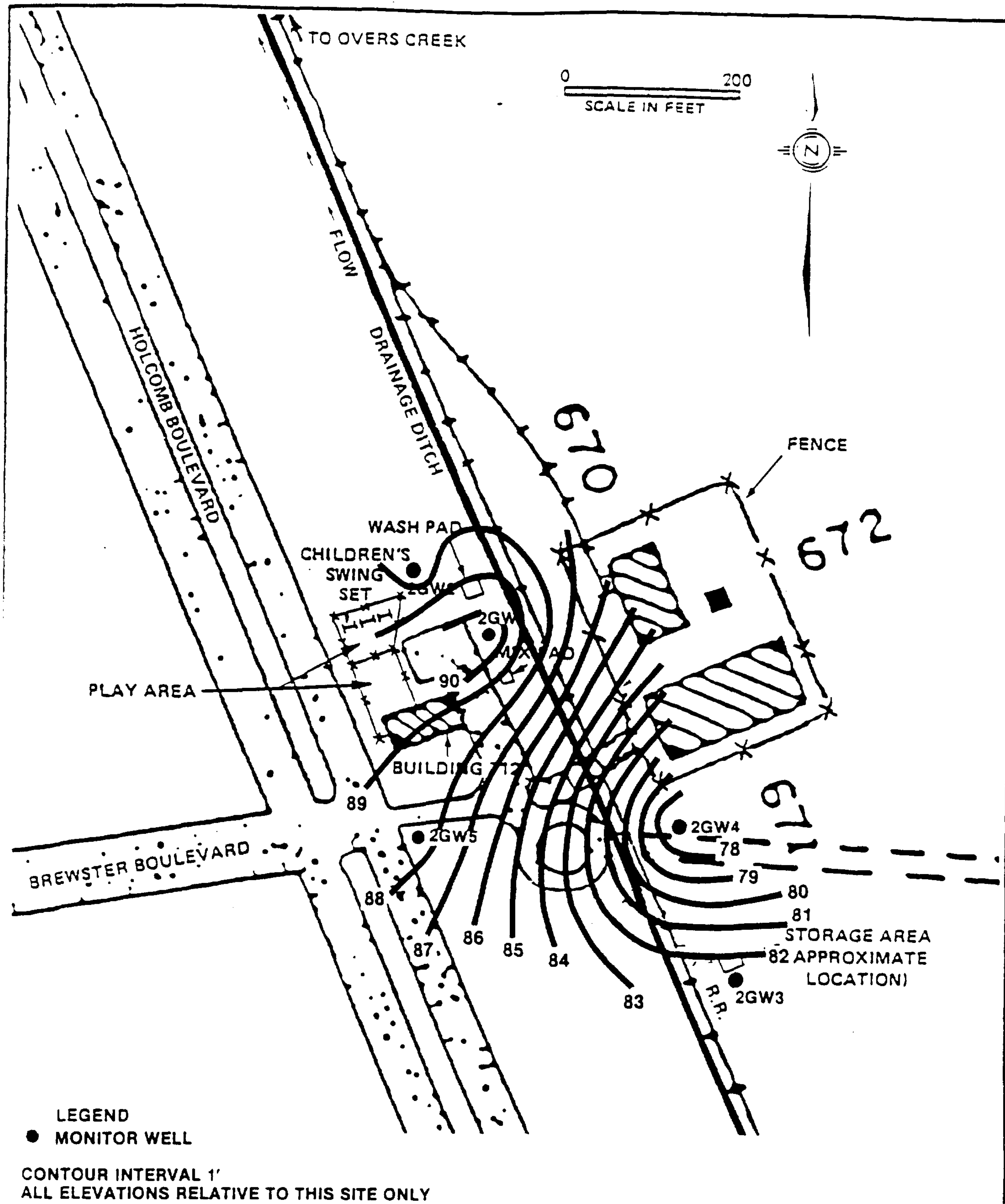
MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

ɡure 2-3
ΞOLOGIC CROSS SECTION LOCATION, SITE 2—
)RMER NURSERY/DAY CARE CENTER

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

igure 2-4
ROUND WATER CONTOUR MAP—
H OW AQUIFER, SITE 2—
ORMER NURSERY/DAY CARE CENTER

MARINE CORPS BASE
CAMP LEJEUNE

analyzed for the following target compounds:

- o Organochlorine pesticides
- o Organochlorine herbicides
- o Tetrachlorodioxin (1986 only)
- o Volatile organics (1986 only)

Appendix A presents a complete listing of the target analytes and their abbreviations.

The groundwater samples collected from the four water supply wells did not contain any VOCs above method detection levels.

Table 2-1 presents the analytical results of the groundwater samples collected from the five shallow monitoring wells. Trace amounts of DDD, DDE, and DDT were identified in Wells 2GW1 (July 1984 sampling event) and 2GW3 (1986 sampling event). Well 2GW3 also contained two VOCs, ethylbenzene and toluene.

SURFACE WATER/SEDIMENT

Two surface water samples were collected in December 1986 from the drainage ditch which parallels the railroad tracks along the eastern boundary of Site 2 (Figure 2-1). The ditch drains in a north-northwest direction towards Overs Creek. The surface water samples were analyzed for the same target compounds as the groundwater.

Table 2-2 indicates that DDD was identified in both surface water samples; DDT was detected in the downstream sample (2SW1) but not in the upstream sample (2SW2).

In August 1984 two sediment samples were collected from the drainage ditch, up- and downstream of the building. In December 1986 two sediment samples were collected from the same locations as the surface water samples. The sediment samples were analyzed for organochlorine pesticides and herbicides and for tetrachlorodioxin (1986 only). Table 2-3 presents the analytical

TABLE 2-1. SITE 2 - FORMER NURSERY/DAY CARE CENTER (BLDG. 712)
DETECTED TARGET ANALYTES
GROUNDWATER SAMPLES

DATE / PARAMETER	NC GW STANDARDS	2GW1 7/5/84	2GW1 12/02/86	2GW2 7/5/84	2GW2 12/02/86	2GW2 3/03/87	2GW3 7/5/84	2GW3 12/02/86	2GW3 3/03/87	2GW4 7/5/84	2GW4 12/02/86	2GW4 3/03/87	2GW5 7/7/84	2GW5 12/02/86	2GW5 3/03/87
DDD,PP'	NONE	0.029	0.03	<0.003	<0.013	<0.012	<0.003	0.097	<0.012	<0.003	<0.013	<0.012	<0.003	<0.013	<0.012
DDE,PP'	NONE	0.016	<0.013	<0.0008	<0.013	<0.012	<0.0008	0.057	0.02	<0.0008	<0.013	<0.012	<0.0008	<0.013	<0.012
DDT,PP'	NONE	0.15	<0.013	<0.005	<0.013	<0.012	<0.005	0.544	<0.012	<0.005	<0.013	<0.012	<0.005	<0.013	<0.012
ETHYLBENZENE	29	NRQ	<7.2	NRQ	<7.2	<7.2	NRQ	330	510	NRQ	<7.2	<7.2	NRQ	<7.2	<7.2
TOLUENE	1000	NRQ	<6.0	NRQ	<6.0	<6.0	NRQ	12	<60	NRQ	<6.0	<6.0	NRQ	<6.0	<6.0

NRQ: analysis not requested.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 2-2. SITE 2 - FORMER NURSERY/DAY-CARE CENTER (BLDG. 712)
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

DATE	NC SW STANDARD	2SW1 12/02/86	2SW2 12/02/86
PARAMETER			
DDD,PP'	NONE	0.742	0.027
DDT,PP'	0.001	0.560	<0.013

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 2-3. SITE 2 - FORMER NURSERY/DAY CARE CENTER (BLDG. 712)
DETECTED TARGET ANALYTES
SOIL/SEDIMENT SAMPLES

	2S4	2SO-6	2SO-7	2SE2	2S5	2SE1	2SO-8	2SO-9
DATE	8/3/84	11/11/86	11/11/86	12/02/86	8/3/84	12/02/86	11/11/86	11/11/86
PARAMETER								
DDD,PP'	0.011	<0.0114	<0.0118	1.570	<0.0007	4.16	<0.0115	1.32
DDE,PP'	0.056	<0.0114	0.0502	0.861	<0.0003	0.805	0.0259	0.138
DDT,PP'	0.150	<0.0172	0.115	0.168	<0.0016	3.53	0.0874	147
2,4-D	<0.0042	0.0491	0.0489	<0.0343	<0.0043	<0.0332	0.131	<0.0101
2,4,5-T	<0.0014	<0.0399	<0.0443	0.024	<0.0014	<0.0197	<0.0445	<0.0404

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

results for the four sediment samples. DDD, DDE, and DDT were identified in the upstream samples in both 1984 and 1986. The concentrations of these compounds increased considerably in 1986. The upstream sediment sample also contained 2,4,5-T in the 1986 sampling event. As Table 2-3 indicates the three metabolites of DDT were also detected in the downstream sediment sample. The concentrations of DDD and DDT were significantly higher than the upstream samples.

SOIL

Three soil borings were hand augered in the former play area during the August 1984 sampling investigation. Three composite soil samples (0-1'(A), 1-2'(B), 2-3'(C)) were collected from each boring and analyzed for organochlorine pesticides and herbicides. Table 2-4 indicates that all three of the shallow samples (0-1'(A)) contained DDD, DDE, and DDT. DDE was also detected in all of the intermediate depth samples (1-2'(B)) and deepest (2-3'(C)) samples. The concentrations of all meeabolites appeared to decrease with depth.

In the November 1986 sampling event, two soil samples were collected adjacent to the upstream surface water/sediment sampling location. These locations (2SO6 and 2SO7) are shown in Figure 2-1. Table 2-3 presents the analytical data and indicates that the sample farthest upstream (2SO7) contained the most contaminants. The herbicide 2,4-D was identified in both of these soil samples, however it was not identified in the sediment sample which was in close proximity. The detected contamination appears to be derived from the handling and mixing of herbicides and pesticides. As a result, the occurrence of these compounds in the soil and sediment are related to numerous spills which occurred throughout the active history of site usage. Spatial variation of contaminants and contaminant concentrations would be expected based on the use of the site. Samples collected from locations closest to the former mixing pads and storage area would be expected to be more contaminated. The current database indicates that a systematic soil/sediment sampling program may be warranted at this site.

TABLE 2-4. SITE 2 - FORMER NURSERY/DAY CARE CENTE LDG. 712)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	2S1A	2S1B	2S1C	2S2A	2S2B	2S2C	2S3A	2S3B	2S3C
DATE	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
PARAMETER									
DDD,PP'	0.0022	0.0006	<0.0005	0.0012	<0.0006	<0.0006	0.0038	<0.0006	<0.0006
DDE,PP'	0.0150	0.0023	0.0015	0.0420	0.0026	0.0003	0.0350	0.0230	0.0012
DDT,PP'	0.0095	0.0050	<0.0012	0.0180	<0.0014	<0.0014	0.057	0.0031	<0.0014

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

3.2.3 SUMMARY AND CONCLUSIONS

Organochlorine pesticides, particularly DDD, DDE, and DDT are still of major concern at this site. These compounds were found in groundwater, surface water, sediment and soil samples collected during 1984 and 1986 sampling events. In the soil samples, the contamination appears to decrease with depth with DDT and DDE at much higher concentrations than DDD. The concentrations of these same metabolites were much higher in the sediment samples relative to the soil samples, with the downstream sample having the highest detected concentrations. Unlike the soils, however, the DDD was found at higher concentrations than DDE or DDT.

3.2.4 RECOMMENDATIONS

The existing data indicates that soil, groundwater, sediment and surface water has been contaminated by DDT and its metabolites. Soils at several of the pesticide mixing/handling areas have not be adequately characterized. Additional soil sampling is required prior to initiation of a Risk Assessment and FS. In addition, soil contamination by VOCs may have occurred in the southern portion of this AOC as a result of storage of construction equipment. Soils in this area should also be characterized. To date, the water supply wells in the vicinity of Site 2 are unaffected by the detected contamination. Additional geohydrological investigation to determine the potential for interconnection of the shallow and deep aquifers should be performed.

3.3 SITE 6 - STORAGE LOTS 201 AND 203

3.3.1 SITE BACKGROUND

Storage Lots 201 and 203 are located on Holcomb Boulevard between Wallace and Bearhead Creeks (PWDM Coordinates 6, F3-4/G3-4/H2-4/I2-4/J3). Lot 201 is estimated to be approximately 25 acres in size, and Lot 203 is approximately 46 total acres (Figure 6-1). These lots have a long history of various uses, including disposal and storage. The land surface is flat and unpaved, and surface soils have been moved about as a result of regrading and equipment movement. The site was and still is used to store hazardous materials. DDT is reported to have been disposed of at Lot 203 when it served as a waste disposal area in the 1940's. Transformers containing PCBs have also been stored at this site; no spills or leaks have been reported.

A geologic cross-section (Figure 6-2) drawn on a northwest-southeast line (Figure 6-3) shows the site to be underlain by silty sand, sand, and coarse sand. The surface of the shallow groundwater at this site lies within the silty sand at depths ranging from 2 to 15 feet below land surface. The groundwater contour map (Figure 6-4) indicates that the groundwater flows radially toward Wallace Creek and Bearhead Creek at a gradient of approximately 0.009 foot per foot (ft/ft).

3.3.2 SITE INVESTIGATION

GROUNDWATER

Eight shallow monitoring wells were installed during the November 1986 sampling effort. Two sets of groundwater samples were collected in November 1986 and January 1987 and analyzed for VOCs and the o,p- and p,p-isomers of DDD, DDE, and DDT. Table 6-1 presents the analytical results of the sampling events. None of the groundwater samples contained DDT or its metabolites. Only three VOCs were detected in the samples. Benzene and 1,1,2,2-tetrachloroethane were detected in the sample from Well 6GW1 located in the northwest corner of Lot 203 and chloromethane was detected in the sample from Well 6GW6 located just east of lot 201.

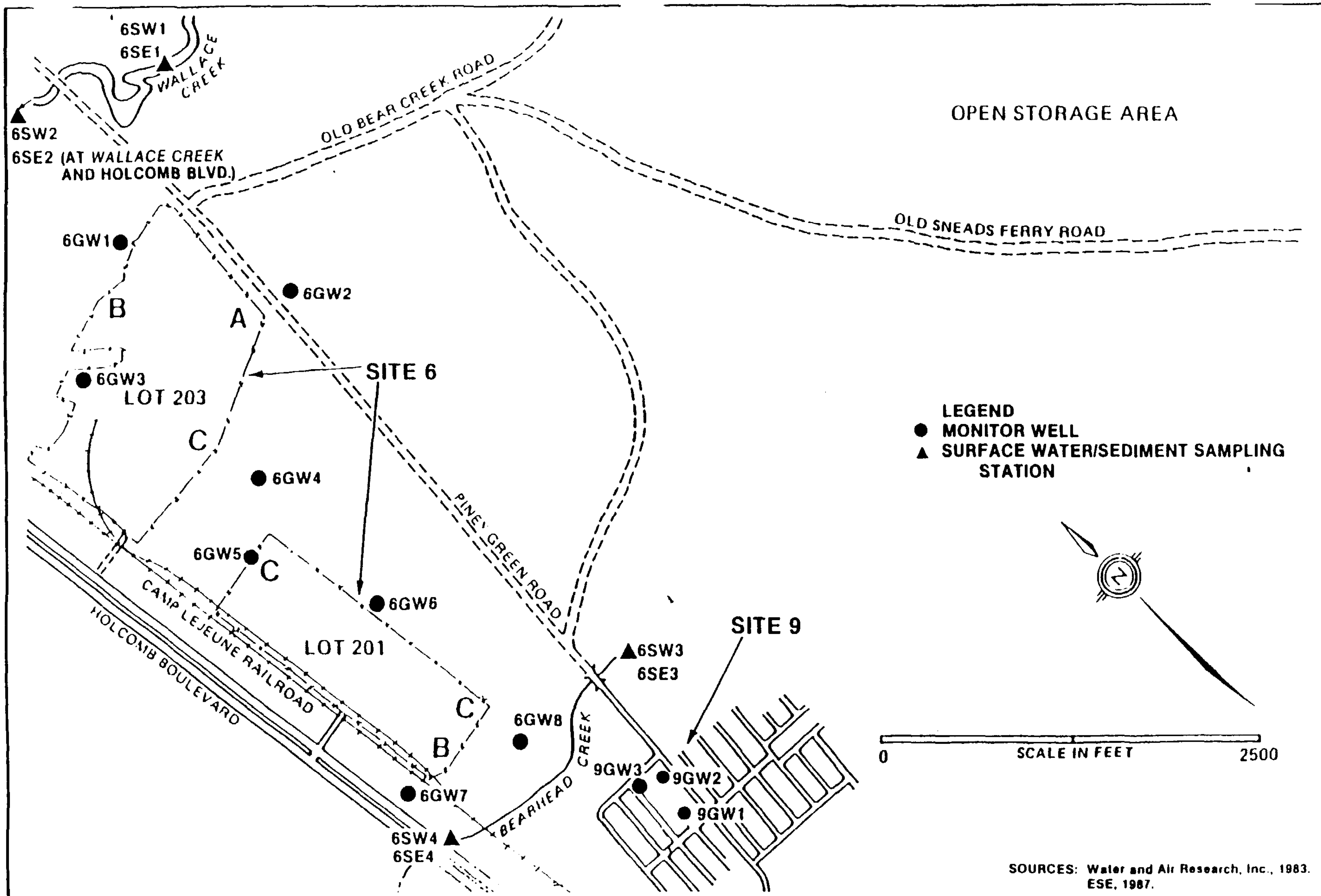


Figure 6-1
SAMPLING LOCATIONS, SITES 6 AND 9—
STORAGE LOTS 201 AND 203 AND FIRE FIGHTING TRAINING PIT

MARINE CORPS BASE
CAMP LEJEUNE

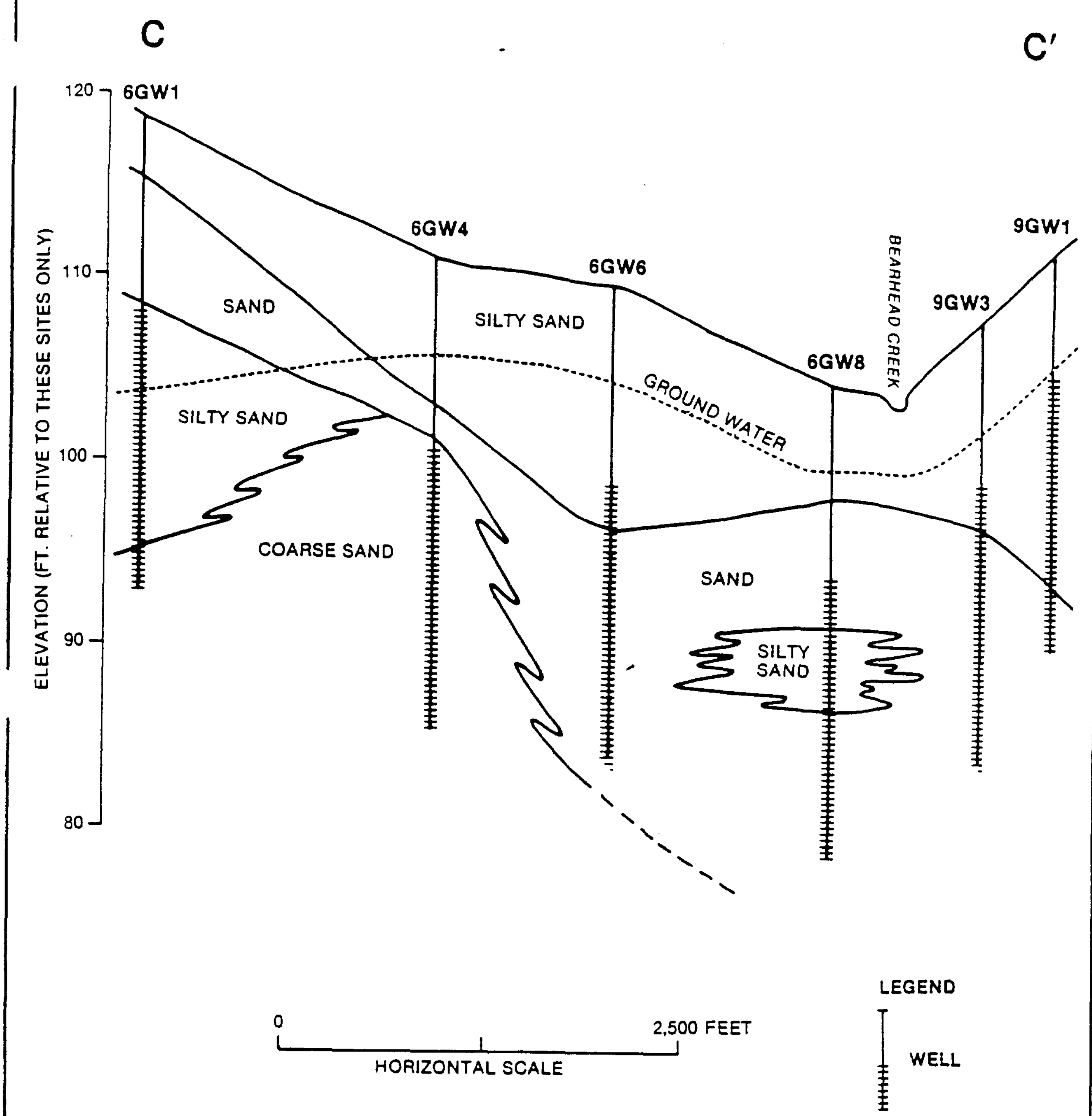


Figure 6-2
GEOLOGIC CROSS SECTION, SITES 6 AND 9—
STORAGE LOTS 201 AND 203 AND FIRE FIGHTING
TRAINING PIT

MARINE CORPS BASE
CAMP LEJEUNE

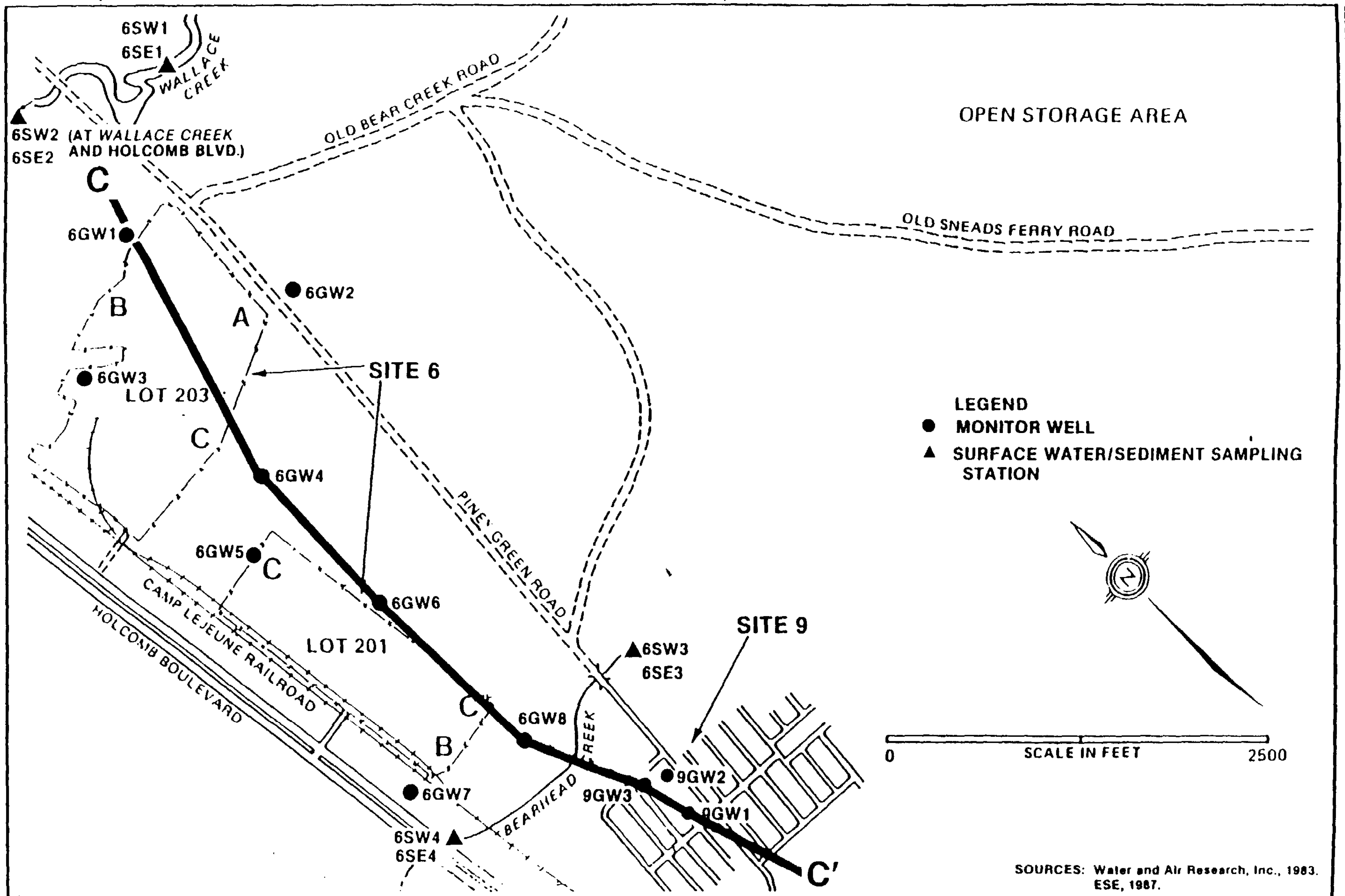


Figure 6-3
GEOLOGIC CROSS SECTION LOCATION, SITES 6 AND 9—
STORAGE LOTS 201 AND 203 AND FIRE FIGHTING TRAINING PIT

MARINE CORPS BASE
CAMP LEJEUNE

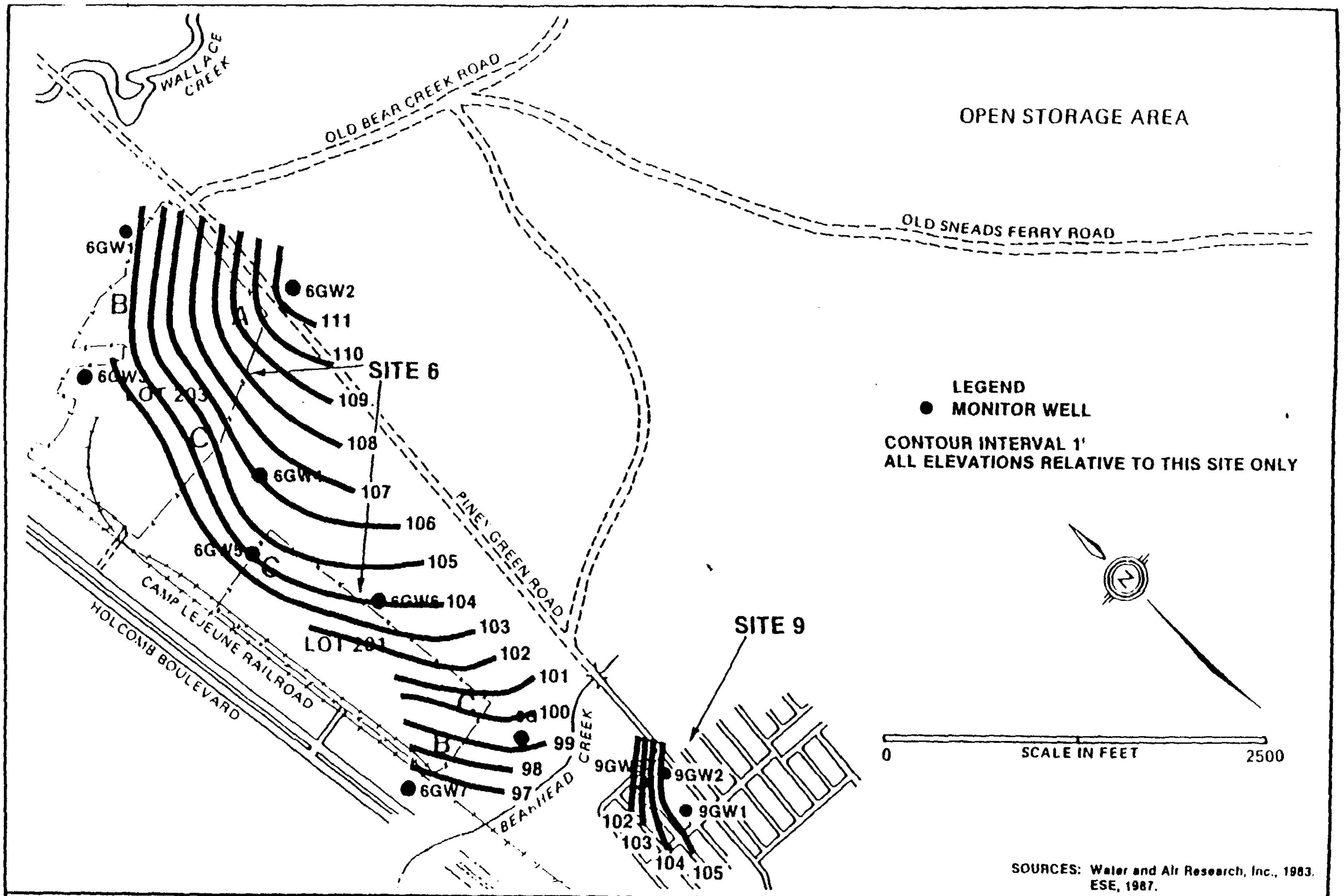


Figure 6-4
GROUND WATER CONTOUR MAP—SHALLOW AQUIFER, SITES 6 AND 9—STORAGE LOTS 201 AND 203 AND FIRE FIGHTING TRAINING PIT

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 6-1 SITE 6 - STORAGE LOTS 201 AND 205

DETECTED TARGET ANALYTES

GROUNDWATER SAMPLES

	NC GW	6GW1	6GW1	6GW2	6GW2	6GW3	6GW3	6GW4	6GW4	6GW5	6GW5	6GW6	6GW6	6GW7	6GW7	6GW8	6GW8
DATE	STANDARDS	11/19/86	1/21/87	11/20/86	1/21/87	11/20/86	1/22/87	11/19/86	1/21/87	11/19/86	1/21/87	11/19/86	1/22/87	11/20/86	1/22/87	11/20/86	1/22/87
PARAMETER																	
BENZENE	1	3.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CHLOROMETHANE	NONE	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	4.3	<4.3	<4.3	<4.3	<4.3	<4.3
1,1,2,2-TETRACHLORO ETHANE	NONE	61	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1

Values reported are concentrations in micrograms per liter (ug/L), the approximate parts per billion (ppb).

Source: ESE, 1990

SURFACE WATER/SEDIMENT

Surface water samples were collected in November 1986 from upstream and downstream locations in Wallace Creek and Bearhead Creek, which are adjacent to this AOC on the northwest and southeast, respectively (Figure 6-1). The samples were analyzed for VOCs and the o,p- and p,p-isomers of DDD, DDE, and DDT.

The surface water samples from Wallace Creek contained three VOCs: trichloroethene, vinyl chloride, and trans-1,2-dichloroethene (Table 6-2). Concentrations of these constituents were higher in the downstream (6SW2) sample than in the upstream (6SW1) sample. Neither of the samples contained DDT or its metabolites. The two surface water samples from Bearhead Creek contained no target compounds above method detection limits.

Sediment samples were collected from the same locations as the surface water samples and analyzed for the same target compounds. Table 6-3 shows that the two Wallace Creek samples did not contain any target analytes above method detection limits. The upstream sediment sample from Bearhead Creek contained both DDE and DDT while the downstream sediment sample contained only DDE.

SOIL

In August 1984 four locations within the two lot boundaries were identified as the most likely areas of contamination. Five soil borings were drilled at each of the four locations and a composite soil sample was collected from the 0-3 foot depth. These samples were analyzed for the o,p- and p,p-isomers of DDD, DDE, and DDT. Table 6-4 presents the analytical results for the soil samples collected during the 1984 investigation.

Borings 6S1 through 6S10 were drilled in Lot 203, borings 6S11 through 6S20 in Lot 201. Three of the five samples collected from the five borings drilled in the northern portion of Lot 203 contained isomers of DDD, DDE and/or DDT. No sample had all six isomers. All of the samples collected from the borings drilled in the southeastern quadrant of Lot 203 contained one of the target analytes, and the p,p-isomers of DDD, DDE and DDT were

TABLE 6-2. SITE 6 - STORAGE LOTS 201 AND 203
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

	NC SW	6SW1	6SW2	6SW3	6SW4
DATE	STANDARDS	11/19/86	11/19/86	11/19/86	11/19/86
PARAMETER					
TRANS-1,2-DICHLORO ETHENE	NONE	6.4	35	<1.6	<1.6
TRICHLOROETHENE	NONE	<3.0	26	<3.0	<3.0
VINYL CHLORIDE	NONE	1.9	3.6	<1.0	<1.0

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 6-3. SITE 6 - STORAGE LOTS 201 AND 203
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	6SE1	6SE2	6S33	6SE4
DATE	11/19/86	11/19/86	11/19/86	11/19/86
PARAMETER				
DDE,PP'	<0.0142	<0.0137	0.0758	0.0131
DDT,PP'	<0.0711	<0.0685	0.2190	<0.0654

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC sediment standards.

Source: ESE, 1990.

TABLE 6-4. SITE 6 - STORAGE LOTS 201 AND 203 (Page 1 of 3)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	6S1	6S1	6S2	6S2	6S3	6S4	6S5	6S6	6S7	6S8
DATE	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84
PARAMETER										
DDD,OP'	<0.000426	<0.000427	<0.000420	0.000657	<0.000535	<0.000419	<0.000418	<0.000430	<0.000432	<0.000437
DDE,OP'	<0.000319	<0.000321	<0.000315	<0.000323	<0.000401	<0.000314	<0.000313	<0.000322	<0.000324	<0.000323
DDT,OP'	0.00117	<0.00118	0.00231	<0.00119	<0.00147	<0.001150	0.00178	<0.001180	<0.00119	0.00480
DDD,PP'	<0.0005	0.0005	<0.000500	<0.0002	<0.00070	<0.000500	0.00107	0.00060	0.0006	0.00090
DDE,PP'	0.0012	0.0006	0.00140	0.0013	<0.00030	0.00050	<0.000200	0.00100	0.0016	0.00100
DDT,PP'	<0.0012	0.0010	<0.001200	<0.0006	<0.00150	<0.001200	0.00730	0.00270	0.0035	0.01400

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

TABLE 6-4. SITE 6 - STORAGE LOTS 201 AND 203 (Page 2 of 3)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	6S9	6S10	6S11	6S12	6S13	6S14	6S15	6S16	6S17	6S18
DATE	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84
PARAMETER										
DDD,OP'	<0.000439	0.00137	0.03640	<0.000426	0.0136	0.00415	<0.000436	0.00134	0.00325	0.00125
DDE,OP'	<0.000329	<0.000316	0.0320	<0.00032	0.00512	0.00773	<0.000327	0.00111	0.00136	<0.000342
DDT,OP'	<0.00121	0.01580	0.3240	<0.00117	0.0426	0.1200	<0.00120	0.0471	0.0774	0.0287
DDD,PP'	<0.00050	0.0048	0.1600	<0.00050	0.0250	0.0120	<0.00050	0.0110	0.0047	0.0035
DDE,PP'	0.0016	0.0015	<0.00120	<0.00120	0.7700	0.3100	0.00120	0.3000	0.1200	0.0730
DDT,PP'	<0.00120	0.0490	0.0100	0.0062	0.0082	0.0133	0.00820	0.0101	0.00436	0.01220

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

TABLE 6-4. SITE 6 - STORAGE LOTS 201 AND 203 (Page 3 of 3)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	6S19	6S20
DATE	8/06/84	8/06/84
PARAMETER		
DDD,OP'	0.00195	0.000442
DDE,OP'	0.00228	<0.000332
DDT,OP'	0.0413	0.0124
DDD,PP'	0.0061	0.0019
DDE,PP'	0.0180	0.0011
DDT,PP'	0.1400	0.0410

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

predominant.

All of the soil samples collected from the borings drilled in Lot 201 (borings 6S11 through 6S20) contained at least one of the target isomers. In general, these samples contained more contaminants than those in Lot 203 (borings 6S1 through 6S10) and at higher concentrations. Five of the samples contained all six isomers (borings 6S13, 6S14, 6S16, 6S17, and 6S19), three soil samples contained 5 of the 6 isomers (borings 6S11 6S18, and 6S20).

3.3.3 SUMMARY AND CONCLUSION

None of the groundwater samples collected from the 8 monitoring wells contained DDT or its metabolites. These target compounds were also not detected in the surface water samples collected from the two creeks bordering the site. However, concentrations of DDT and DDE were noted in sediment samples collected from Bearhead Creek on the south side of the site. The concentrations of DDE and DDT were greater in the upstream sample than in the downstream sample suggesting an additional source of the contaminants may be east of Piney Green Road. Migration of contaminants from Lot 201 may also be occurring resulting in the accumulation of DDT and DDE in the creek sediments.

Three VOCs were detected in the downstream surface water sample collected from Wallace Creek which is located to the northeast of Lot 203. The source of these contaminants is unknown at this time. The VOCs detected in the well located in Lot 203 (6GW1) are different than the VOCs detected in the surface water samples. Based on this limited amount of data it appears that the contaminants detected are originating from different sources.

3.3.4 RECOMMENDATIONS

DDT, DDD, and DDE contamination is widespread in Lots 201 and 203. A detailed soil sampling investigation should be conducted to determine the vertical and areal extent of contamination; previous sampling has occurred to a depth of only 3 feet. The data indicate that contamination has not reached the shallow groundwater as of January 1987. It is possible that the contaminants may be tightly adsorbed to soil particles and thus are unlikely to reach the groundwater.

The source of VOCs in the surface water of Wallace Creek needs further investigation. It appears unlikely that Lot 203 as currently defined is the source of the three VOCs detected in the upstream and downstream water samples.

A forested area between Lot 203 and Wallace Creek appears to have been used as a disposal area at some point in the past. Currently there is surface evidence of debris piles and small depressions. This areas is bounded on the northwest by Wallace Creek and is therefore a reasonable source of the observed VOCs in Wallace. A site investigation consisting of geophysics, soil gas, and subsequent installation of monitor wells and collection of soil samples is recommended in this area.

Following characterization of the environmental contamination at this AOC, a Risk Assessment should be conducted to the determine the risk levels represented by the detected contamination and to determine clean up levels for the FS.

3.4 SITE 9 - FIRE FIGHTING TRAINING PIT

3.4.1 SITE BACKGROUND

This two acre site is located between Piney Green Road and Holcomb Boulevard, south of Bearhead Creek (PWDM coordinates 6, K3/L3). This AOC has been used for fire fighting training exercises from the 1960's to the present. Until 1981 the fire training activities were carried out in an unlined pit. Flammable liquids including used oil, solvents, and contaminated fuels (non-leaded) were burned in the pit. An oil-water separator has been installed at the site as a means of pollution control.

The geology underlying the site is similar to that of Site 6 (Figure 6-2) and consists of sand and silty sand. The groundwater contour map (Figure 6-4) indicates that shallow groundwater from the area of the pit flows to the northwest toward Bearhead Creek at a gradient of approximately 0.026 ft/ft.

3.4.2 SITE INVESTIGATION

GROUNDWATER

Two shallow monitoring wells were installed in 1984 to characterize the groundwater below the fire training pit (Figure 6-1). These two wells along with a water supply Well (639) located just east of Piney Green Road were sampled in July 1984 and analyzed for:

- Cadmium
- Chromium
- Lead
- Oil & Grease (O&G)
- Volatile organics
- Total Phenols

Table 9-1 presents the analytical results of the 1984 sampling event. The data indicate that chromium, lead, and phenols were detected in both Wells 9GW1 and Well 9GW2. The analytical results for the well sample listed as 9GW3 sampled in 1984 represents the data for water supply Well 639. No target analytes were detected in this supply well.

TABLE 9-1. SITE 9 - FIRE FIGHTING TRAINING PIT
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE PARAMETER	NC GW TANDARD	9GW1 7/5/84	9GW1 11/19/86	9GW2 7/5/84	9GW2 11/19/86	9GW3 7/5/84	9GW3 11/18/86	9GW3 1/21/87
CHROMIUM	50	45	36.2	86	79	<6.0	<5.4	30
LEAD	50	80	41.6	94	<22	<40	<22	31
OIL & GREASE	NONE	3	<0.2	<0.7	<0.2	<0.8	<0.2	0.2
PHENOLS	NONE	3	6	4	6	<1	5	<2
1,2-DIBROMO-								
ETHANE	NONE	NRQ	<0.020	NRQ	<0.020	NRQ	0.157	<0.01

NRQ: analysis not requested.
Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

In November 1986 a third monitoring well was installed downgradient of the pit and sampled along with the two previously installed monitoring wells. The 1986 water samples were analyzed for the constituents listed above with the following additions:

- o Xylene
- o Methylethyl ketone
- o Methyl isobutyl ketone
- o Ethylene dibromide
- o Hexavalent Chromium

Table 9-1 indicates that chromium, lead, and phenols were again detected in Well 9GW1. In Well 9GW2, chromium and phenols were again detected but lead was not detected. Two sets of samples were collected from monitoring well 9GW3 (this designation now represents a shallow monitor well, not the water supply well 639). The November 1986 data detected the presence of phenols and 1,2-dibromoethane (ethylene dibromide) while the January 1987 indicated the presence of chromium and lead.

3.4.3 SUMMARY AND CONCLUSIONS

The chemical data and groundwater contour map suggest that the potential for contamination and/or contaminant migration at this AOC site is low. The analysis of the samples collected from Well 9GW1, located immediately adjacent to the pit, has detected low levels of contamination. The samples from Well 9GW3, located hydraulically downgradient from the pit, likewise contained only trace levels of contamination. No target analytes were detected in water supply Well 639.

3.4.4 RECOMMENDATIONS

Because trace levels of contamination were detected in the immediate vicinity of the pit, it is unlikely that this AOC presents a substantial risk to health and the environment. However, it is recommended that a Risk Assessment be conducted to document the lack of risk. Prior to initiation of the Risk Assessment, an additional set of groundwater samples should be collected and analyzed to provide a current data base.

3.5 SITE 21 - TRANSFORMER STORAGE LOT 140

3.5.1 SITE BACKGROUND

This AOC is located between Ash Street and Sneads Ferry Road on Center Road (PWDM coordinates 10,I15). A transformer oil pit was located in the northeastern end of Lot 140 across the railroad tracks from Building 702 (Figure 21-1). The entire lot is approximately 220 feet by 890 feet with the dimensions of the pit measuring 25 to 30 feet long by 6 feet wide by 8 feet deep.

Lot 140 was used from 1958 to 1977 for pesticide mixing and as a cleaning area for pesticide application equipment. The mixing area for the pesticides is believed to have been the southeast corner of the lot. Pesticide contamination possibly occurred as a result of small spills, washout, and excess disposal. In 1977, before activities were moved to a different location, washout was estimated to be about 350 gallons per week of overland discharge.

In 1950-51 an onsite pit was used as a drainage receptor for oil from transformers. Sand was occasionally placed in the pit when oil was found standing in the pit bottom. The total quantity of oil drained in this manner is unknown.

Since only one monitoring well has been installed at this AOC, a geologic cross-section of the site has not been prepared. The boring log for the well indicates that the site is underlain by sandy gravel (fill material), sandy silt, and sandy clay. The surface of the shallow groundwater at the site was measured at nine feet below land surface and lies within a sandy silt interval.

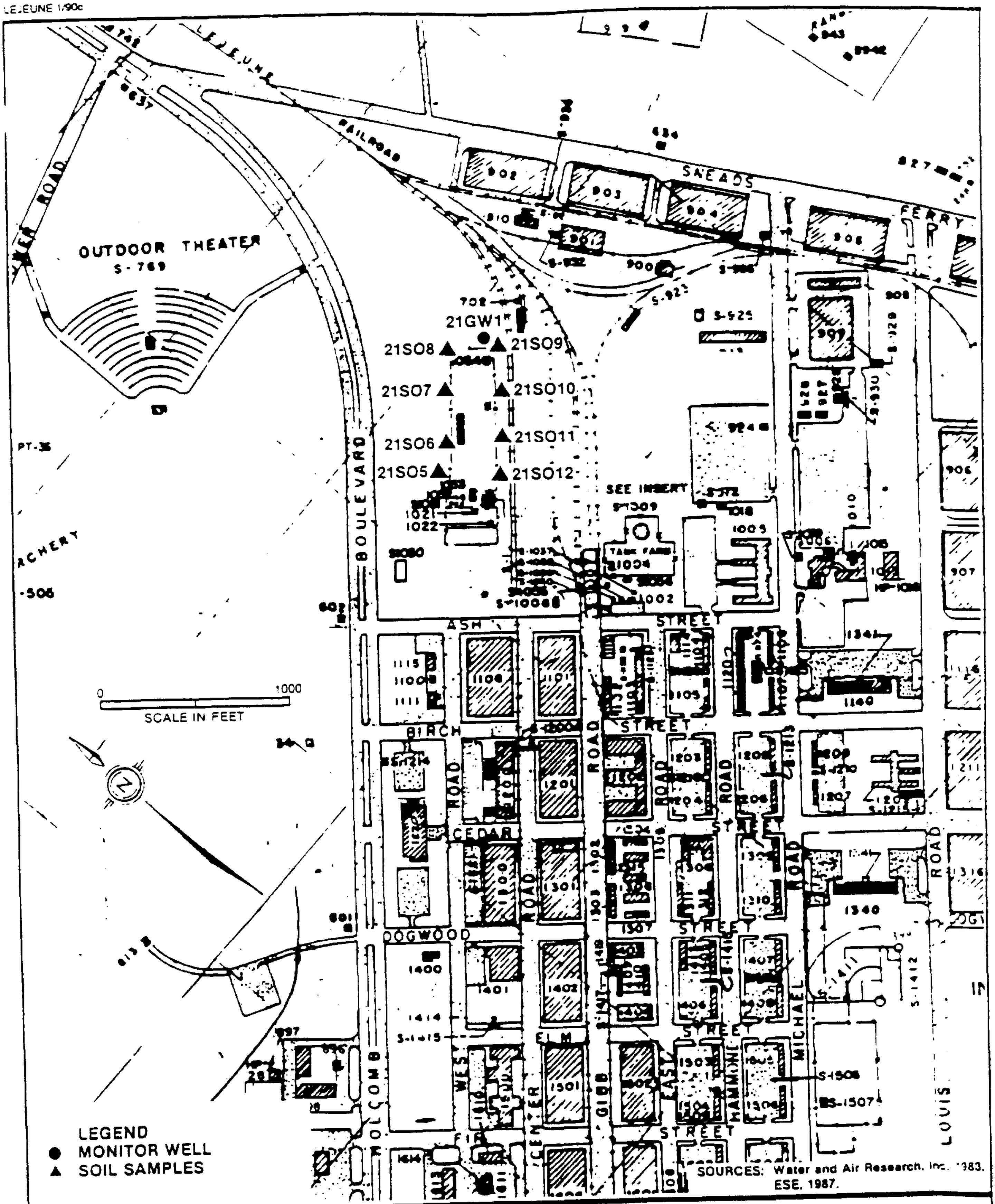


Figure 21-1
SAMPLING LOCATIONS,
SITE 21—TRANSFORMER STORAGE LOT 140

MARINE CORPS BASE
CAMP LEJEUNE

3.5.2 SITE INVESTIGATION

GROUNDWATER

One shallow monitoring well was installed at this site in 1984. Groundwater samples were collected in both July 1984 and November 1986 and analyzed for the following parameters:

- o Organochlorine pesticides
- o Organochlorine herbicides
- o Polychlorinated biphenyls
- o Volatile organics (1986 only)
- o Tetrachlorodioxin (1986 only)
- o Xylene (1986 only)
- o Methylethyl ketone (1986 only)
- o Methyl isobutyl ketone (1986 only)
- o Ethylene dibromide (1986 only)
- o Oil & grease (1986 only)

Appendix A presents a complete listing of all target analytes and their abbreviations.

Table 21-1 indicates that no target analytes were identified in the July 1984 sample collected from 21GW1. Only two parameters, 2,4-D (an organochlorine herbicide) and O&G were detected in the November 1986 sample.

SOIL

In August 1984, 10 soil borings were hand augered at this AOC, four borings inside the fenced area and six borings outside the fenced area. A total of six samples were collected from the four borings located inside the fenced area. These samples were analyzed for organochlorine pesticides and herbicides and polychlorinated biphenyls. Table 21-2 presents the analytical data for these soil samples. The analytical results of several duplicate samples collected from these borings are also presented. Detectable amounts of DDD, DDE, and DDT were found in all the samples collected from the borings. These contaminants were identified in both surface samples as well

TABLE 21-1. SITE 21 - TRANSFORMER STORAGE LOT 140
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE PARAMETER	NC GW STANDARDS	21GW1 7/4/84	21GW1 11/26/86
OIL & GREASE	NONE	NRQ	400
2,4-D	70	<0.08	1.17

NRQ: analysis not requested.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 21-2. SITE 21 - TRANSFORMER STORAGE LOT 140
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S1A	21S1A	21S1B	21S1B	21S1C	21S1C	21S2C	21S2A	21S2A	21S2B
DATE	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
PARAMETER										
ALDRIN	0.0011	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00007	<0.00008
DDD,PP'	0.0051	0.0040	<0.00050	0.00060	<0.00050	<0.00060	<0.00060	0.0074	0.0047	0.0044
DDE,PP'	0.0460	0.0043	<0.00020	0.00560	<0.00020	0.00310	0.0260	0.0740	0.0067	0.0480
DDT,PP'	0.0520	0.0140	<0.00120	0.00580	<0.00120	<0.00120	0.0870	0.0370	0.0057	0.0400
HEPTACHLOR	<0.00006	<0.00006	<0.00007	<0.00006	<0.00007	<0.00007	<0.00007	<0.00007	<0.00006	<0.00006

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

as soil samples collected from the 1-2 foot range. PCBs were not detected in any of these samples.

Six soil samples were collected from six borings augered in the area outside of the fenced compound. These samples were analyzed for organochlorine pesticides and herbicides. The results as shown in Table 21-3 indicate the presence of DDD, DDE, and DDT in all of the surface soil samples collected.

In November 1986 eight additional soil borings were augered outside the fenced area in an attempt to further define the extent of soil contamination. Soil samples were collected from four depths at each of the borings. The 32 soil samples were analyzed for:

- Organochlorine pesticides
- Organochlorine herbicides
- Polychlorinated biphenyls
- Tetrachlorodioxin

The analytical results for the November 1986 sampling effort are presented in Table 21-4. The most prevalent compounds detected were 2,4-D, DDD, DDE, and DDT. Thirty out of the 32 samples collected contained the herbicide 2,4-D. This compound was evenly distributed at all depths. DDD was likewise found in the soils down to a depth of five feet; DDE and DDT were detected down to the 3-5 foot range. Polychlorinated biphenyls were detected in two soil samples collected from Boring 21S09 which is located on the northeast corner of the fenced area. This boring is close to the location of the former transformer oil pit.

3.5.3 SUMMARY AND CONCLUSIONS

The two rounds of sampling data indicate that pesticide compounds are present in the shallow soils as well as to a depth of at least five feet. The organochlorine herbicides and DDT and its derivatives were detected most often in the soil samples. Chlordane and aldrin, organochlorine pesticides, have also been identified in the soils.

TABLE 21-3. SITE 21 - TRANSFORMER STORAGE LOT 140
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S3A	21S3B	21S3C	21S4A	21S4B	21S4C
DATE	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
PARAMETER						
ALDRIN	<0.00008	<0.00008	<0.00008	<0.00007	<0.00008	<0.00007
DDD,PP'	0.0044	0.0036	0.0070	<0.0005	<0.0005	0.0230
DDE,PP'	0.0530	0.0420	0.0400	0.160	0.220	0.0079
DDT,PP'	0.0200	0.0140	0.0300	0.780	2.100	0.0740
HEPTACHLOR	<0.00007	<0.00007	<0.00006	<0.00006	<0.00006	0.0027

Values reported are concentrations in micrograms per gram (ug/g);
this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

TABLE 21-4. SITE 21 - TRANSFORMER STORAGE LOT 140 (Page 1 of 4)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S05A	21S05B	21S05C	21S05D	21S06A	21S06B	21S06C	21S06D
DATE	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86
PARAMETER								
BHC,D	<0.0267	<0.0267	<0.0292	<0.0311	<0.0233	<0.0276	<0.0279	<0.0265
CHLORDANE	76.700	1.290	<0.0761	0.118	<0.0607	<0.072	0.203	<0.0692
DDD,PP'	<0.0116	<0.0116	<0.0127	<0.0135	<0.0101	<0.012	<0.0121	<0.0115
DDE,PP'	1.980	<0.0116	<0.0127	<0.0135	<0.0101	<0.012	<0.0121	<0.0115
DDT,PP'	5.080	<0.0174	<0.019	<0.0203	<0.0152	<0.018	<0.0182	<0.0173
PCBS,TOTAL	<0.545	<0.547	<0.596	<0.635	<0.475	<0.564	<0.571	<0.542
2,4-D	0.0574	0.661	0.298	0.369	0.401	0.394	0.148	0.118

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

TABLE 21-4. SITE 21 - TRANSFORMER STORAGE LOT 140 (Page 2 of 4)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S07A	21S07B	21S07C	21S07D	21S08A	21S08B	21S08C	21S08D
DATE	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86
PARAMETER								
BHC,D	<0.271	<0.0272	<0.0302	<0.0286	<0.0263	<0.027	<0.0276	<0.0282
CHLORDANE	<0.707	<0.071	<0.0789	<0.0746	<0.0824	<0.0704	<0.072	<0.0735
DDD,PP'	<0.118	<0.0118	0.282	<0.0124	<0.0114	<0.0117	<0.012	<0.0122
DDE,PP'	0.047	<0.0118	0.228	<0.0124	0.028	<0.0117	<0.012	<0.0122
DDT,PP'	<0.118	<0.0178	0.461	<0.0186	<0.0114	<0.0176	<0.018	<0.0184
PCBS,TOTAL	<0.554	<0.556	<0.618	<0.584	<0.538	<0.551	<0.564	<0.575
2,4-D	0.618	0.287	0.312	0.166	0.151	0.109	0.248	0.486

Values are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

TABLE 21-4. SITE 21 - TRANSFORMER STORAGE LOT 140 (Page 3 of 4)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S09A	21S09B	21S09C	21S09D	21S010A	21S010B	21S010C	21S010D
DATE	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86
PARAMETER								
BHC,D	0.0297	<0.245	<0.0247	<0.0257	<0.0251	<0.0251	<0.0263	<0.0279
CHLORDANE	<0.0636	<0.639	<0.0643	<0.0669	<0.0655	<0.0654	<0.0686	<0.0728
DDD,PP'	0.0955	0.174	0.218	0.0579	<0.0109	<0.0109	<0.0114	<0.0121
DDE,PP'	<0.0530	<0.0106	<0.0107	<0.0112	<0.0109	<0.0109	<0.0114	<0.0121
DDT,PP'	<0.265	<0.106	<0.0107	<0.0112	<0.0109	<0.0109	<0.0114	<0.0121
PCBS,TOTAL	17.100	1.430	<0.510	0.954	<0.520	<0.519	<0.537	<0.571
2,4-D	0.151	0.152	<0.0793	0.015	0.109	0.268	0.195	<0.0956

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

TABLE 21-4. SITE 21 - TRANSFORMER STORAGE LOT 140 (Page 4 of 4)
DETECTED TARGET ANALYTES
SOIL SAMPLES

	21S11A	21S11B	21S11C	21S11D	21S012A	21S012B	21S012C	21S012D
DATE	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86	11/12/86
PARAMETER								
BHC,D	<0.0247	<0.0253	<0.0284	0.0286	<0.0258	<0.0266	<0.027	<0.0282
CHLORDANE	<0.0645	<0.0661	<0.0741	<0.0747	<0.0674	<0.0694	<0.0704	<0.0735
DDD,PP'	<0.0108	<0.011	<0.0124	<0.0124	0.143	0.032	0.445	0.0126
DDE,PP'	<0.0108	<0.011	<0.0124	<0.0124	0.0531	0.032	<0.0117	<0.0123
DDT,PP'	<0.0108	<0.011	<0.0124	<0.0124	0.556	0.150	0.143	<0.0123
PCBS,TOTAL	<0.505	<0.518	<0.581	<0.585	<0.534	<0.550	<0.558	<0.576
2,4-D	0.190	0.166	0.490	0.345	0.306	0.302	0.484	0.685

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

The information generated from the one monitoring well installed at this site suggests that the majority of the organic compounds identified in the soils have not migrated to the shallow groundwater. However 2,4-D was identified in the 1986 groundwater sample and was detected in 30 of the 32 soil samples. This limited amount of data does indicate that vertical migration can occur.

3.5.4 RECOMMENDATIONS

Soil contamination was noted in several borings down to a depth of five feet. A further characterization of the extent of vertical contamination should be conducted at this AOC.

The contamination detected to date suggests that waste pesticides and PCBs are present at this AOC. In order to determine the risk represented by this contamination, a more detailed delineation of the soils and groundwater should be conducted. Following this additional characterization, a Risk Assessment should be conducted. An FS should then be conducted if the Risk Assessment identifies an unacceptable risk to health and/or the environment.

3.6 SITE 22 - INDUSTRIAL AREA TANK FARM

3.6.1 SITE BACKGROUND

The Industrial Area Tank Farm is located east of the intersection of Gibb Road and Ash Streets (PWDM coordinates 10, J15). Figure 22-1 identifies the location of the tank farm which covers an area of approximately 4 acres; the insert depicts 14 underground storage tanks and one above ground tank. The fuel farm was constructed in the 1940s and several fuel leaks have occurred throughout the years, the latest being a 100-gallon leak of diesel fuel in 1981. In 1979, a fuel leak of an estimated 20,000 to 30,000 gallons of diesel and unleaded fuel occurred in an underground line near the tank truck loading facility.

The soils encountered at this site consist primarily of fine and medium sands, mixed with lesser amounts of silt. Clay stringers were found consistently throughout the silty sand mixtures with an occasional thin layer of clay (up to 2 feet thick). Up to 4 feet of miscellaneous fill material was found adjacent to buildings and developed roads.

3.6.2 SITE INVESTIGATIONS

GROUNDWATER

Two shallow monitoring wells were installed and sampled during the July 1984 sampling investigation to characterize the shallow aquifer underneath the site. In addition, an existing water supply well (602) was also sampled. The three water samples were analyzed for lead, VOCs, and O&G. Appendix A presents a full listing of all target analytes and their abbreviations.

Table 22-1 presents the analytical results for the three groundwater samples. Six VOCs and lead were detected in the sample from the well installed in the tank farm area (22GW1). Several of the compounds identified are associated with fuel components. The other VOCs reported in the water sample suggest other possible sources of contamination. The concentration of benzene (17000 ug/l) detected in the groundwater at Well 22GW1 was substantially greater than the North Carolina groundwater standard of 0.70 ug/l. The concentrations recorded for chloroform, ethylbenzene, and toluene likewise

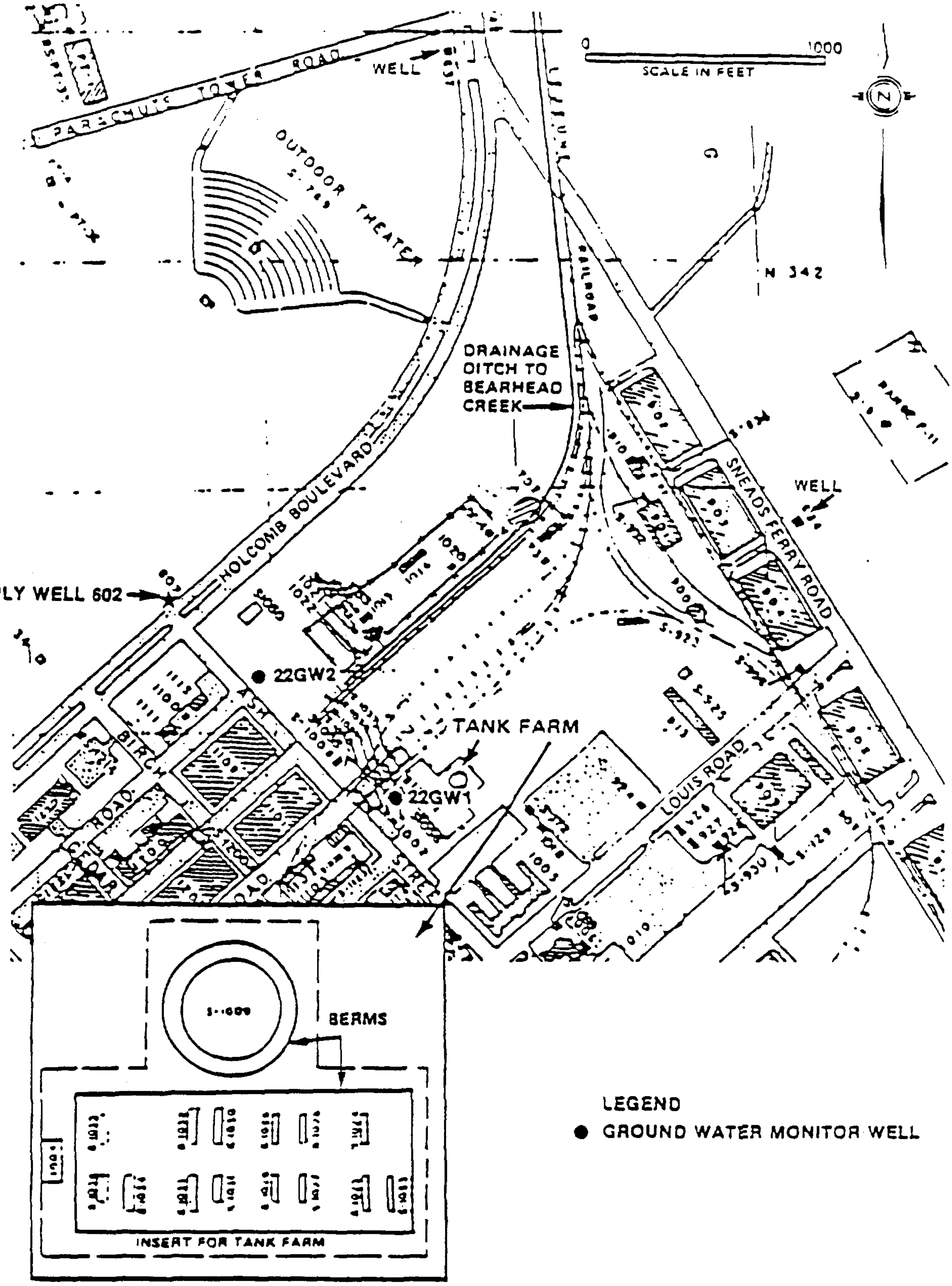


Figure 22-1
SAMPLING LOCATIONS, SITE 22—
HADNOT POINT INDUSTRIAL AREA TANK FARM

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1987.

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 22-1. SITE 22 - INDUSTRIAL AREA TANK FARM

DETECTED TARGET ANALYTES

GROUND WATER SAMPLES

	NC GW	22GW1	22GW1	22GW1	22GW1	22GW2	22GW2	22GW2	22GW2	22GW3
DATE	STANDARDS	7/6/84	1/9/87	3/8/87	5/27/87	7/6/84	1/9/87	3/8/87	5/27/87	7/6/84
PARAMETER										
BENZENE	1	17000	12000	10000	13000	<0.3	<1	<1	<1	380
CHLOROFORM	0.19	0.70	<16	<1600	<1600	<0.70	<1.6	<1.6	<1.6	<0.70
1,2-DICHLOROETHANE	0.38	52	<28	<2800	<2800	<1.0	<2.8	<2.8	<2.8	46
T-1,2-DICHLOROETHENE	70	<0.80	<16	<1600	<1600	<1.3	<1.6	<1.6	<1.6	7.8
1,2-DICHLOROPROPANE	0.56	18	<60	<6000	<6000	<0.7	<6	<6	<6	<0.7
ETHYLBENZENE	29	2800	1800	<7200	<7200	<1	<7.2	<7.2	<7.2	8
TRICHLORO-										
FLUOROMETHANE	NONE	<0.9	<32	<3200	<3200	<1	<3.2	<3.2	<3.2	3
TOLUENE	1000	27000	15000	18000	24000	<0.6	<6	<6	<6	10
XYLENE	400	NA	9000	<12000	<12000	NA	<12	<12	<12	NA
METHYLENE CHLORIDE	5	<0.8	<28	<2800	<50000	<1	7.3	<2.8	<50	<1
LEAD	50	807	33	29	78	<40	28	<27	<49.2	40
OIL & GREASE	NONE	<900	7000	11000	9000	1000	800	<100	<200	<800

NA: not analyzed.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

exceed groundwater standards. O&G was the only target compound identified in the sample collected from Well 22GW2 installed between the tank farm and the Supply Well 602 located approximately 1,200 feet to the west of the tank farm.

The sample from Supply Well 602 (22GW3) contained six VOCs and lead. Benzene was detected at a concentration of 380 ug/l which is in excess of the North Carolina groundwater standard for this compound.

Since the 1984 sampling effort at Site 22 had identified contamination of the deep potable aquifer in the vicinity of the Hadnot Point Industrial Area (HPIA), a more intensive effort was recommended within the HPIA. This effort included a resampling of the monitor wells at Site 22.

A second round of sampling was performed on the two monitoring wells at this AOC in January, March and May 1987. The two groundwater samples were analyzed for the same parameters as the 1984 sampling. Table 22-1 presents the analytical data for the three sets of samples collected during this sampling event. As in 1984, several VOCs and lead were detected in the water samples collected from Well 22GW1. The levels of benzene were consistently above the 10,000 parts per billion (ppb) range. The concentrations recorded for ethylbenzene and toluene were similar to those found during the 1984 sampling effort. Lead was detected at lower concentrations than previously recorded in the earlier round of sampling. Xylene was identified in the January 1987 investigation at a concentration of 9,000 ug/l which is greater than the North Carolina groundwater standard for this compound (400 ug/l). O&G, which was not detected in the July 1984 sample from 22GW1 was found in all three samples collected in 1987.

Two of the three samples collected from 22GW2 in 1987 contained no target analytes above method detection limits. The groundwater sample collected in January 1987 from this same well did contain lead, methylene chloride and O&G. Only O&G was identified in the July 1984 sample collected from 22GW2.

O'Brien & Gere Engineers conducted a field investigation at this AOC in 1988. Among the activities conducted were floating product determination and the characterization of contaminant plume(s). Their study concluded that a 15 foot layer of floating product was noted in a monitoring well drilled on the western edge of the tank farm (approximately 75 ft northwest of 22GW1). The study was also able to characterize a benzene contaminant plume in the vicinity of the tank farm. The extent of the plume has not been fully defined beyond the maximum contaminant level (MCL) of 5 ug/l.

3.6.3 SUMMARY AND CONCLUSIONS

Groundwater movement in the shallow aquifer in this area is generally to the south-southwest toward the New River. Several VOCs have been identified at elevated concentrations in groundwater samples collected from two onsite monitoring wells. The concentrations of the compounds detected during the various sampling efforts have been consistent and in most cases are orders of magnitude greater than established groundwater standards.

An attempt has been made to characterize the contaminant plume(s) using benzene as the indicator compound. The boundaries of the plume have only been identified to a concentration of 5 ug/l which represents the drinking water standard. However North Carolina has established 0.7 ug/l as the groundwater standard for benzene. Of particular concern is the presence of benzene in the Supply Well 602 (22GW3) sampled in July 1984. The concentration of benzene (380 ug/l) was well above the drinking water regulation of 5 ug/l.

As in many other areas of the base, O&G has been identified in several of the groundwater samples collected from the shallow aquifer.

3.6.4 RECOMMENDATIONS

The investigation at Site 22 had identified contamination of the deep potable aquifer in the vicinity of the Hadnot Point Industrial Area (HPIA). A more intensive effort was, therefore, recommended within the HPIA, and this effort included a resampling of the monitor wells at Site 22. The basis for and the scope of this effort is described in the RI/FS reports and the RI/FS Work Plan for HPIA.

3.7 SITE 24 - INDUSTRIAL AREA FLY ASH DUMP

3.7.1 SITE BACKGROUND

This AOC is located south and east of the intersection of Birch and Duncan Streets (PWDM coordinates 10, L16-17/M16-17). As shown in Figure 24-1, four separate disposal locations were investigated as potential areas of contamination. Site 24 was used for the disposal of fly ash, cinders, solvents, used paint stripping compounds, sewage sludge, and water treatment spiractor sludge from the late 1940s to 1980. Approximately 20 to 25 acres in size, the site lies adjacent to upstream portions of Codgels Creek.

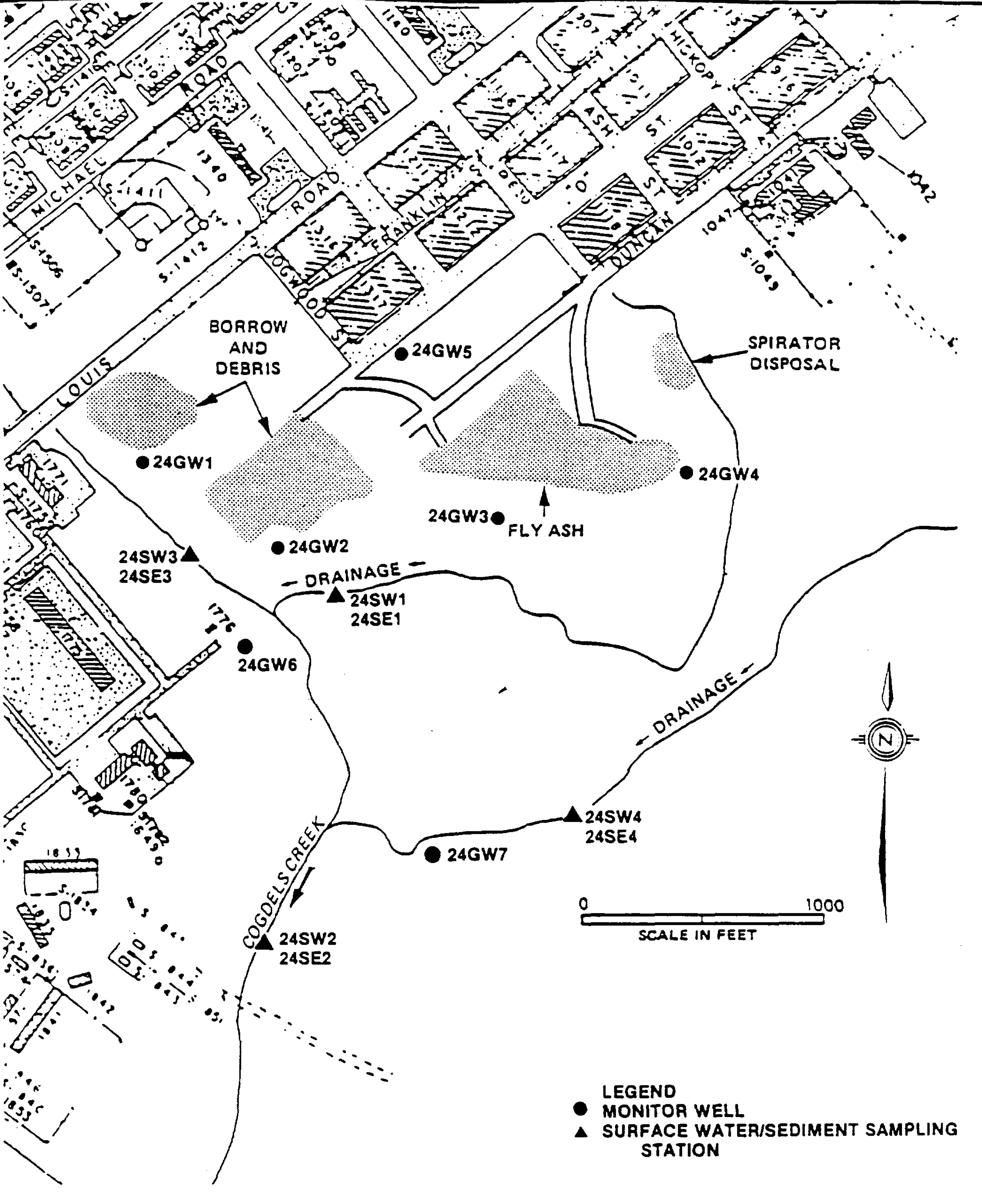
A geologic cross-section (Figure 24-2) was drawn on a line oriented approximately east-west (Figure 24-3) and shows the site to be underlain by layers of sand and silty sand, with limited amounts of sandy gravel. The surface of the shallow groundwater ranges in depth from 2 to 10 feet below land surface. The groundwater contour map (Figure 24-4) shows the groundwater flow to be generally toward the drainage ditches on the south and southwest sides of the filled area at a gradient of approximately 0.009 ft/ft.

3.7.2 SITE INVESTIGATION

GROUNDWATER

Five shallow monitoring wells were installed and sampled in July 1984 to determine the presence or absence of contaminants in the groundwater beneath this site. Two of the wells were installed on the downgradient side of the borrow and debris disposal area, two wells on the downgradient side of the fly ash area, and one well upgradient of the AOC (Figure 24-1). The five groundwater samples were analyzed for Metals A and VOCs. Appendix A presents a full listing of all target analytes and their abbreviations.

Table 24-1 presents the analytical data for the groundwater samples collected and analyzed during the July 1984 round of sampling. The results indicate that chromium, copper, and zinc were found in both samples collected downgradient of the borrow and debris disposal areas. The sample from well 24GW2 also contained arsenic. Each well sample also contained one VOC. The



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 24-1
SAMPLING LOCATIONS, SITE 24—INDUSTRIAL AREA FLY ASH DUMP

MARINE CORPS BASE
CAMP LEJEUNE

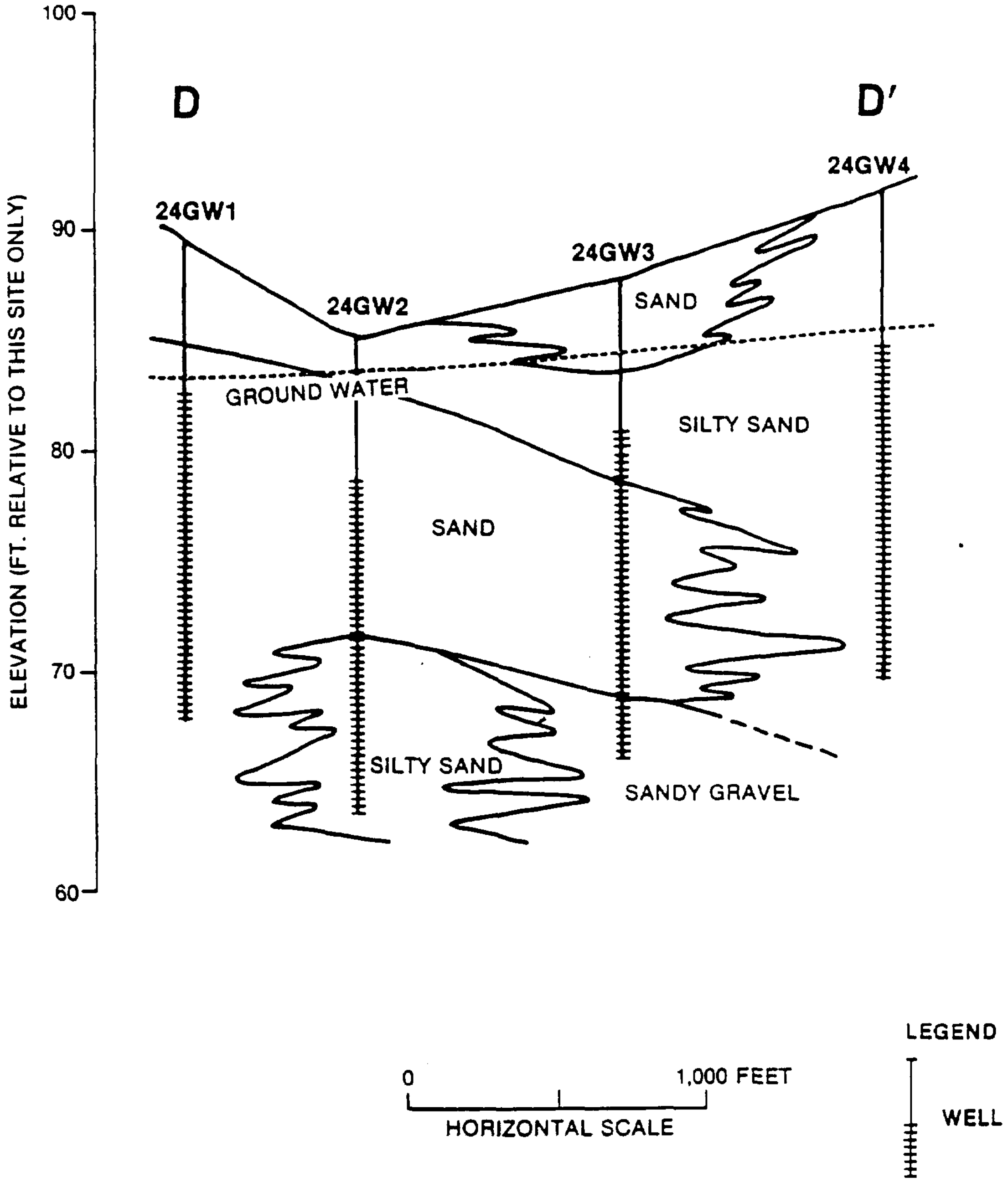
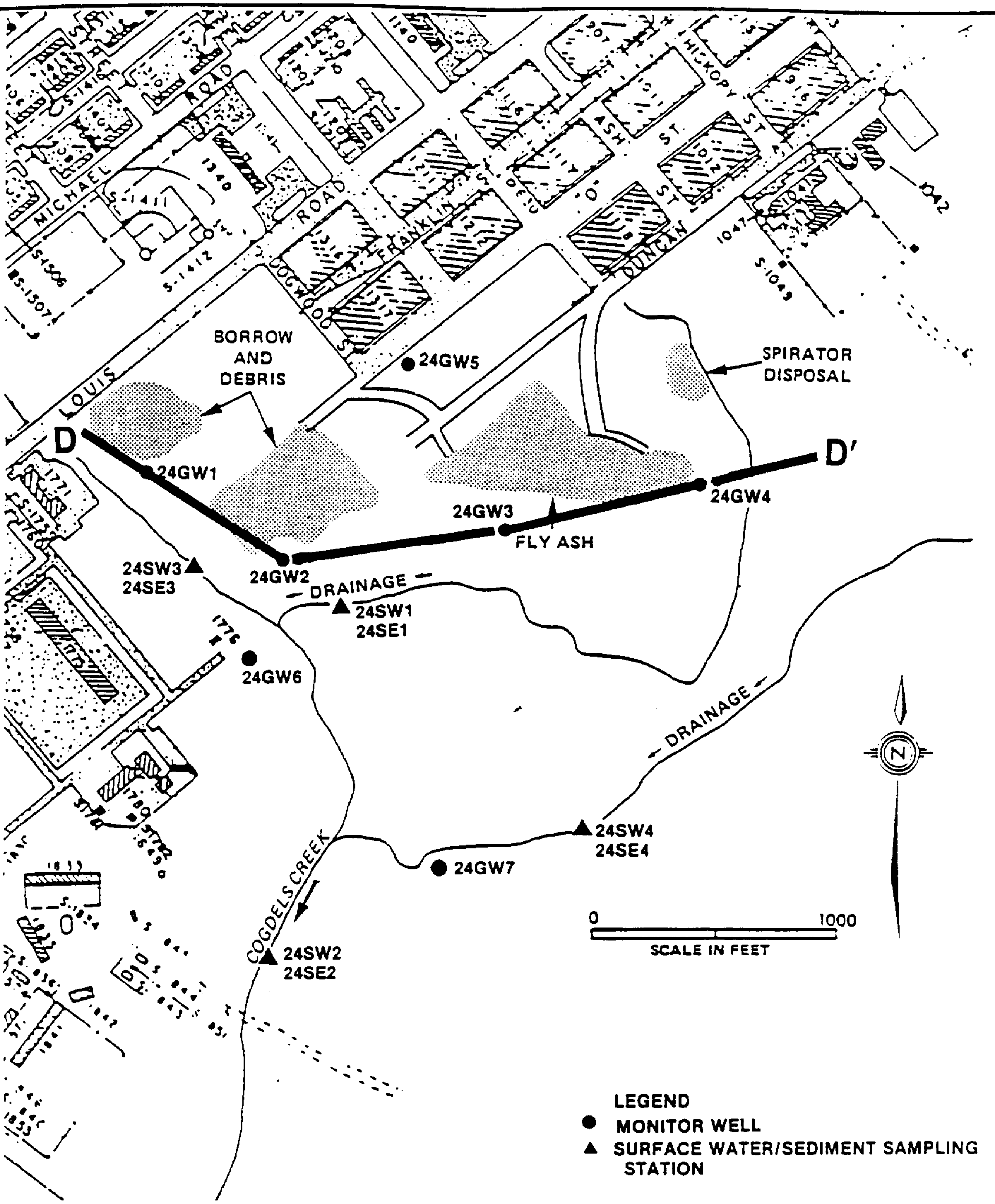


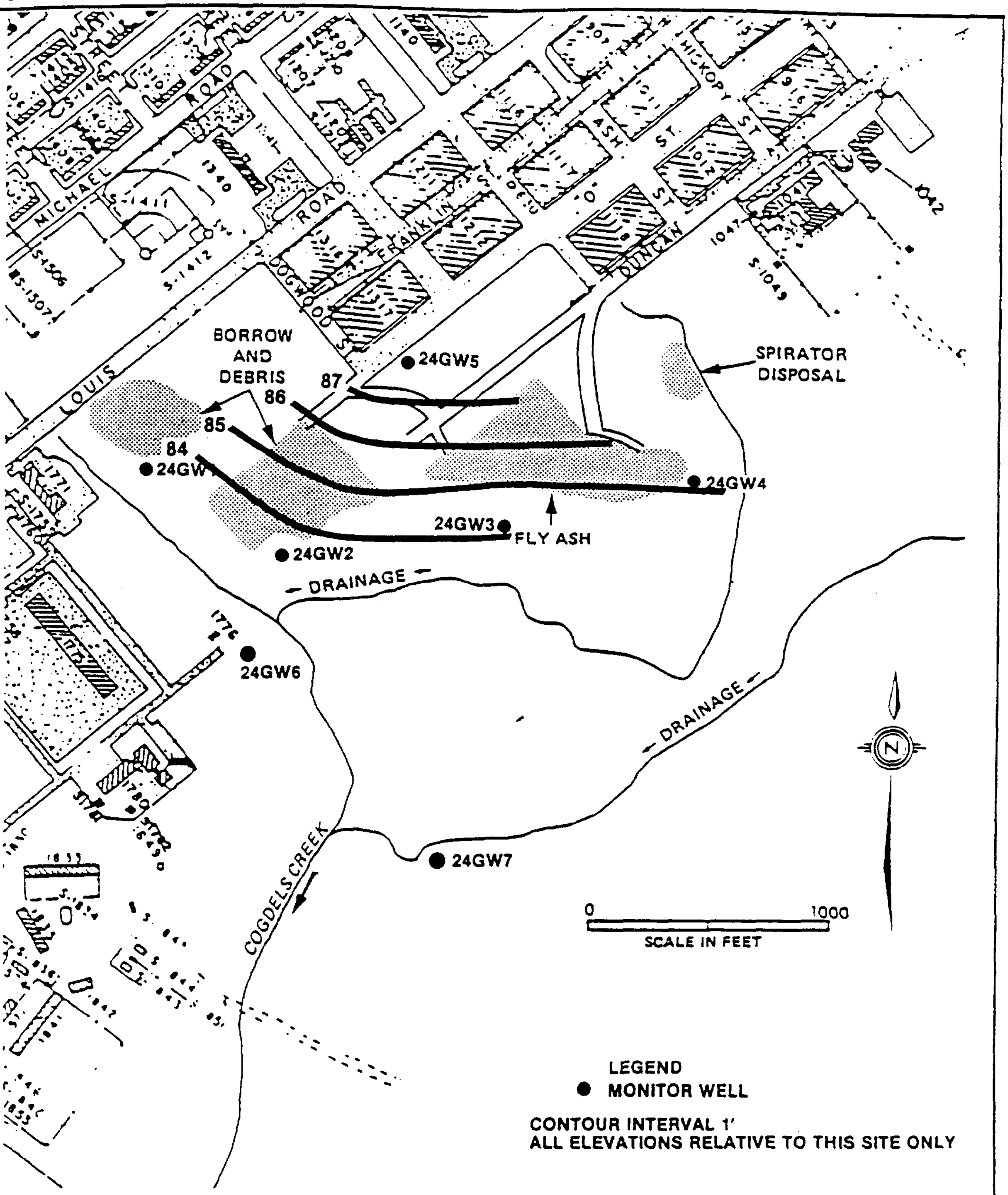
Figure 24-2
GEOLOGIC CROSS SECTION, SITE 24—
INDUSTRIAL AREA FLY ASH DUMP

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 24-3 GEOLOGIC CROSS SECTION LOCATION, SITE 24—INDUSTRIAL AREA FLY ASH DUMP	MARINE CORPS BASE CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 24-4
GROUND WATER CONTOUR MAP— SHALLOW AQUIFER, SITE 24— INDUSTRIAL AREA FLY ASH DUMP

MARINE CORPS BASE CAMP LEJEUNE

TABLE 24-1. SITE 24 - INDUSTRIAL AREA FLY ASH DUMP
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	NC GW STANDARDS	24GW1 7/7/84	24GW1 12/3/86	24GW2 7/7/84	24GW2 12/3/86	24GW3 7/7/84	24GW3 12/3/86	24GW4 7/7/84	24GW4 12/3/86	24GW5 7/7/84	24GW5 12/3/86	24GW6 12/4/86	24GW6 3/4/87	24GW7 12/4/86	24GW7 3/4/87
PARAMETER															
BENZENE	1	<0.4	<1	<0.4	<1	<0.4	<1	<0.6	<1	3	<1	<1	<1	<1	<1
CHLOROFORM	0.19	1	<1.6	<0.8	<1.6	<0.7	<1.6	<1.2	<1.6	<0.7	<1.6	<1.6	<1.6	<1.6	<1.6
METHYLENE CHLORIDE	5	<1	<2.8	2	<2.8	<1	<2.8	<2	<2.8	<1	<2.8	<2.8	<2.8	<2.8	<2.8
ARSENIC	50	<1	<3.1	3	<3.1	7.1	9.3	16	47.3	5.6	9.3	<2.1	5.3	INTF	7.5
CHROMIUM	50	6.6	<9.4	24	<9.4	130	98	<6	37	<6	<9.4	<9.4	14	62	52
CHROMIUM(+6)	NONE	NA	<10	NA	<10	NA	<10	NA	<10	NA	14.2	<10	<10	<10	<10
COPPER	1000	4	<2.8	8.6	<2.8	17.4	16	3	7	3	<2.8	<2.8	<2.1	<2.8	3
LEAD	50	<40	<27	<40	<27	58	<27	<40	<27	<40	<27	<27	<27	<27	<27
NICKEL	150	<15	<22	<15	<22	61	66	<15	<22	<15	<22	<22	<12	<22	<12
SELENIUM	10	<1	<3.1	<1	<3.1	7.6	5.2	2.2	<3.1	<1	<3.1	<3.1	<1	<1.6	<1
ZINC	5000	26	<5.9	87	<5.9	341	502	<3	8	<3	<5.9	20	62	80	69

NA: not analyzed.
INTF: interference

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

sample from Well 24GW3 located on the southwestern edge of the fly ash disposal area contained seven metals. The sample from Well 24GW4, which is near the southeastern boundary of the same disposal area, contained only three metals. Well 24GW5, the well designed to be upgradient contained arsenic and copper as well as benzene. The spatial variability of the groundwater quality data suggest that different portions of the filled areas contain different contaminants at different contaminant strengths. For example, areas adjacent to the fly ash disposal area appear to contain elevated levels of metals. Other areas contain only low levels of VOCs. The detected contaminant strengths may be less than those within the filled areas as all monitor wells installed to date are located along the perimeter of the site. The chemical data suggest that, at a minimum, low level contamination of the filled area is present.

In 1986 two additional shallow monitoring wells were installed downgradient of the filled areas. Figure 24-1 illustrates the locations of these newer wells. All of the existing and newly installed monitoring wells were resampled in December 1986 and analyzed for: Metals A, VOCs and hexavalent chromium. The results are presented in Table 24-1. The two groundwater samples collected in December 1986 from the wells downgradient of the borrow and debris areas (24GW1 and 24GW2) did not contain any target analytes above method detection limits. The results from the 1986 samples collected from Wells 24GW3 and 24GW4, downgradient of the fly ash disposal area, were for the most part consistent with the earlier sampling results. The upgradient well sample (24GW5) had fewer detected target compounds in the 1986 data and no detected VOCs. Analytical techniques were changed between the 1984 and 1986 sampling efforts. As a result, several method detection limits changed. With the exception of lead and hexavalent chromium, all detection limits increased. A reduction in the number of detected target analytes in 1986 and 1987 is partially attributable to the increases in the method detection limits as several of the detected levels in 1984 were less than the 1986 detection limits.

The two new monitoring wells, 24GW6 and 24GW7, were sampled twice, in December 1986 and in March 1987. The results indicate that the samples from the well southwest of the disposal areas (24GW6) contained only limited amounts of metals, none of which were above groundwater standards. Well 24GW7, south of the disposal areas, contained only three metals. However, chromium was detected slightly above the groundwater standard of 50 ug/l in both Well 24GW7 samples.

SURFACE WATER/SEDIMENT

Two surface water (SW) and sediment (SE) samples were collected downstream of the Site 24 disposal areas in 1984. Samples from station 24SW1/SE1 were collected from the drainage ditch immediately south of the filled areas. Samples from sampling stations 24SW2/SE2 were collected from Cogdels Creek, approximately 1000 ft downstream of Site 24 (refer to Figure 24-1). The surface water samples were analyzed for Metals A and VOCs, and the sediment samples for Metals A only. Appendix A present a full listing of all target analytes and their abbreviations. Tables 24-2 and 24-3 present the analytical data for the surface water and sediment samples, respectively.

The surface water sample (24SW1) collected from the downgradient edge of the disposal locations contained two VOCs, copper and zinc. The concentrations for the metals were below North Carolina's standards for freshwater. The water sample collected in August 1984 from the downstream location (24SW2) contained the same two metals also at levels below established standards.

In December 1986, these two sampling stations were resampled and two additional stations were established. The samples were analyzed for Metals A, VOCs, and hexavalent chromium. The results are presented in Table 24-2. The samples collected in 1986 from stations 24SW1 and 24SW2 contained the same metals at concentrations similar to these in the 1984 data. The two VOCs that were identified at station 24SW1 during the 1984 sampling effort were not found above method detection limits in 1986. The surface water sample collected from station 24SW3, which is located to the southwest of the disposal areas, contained lead and zinc. The concentration identified for

TABLE 24-2. SITE 24 - INDUSTRIAL AREA FLY ASH DUMP
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

	NC SW	24SW1	24SW1	24SW1	24SW2	24SW2	24SW3	24SW4
DATE	STANDARDS	8/4/84	8/4/84	12/3/86	8/4/84	12/3/86	12/3/86	12/3/86
PARAMETER								
T-1,2-DICHLOROETHENE	NONE	2.7	NA	<1.6	<0.6	<1.6	<1.6	<1.6
TRICHLOROETHENE	NONE	7.1	NA	<1	<0.8	<1	<1	<1
ARSENIC	50	<30	<30	<2.1	<30	<3.1	<3.1	4
CHROMIUM	50	<3	<3	<9.4	<3	9.7	<9.4	<9.4
CHROMIUM(+6)	NONE	NA	NA	<10	NA	20.6	<10	<10
COPPER	15	4.7	5.4	4.5	2.8	<2.8	<2.8	<2.8
LEAD	25	<33	<33	<27	<33	<27	27.4	<27
ZINC	50	28	25	11.7	20	<5.9	14.8	6.8

NA: not analyzed

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 24-3. SITE 24 - INDUSTRIAL AREA FLY ASH DUMP
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	24SE1	24SE1	24SE2	24SE2	24SE3	24SE4
DATE	8/3/84	12/3/86	8/3/84	12/3/86	12/3/86	12/3/86
PARAMETER						
ARSENIC	<0.05	1.2	0.3	<0.798	0.968	5.15
CADMIUM	0.3	<0.804	1.9	<0.715	<0.761	2.16
CHROMIUM	1.6	5.68	29.3	3.87	3.36	33.8
LEAD	4	13.2	180	12.14	10.1	162
COPPER	1	4.19	7	2	2.94	21.6
NICKEL	0.3	<6.10	1	<5.43	<5.77	<12.9
ZINC	6	13.1	95	14.7	19.5	155

Values reported are concentrations in milligrams per kilogram (mg/kg); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

lead (27.4 ug/l) is slightly above North Carolina's freshwater standard (25 ug/l). The water sample collected from station 24SW4 contained concentrations of arsenic and zinc which were both below the freshwater standards established for these metals.

Sediment samples were collected from each of the four surface water sampling locations at the same sampling frequency. The analytical results, as presented in Table 24-3, indicate that as many as seven metals were detected in the samples. The lowest concentrations of metals were identified in the sample collected from the station immediately downgradient of the disposal areas (24SE1). The sample from location 24SE4, which is located on a tributary to Cogdels Creek, contained the highest concentrations of metals.

3.7.3 SUMMARY AND CONCLUSIONS

Although several metals were detected in the groundwater samples collected at this site, North Carolina groundwater standards were only exceeded in two samples. The concentrations for chromium (130 and 98 ug/l) and lead (58 ug/l) in the samples collected from Well 24GW3 downgradient of the fly ash disposal area are greater than North Carolina's standards for chromium (50 ug/l) and lead (50 ug/l). The samples collected from 24GW7, which is located south of the disposal areas, also slightly exceeded the groundwater standard for chromium.

The concentrations of benzene detected in the sample from Well 24GW5 and chloroform which was detected at Well 24GW1 were both above North Carolina's groundwater standards for those compounds.

Of the surface water samples collected during the two sampling efforts, only one sample (24SW3) contained a parameter (lead) above North Carolina's standards established for freshwater.

All of the sediment samples contained at least four metals, and the sample collected at station 24SE2 contained seven.

3.7.4 RECOMMENDATIONS

The existing monitor wells at Site 24 are located along the margins of the filled areas. No sampling of groundwater or soil has been conducted within the filled areas, and therefore, the strength of the contamination within Site 24 has not yet been determined. Additional monitor wells should be installed and a detailed soil sampling effort should be conducted at this AOC. When these efforts have been completed, a Risk Assessment should be initiated. The Risk Assessment will determine the need for an FS.

3.8 SITE 28 - HADNOT POINT BURN DUMP

3.8.1 SITE BACKGROUND

The Hadnot Point Burn Dump (Figure 28-1) is located east of the Mainside Sewage Treatment Plant (STP) and is on both sides of Cogdels Creek (PWDM Coordinates 10,Q13-14/R13-14). A variety of solid wastes including mixed industrial waste, trash, garbage, oil-based paint, and refuse was burned and subsequently covered with dirt on this 23 acre disposal area which was in operation from 1946 to 1971. Upon its closure in 1971, the surface was graded and grass was planted. The volume of fill is estimated at 185,000 to 379,000 cubic yards. Since the waste was burned, no approximation of the remaining amount of specific substances can reasonably be made. The site is currently used as a recreational area including a stocked fishing pond.

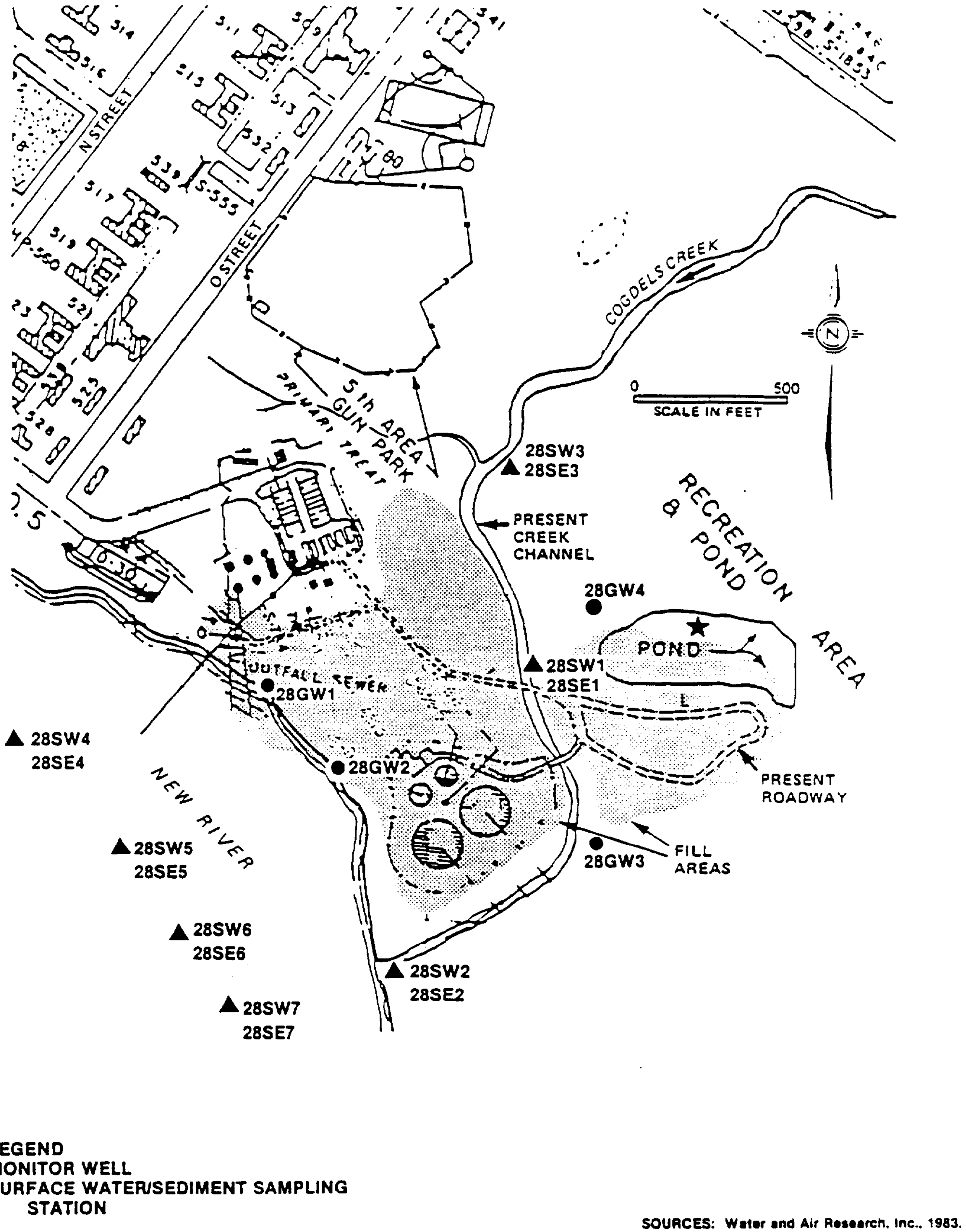
Site 28 is underlain primarily by silty sand, however sandy, gravelly fill material and debris from the former disposal activities were encountered during drilling activities. Figure 28-2 presents a geologic cross section of the area drawn on a northwest-southwest line (Figure 28-3).

The surface of the shallow groundwater at this site ranges in depth from 1.48 to 3.35 feet below land surface and lies within the silty sand and the debris. The cross section and groundwater contour map (Figure 28-4) show the pond and Cogdels Creek to be potential sources of recharge at this site. Groundwater flow is to the west toward the New River at a gradient of approximately 0.002 ft/ft.

3.8.2 SITE INVESTIGATION

GROUNDWATER

Four shallow monitoring wells were installed (Figure 28-1) and sampled as part of the 1984 groundwater investigation. Three wells were installed in 1984; Well 28GW1 and Well 28GW2 on the downgradient side of the site at the shoreline of the New River, and Well 28GW3 on the downgradient side of the eastern portion of the site, east of Cogdels Creek. One monitoring well (28GW4) was installed in 1986 upgradient of the filled areas and the recreational pond. Table 28-1 presents the analytical data from the July



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 28-1
SAMPLING LOCATIONS, SITE 28—
HADNOT POINT BURN DUMP

MARINE CORPS BASE
CAMP LEJEUNE

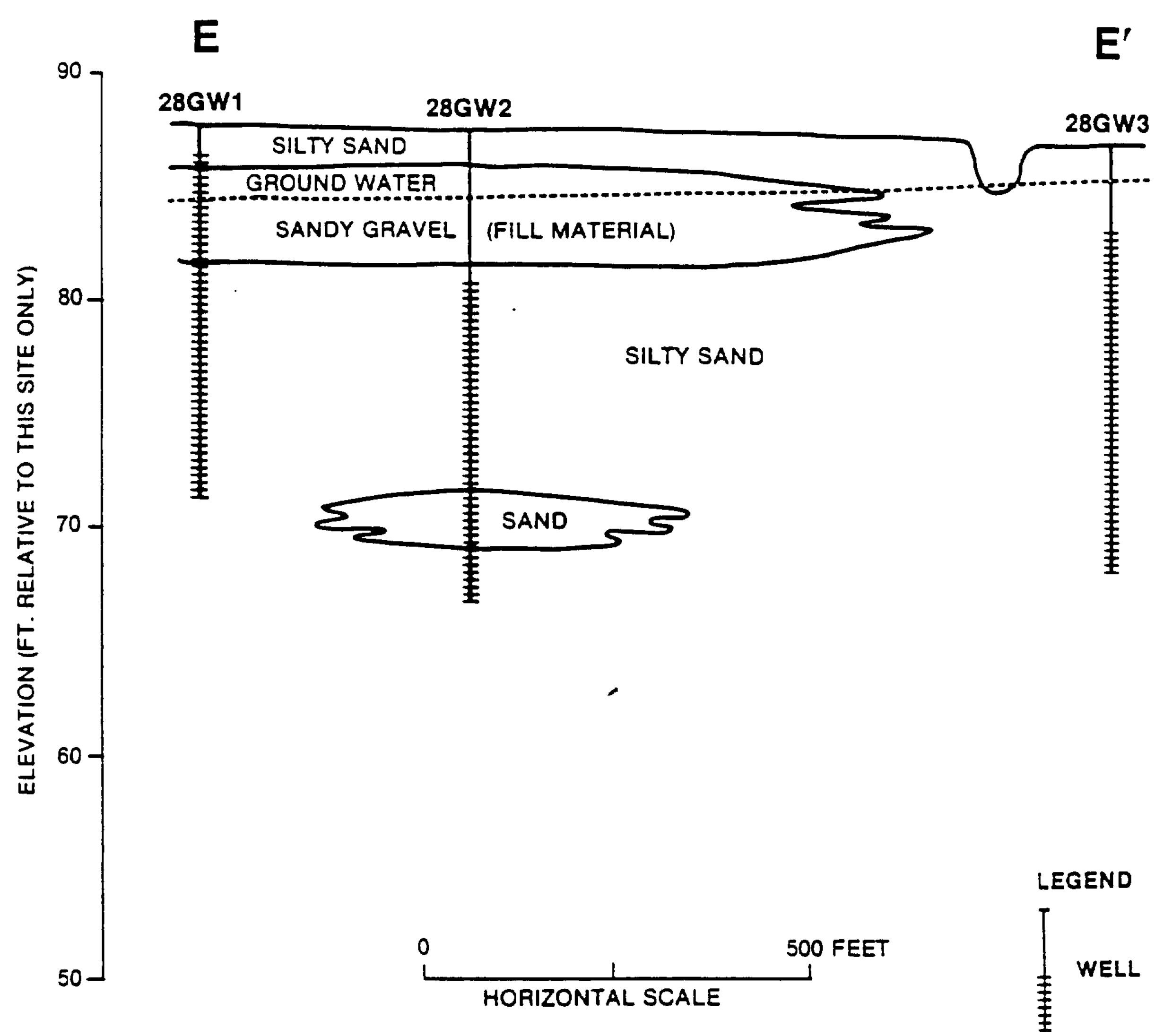
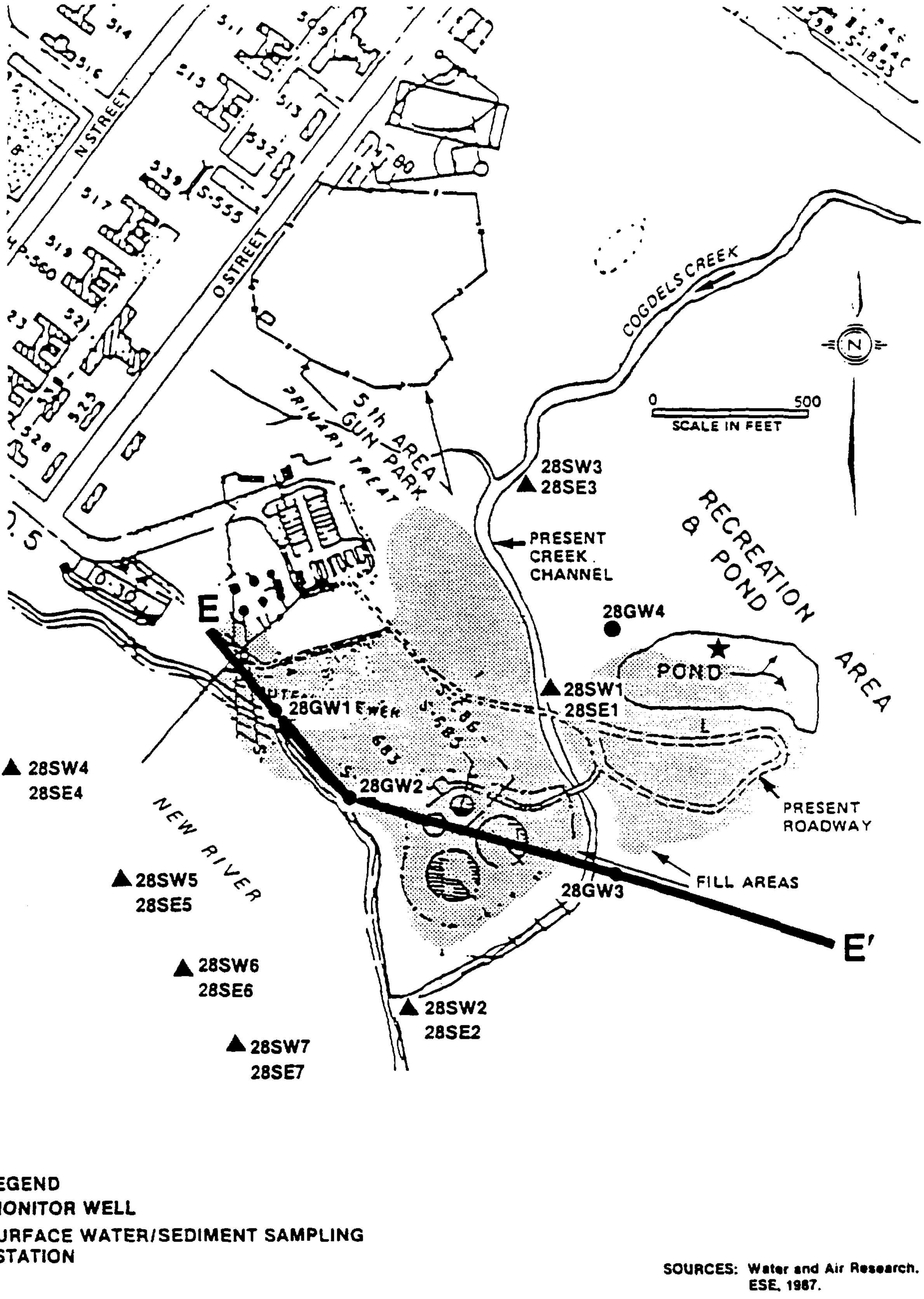


Figure 28-2
GEOLOGIC CROSS SECTION, SITE 28—
HADNOT POINT BURN DUMP

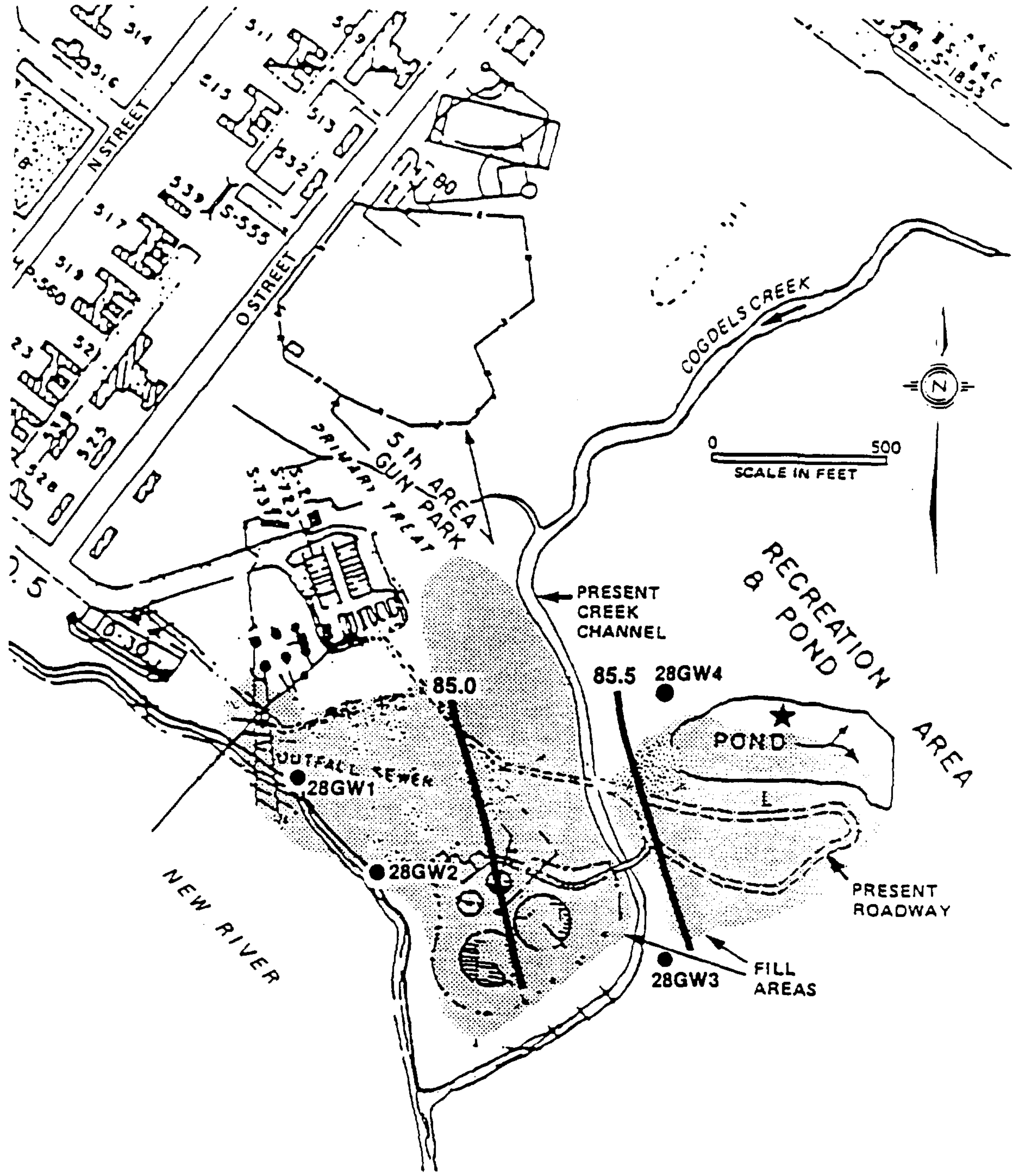
MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 28-3
GEOLOGIC CROSS SECTION LOCATION, SITE 28—HADNOT POINT BURN DUMP

MARINE CORPS BASE
CAMP LEJEUNE



LEGEND
● MONITOR WELL

CONTOUR INTERVAL 0.5'
ALL ELEVATIONS RELATIVE TO THIS SITE ONLY

SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 28-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 28—
HADNOT POINT BURN DUMP

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 28-1. SITE 28 - HADNOT POINT BURN DUMP
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	NC GW STANDARDS	28GW1 7/7/84	28GW1 12/16/86	28GW2 7/7/84	28GW2 12/16/86	28GW3 7/7/84	28GW3 12/11/86	28GW4 12/11/86	28GW4 3/4/87
PARAMETER									
T-1,2-DICHLORO									
ETHENE	70	38	14	<1.3	<1.6	<1.5	<1.6	<1.6	<1.6
TRICHLOROETHENE	NONE	15	4.9	<1.4	<1.0	<1.7	<3.0	<3.0	<3.0
VINYL CHLORIDE	0.015	22	13	<1	<1.0	<1	<1.0	<1.0	<1.0
DDD,PP'	NONE	0.12	<0.013	0.093	0.018	0.22	<0.013	<0.013	<0.006
DDE,PP'	NONE	0.015	<0.013	0.028	<0.013	0.007	<0.013	<0.013	<0.006
DIELDRIN	NONE	0.003	<0.013	<0.001	<0.013	<0.001	<0.013	<0.013	<0.006
OIL & GREASE	NONE	5	8	2	0.4	0.8	<0.3	<0.09	9
ARSENIC	50	18	9.5	<1	<2.1	21	INTF	INTF	12.1
CHROMIUM	50	<6	12	<6	<9.4	330	15.8	92.6	54
CHROMIUM(+6)	NONE	NA	<10	NA	<10	NA	<10	46.4	<10
LEAD	50	<40	140	<40	38	336	<27	<27	<27
MERCURY	1.1	0.3	0.2	<0.2	0.3	<0.2	0.8	0.7	0.5
NICKEL	150	<15	<22	<15	<22	39	<22	43.1	16
ZINC	5000	<3	58	<3	39	143	12.3	142	77

INTF: interference
NA: not analyzed

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

1984, December 1986 and March 1987 sampling efforts. Only those parameters that were detected above the method detection limits are reported in the table. The groundwater samples were analyzed for the following analytes:

- o Metals B
- o Hexavalent chromium (Cr^{+6})
- o Organochlorine pesticides (OCP)
- o Polychlorinated Biphenyls (PCB)
- o Oil and Grease (O&G)
- o Volatile organic compounds (VOC)
- o Tetrachlorodioxin (TCDD) (1986/87 only)
- o Xylene (1986/87 only)
- o Methylethyl ketone (MEK) (1986/87 only)
- o Methyl isobutyl ketone (MIBK) (1986/87 only)

Appendix A presents a full listing of all target analytes and their abbreviations. In July 1984 detectable levels of DDD and DDE were identified in all three monitoring well samples. No pesticides were detected in the 1986 or 1987 samples.

Trace levels of VOCs were detected in the 1984 sample from Well 28GW1 located at the New River shore line downgradient of the filled area in the western portion of Site 28. Vinyl chloride was also detected in this well at a level which exceeded the 10^{-5} risk level (2 ug/L for drinking water only). Three VOCs (trans-1,2-dichloroethene, vinyl chloride, and trichloroethene) were also detected in Well 28GW1 in December 1986. The levels of trans-1,2-dichloroethene detected in 1984 and 1986 were below the groundwater standard of 70 ug/L. The levels of trichloroethene are above the N.C. Groundwater Standard of 2.8 ug/L.

Metals were detected in the July 1984 samples from Wells 28GW1 and 28GW3. The highest concentration of metals found were in Well 28GW3; chromium and lead exceeded the applicable groundwater standards. Mercury was detected in Well 28GW1 at concentrations below the N.C. Groundwater Standard of 1.1 ug/L. A number of metals were detected in all four monitoring wells in the 1986 and

1987 samples, suggesting a relatively uniform disposal pattern throughout the site. Of the detected metals, total chromium was detected above the groundwater standard in Wells 28GW3 and 28GW4. Hexavalent chromium was detected in the 1986 sample from Well 28GW4, but not in the March 1987 sample. Arsenic was detected in Wells 28GW1, 28GW3, and 28GW4 in the July 1984, December 1986 and March 1987 samples where the analysis did not encounter matrix interference.

Low levels of O&G were detected in all three monitoring well samples collected in 1984, and in all four well samples collected in 1986 and 1987 except for Well 28GW3 in 1986.

The levels and mix of detected analytes in the two rounds of sampling are somewhat different. Of the greatest significance is the lack of pesticides detected in the 1986 and 1987 samples suggesting that the occurrence of these analytes in the groundwater is subject to time variance. The levels of VOCs detected in Well 28GW1 in 1986 are in similar proportion to those detected in 1984, but are slightly reduced. The levels of metals detected in all 1986/87 samples are generally similar to the 1984 samples, although there appears to be a general lowering of metal concentrations in the 1986/87 samples overall.

SURFACE WATER

Seven surface water sampling stations (Figure 28-1) were sampled as part of the investigation. Two of the seven sampling locations were sampled in August 1984; 28SW1 in the north central portion of the filled area where Cogdels Creek passes through the landfill and 28SW2 in Cogdels Creek downstream of the filled area near the intersection with the New River. During the December 1986 investigation, five new sampling locations were added, four in the New River and one in Cogdels Creek upstream of the filled area. The surface water samples were analyzed for the same parameters as the groundwater samples. Table 28-2 presents the analytical data for all analytes that were detected over the method detection limit.

TABLE 28-2. SITE 28 - HADNOT POINT BURN DUMP

DETECTED TARGET ANALYTES

SURFACE WATER SAMPLES

	NC SW	28SW1	28SW1	28SW1	28SW2	28SW2	28SW2	28SW3	28SW4	28SW5	28SW6	28SW7
DATE	STANDARDS	8/3/84	8/4/86	12/11/86	8/3/84	8/4/86	12/11/86	12/11/86	12/15/86	12/15/86	12/15/86	12/15/86
PARAMETER												
BHC,A	NONE	0.01	<0.001	<0.035	<0.001	<0.001	<0.035	<0.035	<0.013	<0.025	<0.013	<0.013
BHC,B	NONE	0.0009	<0.0001	<0.013	0.002	<0.0001	<0.013	<0.013	<0.013	<0.025	<0.013	<0.013
BHC,D	NONE	0.004	<0.0003	NR	<0.0003	<0.0003	NR	NR	<0.013	<0.025	<0.013	<0.013
CADMIUM	2	<4	NA	<2.9	<4	8.4	<2.9	<2.9	<2.9	<2.9	<2.9	<2.9
CHROMIUM	50	<3	NA	<9.4	<3	<5	<9.4	<9.4	17.8	<9.4	10.7	<9.4
MERCURY	0.2	<0.2	NA	0.8	<0.2	<0.2	0.5	0.6	<0.2	<0.2	<0.2	<0.2
ZINC	50	32	NA	<5.9	20	29	<5.9	<5.9	8.9	<5.9	<5.9	<5.9
TRICHLOROETHENE	NONE	1.3	NA	<3	1.1	NA	<3	<3	<3	<3	<3	<3

NA: not analyzed.

NR: not reported.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

The water chemistry data for the surface water differed significantly from the groundwater data indicating that the analytes detected in the surface water may be attributed to activities upstream of the site or of a unique disposal at the far northern portion of the site. BHC,A, BHC,B and BHC,D were present in the December 1984 samples from 28SW1 and 28SW2 but were not identified in the groundwater during that same time. These pesticides were not detected in any of the December 1986 samples. However method detection limits in 1986 increased and the absence of detectable levels of the BHC isomers in 1986 may be attributable to this factor.

Trichloroethene was detected in both of the Cogdels Creek surface water samples in 1984 but were not detected in any of the 1986 samples. This VOC was also detected in the samples collected from Well 28GW1 in both 1984 and 1986.

Zinc was detected in surface water samples collected in 1984 from 28SW1 and 28SW2. It was not detected at 28SW1 or 28SW2 in the 1986 samples and was present in only 28SW4 in 1986. Mercury was not detected in 1984 samples but was present in the 1986 samples for all three locations in Cogdels Creek at levels greater than the water quality standard of 0.2 ug/L. Since mercury was present upstream of the site (28SW3), this may indicate that the source is upstream of the Hadnot Point Burn Dump. Chromium was not detected in Cogdels Creek but was present in two of the four samples taken from the New River. Cadmium was detected at sampling station 28SW2 in August 1986 but was not detected in December 1986.

SEDIMENT

Seven sediment locations corresponding to the surface water sampling locations were sampled as part of the investigation (Figure 28-1). The sediment samples were analyzed for the following parameters:

- o Metals B
- o Organochlorine pesticides (OCP)
- o Polychlorinated Biphenyls (PCB)

- Oil and Grease (O&G)
- Tetrachlorodioxin (TCDD) (1986 only)
- Hexavalent Chromium

Appendix A lists the individual target analytes and their abbreviations. Analytical results for the sediment samples are presented in Table 28-3. Only those parameters detected above method detection limits were reported. Chlordane was the only parameter detected in the sediment that was not detected in either the groundwater or the surface water. Chlordane was detected in all three samples from Cogdels Creek during the December 1986 sampling effort. In addition DDE was detected in 1984 and 1986 in both 28SE1 and 28SE2.

O&G levels were higher in 1986 than in 1984 within Cogdels Creek. Similar concentrations were identified in the New River samples.

Detectable levels of arsenic, cadmium, chromium, lead, nickel and zinc were identified in most of the samples in both Cogdels Creek and the New River. Nickel was the only metal of those listed above that was not present in all four of the New River samples.

TISSUE

Two samples from fish tissue were obtained from the fresh water pond at the north terminus of Site 28 in 1984 only. The tissue samples were analyzed for OCP and PCB. Listed below are the analytical results of the sampling effort performed on July 17, 1984:

	Concentration (ug/L)	
Parameter	28TI1	28TI2
PCBs, Total	11	8
BCH,A	0.10	0.1

PCBs were not detected elsewhere in the investigation. PCBs are bioaccumulated in the foodchain and may or may not have originated from the

TABLE 28-3. SITE 28 - HADNOT POINT BURN DUMP
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	28SE1	28SE1	28SE2	28SE2	28SE3	28SE4	28SE5	28SE6	28SE7
DATE	8/3/84	12/11/86	8/3/84	12/11/86	12/11/86	12/15/86	12/15/86	12/15/86	12/15/86
PARAMETER									
CHLORDANE	<0.0023	0.298	<0.0041	0.347	0.595	<0.0639	<0.0645	<0.0661	<0.0645
DDD,PP'	0.084	<0.0159	0.0022	<0.0351	<0.0459	<0.0128	<0.0129	<0.0132	<0.0129
DDE,PP'	0.0012	0.243	0.0005	0.0619	<0.0597	<0.155	<0.156	<0.160	<0.156
OIL & GREASE	474	1520	1440	2750	4630	238	177	<176	144
ARSENIC	1.50	6.86	<0.1	10.3	10.4	<0.561	<0.757	1.32	0.645
CADMIUM	0.100	3.15	<0.1	<1.94	4.47	<0.617	<0.459	<0.473	<0.452
CHROMIUM	10	22.5	0.4	18.2	27.4	2.38	3.53	2.69	2.77
LEAD	46	190	2	42.1	135	<5.75	<4.27	4.52	4.75
NICKEL	2	13.4	0.8	<14.7	<20.1	<4.68	<3.48	<3.590	<3.430
ZINC	16	675	1	79.1	167	4.38	3.73	6.06	4.98

Values reported are concentrations in milligrams per kilogram (mg/kg); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

site depending on the origin of the fish in the pond. The BHC,A data for tissue indicate that this compound was present in this area of Site 28 and may be discharging to Cogdels Creek, as indicated by the surface water chemical data. Levels of PCB and BHC,A were below acute toxicity levels.

3.8.3 SUMMARY AND CONCLUSIONS

The groundwater contour map (Figure 28-4) strongly indicates that groundwater from the shallow aquifer directly discharges to the New River and discharges indirectly through Cogdels Creek. Target analytes in the shallow groundwater have been detected in excess of applicable groundwater standards. Table 28-1 includes a comparison of target analytes found in the shallow groundwater to applicable State of North Carolina groundwater standards contained in Title 15 of the North Carolina Administrative Code. This indicates that contaminants from Site 28, are discharging to the New River.

The surface waters and sediments of Cogdels Creek were also found to contain contaminants at concentrations greater than applicable freshwater standards. By the continuous discharge of surface waters into the New River and through the episodic sediment scour of the creek bottom during high flow conditions, contaminated waters and sediments are migrating to the New River from Site 28.

Metals appear to be the most prevalent contaminant group encountered since they were detected during both rounds of sampling in the groundwater, surface water and sediment samples. All detected metals appear to have their source within the site except for possibly mercury. Groundwater concentrations of the metals appear to be generally lower as time progressed from one round of sampling to the next. Concentrations in sediment samples from Cogdels Creek, however, seemed to have increased with time. Cadmium concentrations in the surface water (28SW2) exceed the state water quality standards for freshwater classes (2.0 ug/L). Mercury levels in the surface water (28SW1, 28SW2, and 28SW3) exceed the standard of 0.20 ug/L.

An upstream sampling station (28SW3 and 28SE3) was sampled in December 1986. Mercury was detected in the surface water at this location and also in Wells 28GW1, 28GW3, and 28GW4. This may indicate that mercury contamination is not only present at the site but is also migrating from an upstream location. Chlordane was detected in only sediment samples from Cogdels Creek during 1986. This may also be migrating from an upstream location since it was only detected in the sediments of Cogdels Creek with the highest concentrations upstream of the site.

Pesticides (BHC,A, BHC,B, BHC,D) were detected in the surface water in Cogdels Creek in 1984 but were not detected in the groundwater at that time. This suggests that these analytes may have originated from activities upstream of the site or from a unique disposal operation at the far northern portion of the site. These pesticides were not detected in the December 1986 sampling effort.

O&G appear to be a consistent contaminant throughout the site. It was detected in both rounds of sampling in the groundwater and sediment samples.

VOCs were detected in 28GW1 in both rounds of sampling but were not detected elsewhere in the site. This may suggest that the disposal of volatiles was limited to the area around 28GW1.

Tissue samples were taken from fish from the recreational pond and concentrations of BHC,A, and PCBs were detected. This suggests that pesticides may be present in the northern reaches of the site, or migrated from upgradient of the site. No conclusion can be drawn from the PCB levels found in the tissue. PCBs were not detected in any other samples taken from Site 28.

3.8.4 RECOMMENDATIONS

The surface water and sediment of the recreational pond have not been sampled to date. It is recommended that analysis for the same parameters as the other surface water and sediment samples be performed. This will provide more data for the origin of PCB in the tissue samples. It will also provide data on the other analytes that are not bioaccumulated and may be originating from the far northern portion of the site, such as BHC,A, BHC,B, and BHC,D.

Chlordane and mercury were detected at the upstream sampling location within Cogdels Creek. These parameters were not detected at Site 24, the nearest site upstream of the Hadnot Point Burn Dump. Additional sampling of surface water and sediments should be performed within Cogdels Creek between Sites 28 and 24. These results will provide data which can be used to determine the source of these contaminants. Metals were also detected in the upstream samples from Cogdels Creek, and in the groundwater and other surface water and sediment samples of Site 28. It is apparent that metals are a concern at this AOC. Metal analyses should be added to any upstream samples to better evaluate migration from an upstream source.

A grid of soil sampling stations should be installed throughout the filled area of Site 28 to determine the volume of contaminated soil, and to determine the strength of the contamination in the soil matrix. Additional monitor wells should be installed in the shallow aquifer to determine if contaminant strength is greater than that identified in the existing monitor wells. Installation of deep monitor wells is also warranted to determine is the water supply aquifer is impacted by the shallow contamination detected to date.

When characterization of the contamination has been completed, a Risk Assessment should be conducted to determine remedial goals to be utilized by the FS.

3.9 SITE 30 - SNEADS FERRY ROAD FUEL TANK SLUDGE AREA

3.9.1 SITE BACKGROUND

The Sneads Ferry Road Fuel Tank Sludge Area (Figure 30-1) located along a tank trail which intersects Sneads Ferry Road from the west, about 6,000 feet south of the intersection with Marines Road (PWDM Coordinates 18,GW12). The site is located approximately 1500 feet east of French Creek. In 1970, sludge from fuel storage tanks storing leaded gasoline containing tetraethyl lead and related compounds, and tank washout waters were disposed of at the site by a private contractor. It is estimated that at a minimum, 600 gallons of sludge or tank bottom deposits were dumped at the site. Two 12,000-gallon tanks were pumped out while the type of fuel stored was changed. The 600 gallon estimate is based on tank capacity below the tank outflow ports. Additional washout water may also have been present. Additional information suggests that the site had also been used for similar wastes from other tanks. Composition of the sludge and/or washout is unknown and may vary from containing substantial amounts of tetraethyl lead to containing mostly cleaning compounds.

Site 30 is underlain by layers of sand, silty sand, and gravelly sand. Figure 30-2 presents the geologic cross section of the area drawn on a east-west line (Figure 30-3). The surface of the shallow groundwater at this site lies within the upper layer of silty sand at depths ranging from 4.32 to 8.06 feet below land surface. The groundwater contour map (Figure 30-4) indicates that groundwater flow is to the northwest towards the unnamed tributary of French Creek at a gradient of approximately 0.004 ft/ft.

3.9.2 SITE INVESTIGATION

GROUNDWATER

Two shallow groundwater monitoring wells were installed as part of the 1984 and 1986 site investigations. Well 30GW1 was installed in 1984 and Well 30GW2 was installed in 1986 topographically downhill from the suspected disposal site. Figure 30-1 illustrates the locations of these wells. The wells were sampled and analyzed for the following target compounds:

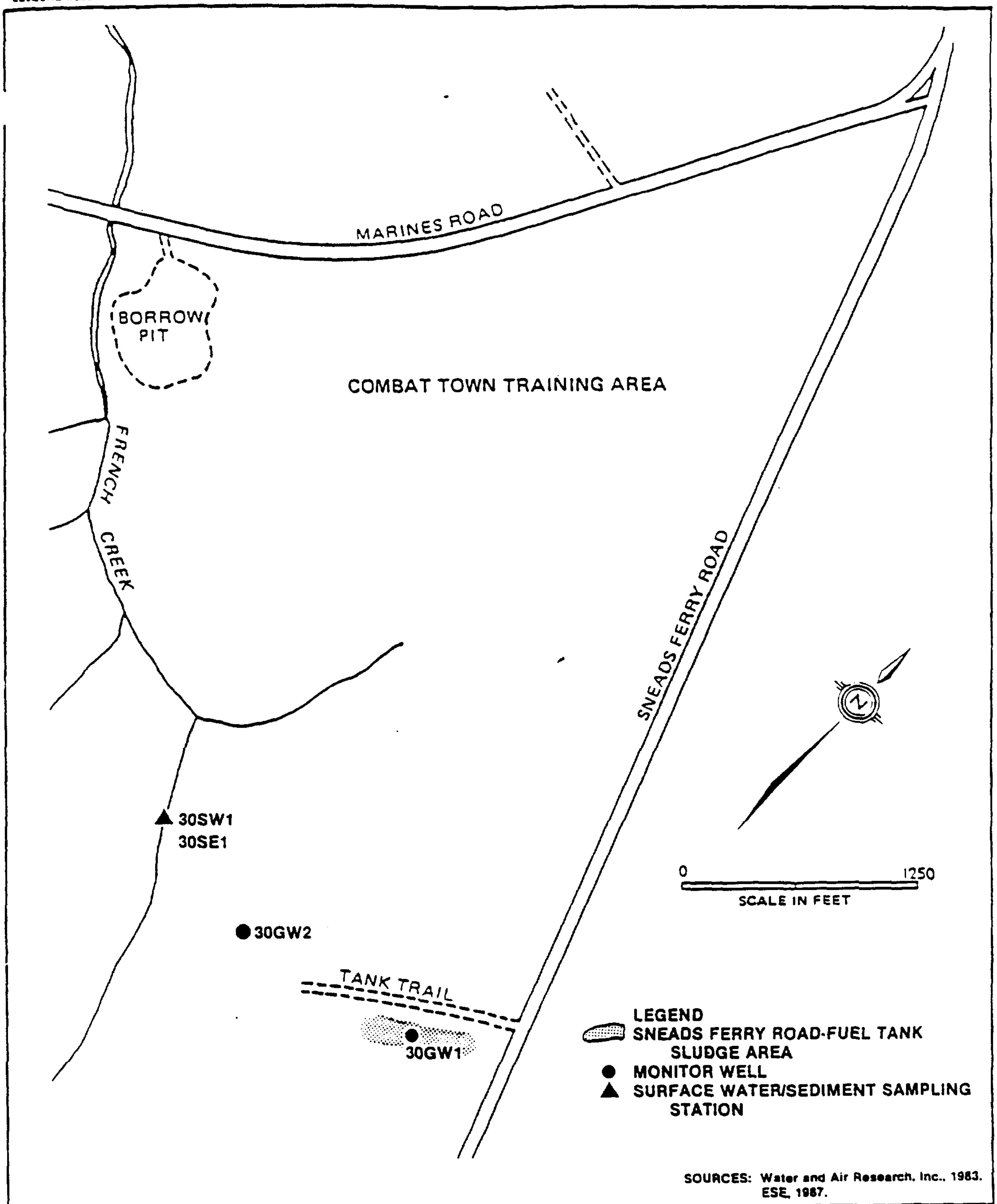


Figure 30-1
ROUND TWO SAMPLING LOCATIONS, SITE 30—COMBAT TOWN TRAINING AREA

MARINE CORPS BASE
CAMP LEJEUNE

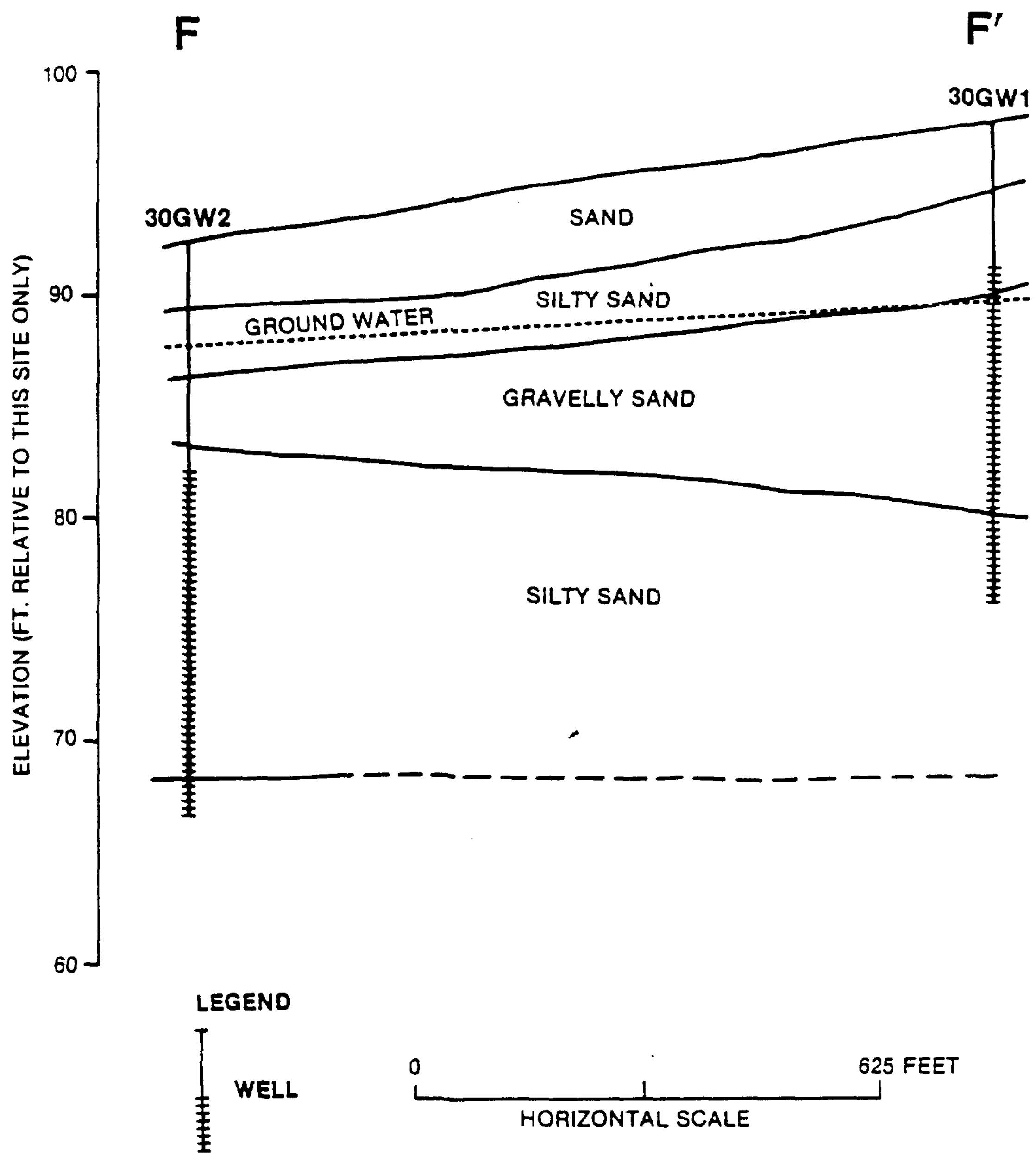


Figure 30-2
GEOLOGIC CROSS SECTION, SITE 30—
COMBAT TOWN TRAINING AREA

MARINE CORPS BASE
CAMP LEJEUNE

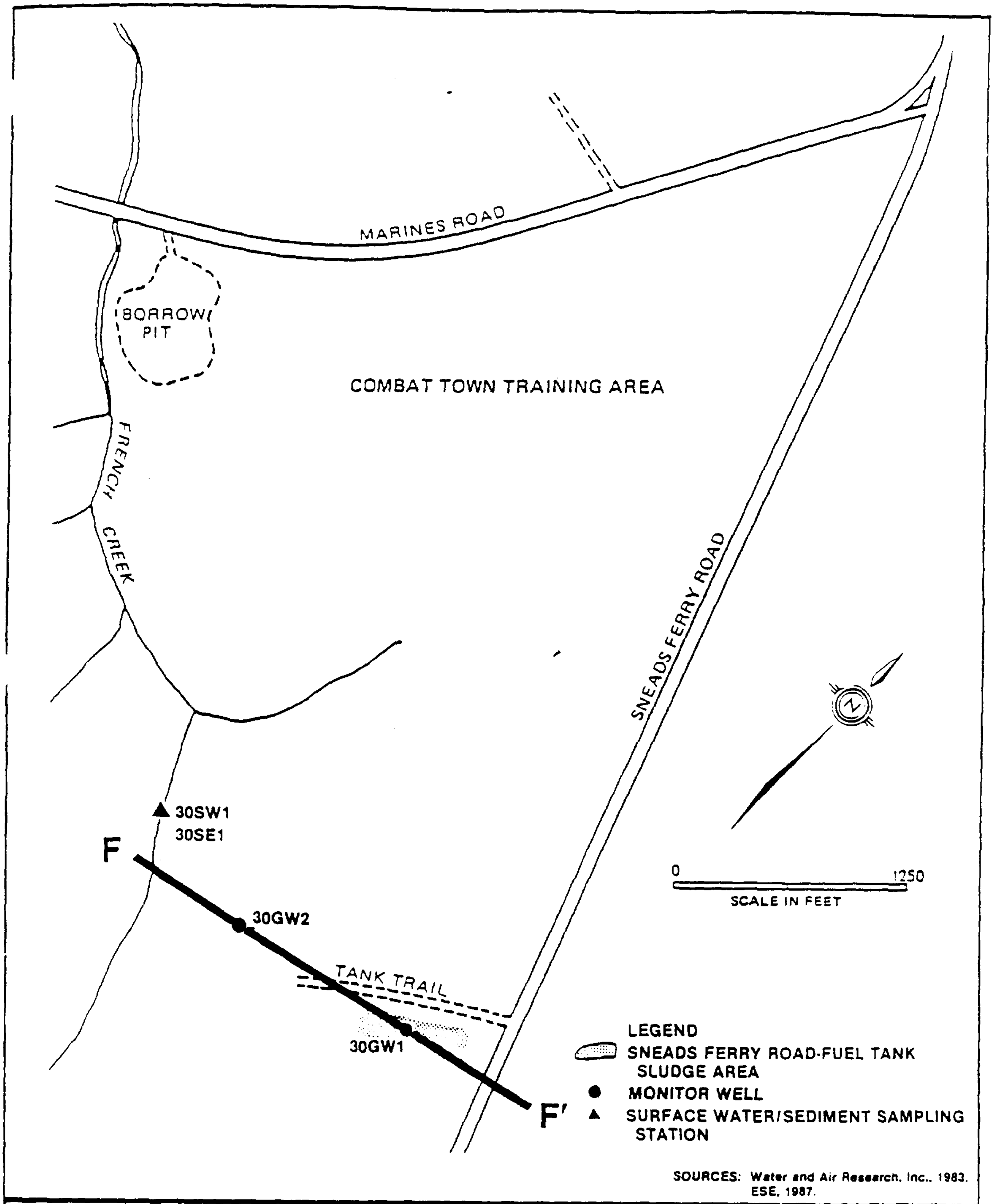


Figure 30-3
GEOLOGIC CROSS SECTION LOCATION, SITE 30—COMBAT TOWN TRAINING AREA

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

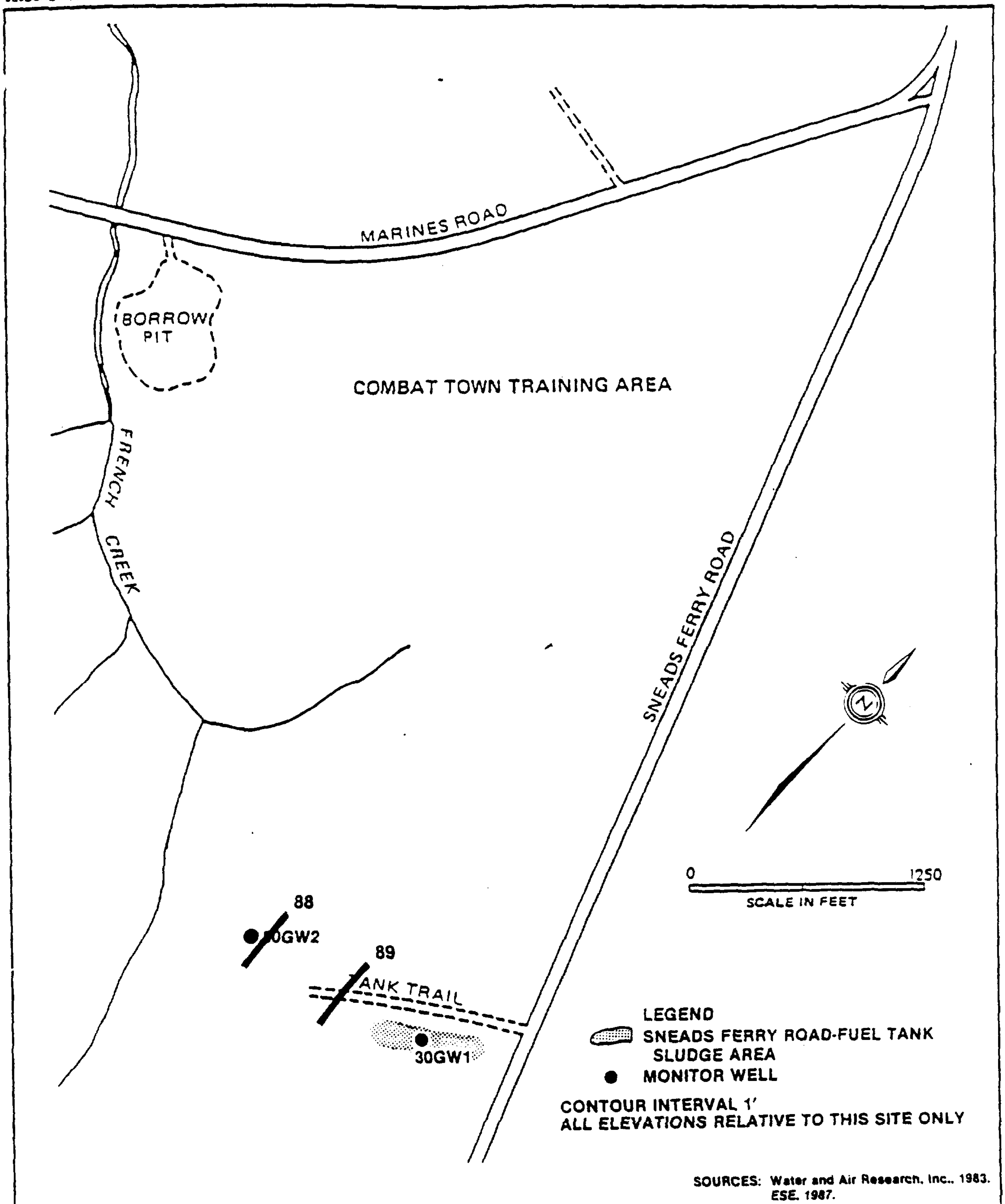


Figure 30-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 30—
COMBAT TOWN TRAINING AREA

MARINE CORPS BASE
CAMP LEJEUNE

- o Lead
- o Volatile Organics (VOA)
- o Oil and Grease (O&G)
- o Xylene (1986/87 only)
- o Methylethyl ketone (MEK) (1986/87 only)
- o Ethylene dibromide (EDB) (1986/87 only)
- o Methyl isobutyl ketone (MIBK) (1986/87 only)

Appendix A contains a full list of all target analytes and their abbreviations. Table 30-1 presents the analytical data for those analytes that had concentrations above the applicable method detection limits. Trace levels of chloroform were detected in Well 30GW1 and methylene chloride was detected in Well 30GW2 in 1986. Since neither analyte was detected in the 1984 sampling it is possible that these levels were laboratory artifacts and do not represent environmental contamination. This does not eliminate the potential presence of VOCs in the groundwater. However, if VOCs are present, it is estimated that the concentrations áre very low.

Lead was detected in Well 30GW1 in 1984 and Well 30GW2 in 1986. O&G was detected in both monitoring wells in 1986/87 but was not detected in 30GW1 in 1984. This may be attributed to a lowering of detection limits in the 1986/87 analyses. The presence of O&G in the groundwater may suggest low levels of contamination resulting from the alleged disposal of gasoline and washwaters at this AOC. However, O&G appears to be ubiquitous at Camp LeJeune so a determination that Site 30 is a point source for O&G can not be definitely determined based on existing data.

SURFACE WATER

A single surface water sample was taken in December 1986 from the unnamed tributary to French Creek (Figure 30-1). The sample was analyzed for the same parameters as the groundwater samples from this site. No detectable levels of any target compounds were identified in the sample.

TABLE 30-1. SITE 30 - SNEADS FERRY ROAD FUEL TANK SLUDGE AREA
(COMBAT TOWN TRAINING AREA)
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	NC GW	30GW1	30GW1	30GW2	30GW2
DATE	STANDARDS	7/6/84	12/4/86	12/4/86	3/6/87
PARAMETER					
LEAD	50	58	<27	30	<27
OIL & GREASE	NONE	<700	600	100	9000
CHLOROFORM	0.19	<1.2	2.6	<1.6	<1.6
METHYLENE CHLORIDE	5	<1	<2.8	3.3	<2.8

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

SEDIMENT

A single sediment sample was taken from the unnamed tributary to French Creek in 1986 (Figure 30-1). The sample was analyzed for lead, O&G, and ethylene dibromide. Only O&G was detected at a concentration of 373 ug/g.

3.9.3 SUMMARY AND CONCLUSIONS

Site 30 is located on the edge of a small stream valley and the groundwater contour map (Figure 30-4) indicates that flow in the shallow aquifer is to the southeast, toward the channel of the stream (unnamed tributary to French Creek). The geochemical data indicate that O&G is present in both the estimated central area of the site (30GW1) and downgradient (30GW2), and in the stream bed sediment. Because the Combat Town Training Area which borders the Sneads Ferry Road Fuel Tank Sludge Area, is subject to heavy vehicular traffic, it is not clear whether the presence of O&G in the environment is attributed to the disposal area or the result of emergency vehicle maintenance in the Combat Town Training Area.

The one-time presence of common laboratory VOCs in one set of groundwater samples does not support the conclusion that the disposal practices at Site 30 contributed VOCs to the site contamination. Lead was detected in Well 30GW1 in the estimated central area in 1984, and Well 30GW2 downgradient of the disposal area in 1986. This may be attributed to the disposal practices but sufficient data are not available to make this conclusion.

3.9.4 RECOMMENDATIONS

At this time, it is unclear if the location of the alleged spill/disposal at Site 30 has been accurately determined. There are no surface indicators of the specific disposal site. Unless additional information can be identified which will more accurately locate the disposal area, it is recommended that an additional set of samples be collected, and that a Risk Assessment be initiated to determine if the trace levels of contamination detected to date represent an unreasonable risk to health or the environment.

3.10 SITE 35 - CAMP GEIGER AREA FUEL FARM

3.10.1 SITE BACKGROUND

Camp Geiger Area Fuel Farm (Figure 35-1) is located north of the intersection of G and Fourth Streets, approximately 400 feet southwest of Brinson Creek (PWDM Coordinates 12, C11). This 2,500 square feet AOC was used in 1957 and 1958 for storing and pumping fuel. Mogas was released to the soil through a leak in an underground line near an above-ground storage tank and tank pad. The Camp Lejeune Fire Department has estimated the amount of fuel released to be in the thousands of gallons. Exact quantities released can not be determined since the records were destroyed. The spill migrated east and northeast towards and into Brinson Creek. Fuel at the surface of the shallow aquifer was disposed of by digging holes to the water table and igniting the fuel. Fuel which contaminated Brinson Creek was also ignited and burned.

Site 35 is underlain by layers of silty sand with interbedded layers of clayey sand, coarse sand, and sandy gravel. A geologic cross section of Site 35 is presented in Figure 35-2. The cross section is drawn on an east-west line (Figure 35-3). The surface of the shallow groundwater lies within the interbedded silty sand and clayey sand at depths ranging from 7.02 to 11.05 feet below land surface. The groundwater contour map presented in Figure 35-4 indicates that the shallow groundwater flows to the northeast toward Brinson Creek with a gradient of approximately 0.014 ft/ft.

3.10.2 SITE INVESTIGATION

GROUNDWATER

Three hand-augered borings to the groundwater surface were dug at the downgradient side of the facility in 1984 and three groundwater samples were collected (35GW1, 35GW2, and 35GW3). The samples were analyzed for lead, O&G, and VOCs. Appendix A lists the individual target analytes and their abbreviations. Table 35-1 presents the analytical results for those analytes that were above the appropriate method detection limits. Levels of lead (above N.C. Groundwater Standards) were identified in all three samples which indicates that the shallow groundwater was contaminated from the release of fuel into the soils. The VOC components of the fuel were not detected.

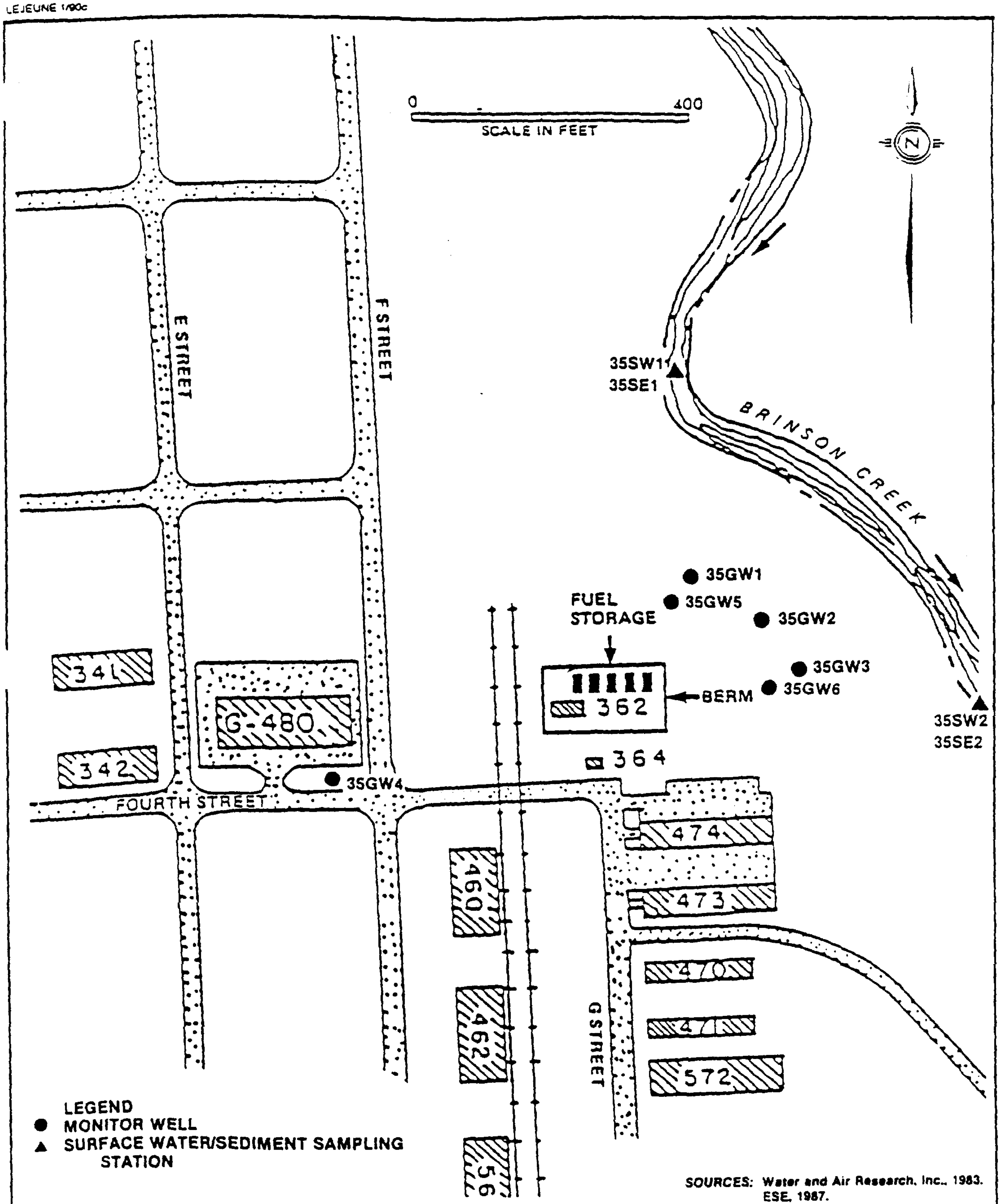


Figure 35-1
SAMPLING LOCATIONS, SITE 35—
CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE
CAMP LEJEUNE

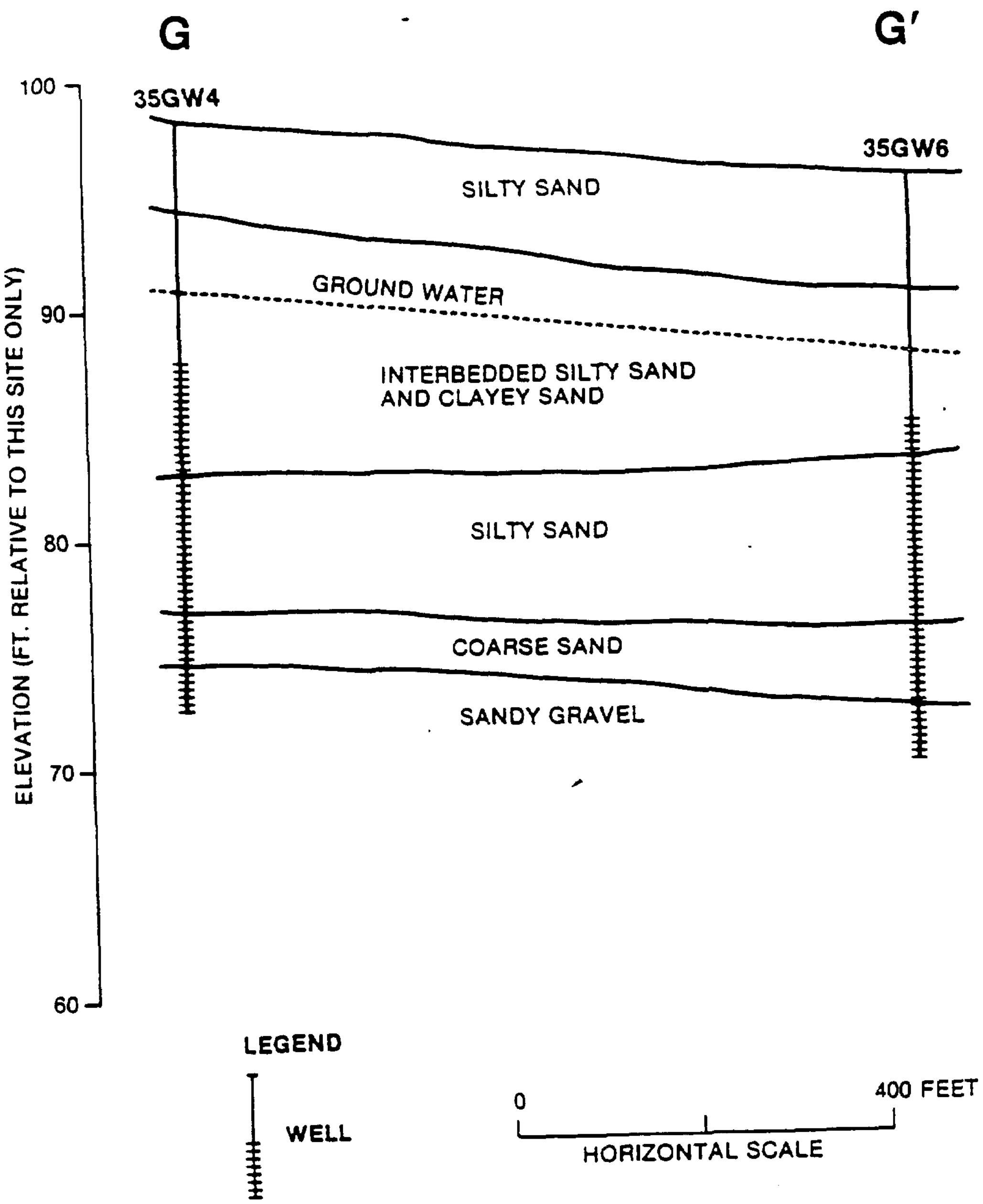


Figure 35-2
GEOLOGIC CROSS SECTION, SITE 35—
CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE
CAMP LEJEUNE

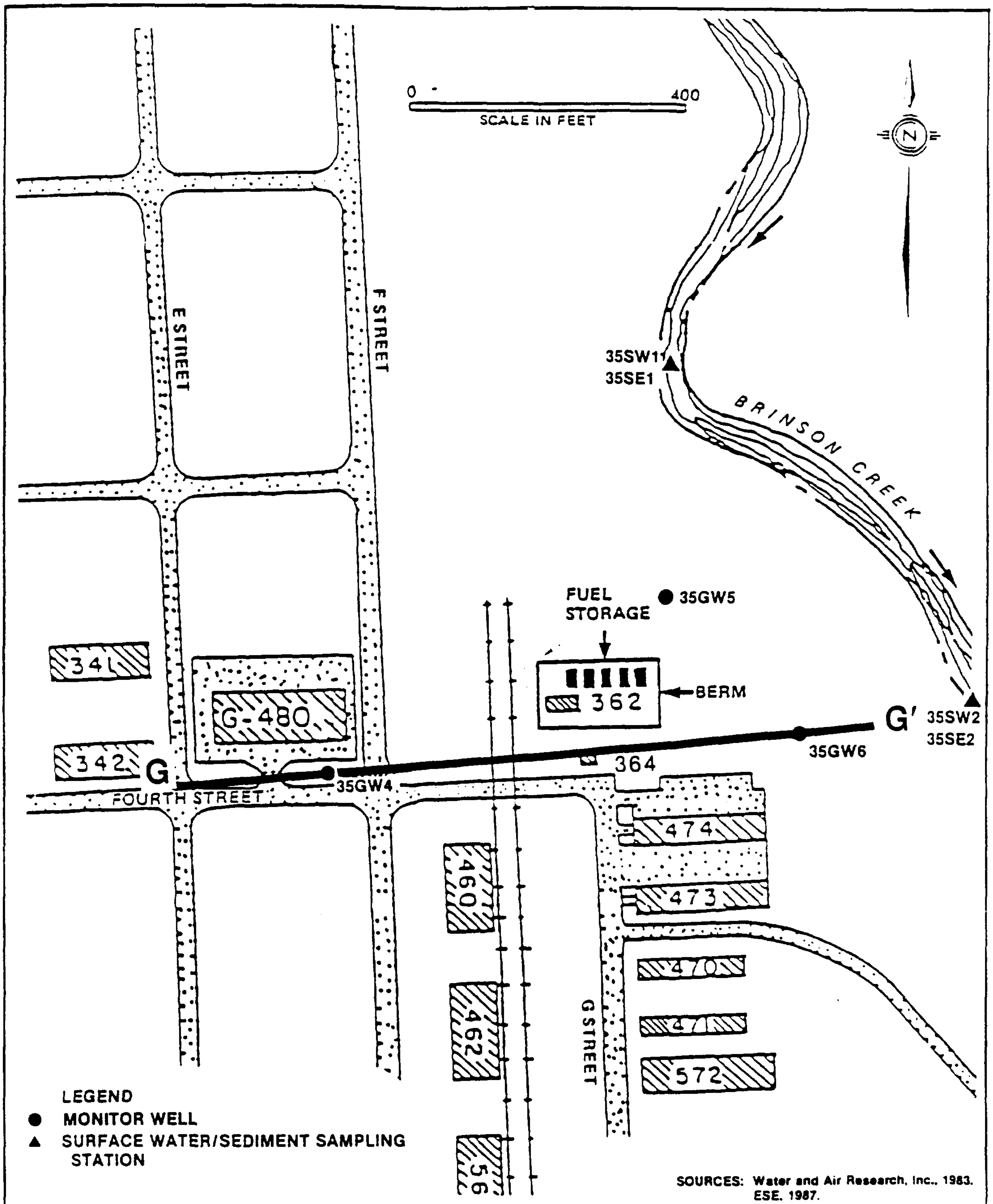


Figure 35-3
GEOLOGIC CROSS SECTION LOCATION, SITE 35—
CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE
CAMP LEJEUNE

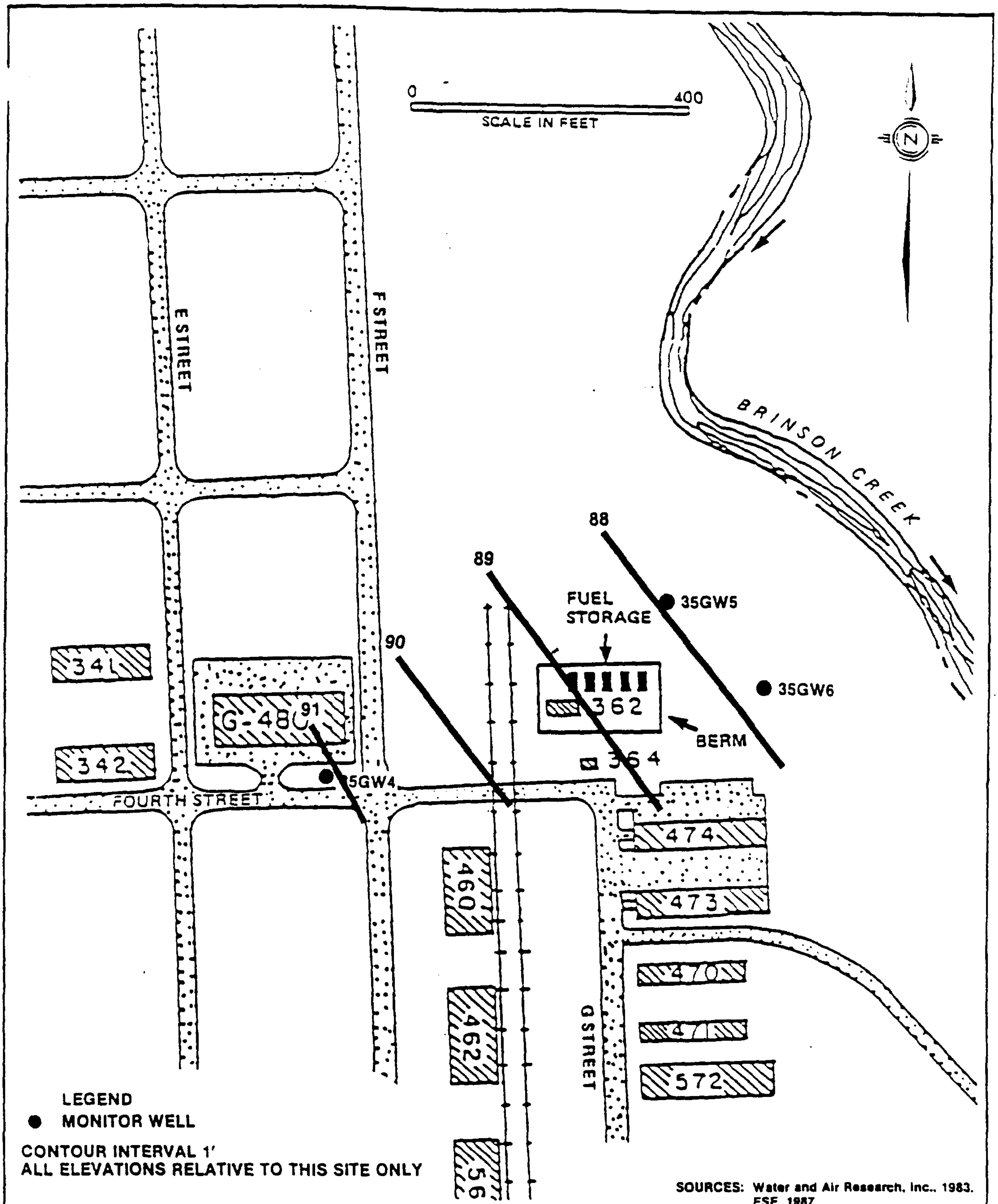


Figure 35-4
GROUND WATER CONTOUR MAP— SHALLOW AQUIFER, SITE 35— CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE CAMP LEJEUNE

TABLE 35-1. SITE 35 - CAMP GEIGER AREA FUEL FARM
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

	NC GW STANDARDS	35GW1	35GW2	35GW3	35GW4	35GW4	35GW5	35GW5	35GW6	35GW6
DATE		8/7/84	8/6/84	8/7/84	12/4/86	3/6/87	12/4/86	3/6/87	12/4/86	3/6/87
PARAMETER										
BENZENE	1	<0.2	<0.2	<0.2	<1	<1	30	17	<1	1.3
T-1,2-DICHLORO										
ETHENE	70	<0.7	<0.7	<0.7	<1.6	3.2	<1.6	<1.6	28	29
TRICHLOROETHENE	NONE	<0.8	<0.9	<0.9	<1.0	<3	<1.0	<3	11	11
METHYLENE CHLORIDE	5	4	<0.7	<0.7	<2.8	<2.8	<2.8	<2.8	<2.8	<2.8
LEAD		1063	1102	3659	<27	<27	33	<27	<27	<27
OIL & GREASE	NONE	<1000	46000	<1000	200	12000	2000	2000	200	1000

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

Three permanent groundwater monitoring wells were installed in 1986 to allow for more representative samples of the groundwater (Figure 35-1). Well 35GW4 was installed upgradient of the spill area and Wells 35GW5 and 35GW6 were installed downgradient. The groundwater samples taken from these wells were analyzed for lead, O&G, and VOCs, as well as xylene and ethylene dibromide (EDB). Table 35-1 presents the analytical results of the December 1986 and March 1987 sampling efforts. In the upgradient well (35GW4), no analytes were detected except for O&G in 1986. In 1987, O&G and trans-1,2-dichloroethene were detected. The source of these two analytes in the upgradient well is not clearly defined in the current database.

Wells 35GW5 and 35GW6 were found to contain sporadic distributions of fuel-derived compounds and VOCs. Benzene, lead and O&G were detected in Well 35GW5, which is located northeast of the tanks. This suggests that the detected analytes are a result of the recorded fuel spillage at the site. Well 35GW6 is located east of the tanks and was found to contain O&G, trans-1,2-dichloroethene, trichloroethene and benzene. The presence of VOCs in this well suggests that widespread low level contamination of the shallow aquifer may be present as a result of the fuel release or other as yet unidentified sources. Well 35GW6 is in a generally cross gradient position of the tanks and is located approximately 200 feet downgradient of an automobile maintenance (hobby) shop. Due to the distance of the well from the tanks, VOCs in the recorded fuel release may not be a sole contributor to VOCs in the groundwater at Well 35GW6. The automobile maintenance shop represents a potential source of waste solvents detected in this well.

SOILS

Three soil samples were analyzed from the three hand-augered borings in 1984. Lead and O&G were detected in all three samples. The analytical results are listed below.

	Concentration (ug/g)		
Parameter	35GW1	35GW2	35GW3
Lead	8	6	6
Oil and grease	67	2200	40

SURFACE WATER

Two surface water samples were collected from Brinson Creek in 1986, one upstream and one downstream of the site (Figure 35-1). These samples were analyzed for lead, O&G, and ethylene dibromide. No target analytes were detected in either sample.

SEDIMENT

Two sediment samples from Brinson Creek were taken in 1986 at the same locations as the surface water samples. These samples were analyzed for lead, O&G, and ethylene dibromide. Both sediment samples were found to contain lead and O&G, suggesting that episodic contamination of the creek has occurred or is occurring. Levels of both these analytes were higher in the upstream sample, suggesting that the discharge of contaminated groundwater to the creek is occurring at the far northern section of site and that the sample was not taken far enough upstream to truly represent upstream conditions. Another possibility is that the source of O&G and lead may be located upstream of Site 35.

3.10.3 SUMMARY AND CONCLUSIONS

The 1986/87 analytical data indicate that widespread contamination of the shallow aquifer with fuel derived contaminants and VOCs may exist at Site 35. The migration mechanisms by which contaminants have migrated to the upgradient well have not been identified. However, due to the nature of hydrocarbon fuel, a spill would tend to widely disperse on the surface of groundwater in a sandy medium. This would explain the concentrations of fuel related compounds in Well 35GW4. A second separate source of observed contaminants may be present at the automobile maintenance shop located upgradient of Well 35GW6.

The groundwater contour map (Figure 35-4) indicates that groundwater flow is towards Brinson Creek. Surface water samples contained no detectable target analytes. Sediment samples, however, contained lead and O&G. Because at the time of the fuel release to the environment, fuel reached the creek, it can be assumed that contaminants may be currently discharging to the creek via the groundwater.

3.10.4 RECOMMENDATIONS

The work efforts to date at this AOC have identified the presence of fuel derived contamination in the soils, shallow groundwater, surface water, and sediments. Further investigations should be designed to determine the extent (horizontal and vertical) of the contamination within the soils and groundwater and within Brinson Creek. In addition, investigation of the adjacent automobile hobby shop should be initiated to determine if that facility is a source of VOC contamination. A Risk Assessment should be conducted upon completion of the environmental characterization.

3.11 SITE 36 - CAMP GEIGER AREA DUMP NEAR SEWAGE TREATMENT PLANT (STP)

3.11.1 SITE BACKGROUND

The Camp Geiger Area Dump (Figure 36-1) is located east of the Camp Geiger STP approximately 200 feet on the south side of Brinson Creek, downstream of Site 35 (PWDM Coordinates 12, D13, E13). An unnamed ditch is located less than 100 feet southeast of the filled area. Site 36 was used for the disposal of municipal wastes and mixed industrial wastes including garbage, trash, waste oils, solvents, and hydraulic fluids from the air station from the late 1940's to the late 1950's. Most of the material was first burned and then buried. However, some unburned material was buried. According to interviews conducted during the IAS process, less than five percent of all hydrocarbons used at the air station were disposed of at the site. The rest was used for dust control on roads or went directly into storm drains. A conservative estimate of the quantities used for dust control is 700 to 1,000 gallon per week. A smaller but undetermined amount was washed down the storm drains. Using a 5-percent estimate for dumping over the nine years of operation, approximately 25,000 gallons of material could have been disposed of in the landfill areas. If it is assumed that this amount was split between this AOC and the trailer park dump (Site 41), 10,000 to 15,000 gallons of solvents and oils may have been placed into Site 36. The records state that all waste solvents and oils were burned after disposal at this AOC.

The site covers about 25,000 square feet and rises about 10 to 12 feet above grade. Based on an average depth of fill of 15 feet, the estimated volume of the disposal area is 14,000 cubic yards. These estimates are based on map and photographic information only. No field measurements have been performed for this purpose.

The site is underlain primarily by silty sand, with layers of silty clayey sand, clay, and coarse sand. A geologic cross section (Figure 36-2) is drawn on a east west line (Figure 36-3). The surface of the shallow groundwater lies within the silty sand at depths ranging from 4.23 to 5.02 feet below land surface. The groundwater contour map (Figure 36-4) indicates that

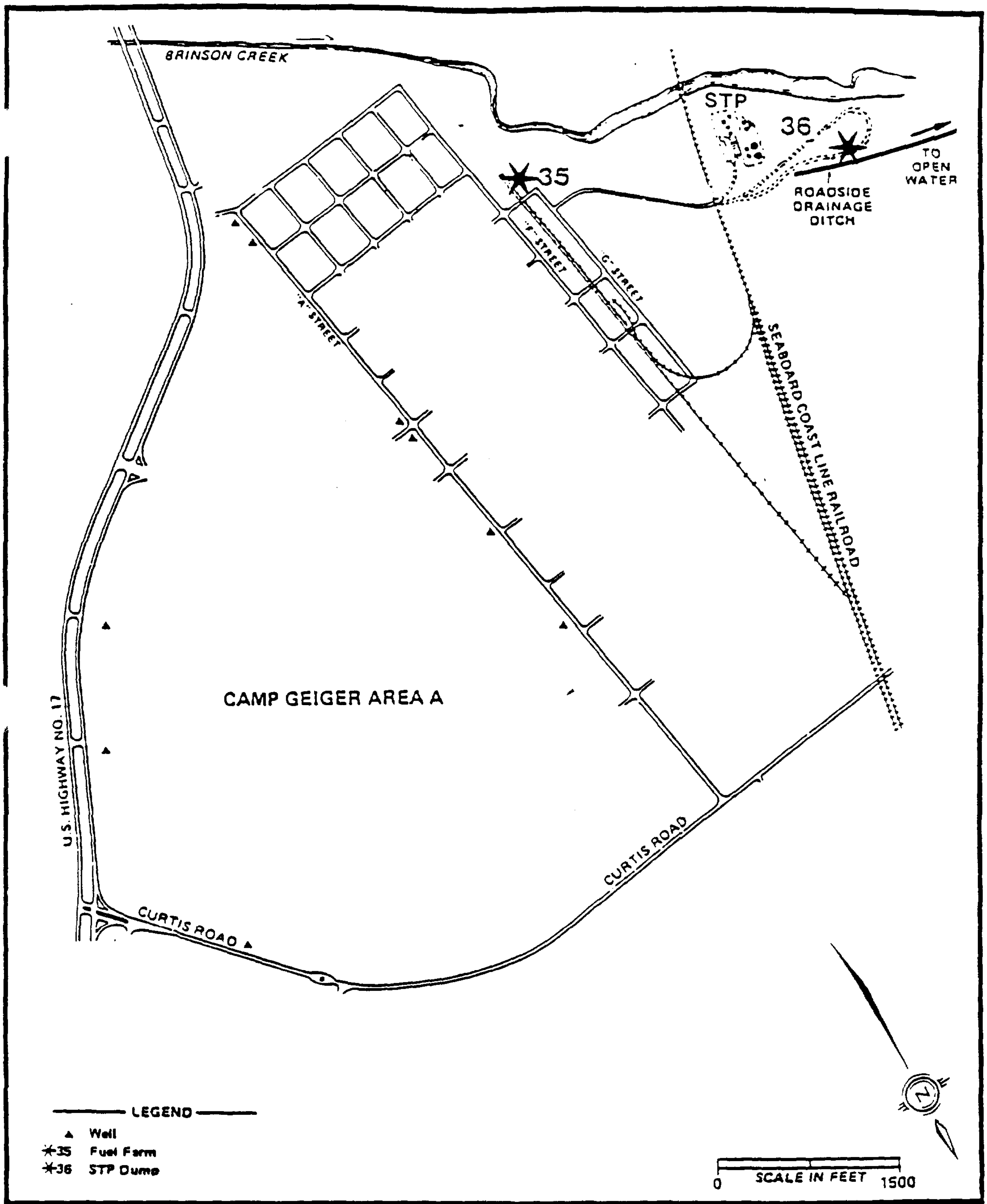


Figure 36-1
SITE LOCATION, SITE 36
CAMP GEIGER AREA DUMP (NEAR STP)

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1990.

MARINE CORPS BASE
CAMP LEJEUNE

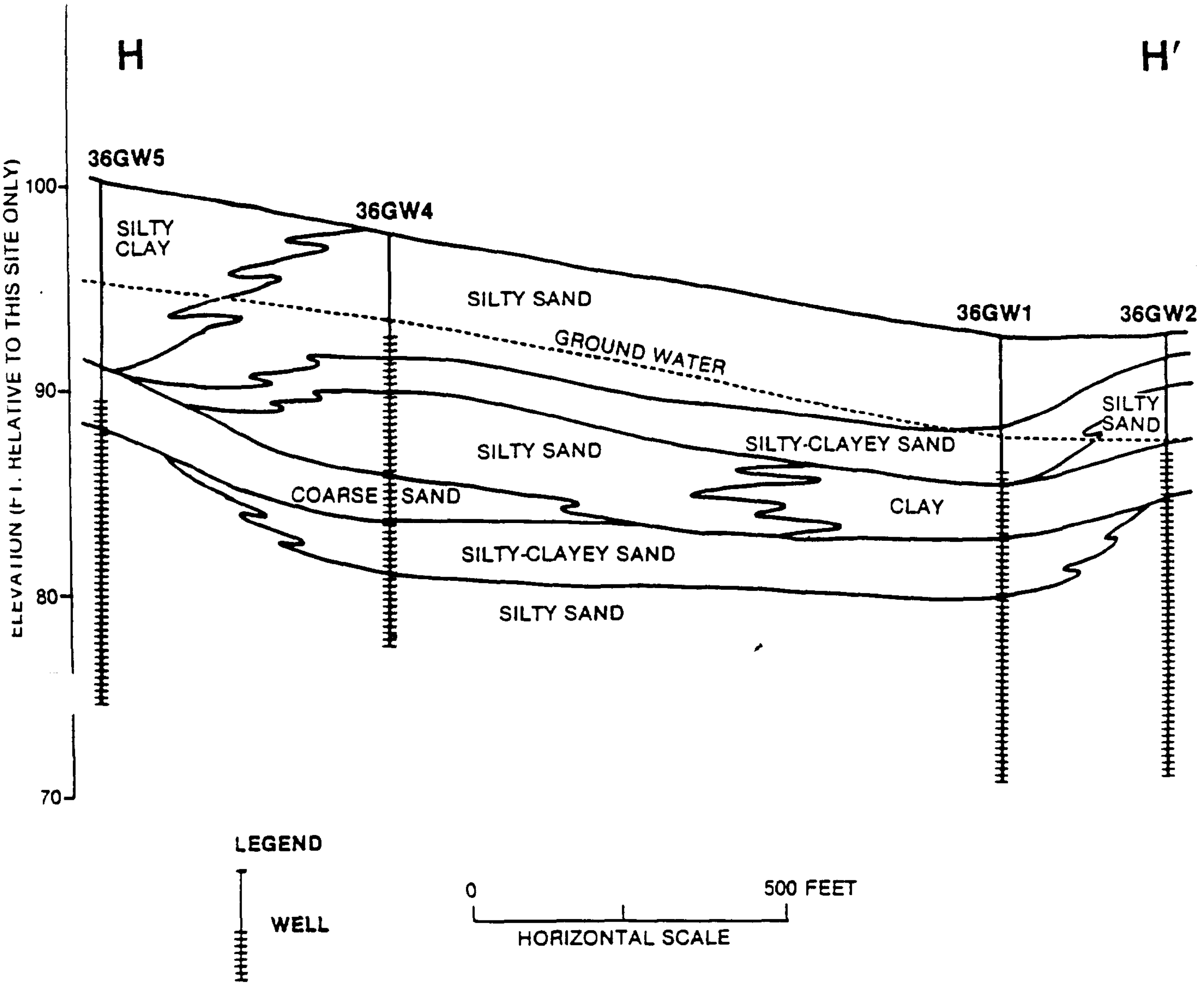
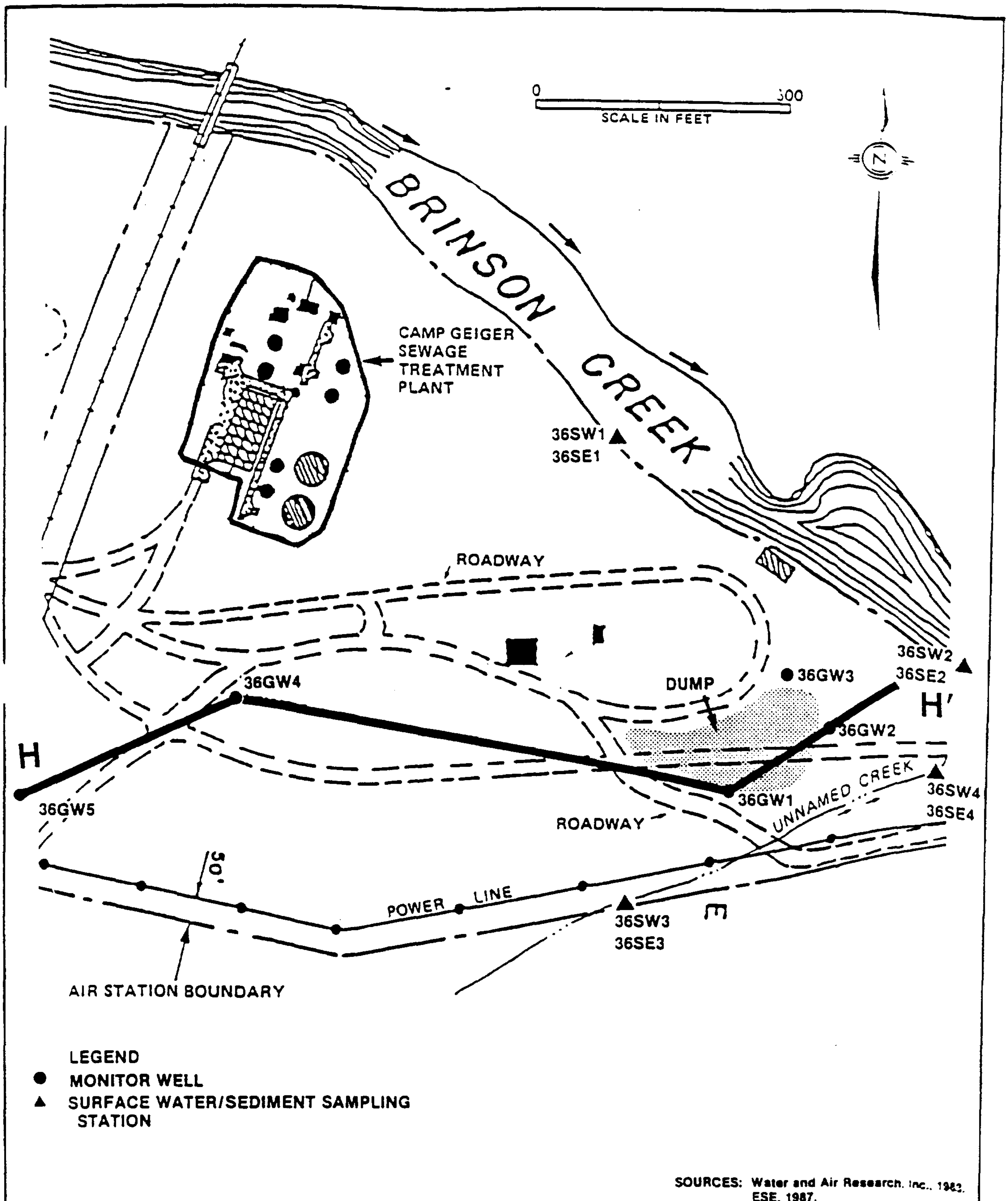


Figure 36-2
GEOLOGIC CROSS SECTION, SITE 36—
GEIGER AREA DUMP (NEAR STP)

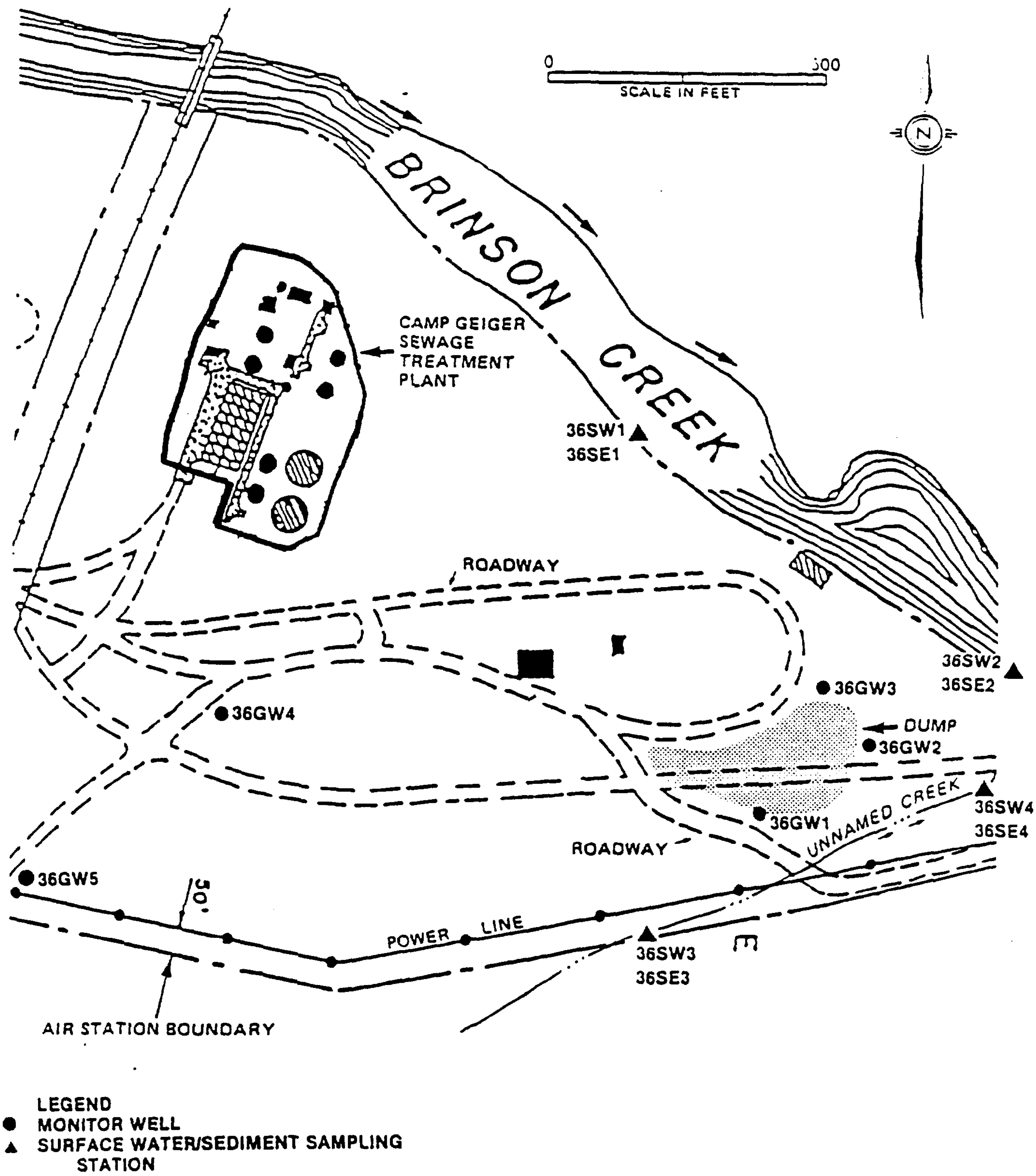
MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 36-3
GEOLOGIC CROSS SECTION LOCATION, SITE 36—
CAMP GEIGER AREA DUMP (NEAR STP)

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 36-5
SAMPLING LOCATIONS, SITE 36—
CAMP GEIGER AREA DUMP (NEAR STP)

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 36-1. SITE 36 - CAMP GEIGER DUMP AREA NEAR SEWAGE TREATMENT PLANT (STP) (Page 1 of 2)
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE PARAMETER	NC GW STANDARD	36GW1 7/31/84	36GW1 7/31/84	36GW1 12/9/86	36GW2 7/31/84	36GW2 7/31/84	36GW2 12/9/89	36GW3 7/31/84	36GW3 7/31/84	36GW3 12/9/86
T-1,2-DICHLORO-										
ETHENE	70	<0.7	<0.7	<1.6	<0.7	<0.7	<1.6	<0.7	<0.7	<1.6
METHYLENE CHLORIDE	5	<0.6	<0.7	<2.8	<0.6	<0.7	<2.8	<0.6	<0.7	<2.8
1,1,2,2-TETRA-										
CHLOROETHANE	NONE	<0.5	<0.5	<4.1	<0.5	<0.5	<4.1	<0.5	<0.5	<4.1
CADMIUM	5	12	8	3	14	19	4	7	NA	<2.9
CHROMIUM	50	480	510	130	420	680	142	280	NA	12
LEAD	50	324	265	45	249	346	73	104	NA	29
PHENOLS	NONE	3	2	4	2	6	7	3	3	3
OIL & GREASE	NONE	<900	<1000	2000	<900	<900	2000	<1000	<1000	2000

NA - not analyzed

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 36-1. SITE 36 - CAMP GEIGER DUMP AREA NEAR SEWAGE TREATMENT PLANT (STP) (Page 2 of 2)
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	NC GW STANDARD	36GW4 7/31/84	36GW4 7/31/84	36GW4 12/9/86	36GW5 12/9/86	36GW5 3/5/87
PARAMETER						
T-1,2-DICHLORO-						
ETHENE	70	2	1.2	<1.6	<1.6	<1.6
METHYLENE CHLORIDE	5	<0.7	7	<2.8	<2.8	<2.8
1,1,2,2-TETRA-						
CHLOROETHANE	NONE	4	3	<4.1	<4.1	<4.1
CADMIUM	5	9	NA	<2.9	<2.9	<3.5
CHROMIUM	50	510	NA	103	18.2	51
LEAD	50	217	NA	<27	<27	<27
PHENOLS	NONE	2	1	<2	<2	<2
OIL & GREASE	NONE	<900	<900	2000	1000	1000

NA - not analyzed.

Values reported are concentrations in micrograms per liter (ug/L);
this approximates parts per billion (ppb).

Source: ESE, 1990.

disposal of waste solvents in the western side of ᴌ ˀhat presence of contamination in Well 36GW4 suggests that ˋlead, extends farther to the west than first thought. ˀts

These four wells were resampled in December 1986 and an additiᴌ m installed farther west of Well 36GW4. The analytical results of ˎ 1986 sampling effort were relatively consistent with 1984 results (1ˎ 1). Most detected levels in 1986 were slightly lower relative to 1984. was detected in all wells in 1986 and 1,1,2,2-tetrachloroethane was detectˎ only in Well 36GW4. Chromium and O&G were detected in the new upgradient well 36GW5 which was sampled in March 1987.

SURFACE WATER

Four surface water samples were collected in 1986, two from Brinson Creek, one upstream and one downstream, and two from the unnamed creek, one upstream and one downstream. The sample locations are indicated on Figure 36-5. These samples were analyzed for the same target compounds as the groundwater. Detectable levels of trans-1,2-dichloroethane (2.5 ug/L), lead (39 ug/L), and total phenols (4 ug/L) were detected in the unnamed creek upstream sample (36SW3). This small stream passes through the southern portion of the filled area. The chemical data corroborate the widespread but low-level contamination of the groundwater. Lead (33.1 ug/L) was also detected in the upstream sample 36SW1 from Brinson creek at a concentration which is slightly above the freshwater standard of 25 ug/L.

SEDIMENT

Four sediment samples were collected in 1986 at the same locations as the surface water samples (Figure 36-5). The sediment samples were analyzed for the following parameters:

- o Cadmium
- o Lead
- o Total Phenols
- o Hexavalent chromium
- o Chromium
- o Oil & Grease (O&G)
- o Ethylene dibromide (EDB)

Table 36-2 presents the analytical results for those target analytes that were detected above the applicable method detection limits. Chromium, lead, O&G, and phenols were detected in all four sediment samples. This suggests that accumulation of these analytes from either the continuous or episodic contamination of Brinson Creek and the unnamed stream has occurred. Cadmium was detected in trace levels in only one sample (36SE4).

3.11.3 SUMMARY AND CONCLUSIONS

The groundwater contour map (Figure 36-4) indicates that the shallow groundwater passing through the disposal area travels to and presumably discharges to Brinson Creek. This suggests that contamination detected adjacent to the fill area can migrate to Brinson Creek. Analytical results identified contaminants in the creek bed sediments but none in the associated surface waters. This may be attributed to the substantial dilution which may occur when the relatively low groundwater discharge encounters the relatively large surface water flow.

Metal and O&G contamination was identified in all groundwater samples. The concentrations of metals displayed a decrease over time. This could be the result of the continual leaching of metals into the groundwater over time. O&G was identified only in the 1986/87 samples. This may be the result of lower detection levels utilized in the 1986/87 analyses, or to the overall O&G levels identified throughout the Camp LeJeune complex. VOCs were identified in one well (36GW4).

3.11.4 RECOMMENDATIONS

The existing monitoring well network has detected low levels of VOC and metal contamination along the margins of this AOC. Additional information regarding contaminant strength and distribution within the filled area is required for both the shallow and deep groundwater as well as the soil. When these data are available, a Risk Assessment should be conducted to properly evaluate the risk to health and the environment.

TABLE 36-2. SITE 36 - CAMP GEIGER DUMP AREA NEAR SEWAGE TREATMENT PLANT (STP)
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	36SE1	36SE2	36SE3	36SE4
DATE	12/9/86	12/10/86	12/10/86	12/10/86
PARAMETER				
CADMIUM	<0.879	<1.94	<0.59	0.722
CHROMIUM	8.49	14.2	5.29	5.44
LEAD	77.5	42.5	15.3	10.7
OIL & GREASE	1480	2410	1200	185
PHENOLS	2030	1950	1080	464

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC sediment standards.

Source: ESE, 1990.

3.12 SITE 41 - CAMP GEIGER DUMP NEAR FORMER TRAILER PARK

3.12.1 SITE BACKGROUND

The Camp Geiger Dump (Figure 41-1) is located south of the terminus of Robert L. Wilson Boulevard and south of the abandoned trailer park (PWDM Coordinates 13, E2-3). The area lies between an unnamed creek and Tank Creek. This 30 acre disposal area was operated from 1946 to 1970 and was used as an open burn dump which received mixed industrial waste, commercial waste, and construction debris including waste oils, solvents from the air station, garbage, trash, asphalt, concrete, old batteries, Mirex, and ordnance. The size estimate for Site 41 is based on map and photographic information. Field estimates have been made but no field measurements were performed.

Based on interviews with MCAS New River and Camp Lejeune personnel, it is estimated that 10,000 to 15,000 gallons of waste oils and solvents were disposed at this AOC (See Section 3.11.1, Site 36). Most of these wastes were probably burned. The number of old batteries containing lead disposed of is assumed to be relatively small. Tons of Mirex in bags were disposed of in 1964. The disposed quantity of ordnance is estimated to include thousands of mortar shells. At least one case of grenades and one 105mm cannon shell were also reported to have been disposed of within the filled area. In the mid-1960's over a 1- to 2- year period, at least two waste disposal incidents occurred during which two truckloads of drummed wastes were unloaded at the site. These wastes were described as being similar to those disposed at the Rifle Range Chemical Dump (See Section 3.17.1, Site 69). No other information concerning drum content was obtained. Based on an estimated fill depth of 5 feet, the total estimated volume of the site is about 110,000 cubic yards.

A geologic cross section (Figure 41-2) was drawn on a generally north-south line (Figure 41-3) and indicated that the site is underlain primarily by silty sand, with discontinuous layers of shelley sand, silty-clayey sand, silt, and clay. The surface of the shallow groundwater lies within the silty sand at depths ranging from 2.56 to 10.75 feet below land surface. The groundwater contour map shown in Figure 41-4 indicates that the shallow

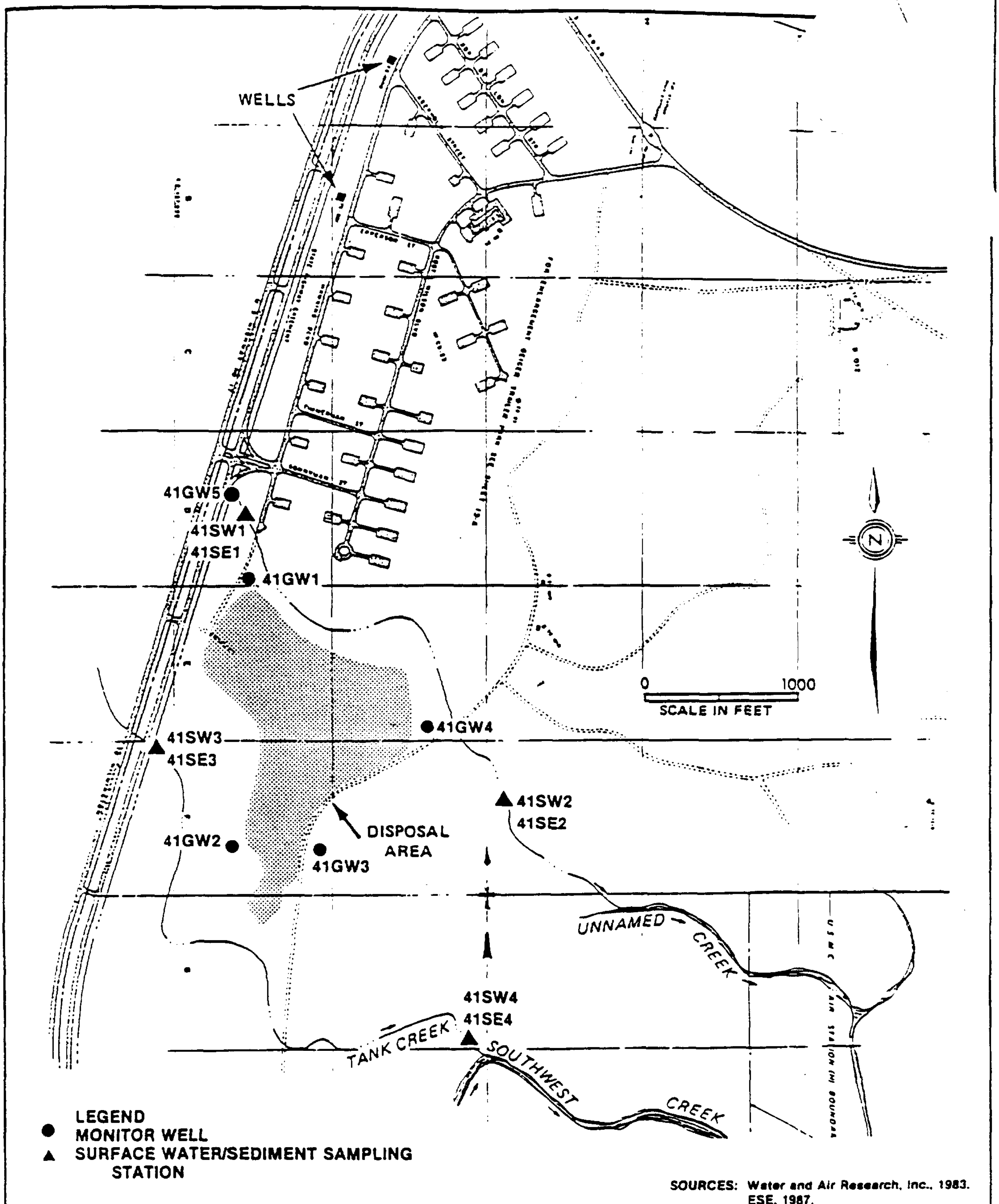


Figure 41-1
ROUND TWO SAMPLING LOCATIONS, SITE 41—CAMP GEIGER DUMP (NEAR FORMER TRAILER PARK)

MARINE CORPS BASE
CAMP LEJEUNE

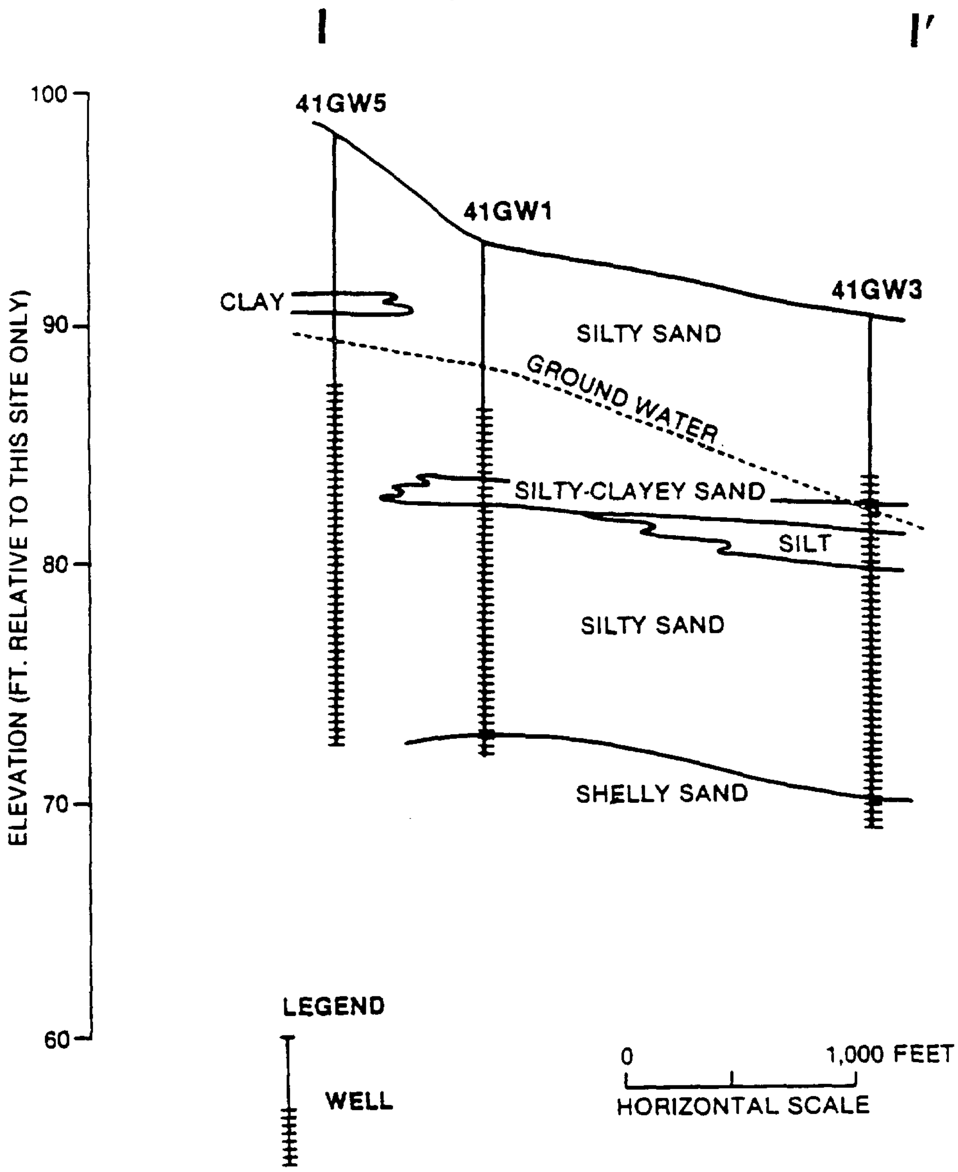


Figure 41-2
GEOLOGIC CROSS SECTION, SITE 41—CAMP GEIGER DUMP (NEAR FORMER TRAILER PARK)

MARINE CORPS BASE CAMP LEJEUNE

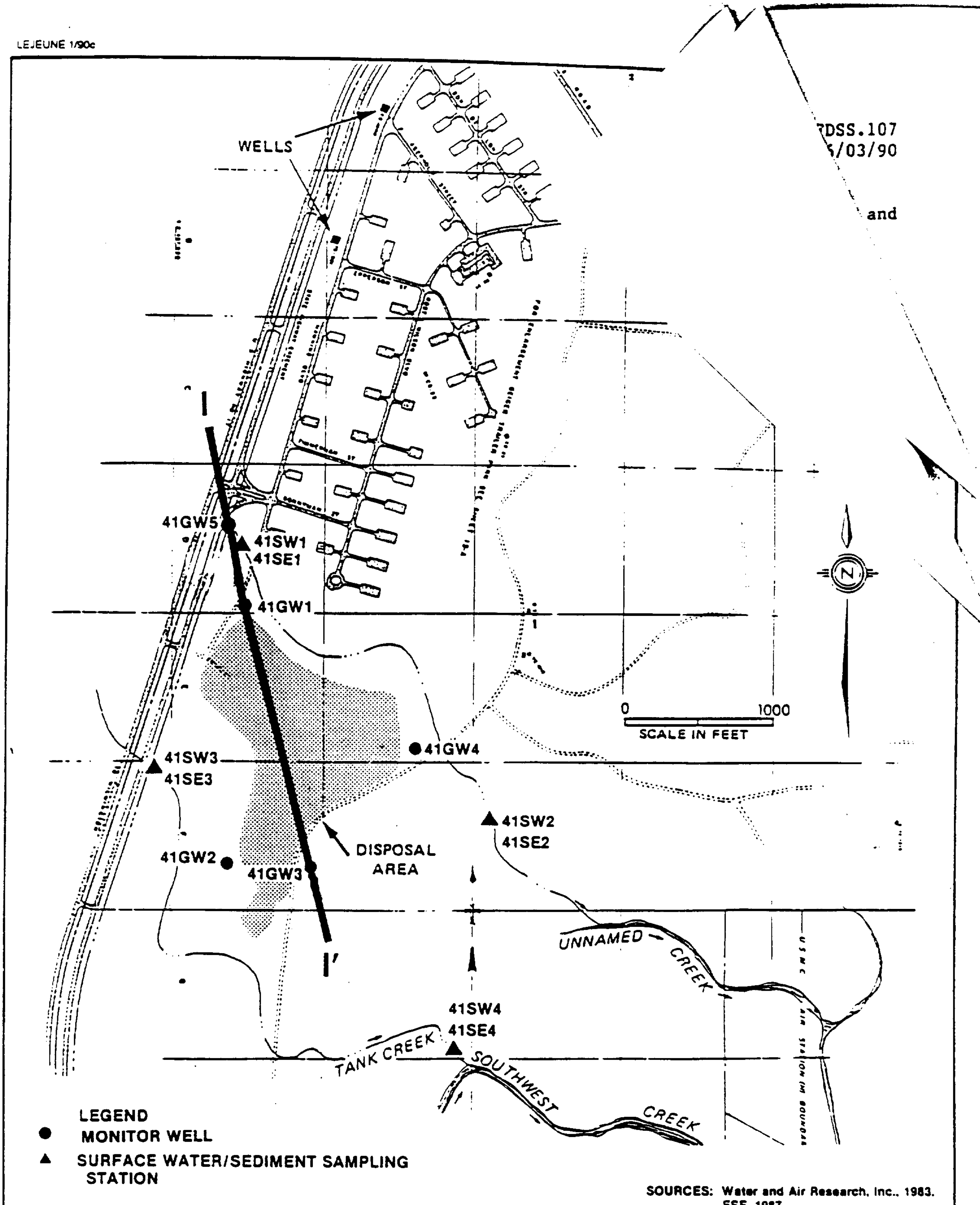
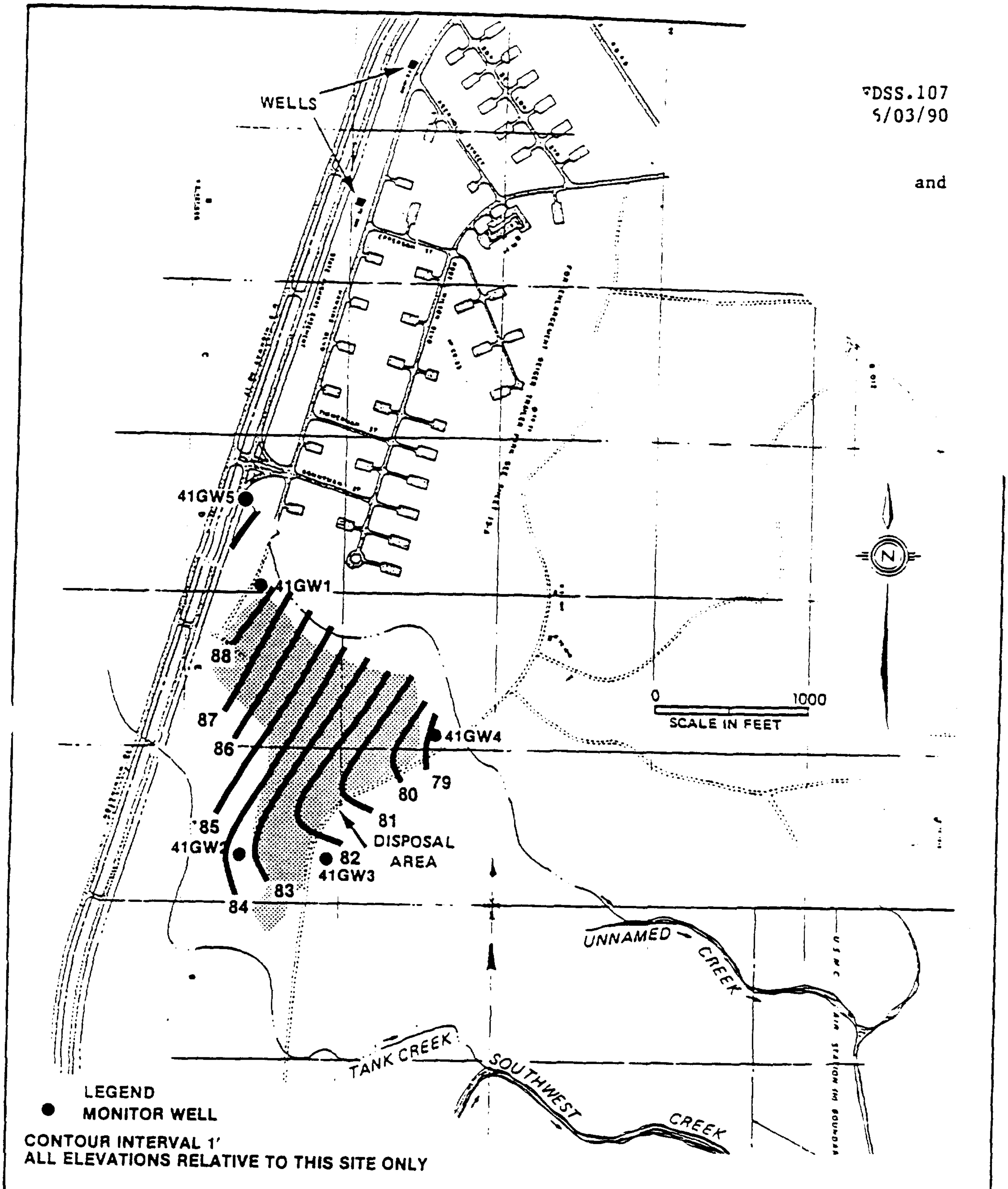


Figure 41-3
GEOLOGIC CROSS SECTION LOCATION, SITE 41—CAMP GEIGER DUMP (NEAR FORMER TRAILER PARK)

MARINE CORPS BASE CAMP LEJEUNE

LEJEUNE 1/90c



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5/03/90

and

SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 41-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 41—
CAMP GEIGER DUMP (NEAR FORMER TRAILER PARK)

MARINE CORPS BASE
CAMP LEJEUNE

groundwater flows to the southeast towards Tank Creek, Southwest Creek, and the unnamed creek with a gradient of approximately 0.011 ft/ft.

3.12.2 SITE INVESTIGATION

GROUNDWATER

Five shallow groundwater monitoring wells were installed as part of the investigation, four in 1984 and one in 1986. Well 41GW1 was placed at the northern (upgradient) end of the disposal area. Wells 41GW2 and 41GW3 were installed at the southern (downgradient) end of the disposal area between the filled area and Tank Creek. Well 41GW4 was placed east (downgradient) of the disposal area between the site and an unnamed tributary to Southwest Creek. Well 41GW5 was installed in 1986 and was placed upgradient of the filled area and Well 41GW1, north of the disposal area. The groundwater samples collected from these wells were analyzed for the following target compounds:

- Cadmium
- Chromium
- Hexavalent Chromium (1987 only)
- Lead
- Volatile Organic Compounds (VOC)
- Total Phenols
- Organochloride pesticides (OCP)
- Oil & Grease (O&G)
- Mirex
- Ordnance compounds
- Tetrachlorodioxin (TCDD) (1987 only)
- Xylene (1987 only)
- Methyl ethyl ketone (MEK) (1987 only)
- Methyl isobutyl ketone (MIBK) (1987 only)

Appendix A lists all target analytes and their abbreviations. Table 41-1 presents the analytical data from both the 1984 and 1987 sampling efforts. Only those compounds which exceeded the method detection limits are reported in the table. Metals were detected in all wells in both 1984 and 1987. Cadmium, chromium, and lead were detected at concentrations above N.C.

TABLE 41-1. SITE 41 - CAMP GEIGER DUMP
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	NC GW STANDARDS	41GW1 7/16/84	41GW1 1/8/87	41GW2 7/16/84	41GW2 1/8/87	41GW3 [illegible]	41GW3 [illegible]	41GW4 [illegible]	41GW4 [illegible]	41GW5 [illegible]	41GW5 [illegible]
PARAMETER											
BENZENE	1	<0.3	<1	0.3	<1	<0.3	<1	<0.3	<1	<1	<1
DICHLORODIFLUORO-											
METHANE	0.19	<1	<10	8	<10	<1	<10	<1	<10	<10	<10
T-1,2-DICHLORO-											
ETHENE	70	<1	<1.6	1.1	<1.6	<1.1	<1.6	<1.1	<1.6	<1.6	<1.6
METHYLENE CHLORIDE	5	<1	7.4	<1	10	<1	<2.8	<1	<2.8	<2.8	<2.8
VINYL CHLORIDE	0.015	<0.7	<1	1	<1	<0.9	<1	<0.9	<1	<1	<1
ALDRIN	NONE	<0.0008	<0.013	<0.0008	0.017	<0.0008	<0.013	<0.0008	<0.013	<0.013	<0.006
HEPTACHLOR	0.076	<0.0007	<0.013	<0.0007	<0.013	<0.0007	<0.013	<0.0007	<0.013	<0.013	0.007
CADMIUM	5	<6	<2.9	<6	<2.9	7.1	<2.9	<6	<2.9	4	<3.5
CHROMIUM	50	76	10	530	43	230	28	32	<9.4	117	17
LEAD	50	74.6	<27	196.3	52	119.4	<27	<40	<27	<27	<27
OIL & GREASE	NONE	2000	1000	2000	1000	2000	900	48000	2000	1000	3000
PHENOLS	NONE	<1	11	4	11	1	<2	2	6	18	<2
RDX	NONE	<3.42	<0.745	<3.23	<7.45	<3.3	1.28	<3.3	<0.745	<0.745	<0.745

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

Groundwater Standards. O&G was also detected in all wells.

VOCs were present in Well 41GW2 in 1984. Benzene, dichlorodifluoromethane, trans-1,2-dichloroethene and vinyl chloride were detected at trace levels. In the 1987 sampling effort only one VOC, methylene chloride, in wells 41GW1 and 41GW2 was detected. The variability of the VOC data with time may reflect the effects of varying amounts of rainfall, infiltration, and groundwater movement.

A single nitroaromatic compound (RDX) was detected in Well 41GW3 in 1987. This data point represents an indication that the groundwater may have been contaminated by ordnance disposed of at the site.

Phenols were detected in four out of the five monitoring wells. The highest level of phenol (18 ug/L) was detected in Well 41GW5, the farthest upgradient well. Heptachlor was also identified in Well 41GW5. This compound was not detected in any other well.

SURFACE WATER

Four surface water samples were collected and analyzed in January 1987; two from Tank Creek and two from the unnamed tributary to Southwest Creek. Both creeks flow adjacent to Site 41 (Figure 41-1). The samples were analyzed for the same parameters as the groundwater samples. The following target analytes were detected in all of the surface water samples: O&G, phenols, and methylene chloride. Aldrin was detected in all samples except for 41SW1, and BHC,D was detected only in 41SW2 (Table 41-2).

ABLE 41-2. SITE 41 - CAMP GEIGER DUMP
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

	NC SW	41SW1	41SW2	41SW3	41SW4
DATE	STANDARDS	1/8/87	1/8/87	1/8/87	1/8/87
PARAMETER					
OIL & GREASE	NONE	1000	500	200	300
PHENOLS	1	4	7	6	10
ALDRIN	0.002	<0.013	0.013	0.015	0.014
BHC,D	NONE	<0.026	0.047	<0.026	<0.026
METHYLENE CHLORIDE	NONE	8.7	5.5	9.7	6.8

Values reported are concentrations in micrograms per liter (ug/L);
this approximates parts per billion (ppb).

Source: ESE, 1990.

SEDIMENT

Four sediment samples were collected from the same locations as the surface water samples (Figure 41-2). The sediment samples were analyzed for the following target compounds:

- o Cadmium
- o Lead
- o Oil and Grease (O&G)
- o Mirex
- o Tetrachlorodioxin (TCDD)
- o Chromium
- o Hexavalent chromium
- o Total phenols
- o Organochloride pesticides (OCP)
- o Ordnance

Appendix A contains a detailed listing of all the individual target analytes. Table 41-3 presents the analytical results for those detected target analytes. The samples were found to contain low levels of total chromium, hexavalent chromium, lead, O&G, and phenols. In addition, both samples from Tank Creek were found to contain 2,4,6-TNT, with the downstream sample showing almost a 2 order-of-magnitude increase over the upstream sample. These data were the first indication that munitions compounds have been disposed of at this AOC.

3.12.3 SUMMARY AND CONCLUSIONS

The flow direction of the shallow aquifer at Site 41 is toward the surface water network. This strongly suggests that contaminants within the disposal area are able to migrate into the surface water. The chemical data are in agreement with this scenario, as metals, VOCs, and ordnance compounds have been detected in the sediments and/or surface waters.

The analytical data confirm that disposal practices at the site have contributed to groundwater and surface water/sediment contamination. Metals and O&G have been detected in all samples. VOCs were identified in groundwater and surface water samples. Pesticides were identified in two groundwater samples and three surface water samples. Two explosive compounds were also identified during the investigation. This confirms that ordnance compounds were disposed of at the site and may be impacting the environment.

TABLE 41-3. SITE 41 - CAMP GEIGER DUMP
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	41SE1	41SE2	41SE3	41SE4
DATE	1/8/87	1/8/87	1/8/87	1/8/87
PARAMETER				
CHROMIUM	2.66	1.77	1.86	5.09
CHROMIUM(+6)	<1.31	1.36	1.57	3.74
LEAD	12.1	4.89	<3.49	<4.63
OIL & GREASE	208	111	40	159
PHENOLS	<0.066	<0.066	0.081	0.118
2,4,6 TNT	<0.00341	<0.00345	0.00459	0.357

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

3.12.4 RECOMMENDATIONS

The existing monitoring well network is located along the margins of this disposal area and have identified a wide range of contamination (low level) directly related to the variety of materials which have been deposited in this landfill. At this time, it is recommended that this AOC be investigated in detail utilizing the following techniques: review of available aerial photography, geophysical surveys to determine specific disposal features within the landfill, soil gas to preliminary map VOC or petroleum hydrocarbon contamination, soil sampling in and around specific disposal features (possibly including installation of test trenches/pits), installation of additional monitor wells, and collection and analysis of extensive soil and sediment samples. All these data are required to adequately characterize the contaminant status so that a Risk Assessment can be conducted to evaluate the potential risk to health and the environment. In addition, the FS must have detailed information to evaluate the most-effective remedial alternative required to treat the wide variety of wastes present at this AOC. Explosive Ordnance Demolition (EOD) activities must be included in any proposed effort as records show that unexploded grenades and mortar shells are buried in the filled areas.

3.13 SITE 45 - CAMPBELL STREET UNDERGROUND FUEL STORAGE AREA

3.13.1 SITE BACKGROUND

The Campbell Street underground aviation gas (Avgas) and adjacent JP fuel farm at the air station is located at the intersection of Campbell and White Streets (JP fuel farm) and approximately 250 feet east of White Street (Avgas) (PWDM Coordinates 23, 013-14/P13-14). The two storage areas are close together and are considered one site AOC (Figure 45-1). The underground Avgas storage area is approximately 40,000 square feet; the JP fuel farm covers approximately 6 acres. The underground tank or tanks leaked at the Avgas storage area during 1978. At the JP fuel farm, extensive leakage from underground connecting lines was discovered in approximately 1981. The southeastern one-third of the area (approximately 2 acres) was affected by the leak in the connecting lines. The most recent leaks from the underground pipes involved JP-4 and JP-5 fuel. These pipes have been replaced with an above-ground system in which leaks can be readily detected. Spill estimates of JP fuel are more than 100,000 gallons and possibly up to 600,000 gallons. This estimate is based on the assumption that the soils overlaying the groundwater were saturated with fuel over approximately 2 acres. Using approximately 20 percent porosity and 5 feet to groundwater, 600,000 gallons of fuel may have been involved. An oil-water separator has been installed on the south boundary of the fuel farm, which typically contains a substantial amount of fuel. It is estimated that approximately 200 to 300 gallons of Avgas were involved in the underground tank(s) leakage.

A geologic cross section of Site 45 is presented in Figure 45-2. The cross section is drawn on an east-west line (Figure 45-3). The site is underlain by dipping layers of silty sand, clayey silt, clay, and sand. The surface of the shallow groundwater at this AOC cuts across these dipping strata at depths ranging from 2.64 to 6.96 feet below land surface. The groundwater contour map (Figure 45-4) indicates that shallow groundwater flows to the southeast, with a gradient of approximately 0.004 ft/ft.

LEJEUNE 1/90c

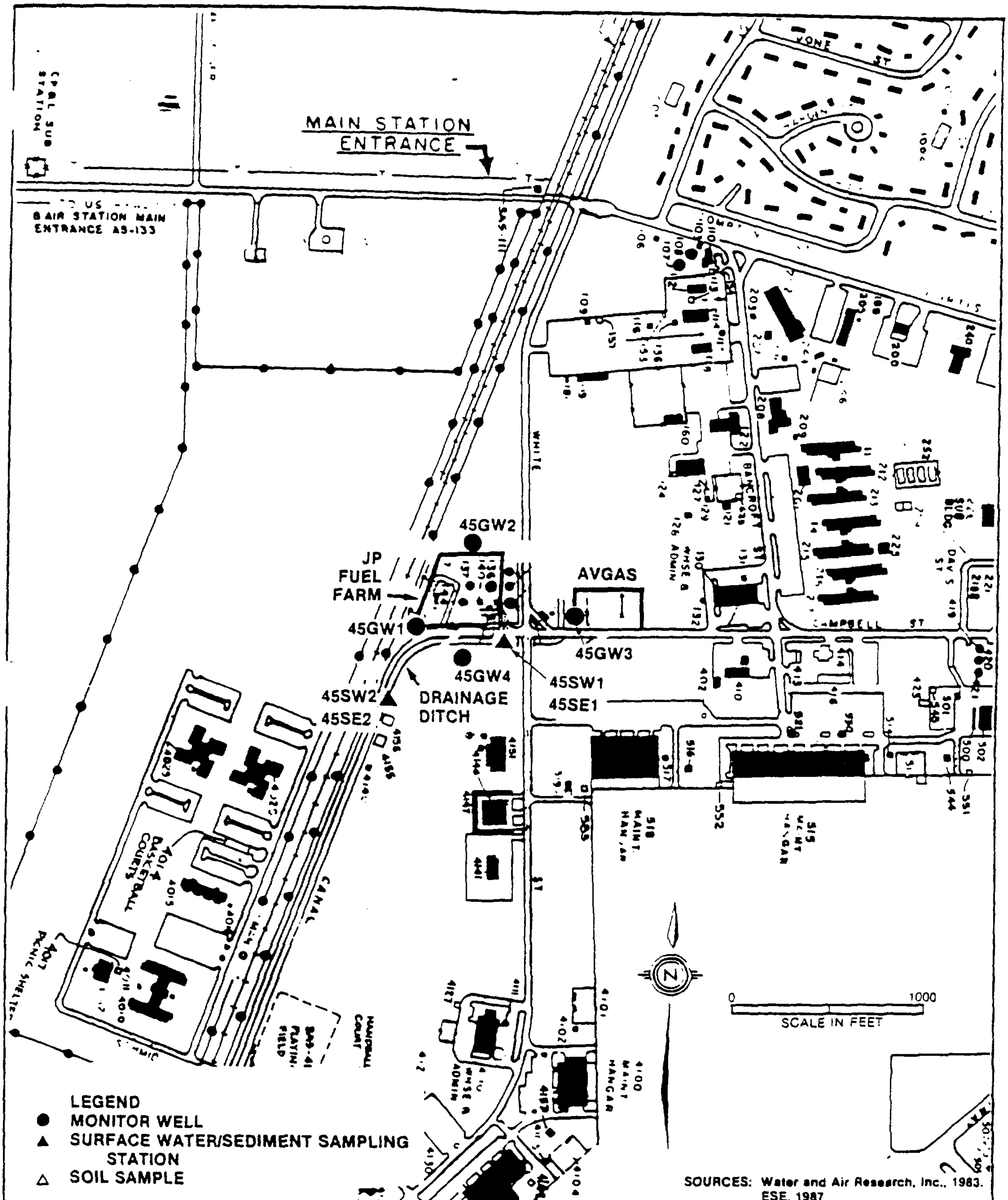


Figure 45-1
…MPLING LOCATIONS, SITE 45—
…MPBELL STREET UNDERGROUND FUEL
STORAGE AREA

MARINE CORPS BASE
CAMP LEJEUNE

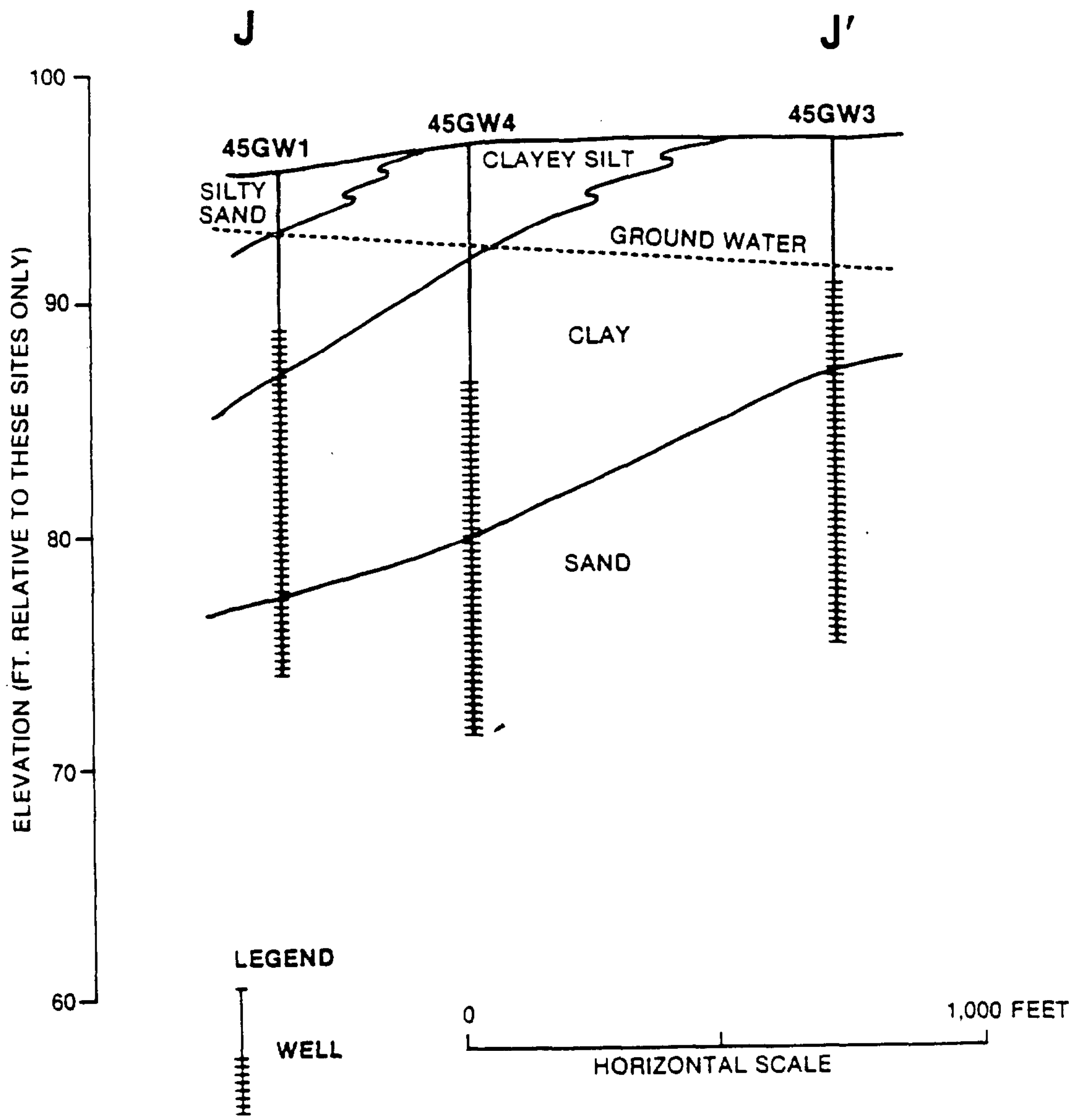


Figure 45-2
GEOLOGIC CROSS SECTION, SITE 45—
CAMPBELL STREET UNDERGROUND FUEL
STORAGE AREA

MARINE CORPS BASE
CAMP LEJEUNE

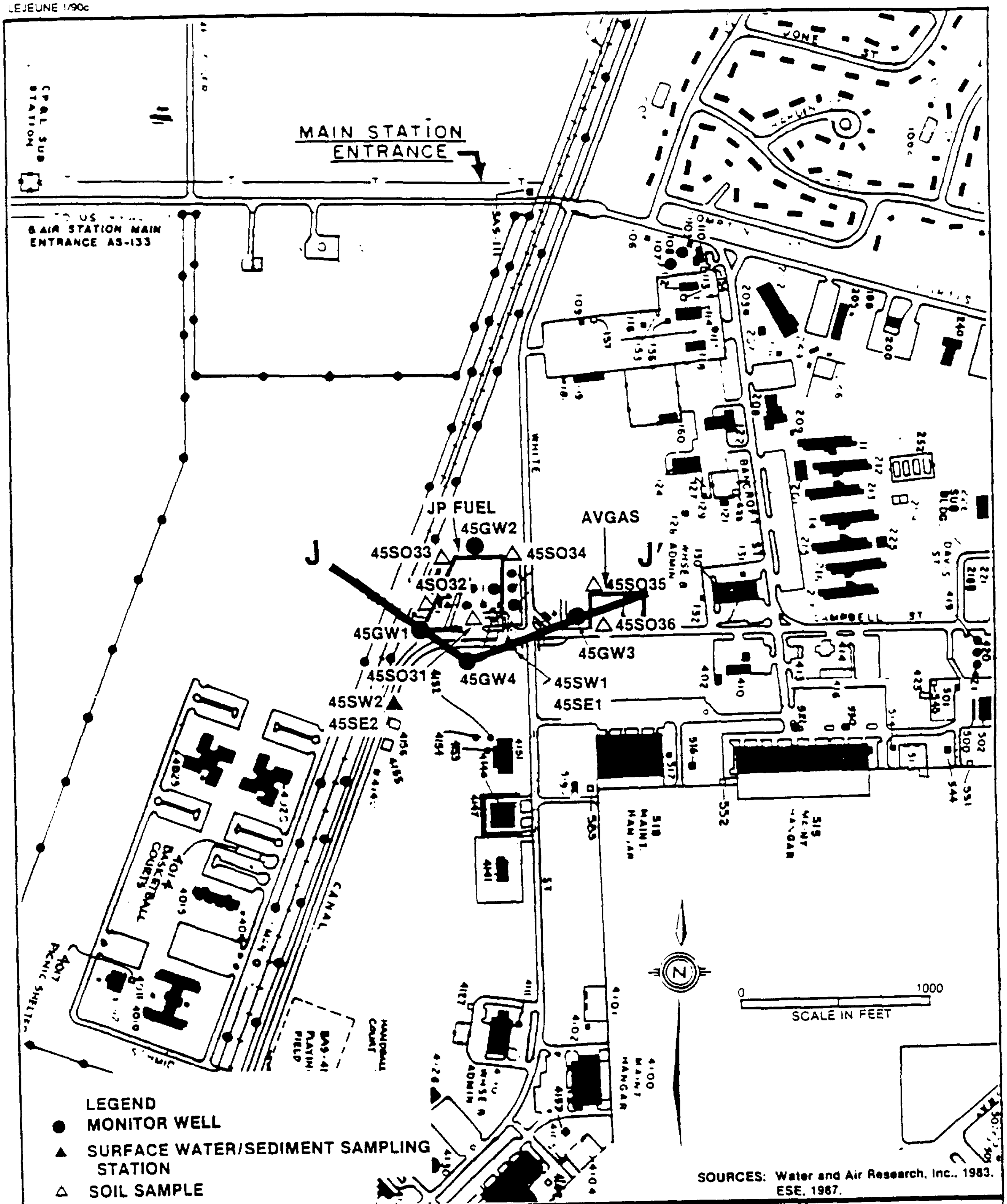


Figure 45-3
GEOLOGIC CROSS SECTION LOCATION, SITE 45—
CAMPBELL STREET UNDERGROUND FUEL
STORAGE AREA

MARINE CORPS BASE
CAMP LEJEUNE

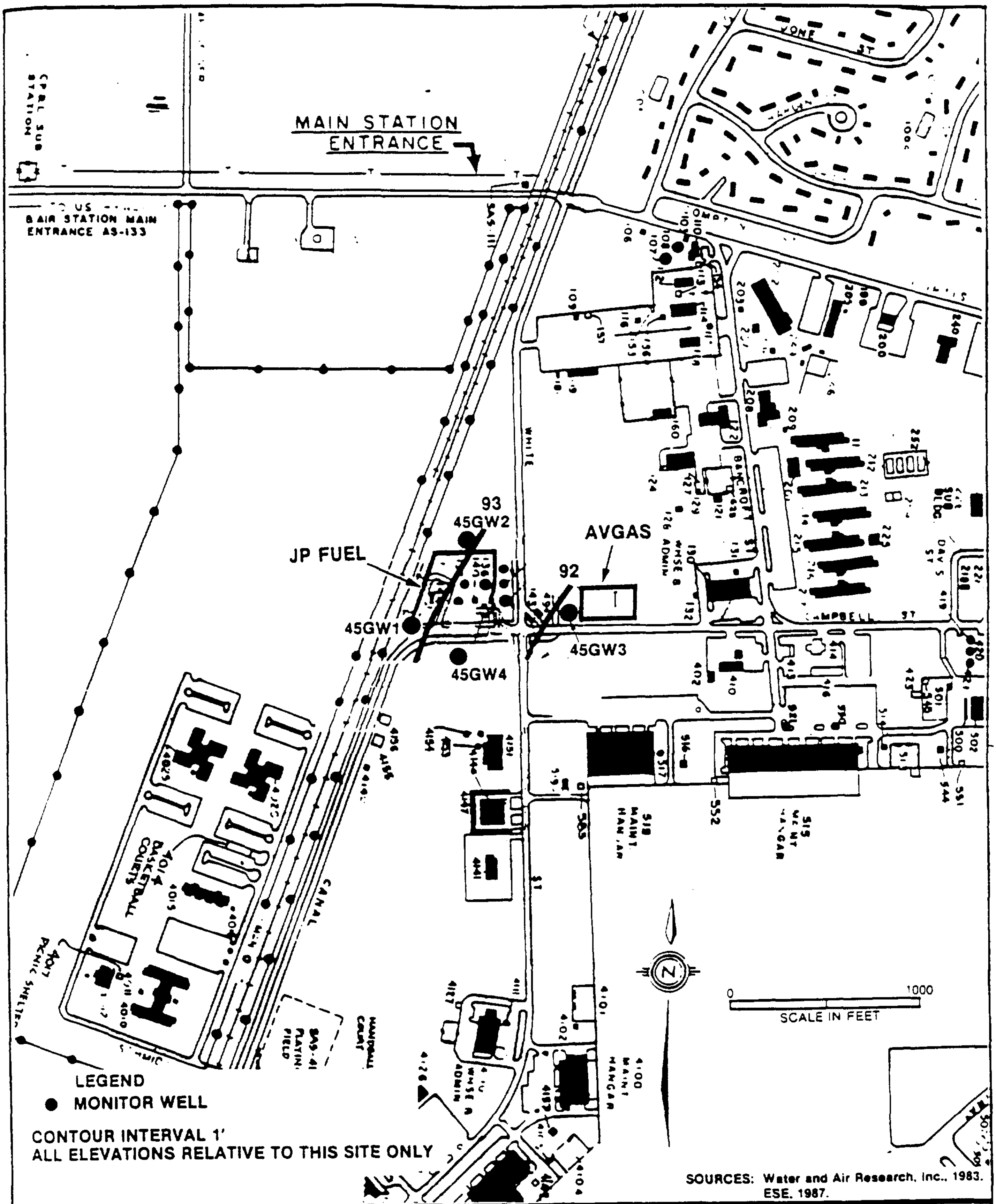


Figure 45-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 45—
CAMPBELL STREET UNDERGROUND FUEL
STORAGE AREA

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 45-1. SITE 45 - CAMPBELL STREET FUEL FARM AND MCAS (Page 1 of 2).
AIR FIELD RAPID REFUELING AREA
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	NC GW STANDARDS	45GW1 7/16/84	45GW1 8/1/84	45GW1 12/8/86	45GW2 8/1/84	45GW2 8/1/84	45GW2 12/8/86	45GW3 8/1/84	45GW3 8/1/84	45GW3 12/8/86
PARAMETER										
LEAD	50	73.6	<50	<27	<50	NA	<27	<50	NA	<27
OIL & GREASE	NONE	2000	4000	2000	22000	<900	2000	2000	1000	2000
CHLOROFORM	0.19	<0.5	NA	<1.6	<0.4	NA	1.9	<0.5	NA	<1.6
T-1,2-DICHLORO-ETHENE	70	<0.8	NA	2.2	<0.6	NA	<1.6	<0.8	NA	<1.6

NA - not analyzed

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 45-1. SITE 45 - CAMPBELL STREET FUEL FARM AND MCAS (Page 2 of 2).
AIR FIELD RAPID REFUELING AREA
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	NC GW STANDARDS	45GW4 8/1/84	45GW4 8/1/84	45GW4 12/8/86	45GW4 3/5/87	45GW5 8/1/84
PARAMETER						
LEAD	50	<50	NA	<27	<27	<50
OIL & GREASE	NONE	2000	<1000	2000	2000	1000
CHLOROFORM	0.19	<0.5	NA	<1.6	<1.6	<0.5
T-1,2-DICHLORO-						
ETHENE	70	<0.8	NA	1.9	<1.6	<0.8

NA - not analyzed

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

SURFACE WATER

Two surface water samples were collected (Figure 45-1) from the drainage ditch on the south side of Site 45 in December 1986. The samples were analyzed for the same target compounds as the groundwater samples. Listed below are those target compounds that were identified above detection limits.

	Concentration (ug/L)	
Parameter	45SW1	45SW2
O&G	600	1000
Benzene	1.4	<1

Low levels of benzene were detected in the sample taken hydraulically downstream at the JP fuel farm. This may be attributed to fuel related compounds leaching out of the soils around the fuel farm.

SEDIMENT

Two sediment samples were collected from the drainage ditch on the south side of the site (Figure 45-1) in December 1986. These samples were analyzed for lead and O&G. Listed below are the analytical results.

	Concentration (ug/g)	
Parameter	45SE1	45SE2
O&G	12000	1810
Lead	234	36.1

Lead was detected in sample 45SE1 directly adjacent to the JP fuel farm, and also in the other sediment sample. Relatively high levels of O&G were identified in both samples. These data suggest that the discharge of fuel into the ditch has occurred.

3.13.3 SUMMARY AND CONCLUSIONS

The gradient for the shallow groundwater is one of the lowest recorded at any of the Camp Lejeune AOCs. As a result, the potential for horizontal migration of contaminants is low. The groundwater has shown evidence of the presence of lead, O&G, and VOCs. These contaminants are more likely attributed to the large quantity of fuel spilled rather than the migration of contaminants. Periodic discharge of contamination from the shallow groundwater into the surface drainage ditch has been documented by the chemical character of the surface water and sediment samples. The O&G identified in the supply wells may or may not be attributed to the release of fuels into the environment of Site 45 because O&G seems to be a facility wide problem.

3.13.4 RECOMMENDATIONS

Documented releases of various fuels at Site 45 strongly suggest that free product may be floating on the groundwater surface. Prior to initiation of detailed field investigations to determine the extent (vertical and horizontal) of the dissolved contamination within the groundwater and soils, a free product recovery system should be installed. In order to provide adequate data to allow a Risk Assessment to be conducted, a program consisting of wells (shallow and deep) and soil samples should be initiated. Following determination of potential risk to health and the environment, an FS should be conducted to select the appropriate remedial technology.

3.14 SITE 48 - MCAS MERCURY DUMP

3.14.1 SITE BACKGROUND

The MCAS Mercury Dump (Figure 48-1) is located on Longstaff Road next to Building 804 (PWDM Coordinates 23, D17/E17). The disposal area was utilized from 1956 to 1966 and covers a 100- to 200- foot wide corridor extending from the rear of Building 804 (photo lab) to the edge of the New River. These dimensions correlate with an area of approximately 20,000 square feet. Metallic mercury was periodically drained from the delay lines of the radar units and disposed of at this AOC. Approximately one gallon per year of mercury was deposited over a 10 year period, amounting to more than 1,000 pounds total. The best information available indicates that the material was carried by hand and dumped or buried in small quantities at randomly selected spots.

3.14.2 SITE INVESTIGATION

SOIL

Four hand-augered soil borings to the water table were performed in August 1984. Five soil samples were collected from materials at the soil and groundwater interface (Samples 48S1 through 48S4, 2 samples from 48S1) and analyzed for mercury. Mercury was found in all five soil samples at the following concentrations:

Sample	Concentration (mg/kg)
48S1	0.02, 0.03
48S2	0.02
48S3	0.02
48S4	0.009

SEDIMENT

Four sediment samples were collected in the marsh area to the north of Building 804 (48SE1 through 48SE4) in August 1984. Mercury was found in all four sediment samples in the following concentrations:

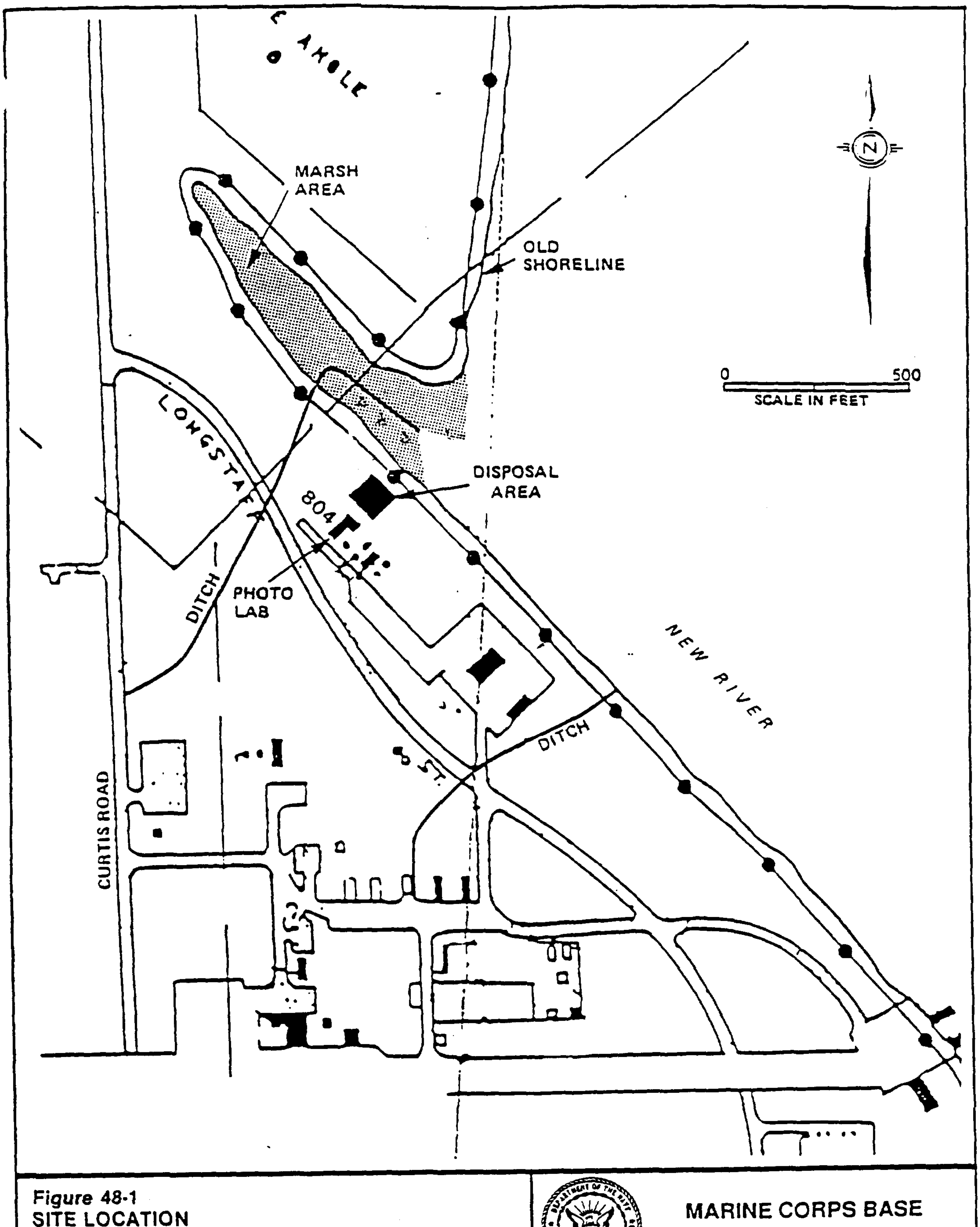


Figure 48-1
SITE LOCATION
MCAS NEW RIVER MERCURY DUMP

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1984.

MARINE CORPS BASE
CAMP LEJEUNE

Sample	Concentration (mg/kg)
48SE1	0.02
48SE2	0.02
48SE3	0.03
48SE4	0.02

3.14.3 SUMMARY AND CONCLUSIONS

The presence of mercury in the soil and in the sediments of the marsh suggests that mercury has migrated to the surface water system via the shallow groundwater. Correlation between mercury levels in solid media and levels in the groundwater and surface waters can not be made with existing data. The solubility of metallic mercury is approximately 25 ug/L, at 25°C, although this may increase due to chlorine or hydride complex formation under the proper environmental conditions. The biological transformations of mercury in the aquatic environment (water and sediment) are complex and can enhance bioaccumulation in the food chain.

No additional sampling took place at Site 48 in 1986 or 1987 since the presence of mercury attributable to prior disposal practices at this AOC was confirmed in the 1984 investigation.

3.14.4 RECOMMENDATIONS

Although low levels of mercury were detected in the solid environmental media at this AOC, the toxicity of mercury and its tendency to bioaccumulate indicate that Site 48 represents an environmental hazard. Recommended efforts should include detailed soil sampling and analysis within and adjacent to the corridor of disposal. Similarly detailed sediment sampling should be conducted in the adjacent marsh. Groundwater monitoring wells should be installed to determine if mercury has affected the groundwater. Because of potential bioaccumulation effects, sampling of aquatic and benthic organisms within the New River adjacent to Site 48 is warranted. All environmental data collected should be utilized in a Risk Assessment, followed by an FS.

3.15 SITE 54 - CRASH CREW FIRE TRAINING BURN PIT

3.15.1 SITE BACKGROUND

This 1.5 acre site within MCAS New River is located adjacent to the southwest end of Runway 5-23 near Building 3614 (PWDM coordinates 23, 024-25/P24-25) (Figure 54-1). This AOC is believed to have been used in the mid-1950s for crash crew training. Contaminated fuels (principally JP-type and possibly leaded fuels) and waste fuels were used in the training exercises. Originally the training was conducted on the ground surface with the area surrounded by a berm. Later a burn pit was used which was lined in approximately 1975.

A geologic cross section (Figure 54-2) was drawn on a northwest-southeast line (Figure 54-3) and shows the site to be underlain primarily by silty sand and silty gravelly sand, with discontinuous layers of coarse sand and clay. The surface of the shallow groundwater lies within the silty sand and coarse sand units at depths ranging from 0.8 to 10 ft below land surface. The groundwater contour map (Figure 54-4) shows that shallow groundwater flow is toward the drainage ditch along the southwest side of the site, with a gradient of approximately 0.037 ft/ft.

3.15.2 SITE INVESTIGATION

GROUNDWATER

One shallow monitoring well was installed during the initial site investigation in 1984. Groundwater samples from the shallow well (54GW1) and Supply Well 5009 (54GW2) were collected and analyzed for: cadmium, chromium, lead, O&G, VOCs, and total phenols. Appendix A presents a detailed listing of all target analytes and their abbreviations. Analytical results for the target analytes detected above method detection limits are presented in Table 54-1. The July 1984 results indicate that chromium, O&G, and phenols were detected in Well 54GW1, but only phenols were detected in the Supply Well 5009 (54GW2). No VOCs were detected in either of the 1984 samples.

Two additional shallow monitoring wells (54GW2 and 54GW3) were installed during the 1986 investigation, one upgradient and one downgradient of the

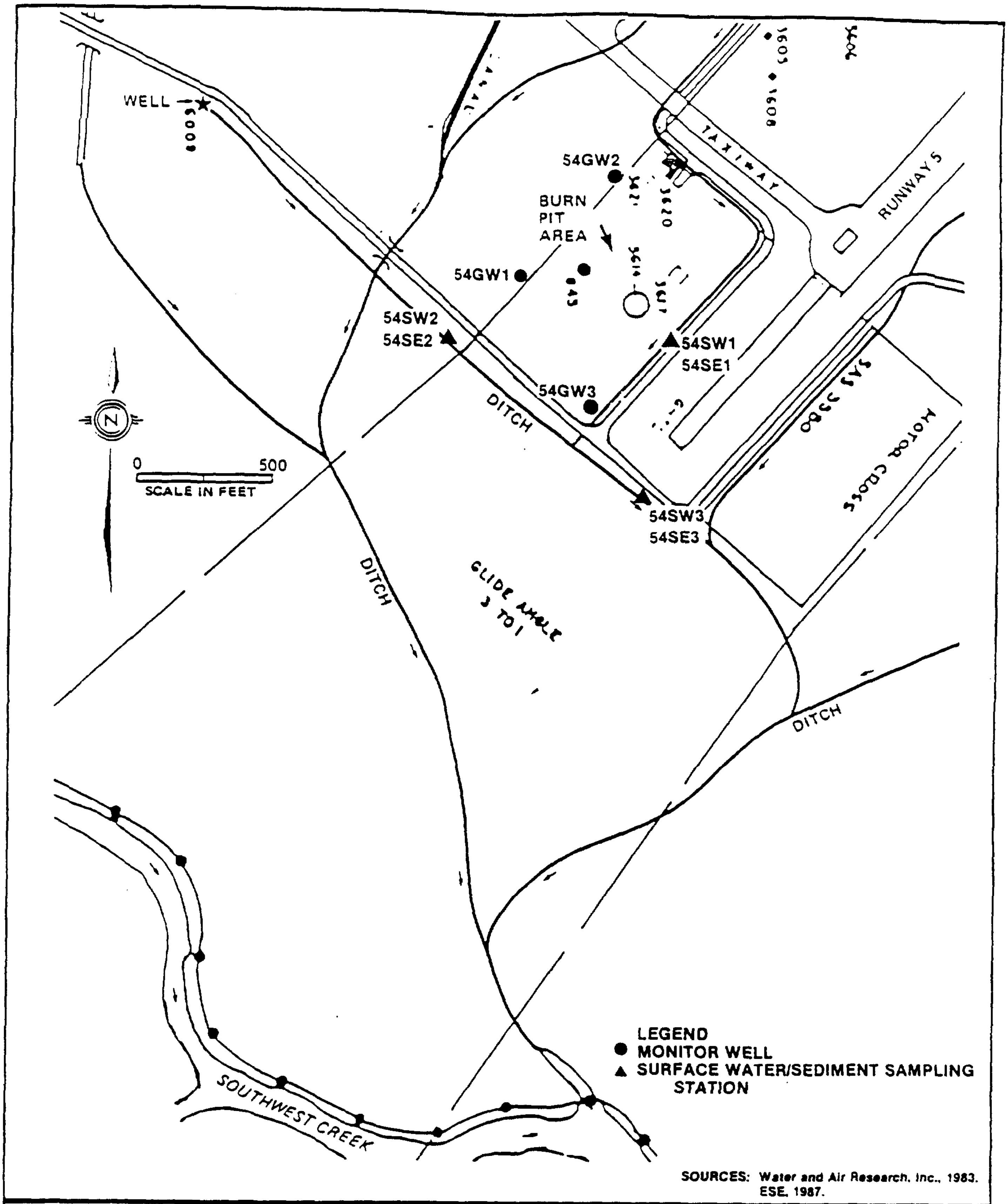


Figure 54-1
SAMPLING LOCATIONS, SITE 54—
CRASH CREW FIRE TRAINING BURN PIT

MARINE CORPS BASE
CAMP LEJEUNE

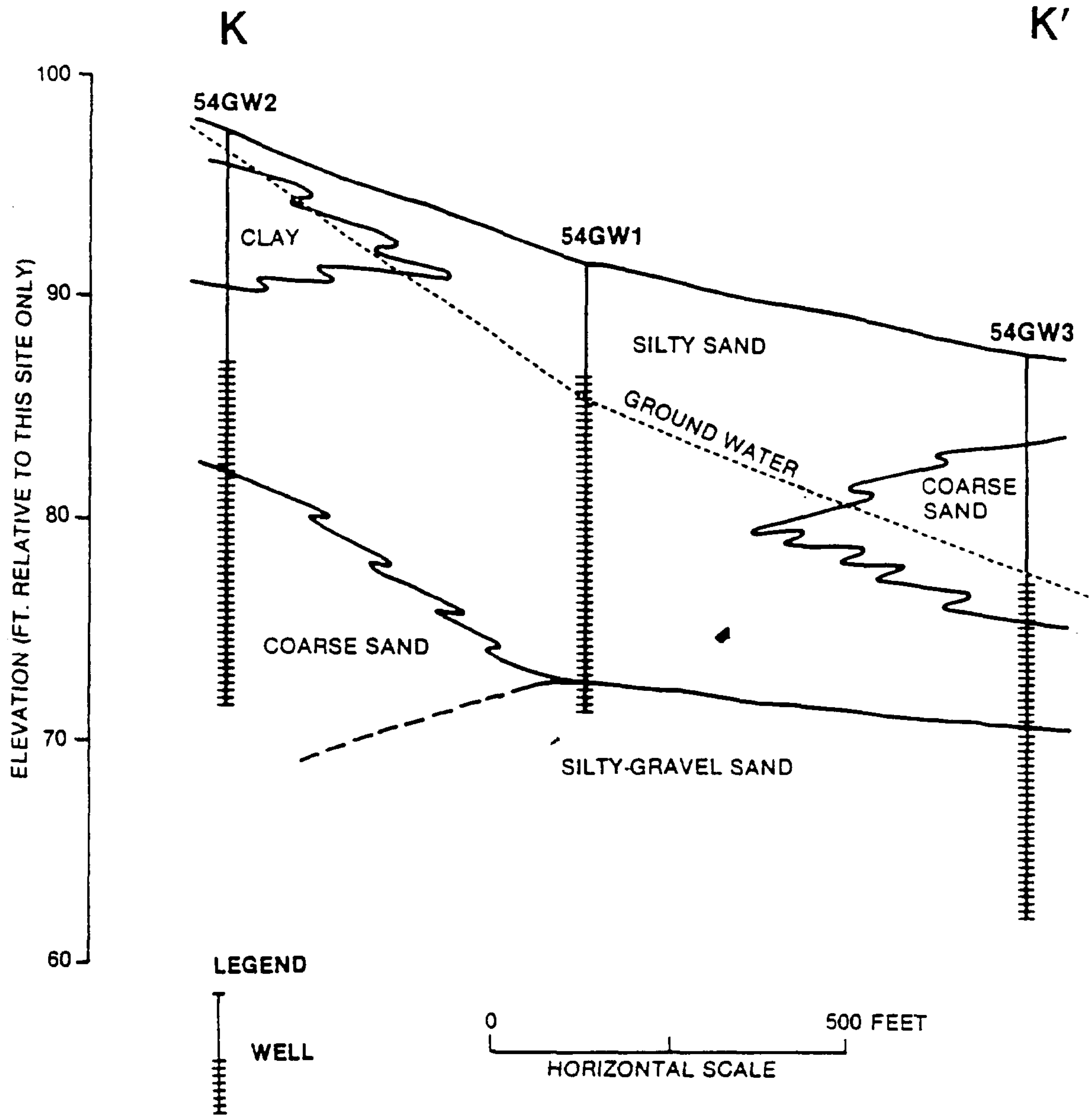


Figure 54-2
GEOLOGIC CROSS SECTION, SITE 54—
CRASH CREW FIRE TRAINING BURN PIT

MARINE CORPS BASE
CAMP LEJEUNE

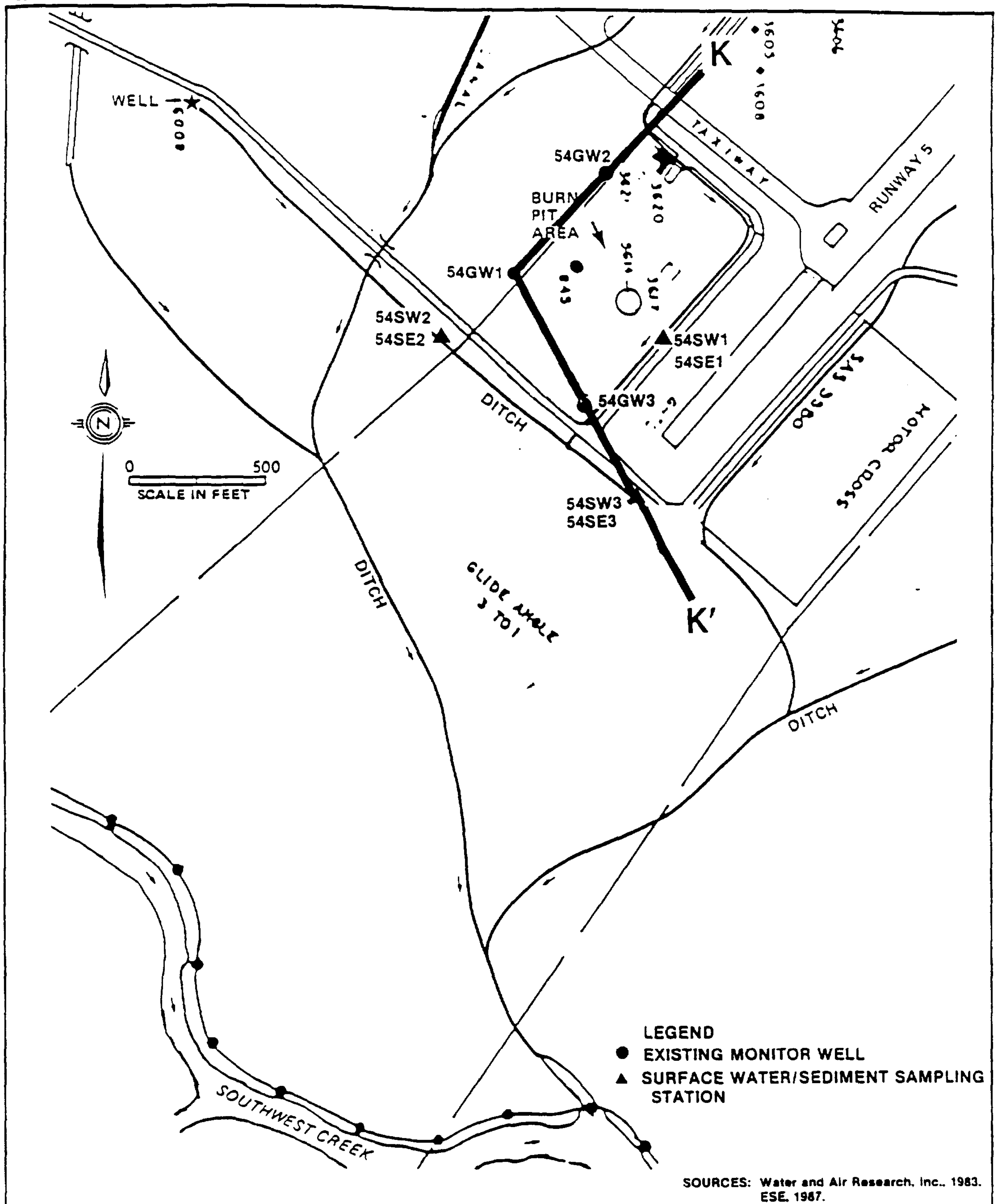


Figure 54-3
GEOLOGIC CROSS SECTION LOCATION, SITE 54—CRASH CREW FIRE TRAINING BURN PIT

MARINE CORPS BASE
CAMP LEJEUNE

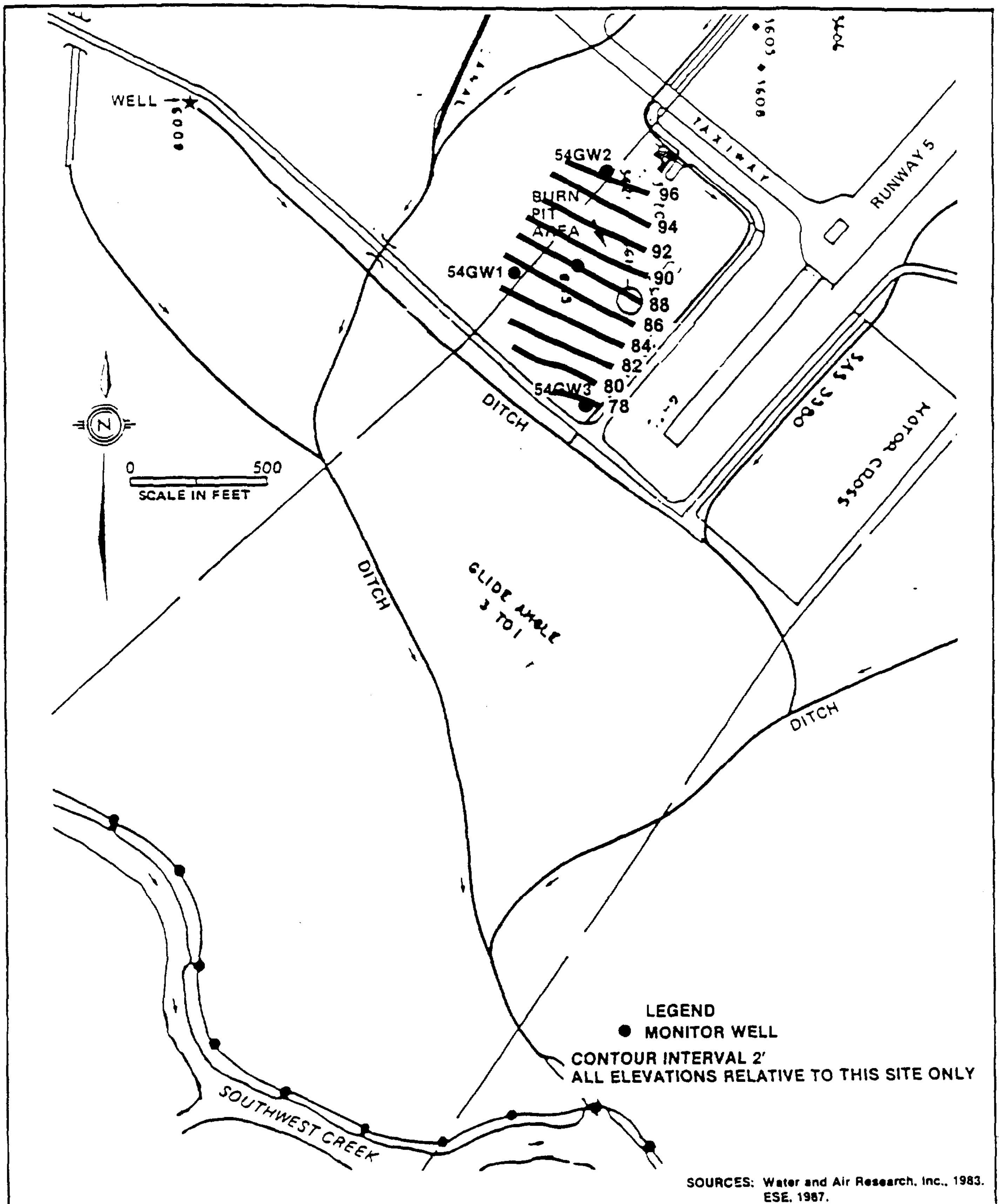


Figure 54-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 54—
CRASH CREW FIRE TRAINING BURN PIT

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 54-1. SITE 54 - CRASH CREW FIRE TRAINING BURN PIT
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	NC GW STANDARDS	54GW1 7/16/84	54GW1 12/11/86	54GW2 7/16/84	54GW2 12/10/86	54GW2 3/5/87	54GW3 12/10/86	54GW3 3/5/87
PARAMETER								
CHROMIUM	50	60	10.7	<8	67.9	28	23.9	32
CHROMIUM(+6)	NONE	NA	<10	NA	14.6	45.9	<10	12.1
LEAD	50	<40	<27	<40	<27	27	<27	<27
OIL & GREASE	NONE	1000	3000	<900	<300	1000	2000	2000
PHENOLS	NONE	3	4	2	<2	<2	6	<2

All units in micrograms per liter (ug/L), this approximates parts per billion (ppb).

Source: ESE, 1990.

existing monitoring well. Samples were collected from these two new wells and the existing shallow well and analyzed for the following target compounds:

- o Cadmium
- o Chromium
- o Hexavalent Chromium
- o Lead
- o Oil & grease (O&G)
- o Volatile organics (VOC)
- o Total phenols
- o Xylene
- o Methyl ethyl ketone
- o Methyl isobutyl ketone
- o Ethylene dibromide

Appendix A presents a detailed listing of all target compounds and their abbreviations.

Table 54-1 presents the analytical results from the December 1986 and March 1987 sampling effort. It should be noted that the 1986 and 1987 analytical results for Monitoring Well 54GW2 represents the upgradient shallow monitoring well and not Supply Well 5009 which was sampled in 1984.

The December 1986 and March 1987 results indicate that the samples collected from upgradient Well 54GW2 contained both total chromium and hexavalent chromium. The sample collected in March 1987 also contained a quantifiable amount of lead (27 ug/L), below North Carolina's Groundwater Standard. At least one of the samples collected from downgradient monitoring well 54GW3 also contained levels of chromium and hexavalent chromium. O&G was documented in each of the samples collected with concentrations ranging from 1000 to 3000 ug/L.

The groundwater sample collected from Well 54GW1 contained the same compounds as in the 1984 sampling effort, chromium, O&G and phenols. None of the groundwater samples collected during the 1986/87 sampling investigation contained VOCs.

SURFACE WATER/SEDIMENT

Three surface water and sediment locations along the drainage ditch southeast and southwest of the pit were sampled during the December 1986 sampling effort (Figure 54-1). The surface water samples were analyzed for the same target compounds as the groundwater samples. The sediment samples were analyzed for the following analytes:

- o Cadmium
- o Chromium
- o Hexavalent Chromium
- o Lead
- o Oil & grease (O&G)
- o Total phenols
- o Ethylene dibromide

The analytical results indicate that total phenols at a concentration of 3 ug/L were detected in the surface water sample (54SW1) collected from the ditch along the southeast side of the site. Because this was the only target analyte detected in any of the surface water samples, a separate table has not been prepared.

Analytical results for the three sediment samples are presented in Table 54-2. All three of the samples contained chromium, O&G, and total phenols. The two upstream samples also contained lead. None of the samples contained VOCs.

SOILS

During the 1984 investigation, nine soil borings were hand augered around the burn pit area to visually determine if contamination of the shallow groundwater underlying the site had occurred. The results of the soil boring investigation indicate that contamination by waste POL underlies the site to the east and southeast of the burn pit, as evidenced by a fuel odor detected

TABLE 54-2. SITE 54 - CRASH CREW FIRE TRAINING BURN PIT
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	54SE1	54SE2	54SE3
DATE	12/10/86	12/10/86	12/10/86
PARAMETER			
CHROMIUM	19.3	6.45	6.48
LEAD	28.2	9.36	<6.73
OIL & GREASE	998	884	1560
PHENOLS	0.443	0.334	2.01

All units in micrograms per gram (ug/g), this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

during augering in these areas. In addition during periods of high rainfall, quantities of waste POL have been observed to seep from the ground into the drainage ditches.

3.15.3 SUMMARY AND CONCLUSIONS

The samples collected from Wells 54GW1 and 54GW2 contained concentrations of chromium in excess of North Carolina's Groundwater Standards for this metal. The state does not have a separate standard for hexavalent chromium.

Although the surface water samples did not contain any significant concentrations of the target analytes, the sediment samples did contain two metals, phenols, and O&G. The presence of O&G is consistent with the findings of the groundwater samples.

The immediate human health concern at this site is the status of the nearby Water Supply Well 5009. The existing data do not indicate that degradation of this potable supply has occurred as a result of the activities at the fire training pit. However the existing database does suggest that low-level contamination does exist in the shallow groundwater, soils, and sediments.

3.15.5 RECOMMENDATIONS

Detectable levels of contamination have been identified at Site 54. However, most of the contaminants are of low toxicity. Rather than expending considerable resources to accurately define the volumes of contaminated soil, sediment, and groundwater, it may be more productive to conduct a Risk Assessment to determine if low levels of low toxicity substances pose a threat to health and the environment. If an unacceptable risk is identified, additional environmental sampling to support the FS process would be required.

3.16 SITE 68 - RIFLE RANGE DUMP

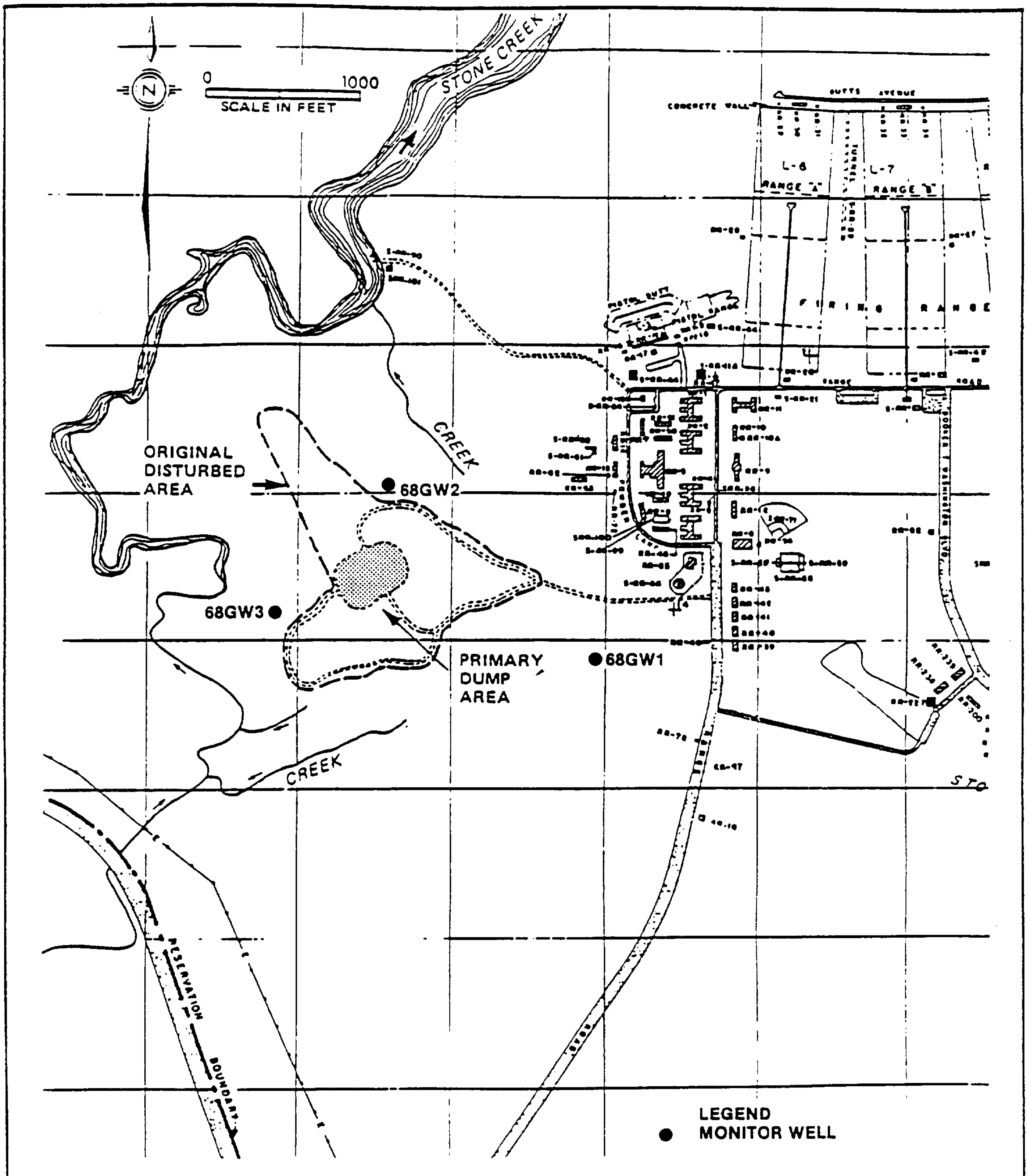
3.16.1 SITE BACKGROUND

The Rifle Range Dump (Figure 68-1) is located west of Range Road approximately 2,000 feet west of the Rifle Range water treatment plant, and 800 feet east of Stone Creek (PWDM Coordinates 16, H6-8/ 16-7). This 3 to 4 acre area was used as a disposal site for various types of wastes including: garbage, building debris, waste treatment sludge, and solvents. The fill lies within a 30 to 40 acre area that showed, in aerial photographs, signs of previous disturbance. However this disturbance may be related to logging activities. The depth of the fill area is approximately 10 feet, and the amount of material deposited has been estimated to be 100,000 cubic yards. An estimated 2,000 gallons of waste solvents were reportedly deposited.

This currently inactive landfill was utilized as a disposal facility for a period of thirty years from 1942 to 1972. The major concern is the potential for waste solvents to affect the groundwater quality beneath the site and stems from the appearance of organic compounds identified in the potable supply wells RR-45 and RR-97. Even though these wells are located upgradient from the site it was suspected that continuous pumping of the well may have drawn contaminants to the wells.

The site topography is variable with elevations ranging from 50 feet msl to the east to 5 feet msl to the northwest. The slope of the site is to the northwest toward Stone Creek. The soils at the Rifle Range Dump are primarily sandy and favor rapid infiltration of surface precipitation. There is however, evidence that surface water runoff does occur in a northwest direction toward Stone Creek.

The site is underlain by sharply dipping layers of silty sand, silty clayey sand, sand, and sandy clay (Figures 68-2 and 68-3). The surface of the shallow groundwater lies within the silty sand at depths ranging from 4.83 ft and 16 ft below ground surface. Groundwater occurs through primary features such as pore spaces between the sand particles. The shallow groundwater flow is in the direction of the topographic slope (northwest) toward Stone Creek



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 68-1
SAMPLING LOCATIONS, SITE 68—
RIFLE RANGE DUMP

MARINE CORPS BASE
CAMP LEJEUNE

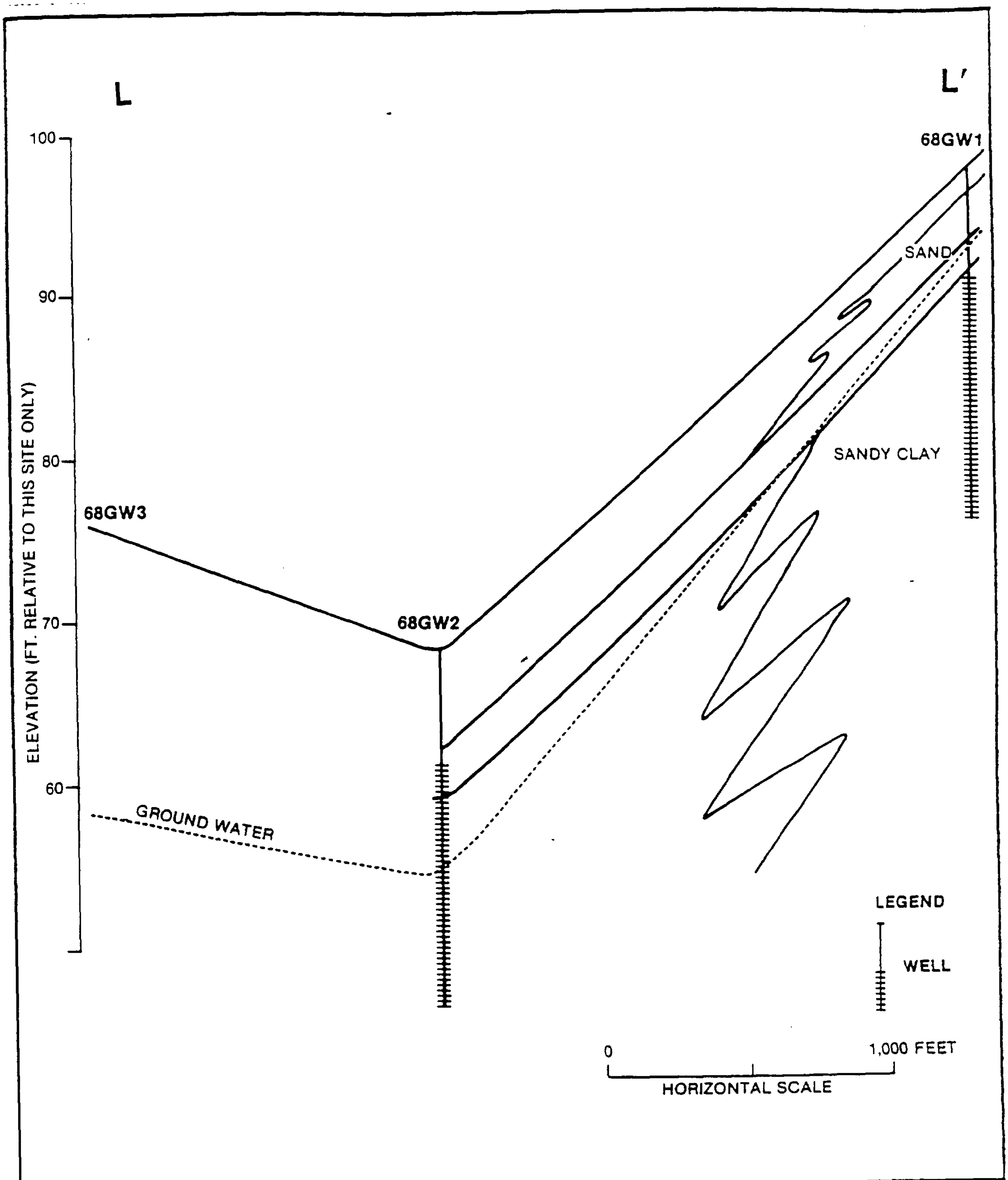
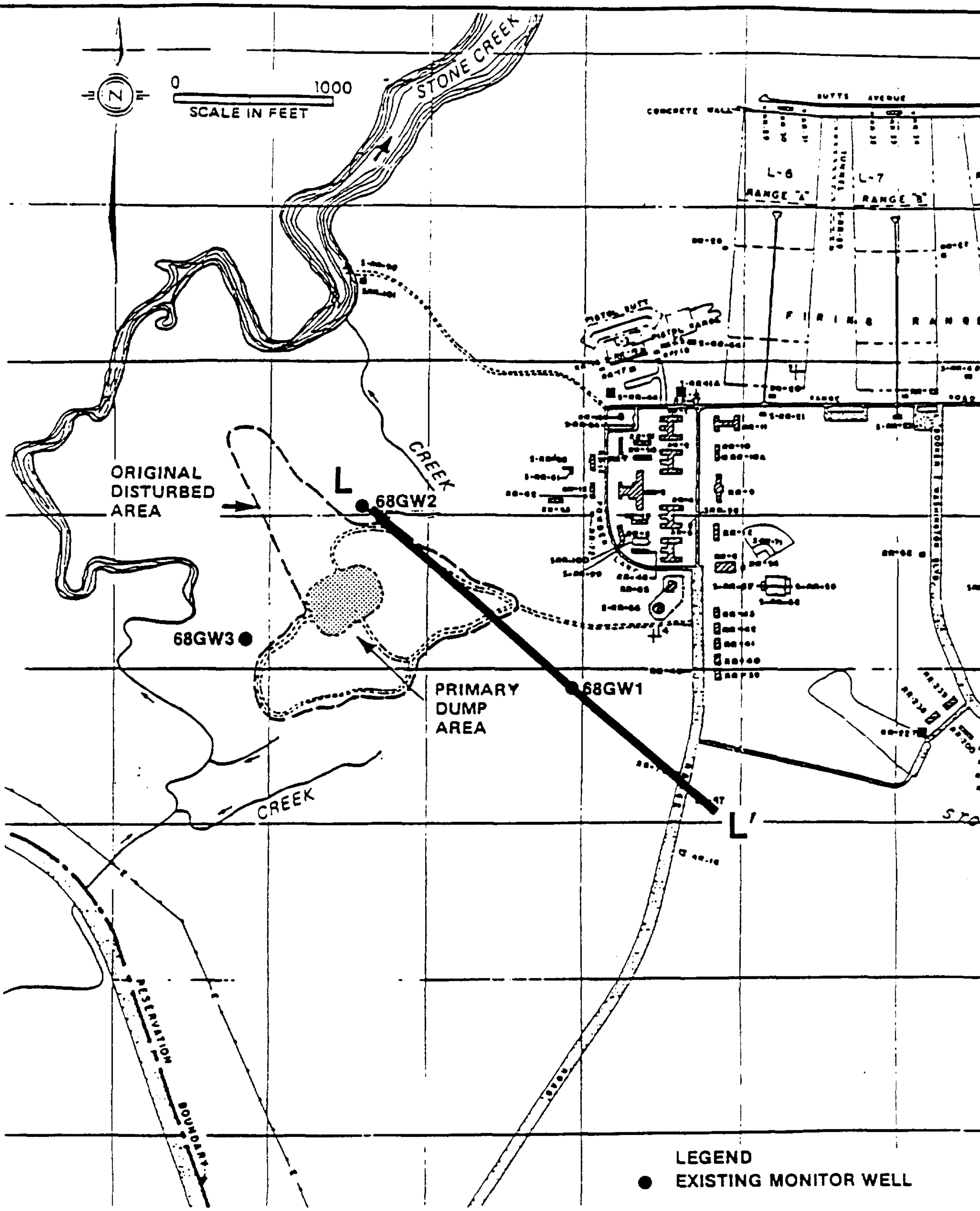


Figure 68-2
GEOLOGIC CROSS SECTION, SITE 68—
RIFLE RANGE DUMP

MARINE CORPS BASE
CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 68-3
GEOLOGIC CROSS SECTION LOCATION, SITE 68—RIFLE RANGE DUMP

MARINE CORPS BASE
CAMP LEJEUNE

(Figure 68-4). The groundwater flow gradient has been measured to be approximately 0.016 ft/ft to the northwest.

3.16.2 SITE INVESTIGATION

GROUNDWATER

Three monitoring wells (Figure 68-1) were installed around the landfill in 1984. Well 68GW1 is located on the upgradient side of the disposal area between the filled area and Supply Wells RR-45 and RR-97. Well 68GW2 is located on the downgradient (northern) side of the fill area between the fill and Stone Creek. Well 68GW3 is also located downgradient of the fill area (west) between the fill area and Stone Creek. These monitoring wells and the Supply Wells RR-45 (68GW4) and RR-97 (68GW5) were sampled as part of the 1984 investigation. The groundwater samples were analyzed for VOCs. Appendix A presents a detailed listing of all target analytes and their abbreviations. The analysis of these samples did not identify any of the compounds of concern in any of the five wells that were sampled.

The shallow monitoring wells (68GW1, 68GW2 and 68GW3) were resampled as part of the investigation performed in November 1986. These samples were analyzed for the same analytes as in the 1984 sampling effort. The 1986 sampling effort did not detect any of the compounds of concern.

3.16.3 SUMMARY AND CONCLUSIONS

The results of the two rounds of sampling indicate that contaminants, if present, are not migrating from the fill area via the shallow aquifer. This information would also indicate that the VOCs identified in the supply wells are no longer present at detectable levels. The source of the VOCs detected in 1981 has not been identified. The fact that the shallow monitor wells do not contain any of the target analytes may suggest that the one time presence of the VOCs in the deep supply wells may be related to laboratory artifacts or use of minor quantities of degreasing solvents in the immediate vicinity of the wells.

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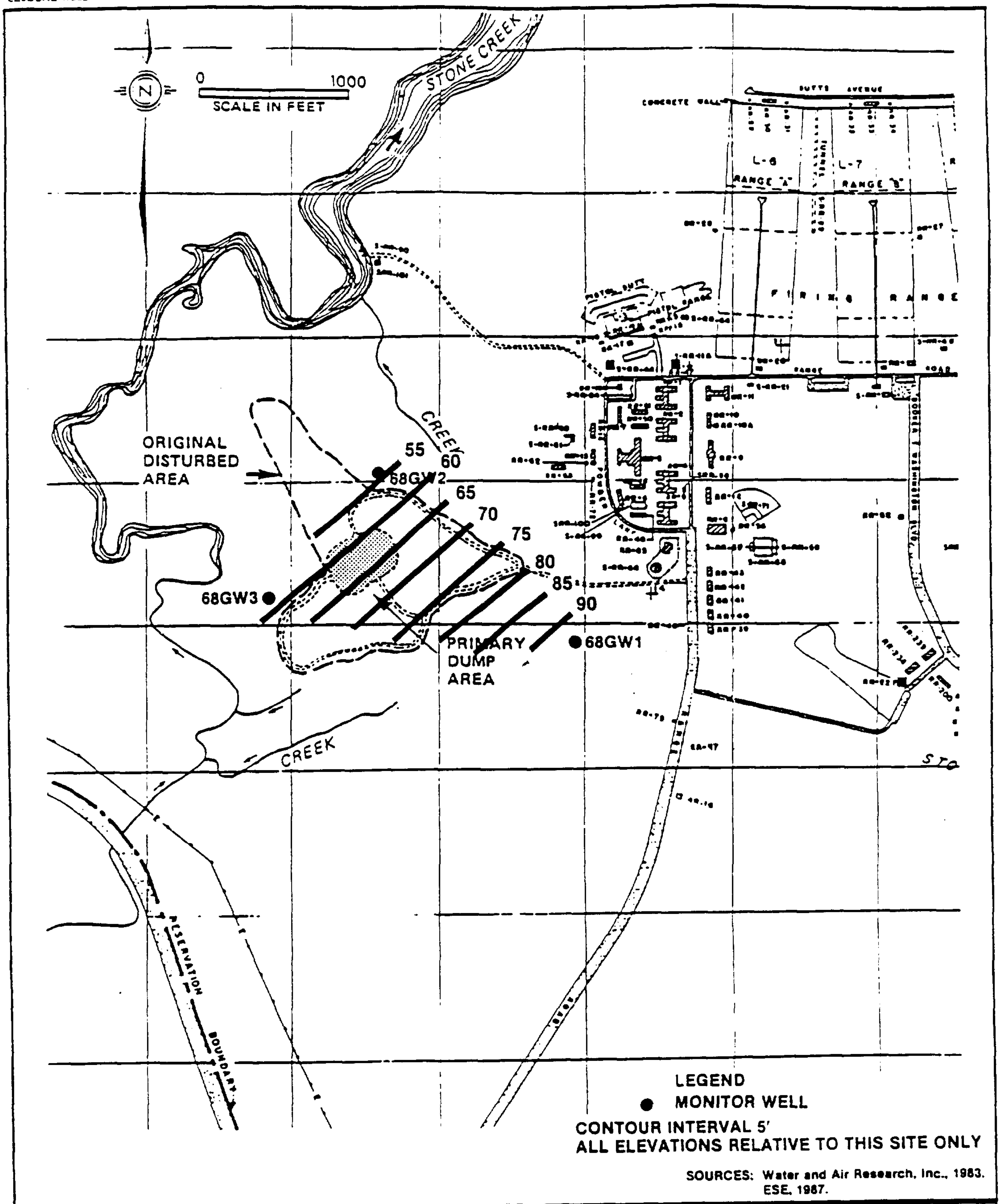


Figure 68-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 68—
RIFLE RANGE DUMP

MARINE CORPS BASE
CAMP LEJEUNE

3.16.4 RECOMMENDATIONS

It is recommended that the supply wells be monitored on a quarterly basis to ensure acceptable water quality is maintained. Additionally the shallow monitoring wells should be sampled on a yearly basis to insure that contaminants do not begin to migrate from the fill area. No other investigative efforts are warranted.

3.17 SITE 69 - RIFLE RANGE CHEMICAL DUMP

3.17.1 SITE BACKGROUND

The Rifle Range Chemical Dump (Figure 69-1) is located approximately 9,000 feet east of the intersection of Range Road and Sneads Ferry Road, north of Everett Creek (PWDM coordinates 16, L14- 15/ M14- 15). The site is an estimated six acres in size, containing approximately 93,000 cubic yards of material. Available records indicate the site was active from the early 1950's until 1976. It is reported that the site was utilized as a disposal area for all chemical wastes generated on the base. The list of materials disposed of at the site include the following materials: pentachlorophenol, DDT, Trichloroethylene, malathion, diazinon, lindane, gas cylinders, HTH, PCB's, drums that appeared to contain training agent consisting of chloroacetophenone (CN) gas, all other hazardous materials generated or used on the base, and chemical agent test kits for chemical warfare, which contain no agent substances. The disposal of material was conducted in trenches or pits which were between 6 to 20 feet deep. At least twelve different disposal events have been documented.

The AOC is primarily underlain by silty sand and sandy clay, with discontinuous layers of clayey sand, sand, sandy silt, and clayey silt. Figures 69-2 and 69-3 are geologic cross sections of the site. Figure 69-4 depicts the areas through which these cross sections were drawn. The shallow groundwater occurs primarily within the silty sand at depths ranging from 2.11 to 20.24 feet below land surface. The groundwater contour map (Figure 69-5) indicates that groundwater flow beneath the site is broken by watershed boundaries. Groundwater northwest of Wells 69GW1 and 69GW4 flows to the northwest and the groundwater south of these wells flows to the southeast. Additionally, a water shed boundary exists between Wells 69GW1 and 69GW2. This divide runs in a northerly direction causing groundwater flow to move in an easterly direction east of 69GW2 and a westerly direction west of this well. Typical groundwater gradients beneath this site average 0.032 ft/ft.

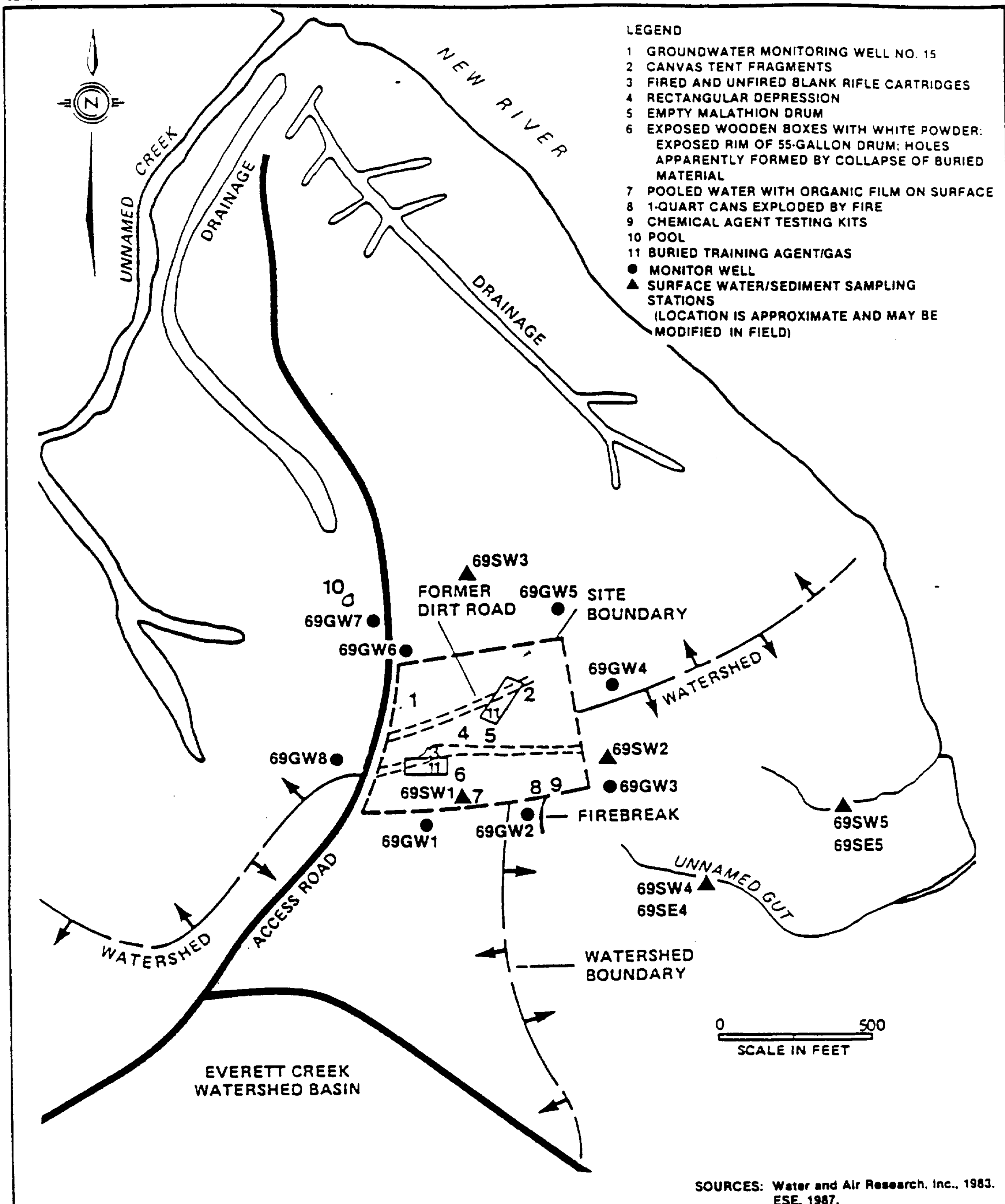


Figure 69-1
SAMPLING LOCATIONS, SITE 69—RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE CAMP LEJEUNE

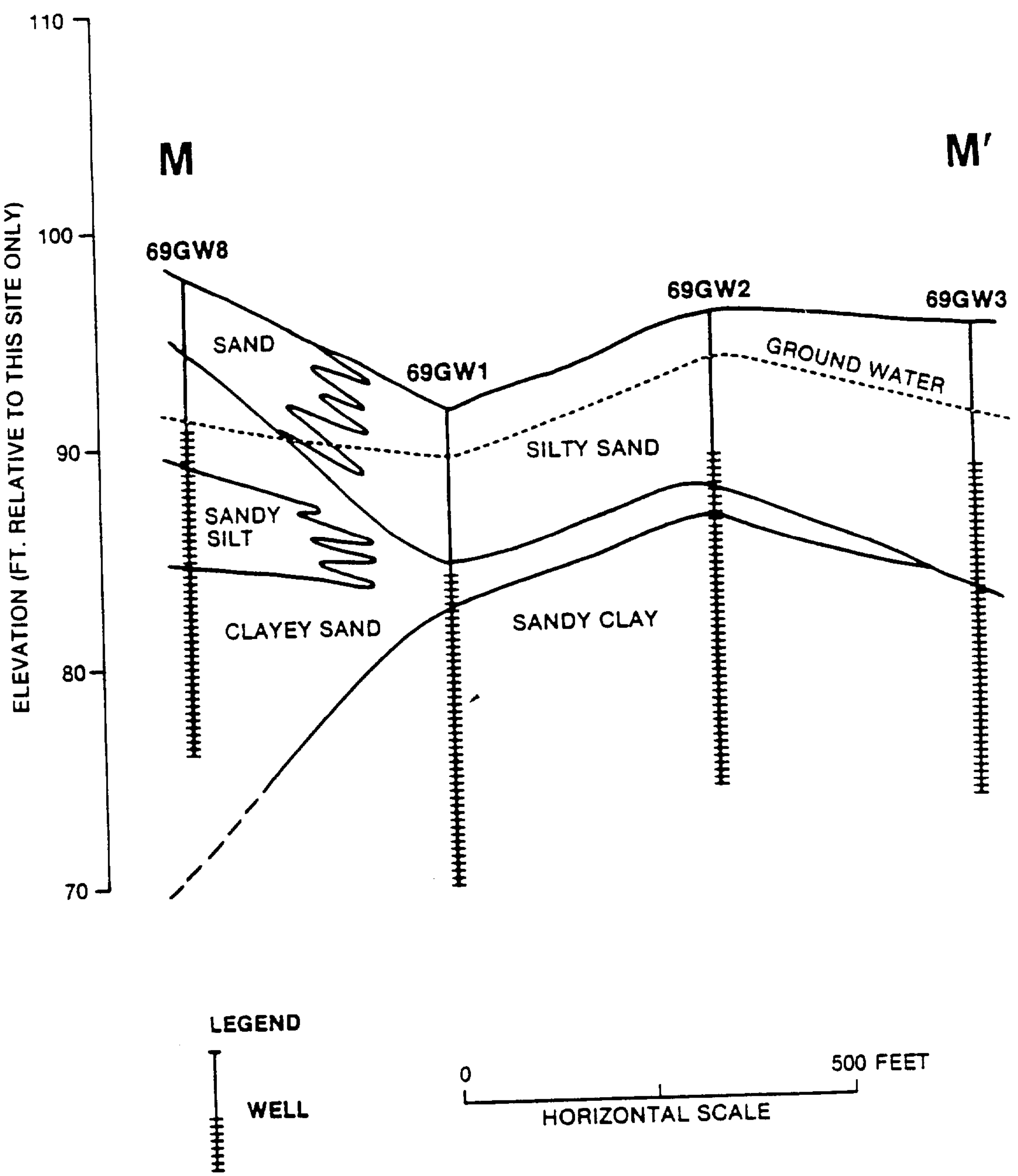


Figure 69-2
GEOLOGIC CROSS SECTION M—M', SITE 69—
RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

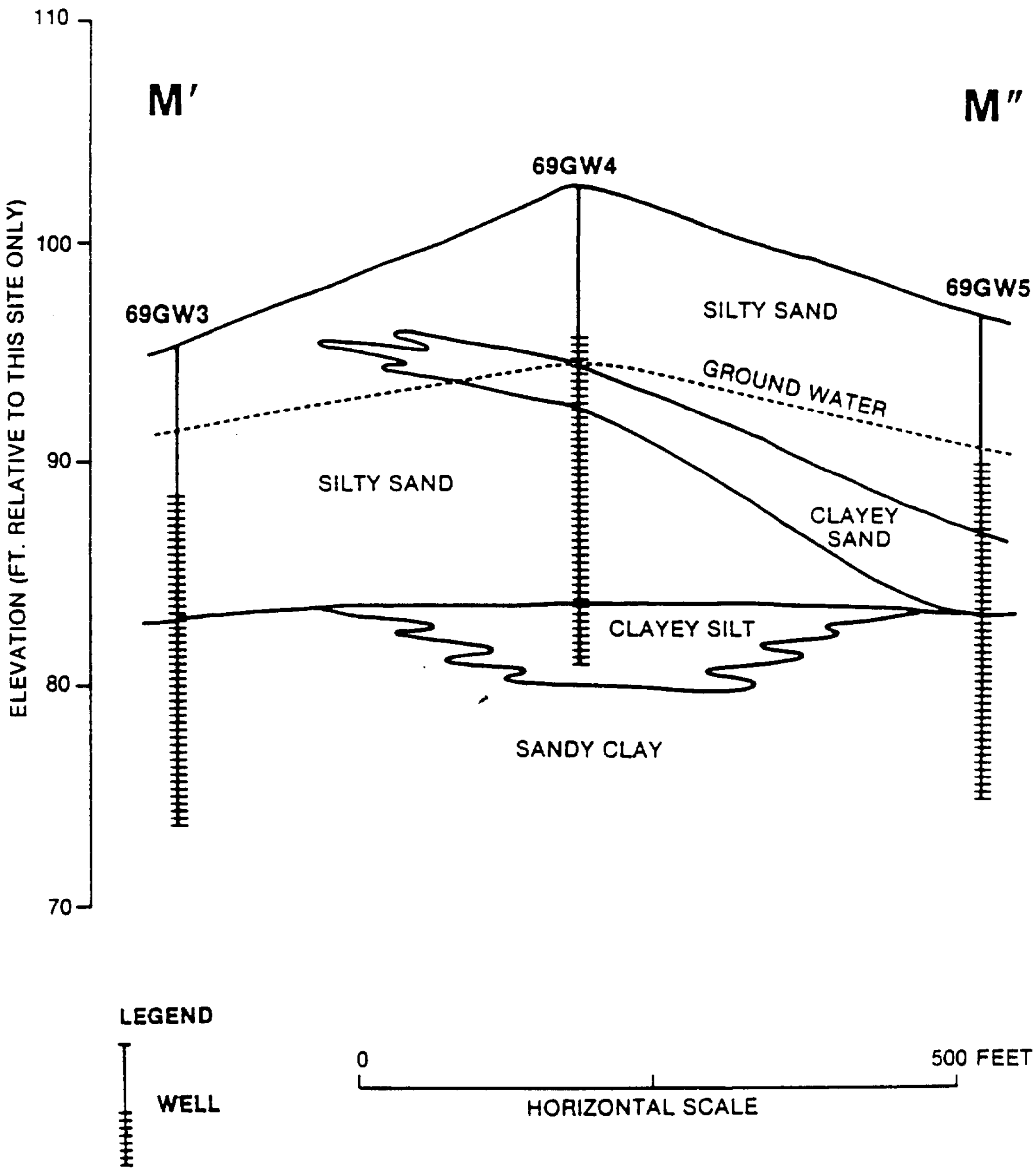


Figure 69-3
GEOLOGIC CROSS SECTION M′—M″, SITE 69—
RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

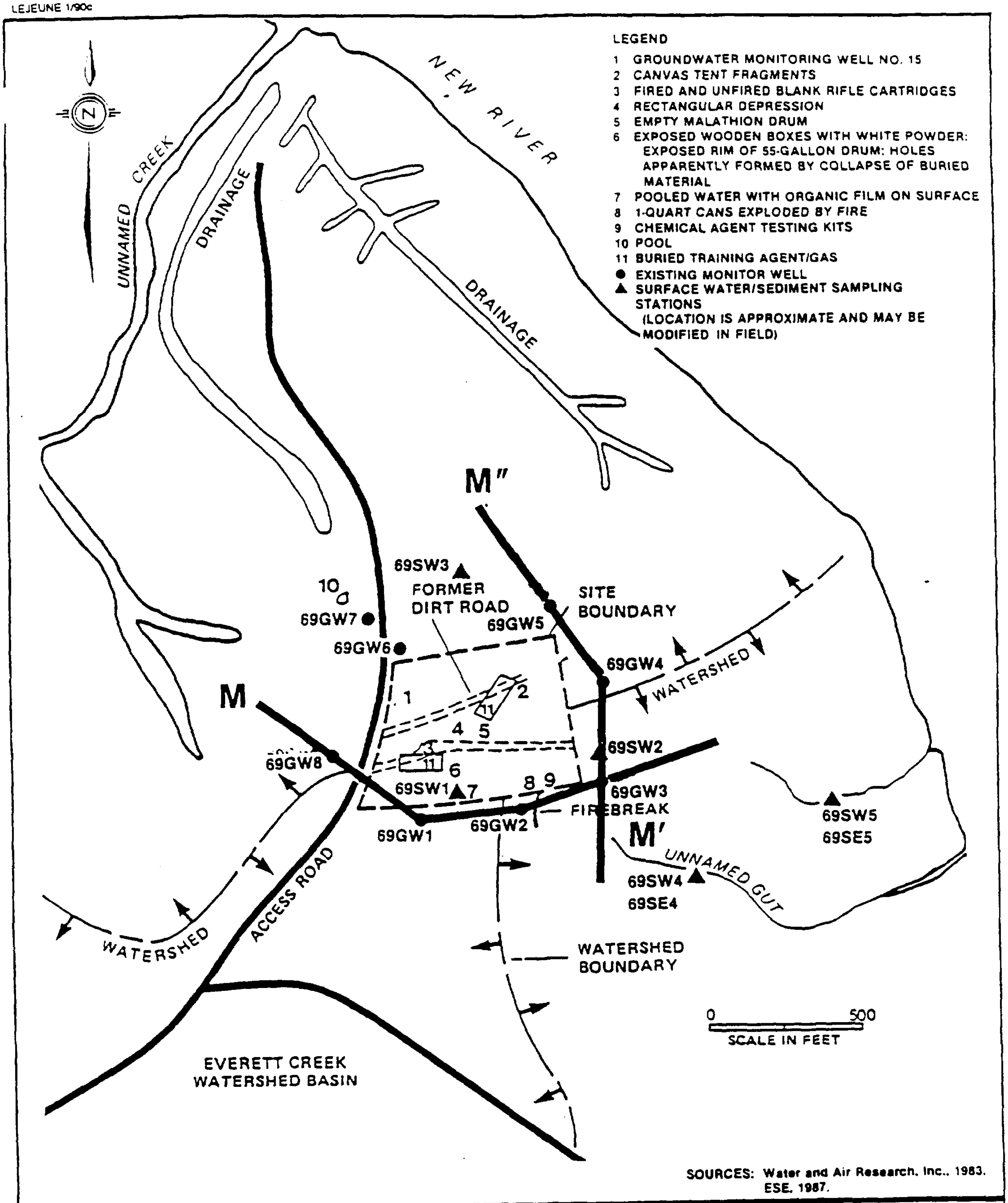


Figure 69-4
GEOLOGIC CROSS SECTION LOCATION, SITE 69—RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

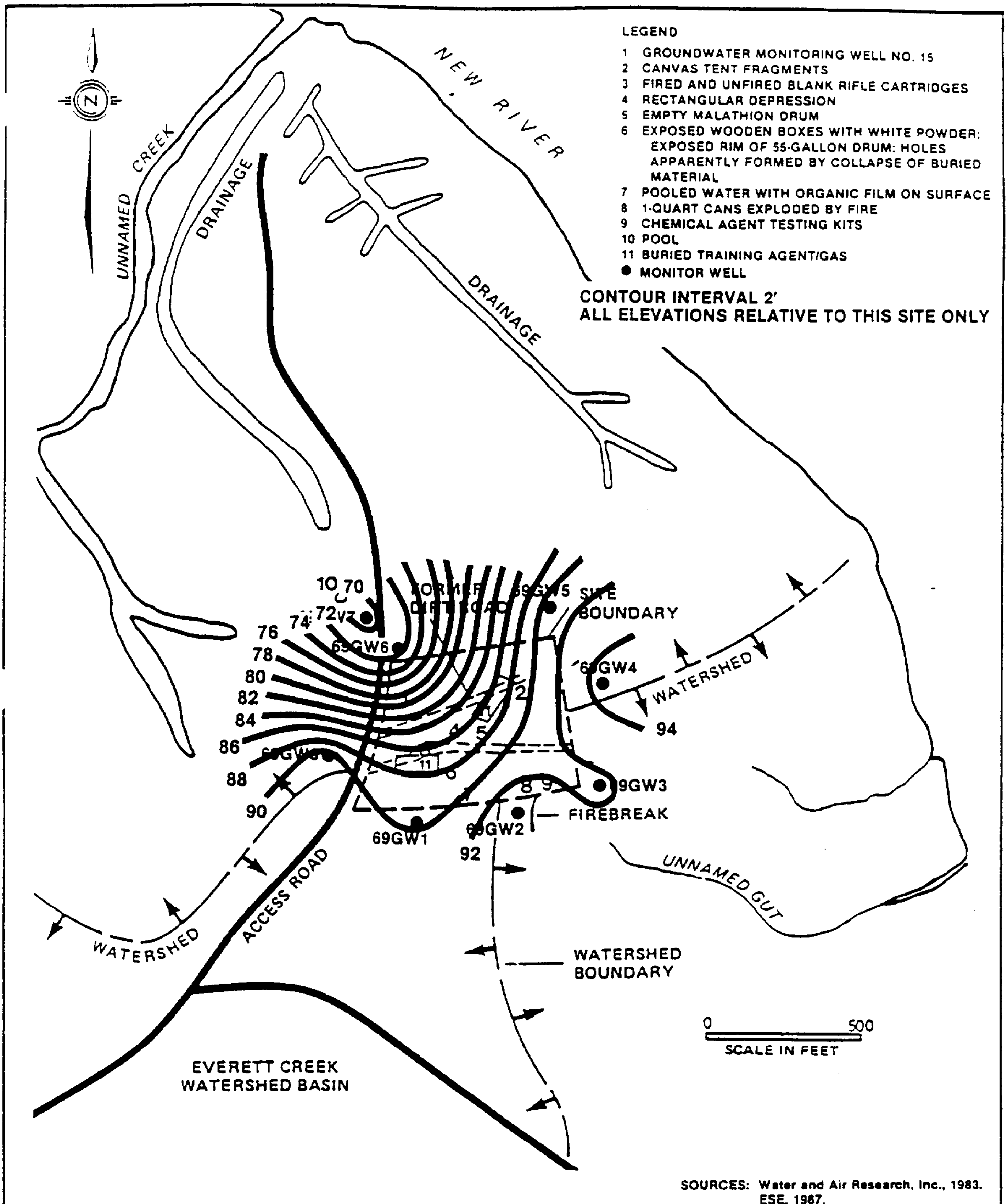


Figure 69-5
GROUND WATER CONTOUR MAP—SHALLOW AQUIFER, SITE 69—RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

3.17.2 SITE INVESTIGATION

GROUNDWATER

Eight groundwater monitoring wells were installed as part of the investigation in 1984. Figure 69-1 shows the location of these wells. Wells 69GW1 and 69GW2 are located south and down gradient of the disposal area. Wells 69GW3 and 69GW4 are located east of the disposal area. Wells 69GW5, 69GW6, and 69GW7 are located north of the disposal area. Well 69GW8 is located west of the site. The groundwater samples collected during July and August 1984 were analyzed for the following target compounds: organochlorine pesticides, PCB's, pentachlorophenol, VOCs, mercury, and residual chlorine. Table 69-1 lists those analytes that were detected at levels greater than the method detection limit.

The samples collected during December 1986 were analyzed for the same target analytes plus the following additional compounds: tetrachlorodioxin, xylene, methyl ethyl ketone, methyl isobutyl ketone, and ethylene dibromide. The results of these investigations show that the groundwater contains high levels of VOCs (Table 69-1).

SURFACE WATER AND SEDIMENTS

Samples of surface water and sediments were collected in the vicinity of the disposal area. These samples contained detectable concentrations of the same compounds identified in the groundwater. Tables 69-2 and 69-3 list those compounds detected in the surface water and sediment samples collected from Site 69. These data indicate that the contaminants within the filled areas periodically discharge into the surface water network.

3.17.3 SUMMARY AND CONCLUSIONS

Contamination at the Rifle Range Chemical Dump is extensive. VOCs have been identified in all media sampled. In addition pesticides and pentachlorophenol have been identified in the surface water and sediment at this AOC. It appears that the contamination detected is concentrated at the southern portion of the filled area. This would indicate that most of the disposal activity may have been conducted in this area. Evidence of the

TABLE 69-1. SITE 69 - RIFLE RANGE CHEMICAL DUMP (Page 1 of 2)

DETECTED TARGET ANALYTES

GROUND WATER SAMPLES

	NC GW	69GW1	69GW1	69GW2	69GW2	69GW3	69GW3	69GW4	69GW4
DATE	STANDARDS	7/18/84	12/12/86	7/18/84	12/17/86	7/18/84	12/17/86	7/18/84	12/18/86
PARAMETER									
MERCURY	1.1	0.2	0.2	<0.2	0.2	<0.2	0.2	<0.2	0.2
BHC,B	NONE	<0.0001	<0.013	<0.0001	<0.013	<0.0001	0.087	<0.0001	<0.013
BHC,D	NONE	<0.0003	NR	<0.0003	0.034	<0.0003	2.44	<0.0003	<0.013
1,2-DIBROMOETHANE	NONE	NA	<0.02	NA	4.74	NA	0.363	NA	<0.02
BENZENE	1	<0.3	<1	0.7	<25	4	4	<0.6	<1
CHLOROBENZENE	300	<0.5	<6	<0.5	<150	49	55	<0.9	<6
CHLOROFORM	0.19	<0.7	<1.6	<0.6	<40	<0.6	<1.6	1.3	14
1,2-DICHLOROETHANE	0.38	<1	<2.8	5.9	<70	1.9	<2.8	<1.8	<2.8
1,1-DICHLOROETHYLENE	7	<1.2	<2.8	1.6	<70	2.7	<2.8	<2.4	<2.8
T-1,2-DICHLORO-									
ETHENE	70	<1.2	<1.6	9700	37000	4000	830	410	91
METHYLENE CHLORIDE	5	10	<2.8	<1	<70	<1	<2.8	<2	<2.8
1,1,2,2-TETRACHLORO-									
ETHANE	NONE	<0.9	<4.1	44	<100	<0.8	<4.1	2	5.4
TETRACHLOROETHENE	NONE	<1.7	<3	20	<75	<1.6	<3	<3.3	<3
1,1,2-TRICHLORO-									
ETHANE	NONE	<1.2	<5	7.9	<130	<1.2	<5	3.1	<5
TRICHLOROETHENE	NONE	<1.3	<3	340	710	4.9	<3	<2.5	<3
TOLUENE	1000	0.7	<6	5	<150	14	10	<1	<6
VINYL CHLORIDE	0.015	<0.9	<1	80	440	2	1.6	<2	<1

NA: not analyzed.

NR: not reported.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 69-1. SITE 69 - RIFLE RANGE CHEMICAL DUMP (Page 2 of 2)

DETECTED TARGET ANALYTES

GROUND WATER SAMPLES

DATE / PARAMETER	NC GW STANDARDS	69GW5 7/18/84	69GW5 12/18/86	69GW6 7/18/84	69GW6 12/18/86	69GW7 7/18/84	69GW7 12/18/86	69GW8 7/18/84	69GW8 12/18/86
MERCURY	1.1	<0.2	<0.2	<0.2	0.2	<0.2	0.2	<0.2	0.2
BHC,B	NONE	<0.0001	<0.017	<0.0001	<0.013	<0.0001	<0.013	<0.0001	<0.013
BHC,D	NONE	<0.0003	<0.017	<0.0003	<0.013	<0.0003	<0.013	<0.0003	<0.013
1,2-DIBROMOETHANE	NONE	NA	<0.02	NA	<0.02	NA	<0.02	NA	<0.02
BENZENE	1	<0.3	<1	<0.3	<1	<0.3	<1	<0.3	<1
CHLOROBENZENE	300	<0.5	<6	<0.5	<6	<0.5	<6	<0.5	<6
CHLOROFORM	0.19	<0.7	<1.6	<0.6	<1.6	<0.7	<1.6	<0.7	<1.6
1,2-DICHLOROETHANE	0.38	<1	<2.8	<0.9	<2.8	<1	<2.8	<1	<2.8
1,1-DICHLOROETHYLENE	7	<1.2	<2.8	<1.2	<2.8	<1.2	<2.8	<1.3	<2.8
T-1,2-DICHLORO-									
ETHENE	70	<1.2	4.2	<1.2	<1.6	<1.2	<1.6	<1.2	<1.6
METHYLENE CHLORIDE	5	<1	<2.8	<1	<2.8	<1	<2.8	<1	<2.8
1,1,2,2-TETRACHLORO-									
ETHANE	NONE	<0.9	<4.1	<0.8	<4.1	<0.9	<4.1	<0.9	<4.1
TETRACHLOROETHENE	NONE	<1.7	<3	<1.6	<3	<1.7	<3	<1.7	<3
1,1,2-TRICHLORO-									
ETHANE	NONE	<1.2	<5	<1.2	<5	<1.2	<5	<1.2	<5
TRICHLOROETHENE	NONE	<1.3	<3	<1.3	<3	<1.3	<3	<1.3	<3
TOLUENE	1000	<0.6	<6	<0.6	<6	<0.6	<6	<0.6	<6
VINYL CHLORIDE	0.015	<1	<1	<0.9	<1	<1	<1	<0.9	<1

NA: not analyzed.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

TABLE 69-2. SITE 69 - RIFLE RANGE CHEMICAL DUMP
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES

DATE	NC SW STANDARDS	69SW1 8/4/84	69SW1 8/4/84	69SW1 12/12/86	69SW2 8/4/84	69SW2 12/12/86	69SW3 12/12/86
PARAMETER							
BHC,A	NONE	<0.001	<0.001	0.043	<0.001	0.056	<0.035
BHC,B	NONE	0.03	<0.0001	0.043	0.005	0.18	<0.013
BHC,D	NONE	0.2	<0.0003	NR	0.02	NR	NR
PENTACHLOROPHENOL	NONE	10	4	<0.89	<0.9	1.24	<0.89
BENZENE	NONE	0.4	NA	<1	<0.2	<1	<1
CHLOROBENZENE	NONE	2.1	NA	<6	<0.3	<6	<6
CHLOROFORM	NONE	6	NA	<1.6	<0.5	<1.6	<1.6
1,2-DICHLOROETHANE	NONE	0.9	NA	<2.8	<0.8	<2.8	<2.8
T-1,2-DICHLORO-ETHENE	NONE	410	NA	310	10	170	<1.6
ETHYLBENZENE	NONE	3	NA	<7.2	<0.6	<7.2	<7.2
METHYLENE CHLORIDE	NONE	<0.6	NA	<2.8	8	<2.8	<2.8
1,1,2,2-TETRACHLORO-ETHANE	NONE	59	NA	<4.1	<0.5	<4.1	<4.1
1,1,2-TRICHLORO-ETHANE	NONE	6	NA	<5	<0.8	<5	<5
TRICHLOROETHENE	NONE	55	NA	63	1.3	12	<3
TOLUENE	NONE	11	NA	<6	<0.4	<6	<6
VINYL CHLORIDE	NONE	15	NA	41	<0.6	<1	<1
MERCURY	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2

NA: not analyzed.
Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).
Source: ESE, 1990.

TABLE 69-3. SITE 69 - RIFLE RANGE CHEMICAL DUMP
DETECTED TARGET ANALTYES
SEDIMENT SAMPLES

	69SE4	69SE5
DATE	12/12/86	12/12/86
PARAMETER		
DDD,PP'	<0.0129	0.113
DDE,PP'	0.0188	<0.0224
PENTACHLOROPHENOL	1.190	<0.0513

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC sediment standards.

Source: ESE, 1990.

contaminants in surface water bodies and sediments would indicate that some of the buried material is near the surface. If this is the case, any disturbance of the soils may expose these materials to the atmosphere. This presents a high risk for direct contact exposure to the contaminants. This risk is due to the training exercises conducted in the area of Site 69 which may involve the potential for military personnel to become separated from the group and to enter Site 69. Signs are posted around Site 69; however, the area is not fenced. The site includes ponded surface water, open bags of pesticides, and exposed test kits. Due to the variety of contaminants at the land surface, exposure routes could include inhalation, dermal contact, and/or incidental ingestion.

3.17.4 RECOMMENDATIONS

The mixed wastes present at this AOC and its proximity to significant aquatic environments, represent a high risk to human health and the environment. Extensive field investigations in elevated levels of protection are required to determine the location and exact nature of the various waste materials. It is recommended that this AOC be separated from the remainder of the AOCs at Camp Lejeune and that a separate RI/FS be conducted. In an accelerated schedule for site characterization, assessment of risk(s), and selection of the preferred remedial alternative should be prepared.

3.18 SITE 73 - COURTHOUSE BAY LIQUIDS DISPOSAL AREA

3.18.1 SITE BACKGROUND

The Courthouse Bay Liquids Disposal Area (Figure 73-1) is located on either side of Courthouse Road approximately 200 feet northwest of Courthouse Bay (PWDM coordinates 17, I 11-12). This AOC was used from 1946 until 1977. Available information indicates that disposal activities occurred within a 13 acre area. An estimated 400,000 gallons of waste oil was deposited of in this area. The waste oil was generated during routine vehicle maintenance. The oil drained directly onto the ground surface. In addition, approximately 20,000 gallons of waste battery acid was reportedly disposed of in this area. Waste battery acid was poured into shallow hand-shoveled holes which were backfilled after disposal.

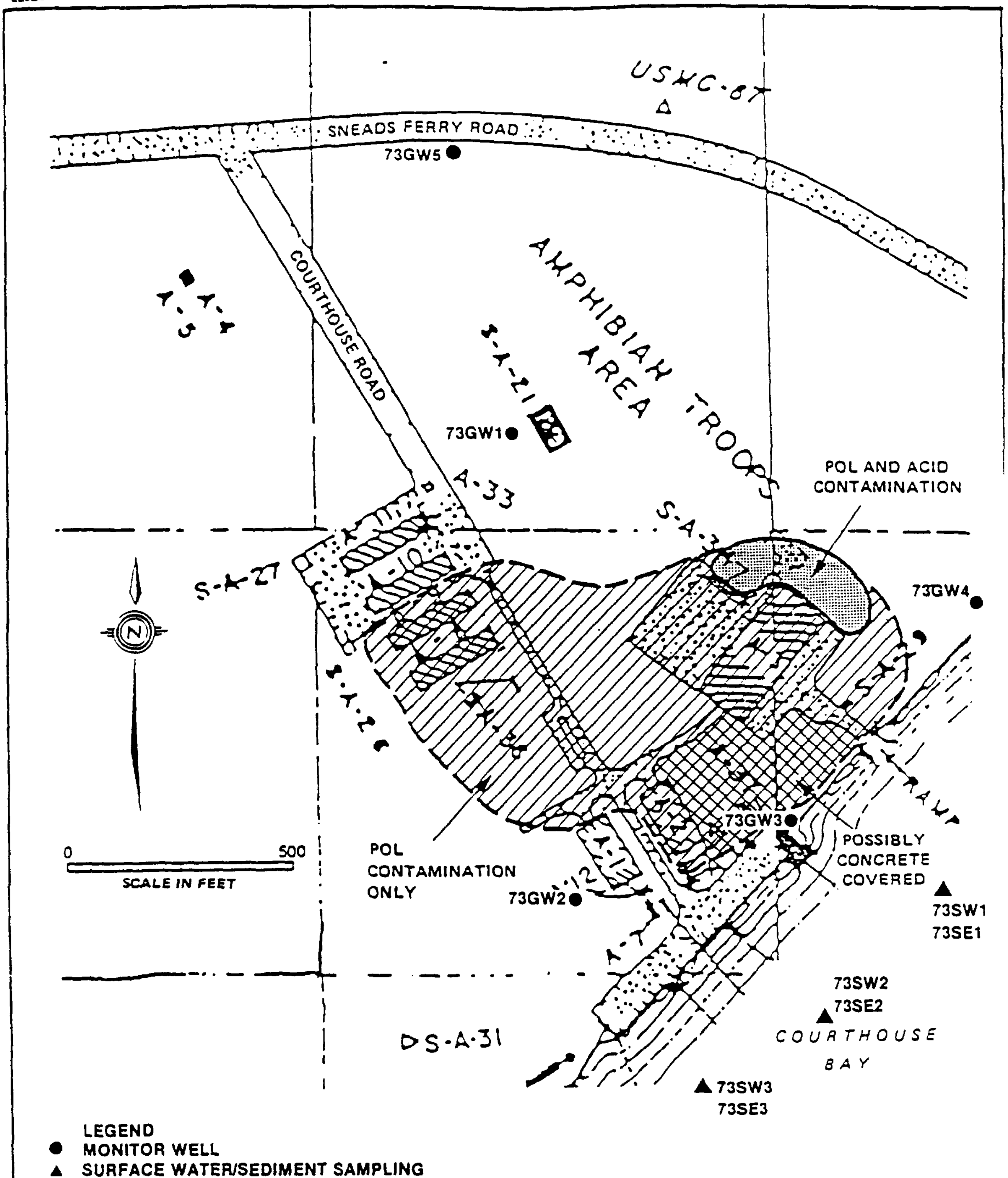
The area is underlain primarily by silty sand overlying sand and clay with discontinuous clay and silty clay lenses (Figure 73-2). Figure 73-2 is a geologic cross section representing the shallow geology of Site 73. This cross section is drawn in a north-south direction (Figure 73-3).

The surface of the shallow groundwater lies within the silty sand at depths ranging from 2.38 to 6.58 feet below land surface. The groundwater contour map (Figure 73-4) indicates that the groundwater flows to the east-southeast towards Courthouse Bay and a drainage ditch along the eastern side of the AOC. The groundwater flow gradient is estimated to be 0.012 ft/ft.

3.18.2 SITE INVESTIGATION

GROUNDWATER

Four shallow groundwater monitoring wells were installed as part of the investigation conducted in 1984. The location of these wells is shown in Figure 73-1. Well 73GW1 is located north of the disposal areas. This well is situated upgradient and between the disposal area and Water Supply Well A-5. Well 73GW2 is located south (downgradient) of the disposal area and upgradient of Courthouse Bay. Wells 73GW3 and 73GW4 are east (downgradient) of the disposal area. A fifth monitoring well (73GW5) was installed during the investigation conducted in 1986/87. This well is located north of the



SOURCES: Water and Air Research, Inc., 1983.
ESE, 1987.

Figure 73-1
SAMPLING LOCATIONS, SITE 73—
COURTHOUSE BAY LIQUID DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

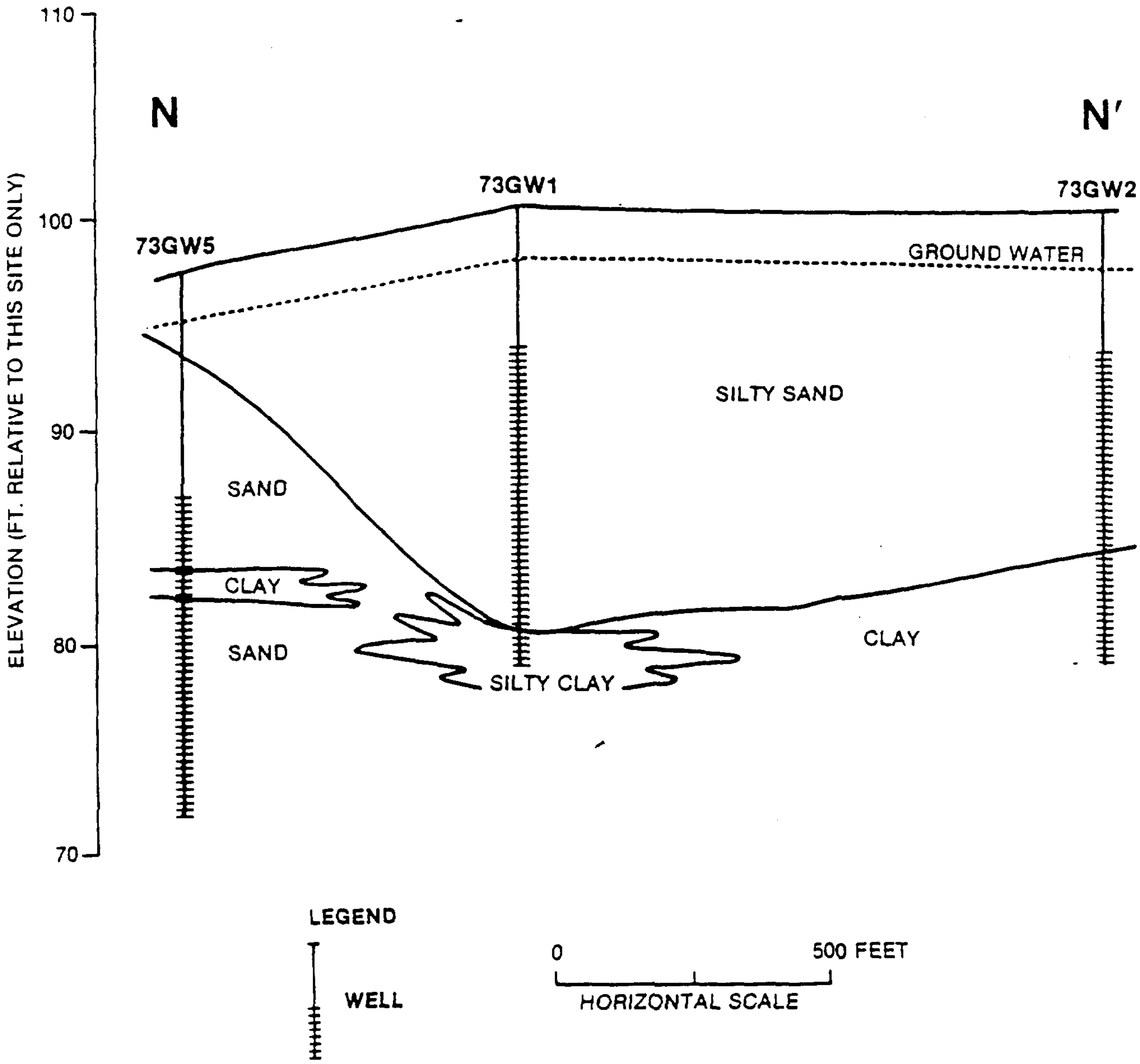


Figure 73-2
GEOLOGIC CROSS SECTION, SITE 73—
COURTHOUSE BAY LIQUID DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

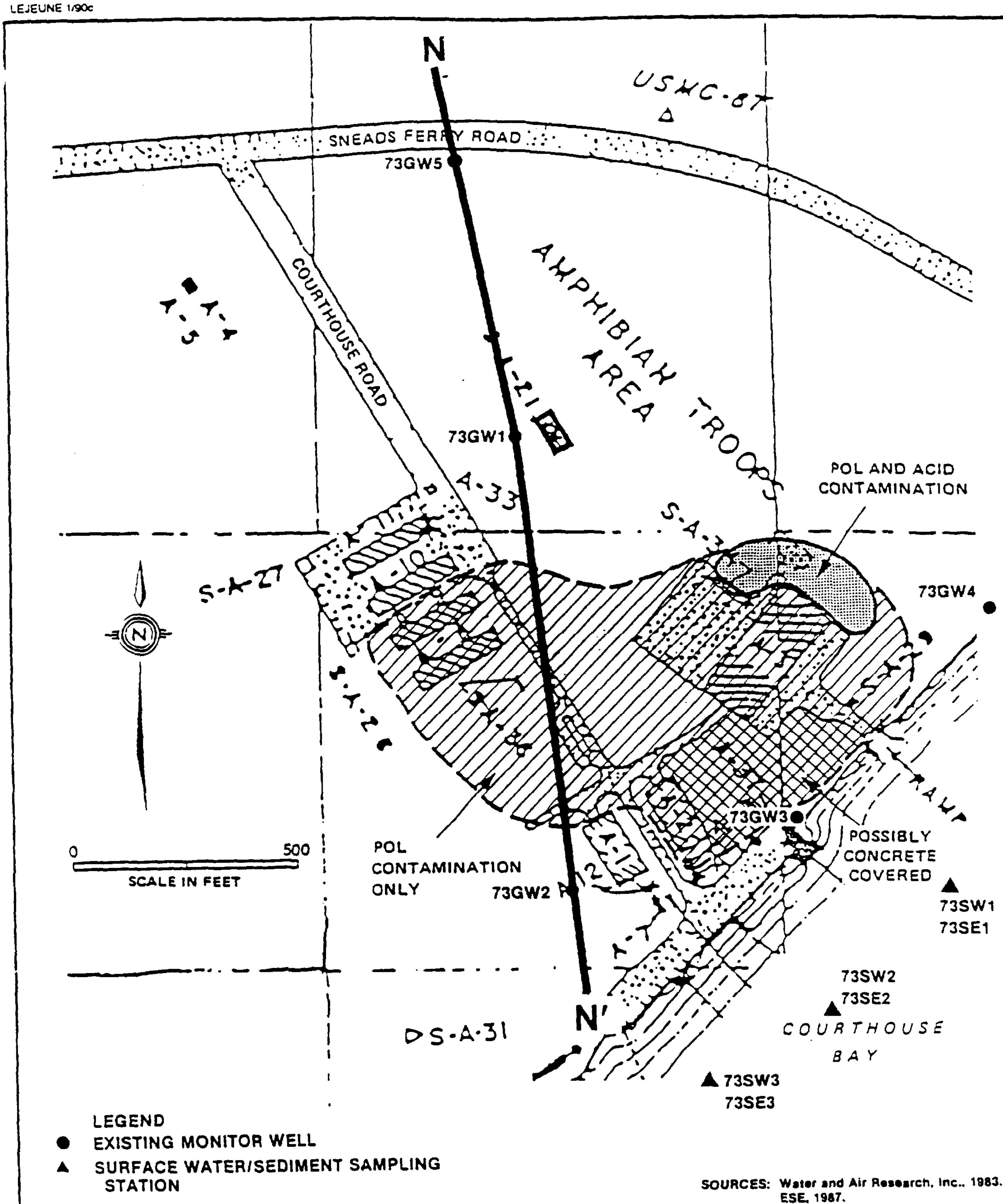
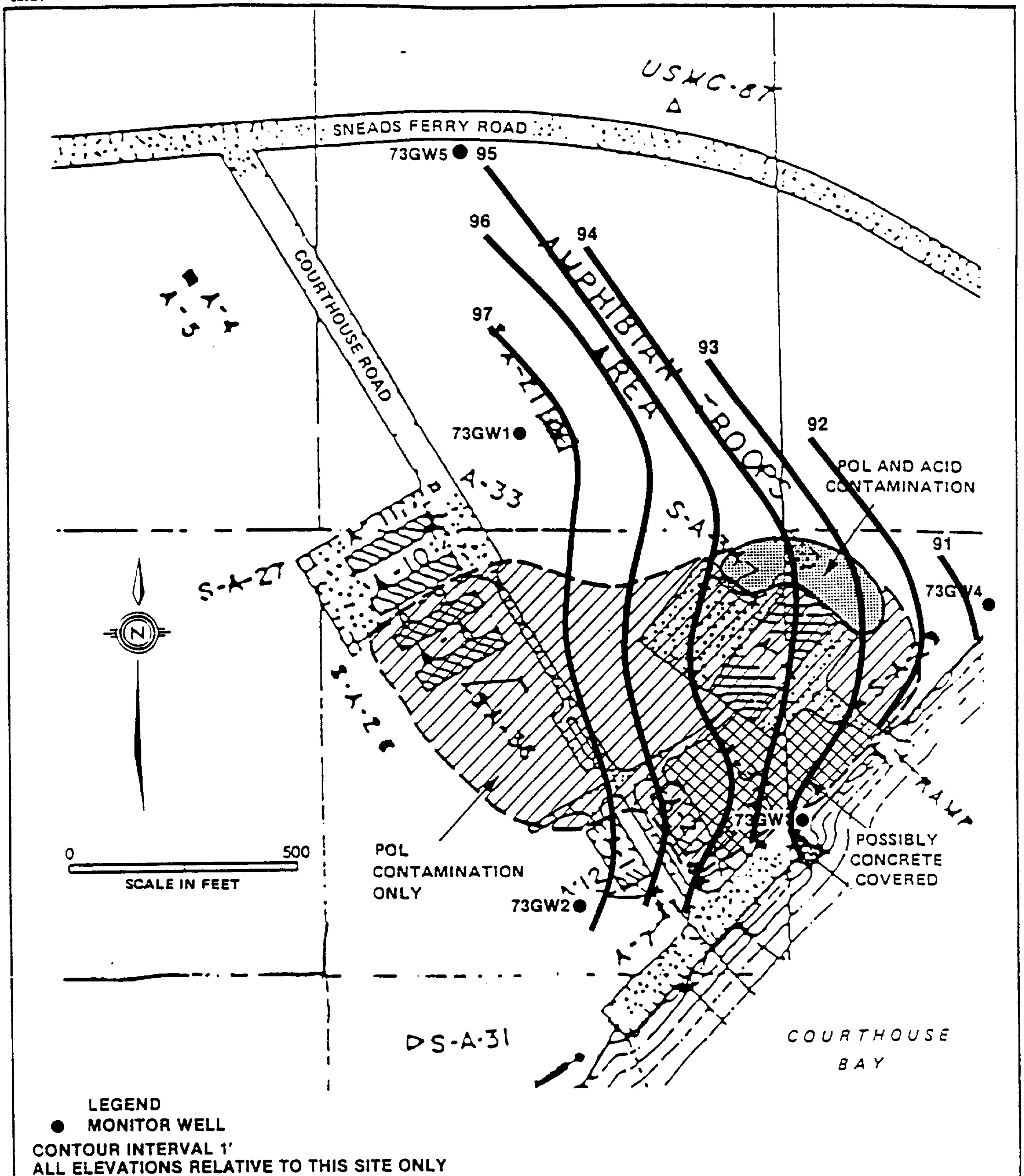


Figure 73-3
GEOLOGIC CROSS SECTION LOCATION, SITE 73—
COURTHOUSE BAY LIQUID DISPOSAL AREA

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 73-4
GROUND WATER CONTOUR MAP—SHALLOW AQUIFER, SITE 73—COURTHOUSE BAY LIQUID DISPOSAL AREA

MARINE CORPS BASE CAMP LEJEUNE

disposal area. The well was installed to provide a background data point within the shallow aquifer zone. On Table 73-1, Supply Well A-5 is designated as 73GW5 for the July 1984 sampling effort only. The monitoring well installed in 1986 and sampled in both January and March, 1987 is also listed as 73GW5 on Table 73-1. The supply well (designated 73GW5 for the July 1984 sampling effort) was found to be contaminated with low levels of chloroform, bromodichloromethane, and dibromochloromethane. Therefore, the 1984 analytical results for the supply well are not comparable to the 1987 data for the monitoring well.

Groundwater samples collected from these wells in July 1984 were analyzed for the following target compounds:

- Cadmium
- Chromium
- Lead
- Antimony
- Oil and Grease (O&G)
- Volatile Organics (VOC)
- Total Phenols

Appendix A lists all individual target analytes and their abbreviations. Table 73-1 presents those compounds that were detected above the method detection limits in groundwater samples collected from Site 73.

A second round of sampling was performed in January and March 1987. The same locations were sampled with the addition of Monitoring Well 73GW5. The previous set of target compounds were analyzed with the addition of the following:

- Xylene
- Methyl ethyl ketone
- Methyl isobutyl ketone
- Ethylene dibromide
- Hexavalent chromium

TABLE 73-1. SITE 73 - COURTHOUSE BAY LIQUIDS DISPOSAL AREA

DETECTED TARGET ANALYTES

GROUND WATER SAMPLES

	NC GW	73GW1	73GW1	73GW2	73GW2	73GW3	73GW3	73GW4	73GW4	73GW5	73GW5	73GW5
DATE	STANDARDS	7/6/84	1/7/87	7/6/84	1/7/87	7/6/84	1/7/87	7/6/84	1/7/87	7/6/84	1/7/87	3/4/87
PARAMETER												
BENZENE	1	<0.4	<1	<0.4	<1	0.9	<1	17	<1	<0.4	<1	<1
BROMODICHLOROMETHANE	NONE	<0.8	<2.2	<0.8	<2.2	<0.8	<2.2	<0.9	<2.2	20	<2.2	<2.2
CHLOROFORM	0.19	<0.7	<1.6	<0.8	<1.6	<0.7	<1.6	<0.9	<1.6	38	<1.6	<1.6
DIBROMOCHLOROMETHANE	NONE	<1.3	<3.1	<1.4	<3.1	<1.3	<3.1	<1.6	<3.1	10	<3.1	<3.1
1,1-DICHLOROETHYLENE	7	<1.4	<2.8	<1.5	<2.8	<1.4	<2.8	2.3	<2.8	<1.5	<2.8	<2.8
TRANS-1,2-DICHLORO-												
ETHENE	70	<1.3	<1.6	<1.4	<1.6	1.3	<1.6	360	<1.6	<1.4	<1.6	<1.6
METHYLENE CHLORIDE	5	<1	12	<1	<2.8	<1	<2.8	<1	<2.8	<1	<2.8	<2.8
TOLUENE	1000	0.7	<6	<0.7	<6	<0.6	<6	4	<6	<0.7	<6	<6
VINYL CHLORIDE	0.015	<1	<1	<1	<1	<1	<1	74	<1	<1	<1	<1
PHENOLS	NONE	10	14	5	13	10	9	15	4	<1	<2	<2
CADMIUM	5	<6	<2.9	<6	10	<6	3	<6	<2.9	<6	<2.9	<3.5
CHROMIUM	50	95	<9.4	46	<9.4	62	<9.4	43	30	<6	<9.4	<9.8
LEAD	50	109	<27	63	<27	89	<27	57	<27	<40	<27	<27
OIL & GREASE	NONE	2000	500	2000	500	<700	1000	<700	1000	<700	800	1000

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Note: Sample 73GW5 (dated 7/6/84) was collected from the supply well,
samples 73GW5 (dated 1/7/87 and 3/4/87) were collected from the monitoring well.
The duplication of this sample number is due to the change made in the sample numbering system between the 1984 and the 1987 sampling events.

Source: ESE, 1990.

The sample analyses identified greater concentrations of metals in 1984 than were found in 1987. The concentrations of VOCs appear to have changed significantly from 1984 to 1987. Well 73GW4 contained high levels of VOCs in 1984; these levels decreased in the samples collected in 1987. This change may be related in part to the relocation of this well. Well 73GW4 was moved from its original location to allow construction to take place in the area. It is possible that this well is now located at the limits of the contaminant plume.

SURFACE WATER/ SEDIMENTS

Surface water and sediments were collected during the investigation in 1986/87. These samples were collected from three locations (Figure 73-1) offshore in Courthouse Bay. The samples were analyzed for the same target compounds as the groundwater samples. The results of this sampling effort identified the presence of cadmium, chromium, lead, phenols, and O&G in the sediment. Table 73-2 lists the analytical results for the sediment samples. Chromium was the only compound identified above detection limits in the surface water. The levels of chromium detected in the surface water are below the freshwater standard of 50 ug/L and are therefore not of concern. The target analytes identified in the sediments are similar to those identified in the groundwater samples.

3.18.3 SUMMARY AND CONCLUSIONS

Disposal activities at this AOC have impacted the groundwater beneath the site, and may have also affected the surface water and sediments in Courthouse Bay. Contaminants may have migrated off-site via groundwater movement, surface water drainage during periods of high flow, and sediment transport during periods of erosion. Past disposal activities at Site 73 may not be the only source of the contaminants detected in the surface water and sediments within the bay. It is possible that other potential sources in the bay area have contributed to the detected contamination.

The shallow groundwater beneath the site flows in an easterly direction toward Courthouse Bay. The groundwater contour map (Figure 73-4) illustrates

TABLE 73-2. SITE 73 - COURTHOUSE BAY LIQUIDS DISPOSAL AREA
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	73SE1	73SE2	73SE3
DATE	12/15/86	12/15/86	12/15/86
PARAMETER			
CADMIUM	<0.406	<1.01	0.694
CHROMIUM	11.8	53	35.9
LEAD	8.51	22.2	15.8
OIL & GREASE	675	1510	314
PHENOLS	0.207	1.56	0.9

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC sediment standards.

Source: ESE, 1990.

the direction of flow in this area. The shallow aquifer discharges directly into Courthouse Bay. Metals and O&G were the most prevalent contaminants detected. At least one of these analytes were identified in the surface water, sediment, and groundwater in both rounds of sampling. The concentrations of contaminants in the groundwater are attributable to past disposal activities conducted at the site.

The concentrations of metals and VOCs detected in the groundwater decrease dramatically from 1984 to 1987. While it is possible that this reduction in the concentrations of metals may be due to natural processes such as migration and dilution, it is not likely. It is more likely that varying groundwater levels effect the mobility of the detected analytes.

3.18.4 RECOMMENDATIONS

The current monitoring well network is located at the margins of the area of know disposal. The low levels of detected contamination may be attributab to distance to the source areas. The volume of waste liquids known to at this AOC strongly suggest that significant soil and groundwater contamination exist. Future efforts should include installation monitoring wells within known or suspected disposal pits. In closely-spaced grid of soil sampling stations should be est accurately measure the volume of contaminated soil for R purposes. The presence of buildings, concrete paving may severely restrict the ability to conduct a det characterization.

3.19 SITE 74 - MESS HALL GREASE DISPOSAL AREA

3.19.1 SITE BACKGROUND

The Mess Hall Grease Disposal Area (Figure 74-1) is located in a wooded area approximately 1/2 mile east of Holcomb Boulevard in the northeast portion of Camp Lejeune. The Pest Control Area is located approximately 20 to 50 yards south of the grease pit and 75 yards east of Supply Well 654. Site 74 is located at PWDM coordinates 5, N13/O14. The disposal area north of the dirt access road is approximately three acres in size. The grease pit measures 135 feet long, 30 feet wide, and 12 feet deep. The total size of the Pest Control Area, has been estimated at 100 feet by 100 feet. Available information indicates the site was active from the early 1950's until 1960. Disposal activities at the site include the placement of mess hall grease and some waste food into a pit. Records indicate that there was at least one unsuccessful attempt to burn the grease using a more volatile substance. The material was washed out of the pit in 1954 when Hurricane Hazel passed through the area. Use of the pit was discontinued at this time. No estimates regarding the quantity of grease disposed of at the site have been made.

Drums and pesticide soaked bags were dumped near the grease pit. Detailed information regarding the contents of the drums is not available. Personnel involved with disposal of the drums were not informed of the drum's contents or origin. It is speculated that the drums may have contained pesticides and/or transformer oil containing PCB's. Best estimates indicate that approximately 500 gallons of pesticides were released from the deposition of the bags. Approximately 2,200 gallons of pesticides, contained in drums, were deposited at the site. It is estimated that 1,100 gallons of PCB containing oil was buried at the site.

Site 74 is underlain primarily by sand and silty sand. The geologic cross section, presented in Figure 74-2, illustrates the shallow geology underlying this site. Figure 74-3 shows the area through which the cross section was drawn. The surface of the shallow groundwater lies within the silty sand. The depth to groundwater was measured to be between 2.01 to 12.12 feet below

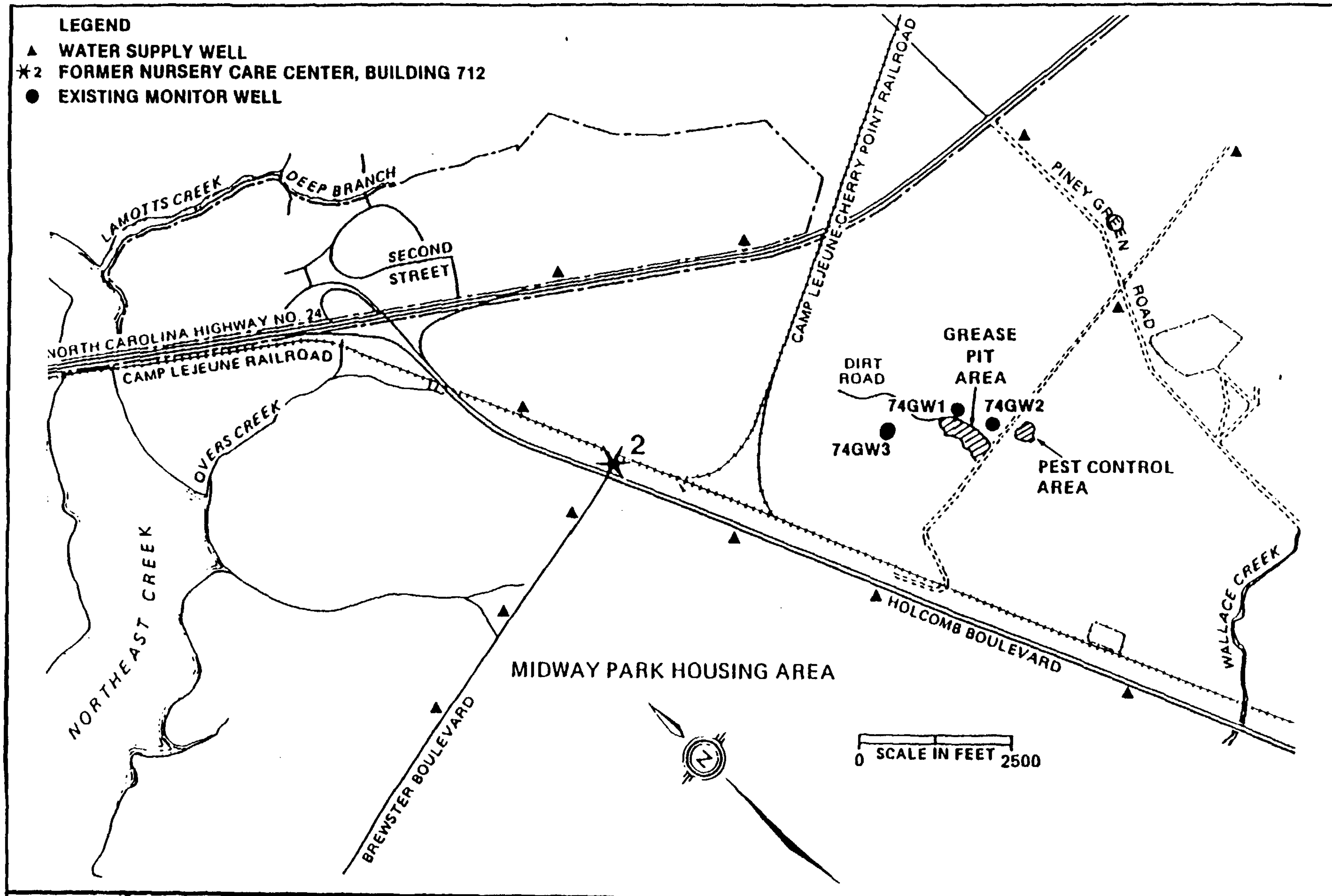


Figure 74-1
SAMPLING LOCATIONS, SITE 74—
GREASE PIT AND PEST CONTROL AREA

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE, 1986.

MARINE CORPS BASE
CAMP LEJEUNE

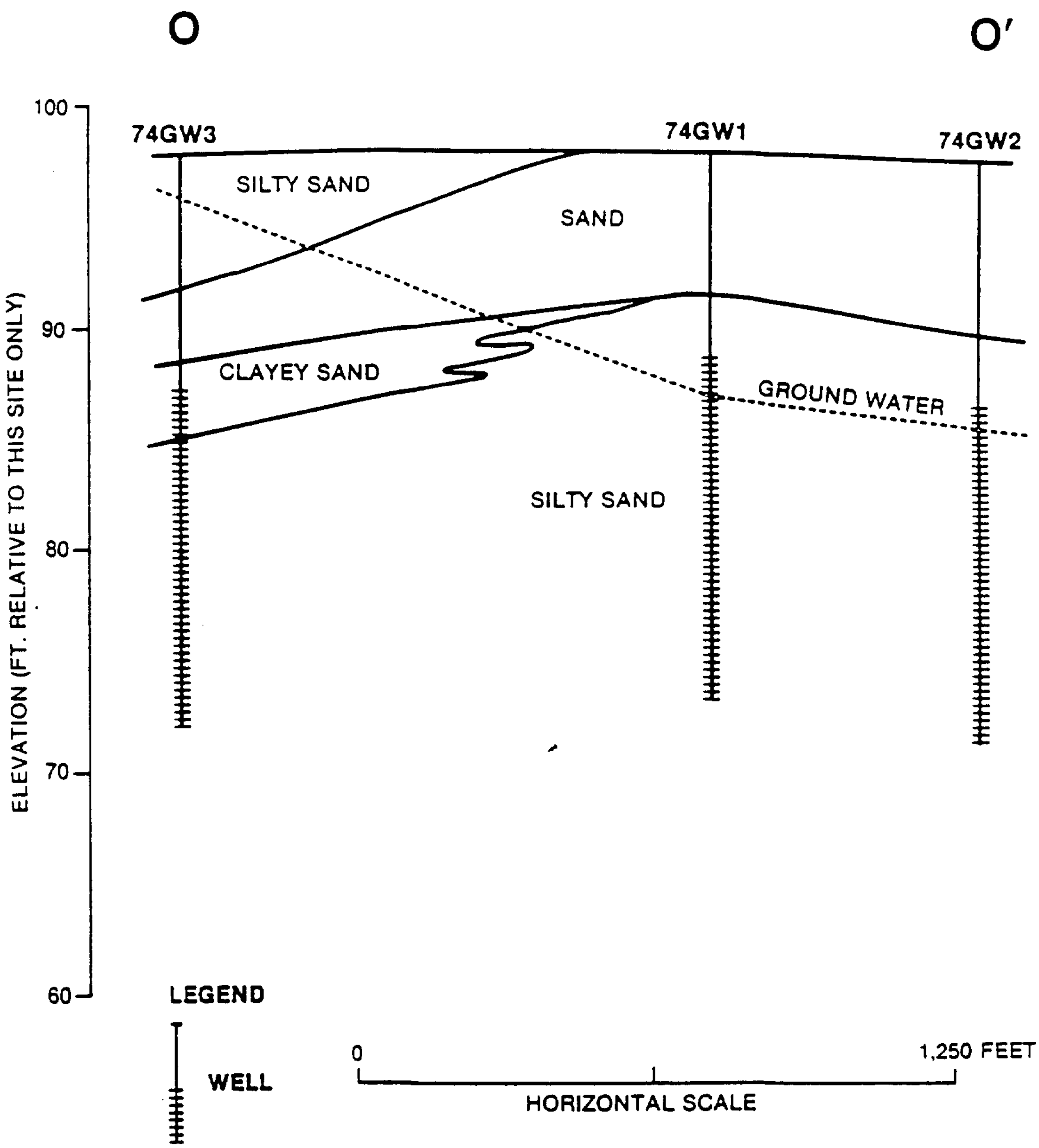
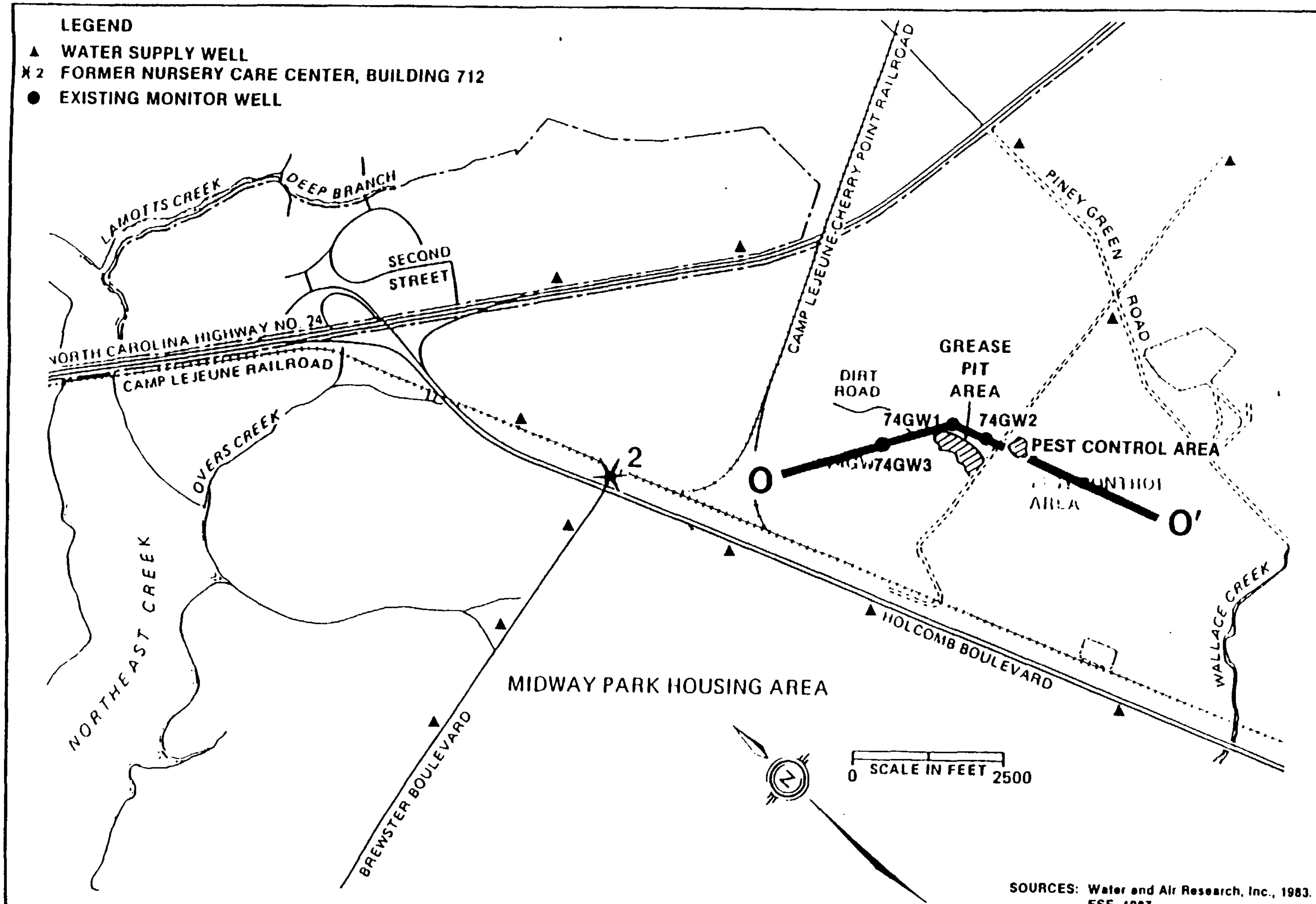


Figure 74-2
GEOLOGIC CROSS SECTION, SITE 74—GREASE PIT AND PEST CONTROL AREA

MARINE CORPS BASE CAMP LEJEUNE



LEJEUNE 1/90c

Figure 74-3
GEOLOGIC CROSS SECTION LOCATION, SITE 74—
GREASE PIT AND PEST CONTROL AREA

MARINE CORPS BASE
CAMP LEJEUNE

the ground surface. The groundwater contour map (Figure 74-4) shows the shallow groundwater to be flowing east at an approximate gradient of 0.014 ft/ft.

3.19.2 SITE INVESTIGATION

GROUNDWATER

Three shallow monitoring wells (Figure 74-1) were installed as part of the investigations conducted at this AOC. Two of the wells 74GW1 and 74GW2 were installed in 1984. The third well 74GW3 was installed in 1986. Well 74GW1 is located within the disposal area. Well 74GW2 is located southeast of the disposal area, downgradient and between the disposal area and Supply Well 654. Well 74GW3 is located northwest and upgradient of the disposal area. This well was installed as part of the second round investigation in 1986/87.

During the investigation conducted in 1984 Supply Well 654 was designated 74GW3. The sampling efforts conducted in December 1986 and March 1987 redesignate 74GW3 as a shallow monitoring well.

The three monitoring wells were sampled during two separate efforts. The first sampling effort was conducted in July 1984. The second effort was conducted in December 1986 and March 1987. Table 74-1 presents the analytical data from both the 1984 and 1986/87 sampling events. Only those target analytes that were detected above the detection limits are reported in the table.

The groundwater samples were analyzed for the following target compounds:

- o Organochlorine pesticides (OCP)
- o Organochlorine herbicides (OCH)
- o Polychlorinated Biphenyls (PCB)
- o Tetrachlorodioxin (1986/87 only)
- o Volatile organic analysis (1986/87 only)

Appendix A presents a detailed listing of all target analytes and their abbreviations.

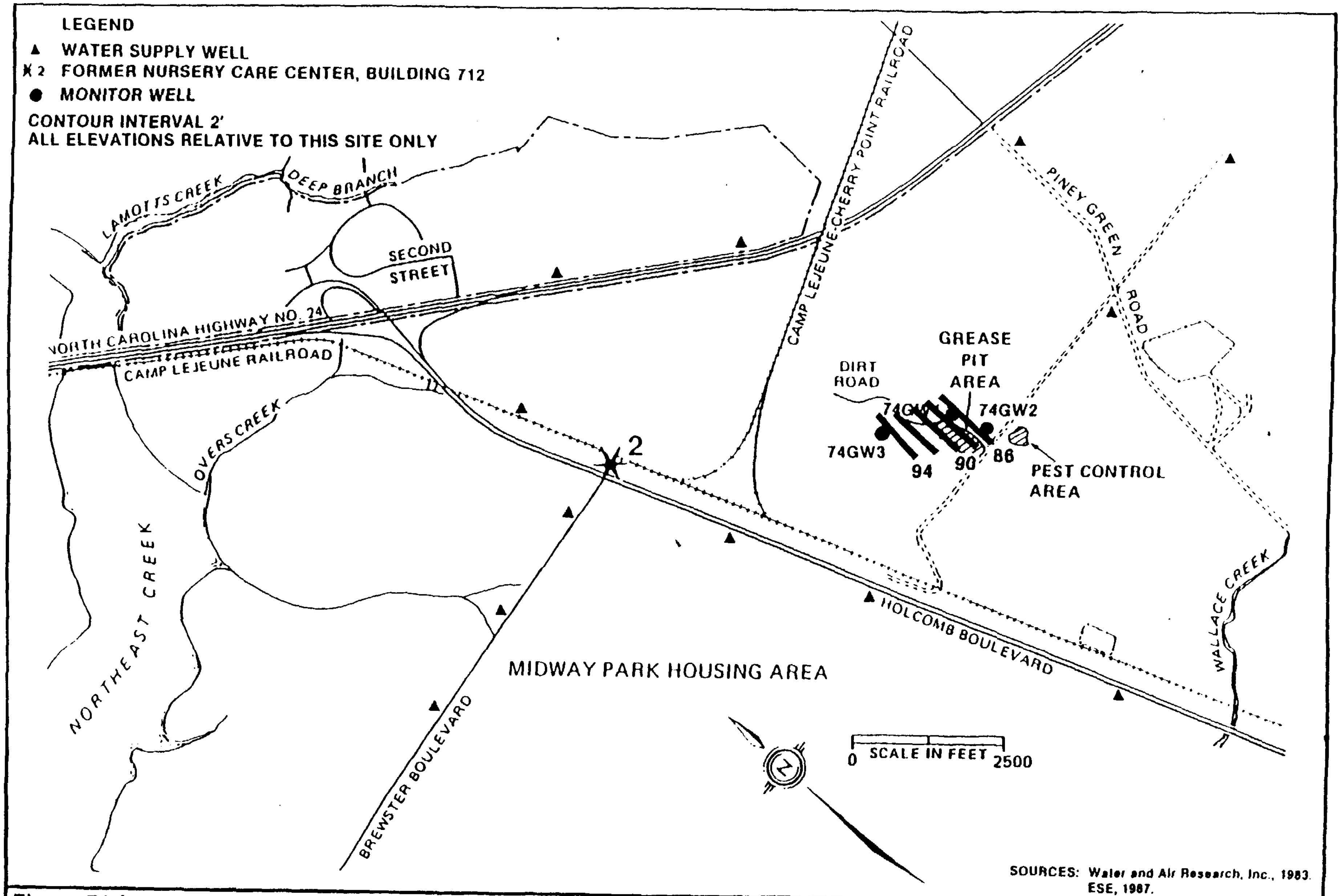


Figure 74-4
GROUND WATER CONTOUR MAP—
SHALLOW AQUIFER, SITE 74—
GREASE PIT AND PEST CONTROL AREA

MARINE CORPS BASE
CAMP LEJEUNE

TABLE 74-1. SITE 74 - MESS HALL GREASE DISPOSAL AREA
DETECTED TARGET ANALYTES
GROUND WATER SAMPLES

DATE	NC GW STANDARDS	74GW1 7/4/84	74GW1 12/4/86	74GW2 7/4/84	74GW2 12/4/86	74GW3 12/4/86	74GW3 3/4/87	74GW3(654) 7/4/84
PARAMETER								
ALDRIN	NONE	<0.0008	<0.006	<0.0008	0.029	<0.006	<0.006	<0
DDE,PP'	NONE	<0.0008	<0.006	0.001	<0.006	<0.006	<0.006	<0.0008
DDT,PP'	NONE	<0.005	<0.006	0.007	<0.006	<0.006	<0.006	<0.005
METHYLENE CHLORIDE	5	NA	<2.8	NA	<2.8	3.8	<2.8	NA

NA: not analyzed.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

Trace levels of DDE and DDT were detected in 1984 in Well 74GW2 located approximately 200 feet west of the Pest Control Area. The most recent groundwater data indicate that this well is cross gradient of the Pest Control Area. In 1986, only trace levels of aldrin were detected in this well. The toxicity of aldrin is high, and the detected level (0.029 ug/L) is well in excess of the 10^{-6} health risk level of 7.4×10^{-8} ug/L. Trace levels of methylene chloride were detected in Well 74GW3 in 1986. This well was sampled twice as part of the 1986/87 investigation. Methylene chloride was not detected in the 1987 data set collected from the well. This may be the result of a general reduction in contaminant levels due to natural conditions experienced throughout Camp Lejeune, or may suggest that the level detected in December 1986 was a laboratory artifact.

SOILS

Two soil borings were hand augered in the Pest Control Area and three samples were taken from each boring during an August sampling effort. Results of these samples are listed in Table 74-2. The analysis indicate that one or all of the following components were detected in each sample taken from the Pest Control Area: DDD, DDE, and DDT.

3.19.3 SUMMARY AND CONCLUSIONS

The laboratory data indicate that the soils in the Pest Control Area are contaminated with pesticides. Pesticides have also been identified in shallow groundwater in Well 74GW2 which is cross gradient from this area. No monitoring wells are currently downgradient from this area, therefore the extent of migration cannot be assessed. Contamination within the grease pit has not been identified.

3.19.4 RECOMMENDATIONS

The grease pit at this AOC does not appear to contain measurable levels of contamination. However, the Pest Control Area has been shown to contain problematic levels of pesticide contamination. Additional groundwater monitoring wells to detect the extent of the pesticide contamination should be installed. In addition, a soil sampling grid should be established to

TABLE 74-2. SITE 74 - MESS HALL GREASE DISPOSAL AREA
DETECTED TARGET ANALYTES
SOIL BORING SAMPLES

	74S1A	74S1B	74S1C	74S2A	74S2B	74S2C
DATE	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84	8/3/84
PARAMETER						
DDD,PP'	0.0084	<0.0006	0.0006	0.0029	0.0006	0.0006
DDE,PP'	0.044	0.006	0.0072	0.0051	0.001	0.0004
DDT,PP'	0.260	0.0086	0.011	<0.0012	<0.0012	<0.0013

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

3.20 SITE 75 - MCAS BASKETBALL COURT SITE

3.20.1 SITE BACKGROUND

The MCAS Basketball Court Site (Figure 75-1) is located at PWDM coordinates 23, 08-8/P8-9, along the north side of Curtis Road. This AOC was reportedly a drum burial area that was used on at least one occasion in the early 1950's. The excavation as seen in an aerial photograph, was an oval shaped pit approximately 90 feet long by 70 feet wide and was sufficiently deep to have cut into the groundwater table. An estimated 75 to 100 55-gallon drums were placed in this pit. The drums reportedly contained a chloroacetophenone tear gas solution used for training. Additional organic chemicals, such as: chloroform, carbon tetrachloride, benzene, and chloropicrin, may have been present in the solution. Degradation of the drums could have resulted in the release of the suspected materials into the groundwater. This was of particular concern due to the proximity of several water supply wells in the area, two of them being within 500 feet of the alleged disposal site.

This AOC is underlain by dipping layers of silty sand, silty-clayey sand, and clay (Figure 75-2). The geologic cross section for this site is drawn on a line from west to east (Figure 75-3). Shallow groundwater lies between 2.37 and 5.87 feet below the land surface. Groundwater measurements taken from the five monitoring wells installed at this AOC indicate that groundwater flows radially northward from Well 75GW3 and then east towards Site 76 (Figure 75-4). The gradient of the shallow groundwater is approximately 0.009 ft/ft to the east paralleling Curtis Road.

3.20.2 SITE INVESTIGATION

Prior to installation of shallow monitoring wells, a geophysical survey consisting of electromagnetic (EM) conductivity and metal detection techniques, was conducted on a grid system throughout this AOC. Areas specifically identified in aerial photography as containing drums were surveyed in detail. No signals representative of buried metallic objects were identified.

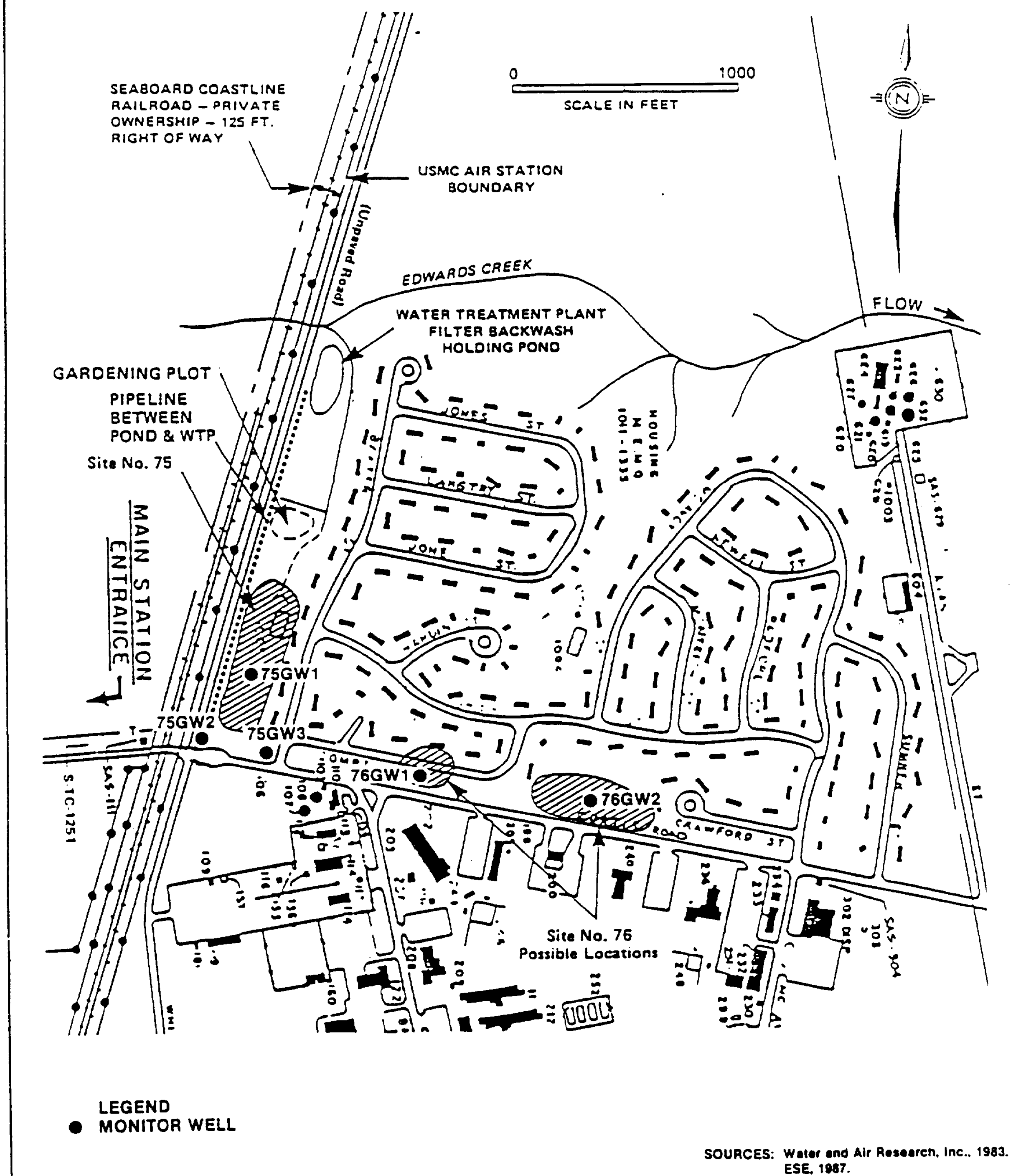


Figure 75-1
SAMPLING LOCATIONS, SITES 75 AND 76—MCAS BASKETBALL COURT AND CURTIS ROAD SITES

MARINE CORPS BASE
CAMP LEJEUNE

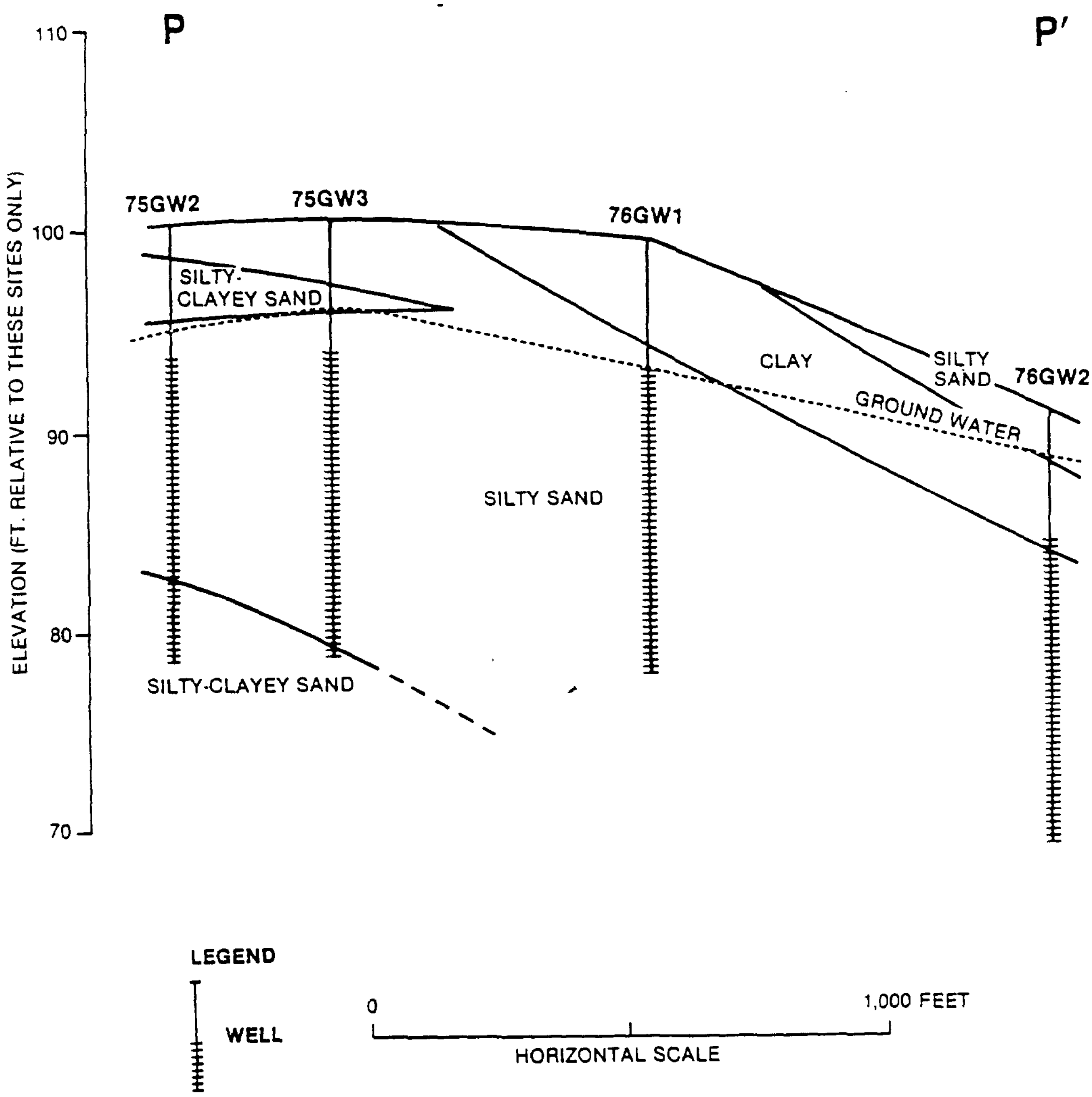
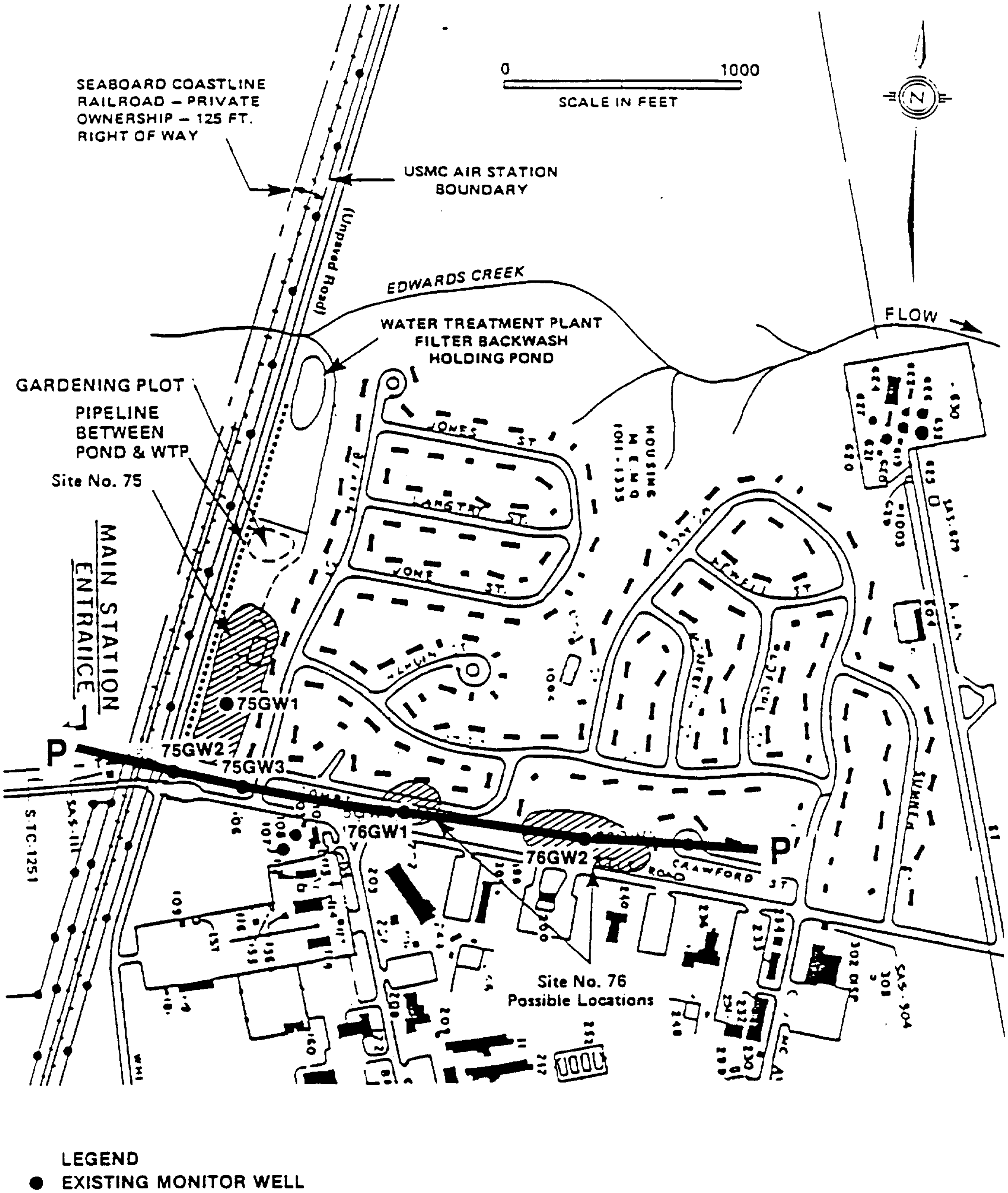


Figure 75-2
GEOLOGIC CROSS SECTION, SITES 75 AND 76—MCAS BASKETBALL COURT AND CURTIS ROAD SITES

MARINE CORPS BASE CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure 75-3
GEOLOGIC CROSS SECTION LOCATION, SITES 75 AND 76—MCAS BASKETBALL COURT AND CURTIS ROAD SITES

MARINE CORPS BASE
CAMP LEJEUNE

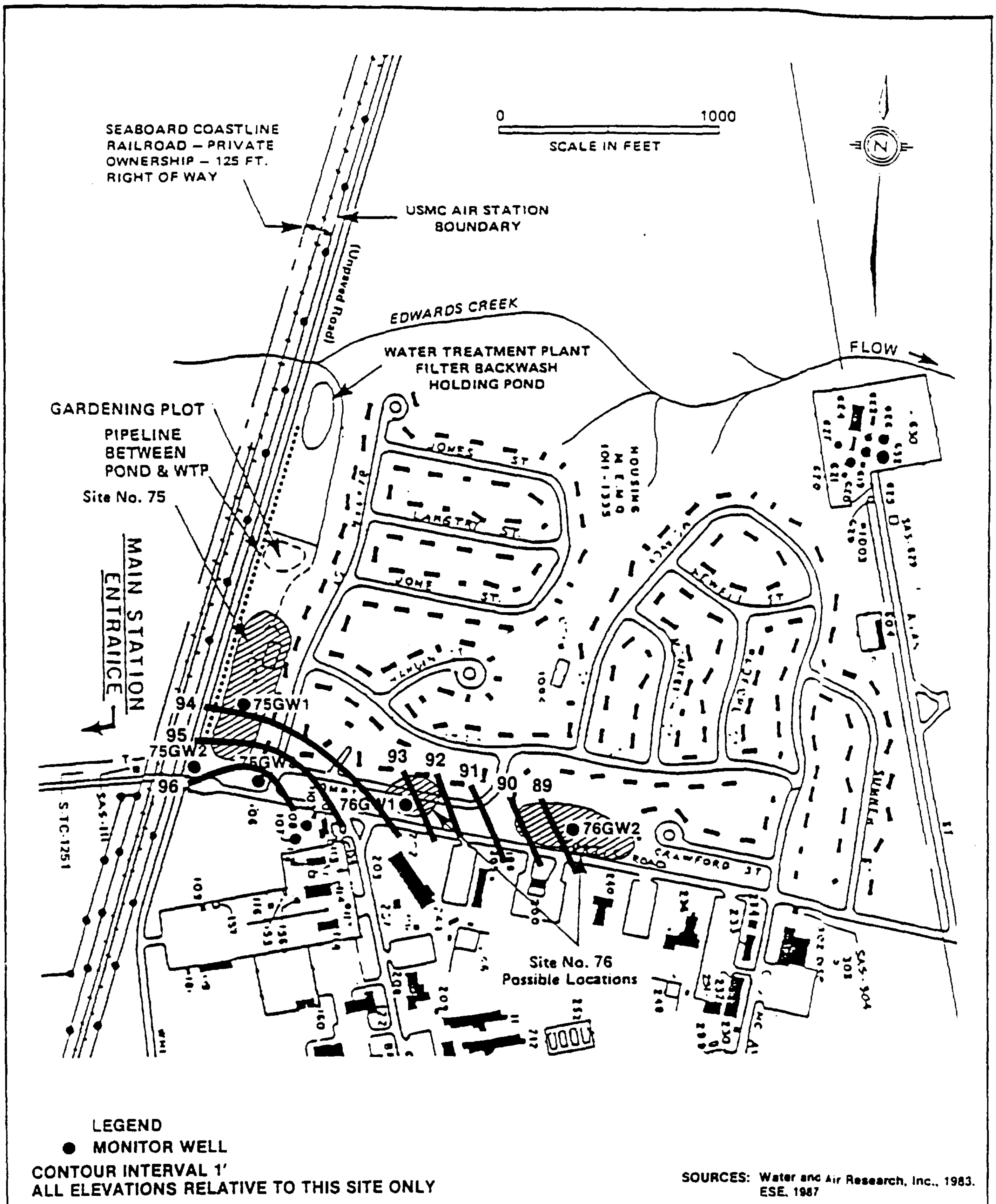


Figure 75-4
GROUND WATER CONTOUR MAP—SHALLOW AQUIFER, SITES 75 AND 76—MCAS BASKET-BALL COURT AND CURTIS ROAD SITES

MARINE CORPS BASE
CAMP LEJEUNE

GROUNDWATER

Three shallow groundwater monitoring wells were installed for the first round of sampling in 1984. These wells (75GW1, 75GW2, and 75GW3) in addition to three Water Supply Wells (75GW4, 75GW5, and 75GW6) in the site vicinity were sampled in July 1984. The locations of these wells are shown in Figure 75-2. All six well samples were analyzed for VOCs only. No target compounds were detected in these samples.

A second round of sampling, performed in November 1986, consisted of resampling the three shallow groundwater monitoring wells. These samples were analyzed for VOCs, chloropicrin, and tetrachlorodioxin. None of the target analytes were detected in these samples.

3.20.3 SUMMARY AND CONCLUSIONS

Since none of the target analytes were detected in the samples, it is unlikely that the groundwater in this area has been affected. The area was also subjected to a geophysical survey which failed to detect any buried objects. These factors suggest that a threat to local groundwater does not exist.

3.20.4 RECOMMENDATIONS

No contamination in this area has been documented and a geophysical survey performed in the site area did not reveal the presence of any buried objects. In addition, the water supply wells, which are the primary environmental concern at this AOC, showed no sign of contamination. It is recommended that no further investigation be performed.

3.21 SITE 76 - MCAS CURTIS ROAD SITE

3.21.1 SITE BACKGROUND

The MCAS Curtis Road Site is located in the vicinity of PWDM coordinates 23, L10/M10/N10, along the north side of Curtis Road (Figure 75-1). The precise location of the site is unknown, and two possible locations have been identified based on interviews and aerial photography. This alleged dumpsite was reportedly used as a drum disposal area on two occasions in 1949. The estimated area of the disposal unit is 1/4 acre and approximately 25 to 75 55-gallon drums were allegedly involved. It is believed that the drums contained a chloroacetophenone tear gas agent similar to that allegedly buried in the MCAS Basketball Court Site (Site 75). Potential contaminants are chloroform, carbon tetrachloride, benzene, and chloropicrin.

The geohydrology for this area was described with Site 75 - MCAS Basketball Court Site (Section 3.19.1).

3.21.2 SITE INVESTIGATION

Prior to installation of the shallow monitoring wells, a geophysical survey consisting of electromagnetic (EM) conductivity and metal detection techniques, was conducted on a grid system throughout this AOC. Areas specifically identified in aerial photography as containing drums were surveyed in detail. No signals representative of buried metallic objects were identified.

GROUNDWATER

Two monitoring wells were installed for the first round of sampling in 1984, both were located at the center of the potential locations identified for the disposal area. These shallow groundwater monitoring wells were designated 76GW1 and 76GW2. The two wells were sampled in July 1984, and the samples were analyzed for VOCs. None of the target analytes were detected in these samples.

A second round of sampling was performed in November 1986. Both wells were sampled and analyzed for VOCs, tetrachlorodioxin, and chloropicrin. Again, none of the target analytes were detected in the samples.

3.21.3 SUMMARY AND CONCLUSIONS

No target analytes were detected in the first or second rounds of sampling. This indicates that the alleged disposal is not currently contributing contaminants to the area surveyed. A geophysical survey was performed in and around the site area, and no buried objects were detected. This information strongly suggests that there are no buried drums of waste in the area. It is possible that the pits were staging areas and the drums were subsequently moved.

3.21.4 RECOMMENDATIONS

No further investigations at this AOC is recommended.

3.22 SITE A - MCAS (H) OFFICERS' HOUSING AREA

3.22.1 SITE BACKGROUND

The MCAS (H) Officers' Housing Area site is located on the west bank of the New River (Figure A-1). This area was identified during the second round of sampling conducted in 1986. Waste was identified eroding out of a cut bank along the New River in the vicinity of an officers' housing area. The materials were tentatively identified as hospital wastes. Various hospital waste materials were noted, including hypodermic needles and vials of white powder which were believed to contain a chlorine based substance. No information was available regarding the volume of the waste or the mode of disposal.

The site is underlain by clay at the surface, followed by layers of silty sand, sand, and returning to silty sand. Figures A-2 and A-3 illustrate a geologic cross section of the area. The shallow ground water surface at this AOC lies within the upper silty sand and sand at depths ranging from 7.68 to 11.10 feet below land surface. Shallow groundwater flows east towards the New River at a gradient of approximately 0.019 ft/ft (Figure A-4).

4.22.2 SITE INVESTIGATION

GROUNDWATER

Two shallow monitoring wells (Figure A-1) were installed in this area, AGW1 and AGW2. They were sampled twice, once in December 1986 and once in March 1987. Both sets of samples were analyzed for free chlorine, O&G, and VOCs. Very low concentrations of O&G were detected in the March 1987 groundwater samples, but not in the December 1986 samples. None of the other target analytes were detected in the groundwater samples.

SURFACE WATER

One surface water sample (Figure A-1) was taken from the New River in December 1986. It was analyzed for free chlorine, O&G, and VOCs. None of the target analytes were detected in this sample.

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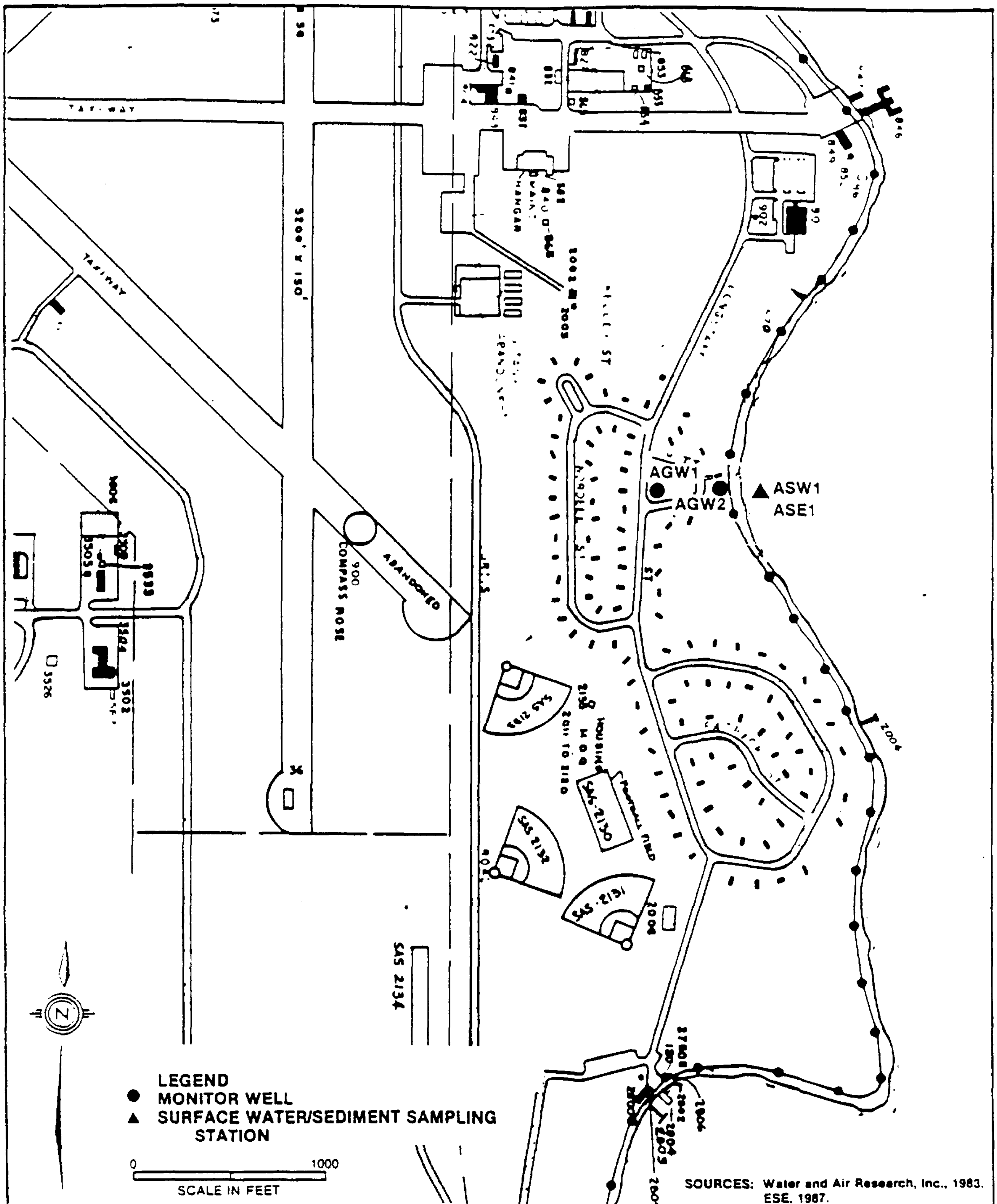


Figure A-1
SAMPLING LOCATIONS, SITE A—
MCAS (H) OFFICERS' HOUSING AREA

MARINE CORPS BASE
CAMP LEJEUNE

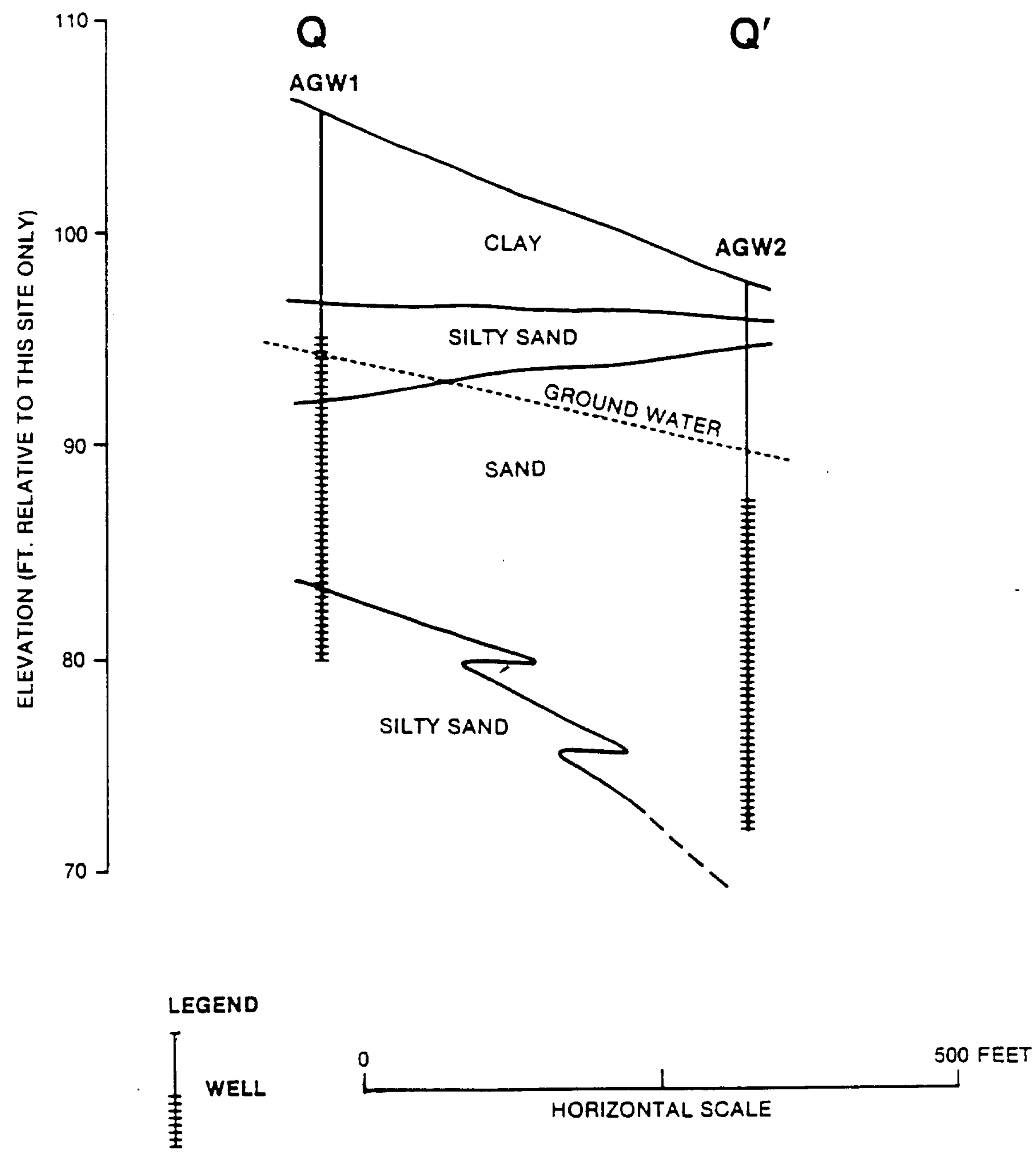


Figure A-2
GEOLOGIC CROSS SECTION, SITE A—
MCAS (H) OFFICERS' HOUSING AREA

MARINE CORPS BASE
CAMP LEJEUNE

LEJEUNE 1/90c

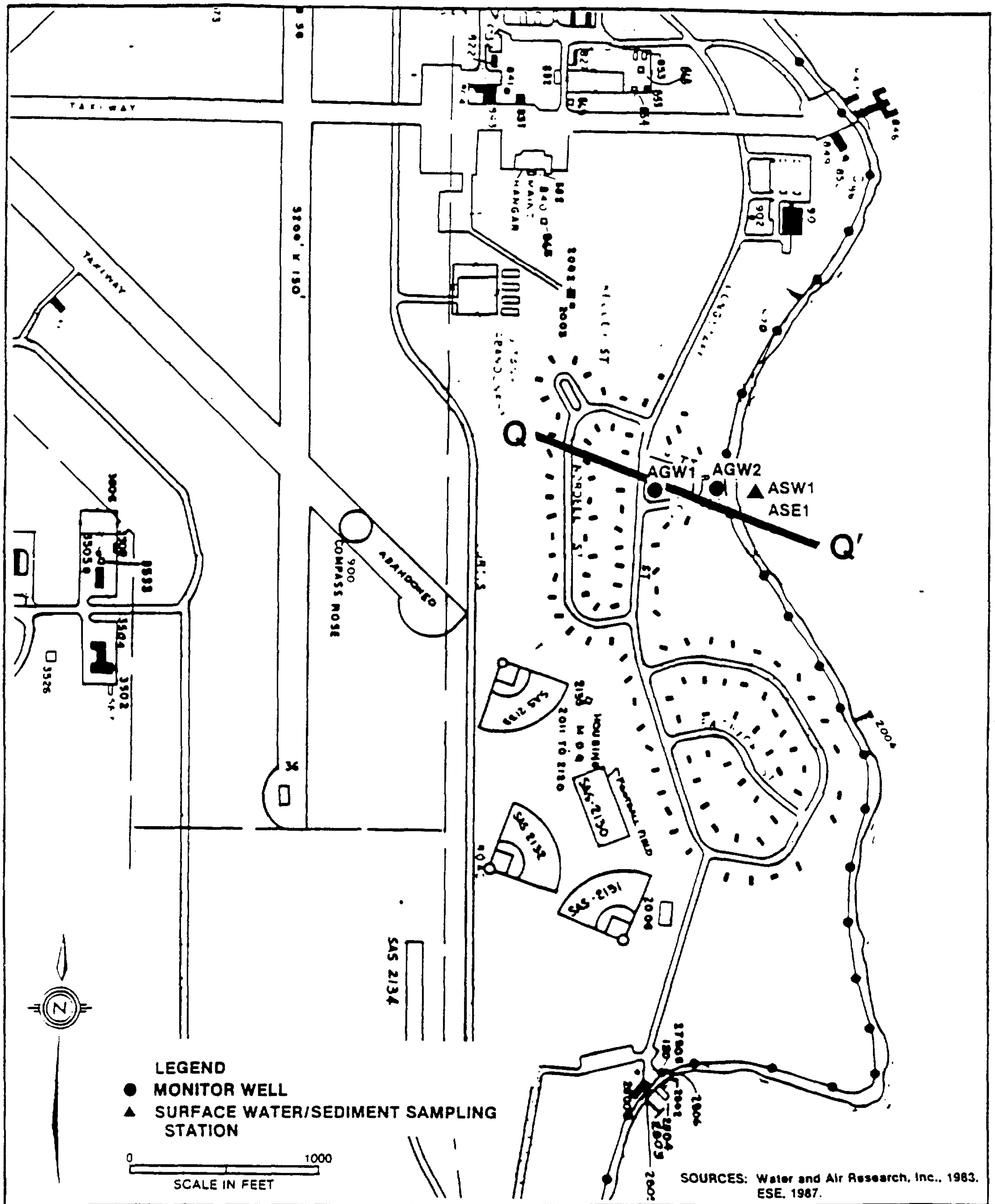
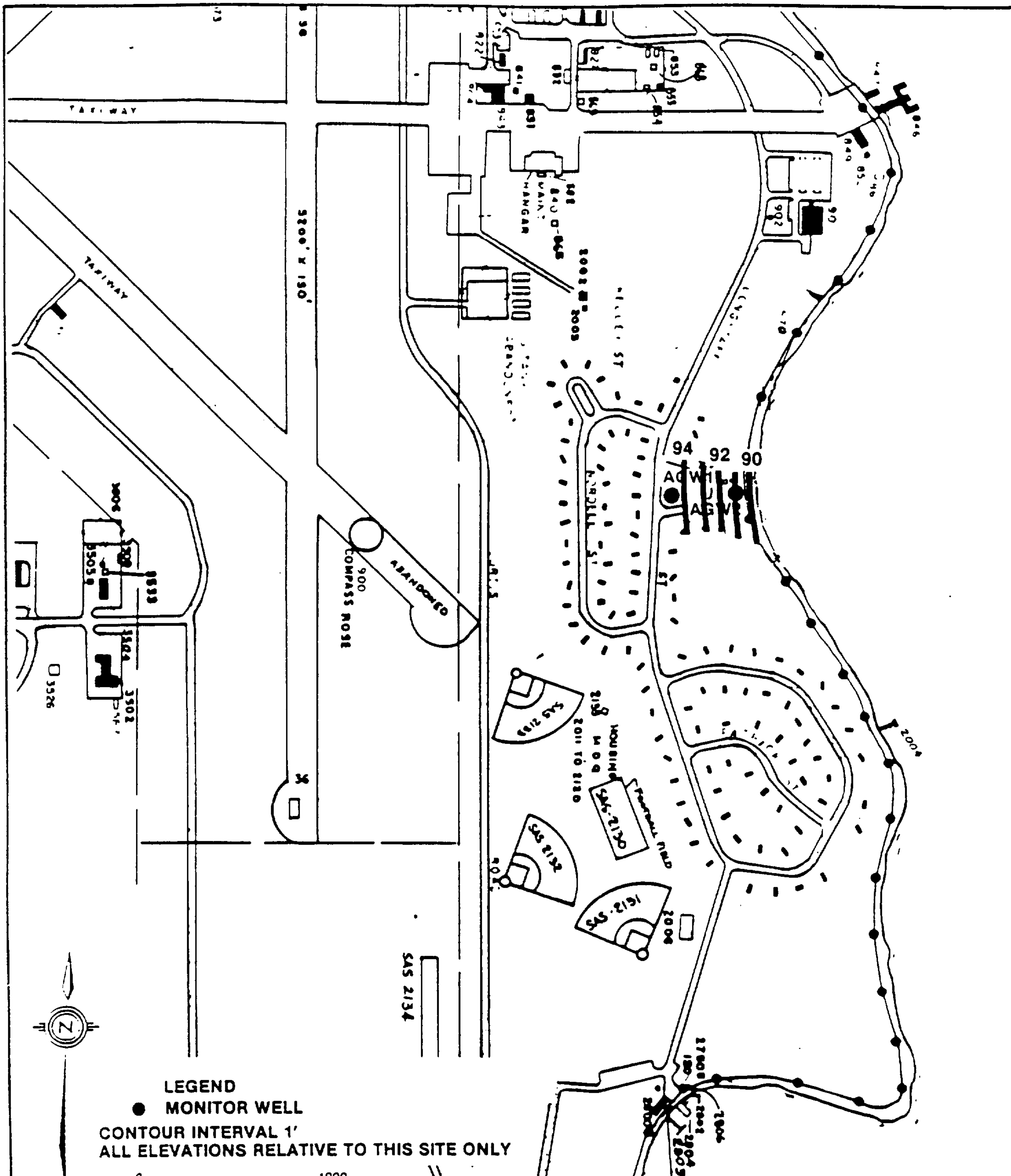


Figure A-3
GEOLOGIC CROSS SECTION LOCATION, SITE A—MCAS (H) OFFICERS' HOUSING AREA

MARINE CORPS BASE CAMP LEJEUNE



SOURCES: Water and Air Research, Inc., 1983. ESE, 1987.

Figure A-4
GROUND WATER CONTOUR MAP— SHALLOW AQUIFER, SITE A— MCAS (H) OFFICERS' HOUSING AREA

MARINE CORPS BASE
CAMP LEJEUNE

SEDIMENT

One sediment sample was taken at the same time and at the same location as the surface water sample. It was analyzed for O&G content only. The O&G concentration (167 ug/g) is typical of the New River sediments in the vicinity of Camp Lejeune, and is not attributable to the hospital type wastes observed in this area.

3.22.3 SUMMARY AND CONCLUSIONS

The only target analytes detected at this AOC was O&G in the surface water and sediment of the New River. These materials are ubiquitous on base and are not related to the material observed at this AOC.

3.22.4 RECOMMENDATIONS

No further action is recommended for this area. No significant contamination was noted in the area and the waste materials that were identified in this site are not "hazardous wastes".

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APPENDIX A

TARGET ANALYTES AND ABBREVIATIONS

TARGET ANALYTES AND ABBREVIATIONS

Cd	=	cadmium
Cr	=	chromium
Pb	=	lead
Sb	=	antimony
O&G	=	oil and grease
VOC	=	volatile organic compounds
T. Phenols	=	total phenols
OCP	=	organochlorine pesticides
OCH	=	organochlorine herbicides
DDT-R	=	o,p- and p,p"-isomers of DDD, DDE, and DDT
EDB	=	ethylene dibromide
TCDD	=	tetrachlorodioxin
PCB	=	polychlorinated biphenyls
Ordnance	=	TNT, DNT, RDX, and white phosphorus (WP)
PCP	=	pentachlorophenol
Hg	=	mercury
Cr+6	=	hexavalent chromium
Xylene	=	o, m, and p- isomers
MEK	=	methylethyl ketone
MIBK	=	methyl isobutyl ketone

Concentrations of all constituents are in parts per billion.

METALS A	NC GROUNDWATER STANDARDS	NC SURFACE WATER STANDARDS	FEDERAL MCL	FEDERAL MCLG
Arsenic	50	50	50	
Cadmium	5	2	10	5
Chromium	50	50	50	100
Copper	1000	15		
Lead	50	25	50	
Nickel	150	50		
Selenium	10	10	10	50
Zinc	5000	50		

METALS B				
Arsenic	50	50	50	
Cadmium	5	2	10	5
Chromium	50	50	50	100
Lead	50	25	50	
Mercury	1.1	0.2	2	
Nickel	150	50		
Zinc	5000	50		

VOLATILE ORGANIC COMPOUNDS (VOC)	NC GROUNDWATER STANDARDS	NC SURFACE WATER STANDARDS	FEDERAL MCL	FEDERAL MCLG
Acrolein				
Acrylonitrile				
Benzene	1		5	
Bromomethane				
Bromodichloromethane				
Bromoform				
Carbon Tetrachloride				
Chlorobenzene	300			
Chloroethane				
Chloroform	0.19			
Chloromethane				
Dibromochloromethane				
Dichlorodifluoromethane	0.19			
1,1-Dichloroethane			5	
1,2-Dichloroethane	0.38			
1,1-Dichloroethylene	7		7	
T-1,2-Dichloroethene	70			
1,2-Dichloropropane	0.56			0
Cis-1,3-dichloropropene				
T-1,3-dichloropropene				
Ethylbenzene	29			70
Methylene Chloride	5			
1,1,2,2-Tetrachloroethane				
Tetrachloroethene				
1,1,1-Trichloroethane	200		200	
1,1,2-Trichloroethane				
Trichloroethene				
Trichlorofluoromethane				
Toluene	1000			2000

VOLATILE ORGANIC COMPOUNDS (VOC)	NC GROUNDWATER STANDARDS	NC SURFACE WATER STANDARDS	FEDERAL MCL	FEDERAL MCLG
Vinyl Chloride	0.015			
2-Chloroethylvinylether				
Xylene	400			10000
Polychlorinated biphenyls (PCB)		0.001		0
Phenols		1		
Pentachlorophenol				2000

ORGANOCHLORINE PESTICIDES (OCP)	NC GROUNDWATER STANDARDS	NC SURFACE WATER STANDARDS	FEDERAL MCL	FEDERAL MCLG
Aldrin		0.002		
a-BHC				
b-BHC				
d-BHC				
g-BHC				
Chlordane	0.027	0.004		0
4,4'-DDD				
4,4'-DDE				
4,4'-DDT		0.001		
Dieldrin		0.002		
Endosulfan I				
Endosulfan II				
Endosulfan Sulfate				
Endrin				
Endrin Aldehyde				
Heptachlor	0.076	0.004		0
Heptachlor Epoxide				
Toxaphene				

ORGANOCHLORINE HERBICIDES (OCH)				
2,4-D	70	100	100	70
2,4,5-T	10	10	10	50
Silvex				
DDT-R				
o,p-DDD				
o,p-DDE				
o,p-DDT				
p,p'-DDD				
p,p'-DDE				
p,p'-DDT				

APRIL 1983

INITIAL ASSESSMENT STUDY OF MARINE CORPS BASE CAMP LEJEUNE NORTH CAROLINA

NEESA 13–011

NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY
Port Hueneme, California 93043

INITIAL ASSESSMENT STUDY

OF MARINE CORPS BASE CAMP LEJEUNE, NORTH CAROLINA

UIC-M67001

Prepared for:

NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY

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Gainesville, Florida

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Mr. Charles Fellows, Environmental Chemist
Dr. Jerry Steinberg, P.E. Environmental Engineer

April, 1983

EXECUTIVE SUMMARY

This report presents the results of an Initial Assessment Study (IAS) conducted at Marine Corps Base (MCB) Camp Lejeune and outlying fields. The purpose of an IAS is to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous materials operations.

Based on information from historical records, aerial photographs, field inspections, and personnel interviews, a total of 76 potentially contaminated sites were identified. Each of the sites was evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors.

The study concludes that, while none of the sites pose an immediate threat to human health or the environment, 22 warrant further investigation under the Navy Assessment and Control of Installation Pollutants (NACIP) Program, to assess potential long-term impacts. A confirmation study, involving actual sampling and monitoring of the 22 sites, is recommended to confirm or deny the existence of the suspected contamination and to quantify the extent of any problems which may exist. Since the on-site survey, MCB Camp Lejeune has taken action to evaluate or mitigate Site No. 2, the Former Nursery/Day-Care Center, and Site No. 16, the Montford Point Burn Dump. The 22 sites recommended for confirmation are listed below in order of priority.

1. Rifle Range Chemical Dump, Site No. 69;
2. Storage Lots 201 and 203, Site No. 6;
3. MCAS Mercury Dumpsite, Site No. 48;
4. Former Nursery/Day-Care Center, Site No. 2;
5. Transformer Storage Lot 140, Site No. 21;
6. Camp Geiger Dump, Site No. 41;
7. Mess Hall Grease Disposal Area, Site No. 74;
8. MCAS Basketball Court Site, Site No. 75;
9. MCAS Curtis Road Site, Site No. 76;
10. Courthouse Bay Liquids Disposal Area, Site No. 73;
11. Fire Fighting Training Pit, Site No. 9;
12. Industrial Area Fly Ash Dump, Site No. 24;
13. Campbell Street Underground Avgas Storage and Adjacent JP Fuel Farm at Air Station, Site No. 45;
14. Hadnot Point Burn Dump, Site No. 28;
15. French Creek Liquids Disposal Area, Site No. 1;
16. Rifle Range Dump, Site No. 68;
17. Montford Point Burn Dump, Site No. 16 (Mitigation undertaken);
18. Industrial Area Tank Farm, Site No. 22;
19. Crash Crew Fire Training Burn Pit; Site No. 54;
20. Sneads Ferry Road--Fuel Tank Sludge Area, Site No. 30;
21. Camp Geiger Area Dump, Site No. 36;
22. Camp Geiger Area Fuel Farm, Site No. 35.

The results of the Confirmation Study will be used to evaluate the necessity of conducting mitigating actions or clean-up operations.

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FOREWORD

The Navy initiated the Navy Assessment and Control of Installation Pollutants (NACIP) program in OPNAVNOTE 6240 ser 45/733503 of 11 September 1980 and Marine Corps Order 6280.1 of 30 January 1981. The purpose of the program is to systematically identify, assess, and control contamination of the environment resulting from past hazardous materials management operations.

An Initial Assessment Study (IAS) was performed at Marine Corps Base (MCB) Camp Lejeune, Jacksonville, North Carolina, by a team of specialists under the direction of the Naval Energy and Environmental Support Activity (NEESA), Port Hueneme, California. Further confirmation studies under the NACIP program were recommended at several areas at the activity. Sections dealing with significant findings, conclusions, and recommendations are presented in the report. Technical sections provide more in-depth discussion on important aspects of the study.

Questions regarding the NACIP program should be referred to the NACIP Program Director, NEESA (Code 112N), Port Hueneme, CA 93043, AUTOVON 360-3351, FTS 799-3351, or commercial (805) 982-3351. Further information regarding this study may be obtained from NACIP Program Director at the above numbers.

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INITIAL ASSESSMENT STUDY
OF MARINE CORPS BASE CAMP LEJEUNE, NORTH CAROLINA

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SECTION 1. INTRODUCTION

1.1 PURPOSE OF INITIAL ASSESSMENT STUDY. The Naval Energy and Environmental Support Activity (NEESA) conducts Initial Assessment Studies (IASs) as directed by the Chief of Naval Operations (CNO). NEESA works in conjunction with the Ordnance Environmental Support Office (OESO) during IASs. The purpose of an IAS is to collect and evaluate evidence which indicates existance of pollutants that may have contaminated a site or that pose a potential health hazard for people located on or off an installation. The IAS is the first phase of the Navy Assessment and Control of Installation Pollutants (NACIP) program. The objective of the NACIP program is to identify, assess, and control environmental contamination from past hazardous materials storage, transfer, processing, and disposal operations. The NACIP program was initiated by OPNAVNOTE 6240 ser 45/733503 of 11 September 1980 and Marine Corps Order 6280.1 of 30 January 1981.

1.2 SEQUENCE OF EVENTS.

1.2.1 Marine Corps Base (MCB) Camp Lejeune was designated for an IAS by CNO letter ser 451/397464 of August 1981. Included in this IAS is Helicopter Outer Landing Field (HOLF) Oak Grove. The environmental consulting firm of Water and Air Research, Inc. (WAR) was selected to conduct the IAS in October 1981.

1.2.2 The Commanding Officer of MCB Camp Lejeune was notified via Atlantic Division, Naval Facilities Engineering Command (LANTNAVFACENGCOM) and by NEESA of the selection of MCB Camp Lejeune for an IAS. The NACIP Program Management Plan (Appendix A to NEESA 20.2-035) and Activity Support Requirements for IAS were forwarded to the installation to outline assessment scope, provide guidelines to personnel, and request advance information for review by the IAS team.

1.2.3 The LANTNAVFACENGCOM staff was briefed on the NACIP program and IAS on 25 January 1982 by Mr. Wallace Eakes, NEESA Contract Coordinator; Dr. Jerry Steinberg, WAR Project Coordinator; and Dr. Hugh Putnam, WAR Team Leader.

1.2.4 MCB Camp Lejeune Chief of Staff and other staff personnel were briefed by the same team on 28 January 1982.

1.2.5 Various government agencies were contacted during 8-25 February 1982 for documents pertinent to the IAS effort. Agencies contacted included:

1. NAVFACENGCOM Historian, Naval Construction Battalion Center (NCBC), Port Hueneme, California;
2. NEESA Information Management Department, NCBC, Port Hueneme, California;
3. NEESA Information Services Department, NCBC, Port Hueneme, California;

4. Installations Planning Division and Real Estate Division of the LANTNAVFACENGCOM Facilities Planning and Real Estate Department;
5. Utilities, Energy, and Environmental Division of the LANTNAVFACENGCOM Facilities Management Department;
6. Federal Records Service Center, Southeast Regional Branch, East Point, Georgia;
7. National Archives, Washington, D.C.;
8. National Archives Annex, Suitland, Maryland;
9. Federal Records Service Center, Suitland, Maryland;
10. Operational Archives, Naval History Office, Washington Navy Yard, Washington, D.C.;
11. Aviation History Office, Washington Navy Yard, Washington, D.C.;
12. Naval History Division, Curator's Branch, Photographic Collection, Washington Navy Yard, Washington, D.C.;
13. Department of Defense Explosive Safety Board, Alexandria, Virginia;
14. Navy Bureau of Medicine and Surgery, Washington, D.C.;
15. Marine Corps History Office, Washington Navy Yard, Washington, D.C.;
16. Naval Sea Systems Command, Safety Ordnance File (SAFEORD), Naval Surface Weapons Center (NSWC), Dahlgren, Virginia;
17. Accident Incident Data Bank (AID), NSWC, Dahlgren, Virginia;
18. EPA Environmental Photo Interpretative Center, Vint Hill Farm, Virginia (aerial photos);
19. NAVFACENGCOM Real Estate Office, Alexandria, Virginia;
20. United States Geological Survey (USGS) Public Information Office, Reston, Virginia; and
21. National Cartographic Information Center (NCIC), Reston, Virginia.

1.2.6 On-site investigations were conducted during the periods of 15-24 March 1982 and 1 January-3 February 1983. The field team interviewed current and past employees, examined records, and visited potential disposal sites. Mr. Wallace Eakes of NEESA and the following WAR personnel participated in on-site work:

1. Dr. Hugh Putnam, Team Leader, Report Author, Biologist;
2. Mr. James Nichols, P.E., Environmental Engineer;
3. Mr. Michael Hein, Environmental Scientist;
4. Mr. William Adams, Hydrogeologist;
5. Mr. Charles Fellows, Environmental Chemist; and
6. Dr. Jerry Steinberg, P.E., Environmental Engineer.

Ground and aerial tours were made of MCB Camp Lejeune and HOLF Oak Grove. Efforts were made to corroborate specific information discovered during interviews. Verification sources included present and past employees with direct knowledge, aerial photographs, and documents. Substantiation has been obtained for most interview information affecting significant findings and recommendations.

1.2.7 From 1 April 1982 through 7 March 1983, information, conclusions, and recommendations were developed into this final report document. This included review and comment by NEESA, LANTNAVFACENGCOM, Marine Corps Air Station (MCAS) New River, NAVFACENGCOM Headquarters, and Commandant Marine Corps (CMC) staff.

1.3 SUBSEQUENT NACIP STUDIES. Recommendations for a Confirmation Study phase of the NACIP program is based on the findings of an IAS. A Confirmation Study is recommended only if the following circumstances exist:

1. Sufficient evidence exists to suspect that the activity is contaminated; and
2. The potential contamination may present a danger to:
   a. The health of civilians in nearby communities or personnel within the activity fenceline, or
   b. The environment within or outside the installation.

No further studies are conducted under the NACIP program if these criteria are not met.

SECTION 2. SIGNIFICANT FINDINGS

2.1 INTRODUCTION. Substantial information has been collected during this Initial Assessment Study (IAS). This chapter summarizes the information collected and it includes three sections:

1. Brief statements of significant facts;
2. Narrative discussion elaborating on the statements, and
3. Abbreviated descriptions of all sites judged to require further assessment (i.e., confirmation).

Information and data are presented in Section 6. Conclusions based on study findings are presented in Section 3.

2.2 GENERAL FINDINGS.

2.2.1 Potentially hazardous chemical wastes have been generated by military activities at Marine Corps Base (MCB) Camp Lejeune.

2.2.2 Seventy-six waste disposal sites have been identified; however, most (54) do not contain hazardous waste or do not pose a significant threat to human health or the environment.

2.2.3 Although sites were identified throughout the base, the air station and Hadnot Point areas had the largest number. Helicopter Outlying Landing Field (HOLF) Oak Grove does not contain any significant sites.

2.2.4 No industrial or municipal wastes were found to be migrating onto base property.

2.2.5 Past use of aircraft and tracked and wheeled vehicles has caused Petroleum, Oil, Lubricants (POL) contamination. These substances were involved in 10 of the 22 sites judged to require confirmation.

2.2.6 Contaminants from the chemical landfill (Site No. 69) are expected to move downgradient and away from the potable wells at the Rifle Range. (Defining movement of pollutants is addressed in more detail in Section 5.) On the basis of this preliminary study, these wells are not at risk from the chemical landfill wastes. The Rifle Range Dump (Site No. 68) west of Well Nos. RR-45 and RR-97, requires further investigation. Solvents buried at this site may have moved upgradient toward Well Nos. RR-45 and RR-97 during heavy groundwater withdrawal.

2.2.7 Ordnance operations are, in general, carefully controlled. However, there is evidence to indicate that limited disposal of some ordnance has occurred at one disposal site (Site No. 41). Potential adverse public health or environmental impacts can be minimized by carefully controlling any future digging or construction activities at the disposal area.

2.2.8 Confining beds separating the water table aquifer and the semiconfined aquifer are discontinuous at Camp Lejeune. This condition increases the chance of leachate from old disposal sites migrating into the semiconfined aquifer, the source of potable water.

2.2.9 Groundwater near the surface is not used for drinking water but is highly susceptible to contamination from hazardous waste disposal practices.

2.2.10 Surface water contamination is also possible because flow in the shallow unconfined aquifer generally follows land contours and discharges to the New River or its tributaries.

2.3 DISCUSSION. The Camp Lejeune complex covers approximately 170 square miles. Wastes have been disposed of in many areas during the existence of the base. Because it is so large, Camp Lejeune has used localized sites for waste disposal. However, all waste was not disposed of at authorized areas. Waste disposal occurred in many parts of the installation and included disposal on the ground surface; the use of borrow pits; and spreading of waste oils, solvents, and other POL compounds on roads for dust control.

Located on the Camp Lejeune complex (including Marine Corps Air Station (MCAS) New River and HOLF Oak Grove) are 76 sites at which some form of waste disposal took place. These sites were documented through past records and interviews with former employees. Sites at MCB Camp Lejeune and HOLF Oak Grove are indicated in Figures 2-1 and 6-37, respectively. Knowledge regarding the exact location of all base disposal sites is incomplete. Some sites may never be found and much information now known lacks detail.

Assessments of human health or environmental risk have been made by considering factors such as the type of material involved and the potential for contaminant migration. Fifty-four sites were judged to present no significant risk and do not need to be further evaluated. Twenty-two sites have potentially hazardous materials and reasonable potential for material migration. These 22 sites warrant more analysis, i.e., confirmation analysis.

Overall, most old disposal sites and areas which received wastes are in Hadnot Point area (location of much of the base industrial activity), and at MCAS New River. Many of the sites judged as needing confirmation contain buried POL compounds (e.g., contaminated fuels, waste oils, solvents, and hydraulic fluids). There have been unavoidable POL spills and leaks throughout the base. At Hadnot Point, the Air Station, and Camp Geiger fuel farms, there have been releases of either Avgas, Mogas, JP-4, or JP-5 in significant quantities to generate concern about the groundwater aquifer.

Training functions on the base require use of large numbers of tracked and wheeled vehicles. In the past, waste oils from maintenance operations were either poured on the ground or put into storm drains. This practice has been stopped and a pollution abatement program using

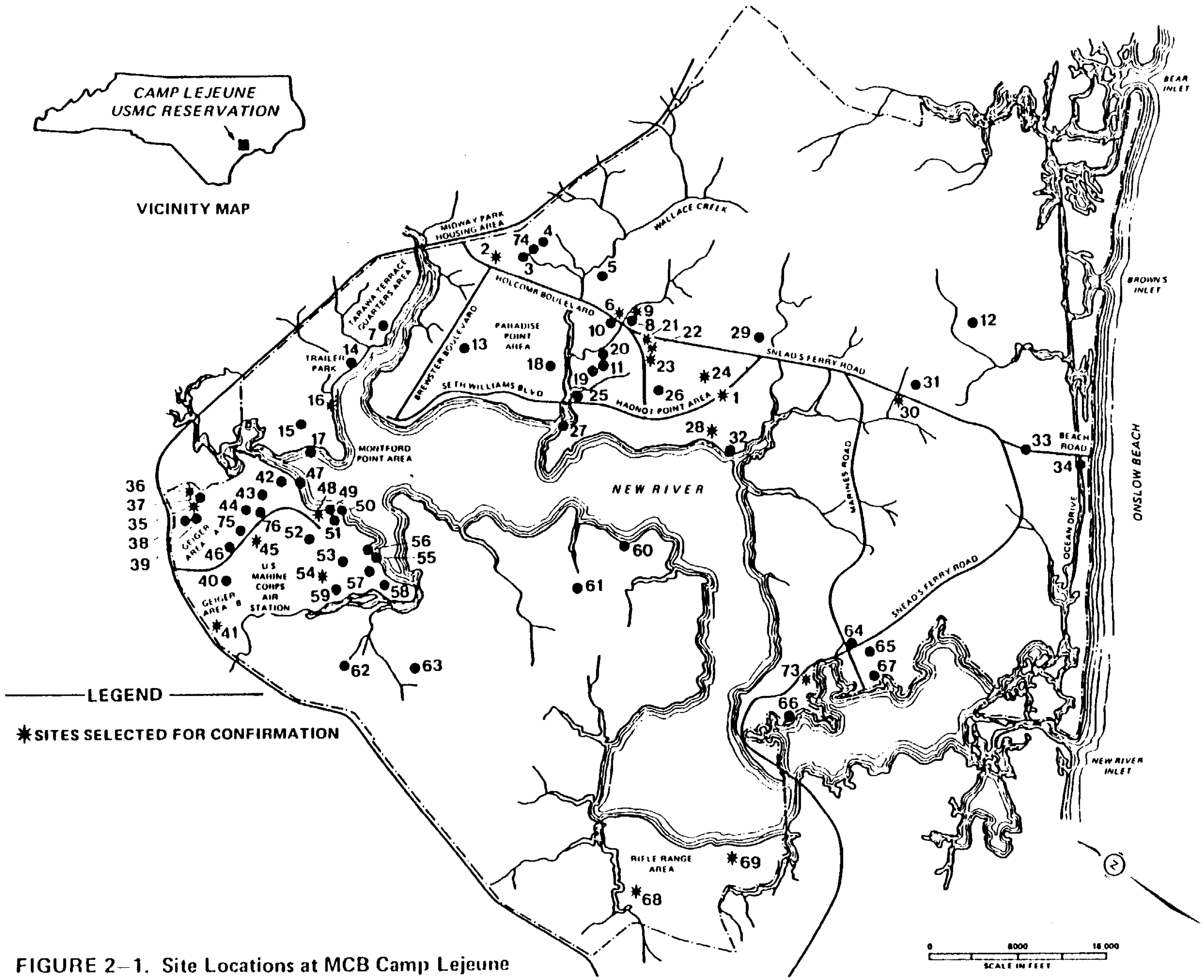


FIGURE 2–1. Site Locations at MCB Camp Lejeune

oil-water separators has been instituted. At MCAS New River, waste oils, solvents and other compounds were often released to storm drains that entered the New River. Another practice was to store waste fuel, oils, and solvents and use them to control dust on unimproved roads. About 1,000 gallons per week of contaminated JP fuel, crankcase fluids, paint thinners, and other assorted POL compounds were used. Fuels and solvents were used during crash crew and firefighting training.

Since the base was constructed in the 1940s, large amounts of chemicals have been stored, used, and disposed of. One principal disposal site is the chemical landfill. The area is now closed, but all types of hazardous materials were buried here in the past. Although some of the chemicals are known, records identifying other chemicals have been lost. It is not known exactly how much material is involved, although it is recognized to involve hundreds of pounds of wastes. Because groundwater contamination is a concern, test wells have been installed and a sampling program instituted.

The mission of the base requires training using live ordnance. For this purpose, year-round impact areas have been set aside. Explosions have a local blast effect on the environment, but they are not thought to threaten the ground water. Skilled Explosive Ordnance Disposal (EOD) personnel have typically handled unexploded rounds in contained areas where ordnance is either burned or electrically exploded. However, some relatively small amounts of unexploded ordnance may have been disposed of in dumpsters and then buried in at least one landfill.

Potential for contamination of the aquifer varies at Camp Lejeune because of the discontinuous nature of confining layers. Therefore knowledge of nearby geological conditions is needed to completely evaluate a specific site. Geohydrology of the Camp Lejeune complex is such that groundwater generally moves toward the New River and its tributaries. Potable wells at the base are usually deep, but, due to voids in the confining layer, some wells may not be completely isolated from shallow groundwater. Also, heavy demands for water may at times produce an overall decline of pressure in the semiconfined aquifer. Therefore, contaminants can migrate laterally and vertically through gaps in the confining layer. Another factor possibly affecting groundwater quality is the unknown status of abandoned wells. Wells improperly sealed when abandoned may become pathways for contaminant migration.

2.4 SITES REQUIRING CONFIRMATION INVESTIGATION. The following sites warrant confirmation based on consideration of the type of material and the migration potential. Information in this section is extracted from one or more later sections in this report. As a minimum, reference should be made to detailed site information forms included in Section 6.7 for:

1. Cautions regarding estimate limitations of some quantities;
2. Supporting information regarding activities and dates of use;

3. Locations according to streets or other known landmarks; and
4. References to figures which show site location and/or details.

Site locations are referenced to the 1979 edition of the Public Works Development Map (PWDM) which is a set of 24 sheets. Each sheet contains a locator system using a letter and a number to identify a specific grid. Throughout this report, locations are given using the following format: PWDM "sheet number", "grid letter and number." For example, a site situated in grid A17 on sheet 11 of 24 is referenced as PWDM coordinates 11, A17.

2.4.1 Site No. 1: French Creek Liquids Disposal Area. This site (PWDM coordinates 11, C7/D7) has been used intermittently from the late 1940s to the mid-1970s. Liquid wastes from vehicle maintenance were poured on the ground as part of routine operations. Dead batteries were emptied of acid before disposal. Batteries and used battery acid usually were hand carried from maintenance buildings to a disposal point. Sometimes, holes were dug for waste acid disposal; these were immediately refilled with dirt. During oil changes, vehicles were driven to a disposal point before the used oil (or other fluid) was drained and replaced with new oil. Acid and oil disposal areas were not necessarily congruent. Suspected quantities involved are 5,000 to 20,000 gallons of waste POL and 1,000 to 10,000 gallons of battery acid. Comparing these quantities to better documented quantities for a similar site (i.e., Site No. 73) indicates that POL quantity estimates may be low at Site No. 1.

2.4.2 Site No. 2: Former Nursery/Day-Care Center (Building 712). This site is at PWDM coordinates 5, K10. This area had been recently operated as a day care center. From 1945 to 1958, pesticides of various kinds were stored, handled, and dispensed here. Residuals are present but reliable data from which to quantify residuals or spill volumes have not been found. Chemicals used in significant amounts include Chlordane, DDT, Diazinon, and 2,4-D. Stored only or used to a minor extent were Dieldrin, Lindane, Malathion, Silvex, and 2,4,5-T. Contaminated areas are the fenced playground, approximately 6,300 square feet; the mixing pad covering approximately 100 square feet; and the wash pad, approximately 225 square feet. An adjacent drainage ditch possibly received washout and spills. Table 2-1 presents results of a preliminary sampling program in April 1982. Based on test data, the day care activities were ceased in April 1982.

2.4.3 Site No. 6: Storage Lots 201 and 203. This site is at PWDM coordinates 6, F3-4/G3-4/H2-4/I2-4/J3. In the 1940s, the area occupied by Lot 203 was a waste disposal site. In the northeast corner, a site is marked where an unknown quantity of DDT was buried. Attempts to estimate the amount have been unsuccessful. The area where DDT was discharged is assumed to be within an 80- to 100-foot radius of the dump marker. The size of Storage Lots 201 and 203 is approximately 25 and 46 acres, respectively. DDT and transformers containing PCBs were stored here.

Table 2-1. Pesticide Levels in Soil at Camp Lejeune Day-Care Center (in ppm, mg/kg), 1982

Station No.	Location*	DDE	DDD	DDT	Chlordane
1	Front play area	0.022	0.240	6.30	0.170
2	Rear play area	0.805	0.850	6.70	0.105
3	Wash pad	27.36	83.10	518.7	36.42
4	Mixing area	68.68	643.60	7,500	45.68
5	Storage area	0.021	0.100	0.061	0.060

* See Figure 6-4.

NOTE 1: Data reported as received without regard for significant digits.

NOTE 2: Since these analyses were made, more testing has been performed.

Source: Jacobs Environmental Laboratories, 1982.

No information referring specifically to PCB leaks has been found. Reports of white powder on the ground indicate DDT spills have occurred.

2.4.4 Site No. 9: Fire Fighting Training Pit at Piney Green Road. This site (PWDM coordinates 6, K3/L3) has been in operation from the 1960s to the present. Pollution abatement devices, including an oil-water separator and an impermeable liner in the training pit (approximately 800 square feet), have been installed. About 30,000 gallons per year of used oil, solvents, and contaminated fuels are burned during training exercises. Until the mid- to late 1960s, the pit was unlined. The entire site is about 1 to 2 acres in size. The soils are sandy and without ground cover.

2.4.5 Site No. 16: Montford Point Burn Dump--The dump (PWDM coordinates 2, N11-12) was opened around 1958 and was closed in 1972, although unauthorized dumping has subsequently occurred. The site contains building debris, garbage, tires, and waste oils. The quantity of these wastes is unknown, but the amount of oil buried here is considered insignificant. Materials have been dumped on the surface and include asbestos insulating material (estimated at less than 1 cubic yard) for pipes. (Note: Mitigation has been undertaken.) The site covers about 4 acres.

2.4.6 Site No. 21: Transformer Storage Lot 140. This site is at PWDM coordinates 10, I15. In 1958, the Pest Control Shop moved from Building 712 to Building 1105 as a storage and administration area and to Lot 140 as a mixing and equipment cleanup area. This shop probably used similar pesticide handling and mixing practices as those used at Building 712. This suggests the possibility for pesticide contamination at this site. Additional information documents overland discharge of waste water generated by rinsing pesticide application equipment on a routine basis. Wastewater discharge was estimated at 350 gallons per week in 1977. Chemicals stored in Building 1105 were identified as Diazinon; Chlordane (dust); Lindane; DDT (dust); Malathion (46-percent solution); Mirex; 2,4-D; Silvex; Dalpon; and Dursban.

In the early 1950s, transformer oil was drained into a pit located at Lot 140. The quantity of oil drained into this pit, over about a 1-year period, is unknown.

Also, surface discharge of transformer oils has been reported. In response to this, the upper 4 inches of soil at Lot 140 was sampled for PCBs in 1980. One part per million PCB or less was found in this topsoil layer.

2.4.7 Site No. 22: Industrial Area Tank Farm. The tank farm (PWDM coordinates 10, J15) is currently in operation. In 1979, a fuel leak estimated at 20,000 to 50,000 gallons occurred. The leak was in an underground line slightly behind the tank truck loading facility, between the building and the large above-ground fuel tank. The site covers about 4 acres.

2.4.8 Site No. 24: Industrial Area Fly Ash Dump. This site (PWDM coordinates 10, L16-17, M16-17) was first disturbed in the 1940s. The disposal area was used until approximately 1980, when transporting ash to the present sanitary landfill began. The site (estimated to be 20 to 25 acres) is adjacent to upstream portions of Cogdels Creek. Materials disposed of include fly ash, solvents, used paint stripping compounds, sewage sludge, and water treatment spiractor sludge. The amount of fly ash is estimated at 31,500 tons. The estimate of stripping compounds disposed of here is about 45,000 gallons over 7 years.

2.4.9 Site No. 28: Hadnot Point Burn Dump. This disposal site (PWDM coordinates 10, Q13-14) was used for industrial area waste from 1946 to 1971. A variety of industrial waste (estimated between 185,000 to 370,000 cubic yards) was burned and covered. The area has been graded, seeded with grass, and now supports a good ground cover. Its proximity to Cogdels Creek and the New River poses health and environmental risks. Leachate and seepage to Cogdels Creek have been observed.

2.4.10 Site No. 30: Sneads Ferry Road--Fuel Tank Sludge Area. This site (PWDM cooridnates 18, G12) contains sludge and/or washout from storage tanks at the industrial area fuel farm. When the contents of two 12,000-gallon tanks were changed from leaded to unleaded fuel in 1970, sludge and/or washout was drained from the tanks by a private contractor and disposed of along a tank trail which intersects Sneads Ferry Road. Based on knowledge of tank capacity below tank outflow ports, about 600 gallons of sludge and washout were disposed of. It is possible that the site has been used for similar wastes from other tanks. Therefore, the 600-gallon amount must be considered a minimum quantity estimate. Composition of sludge and/or washout is unknown and may vary from substantial amounts of tetraethyl lead to mostly cleaning compounds. Soils in the area are sandy and conducive to migration toward French Creek, about 1,500 feet away.

2.4.11 Site No. 35: Camp Geiger Area Fuel Farm. The site is at PWDM coordinates 12, C11. A leak in an underground fuel line occurred in the late 1950s (probably 1958) near the pad supporting the overhead tanks. Amount of fuel is estimated to be in the thousands of gallons and the fuel moved east toward Brinson Creek. Holes were dug to the water table. Where fuel was floating on the groundwater surface, it was ignited and burned. Fuel contaminating Brinson Creek also was ignited and burned. Distance from the fuel farm to Brinson Creek is approximately 400 feet.

2.4.12 Site No. 36: Camp Geiger Area Dump Near Sewage Treatment Plant. The site (PWDM coordinates 12, D13/E13) received mixed industrial and municipal wastes from 1950 and 1959. These were burned and later covered; however, some materials may have been deposited on the ground surface and covered unburned. The site is about 200 feet from Brinson Creek and a small roadside drainage ditch, located on the opposite side of the landfill, is less than 100 feet away. The site covers 25,000 square feet and rises 10 to 12 feet above grade. Estimated volume is 14,000 cubic yards. Wastes of concern are hydrocarbons (solvents, waste oils, and hydraulic fluids) that were generated at Camp Geiger or

MCAS New River. As many as 10,000 to 15,000 gallons may have been disposed of over 9 years. Most were probably burned.

2.4.13 Site No. 41: Camp Geiger Dump Near Former Trailer Park. This dump (at PWDM coordinates 13, E2-3) was active from 1953 to 1970. According to interviews with MCAS New River and Camp Lejeune Base personnel, it received POL compounds, solvents, old batteries, other assorted municipal waste, some ordnance and, in 1964, bags of Mirex. The site is estimated to cover 15 acres and to contain 110,000 cubic yards of waste. The amount of solvents and oils disposed of is estimated to be about 10,000 to 15,000 gallons; the amount of Mirex is estimated to be several tons. The amount of ordnance is not known.

2.4.14 Site No. 45: Campbell Street Underground Avgas Storage and Adjacent JP Fuel Farm. This site is at PWDM coordinates 23, O13-14/P13-14. The two facilities are on each side of White Street and on the north side of Campbell Street. In 1978, 200 to 300 gallons of Avgas were spilled or leaked from this facility. It is estimated that during 1981-1982 more than 100,000 gallons of fuel leaked into the surrounding soil due to corrosion of underground lines at the JP Fuel Farm. These lines have been replaced with an aboveground system. Although the volume of Avgas loss is low, the estimate may be conservative.

2.4.15 Site No. 48: MCAS New River Mercury Dump Site. This area is at PWDM coordinates 23, D17/E17. From 1956 to 1966, metallic mercury from the delay lines of the radar units was reported to have been buried around the photo lab, Building 804. One gallon per year was disposed of in this area. More than 1000 pounds may be dispersed over approximately 20,000 square feet adjacent to the New River.

2.4.16 Site No. 54: Crash Crew Fire Training Burn Pit. This site (PWDM coordinates 23, O24-25/P24-25) is an area off Runway 5-23 that has been used since the 1950s for crash crew training with various POL compounds. Originally, training was on the ground surface with the area surrounded by a berm. Later, a pit was used, which was eventually lined. The area is about 1.5 acres. Based on present annual POL usage of 15,000 gallons, nearly one-half million gallons of these compounds have been used at this site. Most of the POL was burned, but as many as 3,000 to 4,000 gallons may have soaked into the soil.

2.4.17 Site No. 68: Rifle Range Dump. This site (PWDM coordinates 16, H6-8/I6-7) was active from 1942 to 1972. Fill capacity of the dump is estiimated at 100,000 cubic yards. Types of wastes buried here include garbage, building debris, Waste Treatment Plant (WTP) sludge, and solvents. Solvents are used extensively for weapons cleaning. However, the amount disposed of at this site is relatively small and estimated to be approximately 1,000 to 2,000 gallons. Solvents are of concern because nearby Well Nos. RR-45 and RR-97 have been found to contain organic contaminants. The distance between the wells and the site is approximately 1,500 feet. Although the wells are upgradient, pumping could draw contaminants toward these wells. Table 2-2 contains results of volatile organic analyses run on samples from active Well Nos. RR-45, RR-47,

Table 2-2. Volatile Organic Contaminant Levels in Potable Wells and WTP at the Rifle Range

Sampling Site	Date Sampled	Contaminant	Levels (in ppb)	
Well No. RR-45--Drinking Water Well	April 10, 1981	Methylene Chloride	4.0	
Well No. RR-47--Drinking Water Well	April 10, 1981	Clean		
Well No. RR-97--Drinking Water Well	April 10, 1981	Chloroform	16.6	
		Methylene Chloride	5.8	
		Trichloroethylene	1.8	
Bldg. No. RR-85--Water Treatment Plant--Treated Water	April 10, 1982	Chloroform	17.0	
		Methylene Chloride	3.0	
			Raw	Treated
RR Water Plant	May 20, 1981	1,1-Dichloroethane	5.40	3.40
		Chloroform	53.40	94.40
		Methylene Chloride	14.60	4.0

Note: Data reported as received without regard for significant digits.

Source: Jennings Laboratories, Inc., 1981.
Reports Dated: April 16, 1981
May 29, 1981

RR-97, and the WTP Bldg. No. RR85. Results are discussed in Section 2.4.18.

2.4.18 Site No. 69: Rifle Range Chemical Dump. This site (PWDM coordinate 16, L14-15/M14-15) was once designated for disposal of all hazardous chemicals. It has received much attention and is discussed in detail here. Although past records have been lost, it is known that pesticides, PCBs, pentachlorophenol, trichloroethylene (TCE), and many other compounds were buried here. This landfill was active from the early to mid-1950s to approximately 1976.

Tributaries to the New River (including Everett Creek and unnamed creeks and guts), the Rifle Range wells, and surface seeps are nearby. Test wells already exist and intermittent sampling has been done. Also, samples have been collected from a small tributary to Everett Creek and from pools on or near the site. Results of analyses for the presence of volatile organics are in Table 2-3.

Data on Table 2-3 show that water from Test Well Nos. 15 and 16 contains elevated levels of organic contaminants. Samples of surface water from a nearby pool also indicated a high concentration of volatile organic compounds. The pool is a pit 10 to 15 feet deep. It collects groundwater through its sides and bottom.

Because there is a risk of contaminating the potable water supply at the Rifle Range, samples were collected at three operating wells (RR-45, RR-47 and RR-97). The latter well is about 6,000 feet from the dump site. Analyses were run for organic contaminants in both raw and finished water. The results, shown in Table 2-2, indicate that Well No. RR-97 had three organic contaminants. No contaminants were detected in Well No. RR-47, but Well No. RR-45 had 4 parts per billion (ppb) of methylene chloride. Finished water (Well No. RR-85) showed levels of 17 ppb of chloroform and 3 ppb of methylene chloride. Possible sources of contamination are discussed in Secton 6.

Samples from the Rifle Range wells of raw and treated water have been analyzed for trihalomethane compounds. Results show that treated water in August of 1981 contained total trihalomethane (THM) in excess of 100 ppb. Further sampling in 1981 and 1982 indicates levels (except in December 1981) approximately half those observed in August. Reduction of trihalomethanes may be possible through changes in the water treatment process. Elimination or reduction of prechlorination has been successful in reducing trihalomethanes in other plants.

2.4.19 Site No. 73: Courthouse Bay Liquids Disposal Area. This site (PWDM coordinates 17, I11-12) was used from 1946 to 1977. The site is located about 200 feet from Courthouse Bay and 200 feet downgradient from the nearest well. About 13 acres have been identified as a possible POL disposal area, of which about 1 acre also has been used for waste acid disposal. Motor oil from vehicles was drained onto the ground during oil changes (potentially up to 400,000 gal of oil over 32 years). Dead batteries were drained of acid daily or weekly. The acid was poured into

Table 2-3. Volatile Organic Contaminant Levels in Test Well Nos. 15 and 16 and Potable Wells at Rifle Range (in ppb), April 10, 1981 (Page 1 of 2)

Sampling Site	Contaminant	Levels (in ppb)
Test Well No. 15	Methylene chloride	2
Test Well No. 16	1,1-Dichloroethane	38
	Methylene chloride	13
	1,2-Dichloroethane	52
	1,1-Dichloroethylene	73.6
	Toluene	51.8
Pool Below Test Well No. 16	Methylene chloride	3.4
Rad Pool	1,1-Dichloroethane	2.0
	Methylene chloride	2.4
Pool with Barrel	Benzene	1.0
	Toluene	181
	1,1-Dichloroethane	176
	1,1,1-Trichloroethane	103
	1,2-Dichloroethane	101
	1,1-Dichloroethylene	258
	1,1,2-Trichloroethane	252
	Chloroform	34.6
	Methylene chloride	37
	Trichloroethylene	141
Stream Bed Below, Behind Dump about 100 yds SSE of Test Well No. 17	Methylene chloride	14
	Tetrachloroethylene	5.8
Tidal Marsh at End of Road	Clean	
Mouth of Stream at Everett Creek	Clean	
Well No. RR-45--Drinking Water Well	Methylene chloride	4.0
Well No. RR-47--Drinking Water Well	Clean	

Table 2-3. Volatile Organic Contaminant Levels in Test Well Nos. 15 and 16 and Potable Wells at Rifle Range (in ppb), April 10, 1982 (Continued, Page 2 of 2)

Sampling Site	Contaminant	Levels (in ppb)
Well No. RR-97-- Drinking Water Well	Chloroform	16.6
	Methylene chloride	5.8
	Trichloroethylene	1.8
Bldg. No. RR-85-- Water Treatment Plant--Treated Water	Chloroform	17
	Methylene chloride	3.0

Source: U.S. Navy, 1982.

shallow, hand-shoveled holes in the disposal area. The holes were then refilled. It is estimated that 10,000 to 20,000 gallons of waste battery liquid were disposed of.

2.4.20 Site No. 74: Mess Hall Grease Pit Area. This site of 2 to 3 acres is at PWDM coordinates 5, N12/O14 and was used from about 1950 to the early 1960s. A large pit at this site received waste grease from mess halls; however, this activity is not considered to pose a hazard to the environment or human health. Burial of pesticides and PCB-containing oil probably occurred near the grease pit. A nearby area (about 400 feet southeast) was the site of a pest control activity where bags of sawdust were soaked in DDT solution before being placed in swamp waters. Spillage, wastage, and rinse-out may have resulted in pesticide contamination of soil and groundwater. Estimates of quantities involved include: 1,100 gallons of PCB oil, 50 to 500 gallons of DDT solution, and 2,200 gallons of drummed pesticides. Both areas of this site are within 100 yards of an inactive potable water well.

2.4.21 Site No. 75: MCAS Basketball Court Site. This site is at PWDM coordinates 23, O8-9/P8-9 and was used at least once in the early 1950s for burial disposal of drums. Up to one hundred 55-gallon drums of chloroacetophenone (CN) training agent(s) (a tear-causing compound) are believed to be buried at this site. In addition to CN, chloropicrin (PS), chloroform, carbon tetrachloride, and benzene may also be present. This site is located within 100 yards of on-base housing and within 500 feet of two potable water wells. Another potable water well is located about 800 feet from this site.

2.4.22 Site No. 76: MCAS Curtin Road Site. This site is at PWDM coordinates 23, L10/M10/N10. Drums were buried at this site on two separate occasions in 1949. The drums are believed to have contained some type of chloroacetophenone training agent (CN, CNC, CNB, CNS). Depending upon training agent type, other chemicals may be present including chloroform, benzene, carbon tetrachloride, and chloropicrin. Up to seventy-five 55-gallon drums may be present at this site located next to a residential area and within 1,000 feet of two potable water wells.

SECTION 3. CONCLUSIONS

3.1 INTRODUCTION. Based on findings of the Initial Assessment Study (IAS), general and site-specific conclusions can be drawn regarding potential for contamination from past disposal of hazardous wastes.

3.2 GENERAL. At 54 of the 76 sites identified, there is little or no potential for harm to public health or the environment. This is because:

1. Most sites contain no significant amount of hazardous substances;
2. Potential for migration of wastes is small, or
3. Waste movement is not reasonably expected to cause exposure to humans or biological resources.

Potential for adverse impact exists at 22 sites (Nos. 1, 2, 6, 9, 16, 21, 22, 24, 28, 30, 35, 36, 41, 45, 48, 54, 68, 69, 73, 74, 75, and 76). Documentation of pollutant movement does not exist at most of these sites. At least some limited field investigation is needed to confirm or deny pollutant migration from suspected past disposal sites of hazardous wastes.

3.3 SITES NOT REQUIRING FURTHER ASSESSMENT. Sites judged not to need additional work are discussed below.

3.3.1 Inert Wastes. Twenty-five sites contain wastes which are inert, such as scrap wood, metal, and construction debris. These sites are Nos. 3, 4, 13, 14, 15, 17, 20, 25, 27, 32, 37, 38, 39, 40, 42, 46, 47, 50, 55, 57, 58, 59, 61, 62, and 63.

3.3.2 Nonverification of Sites. Five sites (Nos. 8, 11, 23, 26, and 72) were reported as possible hazardous wastes sites prior to or during the IAS. However, further investigation has revealed that, while hazardous materials may have been stored there, no spills or disposal of materials occurred.

3.3.3 Petroleum, Oil, Lubricant (POL) Spills with Insigificant Migration Potential. Although spills of POL have occurred at 9 sites (Nos. 5, 31, 33, 34, 52, 53, 56, 64, and 66), significant contamination is not expected because of the small quantities involved or the considerable distance to receiving streams, or both.

3.3.4 Landfilled or Open Dumped Waste in Small Quantities. At 14 sites, quantities of wastes, whether hazardous or not, were judged to be insignificant. These sites are Nos. 7, 10, 12, 18, 19, 43, 44, 49, 51, 60, 65, 67, 70, and 71.

3.3.5 Permitted Sites. The existing base sanitary landfill (Site No. 29) is a permitted site and therefore requires no further NACIP action.

3.4 SITES REQUIRING FURTHER ASSESSMENT.

3.4.1 Site No. 1: French Creek Liquids Disposal Area. Waste POL and used battery acid may threaten a potable water well at Building 636. Potential also exists for pollutant migration off-site into Cogdels Creek and then into the New River. Hence, adverse public health and/or environmental impacts are possible.

3.4.2 Site No. 2: Former Nursery/Day-Care Center. Residual pesticides may exist in soils and drainage conveyance sediments. Potential exists for movement to potable groundwater and Overs Creek. Therefore, adverse public health and/or environmental impacts are possible.

3.4.3 Site No. 6: Storage Lots 201 and 203. Residual from past disposal and spills of DDT may be present in great enough amounts to move off-site to surface waters (Wallace and Bearhead Creeks) and impact the aquatic environment.

3.4.4 Site No. 9: Fire Fighting Training Pit at Piney Green Road. Residual POL from fire fighting training potentially threatens surface waters (Bearhead Creek) with possible adverse health and/or environmental impacts.

3.4.5 Site No. 16: Montford Point Burn Dump, Site A. Asbestos on the ground poses a public health threat to persons being exposed to it. (Note: Mitigation has been undertaken.)

3.4.6. Site No. 21: Transformer Storage Lot 140. Transformer oil, possibly containing PCBs, may have seeped into the groundwater table and may be migrating toward potable water wells. Residual pesticides in the soil and in the drainage ditch sediment may threaten human health by direct contact. Migration potential to Bearhead Creek exists, hence, adverse public health and/or environmental impacts are possible.

3.4.7 Site No. 22: Industrial Area Tank Farm. Fuel leakage may have produced residual contamination of soils with potential for movement to potable groundwater (e.g., Well No. 602).

3.4.8 Site No. 24: Industrial Area Fly Ash Dump. Past disposal of fly ash and solvents may result in migration of harmful substances to Cogdels Creek with adverse public health and/or environmental impacts.

3.4.9 Site No. 28: Hadnot Point Burn Dump. Residuals from past industrial waste disposal potentially threatens Cogdels Creek, the New River, and a recreation pond with adverse health and environmental impacts.

3.4.10 Site No. 30: Sneads Ferry Road--Fuel Tank Sludge Area. Sludge deposits from fuel storage may leach hazardous fuel additives. Subsequent migration to French Creek could result in environmental degradation.

3.4.11 Site No. 35: Camp Geiger Area Fuel Farm. Hazardous chemicals in residuals from past fuel spills may presently exist in soils. Migration of these chemicals to nearby Brinson Creek could adversely impact the aquatic environment.

3.4.12 Site No. 36: Camp Geiger Area Dump Near Sewage Treatment Plant. Solvents, waste oils, and hydraulic fluids in the landfill may move through the soil to contaminate nearby Brinson Creek or roadside drainage ditches flowing to Brinson Creek. Adverse effects on stream biota could then occur.

3.4.13 Site No. 41: Camp Geiger Dump Near Former Trailer Park. POL, solvents, Mirex, and lead from batteries are among hazardous substances which were disposed of at this site. These substances may migrate to tributaries of Southwest Creek, thereby causing environmental harm. Some ordnance was disposed of at this site and may pose a health hazard during on-site investigations or construction.

3.4.14 Site No. 45: Campbell Street Underground Avgas Storage and Adjacent JP Fuel Farm at MCAC New River. As a result of fuel spillage/leakage, tetraethyl lead and hydrocarbons may move through the soils to nearby drainage ditches and eventually to Southwest Creek or potable water wells.

3.4.15 Site No. 48: MCAS New River Mercury Dump Site. Mercury dumped on or in the ground near the New River may be migrating to the river causing toxic effects to stream biota and persons consuming fish.

3.4.16 Site No. 54: Crash Crew Fire Training Burn Pit at MCAC New River. Harmful substances (e.g., lead) in waste fuels, oils, and solvents may still remain in the soils near the pit. Potentially, they could migrate toward and into drainage ditches flowing to Southwest Creek and cause adverse impacts on aquatic systems.

3.4.17 Site No. 68: Rifle Range Dump. Solvents may have been disposed of in large enough quantities to be migrating downgradient to Stone Creek or moving upgradient into potable wells (e.g., Well Nos. RR-45 and RR-97).

3.4.18 Site No. 69: Rifle Range Chemical Dump. Toxic substances (including pesticides, PCBs, pentachlorophenol, and TCE) may be moving toward and into waters of Everette Creek or other unnamed tributaries of the New River. This poses threats to human health, via fish consumption or direct contact, and the environment. Troop training in the area occurs and risks of direct exposure to persons exist.

3.4.19 Site No. 73: Courthouse Bay Liquids Disposal Area. Waste motor oil and battery acid potentially could migrate into Courthouse Bay. Phenolics and heavy metals (e.g., lead and antimony) may be associated with these materials. A small potential exists for contamination of a potable water well (i.e., near Building A-5). Therefore, adverse public health and/or environmental impacts are possible.

3.4.20 Site No. 74: Mess Hall Grease Pit Area. Spilled DDT solution and buried drums of PCB oil, pesticides, and other wastes may cause groundwater contamination and pose a threat to human health via potable water well contamination.

3.4.21 Site No. 75: MCAS Basketball Court Site. Buried drums of waste, probably training agent(s), may threaten potable water wells and a water treatment plant pond with contamination by training agent and associated solvents.

3.4.22 Site No. 76: MCAS Curtis Road Site. Buried drums, possibly containing either dry or dissolved training agent(s), may contaminate groundwater and migrate to existing potable water wells.

SECTION 4. RECOMMENDATIONS

4.1 INTRODUCTION. No further work is recommended at 54 of the 76 sites identified during the Initial Assessment Study (IAS). In this section, specific suggestions are made for further study at the remaining 22 sites judged to require confirmation investigation. Recommendations for confirmation studies are made only for sites located on military property or adjacent surface waters where comingling of on and off property waters typically occurs. Specifically excluded are any recommendations regarding interim measures at prospective confirmation study sites and sites not located on military property.

Recommendations typically involve field work which varies in effort according to perceived magnitude and extent of contamination potential. Important information at sites may remain to be gathered during confirmation. This is because the purpose of the IAS study has been to determine contamination potential, and at many sites, this has been satisfactorily assessed without processing all information which may be relevent to a confirmation investigation. For example, at some sites, precise location of site boundaries remain inexact, and an important aspect of confirmation will be to better define them.

Hazardous waste sites identified by the IAS team were evaluated using a Confirmation Study Ranking System (CSRS) developed by Naval Energy and Environmental Support Activity (NEESA) for the Navy Assessment and Control of Installation Pollutants (NACIP) program. The system is a two-step procedure for systematically evaluating a site's potential hazard to human health and the environment, based on evidence collected during the IAS.

Step one of the system is a flowchart which eliminates innocuous sites from further consideration. Step two is a ranking model which assigns a numerical score within a range of 0 to 100, to indicate the potential severity of a site. Scores are a reflection of the characteristics of the wastes disposed of at a site, contaminant migration pathways, and potential contaminant receptors on and off the installation. CSRS scores and engineering judgment are then used to evaluate the need for a confirmation study based on the criteria stipulated in Section 1.3. CSRS scores assigned to sites recommended for confirmation studies also assist Navy managers to establish priorities for accomplishing the recommended actions.

A more detailed description of the Confirmation Study Ranking System is contained in NEESA Report 20.2-042.

4.2 OVERVIEW OF THE RECOMMENDATIONS PROCESS. Recommendations are presented in the following section for additional investigation at each site requiring confirmation. A confirmation study may require multiple sampling efforts before concluding that a problem does not exist. Movement of pollutants in groundwater may be very slow and/or nonuniform, so that sample wells may not draw from affected parts of the aquifers.

Therefore, in addition to sampling results, recommendations and conclusions should be based on all facts known about a site, including the types and quantities of waste, hydrogeology, and potential routes of pollutants back into the environment. Detection of pollutants in groundwater samples is generally conclusive evidence, but negative results for a limited number of samples does not prove that pollutants are not and/or will not be present.

Recommendations (intended to be used as general guidance for subsequent investigation) are presented on a site-by-site basis using the following format:

Problem: A short statement indicating types of materials involved. Information regarding type of potential environmental contamination may also be given.

Goal: A concise statement addressing specific confirmation objectives.

Approach: An overview of general strategy applied.

Wells: General instructions for siting wells, if used.

Samples: General directions giving types and numbers of soil, sediment, groundwater, or surface water samples specified. General location for samples, other than wells, is often included.

Frequency: A brief specification of when, and over what period, to collect the various types of samples.

Analyses: Specification of information to be collected for each different type of sample. Generally, laboratory analyses are specified, but relevant supporting information may also be noted.

Frequency and analyses specifications are omitted if no samples are recommended.

4.3 SUMMARY OF RECOMMENDATIONS. Recommended principal activities are summarized in Table 4-1. For each site, the suggested number of well installations is shown. Total number of analyses required in well water, surface water, surface water sediments, and soils is shown for a 1-year period. Constituents recommended for analysis and frequency (where repetitive sampling is recommended) are also indicated.

Table 4-1 should be used with the detailed recommendations given for each site in Section 4.4.

4.4 SPECIFIC RECOMMENDATIONS BY SITE. Recommendations for confirmation work at specific sites are outlined below. Details for monitoring-well construction are given in Appendix A.

Table 4-1. Summary of Recommended Field Work

Site No.	CSRS Score and Study Type*	Wells to be In-stalled	Samples: Wells	Samples: Surface Water	Samples: Sediments - S or Tissues - T	Samples: Soil Cores	Frequency†	Constituents**
1	17C	7	16	-	-	-	2	SC, pH, o & g, Antimony, Chromium, Lead, Zinc Phenolics
2	27C	0	8	-	-	-	2	Cl pest, P pest, herb.
			-	-	4S	8	1	Cl pest, P pest, herb.
6	37V	0	0	-	-	20	1	DDT-R
9	19C	3	8	-	-	-	2	Aromat, TOX, phenolics
16	17	0	-	-	-	-	-	-
21	27C	3	12	-	-	-	2	Cl pest, PCBs
			-	-	2S	8	1	Cl pest, P pest, herb.
22	15C	2	6	-	-	-	2	Aromat/Pb
24	19C		-	-	5S	-	1	Metals A
			-	2	-	-	1	Metals A, F, SC, pH
		6	12	-	-	-	2	Metals A, F, SC, pH, TOX
28	17C		-	-	3S	-	1	o & g, Metals C, PCBs, Cl pest,
					2T		1	Cl pest
		5	10	6	-	-	2	o & g, Metals C, GWCI
30	11C	3††	6	-	-	-	2	SC, o & g, Pb
			-	-	-	5	1	o & g, Pb
35	6V	0	-	-	-	24	1	o & g, Pb
36	9C	5	10	-	-	-	2	GWCI
41	26C	4	8	-	-	-	2	GWCI, Cl pest
45	18C	0	-	-	3S	30	1	o & g, Pb
			2	-	-	-	2	Pb, Aromat

Table 4-1. Summary of Recommended Field Work (Continued, Page 2 of 2)

Site No.	CSRS Score and Study Type*	Wells to be Installed	Samples: Wells	Samples: Surface Water	Samples: Sediments - S or Tissues - T	Samples: Soil Cores	Frequency†	Constituents**
48	30C	6††	12	-	-	-	2	Total Hg
54	11V	0	-	-	-	24	1	o & g, Pb
68	17C	6	12	-	-	-	2	PHH, o & g
			8	-	-	-	4	PHH, o & g
69	47C	12††	36	3	-	-	3	GWCI, o & g, Cl pest, PCBs, Hg, Residual Chlorine, TCE, PCP
		6	18	-	-	-	3	GWCI, o & g, Cl pest, PCBs, Hg, Residual Chlorine, TCE, PCP
73	23C	4††	10	-	-	-	2	SC, pH, o & g, Antimony Chromium, Lead, Zinc Phenolics
74	24C	4	10	-	-	-	2	GWCI, Cl pest, PCBs
75	23C	4	14	2	-	-	2	GWCI, benzene
76	23C	3	10	-	-	-	2	GWCI, benzene

* Confirmation Study Ranking System Score is the numerical value; "C" indicates Characterization Study and "V" indicates Verification Study.

† Number of samplings during initial year of program. Additional sampling may be required.

** Key to constituent abbreviations:

Cl pest. - Organochlorine pesticides including DDT-R
P pest. - Organophosphorous pesticides
DDT-R - DDT and residues
o & g - Oil and grease
PHH - Purgeable halogenated hydrocarbons
TOC - Total organic carbon
SC - Specific conductance
Metals A - Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, and Zinc.
Metals B - Antimony, Chromium, Lead, and Zinc.
Metals C - Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, and Zinc.
GWCI - Groundwater contamination indicators, i.e., SC, pH, TOC, TOX (total organic halogen)
TOX - Total organic halogen
TCE - Trichloroethylene
Herb. - Phenoxyalkanoic acid herbicides
PCP - Pentachorophenol
Aromat - Aromatics commonly found in fuels, e.g., benzene, toluene, xylene

†† Hand-augered wells.

Source: WAR, 1982.

4.4.1 Core sampling is generally specified as at 1- to 2-foot intervals down into the water table. This spacing is based on an assumed depth to groundwater of 5 to 10 feet (i.e., 4 or 5 total samples). If depth to groundwater is greater, intervals should be selected to yield 4 or 5 samples between the surface and 1 foot below the water table. Core holes should be filled with cement grout following samplings.

4.4.2 Lead analysis has been specified in certain instances of potential gasoline contamination. Other hazardous substances may also be present in fuels, e.g., benzene. However, lead is considered a useful indicator and is a toxicant in some fuels.

4.4.3 Upgradient wells to document background groundwater quality are specified at many sites. Where several sites are relatively close, one or two background wells may serve more than one site.

4.4.4 Static and dynamic (if appropriate) water levels should be measured whenever wells are sampled. Provisions should be made to permit referencing levels to appropriate data [e.g., mean sea level (msl)].

4.4.5 Whenever DDT-R is recommended for analyses, this refers to analyzing o,p' and p,p' isomers of each of the following: DDT, DDD, and DDE (i.e., a total of six individual compounds).

4.4.6 Analyses denoted as RCRA groundwater contamination indicators refer to specific conductance, pH, total organic carbon (TOC), and total organic halogen (TOX).

Site No. 1: French Creek Liquids Disposal Area

Problem: Uncontained disposal of POL and used battery acid has occurred. Radiator flushing containing dichromate probably occurred. There is potential for migration to groundwater and less potential for surface water contamination. A potable water well is located in the vicinity.

Goal: Determine magnitude of disposal area and assess potential for migration.

Approach: Conduct an inspection of the site to determine boundaries. Install wells and sample shallow groundwater.

Wells: Use existing well (Building 636). Install a total of seven shallow wells--three at downgradient edge of each disposal area and one background, shallow well east of Daly Road and south of Main Service Road.

Samples: Sample each well.

Frequency: Wells: Sample twice, separated by 2 to 3 months

Analyses: Test for specific conductance, pH, oil and grease, phenolics, antimony, chromium, lead, and zinc.

Site No. 2: Former Nursery/Day-Care Center at Building 712 (Formerly the Pest Control Shop)

Problem: This building (presently closed to use) and an adjacent area across the railroad tracks was formerly the pesticide storage and handling facility. Residual pesticides in the soil and the building may pose health risks to supervisory personnel and small children. Preliminary sampling results are shown in Table 2-1. An adjacent drainage creek (ditch) probably received washout and spills. A playground, an old wash pad, an old mixing area, and an old storage area are involved.

Goal: Determine types and amounts of pesticides in the building and playground area, remainder of the area, and in the creek sediments. Determine if pesticides have migrated to nearby wells.

Approach: Collect cores from three sites in the playground. Conduct a thorough inspection of other outdoor areas (both inside and outside the fence) where mixing and handling occurred and obtain three additional soil samples. Collect two soil samples from storage area east of railroad tracks. Examine the building thoroughly and sample for pesticide residue or volatile Chlordane. Sample creek sediments. Collect samples from water supply wells nearby.

Wells: Use existing Well Nos. 645, 646, 647, 616.

Samples: In playground, take 18-inch-deep cores of soil from three separate locations. In other outdoor areas (washing, mixing, and storing), take one 18-inch-deep core from each area (See Section 4.4.1). From building, sample air for volatiles plus, from most used rooms, the residue samples from places likely to harbor fugitive substances, e.g., behind moldings. In creek, take sediment samples at four places: immediately downstream of site, about 1,400 feet downstream near Well No. 646, about 4,000 feet downstream above confluence with Overs Creek, and in Overs Creek upstream of creek widening at Northeast Creek. In wells, sample each well.

Frequency: Sample sediments and soils once. In wells, sample twice, separated by three months. If residuals are present, then further intensive sampling is needed to determine extent and distribution of contamination.

Analyses: For soils, sediments, well, and residues, test for organochlorine pesticides, including DDT-R, phenoxy alkanoic acid herbicides (including 2,4,5-T), malathion, diazinon. For air in the building, test for volatile Chlordane and Dieldrin.

Site No. 6: Transformer Storage Lots 201 and 203

Problem: DDT contamination of soils due to burial in northeast section of Lot 203 and spills.

Goal: Determine presence of DDT in soils.

Approach: Sample soils in vicinity of suspected dumping and spilling of DDT. Emphasize areas radially from the four DDT-related locations.

Samples: At each of the four spill locations, select five places to obtain cores (i.e., 20 samples total). Unless there are on-site indications to concentrate sampling places, encircle locations. At each of the five sampling places, within an approximately 3-foot-diameter circle, take approximately four shallow cores 12 inches deep to produce a single composite sample totaling about 3 kilograms (kg) of soil. At the DDT dump, deeper cores may be necessary (see Section 4.4.1).

Frequency: Sample once.

Analyses: Analyze for DDT-R.

Site No. 9: Fire Fighting Training Pit at Piney Green Road

Problem: Contaminated fuels and smaller amounts of solvents and other Petroleum, Oil, Lubricants (POL) compounds have been used at this site with potential contamination of soil and water table.

Goal: Determine if POL and solvent compounds are present and if migration has occurred.

Approach: Sample groundwater and determine contamination from fuel or solvents. Even though pit is now lined, a plume of material may have moved downgradient during approximately 20 years before lining. Therefore, collect samples adjacent to and downgradient of pit. Well HP-635 is approximately 500 feet away. Although not downgradient, it is pumping and should be sampled.

Wells: Use Well No. 635 and install two downgradient wells and one well adjacent to pit.

Samples: Sample each well. Static and dynamic water levels should be recorded referenced to datum (see Section 4.4.1).

Frequency: Sample each well twice, 3 months apart.

Analyses: Analyze for aromatics commonly found in fuels (e.g., benzene, toluene, xylene) TOX and phenolics. Measure thickness of any POL layer encountered.

Site No. 16: Montford Point Burn Dump

Problem: Unauthorized dumping of asbestos here.

Goal: Confirm quantity of asbestos on land surface in order to estimate cleanup effort. Alternately, proceed directly to clean up and remove friable asbestos to an appropriately operated landfill.

Approach: Conduct a careful inspection of the site. Alternately, collect asbestos material on ground surface and dispose in an approved manner.

Samples: None

NOTE: Corrective action has been initiated.

Site No. 21: Transformer Storage Lot 140

Problem: Pesticide handling and mixing, and cleaning of pesticide contaminated equipment occurred at this site and soil contamination is probable. Storm water runoff may carry pesticides into Bearhead Creek via a railroad track drainage ditch adjacent to Storage Lot 140. Potential PCB disposal in pit may have contaminated groundwater with subsequent movement to potable wells (Pump Houses 602, 634, and 637).

Goal: Determine types and amounts of pesticides at Storage Lot 140 (to include the rinse pad, mixing area, and adjacent areas), and in drainage ditch sediment. Determine PCB content in groundwater between pit site and wells. Sample existing wells.

Approach: Collect soil and ditch sediment samples and install monitoring wells. Inspect site to determine if the 1958 to 1977 surface material has been covered by new material. Emphasize areas adjacent to wash pad and in mixing area.

Wells: Install three monitoring wells approximately 100 feet from pit site in directions of potable wells. Also use existing wells.

Samples: Collect soil samples at two depths from each of four places (i.e., eight samples total). Locate four places as follows: two in lot near the southeast corner, plus two outside lot in areas apparently within surface drainage route. Sample two depths: upper 6 inches and 12 to 18 inches below the surface. Insure that sampled soil is not fill material.

Collect ditch sediment samples at two locations: downstream end of Storage Lot 140 and immediately upstream of Sneads Ferry Road.

Frequency: Sample each well. Soil and sediment: sample once. Wells: sample twice.

Analysis: For soils and sediments, test for organochlorine pesticides including DDT-R, organophosphorus pesticides, phenoxy alkanoic acid herbicides (including 2,4,5-T). For wells: test for organochlorine pesticide scans (including PCBs).

Site No. 22: Industrial Area Tank Farm

Problem: Fuels amounting to 20,000 to 50,000 gallons leaked into soils around tank farm. There is potential for migration to a potable well, i.e., Well No. 602.

Goal: Determine whether fuel components are present in groundwater at Well No. 602 or between site and Well No. 602.

Approach: Sample groundwater from two new wells and from Well No. 602, which is 1,100 feet downgradient and pumping.

Wells: Use existing Well No. 602. Install two new wells at approximately third points between site and Well No. 602.

Samples: Sample all wells.

Frequency: Sample well water twice, separated by 2 to 3 months.

Analyses: Analyze for aromatics commonly found in fuels (e.g., benzene, toluene, xylene) and lead. Measure thickness of any POL layer present.

Site No. 24: Industrial Area Fly Ash Dump

Problem: Disposal of fly ash, sludges from water and wastewater treatment plants, and solvents has occurred. There is potential for migration to groundwater and/or surface water.

Goal: Determine whether hazardous wastes are present and assess potential for migration.

Approach: Conduct an inspection of the site to determine boundaries. Install wells and sample groundwater. Sample sediments and water in adjacent creek.

Wells: Install five wells at the downgradient edge of the site and one upgradient to establish background.

Samples: Sample each well. For creek sediments, take samples from four places near site plus one place about 1,000 feet downstream. Sample creek water at two locations below site (approximately east of Building 1775 and about 1,000 feet further downstream).

Frequency: For wells, sample twice in wet season, separated by 2 months. For sediments and water, sample once.

Analyses: For surface water, analyze for specific conductance, pH, fluoride and heavy metals (see list below). For groundwater, analyze for TOX (as an indicator of paint stripping solvents) plus surface water constituents with static water levels in wells referenced to msl. For sediments, test for metals only.

Note: Metals: Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, and Zinc.

Site No. 28: Hadnot Point Burn Dump

Problem: Domestic and industrial wastes were disposed of at this site.

Goal: Determine whether hazardous wastes are present in groundwater near creek and assess potential for migration. Check on potential impacts on recreational pond fishes.

Approach: Conduct a careful inspection of the site to better define boundaries to insure proper well siting. Install wells and sample surface water and sediment in Cogdels Creek. Sample fish from the pond for chlorinated organic compounds.

Wells: Install one well upgradient for background, one well downgradient of the dump on the east side of Cogdels Creek, and three wells between dump and either Cogdels Creek or the New River.

Samples: Sample each well. Sample water column and sediment from three creek locations: (1) upstream of dump, (2) adjacent to dump area, and (3) downstream at the mouth of Cogdels Creek. Sample one composite each for two edible fish species from recreation pond.

Frequency: For wells and water column, sample twice during the wet season, separated by 2 months. Sample sediments once.

Analyses: Analyze well and surface water for specific conductance, oil and grease, pH, metals, TOX and TOC. Analyze sediment for oil and grease, metals, PCBs, and pesticides. Static water level in wells should be referenced to common datum. Analyze fish composites for chlorinated pesticides.

Note: Metals--Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, and Zinc.

Site No. 30: Sneads Ferry Road Fuel Tank Sludge Area

Problem: Sludge or bottom deposits from a large fuel tank were disposed of on the ground.

Goal: Determine whether hazardous waste is present and migrating toward groundwater

Approach: Define location of dumping. Sample soil for substantial residuals. Sample groundwater toward French Creek using simple wells.

Wells: Use three hand-augered wells downgradient toward French Creek.

Samples: Sample each well. Take surface cores at 5 places near dumping sites (see Section 4.4.1).

Frequency: Sample each well twice separated by 2 to 3 months. Sample sediments once.

Analyses: Analyze for specific conductance, oil and grease, and lead.

Site No. 35: Camp Geiger Area Fuel Farm

Problem: Fuel spills have contaminated soils. There is a possibility of groundwater contamination.

Goal: Determine if soils and groundwater remain contaminated with Mogas containing tetraethyl lead.

Approach: Sample soil between leak and Brinson Creek to assess extent and location of residual contamination, and to assess potential for movement into Brinson Creek. Surface gradient to creek is near due east; however, exact path of spill migration is not documented. Therefore, sample soil at points along the topographic gradient, but at locations on each side of the gradient line passing directly through the leak.

Samples: Collect a total of 24 soil cores down to 1 foot below the water table at 1- to 2-foot increments. At each of six points, collect cores at 4 depths. Determine the six points as follows: Establish a line parallel to the gradient passing through the leak. Establish three perpendicular crosslines along the line: near leak, near creek, and intermediate. Along each crossline, core at two points, 50 to 100 feet on each side of original line (see Section 4.4.1).

Frequency: Sample once.

Analyses: Analyze for oil and grease and lead.

Site No. 36: Camp Geiger Area Dump near Sewage Treatment Plant

Problem: Industrial wastes have been disposed of at this site.

Goal: Determine whether hazardous wastes are present and if migration has occurred.

Approach: Establish monitoring wells to document groundwater quality

Wells: Install a total of five wells: one background plus four downgradient, close to boundary, surrounding mound clockwise from north to south.

Samples: Sample each well.

Frequency: Sample twice, separated by 2 to 3 months.

Analyses: Analyze for RCRA groundwater contamination indicators (GWCI) with static water level referenced to msl.

Site No. 41: Camp Geiger Dump near former Trailer Park

Problem: Industrial wastes and pesticides have been disposed of here, resulting in potential contamination of groundwater and two small tributaries to Southwest Creek.

Goal: Determine whether groundwater is contaminated and whether migration has occurred toward nearby surface water.

Approach: Install four monitor wells, one upgradient and three downgradient. Suitability of existing Test Well Nos. 18, 19, 20, and 21 will be determined by Phase II geologists (see Appendix A). If any existing wells are found unsuitable, then casings should be removed and holes plugged. Downgradient wells should address potential movement to each small tributary and wetland.

Wells: See above.

Samples: Sample each well.

Frequency: Sample twice in a 3-month period during wet season.

Analyses: Analyze for RCRA groundwater contamination indicators and organochlorine pesticides with static water levels referenced to msl.

Site No. 45: Campbell Street Underground Avgas Storage and Adjacent JP Fuel Farm at Air Station

Problem: There is potential migration and groundwater contamination from fuels containing tetraethyl lead. A potable water well is located near drainage canal.

Goals: Determine if JP fuel has contaminated soils outside of the fuel farm or the groundwater or surface drainage. Determine extent of contamination of soil and surface drainage due to Avgas leak.

Approach: Sample soils near both sites to define extent of impact. Sample surface drainage canal which parallels roadway south (downgradient) of fuel farm. This ditch should intercept most southward surface and subsurface flow. Sample Well No. 4140, which is about 700 to 800 feet downgradient of sites and lies near the drainage ditch/canal.

Wells: Use existing Well No. 4140.

Samples: Sample Well No. 4140. In the drainage ditch/canal, sample bottom sediments at three places, i.e., near sites on Campbell Street, near Well No. 4140, and south of Schmidt Street (i.e., about 3,000 feet from site). For soil cores, select 10 coring locations--five locations around perimeter of both sites. At each location, collect cores at three depths from surface down to 1 foot below water table (see Section 4.4.1).

Frequency: Sample soils and sediments once. Sample Well No. 4140 twice, separated by 2 to 3 months.

Analyses: Analyze every soil sample for lead and oil and grease. For well water, analyze for aromatics commonly found in fuels (e.g., benzene, toluene, xylene) and for lead. Static and dynamic water levels should be referenced to common datum.

Site No. 48: MCAS New River Mercury Dumpsite

Problem: Metallic mercury may have been dumped over a 10-year period behind Building 804. No evidence has been found to indicate a central disposal place. It is surmised that disposal occurred at random places with each place containing relatively small amounts of mercury.

Goal: Determine whether mercury is in groundwater near river.

Approach: Install wells in line parallel to river. About 100 feet of shoreline is involved. Well spacing should be relatively close due to potential for several pockets of mercury to exist. Elaborate wells are not needed because mercury is only consitutent of interest.

Wells: Install six simple (hand-augered) monitoring wells.

Samples: Sample each well.

Frequency: Take initial samples, sample 6 months later, then sample annually.

Analyses: Analyze for total mercury.

Site No. 54: Crash Crew Fire Training Burn Pit at the Air Station

Problem: Contaminated fuels, including leaded fuel, and various POL compounds are used for training purposes. Spills may have contaminated the surrounding soil.

Goal: Determine whether soils in immediate area of site are contaminated and whether there is potential for POL to enter groundwater.

Approach: Sample the soil in immediate area.

Wells: None

Samples: Collect a total of 24 cores. Cores should be deep enough to extend 1 foot into groundwater table. Take samples at 1- to 2-foot intervals (i.e., four depths at each place). Locate cores six places around pit counter clockwise from northwest to southeast of the pit (i.e., between pit and drainage ditches). Core at places equidistant from pit and nearest ditch (see Section 4.4.1).

Frequency: Sample once.

Analyses: Analyze for oil and grease and lead.

Site No. 68: Rifle Range Dump

Problem: Solvents disposed of at this site may be affecting nearby potable wells.

Goal: Determine whether solvents are present and have moved upgradient to threatened potable wells.

Approach: Establish test wells upgradient and downgradient of dump site to be sampled in conjunction with nearby water supply wells. Upgradient wells used to assess possible migration toward potable water wells rather than to document background.

Wells: Install three wells downgradient of dump site to determine whether pollutants have moved toward Stone Creek. Install three wells upgradient between dump site and Well Nos. RR-45 and RR-97.

Sampling: Sample each well.

Frequency: Test wells are to be sampled twice, separated by 2 or 3 months. Well Nos. RR-45 and RR-97 are to be sampled quarterly.

Analyses: Analyze for volatile organic compounds and oil and grease with static and dynamic water levels referenced to msl datum.

Site No. 69: Rifle Range Chemical Dump

Problem: Hazardous wastes of various types were buried here over a period of years and may migrate to surface water or groundwater.

Goal: Determine whether wastes are migrating to groundwater or surface water in sufficient quantities to cause risk to health.

Approach: Remove old monitoring wells, plug holes, and put in properly installed wells. Because of multidirectional drainage, use a two-phase approach to help place final wells.

Surround site with simple observation wells (i.e., hand-augered, PVC) located about 100 feet outside site boundary. Use 12 wells about 250 feet apart. Collect soil strata data when installing bores. Soil data will be used to estimate hydraulic conductivities and potential groundwater movement patterns. Collect specific conductivity and pH data to provide general indicators of contaminant plume location. Obtain static water levels referenced to common datum to define potentiometric gradient. Use hydraulic conductivity, gradient, and quality data to locate areas (directions) of highest potential contaminant movement.

Based on this initial evaluation of three samplings (at 4 month intervals during 1 year), install approximately six monitoring wells to rigorously define contaminant migration, if any.

Document background from off-site wells. Sample some nearby surface seeps.

Wells: Install twelve initial observation wells down to 2 feet into water table, three in Everett Creek basin, three in basin to southeast plus six in basin to north, and six formal monitoring wells.

Samples: Sample each well and three seeps northward.

Frequency: Sample both wells and seeps every 4 months.

Analyses: Analyze for GWCI, oil and grease, organochlorine pesticides (including DDT-R), PCBs, TCE, pentachlorophenol, residual chlorine, mercury. Water levels are to be taken referenced to common datum.

Site No. 73: Courthouse Bay Liquids Disposal Area

Problem: Used vehicle battery acid and motor oil were disposed of at this site and may migrate to Courthouse Bay or a potable water well.

Goal: Determine presence and levels of metals, phenolics and oil in groundwater and determine if migration has occurred. Evaluate potential for corrosion damage to present or future structures (including underground pipes and cables) from acidic waste.

Approach: Sample groundwater between site and Courthouse Bay and at closest potable well.

Wells: Use existing Well Building A-5. Install four simple, hand-augered wells: one well up gradient of disposal area, three wells down gradient near the Courthouse Bay shoreline.

Samples: Sample each well.

Frequency: Sample twice, separated by 3 months.

Analyses: Test for antimony, chromium, lead, zinc, oil and grease, phenolics, specific conductance, and pH.

Site No. 74: Mess Hall Grease Pit Area

Problem: Disposal of drummed wastes including pesticides and PCBs and possibly other wastes may contaminate groundwater near potable water well (Pump House No. 654).

Goal: Determine whether groundwater contamination has occurred and if migration of contaminants toward well has occurred.

Approach: Install three monitoring wells between grease pit/drum burial area and existing well. Install one monitoring well between pest control area and existing well. Sample potable well and verify screened depth.

Wells: Install 4 wells and screen to sample both the upper and lower portions of the unconfined aquifer.

Samples: Sample all five wells.

Frequency: Sample twice, separated by 2-3 months.

Analyses: Analyze for RCRA groundwater contamination indicators (GWCI) and organochlorine pesticides, to include PCBs.

Site No. 75: MCAS Basketball Court Site

Problem: Disposal of drums, possibly containing training agents dissolved in solvents, may contaminate groundwater in the vicinity of the site. Three potable water wells (Pump House Nos. S-TC-1251, 106, and 203) and/or a pond containing water treatment plant filter backwash water may be affected.

Goal: Determine specific location of buried drums and whether groundwater is contaminated and if contamination has migrated toward wells or pond.

Approach: Survey site using geophysical techniques to identify specific location of drums. Install monitoring wells surrounding drums, approximately 100-200 feet from drum locations to identify plume movement and quantify contaminant concentrations. Sample backwash pond and existing wells.

Wells: Install 4 monitoring wells in shallow aquifer.

Samples: Sample each well and backwash pond.

Frequency: Sample twice, separated by at least 3 months.

Analyses: Analyze for RCRA groundwater contamination indicators (GWCI) and benzene.

Site No. 76: MCAS Curtis Road Site

Problem: Buried drums, possibly containing training agents, may contaminate groundwater in the vicinity of two potable water wells (Pump House Nos. 106 and 203).

Goal: Determine specific location of buried drums and if groundwater is contaminated and whether migration toward wells has occurred.

Approach: Survey site using geophysical techniques to identify specific location of drums. Install monitoring wells surrounding drums, approximately 100-200 feet from drum locations to identify plume movement and quantify contaminant concentrations. Sample existing wells.

Wells: Install 3 monitoring wells in shallow aquifer.

Samples: Sample each well.

Frequency: Sample twice, separated by at least 3 months.

Analyses: Analyze for RCRA groundwater contamination indicators (GWCI) and benzene.

SECTION 5. BACKGROUND

5.1 GENERAL. Marine Corps Base (MCB) Camp Lejeune is on the coastal plain in Onslow County, North Carolina. The facility covers approximately 170 square miles and is bisected by the New River, which flows in a generally southeasterly direction. This system forms a large estuary before entering the Atlantic Ocean.

Eleven miles of Atlantic shoreline form the eastern boundary of Camp Lejeune. The western and northeastern boundaries are U.S. 17 and State Road 24, respectively. Jacksonville, North Carolina, acts as the northern boundary. The complex has a roughly triangular outline.

Development at the Camp Lejeune complex is primarily in five geographical locations under the jurisdiction of the Base Command. They include Camp Geiger, Montford Point, Mainside, Courthouse Bay, and the Rifle Range area. Marine Corps Air Station (MCAS) New River, a helicopter base, is a separate command on the west side of the New River. There are also two Outlying Landing Fields (OLFs) under control of MCAS New River. These are Helicopter Outlying Landing Field (HOLF) Oak Grove, approximately 25 miles to the north, and OLF Camp Davis, 10 miles to the southwest (NAVFACENGCOM, 1975).

North of the base, 2,672 acres have been used for the air station. In the past, training for fixed-wing aircraft was carried out. Presently, only helicopter training occurs here.

North of Camp Lejeune is HOLF Oak Grove. The field is no longer active and is under caretaker status. The property has some camping facilities and occasionally is used for recreation by scouting groups. Infrequent use is also made for ground troop exercises and helicopter landings. HOLF Oak Grove is on 976 acres in eastern Jones County.

Within 15 miles of Camp Lejeune are three large, publicly owned tracts of land--Croatan National Forest, Hofmann Forest, and Camp Davis Forest. Because of the low elevations in the coastal plain, wetlands form significant acreage. These areas, to some extent, have been exploited by agricultural and silvicultural interests. There is a growing concern on a state and national level that these ecosystems, unique to the coastal plain, require a protected status to survive.

For the most part, remaining land use is agricultural. Typical crops are soybeans, small grains, and tobacco.

Productive estuaries along the coast support commercial finfish and shellfish industries. Increased leisure time has boosted tourism and enlarged resort residential areas. This, in turn, has stimulated the regional economy.

According to the most recent master plan (NAVFACENGCOM, 1975), there are two major corridors of developable land in the area. These extend south from New Bern along U.S. 17 and U.S. 58, and from Swansboro northwest to Jacksonville and Richlands along Routes 24 and 258. The principal economic base is MCB Camp Lejeune and associated military activities. More than 46,000 military personnel are stationed at the base, and more than 110,000 people are either employed or are eligible for support (NAVFACENGCOM, 1975).

5.2 HISTORY. Site selection for "The World's Most Complete Amphibious Training Base" was made in the 1940s. Construction of the camp began in 1941 after extensive land acquisition and was named in honor of Lieutenant General John A. Lejeune, USMC (Odell, 1970).

During construction, 9 million board feet of timber were harvested from the reservation. In 1944, a sawmill with a daily capacity of 10,000 board feet was being operated by base maintenance personnel. The sawmill closed in 1954, when lumber needs were filled by contract.

Construction of the base started on Hadnot Point, where the major functions were centered. As the facility grew and developed, Hadnot Point became crowded with maintenance and industrial activities. The problem led to the creation of a master plan that addressed these and other present and potential problems.

During World War II, Camp Lejeune was used as a training area to prepare Marines for combat. This has been a continuing function of the facility during the Korean and Vietnam conflicts. Toward the end of World War II, the camp was designated as a home base for the Second Marine Division. Since that time, Fleet Marine Force (FMF) units also have been stationed here as tenant commands.

By 1945, construction in the Montford Point, Camp Geiger, and Courthouse Bay areas was complete. Montford Point, originally designated for training of troops, now is used for Marine Corps Service Support Schools. In the 1940s, recent recruits from Parris Island received tactical training at Camp Geiger. This practice has been discontinued, however. Courthouse Bay hosts amphibious training, while Paradise Point is still the site of housing commissioned personnel. Noncommissioned housing is provided in Tarawa Terrace I and II, Midway Park, and other designated areas.

The U.S. Naval Hospital opened in 1943 and has served military personnel during World War II and the Korean War. In addition, the hospital provides medical services for all assigned military personnel and their dependents. It once operated as a 500-bed unit, but has become obsolete, and a new medical center is under construction along Brewster Boulevard (NAVFACENGCOM, 1975).

MCAS New River was set up as a separate command in 1951. At that time, it was called Peterfield Point, but the name was changed to

New River in 1968. In 1942, three new runways were added and the station came under the jurisdiction of MCAS Cherry Point. During this time, a PBJ squadron was based here and the facility was also used for glider training (NAVFACENGCOM, 1975). During the Korean War, it was used as a helicopter training base and for touch-and-go training for jet fighters (Natural Resource Management Plan, 1975).

In 1968, Marine Corps Outlying Landing Field (MCOLF) Oak Grove was placed under the jurisdiction of MCAS New River. The field was used as a helicopter base and renamed HOLF Oak Grove. During World War II, the field was under the command of MCAS Cherry Point. At the end of that war, all structures were destroyed with the exception of the runways.

5.3 PHYSICAL FEATURES.

5.3.1 Climatology. The North Carolina coastal plain area in which MCB Camp Lejeune is located is influenced by mild winters. Summers are humid with typically elevated temperatures. Rainfall usually averages more than 50 inches per year. Potential evapotranspiration in the region varies from 34 to 36 inches of rainfall equivalent per year (Narkunas, 1980). Winter and summer are the usual wet seasons. Temperature ranges are reported to be 33°F to 53°F during January and 71°F to 88°F in July (Odell, 1970).

Winds during the warm seasons are generally south-southwesterly while north-northwest winds predominate in winter. There is a relatively long growing season of 230 days. A summary of regional climatic conditions is shown in Figure 5-1.

5.3.2 Topography and Surface Drainage. The generally flat topography of the Camp Lejeune complex is typical of the seaward portions of the North Carolina coastal plain. Elevations on the base vary from sea level to 72 feet above msl; however, the elevation of most of Camp Lejeune is between 20 and 40 feet above msl. The coast is guarded by a 200- to 500-foot-wide barrier island complex. Elevations of the dune field on the barrier islands range from 10 to 40 feet above msl. Drainage at Camp Lejeune is predominately toward the New River, although areas near the coast drain directly toward the Atlantic Ocean through the Intracoastal Waterway. In developed areas, natural drainage has been changed by drainage ditches, storm sewers, and extensive concrete and asphalt areas. Drainage sub-basins for Hadnot Point area and MCAS New River are shown in Figures 5-2 and 5-3, respectively. Most sites evaluated in this study are in these two areas.

Approximately 70 percent of Camp Lejeune is in the broad, flat interstream areas (Atlantic Division, Bureau of Yards and Docks, 1965). Drainage here is poor, and the soils are often wet.

Flooding is a potential problem for base areas within the 100-year floodplain. The U.S. Army Corps of Engineers has mapped the limits of 100-year floodplain at Camp Lejeune at 7.0 feet above msl in the upper reaches of the New River (Natural Resource Management Plan,

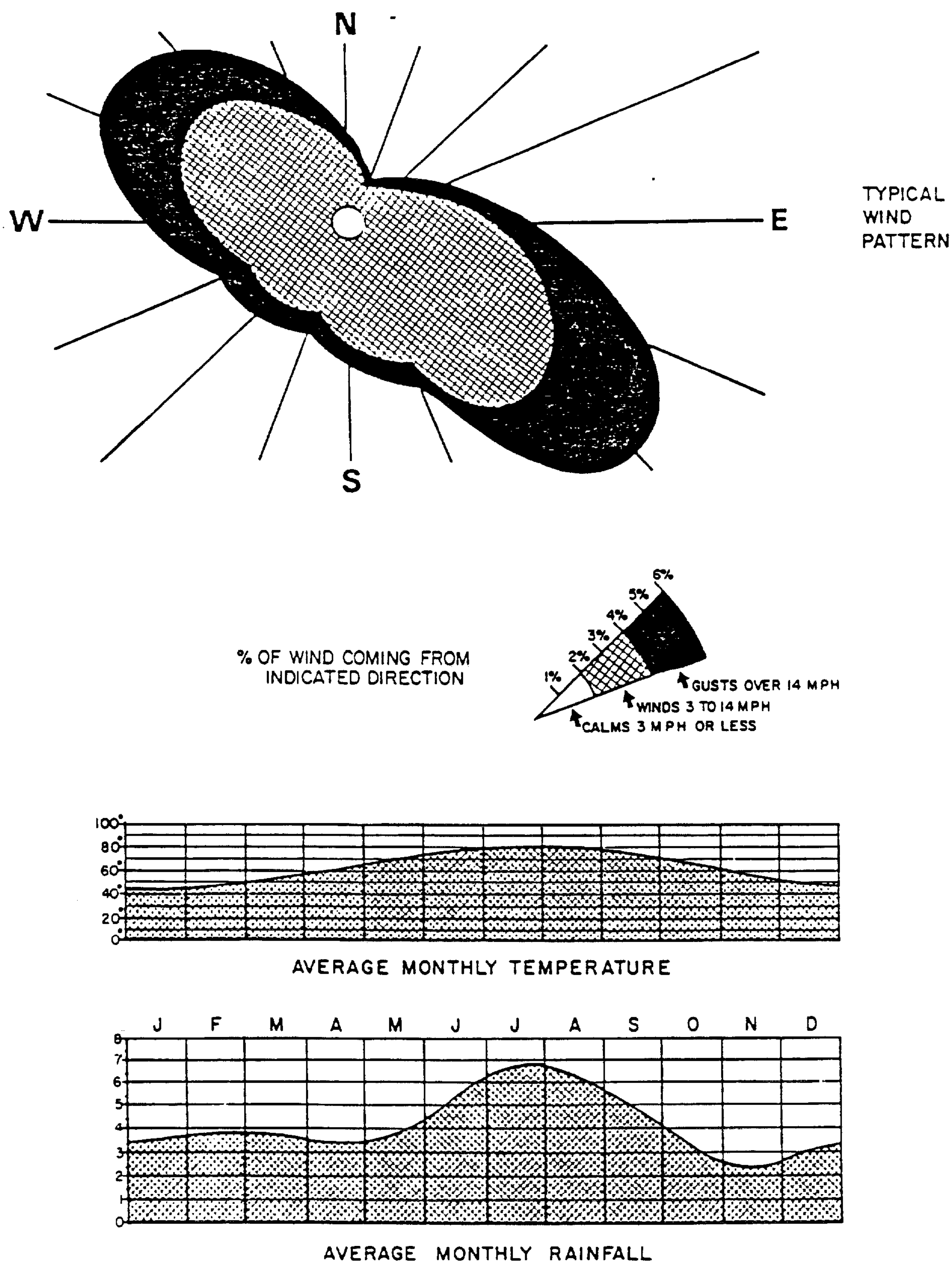
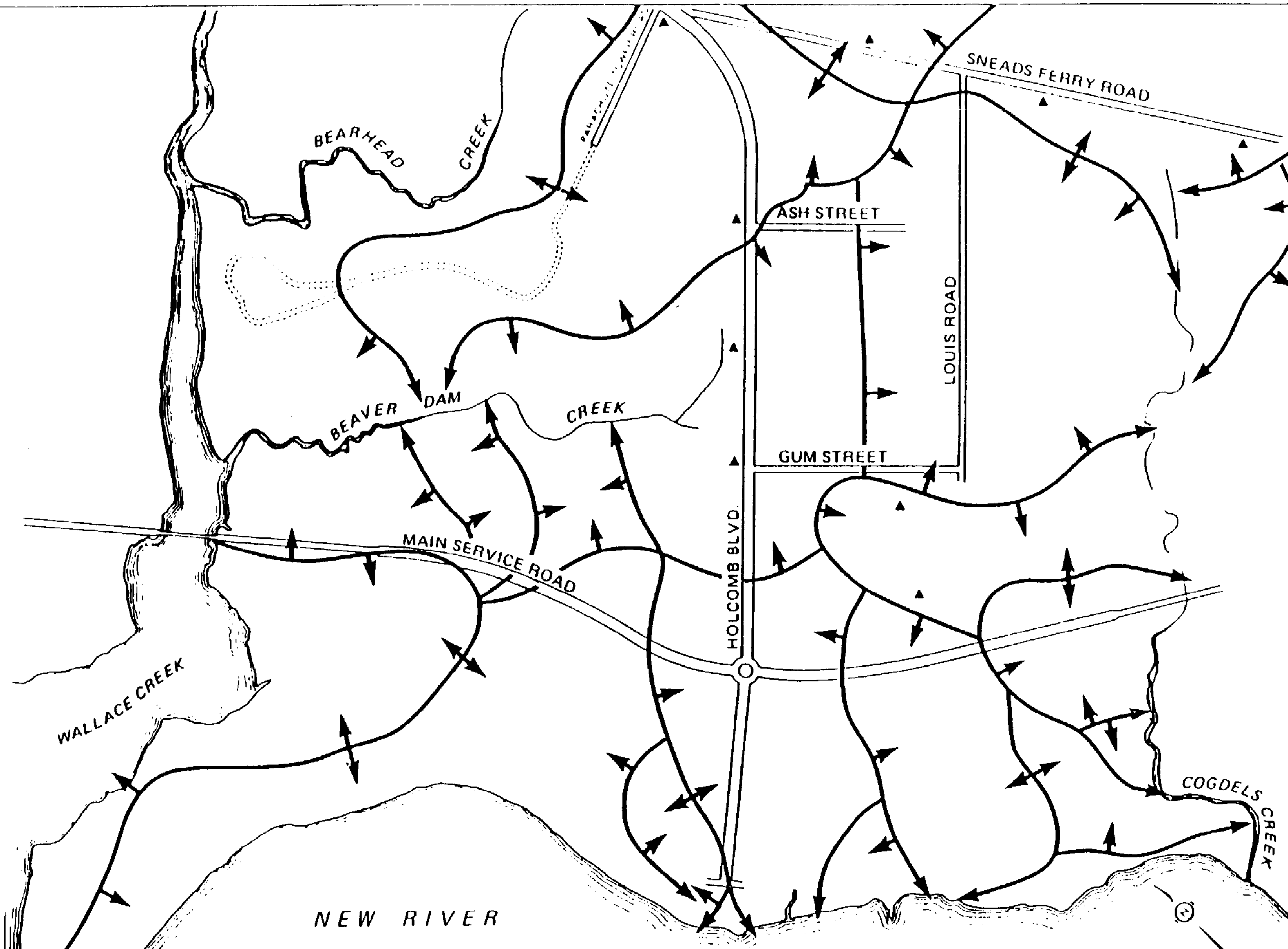


FIGURE 5–1
Regional Climatic Conditions in the Vicinity of MCB Camp Lejeune

SOURCE: NAVFACENGCOM, 1975



HADNOT POINT AREA

FIGURE 5–2

Surface Water Drainage Sub-Basins at Hadnot Point, MCB Camp Lejeune

SOURCE: NAVFACENGCOM, 1975

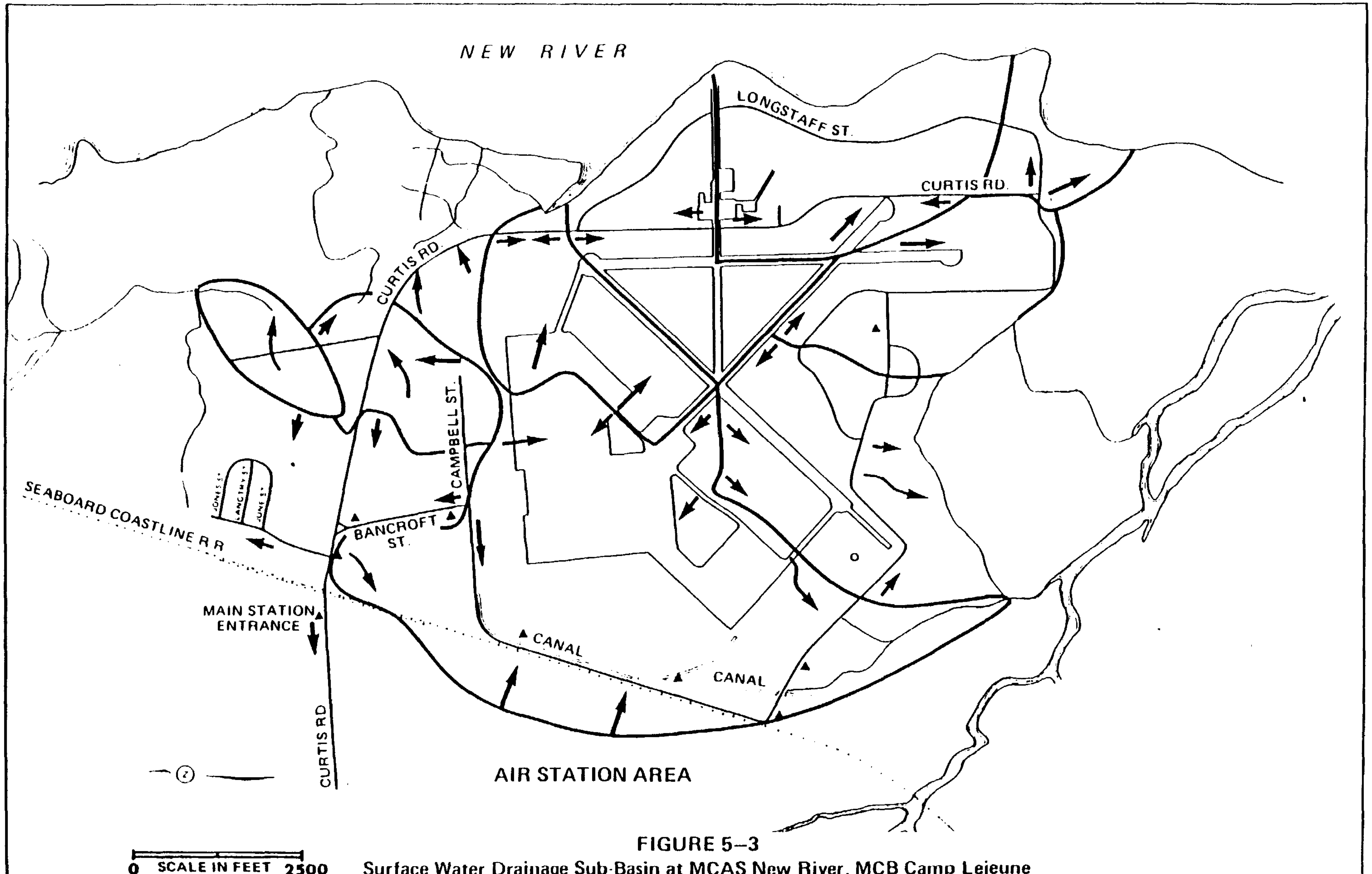


FIGURE 5–3
Surface Water Drainage Sub-Basin at MCAS New River, MCB Camp Lejeune

SOURCE: WAR, 1982

1975). The elevation of the 100-year floodplain increases downstream and is 11.0 feet above msl on the open coast.

5.3.3 Geology. The geology of the Atlantic Coastal Plain physiographic province is typically a seaward-thickening wedge of sediments (Figures 5-4 and 5-5) on a basement complex of igneous and metamorphic rock similar to that at the surface in the Piedmont physiographic province. Sediments of the coastal plain vary in age from Cretaceous to Recent and consist of layers of sand, silt, clay, marl, limestone, and dolostone.

A mantle of Pleistocene and Recent sands and clays commonly covers the older sediments of the area. Beneath this mantle is a belted subcrop pattern with Cretaceous sediments nearest the surface in the west and progressively younger sediments nearest land surface toward the coast (Figure 5-6).

Although the sedimentary sequence is approximately 1,400 to 1,700 feet thick beneath MCB Camp Lejeune, only the uppermost 300 feet are pertinent to the purpose of this report because these strata contain the important water-bearing rocks at MCB Camp Lejeune.

The Eocene Castle Hayne Limestone consists of shell limestone, marl, calcareous sand, and clay. In Onslow County, the Castle Hayne varies in thickness from approximately 100 feet to more than 200 feet. Rocks of Oligocene age unconformably overlie the Castle Hayne. These sediments consist of fossiliferous limestone, calcareous sand, and clay and are equivalent to the Trent Formation according to recent correlation charts (Baum et al., 1979). In the subsurface of Onslow County, rocks of Oligocene age vary from approximately 40 feet to more than 200 feet thick (Brown et al., 1972).

The Yorktown Formation overlies the Oligocene and outcrops in a band east and south of Jacksonville. This unit consists of lenses of sand, clay, marl, and limestone. The Yorktown Formation has long been considered Late Miocene, but the latest correlation charts (Baum et al., 1979) date it in the Pliocene.

Pleistocene and Recent sands and clays mantle the older stratigraphic units in most of the study area and form the most seaward band of sediments. These sediments were deposited in Pleistocene and Recent time, when the retreat of continental glaciers raised sea levels.

5.3.4 Hydrology.

5.3.4.1 Surface Water. The dominant surface water feature at MCB Camp Lejeune is the New River. It receives drainage from most of the base. The New River is short, with a course of approximately 50 miles on the central coastal plain of North Carolina. Over most of its course, the New River is confined to a relatively narrow channel entrenched in the Eocene and Oligocene limestones. South of Jacksonville, the river widens dramatically as it flows across less resistant sands, clays, and marls

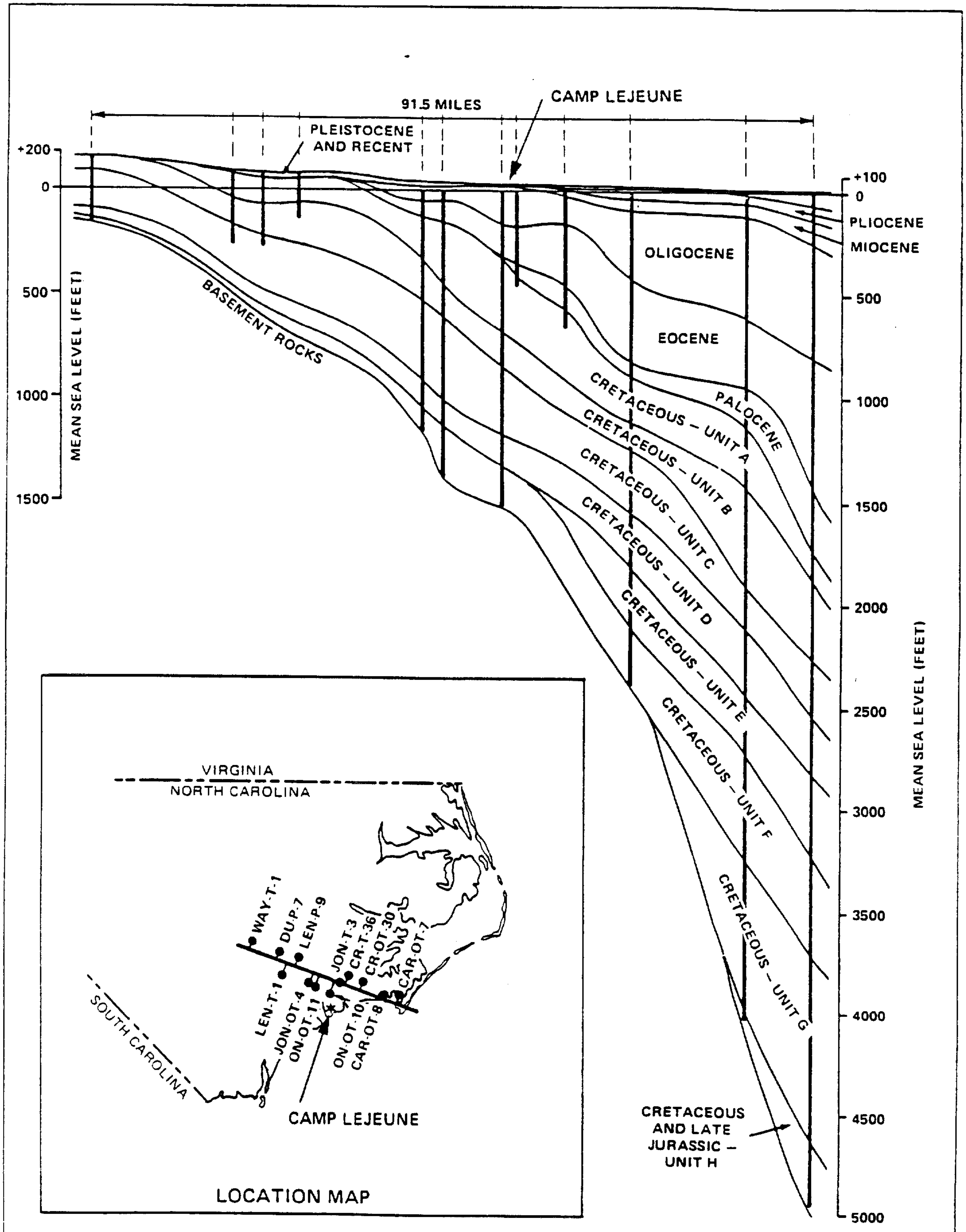


FIGURE 5–4
Geologic Cross Section From Wayne County, N.C. to Carteret County, N.C.

SOURCE: BROWN, ET AL., 1972

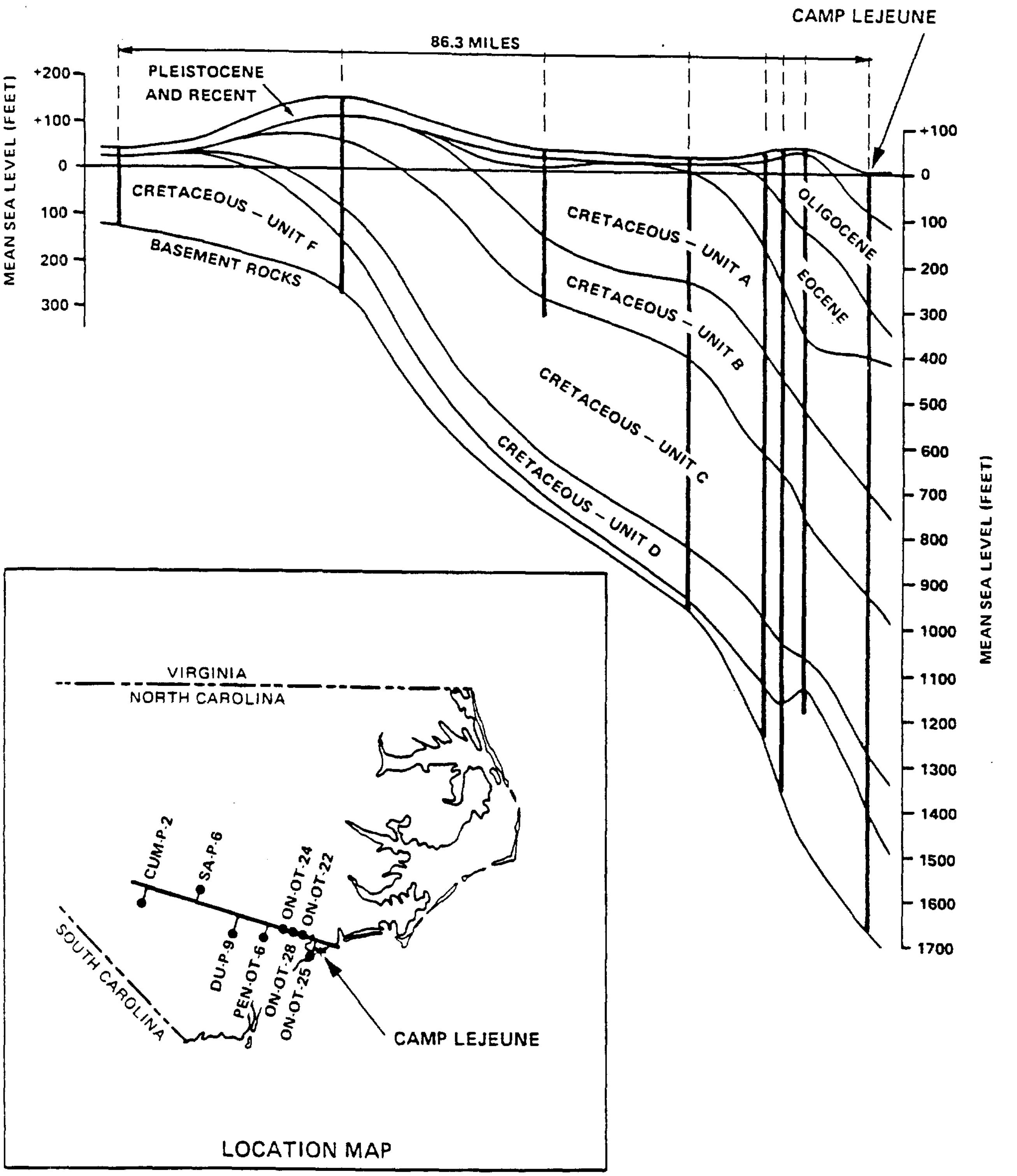
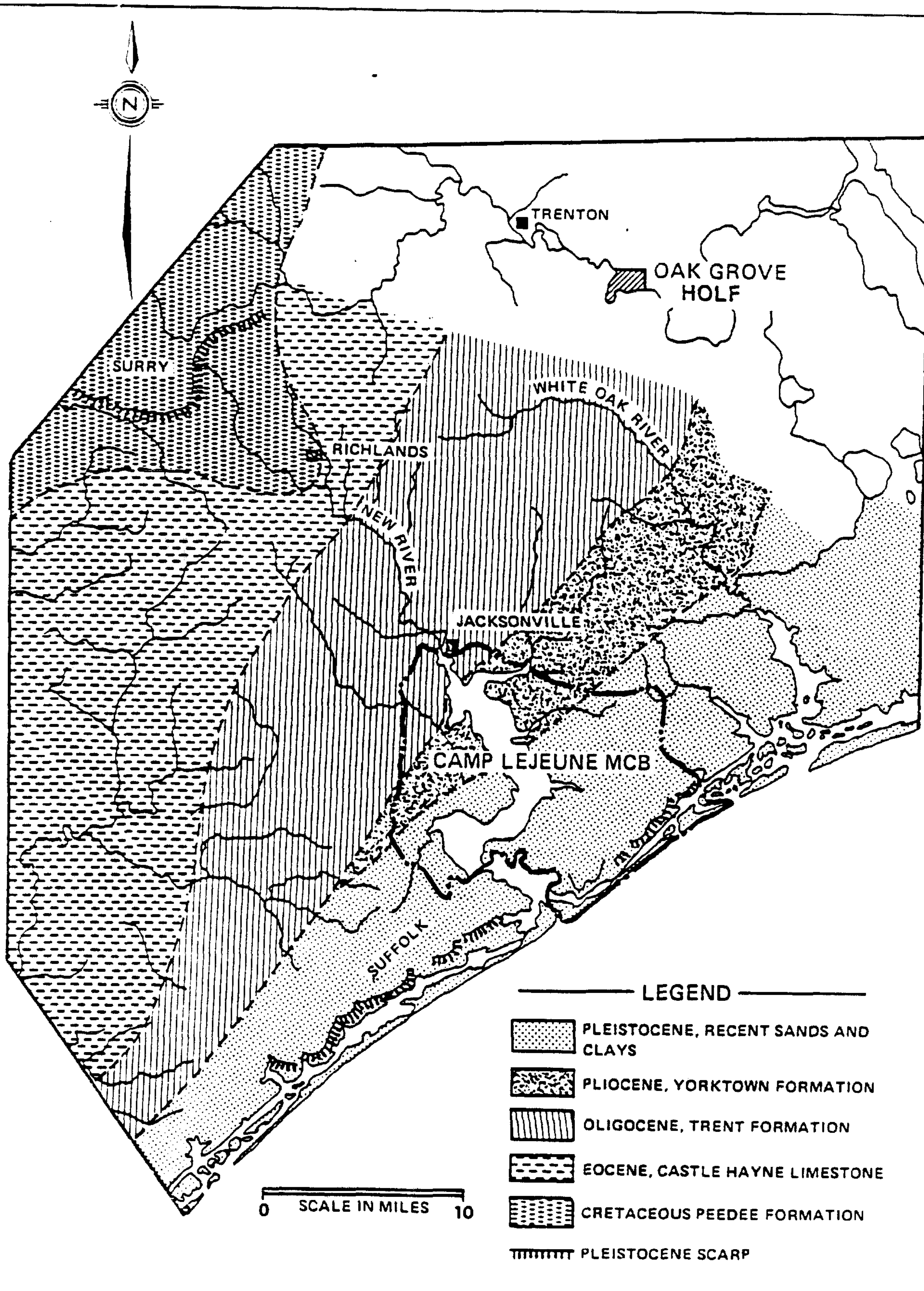


FIGURE 5–5

Geologic Cross Section From Cumberland County, N.C. to Onslow County, N.C.

SOURCE: BROWN, ET AL., 1972



SOURCE: AFTER BURNETTE, 1977

FIGURE 5–6

New River Area Geology

(Burnette, 1977). At MCB Camp Lejeune, the New River flows in a southerly direction and empties into the Atlantic Ocean through the New River Inlet. Several small coastal creeks drain the area of MCB Camp Lejeune that is not drained by the New River and its tributaries. These creeks flow into the Intracoastal Waterway, which is connected to the Atlantic Ocean by Bear Inlet, Brown's Inlet, and the New River Inlet.

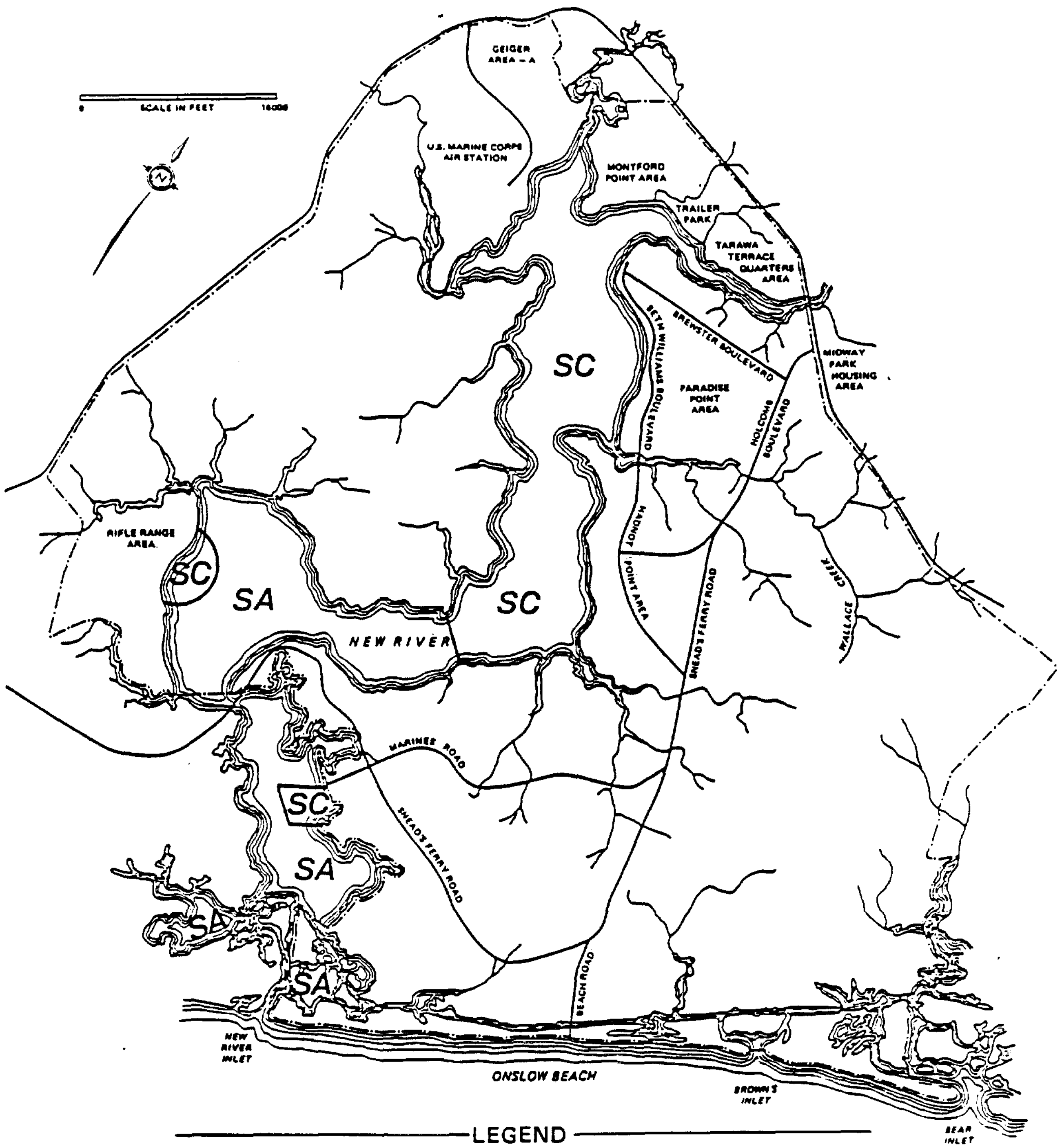
Wilder et al. (1978) state the standard streamflow measurements employed by the U.S. Geological Survey are not applicable in low-gradient, tidal conditions. This is probably why streamflow in the New River below Jacksonville has not been determined. The tides at New River Inlet have a normal range of 3.0 feet and a spring range of 3.6 feet (U.S. Department of Commerce, 1979). The tidal range diminishes upstream to approximately 1 foot at Jacksonville (Howard, 1982). The flood tidal prism entering the New River Inlet in one tidal cycle was determined to be approximately 2.35×10^5 ft^3 (Burnette, 1977).

The average annual runoff of the MCB Camp Lejeune area has not been determined; however, Craven and Carteret Counties, to the northeast, have an average annual runoff of approximately 18 inches. The ground-water contribution to runoff in the same area northeast of MCB Camp Lejeune is estimated as 65 percent of total runoff (Wilder et al., 1978).

The water in the New River at MCB Camp Lejeune is brackish, shallow, and warm. Salinity is largely a function of distance from the ocean and rainfall. At Jacksonville, the New River may reach salinities of 10 parts per thousand (ppt) during extended periods of low rainfall. However, near the New River Inlet, salinity in the river is usually equivalent to that of sea water (35 ppt). Salinities near the inlet become significantly lower only during heavy rains (Burnette, 1977).

Water quality criteria for surface waters in North Carolina have been published under Title 15 of the North Carolina Administrative Code. The New River at MCB Camp Lejeune falls into two classifications (Figure 5-7). Classification SC applies to three areas of the New River at MCB Camp Lejeune. The best usage of Class SC waters is "fishing, secondary recreation, and any other usage except primary recreation or shellfishing for market purposes." The rest of the New River at MCB Camp Lejeune is Class SA, the highest estuarine classification. The best usage of Class SA waters is "shellfishing for market purposes and any other usage specified by the SB or SC classification."

5.3.4.2 Groundwater. The uppermost 300 feet of sediments at MCB Camp Lejeune is the source of fresh water for the base. Brackish water is usually found deeper than 300 feet below msl (Shiver, 1982). In general, the aquifer system consists of a water table aquifer and one or more semi-confined aquifers. Confining beds lie between the two aquifer systems and between the layers of the semi-confined aquifers. Variations in the local hydrogeology result from the complex depositional history of the area.



LEGEND

SC ESTUARINE WATERS NOT SUITED FOR BODY CONTACT SPORTS OR COMMERCIAL SHELLFISHING

SA ESTUARINE WATERS SUITED FOR COMMERCIAL SHELLFISHING

FIGURE 5–7
Water Quality Classifications for the New River at MCB Camp Lejeune

SOURCE: NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES, 1977

The uppermost hydrogeologic unit, the water table aquifer, extends from land surface to the first confining bed. This aquifer consists of sand, silt, limestone, and small amounts of clay. These sediments are usually Pliocene and younger.

The water table aquifer is recharged when rainfall seeps into the ground and percolates into the zone of saturation. Depth to the zone of saturation is 10 feet or less at MCB Camp Lejeune (Atlantic Division, Bureau of Yards and Docks, 1965). Groundwater in the water table aquifer generally flows from upland areas toward stream valleys where it discharges to surface water. In interstream areas, some groundwater will flow from the water table aquifer to the first semiconfined aquifer as recharge, given favorable hydraulic gradient and geology. Recharge of the semiconfined aquifer may be expressed using Darcy's Law (Freeze and Cherry, 1979) as:

$$Q = \frac{h_1 - h_2}{m} k A$$

where: Q = Quantity of recharge per unit time,
h_1 = Hydraulic head in the water table aquifer,
h_2 = Hydraulic head in the semiconfined aquifer,
m = Thickness of the confining bed,
k = Hydraulic conductivity of the confining bed, and
A = Area for which recharge is calculated.

From this, it may be seen that groundwater will flow from the upper aquifer to the lower aquifer only if the hydraulic head in the water table aquifer is greater than the hydraulic head in the semiconfined aquifer. The thickness and lower hydraulic conductivity of the confining bed retard the flow of water between the two aquifers.

The semiconfined aquifer is composed of limestone and calcarous sands of the Eocene Castle Hayne Limestone, the Oligocene Trent Formation, and in some places, sand and limestone of the Pliocene Yorktown Formation. Regional groundwater flow in the semiconfined aquifer is toward the southeast. The regional flow is altered locally by pumping wells that penetrate this aquifer.

Narkunas (1980) reported that transmissivity of the limestone aquifer in the central coastal plain of North Carolina varied from 6,100 feet^2/day to 12,100 feet^2/day. Storage varied from 2.6×10^{-3} to 7.4×10^{-5}. Specific capacity of wells at MCB Camp Lejeune was reported as 5 to 10 gallons per minute per foot of drawdown (gpm/ft) in 1960 (LeGrand, 1960). Recent data indicate that the specific capacity of the wells tapping the semiconfined aquifer at MCB Camp Lejeune varies from less than 3 gpm/ft to approximately 20 gpm/ft.

The confining units, where present, consist of clay, sandy clay, silty clay, and occasionally dense limestone. These units occur as discontinuous lenses and may be present at any depth. A comparison of the logs for Well Nos. HP-613 and HP-616 (Appendix C) shows a reduction in the thickness of the confining bed from 27 feet to 6 feet in less than 2,000 feet. Many of the well logs for the base indicate that the confining units are either thin or absent. Wells in these areas withdraw at least some water from the water table aquifer.

5.3.4.3 Migration Potential. Pollutant migration potential is a function of both water movement potential and chemical and/or physical interactions of specific contaminants with specific environments. Regarding the latter, various contaminants can move greater or lesser distances depending upon such factors as: chemical reactions between contaminants and soils or strata; physical trapping of contaminants in strata voids; stratification caused by differences between contaminant densities and surface water or groundwater densities; and, solubility characteristics of specific contaminants among other factors.

Because these factors are site-specific, they cannot be discussed in detail in this background section. However, general characteristics of possible water movement and its effect on contaminant transport are discussed.

There are three potential migration pathways at MCB Camp Lejeune. In the first case, contaminants may be carried off-base by surface water drainage to the New River and its tributaries. The other two pathways are in groundwater. Contaminants entering the water table aquifer may then migrate to surface water, or they may migrate down into the semiconfined aquifer.

Surface water drainage is most rapid in the developed areas of the base where natural drainage has been modifed by ditches, storm sewers, and extensive areas of asphalt and concrete. Contaminants are most likely to be transported directly to surface drainage during periods of heavy rainfall. At other times, transport is likely to be to and through groundwater, except in areas adjacent to surface streams.

The water table aquifer is highly susceptible to contamination because it is composed predominantly of permeable materials at the earth surface. If a site is near a surface water feature, contaminants in the water table aquifer can be expected to move horizontally and toward the zone of discharge at the groundwater/surface water interface.

In the interstream areas (i.e., relatively distant from surface drainage), the horizontal component of flow will still tend to follow the topography, but under some circumstances a vertical flow may develop from the water table aquifer to the semiconfined limestone aquifer. These conditions depend on: (1) a hydraulic gradient from the water table aquifer toward the semiconfined aquifer, and (2) on the thickness and hydraulic conductivity of confining units. These factors are not well known at MCB Camp Lejeune. What is known is that conditions vary with locations.

In some areas, contamination of lower aquifers is very unlikely. For example, at Georgetown, near the Camp Geiger area, the hydrogeology tends to prevent migration of water from the water table aquifer to the deeper aquifer (Division of Environmental Management, 1979). This is because the confining zone is approximately 50 feet thick and the hydraulic gradient is from the limestone aquifer toward the water table aquifer. These same conditions may be present in parts, but not all, of MCB Camp Lejeune.

Variability of the confining units decreases assurance of protection of the semiconfined limestone aquifer. Furthermore, although the hydraulic gradient between the water table and semiconfined aquifers is unknown at MCB Camp Lejeune, large-scale withdrawals of groundwater necessary to supply the base with water may have produced an overall decline of pressure in the semiconfined aquifer. This would tend to increase the potential for contaminant movement to the deeper aquifer.

Another possible factor affecting groundwater quality at MCB Camp Lejeune is the condition of abandoned wells. If a well is not properly sealed when abandoned, it may become a pathway for contaminants. Conversations with personnel at base maintenance and the water treatment plant have indicated that there is no inventory of abandoned wells nor are closure details available.

5.4 BIOLOGICAL FEATURES. The three forest areas surrounding Camp Lejeune--Croatan, Hofmann, and Camp Davis--provide extensive wildlife habitat. Animal life includes deer, black bear, turkey, squirrel, quail, rabbits, raccoons, muskrat, mink, and otter. The creeks, bays, swamps, marshes, and pocosins provide habitat for many types of birds, including egrets, fly catchers, woodpeckers, hawks, woodcocks, owls, bald eagles, peregrine falcons, and osprey. Reptiles include alligators, turtles, and snakes. Several species of the latter group are venemous. Freshwater fish in the streams and lakes of the forests include largemouth bass, redbreast sunfish, bluegill, chain pickerel, warmouth, yellow perch, and catfish. Trees found in the forests include loblolly, pond, longleaf, and shortleaf pines; sweet gum, tupelo gum, yellow-poplar, oak, red maple, sweet bay, and loblolly bay. In the pocosin wetlands, there is generally a shrub understory of evergreen and deciduous species. Several unusual plant species also can be found, including pitcher plants, sundews, and Venus flytraps (Richardson, 1981; Yong, 1982; Wilson, 1982).

The Camp Lejeune complex is predominantly tree covered, with large amounts of softwood (shortleaf, longleaf, pond, and primarily loblolly pines) and substantial stands of hardwood species. Timber-producing areas are under even-aged management with the exception of those along major streams and in swamps. These areas are managed to provide both wildlife habitat and erosion control. Smaller areas are managed for the benefit of endangered or threatened wildlife species such as the red-cockaded woodpecker.

Of Camp Lejeune's 112,000 acres, more than 60,000 are under forestry management. At the forests' borders are several species of shrubs, vines, and herbs. Acidic soils host carnivorous plants, including pitcher plants, sundews, and Venus flytraps. Forest management provides wood production, increased wildlife populations, enhancement of natural beauty, soil protection, prevention of stream pollution, and protection of endangered wildlife species (Natural Resource Management Plan, 1975).

Wildlife management at Camp Lejeune is based on guidelines in the United States Forest Service Wildlife Management Handbook. Upland game species (including deer, black bear, gray squirrel, fox squirrel, quail, turkey, and waterfowl) are abundant and are considered in the wildlife management program. There is an attempt to coordinate forest and wildlife management. Wildlife management is accomplished in part by providing a variety of habitats, including forests, perennial grass clearings, small-game strips, wildlife food plots, planted forest access roads, and plantings of shrub and fruit trees which produce edible seeds and fruits. Figure 5-8 presents the locations of wildlife food plots, fish ponds, wildlife openings, and small-game plots within the 14 wildlife units of the complex (Natural Resource Management Plan, 1975; NAVFACENGCOM, 1975).

Ecosystems discussed in this report will be broken into terrestrial (or upland), wetland, and aquatic communities.

5.4.1 Terrestrial Ecosystems. Camp Lejeune contains four upland habitat types (Natural Resource Management Plan, 1975). These are:

1. Longleaf pine,
2. Loblolly pine,
3. Loblolly pine/hardwood, and
4. Oak/hickory.

5.4.1.1 Longleaf Pine. Longleaf is the principal pine species and occurs on higher upland sites. Turkey, blackjack, post, and willow oaks, along with red bay, holly, and black gum, are the associated species. Gallberry, yaupon, low-bush huckleberry, titi, and chinquapin are also common in the understory. Herbaceous species include teaberry, ferns, and sawgrass. Quail and fox squirrel are common in this habitat and wild turkey find this forest type quite conducive for nesting and brooding range.

5.4.1.2 Loblolly Pine. Loblolly pine is the main timber stand of the area and many now grow on old farm homesteads. Persimmon, black cherry, red cedar, holly, dogwood, and scrub oak are common, while huckleberry, chinquapin, gallberry, beauty-berry, and wax myrtle make up the understory. Weeds and herbaceous plants include pokeweed, ragweed, smartweed, beggarweed, and partridge pea. Deer, turkey, gray squirrel, and quail are common in this forest type, especially if clearings are provided or prescribed burning is done to improve food and cover for the above species.

5.4.1.3 Loblolly Pine/Hardwood. This mixed forest occurs above the hardwoods and just below the pure stands of loblolly pine. Sweet gum, black cherry, red cedar, holly, sweet bay, and dogwood trees are common, while high bush huckleberry, gallberry, and wax myrtle comprise the

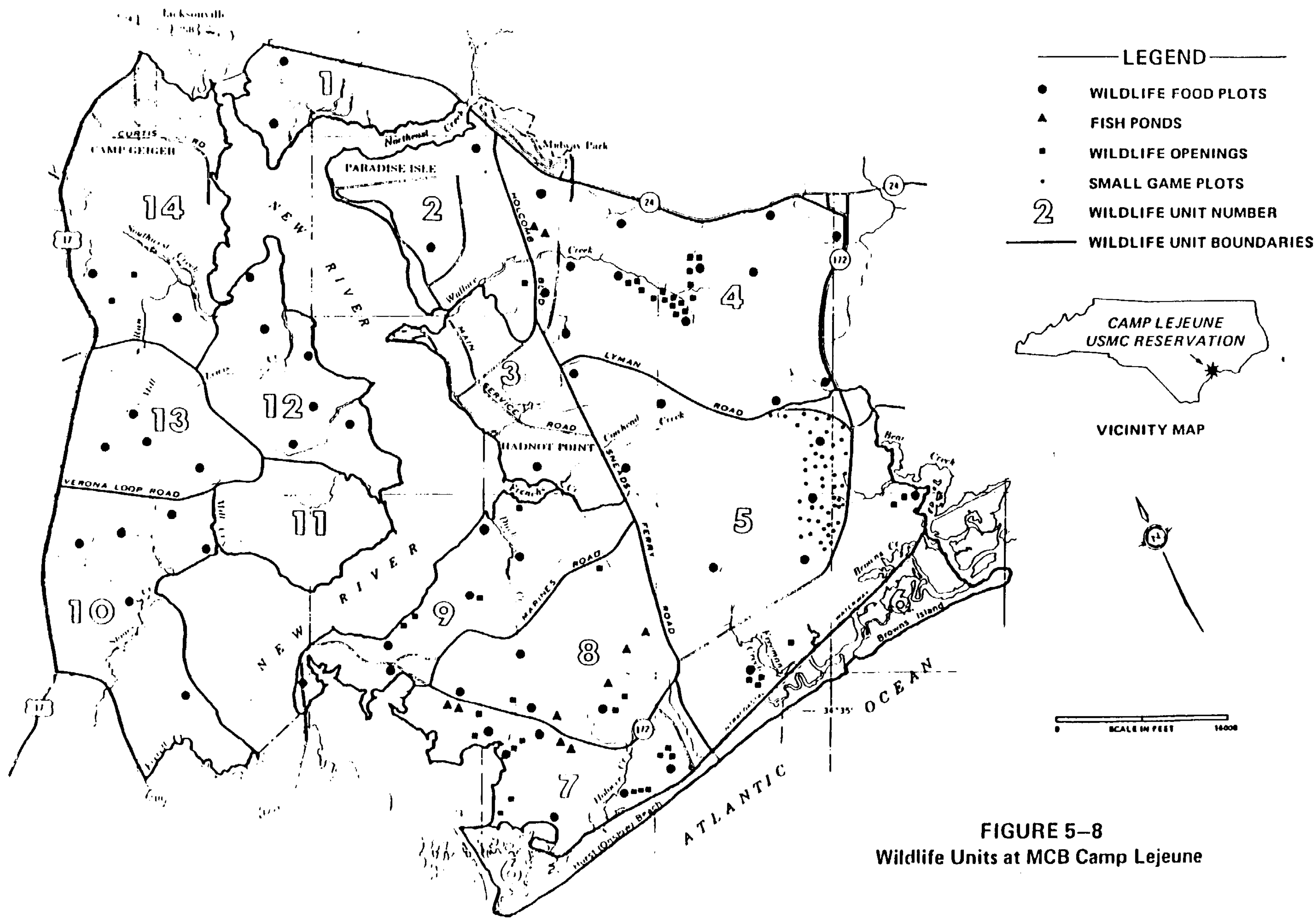


FIGURE 5–8
Wildlife Units at MCB Camp Lejeune

SOURCE: NATURAL RESOURCE MANAGEMENT PLAN CAMP LEJEUNE, NORTH CAROLINA, 1975 understory. Weeds and herbaceous plants include panic grass, broomsedge, pokeweed, partridge pea, and beggarweed. Gray squirrel, deer, and other small mammals are common here. The habitat is also conducive to wild turkey.

5.4.1.4 Oak/Hickory. This association is frequently found along streams and creeks below the loblolly/hardwood stands and above the bottomland hardwoods. White oak and southern red oak are the principal species. Black, post, chestnut, scrub oak; yellow poplar, sweet gum, black gum, persimmon, black cherry, maple, and dogwood also are common. Blueberry, chinquapin, and beauty-berry make up the understory. Herbaceous plants include ferns, teaberry, paspalums, and sedges. Wildlife frequently observed in this habitat include gray squirrel, wild turkey, deer, and wood duck. Black bears are also found here.

5.4.2 Wetland Ecosystems. Wetlands found in the coastal plain vary from those bordering freshwater streams and ponds to salt marshes along coastal estuaries. The most unusual wetland system is the pocosin, which has been referred to as a shrub bog by Christensen (1979). The term pocosin originates from an Algonquin Indian name meaning "swamp on a hill." Pocosins initially develop as wetlands formed in basins or depressions. The wetlands expand beyond the physical boundaries of the depression as the peat retains water. Eventually, the wetland expands above the groundwater, with peat acting as a reservoir, holding water by capillarity above the level of the main groundwater mass (Moore and Bellamy, 1974).

According to Richardson (1981), these evergreen shrub bogs comprise more than 50 percent of North Carolina's freshwater wetlands. Typically, these systems cover thousands of acres, are isolated from other water bodies, and periodically are subject to fire. Much of the pocosin habitat in North Carolina is gradually being lost to timber cutting or drainage with subsequent agricultural development. In 1962, for example, pocosins covered more than 2.2 million acres, but by 1979, only 695,000 acres remained undisturbed. Destruction of pocosins has resulted in changes of hydrologic regime, and nutrient export to other aquatic systems (Richardson, 1981).

A shrub understory with scattered emergent trees dominates pocosin vegetation. The most common species is pond pine. Other species include Atlantic white cedar, loblolly and longleaf pine, red maple, sweet bay, and loblolly bay (Christensen et al., 1981.)

The characteristics of pocosin fauna are less well understood than those of the plant community. Wilbur (1981) notes that pocosins serve wildlife species two ways: They are habitat for endemic species, but also are refuge for those species which once ranged widely, but now are confined because of habitat destruction. Endemics include two vertebrates, the pine barrens treefrog and the spotted turtle. Various small mammals and reptiles also are endemic to the pocosins. Such species as white-tailed deer and black bear also find refuge in the pocosins.

Wetland ecosystems on the Camp Lejeune complex can be separated into five habitat types (Natural Resource Management Plan, 1975).

1. Pond pine or pocosin,
2. Sweet gum/water oak/cypress and tupelo,
3. Sweet bay/swamp black gum and red maple,
4. Tidal marshes, and
5. Coastal beaches.

5.4.2.1 Pond Pine. This habitat (commonly known as pocosin or upland swamp) is dominated by pond pine with Atlantic white cedar, loblolly and longleaf pine, red maple, sweet bay, and loblolly bay also present as stated above. Understory plant species include greenbriar, cyrilla, fetter bush, and sheep laurel. Associated marsh and aquatic plants include mosses, ferns, pitcher plants, sundews, and Venus flytraps. Animals which can be frequently observed here include deer and black bear. Pocosins provide excellent escape cover for bear because pocosins are seldom disturbed by humans. The presence of pocosin-type habitat at Camp Lejeune is primarily responsible for the continued existence of black bear in the area. Many of the pocosins on the base are overgrown with brush and pine species that would be unprofitable to harvest.

5.4.2.2 Sweet Gum/Water Oak/Cypress and Tupelo. This habitat is found in the rich, moist bottomlands along streams and rivers and extends to the marine shoreline. Cypress dominate if water is present most of the year, while gums dominate if water availability is seasonal. Maple, black gum, hawthorn, sweet bay, red bay, and elm along with hornbeam, holly, and mulberry are also frequently present. Huckleberry, grape, and palmetto make up the understory. Deer, bear, turkey, and waterfowl (including woodcocks) are commonly found in this type of habitat.

5.4.2.3 Sweet Bay/Swamp Black Gum and Red Maple. As the name implies, sweet bay or swamp black gum and red maple are the dominant tree species in this floodplain habitat. Swamp tupelo, ash, and elm are also present. Greenbrier, rattan-vine, grape, and rose make up the understory. Fauna frequently found in this area include waterfowl, mink, otter, raccoon, deer, bear, and gray squirrel.

5.4.2.4 Tidal Marshes. The tidal marsh at the mouth of the New River on MCB Camp Lejeune is one of the few remaining North Carolina coastal areas relatively free from filling or other man-made changes. Vegetation consists of marsh and aquatic plants such as algae, cattails, saltgrass, cordgrass, bulrush, and spikerush. This habitat generously provides wildlife with food and cover. Migratory waterfowl, shorebirds, alligators, raccoons, and river otter are frequently seen within this habitat type.

5.4.2.5 Coastal Beaches. Coastal beaches along the Intracoastal Waterway and along the Outer Banks of MCB Camp Lejeune are used for recreation and to house a small military command unit on the beach. The Marines also conduct beach assault training maneuvers from company-size units to combined 2nd Division, Force Troops, and Marine Air Wing units.

These exercises involve the use of heavy equipment including Amphibious Tractors (AMTRACs). Training regulations presently restrict where heavy tracked vehicles are permitted to cross the dunes. These restrictions are intended to protect the ecologically sensitive coastal barrier dunes. The vegetation along the beaches includes trees (live oak and red cedar), woody plants (greenbrier, yaupon, holly, wax myrtle, and palmetto), and weeds and herbs (sea oats, beachgrass, butterfly pen, Virginia creeper, swamp mallow, and passion flower). Although in comparison to other types the coastal beaches are generally low in value to most game species, they serve as buffers to the mainland and provide habitat for many shorebirds.

5.4.3 Aquatic Ecosystems. Aquatic ecosystems on MCB Camp Lejeune consist of small lakes, the New River estuary, numerous tributary creeks, and part of the Intracoastal Waterway. A wide variety of freshwater and saltwater fish species live here. A number of freshwater ponds are under management to produce optimum yields and ensure continued harvest of desirable fish species (Natural Resource Management Plan, 1975).

Principal freshwater game fish species in the ponds, creeks, and the New River include largemouth bass, bluegill, redear sunfish, warmouth, pumpkinseed, yellow perch, redfin pickerel, jack pickerel, and channel catfish. The New River estuary is used extensively for shellfishing, especially in the bays and protected areas of the river such as Stone Bay, Traps Bay, and Ellis Cove.

The Intracoastal Waterway cuts the southeast edge of MCB Camp Lejeune. As it passes between the mainland and the barrier islands, the waterway carries a heavy flow of private pleasure boats during the summer and a steady flow of commercial barges year-round. A variety of saltwater fish is found in the Intracoastal Waterway and in the Atlantic Ocean adjacent to the base. These include flounder, weakfish, bluefish, spot, croaker, whiting, drum, mackeral, tarpon, marlin, and sailfish. Shellfish, represented by oysters, scallops, and clams, are also abundant (Natural Resource Management Plan, 1975; NAVFACENGCOM, 1975).

This part of the North Carolina coast is within the Atlantic flyway and many species of migrating birds pass through the region. Area habitats are used by migrating birds, and local species of shorebirds also employ the marsh areas as a nursery.

The long-range management plan for MCB Camp Lejeune calls for recreational improvements and increased access along the New River and Intracoastal Waterway for the wildlife observer and photographer as well as the game hunter and fisherman (NAVFACENGCOM, 1975).

Regionally, the area is important because of the marine fisheries resource. At nearby Beaufort, Duke University has a marine laboratory. The National Marine Fisheries Service Center for Menhaden Research is also near Beaufort. The University of North Carolina Institute of Marine Sciences and the State of North Carolina Department of Natural Resources Division of Marine Fisheries are in Morehead City.

5.4.4 Rare, Threatened, or Endangered Species. The flora of North Carolina consists of approximately 3,400 taxa of vascular plants. The vertebrate fauna of over 865 species and subspecies includes 200 freshwater fish, 78 amphibians, 79 reptiles, 225 breeding and 175 winter and transient birds, 80 nonmarine mammals, and 28 pelagic or offshore mammals (Cooper, 1977). Of these organisms, 26 have been designated as endangered or threatened by the State of North Carolina and 25 are listed by the federal government as endangered or threatened for North Carolina (Table 5-1). The North Carolina Department of agriculture is currently (1982) reviewing additional plants for inclusion on the state endangered and threatened plant list. Table 5-2 presents 14 additional proposed taxa and taxa under review which are known to occur in Carteret, Craven, Jones, or Onslow Counties. The presence of North Carolina's sensitive species on the Camp Lejeune complex is described in Table 5-3.

The Natural Resources and Environmental Affairs (NREA) Division of MCB Camp Lejeune, the U.S. Fish and Wildlife Service, and the North Carolina Wildlife Resource Commission have entered into an agreement for the protection of endangered and threatened species that might inhabit MCB Camp Lejeune. Habitats are maintained at MCB Camp Lejeune for the preservation and protection of rare and endangered species through the base's forest and wildlife management programs. Full protection is provided to such species and critical habitat is designated in management plans to prevent or mitigate adverse effects of station activities.

As part of the rare and endangered species management program, special emphasis is placed on habitat and sightings of alligators, osprey, bald eagles, cougars, dusky seaside sparrows, and red-cockaded woodpeckers. The red-cockaded woodpecker is present in pine forests on MCB Camp Lejeune as noted in Table 5-3. This small woodpecker subsists on insects and is important in controlling insect pests which attack pine trees. Nesting cavities used by these birds are usually in overmature pine trees with red-heart disease. In some colonies, all the cavity trees are within 300 feet of each other, but in other colonies, they may be 0.5 mile apart (Hooper et al., 1980). Numerous red-cockaded woodpecker colonies on Camp Lejeune have been mapped and marked (Natural Resource Management Plan, 1975). These areas are shown in Figure 5-9.

Table 5-1. State and Federal Status of Sensitive Species for North Carolina

Scientific Name	Common Name	North Carolina*	Federal†
MAMMALS			
Felis concolor cougar	Eastern cougar	E	E
Trichechus manatus	Florida manatee	E	E
Myotis grisescens	Gray bat	E	E
Myotis sodalis	Indiana bat	E	E
Eubalaena glacialis	Atlantic right whale	E	E
Balaenoptera physalus	Finback whale	E	E
Megaptera novaeangliae	Humpback whale	E	E
Balaenoptera borealis	Sei whale	E	E
BIRDS			
Falco peregrinus anatum	American peregrine falcon	E	E
Falco peregrinus tundrius	Artic peregrine falcon	E	E
Haliaeetus leucocephalus	Bald eagle	E	E
Vermivora bachmanii	Bachman's warbler	E	E
Dendroica kirtlandii	Kirtland's warbler	E	E
Pelecanus occidentalis carolinensis	Eastern brown pelican	E	E
Picoides borealis	Red-cockaded woodpecker	E	E
FISH			
Acipenser brevirostrum	Shortnose sturgeon	E	E
Hybopsis monacha	Spotfin chub	T	T
REPTILES			
Alligator mississippiensis	American alligator	E	E
Chelonia mydas	Green turtle	T	T
Eretmochelys imbricata	Hawksbill turtle	E	E
Lepidochelys kempii	Kemp's ridley turtle	E	E
Dermochelys coriacea	Leatherback turtle	E	E
Caretta caretta	Loggerhead turtle	T	T
MOLLUSKS			
Mesodon clarki nantahala	Noonday land snail	T	T
PLANTS			
Sagittaria fasciculata	Bunched arrowhead	E	E
Hudsonia montana	Mountain golden heather	T	

E = Endangered and T = Threatened.

Sources: * Parker, W. and L. Dixon, 1980.
† U.S. Fish and Wildlife Service, 1980.

Table 5-2. Proposed Protected Plant List for North Carolina* Listing Only Those Taxa Known to Occur in Carteret, Craven, Jones, or Onslow Counties

Scientific Name	Common Name	Known Counties†	Habitat**	Proposed Status
Proposed Taxa				
Arenaria godfreyi	Godfrey's sandwort	Craven, Jones	Woodland seepage slopes of marl substrates	E
Asplenium heteroresiliens	Carolina spleenwort fern	Jones	Shaded marl outcrops	E
Calamovilfa brevipilis	Riverbank sandreed	Carteret, Craven Onslow	Long-leaf pine forests, bogs, and savannahs	T
Carex chapmanii	Chapman's sedge	Craven	Dry, sandy woods and roadsides	T
Cystopteris tennesseensis	Tennessee bladder fern	Craven, Jones	Marl outcrops	E
Lysimachia asperulaefolia	Rough-leaf loosestrife	Carteret, Craven, Jones, Onslow	Savannahs, pocosins, lowbay, upland bogs, and mesic environments. Acidic soils.	E
Myriophyllum laxum	Loose watermilfoil	Carteret, Craven	Lime sinks, pools, and ponds	T
Sarracenia rubra	Mountain sweet pitcher-plant	Carteret, Craven, Onslow	Shrub bogs and savannahs in the coastal plain	SC-E
Solidago verna	Spring-flowering goldenrod	Craven, Onslow	Savannahs, pocosins, pine barrens, pine flatwoods, and shrub bogs	E
Utricularia olivacea	Dwarf bladderwort	Carteret	Shallow, acid ponds with pH of 3 to 5	T
Taxa Under Review				
Aeschynomene virginica	Sensitive joint-vetch	Craven	Riverbanks, swamps, and tidal marshes in the coastal plain	I
Dionaea muscipula	Venus flytrap	Carteret, Craven Jones, Onslow	Wet, sandy ditches, pocosins, savannahs, and open bog margins	PP
Gentiana autumnalis	Pine barren gentian	Craven, Onslow	Pocosins, savannahs, and pine barrens	PP
Parnassia caroliniana	Carolina parnassia	Onslow	Savannahs	PP

E = Endangered, T = Threatened, SC-E = Special Concern--Endangered, I = Indeterminate, and PP = Primary Proposed Species.

Sources: * North Carolina Department of Agriculture, 1981a, 1981b.
† Radford, Ahles, and Bell, 1968; Justice and Bell, 1968; Beal, 1977; and Wilson, 1982.
** Radford, Ahles, and Bell, 1968; Cooper, 1977.

Table 5-3. Comments on Sensitive Species Regarding Occurrence Within Study Area (Camp Lejeune Complex)

Species	Comment
MAMMALS	
Eastern cougar	Possible transient but not seen since 1974
Florida manatee	Study area is northern extreme of summer range
Gray bat	Not in area
Indiana bat	Not in area
Atlantic right whale	Possible migrant offshore
Finback whale	Possible migrant offshore
Humpback whale	Possible migrant offshore
Sei whale	Possible migrant offshore
BIRDS	
American peregrine falcon	Possible but not common
Arctic peregrine falcon	Possible
Bald eagle	Not reported or seen
Bachman's warbler	Possible migrant but not observed
Kirtland's warbler	Possible migrant but not reported
Eastern brown pelican	Reported in area
Red-cockaded woodpecker	Frequent in area with known nesting areas
FISH	
Shortnose sturgeon	Not observed recently
Spotfin chub	Not in area
REPTILES	
American alligator	Routinely observed
Green turtle	Known nesting sites along coast
Hawksbill turtle	Possible migrant offshore
Kemp's ridley turtle	Possible migrant offshore
Leatherback turtle	Possible migrant offshore
Loggerhead turtle	Known nesting sites along coast
MOLLUSKS	
Noonday land snail	Not in area
PLANTS	
Bunched arrowhead	Not in area
Mountain golden heather	Not in area

Sources: Peterson, 1982.
Cooper, 1977.
Parker and Dixon, 1980.

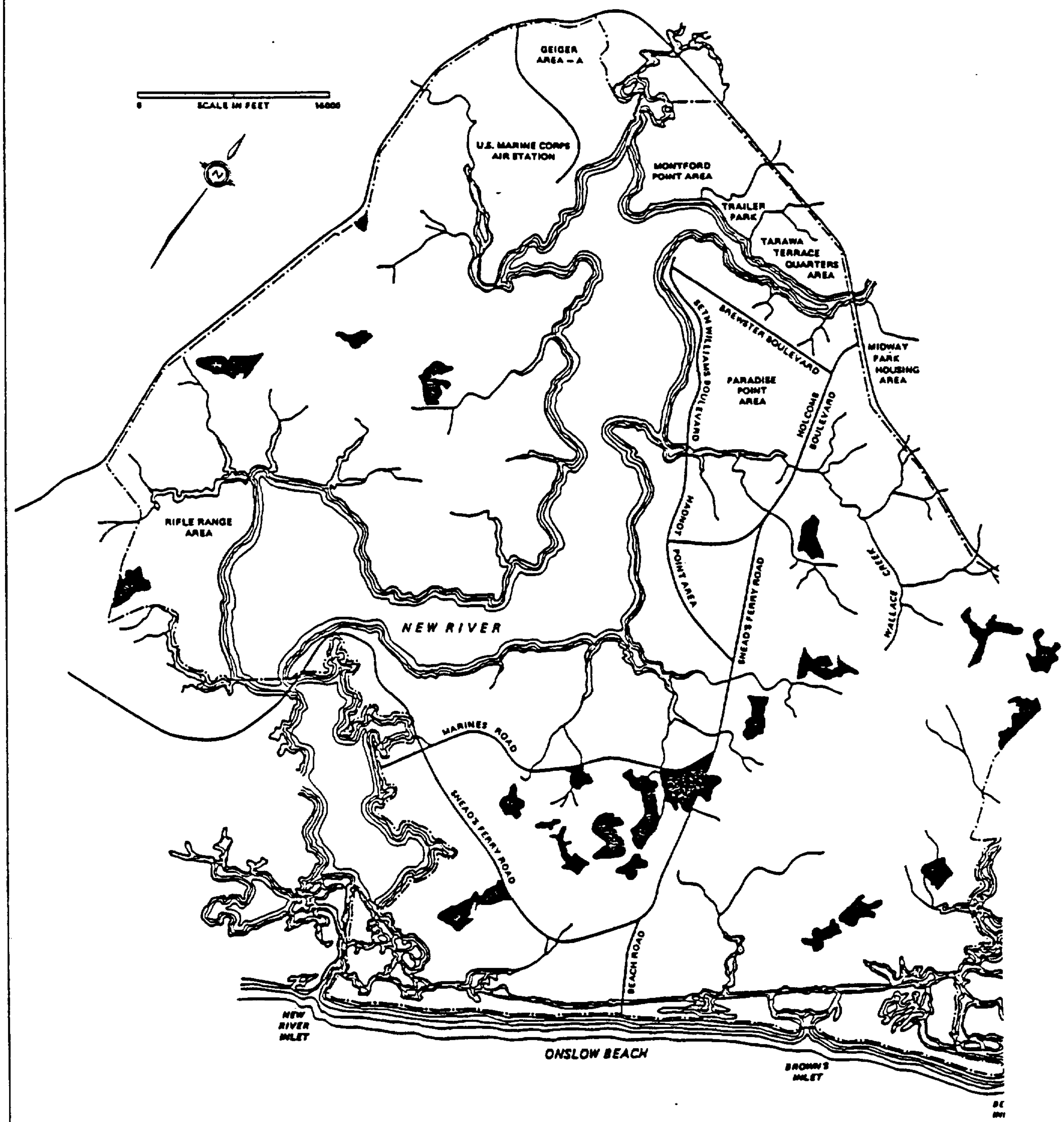


FIGURE 5–9
Red-Cockaded Woodpecker Colony Areas at MCB Camp Lejeune

SOURCE: PETERSON, 1982

SECTION 6. ACTIVITY FINDINGS

6.1 INTRODUCTION. Section 6 summarizes base activities and operations which may involve potential environmental contamination. Emphasis is placed on past practices. At the end of the section is an inventory of all waste disposal sites which includes site descriptions. Information is more detailed for sites requiring confirmation.

Throughout the activities and operations summaries, the reader is referred to specific sites for more information. In these instances, site descriptions at the end of this section should be consulted.

6.2 OPERATIONS, ORDNANCE. Because ordnance operations at Marine Corps Base (MCB) Camp Lejeune are carefully controlled, there is little public health or environmental concern about past disposal practices. For that reason, only an overview of this function is presented. Camp Lejeune was established as a training center before World War II and has retained this characteristic feature. Numerous activities, from infantry and tank training to amphibious operations, require substantial amounts of ordnance each year. No manufacturing or load and pack operations occur on the base. All ordnance is shipped in and stored on the facility. Types of ordnance range from small arms ammunition to rockets, artillery, and mortar rounds. Principal magazine storage is in the Frenchs Creek area, while smaller storage areas exist in other designated places on the base. No reports of spills or accidents were discovered during this study.

There is evidence that, on a nonroutine, irregular basis, some ordnance was buried at the Camp Geiger landfill near the trailer park (Site No. 41). Reports indicate that some mortar shells were placed in dumpsters and ultimately taken to the landfill. A case of grenades was once found at that site and subsequently buried there. A 105mm cannon shell apparently blew up while being buried there. This suggests that care be taken when drilling or boring at Site No. 41.

Because of the training mission, a substantial amount of land has been designated as firing ranges and impact areas. There are three impact zones, called G-10, N-2, and K-2, for high explosives. Locations of these zones are as follows:

1. G-10 Impact Area--PWDM 1, D5-6.
2. N-2 Impact Area--Extends east from the junction of Gridline 94 and Onslow Beach along the beach line to Bear Creek Inlet, and then along Bear Creek to a point 400 yards north of the Intracoastal Waterway, and thence on a line 400 yards north of a parallel to the Intracoastal Waterway to Gridline 94. Ordnance from aircraft will impact on Brown's Island.
3. K-2 Impact Area--PWDM 1, D3/E3.

The New River bisects MCB Camp Lejeune and splits impact zones G-10 and K-2 into east and west sections. N-2 is southeast of G-10 and borders the Atlantic.

A bombing range known as BT-3 has been established at Brown's Island. This property is 7 miles southwest of Swansboro, North Carolina. The island, referred to as the Brown's Island Target Complex, is used by aircraft for target runs with ordnance not to exceed an equivalent net explosive weight of 250 pounds TNT. The target complex also receives high trajectory artillery rounds.

There are two Explosive Ordnance Disposal (EOD) areas on the base near the impact zones. They are G-4 for the east and K-326 for the west side of the camp. They are used to dispose of inert, unserviceable, or dud ordnance. Ordnance is routinely collected by skilled EOD personnel and disposed of by burning or electrically exploding. There is no significant chemical waste generated by this activity. At times, residual propellant or incompletely burned munition compounds may remain, but amounts are typically less than 1 pound.

6.3 OPERATIONS, NONORDNANCE.

6.3.1 Introduction and Summary. Most waste material is generated by the support and maintenance functions of the base. Decentralization of utilities and other essential services is necessitated by the 170-square-mile land area. For instance, vehicle maintenance functions are carried out at several places. Past generation of hazardous waste is primarily a result of maintenance-type activities. Only light industrial activity has taken place.

In a facility the size of MCB Camp Lejeune, hazardous waste may be generated at many places. For instance, the 1979 Facility Development Map set indicates the following numbers of facilities:

1. Vehicle maintenance (except ramps and racks)--45 to 50 buildings,
2. Vehicle/aircraft racks/ramps--85 to 90 buildings,
3. Other maintenance--10 to 15 buildings,
4. Fuel related operations--approximately 50 buildings,
5. Maintenance shops--approximately 20 buildings, and
6. Other shops--approximately 10 buildings.

The actual number of shops is probably greater since individual shops within buildings are not distinguished in these numbers.

Because this investigation is conducted within finite military resources, priorities must be established. Priority criteria include types of substances potentially involved, intensity or size of activity or organization, and level of information available. More information is provided in this report on these activities assigned higher priorities.

Another important factor relating to information reported in this section is on-site judgment. Observed circumstances and information gathered during interviews indicate minimal contamination potential at many shops and activities. In these instances, priority was given to identifying and gathering information regarding other disposal sites, rather than gathering detailed information on activity, history, and productivity at what appeared to be lower priority activities.

6.3.2 Marine Air Groups. Marine Air Groups (MAG) 26 and 29 presently operate at Marine Corps Air Station (MCAS) New River. MAG-26 consists of the headquarters unit plus aircraft squadrons. Hazardous wastes are generated as a result of aircraft maintenance. These wastes include used Petroleum, Oil, Lubricant (POL), Methyl Ethyl Ketone (MEK), and PD-680. In the past, MAG-26 wastes included petroleum naptha, aircraft surface cleaning compound, toluene, methyl ketone, paint remover, ammonium hydroxide, sulfuric acid, trichloroethane, corrosion control agents, and waste POL.

MAG-29 consists of a headquarters unit plus aircraft squadrons. Hazardous wastes are generated as a result of aircraft maintenance. Present wastes include waste POL (650 gal/mo), paint, solvents (10 gal/mo of PD-680, Freon, and MEK), nitric acid, and epoxy paint stripper (30 gal/mo). Past wastes were reported to include strippers and ammonia-based paint stripper.

Present activities and information indicates types of waste disposed of in the past. A review of building construction has been used to infer history and location of waste generation from aircraft maintenance activities. Of existing structures, Building AS 840 (built in 1952) is the initial aircraft maintenance hanger. Square footage available for the aircraft maintenance area increased tenfold when Hangar AS 504 was added 2 years later. The addition of Building AS 515 in 1963 resulted in a two-thirds increase in capacity. In the late 1960s, Hangars AS 518, 4106, and 4108 were completed, doubling the size again. Finally, in 1975, Hangar 4100 was added, which increased capacity about 10 percent. Increases in quantities of waste products are expected to parallel facility growth.

Wastes (except POL) generated on MCAS New River are presently collected and prepared for transfer to DPDO for accounting. Waste POL is collected by the Heavy Equipment Unit at Building 45. In the past, liquid wastes were disposed of in sewers and sprayed on dirt roads for dust control. Nonliquids were at first taken to the Camp Geiger Sewage Treatment Plant (STP) Dump (Site No. 36), later to the Camp Geiger Trailer Park Dump (Site No. 41), and most recently to the current Base Sanitary Landfill (Site No. 29).

6.3.3 Activities of 2nd Marine Division. The division is composed of several groups which are discussed in the following sections.

6.3.3.1 Assault Amphibious Battalion. This group is located at the boat basin on Courthouse Bay. Amphibious vessels are parked and maintained in Buildings A-1 and A-2. The battalion trains on Courthouse Bay, other outer waters, and in wooded lands nearby. Waste POL is generated during routine, nonroutine, and working maintenance. Waste POL from routine maintenance is estimated to be 5,000 to 15,000 gallons per year based on the following:

1. 47 vehicles per company,
2. 4 companies,
3. 17 gallons of crankcase oil per change,

4. 21 gallons of transmission oil per change,
5. 1 change per year, and
6. The assumption that vehicle numbers and characteristics are constant throughout the history of the area.

Oils are taken to the main base for recycling disposal. The remoteness of this area indicates that in the 1940s through 1960s much oil was disposed of in nearby wooded areas. Inspection of nearby areas revealed no indications of significant contamination. However, substantial quantities of waste oil have been spread over the area (Site No. 73).

Vehicle maintenance can be expected to release small amounts of POL to work area drains. Before oil-water separators were used, it is likely that this POL went to receiving waters.

Waste battery acid also was generated. Between the early 1950s and late 1970s, battery liquids were poured onto the ground nearby (Site No. 73). Over the years this is estimated to have totaled 10,000 to 20,000 gallons of acidic liquid containing lead and antimony.

6.3.3.2 Reconnaissance Battalion. This battalion has been headquartered at Onslow Beach since 1953. No prior similar nearby activity is indicated on older development maps. Building BA-130 is used for vehicle maintenance which involves trucks and other light vehicles. Inspection of the site revealed no significant waste disposal locations. However, due to the remoteness of this activity, it is reasonable to assume that some nearby disposal took place. No data regarding numbers of vehicles maintained have been collected. However, the size of the parking area suggests tens (not hundreds) of vehicles. Therefore, waste POL amounts can be expected to be less than 200 gallons per year or 4,000-5,000 gallons over 20 to 25 years.

6.3.3.3 Tank Battalion. Tanks have been parked and maintained in the Gun Park and 1800 areas of MCB Camp Lejeune. Both zones are along the Main Service Road near Cogdels Creek. Earliest tank activity was near MCAS New River in the 1940s and early 1950s. Then, until the early 1960s, tanks were parked and maintained in the Gun Park area until they were moved to the "1800" area where they remained until the early 1980s, when they were returned to the Gun Park area. These areas are unpaved and cover 30 to 50 acres each. Buildings and grease racks involved in maintenance of tanks and smaller vehicles at the Gun Park area include GP-7, GP-8, 739, and 816, which were built in the mid-1940s. Buildings used at the "1800" area include 1832, 1841, and 1842 which were constructed in the early 1950s. Building 1832 and nearby structures have been removed and new tank park facilities have been constructed.

Many of the lots drain to nearby ditches which flow to Cogdels Creek. No signs of significant contamination were observed at buildings or parking areas. However, POL and battery fluids disposal has occurred (See Site No. 74).

6.3.3.4 Old 10th Regiment. This group occupied the "1800" area when only buildings with 500 designations were standing. Artillery was parked adjacent to the buildings. Maintenance activities took place in and around Buildings 571, 574, 576, 598, and 599. No information was obtained regarding wastes generated by this regiment. The area is now occupied by the 2nd Combat Engineers Battalion.

6.3.3.5 2nd Combat Engineers Battalion. This battalion is presently in the "1800" area. Routine maintenance of small combat vehicles takes place in Buildings 574, 576, and 598. No significant areas of contamination were observed.

6.3.3.6 2nd, 6th, and 10th Regiments. These regiments use several sections of the supply and industrial area. Buildings 1205, 1206, 1310, 1405, 1406, 1502, 1503, 1601, 1604, 1605, 1607, 1711, 1739, 1750, 1755, 1760, 1775, and 1780 are used for maintenance of small combat vehicles. Except for the 1700 area, many of these buildings were constructed in the early 1940s and early 1950s. The area is urban with most surfaces paved. Spills and other disposal activities may have occurred. However, no indications of significant contamination were found.

6.3.3.7 8th Marine Regiment. This regiment occupies a portion of Camp Geiger. Combat vehicles are maintained at Building TC-952. Large paved parking areas slope eastward to a tributary of Brinson Creek. This small creek has received runoff POL from the lots. There was evidence of dumping near the creek but no significant contamination was observed.

6.3.4 Fire Fighting Activities. Presently, there are two fire fighting training burn pits at MCB Camp Lejeune. One site used by the MCB Camp Lejeune Fire Department is located south of Bearhead Creek and between Holcomb Boulevard and Piney Green Road (see Site No. 9). The other is located near the end of Runway 5 at MCAS New River (see Site No. 54) and has been used for crash crew training. Both pits were initially unlined.

The fire department pit was first used in 1961 using water-contaminated JP-4 and JP-5. The fuel sat on top of a water layer in the bottom of the pit. The water layer was not treated after the training exercises were completed. This pit was lined in the late 1960s. From 1965 to 1971, approximately 30,000 gal/yr was burned at this pit. The current use is now about 5,000 gal/yr.

The Crash Crew Training Area at MCAS New River was used in the mid-1950s. Originally, training was on the ground and surrounded by a berm. Later, a pit was used which was lined in 1975. MCAS New River drainage ditches were reported to carry "Protien" fire fighting foam toward Southwest Creek during or after practice exercises. The affected area is about 1.5 acres. Based on a present annual usage of 15,000 gallons of POL, approximately 0.5 million gallons of these compounds have been used at this site. Most of these were burned, but as many as 3,000 to 4,000 gallons may have soaked into the soil.

6.3.5 Naval Field Research Laboratory. From 1947 to 1976, the Naval Research Laboratory was located in the area of the present Pest Control Shop (Building PT-37, see Site Nos. 19 and 20). Activities at the laboratory included using radionuclides (Iodine 131) for metabolic studies on small animals. These actions are not believed to have produced any lasting hazardous waste contamination (see Section 6.4).

6.3.6 Creosote Plant. During 1951 and 1952, a saw mill and creosote plant (Building 776; Site No. 3) manufactured railroad ties. This activity was located about 800 feet east of Building 613 (pump house and Well No. 13), on the opposite side of Holcomb Boulevard and the railroad tracks. Logs were cut into ties which were then placed in a chamber and pressure-treated with hot creosote. Creosote was used directly from a railroad tank car. Creosote remaining in the pressure chamber at the end of the treatment cycle was saved for later use. There were no reports of any creosote waste generation. Oil-burning boilers provided steam to heat the creosote.

The ties were used to build a railroad from Camp Lejeune to Cherry Point, North Carolina. Upon completion of the railroad, the mill and plant were sold and removed from Camp Lejeune. All that remained at the time of this IAS site visit were concrete pads and the boiler chimney. An inspection of the area did not reveal any indication of creosote or other wastes of concern.

6.3.7 Utility Operations. Utility operations have influenced environmental issues at the base. Power, steam, and water are discussed below. Waste disposal is discussed in Section 6.5

Power for the base is supplied by Carolina Power and Light Company with all lines above ground. Maintenance of the system is performed by the company, although transformer leakage within the systems is a concern of base environmental affairs personnel because of potential PCB contamination. Transformer storage is temporary and is now carried out with proper environmental controls. Presently, transformers are stored in Storage Lot 140, between Ash Street and Sneads Ferry Road on Center Road Extension. It is currently designated as a hazardous waste storage area. Historically, transformers were stored at Storage Lots 201 and 203. One incident of leaky 55-gallon drums of transformer oil near Building 1502 was reported. The problem was dealt with by disposing of the drums at Site No. 74 and the area near Building 1502 is believed to be cleaned up. (Refer to description of Site Nos. 6, 21, and 74 for additional information.)

The steam plant at Hadnot Point can produce 480,000 pounds of steam per hour and supplies the French Creek area as well as mainside. Steam is used for heating and cleaning of equipment. Substantial amounts of coal are stored near this facility. The area is identified as Site No. 26. This is a currently operating site and NACIP confirmation is not required. However, berms to prevent coal pile runoff were not noted and some alterations to runoff control may be warranted. The current master plan indicates that increased demand will be placed on the system in the future. As many as 45,000 tons of coal are used per year. Fly ash has been disposed of on base for many years. (Refer to Site No. 24 for additional waste disposal information.)

Groundwater is the potable supply. This is significant, not as a potential source of contamination, but rather as a potential receptor. Strategically located wells provide water to eight treatment plants within the military complex. Generally, wells are deep enough to penetrate at least one impervious layer. The Hadnot Point plant serves French Creek, Tarawa Terrace, and Berkeley Manor. Storage is in elevated tanks with a total capacity of 1.4 million gallons. Table 6-1 presents characteristics of the water treatment plants.

The drinking water system at the Rifle Range area has been a concern because of elevated trihalomethane (THM) levels and proximity of wells to the chemical landfill (Site No. 69). This concern for impacts of Site No. 69 exists despite the fact that THM levels at other places are also somewhat high. For example, note Samples 14, 15, and 16 in Table 6-3. Test wells have been placed around the landfill to monitor groundwater characteristics. Table 6-2 shows THM levels in treated water at the Rifle Range. Strategies to reduce THM levels such as changes in chlorination procedures are being evaluated now (1982). Source of THM precursors is not known, but groundwater monitoring related to the chemical landfill is continuing. THM levels at 41 locations at Camp Lejeune are shown in Table 6-3. Three one-time samples (see Samples 14, 15, and 16) contained total THM at or greater than the 100 ppb EPA (annual average) drinking water limit. THM precursors obviously exist at various locations. However, sources of precursors may or may not be related to past hazardous material disposal. In fact, origins of precursors may not be related to any human activity (e.g., detrital matter or algae).

6.3.8 Radar Equipment Operations. At MCAS New River, metallic mercury was drained from delay lines at the radar site and buried without containment. The radar units were located near the Photo Lab, Building 804 (Site No. 48). This took place from the mid-1950s to the mid-1960s at a rate of about 1 gallon per year.

6.3.9 Pest Control Shop. The control of nuisance organisms at Camp Lejeune has been the mission of an activity called, at various times, Malaria Control, Insect Vector Control, and Pest Control Shop. Building 712 (Site No. 2) housed this activity from 1945 to 1958. Insecticides and herbicides were stored and mixed at this site until the activity moved to Building 1105. At Building 1105, the administrative and storage functions were accomplished while the mixing of chemicals was performed in the southeast portion of Lot 140 (Site No. 21). In 1977, this shop moved to Building PT-37 where it presently is located.

For a listing of the names and quantities of insecticides and herbicides used by this activity, see Site Nos. 2 and 21 in Section 6.7. Equipment washing without containment and treatment of the resulting wastewater was common practice at both Building 712 and Storage Lot 140.

Table 6-1. Water Treatment at MCB Camp Lejeune

Water Treatment Plant	Building	Capacity	Approx. Daily Flow	Treatment
Hadnot Point	HD-20	5 mgd	3.1 mgd	Lime
Holcomb Boulevard*	670	2 mgd	1.5 to 2 mgd	Lime
Tarawa Terrace†	TT-38	1 mgd	1 mpd	Lime
Air Station	AS-110	3.5 mgd	1 mgd	Lime
Camp Johnson†	M-168	0.75 mgd	0.25 mgd	Zeolite
Rifle Range	RR-85	0.6 mgd	0.25 mgd	Zeolite
Courthouse Bay**	BB-190	0.6 mgd	0.5 mgd	Zeolite
Onslow Beach	BA-138	0.25 mgd	0.15 to 0.2 mgd	Zeolite

* There are plans to expand the Holcomb Boulevard plant's capacity to 5 mgd.
† Scheduled for elimination.
** Scheduled for expansion to 1 mgd capacity.

Source: WAR, 1982.

Table 6-2. Total Trihalomethane Values in Treated Water at Rifle Range, MCB Camp Lejeune, 1981 and 1982

Date	Sample No.	Total THM (ppb)
1981		
8/20	467	100
8/20	468	100
8/20	469	98
8/20	470	98
9/24	542	42
9/24	543	43
9/24	544	40
9/24	545	44
10/28	552	49
10/28	553	53
10/28	554	51
10/28	555	55
12/30	567	105
12/30	568	99
12/30	569	104
12/30	570	103
1982		
1/28	572	63
1/28	573	57
1/28	574	71
1/28	575	63
3/18	577	32
3/18	578	47
3/18	579	--
3/18	580	58

Note: Data shown are to demonstrate levels and range of THM encountered.

Source: LANTNAVFACENGCOM, 1982.

Table 6-3. Trihalomethane (THM) Levels at MCB Camp Lejeune, 1982 (in ug/l)

Sample No.	General Area	Location	Chloroform	Bromodichloro-methane	Chlorodibromo-methane	Bromoform	Total THM*
1	Tarawa Terrace	Bldg. SST-39A, Water Plant @ first pump	1	4	3	2	10
2	Tarawa Terrace	Bldg. TT-60, TT Elementary School I, Main Hall Men's Room Sink	1	5	4	2	12
3	Tarawa Terrace	Bldg. TT-48, TT Elementary School II, Men's Room across Office	1	5	3	2	11
4	Tarawa Terrace	Bldg. TT-2453, TT Exchange Gas Station's Ladies Room	1	4	3	2	10
5	Tarawa Terrace	Bldg. TT-35, Sewage Plant's Office Sink	1	4	3	2	10
6	Knox Trailer Park	Bldg. E-23, Sewage Lift Station	3	3	1	<1	7

Table 6-3. Trihalomethane (THM) Levels at MCB Camp Lejeune, 1982 (in ug/l) (Continued, Page 2 of 6)

Sample No.	General Area	Location	Chloroform	Bromodichloro-methane	Chlorodibromo-methane	Bromoform	Total THM*
7	Montford Point	Bldg. M-178, Water Plant @ Sink Faucet	3	4	2	<1	9
8	Montford Point	Bldg. M-625, Steam Plant, Bathroom Sink	2	<1	<1	<1	2
9	Montford Point	Bldg. M-128, Branch Clinic, Men's Room	3	4	2	<1	9
10	Montford Point	Bldg. M-136, Sewage Plant Sink	3	4	2	<1	9
11	Montford Point	Bldg. M-231, BOQ, First Floor Men's Room	4	4	2	<1	10
12	New River	Bldg. AS-110 Water Plant @ Pump	11	15	20	5	51
13	New River	Bldg. G-520, Career Planner, Second Floor Men's Room	13	21	28	11	73

Table 6-3. Trihalomethane (THM) Levels at MCB Camp Lejeune, 1982 (in ug/l) (Continued, Page 3 of 6)

Sample No.	General Area	Location	Chloroform	Bromodichloro-methane	Chlorodibromo-methane	Bromoform	Total THM*
14	New River	Bldg. AS-4025, Barracks Rec. Room, Bathroom Sink	15	28	45	32	120
15	New River	Bldg. 710, Officer's Club Gally Sink	15	25	37	22	99
16	New River	Bldg. 2800, Boat Marina Men's Room	15	24	37	24	100
17	Holcomb Blvd.	Bldg. 670, Water Plant @ Pump	18	8	2	<1	28
18	Holcomb Blvd.	Bldg. 4022, Fire Station, Bathroom Sink	22	9	2	<1	33
19	Holcomb Blvd.	Bldg. 1915, Golf Course, Men's Locker Room	24	11	3	<1	38
20	Holcomb Blvd.	Bldg. 5400, Berkeley Manor Elementary School, Main Hall Bathroom	20	13	2	<1	35

Table 6-3. Trihalomethane (THM) Levels at MCB Camp Lejeune, 1982 (in ug/l) (Continued, Page 4 of 6)

Sample No.	General Area	Location	Chloroform	Bromodichloro-methane	Chlorodibromo-methane	Bromoform	Total THM*
21	Holcomb Blvd.	Bldg. 2615, PP Officer's Club, Gally Dishwashing Sink	23	21	3	<1	47
22	Rifle Range	Bldg. RR-85, Water Plant @ Finish Tap	29	15	4	<1	48
23	Rifle Range	Bldg. RR-6, Fire House Sink	29	14	4	<1	47
24	Rifle Range	Bldg. RR-10, Snack Bar Sink	29	15	4	<1	48
25	Rifle Range	Bldg. RR-200, Across from Target Shed	28	14	4	<1	46
26	Rifle Range	Bldg. RR-92, Sewage Plant Sink	29	15	5	<1	49
27	Court-house Bay	Bldg. BB-190, Water Plant @ Faucet	27	13	4	<1	44
28	Court-house Bay	Bldg. BB-7, Mess Hall Sink	27	13	4	<1	44

Table 6-3. Trihalomethane (THM) Levels at MCB Camp Lejeune, 1982 (in ug/l) (Continued, Page 5 of 6)

Sample No.	General Area	Location	Chloroform	Bromodichloro-methane	Chlorodibromo-methane	Bromoform	Total THM*
29	Court-house Bay	Bldg. BB-54, Service Club	29	13	4	<1	46
30	Court-house Bay	Bldg. SBB-204 Sewage Plant Sink	29	14	4	<1	47
31	Court-house Bay	Bldg. BB-46, Marina Bathroom Sink	38	18	6	<1	62
32	Onslow Beach	Bldg. BA-138, Water Plant	32	9	1	<1	42
33	Onslow Beach	Campsite #2, Spigot 10 (Mainland)	41	10	2	<1	53
34	Onslow Beach	Bldg. BA-103, Mess Hall	32	9	1	<1	42
35	Onslow Beach	Campsite #1, Spigot 2 (Beachside)	39	6	<1	<1	45
36	Onslow Beach	Bldg. SBA-142, Spigot at bottom of Pier	29	9	1	<1	39

Table 6-3. Trihalomethane (THM) Levels at MCB Camp Lejeune, 1982 (in ug/l) (Continued, Page 6 of 6)

Sample No.	General Area	Location	Chloroform	Bromodichloro-methane	Chlorodibromo-methane	Bromoform	Total THM*
37	Hadnot Point	Bldg. 20, Water Plant @ Pump	23	20†	2	<1	45**
38	Hadnot Point	Bldg. NH-1, Emergency Room Sink	28	20†	3	<1	51**
39	Hadnot Point	Bldg. 1202, Men's Room Sink	25	20†	2	<1	47**
40	Hadnot Point	Bldg. 65, Quality Control Lab, Room 220 Sink	25	20†	2	<1	47**
41	Hadnot Point	Bldg. FC-530, Laundry Room Sink, First Floor	28	20†	3	<1	51**

* Interim drinking water standard for TTHM is 100 ug/l (maximum) (annual average).
† This represents an upper limit on the possible bromodichloromethane level.
** This represents an upper limit on the possible total trihalomethane level.

Note: Data shown are to demonstrate levels and ranges of THM encountered.

Source: LANTNAVFACENGCOM, 1982.

wastewater at Storage Lot 140 was estimated to be about 350 gallons of overland discharge per week (NAVFACENGCOM, FY1977). Spillage during the mixing process occurred at Building 712 and possibly occurred at Storage Lot 140. Soil samples taken around Building 712 after this IAS team site visit have shown DDT residues at levels up to 0.75 percent, on a dry weight basis (see Table 2-1).

Building 712 most recently has been used as a day-care center (now relocated). Building 1105 now houses Roads and Grounds Department. Storage and handling procedures at Building 1105 were reported to be adequate to prevent any large spills and to insure a current safe working environment. Any pesticide solution not consumed during the day it was prepared was saved for later use.

6.3.10 Dry Cleaning Shop. Although there are many laundry distribution centers located within Camp Lejeune and MCAS New River, all dry cleaning is performed in Building 25. This laundry facility has been at the same location since 1943. The solvent used for dry cleaning was changed in 1970 from a petroleum based solvent to perchloroethylene (tetrachloroethene). Current consumption rate is approximately 34 tons per year. Solvent losses are reported to occur only as a result of evaporation during the dry cycle. Solvent is reclaimed by filtration and distillation. Therefore, little or no wastes have been generated. Spent filters are dried at high temperatures while any vapors are vented into the solvent storage tank. After drying, spent filters are bagged and sent to the landfill.

6.3.11 Preparation, Preservation, and Packaging Shops.

6.3.11.1 MCB Shop Stores Branch. The Preparation, Preservation, and Packaging (P, P, and P) Shop is responsible for rendering equipment and materials ready for storage and shipment or for rendering such stored items operational from storage. Located in Building 909 at Hadnot Point, this shop is presently accountable for packaging hazardous materials to be transported to the Defense Property Disposal Office (DPDO), or other storage locations. Prior to 1977, rinse water from this facility (300 gal/week in 1977) was discharged by storm sewer into Beaver Dam Creek. The shop last used the degreaser Trichloroethylene (TCE) in 1978.

6.3.11.2 2dFSSG, 2d Supply Battalion. The degreaser TCE was used in Buildings 901 and 1601 by the Marine 2nd Force Service Support Group (2dFSSG) to degrease engines at various times. Approximately 440 gallons of TCE were contained in a tank. In 1976 or 1977, this TCE tank was drained and the solvent sent to DPDO. No information was found regarding spills, leaks, or discharges from the tank.

6.3.12 Furniture Repair Shops. The Furniture Repair Shop operated by Base Maintenance is located in Building 1409. This shop used paint stripper (contained in an approximately 550 gallon vat) to remove clear finishes (i.e., lacquer and varnish). The vat was emptied irregularly every 1 to 4 months. The paint stripper was placed in 55-gallon drums, transported to the industrial area fly ash dump (Site No. 24), and poured onto the ground but not burned.

Special Services operates a furniture repair facility at Camp Geiger in Building TC-609. This facility has been in operation since at least 1968. Only small amounts of wastes are generated.

6.3.13 Paint Shops. Three paint shops are located in the Hadnot Point area. The Base Maintenance Paint Shop (Building 1202) used an estimated 9 tons of paint per year in 1980; similarly, the Central Paint Shop (Building 908) used 1 ton and the Hobby Paint Shop (Building 1103) used 2 tons. The Base Maintenance Paint Shop has been located in Building 1202 at least since pre-1951 and probably since the building was constructed in 1942.

As a matter of long standing shop policy, oil-based paint of all colors has been saved, combined, and the resulting gray paint then used. It has been reported that starting in 1964, about 20 to 40 gallons of oil-based paint were disposed of at the Hadnot Point Burn Dump (see Site No. 28) every other week. Some of this paint was burned. It is not known when this practice ceased. Thinning solvents are rarely used.

6.3.14 Photographic Laboratories. Six photographic facilities have been identified at Camp Lejeune. In 1968, Buildings 11 and 27 were used by the 2nd Marine Division, and Headquarters and Service Battalion, respectively, for photographic uses.

The Sanitary Engineering Survey for FY 1977 (NAVFACENGCONM, FY 1977) identified Building 54 (originally a mess hall built in 1943) as a photo lab generating 300 to 400 gallons per week of wastewater containing acetic acid, sodium sulfite, and ferric cyanide. It further described the Naval Regional Medical Center Hospital as generating 200 to 300 gallons per week of photographic wastes containing hydroquinone, alkali, and silver nitrate. The photo lab in Building 302, presently the Public Affairs Office, produced 15 gallons per day of wastes containing hydroquinone and methylaminophenol sulfate.

The Administration Office and Photographic Laboratory (Building 804 at MCAS New River) was built in 1955. This laboratory presently discharges about 50 gallons of developers and stop bath per month to a sanitary sewer. Fix bath solution is sent to DPDO for reclamation. Past waste disposal quantities are presumed similar to current ones. Discharge is expected to have been to sewers and not to landfills.

6.3.15 Other Industrial Trade Shops. Other general trade shops are associated with routine base maintenance functions. The Plaster and Masonry Shop is located in Building 1304 while Building 1202 houses the following shops: Electric, Metal Working, Plumbing and Heating, Refrigeration and Air Conditioning, and Carpenter. Generally, the materials used by these shops are consumed during the repair and construction functions that they perform. The metal refuse collection system has been in use at Camp Lejeune for several decades and eliminated solid metal disposal problems. The Metal Working Shop is primarily a metal-forming facility without pickling or similar metal re-working operations. The Electric Shop sends any accumulated transformer oil to DPDO and rarely has disposed of any motor winding varnish. The Plumbing and Heating Shop used "Sizzle" to unclog indoor drain pipes but has since discontinued the use of this product which was probably a caustic cleaning agent. The Carpenter Shop was united with the Upholstery Shop in Building 1409 in 1951 before moving to its present location.

6.3.16 Fuel-Related Operations. Fuel storage, dispensing, and disposal are significant activities related to environmental contamination issues. One principal tank farm, for gasoline and diesel fuel, is located in the Hadnot Point area. Here, fuel is transferred into tank trucks and transported to smaller dispensing facilities on base. In the past, this operation has resulted in the release of POL compounds to the environment via leaks (see Section 6.5, Material Storage) or spills from tank trucks (e.g., refer to Site No. 64). Prompt action in the past has, by and large, prevented serious contamination from major spills.

6.4 OPERATIONS, RADIOLOGICAL. The Naval Research Laboratory site is near the present Pest Control Shop. Activities at the laboratory included using radionuclides for metabolic studies on small animals. Approximately 100 dogs were disposed of in a small area near the building. In November 1980, strontium 90 beta buttons were found while grading a parking lot near the building. The area was surveyed, and contaminated items were recovered. Soil samples were obtained and the site was cleaned of radioactive substances. Five 55-gallon drums of soil and animal residues were collected along with 499 beta buttons (400 microcuries per button).

Iodine 131 was used in metabolic studies at the Naval Research Laboratory. Because Iodine 131 has a half-life of only 8 days, potential for residual radiological contamination is nil.

6.5 MATERIAL STORAGE. Responsibility for support of the facility activities rests with the supply organizations of the various commands. Materials of interest include POL, pesticides, chemicals, and radiological substances.

Central stores located in the supply and industrial area of Hadnot Point receive all incoming supplies for the Camp Lejeune complex. The group gives support to the 2dFSSG as well as to other tenant commands on the base. The central stores group handles all commodities such as ammunition, fuels, shop stores, and food. In addition, the group inspects all materials that enter the base. There is also a materials stores traffic management unit which is responsible for waste storage and shipment from the base to proper receiving facilities. Following a DPDO declaration that a given material is waste, this group stores and transports it. The P,P, and P group certifies that the material is safe to move.

Storage of oils, fuels, and other lubricants is scattered throughout the base. The Environmental Engineering Survey FY80 Update, while addressing wastewater treatment needs, identified 69 waste oil systems, 46 grease racks, 50 POL storage areas, 144 fuel tanks, and 9 fueling areas. Under the present plan, POL are stored with adequate environmental safeguards; large fuel tanks or tank farms have earthen berms to contain spills. Other POL products in cans or drums are stored on fenced concrete pads. Historically, there was no awareness of the hazards associated with these compounds and containment measures were minor or did not exist. In the past, there have been leaks in fuel tanks or underground lines. When the break or leak is minor, there may be a considerable time before detection, sometimes resulting in a large amount entering surrounding soils. For example, tank farms at Hadnot Point, MCAS New River, and Camp Geiger have experienced losses through tank or line leakage. These events have prompted an awareness by base personnel of contamination problems associated with underground pipelines. Construction of aboveground lines has been one control measure at the JP Fuel Farm (Site No. 45). Refer to Site Nos. 22, 35, and 45 for detailed descriptions of various fuel storage problems.

Generally, POL contamination can be grouped as spillage of unused POL of a defined type or spillage/disposal of waste POL of an unknown type or types. When POL at a spill site can be identified as a single type of organic mixture, like Mogas or JP-4, the areas of concern may be limited to one or a few specific categories. These categories may be limited to such areas as: tainting of fish and shellfish flesh; taste and odor problems in potable water; migration of lead, lead compounds, and potential carcinogens (e.g., benzene) to human or environmental receptors; fire and/or explosion hazards; and problems at building construction sites.

Situations dealing with waste POL are potentially more complicated because many different types of wastes may have been combined, including toxic and hazardous organic substances. Additionally, waste motor oil alone has been known to contain some heavy metals and phenolics. Phenolic compounds are known to taint fish flesh and, when chlorinated in water treatment systems, to cause taste and odor problems at concentrations near 2 parts per billion. Consequently, waste POL sites may require more extensive analytical investigations to determine what wastes are present and thereby better define the specific areas of concern.

Hazardous chemicals are now segregated and stored in accordance with federal regulations to minimize risk to environment and to human health. Chemicals such as solvents are now stored on concrete pads which are fenced. There is adequate protection against runoff in case of a spill.

Pesticides currently are stored at the former Naval Research Laboratory (see Section 6.3.9). From 1943 to approximately 1958, pesticides were stored in Building 712; this building was used as a day-care center from the early 1960s until mid-1982. Subsequently, pesticides were moved to Building 1105, where they remained until 1977. Stored in Building 1105 were chlorinated hydrocarbons such as DDT and Chlordane as well as Diazinon, Malathion, Lindane, Mirex, 2,4-D, Dalapon, and Dursban.

In the hazardous materials storage area (Building TP-452) HTH was being stored below antifreeze (ethylene glycol). The liquid either spilled or was released in some manner and contacted the HTH. Combustion resulted and the entire facility burned in 1977. This is an example of storage which was improperly planned or without knowledge of the hazard involved from putting these two substances in close proximity. Paint stored here was also consumed in the fire.

6.6 WASTE DISPOSAL OPERATIONS.

6.6.1 Sewage Treatment. Liquid sanitary wastes are conventionally treated throughout the complex. Because of the large surface area, sewage treatment plants (STPs) must be located in various areas. At Hadnot Point, gravity and force mains convey waste to a secondary trickling filter plant capable of treating 8 mgd. This plant, originally serving Hadnot Point, has been extended to Paradise Point, French Creek, and the Berkeley Manor housing area.

Courthouse Bay houses the Engineer's School and the Second Amphibious Tractor Battalion. Sewage treatment is at the secondary level using lime as a pH control. The design capacity of the plant is 0.5 mgd.

MCAS New River and nearby Camp Geiger at one time had separate treatment plants, each capable of providing secondary treatment. The Camp Geiger plant has been upgraded and now also serves the air station. Design capacity of this facility is 1.6 mgd.

6.6.2 Solid Wastes and POL Disposal. Solid waste disposal in the base complex has been on land in the past. Past practice has not been well regulated, and unauthorized disposal sites were used for many substances, some of which were hazardous. A chronology of principal waste disposal areas is given in Figure 6-1. The original base waste disposal site (prior to 1950) was off Holcomb Boulevard across from Storage Lot 203 (See Site No. 10). The site was a borrow pit used for disposal of construction debris. Following construction, which began in 1941, disposal areas were located near individual activities (see Site Nos. 1, 7, 10, 13, 15, 16, 19, 24, 25, 36, 37, 40, 42, 43, 44, 46, 55, 57, 61, 62, 63, 65, and 68). As a result, a number of sites were active simultaneously. In the early 1970s, a central landfill (Site No. 29) was established to receive wastes from the entire complex while other landfills were gradually phased out. One possible exception is the Chemical Dump in the Rifle Range area (Site No. 69) at which disposal continued.

A 1977 report by SCS Engineers shows that MCB Camp Lejeune generates 664 tons of solid waste per week, or approximately 95 tons per

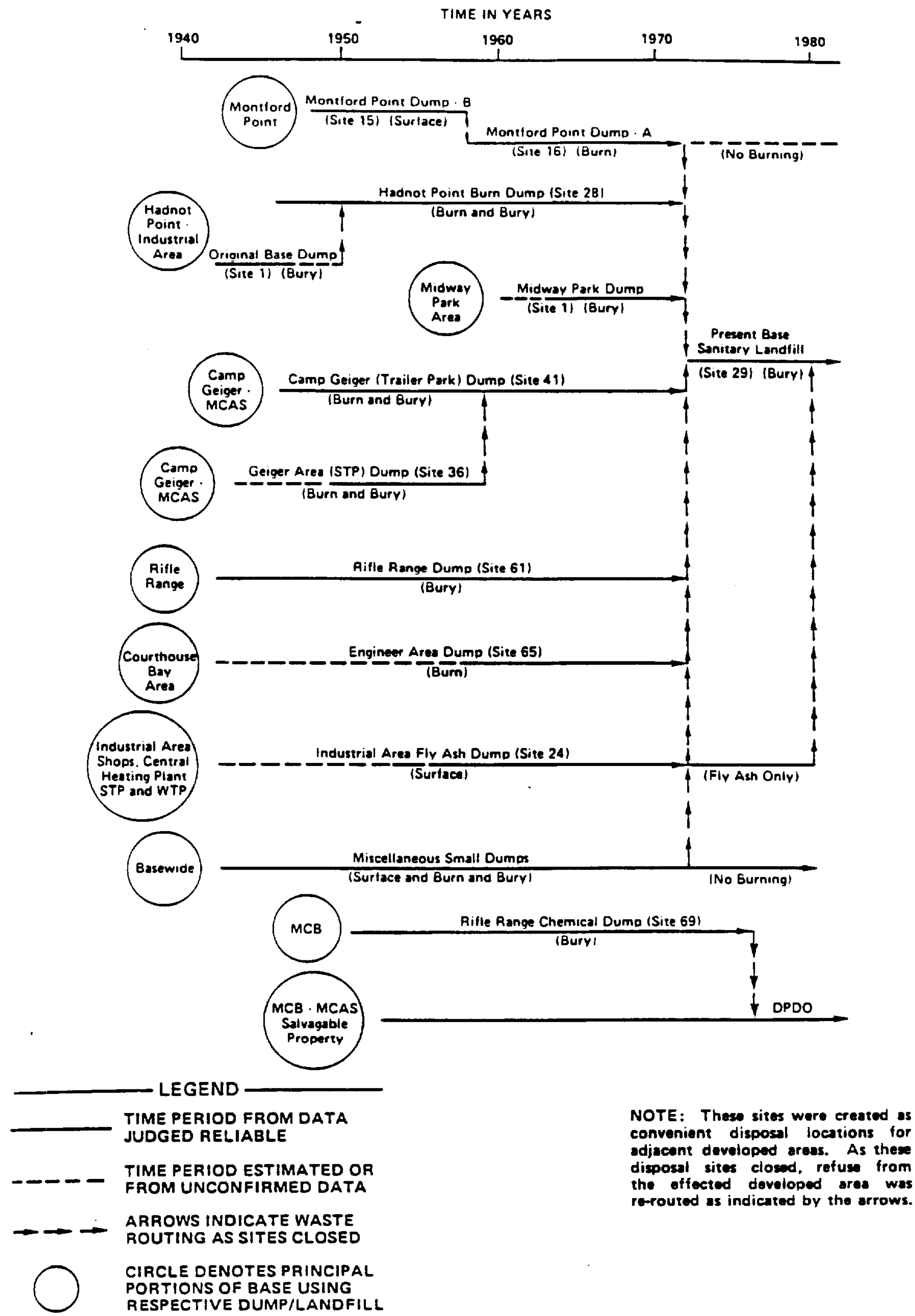


FIGURE 6–1

Chronology of Solid Waste Disposal Sites and Waste Routing at Camp Lejeune, N.C.

day. The composition is similar to municipal waste in other communities. The industrial waste contains nonhazardous materials and is typical of commercial industrial wastes from similar activities.

In addition to solid wastes, base personnel have estimated that prior to the early 1970s, about 5 percent of the waste oils (and other POL) was disposed of at landfills while the remainder was spread on roadways or poured down storm drains. Other liquid wastes disposed of at these scattered disposal sites include solvents and some paints that may have been burned or allowed to seep through the other wastes.

The Rifle Range Chemical Dump (Site No. 69) was set aside in about 1950 to receive toxic waste materials. A complete inventory was kept of types of wastes, amounts, and position of burial. These records have been lost, but according to a former base safety officer, an estimated 50 barrels of DDT, other pesticides, trichloroethylene sludge, wood preservative compounds, training agents (like "tear gas"), and PCBs (some in sealed cement septic tanks) were buried here. The surface area is about 6 acres and the volume of disposed materials may be as high as 93,000 cubic yards. This site was closed in 1978. Storage Lot 140 and Building TP-451 are currently designated as long-term hazardous waste storage areas.

Before a pollution control program was implemented in the early 1970s, it was common to spread waste oils and other POL materials on road surfaces for dust control. As many as 1,400 gallons per week were disposed of in this way. There are five sites (Nos. 5, 31, 33, 34, and 56) which are noted for this type of disposal. Wastes were collected from various maintenance shops on the station at intervals throughout the year. There was no regulated collection practice, and substantial quantities were flushed to drains that emptied into the New River.

Some characteristics of the waste oil currently generated are presented in Table 6-4. The data show significant levels of metals such as lead (376 mg/l) and zinc (475 mg/l). Cadmium, copper, chromium, and barium were also at elevated levels. Amounts of volatile organic compounds were found in the parts-per-billion (ppb) range with the exception of phenols (20 mg/l). These data emphasize the potential contamination which could result from improper disposal of waste oils. It is recognized that past practice in many vehicle maintenance shops allowed oil to seep into the soil on site and cause contamination. This generally has been stopped and current (1982) controls regulate collection and proper disposal of these materials.

6.6.3 Chemical and Training Agent Disposal. For the purpose of this report, a chemical agent is defined as a chemical that is capable of producing lethal or damaging effects on humans and which exists solely for that potential use. Chemical agents differ from training agents in that the latter are authorized for use in training people to function in a chemical environment. Training agents produce irritating/incapacitating

Table 6-4. Constituents in Waste Oil, MCB Camp Lejeune, 1981

Component	Concentration (mg/l)
Antimony	<0.02
Arsenic	<0.002
Barium	1.08
Beryllium	<0.005
Cadmium	1.88
Chromium	0.16
Copper	4.44
Lead	376.0
Mercury	<0.002
Nickel	0.36
Selenium	<0.002
Silver	0.16
Thallium	<0.1
Zinc	475.0
Toluene	0.012
1,1-Dichloroethane	0.004
Phenol	20

Source: LANTNAVFACENGCOM, 1981.

effects at low concentrations and are not lethal except at much higher concentrations. (Definitions adapted from Departments of Army and Air Force, 1975).

Information obtained from various sources indicates that some type of chemical warfare training has always been present at Camp Lejeune. Information has not been found to conclusively indicate whether or not chemical agents were present on-base. Information is also lacking which conclusively indicates whether, if present in large quantities, these agents were present in forms strictly usable as training aids or as stores for chemical warfare use.

Supporting the argument of chemical agent presence is the fact that, in the early 1950s, adequate storage facilities to maintain a supply of chemical agents did exist on-base. One unconfirmed report of phosgene vials being found on-base and other details of eyewitness observations tend to add credibility to this supposition. (These reports will be presented later in this section.)

The argument against chemical agent presence is supported by the fact that, historically, the development and storage of chemical agents has been assigned to the Army and Air Force with minimal Marine Corps involvement. Also, there is only a small probability that domestic or captured chemical agents were returned to Camp Lejeune from overseas war zones.

Most reported observations of "gas" disposal are consistent with training agent disposal. Training agents were sometimes spread as solids over areas used for training exercises. Disposal of large quantities of these training agents (e.g., drums of wet material that would not disperse properly) would be consistent with the Camp Lejeune training mission.

To summarize the "chemical agent presence question," there is little evidence supporting it. However, absence of information cannot be construed as evidence that large quantities of chemical agents were never present or disposed of on-base.

The remaining portions of this section will present a summary of the salient details and observations reported by former and current base employees regarding "gas" disposal operations. Data that might assist in the identification of the disposed material are presented.

Only one unconfirmed report of a chemical agent at Camp Lejeune was found. Recollections of an interviewed staff member were that in 1958 or 1959, during construction of Air Station housing north of Curtis Road, a bulldozer operator uncovered some glass ampules or vials. Both the operator and his supervisor smelled an odor of "new-mown hay." Subsequently, the area was cleared to a depth of 18 inches and a total of eight broken or intact vials were found. The staff member believed the vials had been "sent away" and were determined to contain phosgene. However, no written documentation or other verbal reports of this incident were found. The reported odor is consistent with the odor of phosgene.

It is believed that if these vials did indeed contain phosgene, they were most likely training aids for troop education.

Three other incidences of "gas" burials have been identified (see Site Nos. 69, 75, and 76). These usually involved reports of Marines being present, sometimes with protective clothing. Care was usually exercised during unloading from trucks and placement in pits to ensure the integrity of 55-gallon drums and possibly 5-gallon cans. Some drums were rusty, while others were in good condition. Drums were painted various colors. Some drums were described as being much lighter than drums filled with oil.

At one of these incidents, some drums broke open, releasing a yellow or brown liquid that appeared like fuel oil but was not fuel oil. No distinctive odor was reported. No protective equipment or clothing was worn by the delivery and unloading personnel. The color and appearance are similar to various chemical agents, i.e., distilled mustard gas, nitrogen mustards, and lewisite. The lack of a distinctive odor may have been due to the fact that these agents have vapor densities 5 to 7 times greater than air and vapors may have been confined to the bottom of the pit. Despite these similarities, it is unlikely that such material would be handled by personnel without any protective equipment or clothing. However, this does not conclusively eliminate the possibility that these chemicals were present.

These three drum disposal incidences probably involved disposal of training agents, most probably chloroacetophenone (CN), as a solid or dissolved in one or more solvents. CN dissolved in chloroform, in chloropicrin and chloroform, or in carbon tetrachloride and benzene becomes the different training agents CNC, CNS, and CNB, respectively. The most probable liquid training agent would have been CNC. CN or another training agent, o-chlorobenzylidene malonitrile (CS), may have been present in the "much lighter than oil" drums. CS was developed around the time of the Korean War and replaced CN, which was developed in 1915. Both CS and CN have similar bulk densities (CS is about 0.25 g/cc), and both were stored and handled in 55-gallon drums.

6.7 SITES.

6.7.1 Introduction. A total of 76 waste disposal sites have been identified at MCB Camp Lejeune, MCAS New River, and HOLF Oak Grove. The sites are listed in Table 6-5, and are located on maps included with this section. For many sites, photographs have been included with the site reports. These show limited information regarding foliage, land use, and topography near sites.

The confirmation study ranking system (model) has been applied to these sites. A total of 54 sites were judged not to require further consideration. These sites include 12 at MCAS New River, 3 at HOLF Oak

Grove, and 39 at MCB Camp Lejeune. Five MCAS New River plus 17 MCB Camp Lejeune sites have been judged to require further assessment. These judgments were based on factors such as type of waste material and potential for migration.

Summaries of pertinent information concerning all sites are given in Table 6-5.

6.7.2 Sites Requiring Confirmation. The 22 sites requiring confirmation are described on individual forms in this section. The remaining 54 sites excluded from further consideration are described in Section 6.7.3 using similar, but abridged, forms.

Table 6-5. Disposal Sites at Camp Lejeune Complex*

Site No.	Site Description	Dates Used	Material Deposited	Public Works Development Map Sheet and Coordinates
1**	French Creek Liquids Disposal Area	Late 1940s to mid-1970s	Waste battery acid, POL	11 C7/D7
2**	Former Nursery/Day-Center (Bldg. 712)	1945-1958	Various pesticides	5, K10
3	Old Creosote Plant	1951-1952	Trash, general debris	5, N11-12/O11-12
4	Sawmill Road Construction Debris Dump	Unknown	Asphalt, old bricks, and cement	5, N14-15/O14-15
5	Piney Green Road	Unknown	Waste oil for dust control	6, G4/H4
6**	Storage Lots 201 & 203	1940s-Present	Metals, DDT, PCBs	6, F3-4/G3-4/H2-4/J2-4/
7	Tarawa Terrace Dump	1972	Construction debris, STP filter, sand, household trash	3, F4
8	Flammable Storage Ware-House Bldg. TP451 & TP452	Current	Flammables	6, K3
9**	Fire Fighting Training Pit	1960s-Present	JP-4, JP-5, solvents	6, K3/L3
10	Original Base Dump	Pre-1950	Construction debris	6, G2/H2
11	Pest Control Shop	1976-1982	Pesticide storage, beta buttons, animal carcasses with low-level radiation	10, F10
12	Explosive Ordnance Disposal	Early 1960s	Ordnance burned or exploded, colored smokes, white phosphorus	20, G9
13	Golf Course Construction Dump Site	1944	Clippings, branches, some asphalt	7, G12-13
14	Knox Area Rip-Rap	1973	Broken concrete and asphalt	2, L16-17/M16-17
15	Montford Point Dump, 1948-1954	1948-1958	Litter, asphalt, STP sand	2, M9-10
16**	Montford Point Burn Dump, 1958-1972	1958-1972	Garbage, waste oils, asbestos	2, N11-12
17	Montford Point Area Rip-Rap	1968-Unknown	Concrete rubble	2, N9/O9

Table 6-5. Disposal Sites at Camp Lejeune Complex* (Continued Page 2 of 5)

Site No.	Site Description	Dates Used	Material Deposited	Public Works Development Map Sheet and Coordinates
18	Watkins Village (E) Site	1976-1978	Construction materials and debris	7, L21
19	Naval Research Lab Dump	1956-1960	Radioactive contaminated animals, empty tanks, scrap metals	10, E10/F10
20	Naval Research Lab Incinerator	1956-1960	Some ash, debris	10, F10
21**	Transformer Storage Lot 140	1950-Present	PCB spill, DDT, transformer oil	10, I15
22**	Industrial Area Tank Farm	1979	Fuel (leaks)	10, J15
23	Roads and Grounds, Bldg. 1105	1957-1960	Pesticide, herbicide storage	10, J15
24**	Industrial Area Fly Ash Dump	1972-Approx. 1980	Fly ash and cinders, WTP sludge, STP sludge, construction debris	10, L16-17/M16-17
25	Base Incinerator	1940-1960	Burned trash, melted glass	10, G8
26	Coal Storage Area	Present	Coal storage runoff	10, L12
27	Naval Hospital Area Rip-Rap	1970-Unknown	Concrete, granite rip-rap erosion control	10, H5
28**	Hadnot Point Burn Dump	1946-1971	Solid wastes, industrial wastes, garbage, trash, oil-based paint	10, Q13-14/R13-14
29	Base Sanitary Landfill	1972-Present	Garbage, construction debris, general trash	11, A12/B12-13/C12-13/D13
30**	Sneads Ferry Road-Fuel Tank Sludge Area	1970	Sluge from fuel storage tank, tetraethyl lead and related compounds	18, G12
31	Engineering Stockage-G-4 Range Road	1950-early 1970s	Waste oils	20, G7-8/H3-8/I1-7/J1-5
32	French Creek	1973-1979	Rip-rap dumped	11, F3/G3-4/H4

Table 6-5. Disposal Sites at Camp Lejeune Complex* (Continued Page 3 of 5)

Site No.	Site Description	Dates Used	Material Deposited	Public Works Development Map Sheet and Coordinates
33	Onslow Beach Road	Unknown	Waste oil and cinders for dust control	19, G11-12/H11-12/ I12-13/J12-13
34	Ocean Drive	Unknown	Waste oil	19, L16-17/M15-16 N14-15/O13-14 P12-13/Q10-12
35**	Camp Geiger Area Fuel Farm	1957-1958	Mogas (spill)	12, C11
36**	Camp Geiger Area Dump	Late 1940s-late 1950s	Mixed industrial and municipal solid waste	12, D13/E13
37	Camp Geiger Area Surface Dump	1950-1951	Motor parts, garbage, wood	12, D11-12
38	Camp Geiger Construction Dump	Present	Construction debris, branches	12 B10
39	Camp Geiger Construction Slab Dump	Unknown	Concrete slabs	12, B9-10/C9-10
40	Camp Geiger Area Borrow Pit	1969-	Auto parts, metal	13, D4
41**	Camp Geiger Dump	Approx. 1946-1970	Mixed industrial and municipal wastes, POL, solvents, old batteries, Mirex, ordnance	13, E2-3
42	Bldg. 705, BOQ Dump	1950-1960	Trees, tree stumps, boards	23, D10
43	Agan Street Borrow Pit	Unknown	Boards, trash, WTP sludge, fiberglass	23, H6-7/I6-7
44	Jones Street Dump	1950s	Debris, cloth, boards, old paint cans	23, L6-7/M6-7
45**	Campbell Street Underground Avgas Storage and Adjacent JP Fuel Farm at Air Station	1978	Avgas, JP-4 and JP-5	23, O13-14/P13-14
46	MCAS Main Gate Dump	1958-1962	Construction and demolition debris	23, Q8-9
47	MCAS Rip-Rap Near Stick Creek	Unknown	Construction and demolition debris	23, B11

Table 6-5. Disposal Sites at Camp Lejeune Complex* (Continued Page 4 of 5)

Site No.	Site Description	Dates Used	Material Deposited	Public Works Development Map Sheet and Coordinates
48**	MCAS Mercury Dumpsite	1956-1966	Dumping of approximately 1 gal. mercury yearly for approximately 10 years	23, D17/E17
49	MCAS Suspected Minor Dump	Unknown	Paint cans	23, C18-19
50	MCAS Small-Craft Berthing Rip-Rap	Unknown	Demolition debris, asphalt, concrete	23, A19-20/B19-20
51	MCAS Football Field	Approx. 1967-1968	Paint cans, hydraulic fluid cans	23, C21-22/D21-22
52	MCAS Direct Refuel Depot	1971	Aviation fuel spill, JP fuels	23, L19-20/M19-20
53	MCAS Warehouse Building Area. Oiled Roads	1970-1975	Crankcase, waste oils, JP fuels, paint thinners	23, H-Q23-26
54**	Crash Crew Fire Training Burn Pit	1950s-Present	Contaminated fuels, oil spills	23, O24-25/P24-25
55	Air Station East Perimeter Dump	1950s-1960	Barrels, tires, trash, metal planking, telephone poles	23, C29-30
56	MCAS Oiled Roads to Marina	1975-	Crankcase and waste oils, contaminated fuels	23, C28-30
57	Runway 36 Dump	Unknown	Debris	23, E-G30-32
58	MCAS Tank Training Area	Unknown	Tank parts, miscellaneous trash	23, D-G33-39
59	MCAS Infantry Training Area	1950s	Stumps	23, P-T26-30
60	Explosive Ordnance Disposal K-326 Range	1974-Present	Burn pits for explosives	15, O9
61	Rhodes Point Road Dump	Unknown	Bivouac waste	15, I9
62	Race Course Area Dump	Unknown	Bivouac waste	14, D8
63	Vernon Road Dump	Unknown	Bivouac wastes	14, H5
64	Marines Road-Sneads Ferry Road - Mogas Spill	1978	Mogas spill Feb. 28, 1975	17, I15/J15

Table 6-5. Disposal Sites at Camp Lejeune Complex* (Continued Page 5 of 5)

Site No.	Site Description	Dates Used	Material Deposited	Public Works Development Map Sheet and Coordinates
65	Engineer Area Dump	Pre-1958 to 1972	Burn area dump, construction debris	17, K16
66	AMTRAC Landing Site and Storage Area	1950s-Present	Oil spills, POL, battery acid	17, J8
67	Engineers TNT Burn Site	1951	TNT disposal	23, A19-20/B19-20
68**	Rifle Range Dump	1942-1972	Solvents, construction materials, WTP sludge	16, H6-8/I6-7
69**	Rifle Range Chemical Dump	Mid 1950s-1976	Chemical agent test kits, Malathion, DDT, PCBs	16, L14-15/M14-15
70	Oak Grove Field Surface Dump	1940s-1950s	Mess hall wastes, cans, bottles, old paint cans	24, H2/I2
71	Oak Grove Buried Dump	1940s-1950s	Garbage, cans and bottles	24, L1
72	Oak Grove Coal Pile	1940s	Coal storage use for heating living quarters	24, F6
73**	Courthouse Bay Liquids Disposal Area	Late 1940s-mid-1970s	Waste battery acid, POL	17, I11-12
74**	Mess Hall Grease Disposal Area	1950-early 1960s	Pesticides, PCBs	5, N13/014
75**	MCAS Basketball Court Site	Early 1950s	Training agents (CN, CNC, CNB, and/or CNS)	23, 08-9/P8-9
76**	MCAS Curtis Road Site	1949	Training agents (CN, CNC, CNB, and/or CNS)	23, L10/M10/N10

* Site Nos. 1-69 and 73-76 are shown on Figure 2-1; Site Nos. 70-72 are shown on Figure 6-36.
** Sites recommended for Confirmation Studies.

Source: WAR, 1982.

Site No.: 1

Name: French Creek Liquids Disposal Area.

Location: PWDM Coordinates 11, C7/D7; on both sides of Main Service Road at the western portion of the Gun Park Area and Force Troops Complex.

Figures and Photos: 2-1, 6-2, 6-3

Size: Area estimated at 7 to 8 acres (total) for both areas

Previously Reported: No

Activity: These two areas were used for disposal of vehicle fluids.

Materials Involved: Waste motor oil, waste hydraulic fluid, and used battery acid

Quantity: One estimate for oil and hydraulic fluids was 5,000 to 20,000 gallons; for used battery acid, 1,000 to 10,000 gallons. See comments below.

When: Late 1940s to mid-1970s

Comments: This area has been used by many different Marine organizations over three decades. These groups included motor transportation, armored personnel carriers, tank battalions, and self-propelled guns. Liquids waste disposal at this site was similar to practices at Courthouse Bay (Site No. 73). The transient nature of the units assigned to this area make it difficult to more accurately estimate waste quantities. Based on Courthouse Bay data, estimated POL quantity is probably low if the estimated waste acid volume is in the correct range. A potable water well is located within about 100 yards and between these disposal areas.

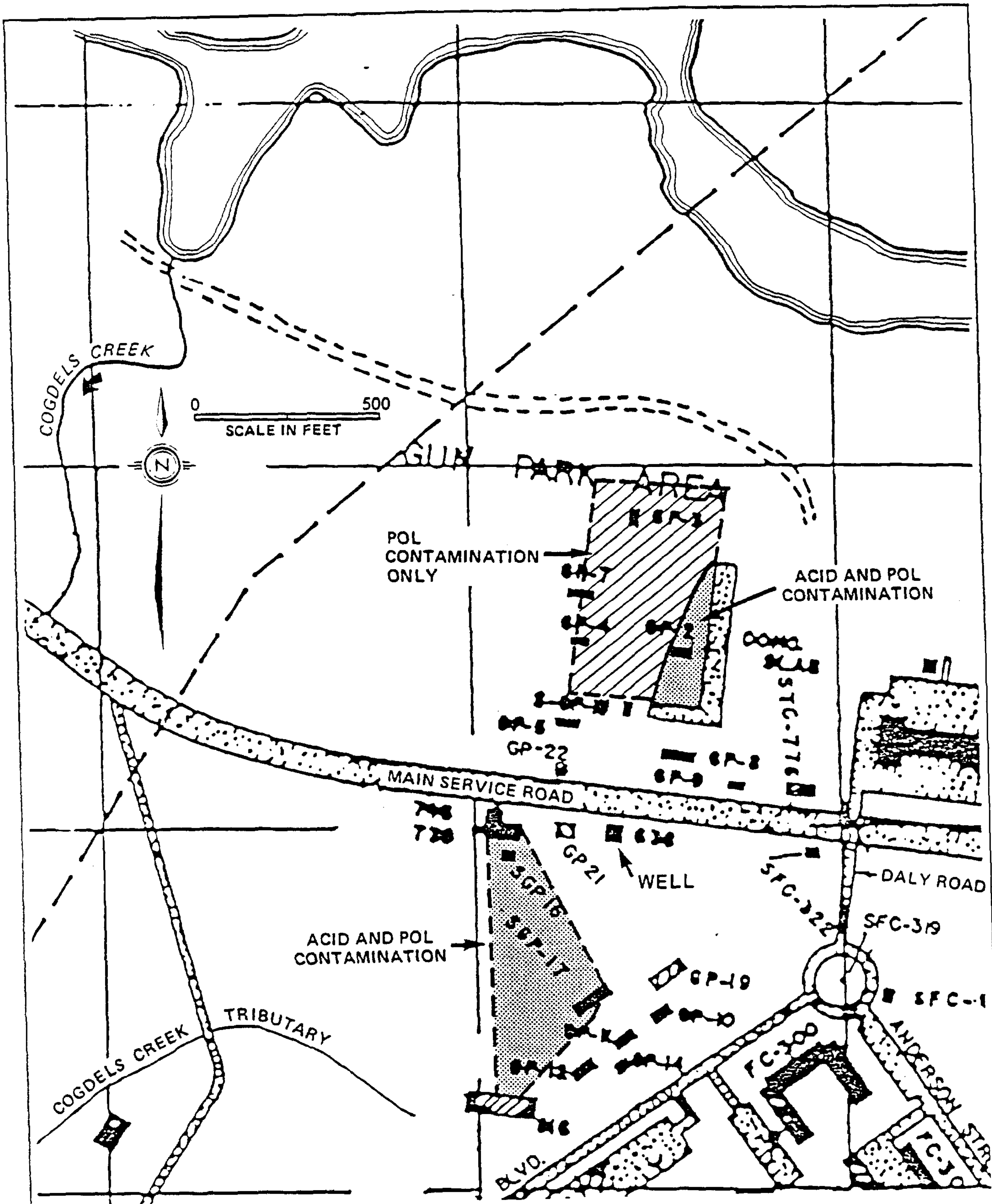


FIGURE 6–2
Detail of Site No. 1, French Creek Liquids Disposal Area

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAPS, SHEET 11 OF 24, JUNE 30, 1979

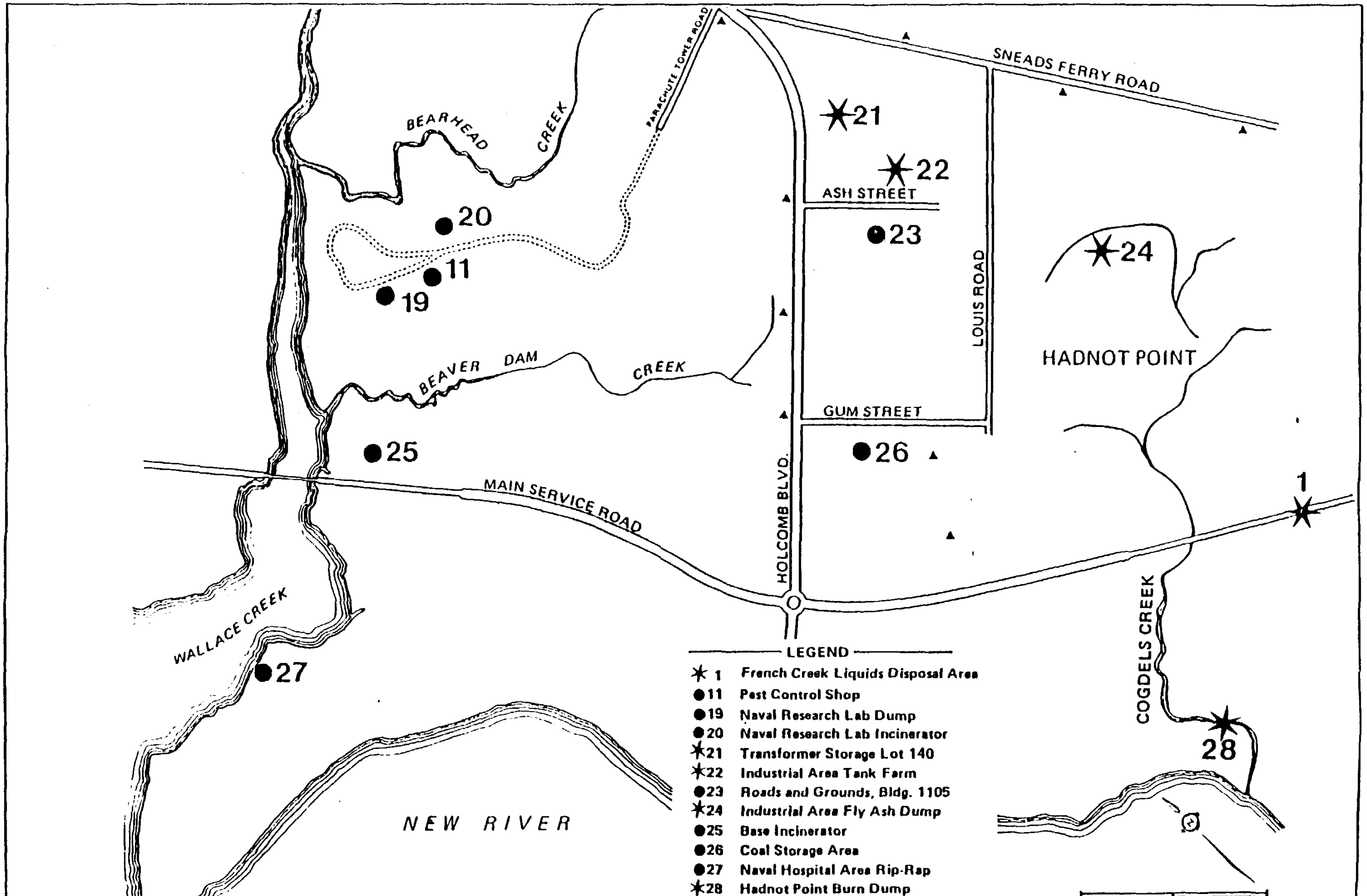


FIGURE 6–3
Site Locations at Hadnot Point

Site No.: 2

Name: Former Nursery/Day-Care Center*

Location: PWDM Coordinates 5, K10; Building 712 on Holcomb Boulevard at Brewster Boulevard.

Figures and Photos: 2-1, 6-4, 6-5, 6-6

Size: See comments section.

Previously Reported: No

Activity: Building 712 first was used for pesticide storage and mixing; later as a children's day-care center.

Materials Involved: Chlordane, DDT, Diazinon, Dieldrin, Lindane, Malathion, 2,4-D, 2,4,5-T, Silvex, Dalapon

Quantity: Contamination would have occurred as a result of small spills, washout, and excess disposal. During 15-year use, it is reasonable to assume several gallons per year were involved. Therefore, estimated quantity involved is on the order of 100 to 500 gallons of various strength liquids. Solid residues in cracks and crevasses may total 1 to 5 pounds. Caution: Quantity estimates are not based on reliable data and are provided for order of magnitude guidance only. Disposal to creek is undocumented.

When: 1945 to 1958

Comments: In late 1957 or 1958, pesticide storage and mixing were moved to Building 1105. Chemical use is reported to have been: Chlordane--100 gallons of 40-percent powder per year; DDT--750 to 1,000 gallons per day of 5- to 15-percent material; Diazinon--25 gallons per month; Dieldrin--less than 100 pounds per year; Lindane--less than 10 gallons of 1-percent material per year; Malathion--100 gallons per year; Silvex (2,4,5-TP)--stored but not used; 2,4,5-T--50 gallons per year--used for 1 year only. The contaminated areas are the fenced playground, approximately 6,300 square feet; the mixing pad covering approximately 100 square feet; the wash pad, approximately 225 square feet; and possibly, the railroad tracks drainage ditch that is a tributary of Overs Creek. Contamination of groundwater or movement of pesticides in groundwater or surface water is as yet undefined.

* Since the IAS team on-site visit, the Nursery/Day-Care Center has been relocated. Table 2-1 shows soil pesticide levels around Building 712. Sampling locations are indicated on Figure 6-4. More testing has been performed at this site.

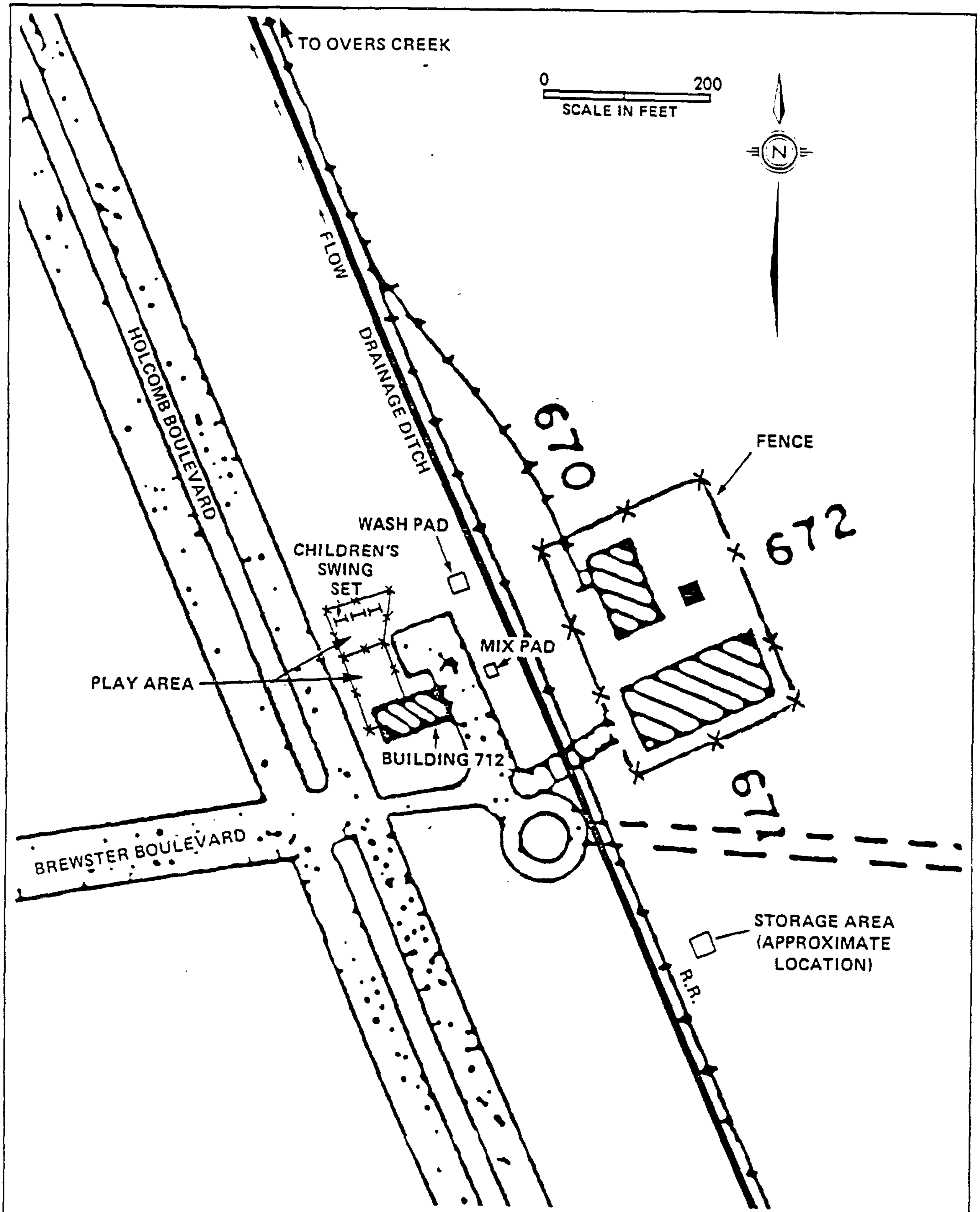


FIGURE 6–4
Detail of Site No. 2, Former Nursery/Day Care Center

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 5 OF 24, JUNE 30, 1979.

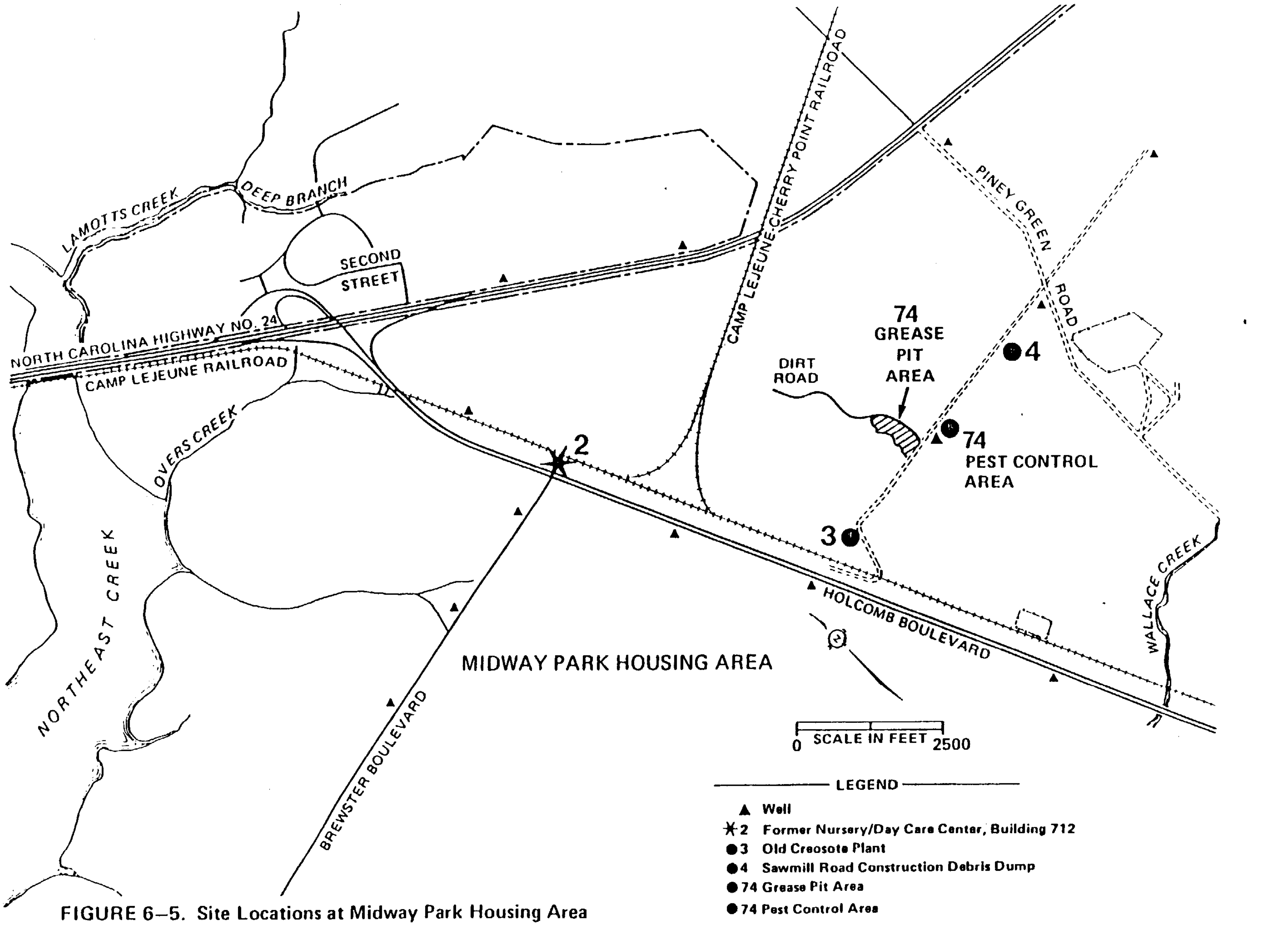


FIGURE 6–5. Site Locations at Midway Park Housing Area

FIGURE 6–6
Site No. 2 – Former Nursery/Day Care Center at Building 712
Water Treatment Plant in Foreground

Site No.: 6

Name: Storage Lots 201 and 203

Location: PWDM Coordinates 6, F3-4/G3-4/H2-4/I2-4/J3; on Holcomb Boulevard between Wallace and Bearhead Creeks.

Figures and Photos: 2-1, 6-7, 6-8a

Size: Lots 201 and 203 are estimated at 25 and 46 acres, respectively.

Previously Reported: Yes EPA Form 8900-1 MC Bul 6280

Activity: The site was and still is used to store hazardous materials. DDT is reported to have been disposed of at Lot 203 when it served as a waste disposal area in the 1940s. There has been long-term storage of DDT and transformers containing PCB. No spills or leaks of PCB have been reported, but reports of white powder (DDT) were noted.

Materials Involved: Pesticides and building debris

Quantity: Inspection of the DDT disposal area reveals no clues to areal extent of disposal. Trees are not disturbed and no ground depressions or mounds can been seen. Reports of disposal activities are vague; no indication of types of containers disposed of, e.g., aerosol cans versus 55-gallon drums. It is reasonable to assume more than 1 or 2 pounds were involved. However, there is no basis for assuming massive quantities were involved. Therefore, for purposes of indicating the perceived magnitude of importance of site, several hundreds of pounds of DDT are assumed to have been disposed of. No physical or other reliable evidence is available to indicate size of contaminated area. However, because some assessment of size is needed to guide any further actions (if any), assume that an area within, say, an 80- to 100-foot radius is involved.

Regarding PCB and DDT spills near storage areas: Minimal information has been discovered during site investigations. No amount of judgment by environmental and public health professionals can yield reliable estimates of spill quantities

(Continued)

Site No.: 6 (continued)

because conditions are so variable. Guidance for assessing magnitude may be obtained as follows: No direct evidence of PCB spills was found. Therefore, assume no PCBs are involved. Inferences of DDT spills come from reports of white powder on ground. No recollection of size of powdered area is available. Assume that around storage pallets, DDT was spilled in a 1- or 2-foot band. This suggests pounds, not hundreds of pounds, were involved. Over time, quantities may be added. Therefore, assume 100 to 200 pounds of DDT involved.

Caution: Estimates of quantities are not based on reliable data and are provided as order of magnitude guidance only.

When: Lots in a variety of uses from 1940s to present

Comments: These areas have a long history of various uses, including disposal and storage. Area is flat, unpaved, and surface soils have been moved about substantially due to regrading and equipment movement. There is no direct physical evidence of hazardous material contamination.

There are 4 areas at the 2 sites which have highest likelihood of DDT contamination, if any contamination exists. These are identified on Figure 6-7. Representative photo is given in Figure 6-8a.

Disturbance of trees is not evident; however, age of trees is estimated at 10 to 20 years. Therefore, trees are more recent than disposal activities and cannot be used as clues to define the disposal area.

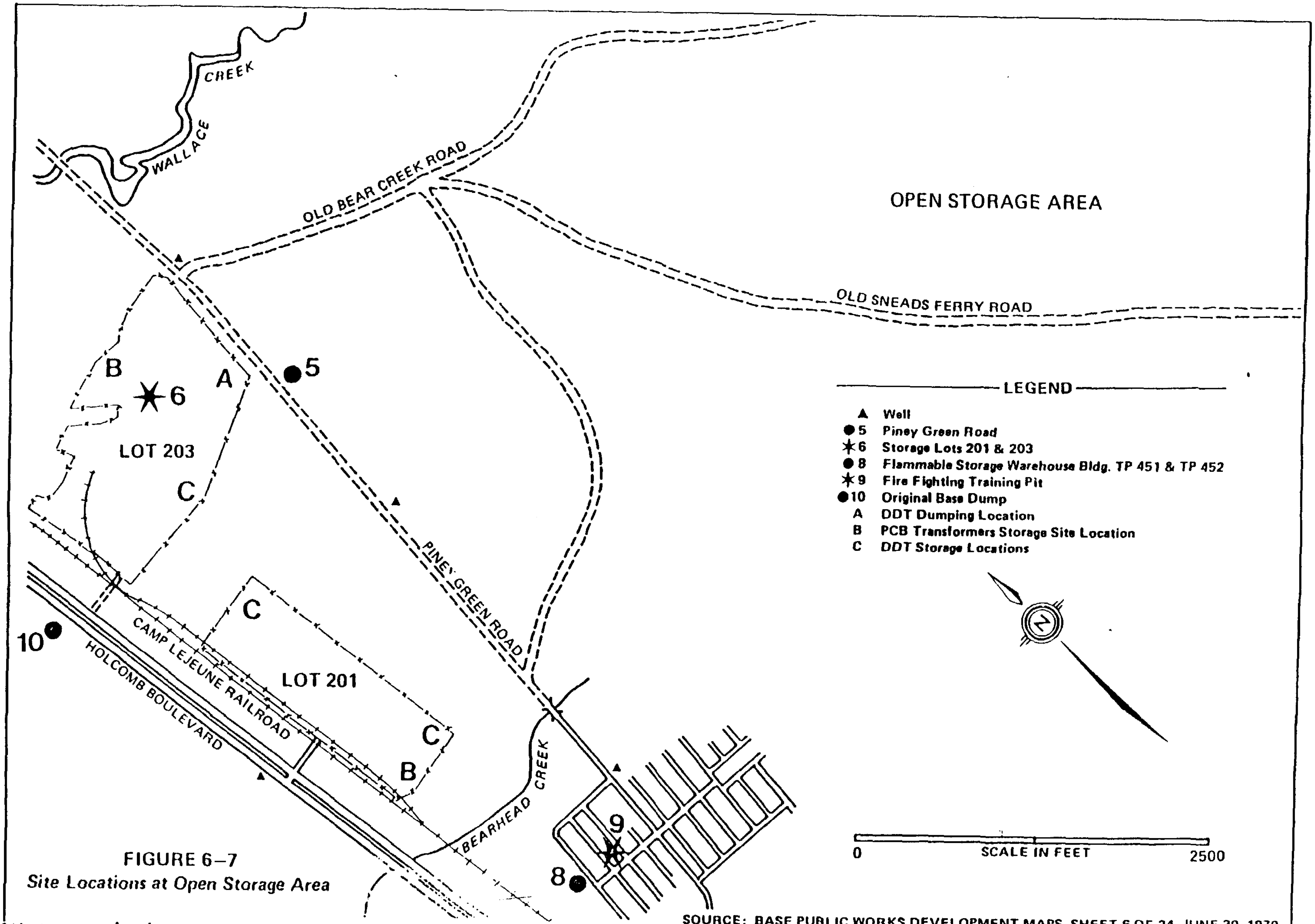


FIGURE 6–7
Site Locations at Open Storage Area

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAPS, SHEET 6 OF 24, JUNE 30, 1979.

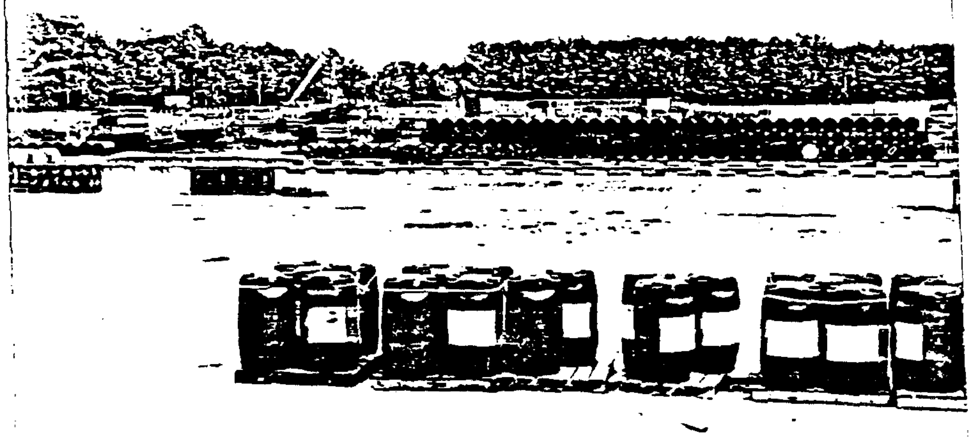


FIGURE 6–8a
Site No. 6 – Storage Lots 201-203

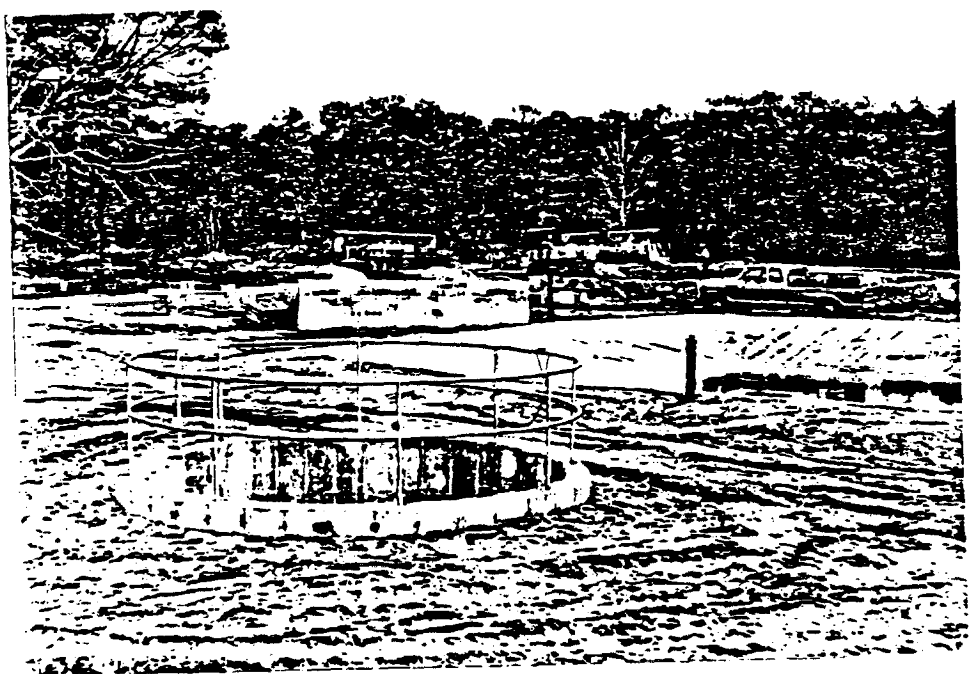


FIGURE 6–8b
Site No. 9 – Fire Fighting Training Pit near Piney Green Road.
Oil Water Separation Pit in Foreground

Site No.: 9

Name: Fire Fighting Training Pit at Piney Green Road

Location: PWDM Coordinates 6, K3/L3; near Building S-TP-454, between Piney Geen Road and Holcomb Boulevard, south of Bearhead Creek.

Figures and Photos: 2-1, 6-7, 6-8b

Size: Estimated area is approximately 2 acres.

Previously Reported: Yes EPA Form 8900-1 MC Bul 6280

Activity: Fire fighting training carried out in an unlined pit. Flammable liquids burned in pit. No pollution control equipment such as oil-water separators.

Materials Involved: Used oil, solvents, contaminated fuels

Quantity: Approximately 30,000 gallons per year (mostly JP-4 and JP-5).

When: 1960s to present

Comments: Training began after 1961. The pit was unlined until 1981. No leaded fuels were burned. Pit is presently used and an oil-water separator has been installed.

Site No.: 16

Name: Montford Point Burn Dump (1958-1972)

Location: PWDM Coordinates 2, N11-12; between Wilson Drive and Northeast Creek, about 900 feet east of intersection of Coolidge and Harding Roads.

Figures and Photos: 2-1, 6-9, 6-10, 6-11

Size: Area affected is about 3.5 to 4 acres.

Previously Reported: No

Activity: Burn dump for debris, garbage, and minor quantities of oil

Materials Involved: Building debris, including asbestos, garbage, tires, waste oils

Quantity: Amount of asbestos visible on the surface is estimated to be less than 1 cubic yard. Quantity of waste oil is believed to be very small.

When: Approximately 1958 to 1972. Site now closed.

Comments: Mitigation has been undertaken. Site has been used occasionally for unauthorized disposal of debris since 1972.

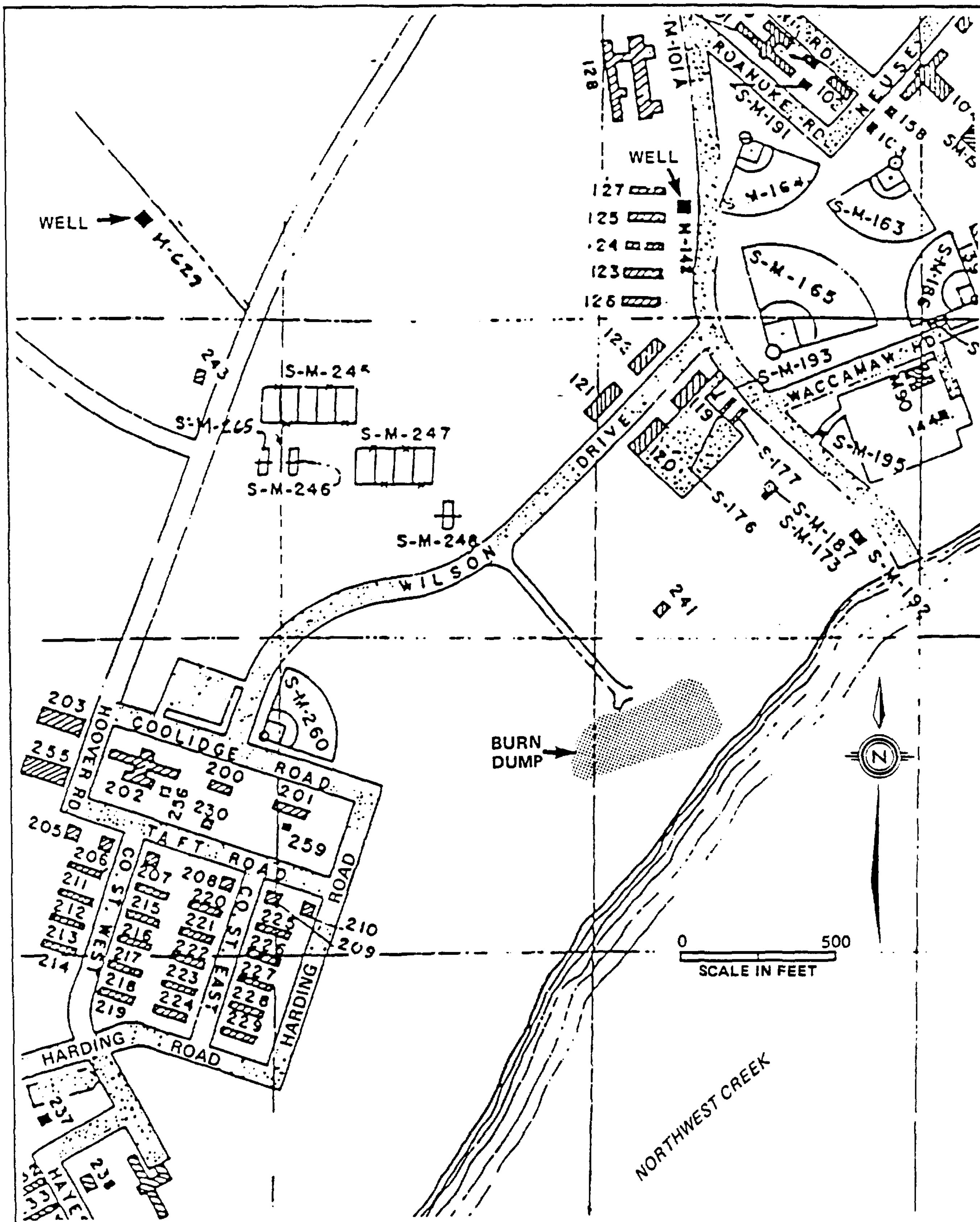


FIGURE 6–9
Detail of Site No. 16, Montford Point Burn Dump

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 2 OF 24, JUNE 30, 1979.

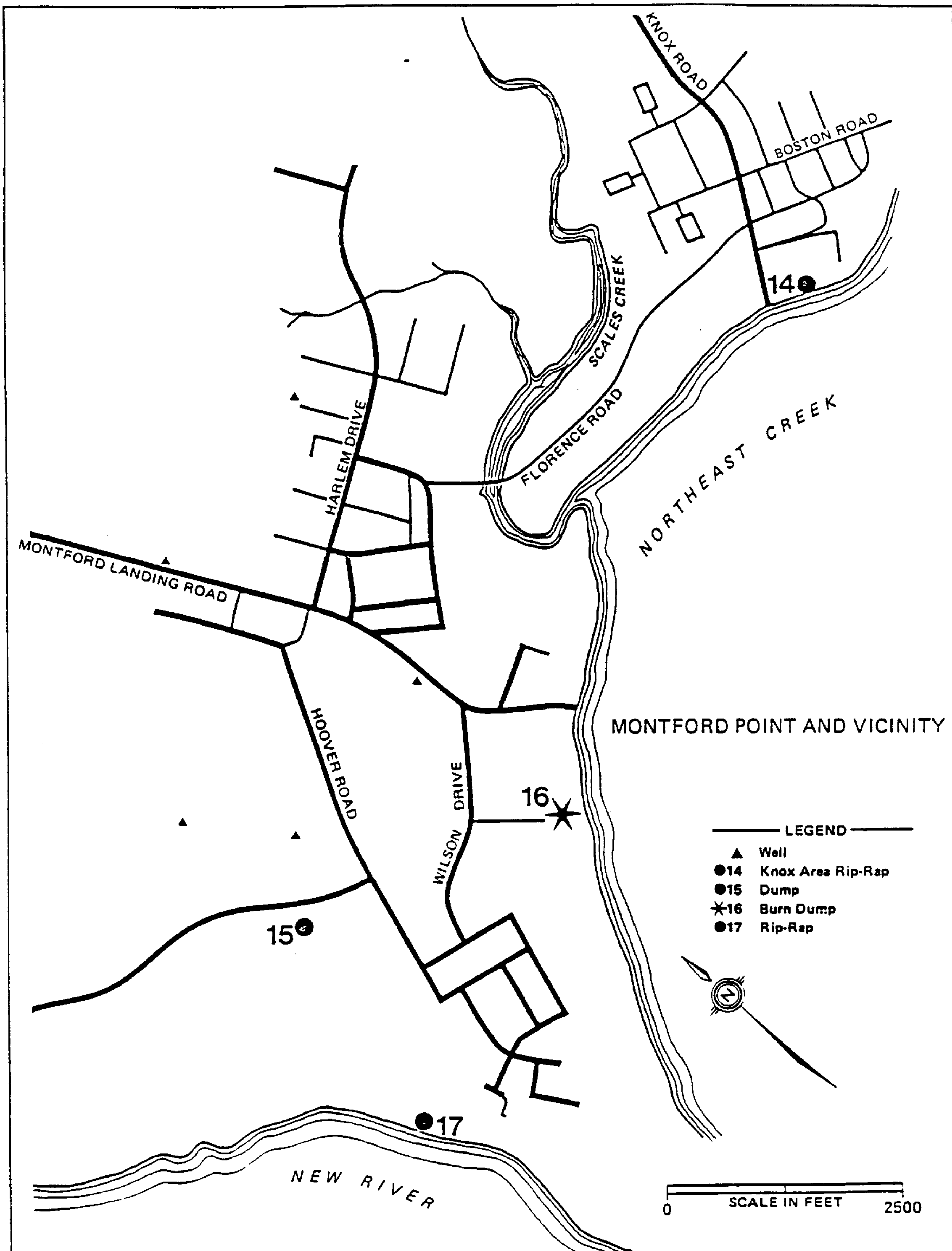


FIGURE 6–10. Site Locations at Montford Point and Vicinity

FIGURE 6–11
Site No. 16 – Montford Point Burn Dump
Showing Asbestos Pipe Insulation

Site No.: 21

Name: Transformer Storage Lot 140

Location: PWDM Coordinates 10, I15; between Ash Street and Sneads Ferry Road on Center Road; transformer oil pit located at the northeastern end of Lot 140, across railroad tracks from Building 702 and about 50 to 60 feet from railroad tracks.

Figures and Photos: 2-1, 6-3, 6-12

Size: Lot 140, approximately 220 feet by 890 feet (almost rectangular); pit, about 25 to 30 feet long by 6 feet wide by 8 feet deep.

Previously Reported: Lot 140, yes (as PCB contamination site only) EPA Form 8900-1, MC Bul 6280; pit, no.

Activity: Lot 140 was used for pesticide mixing and as cleaning site for pesticide application equipment. A pit at this site received oil from transformers.

Materials Involved: Lot 140--Chlordane (dust), DDT (dust), Diazinon, Lindane, Malathion (46-percent solution), Mirex, 2,4-D, Silvex, Dalpon, and Dursban; PCB in small quantities (see below). Pit--transformer oil, probably containing PCBs.

Quantity: Pesticide contamination would have resulted from small spills, washout, and excess disposal. In 1977, before this activity moved to Building PT37, washout was estimated to be 350 gallons per week of overland discharge. At that time, the procedure was to save for reuse any excess pesticide solution. It is reasonable to assume that at least several gallons per year were involved. Therefore, over 20 years, the quantity involved is estimated to be on the order of 100 to 1,000 gallons of various strength liquids.

Transformer oil was drained into pit over about a 1-year period. Sand was occasionally placed in pit by heavy equipment when oil was found standing in pit bottom. The quantity involved is unknown. Assuming the pit received (over 1 year)

(Continued)

Site No.: 21 (continued)

enough oil to fill the pit to between 1 and 8 vertical feet, the estimated quantity would be on the order of 1,300 to 11,000 gallons.

Caution: Quantity estimates are not based on reliable data and are provided for order of magnitude guidance only.

When: Early 1958 to 1977 for pest control activities; 1950-51 for transformer oil pit usage

Comments: Lot 140 was a multi-purpose area when the Pest Control Shop used it. (Before this, pesticide storage and mixing were at Building 712. Practices there, probably similar to those at Lot 140, resulted in soil contamination (see Table 2-1). For a more detailed listing of quantities involved at Building 712, see Site No. 2 of this section.) The mixing area for pesticides was described as the "southeast corner" of Lot 140. According to MC Bul 6280 for the site, soil in this area is "highly disturbed." There is a possibility that surface soil consists of fill material used for lot leveling. Any soils sampled should be those layers existing at the site in the 1960s (i.e., not fill material).

According to MC Bul 6280, the upper 4 inches of soil in Lot 140 was sampled for PCBs in October 1980. PCB levels of 1 ppm or less were found. No reference to an oil disposal pit was made in MC Bul 6280.

Lot 140 is bounded on its longer sides by dirt roads. An adjacent railroad drainage ditch is a possible off-site and off-base migration route for pesticide-contaminated water and sediment.

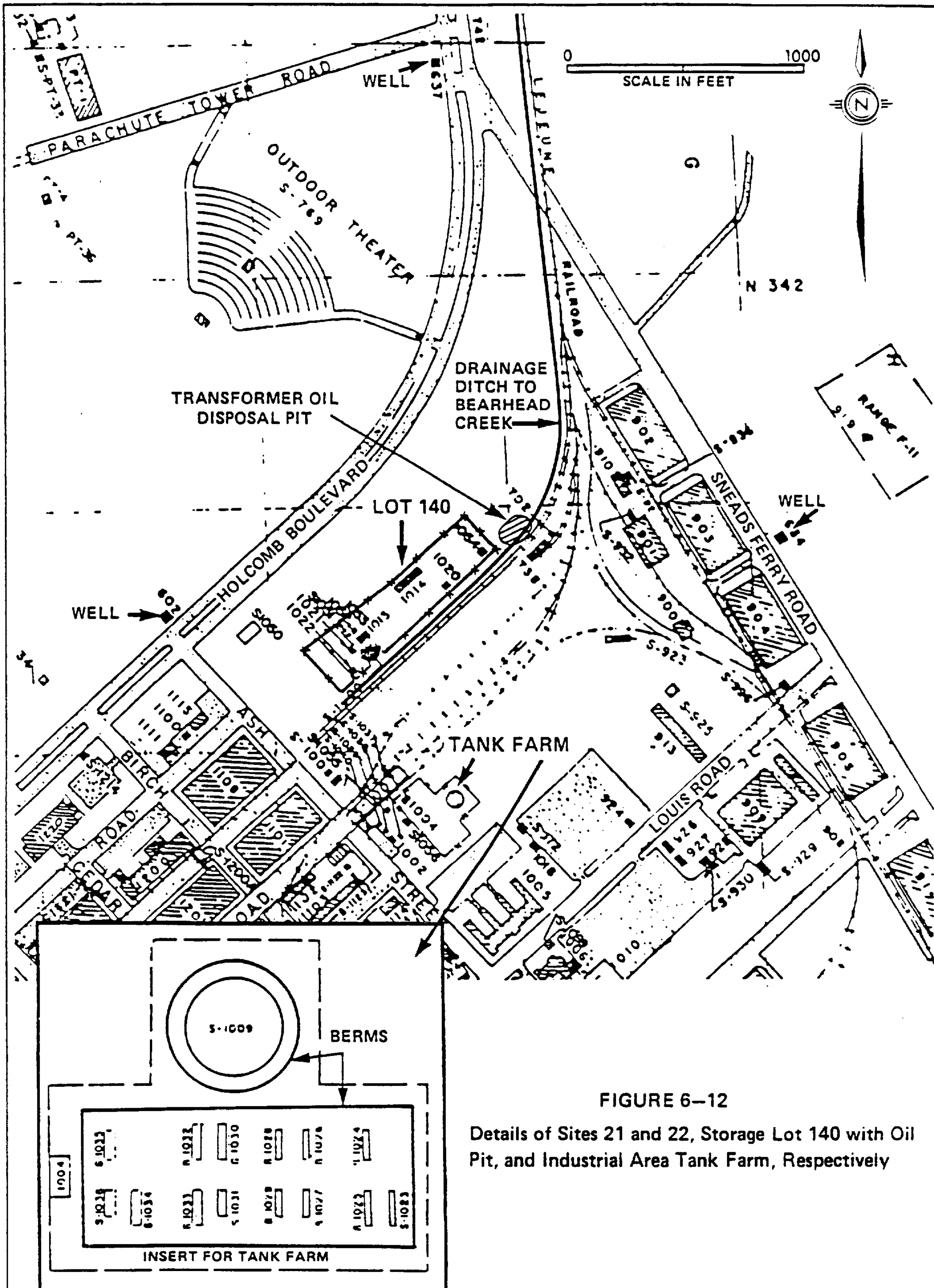


FIGURE 6–12

Details of Sites 21 and 22, Storage Lot 140 with Oil Pit, and Industrial Area Tank Farm, Respectively

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 10 OF 24, JUNE 30, 1979.

Site No.: 22

Name: Industrial Area Tank Farm

Location: PWDM Coordinates 10, J15; east of intersection of Cribb Road and Ash Street.

Figures and Photos: 2-1, 6-3, 6-12, 6-13a

Size: Area estimated at 3.5 to 4 acres.

Previously Reported: No

Activity: Site is a fuel storage and dispensing area for vehicles. Leakage has occurred from fuel lines.

Materials Involved: Diesel, unleaded and possibly leaded gasoline

Quantity: 20,000 to 50,000 gallons from an underground line near the tank truck loading facility

When: 1979

Comments: Fuel farm installed in 1940s. There have been problems with leaks. The latest was a 100-gallon leak of diesel fuel in 1981. In 1979, a fuel leak of an estimated 20,000 to 30,000 gallons occurred. The leak was in an underground line slightly to the rear of the tank truck loading facility and between the building and the large aboveground fuel tank. Fuel has been lost through pinhole leaks in the underground lines. There is no evidence of extensive corrosion in the system. Control is maintained by an established fuel audit system.

FIGURE 6–13a
Site No. 22 – Industrial Area Tank Farm

FIGURE 6–13b
Site No. 24 – Industrial Area Fly Ash Dump

Site No.: 24

Name: Industrial Area Fly Ash Dump

Location: PWDM Coordinates 10, L16-17/M16-17; South of intersection of Birch and Duncan Streets.

Figures and Photos: 2-1, 6-3, 6-13b, 6-14

Size: Area is about 20 to 25 acres.

Previously Reported: No

Activity: Fly ash and cinders dumped on ground surface. Solvents used to clean out boilers were poured on fly ash and cinder piles. During 1960s, construction rubble dumped here. Sludges from WTP and STP also placed here. Furniture stripping wastes also dumped between 1972 and 1979.

Materials Involved: Fly ash, cinders, and solvent from central heating plant, WTP spiractor sludge and sludge from the sewage treatment plant. Limited quantities of furniture lacquers and varnish.

Quantity: The amount of fly ash is estimated at 31,500 tons based on a 10-percent ash content and a usage of 45,000 tons per year of coal over 7 years. The estimate of furniture stripping compounds dumped here is about 45,000 gallons over 7 years. This estimate is based on assuming that one vat of fluids per month was disposed. A vat contains approximately 500 to 550 gallons. The quantity of cleaning solvents which reached this site is not known but is considered to be small.

When: Late 1940s to approximately 1980

Comments: Sandy soil conducive to migration. The eastern boundary of this site is a tributary of Cogdels Creek. Drainage is probably to the east, south and west toward Cogdels Creek and its tributaries. Creek has been rerouted. Old creek channel is now part of fill area.

(Continued)

Site No.: 24 (continued)

Site includes four areas of potential contamination which are designated on Figure 6-15: (1) the main fly ash dump, (2) a small area to the northeast containing spiractor sludge which has been disturbed since the early 1950s, (3) a denuded area west which has existed since the early 1950s which is a borrow area at which dumping may have occurred, and (4) a smaller denuded area farther west which has existed since before 1949 and at which dumping may have occurred.

Fly ash and bottom ash contain heavy metals that may be mobilized by dissolution in rain water. No thorough mixing of the various solid wastes disposed of at this site is believed to have occurred. Insufficient data exists to try to speculate on possible chemical interactions between these various wastes or to try to define which wastes went to which of the four areas.

Note: Size estimates are based on map and photograph information. Field estimates may have been made, but no field measurements have been performed. Estimates are provided for general guidance only.

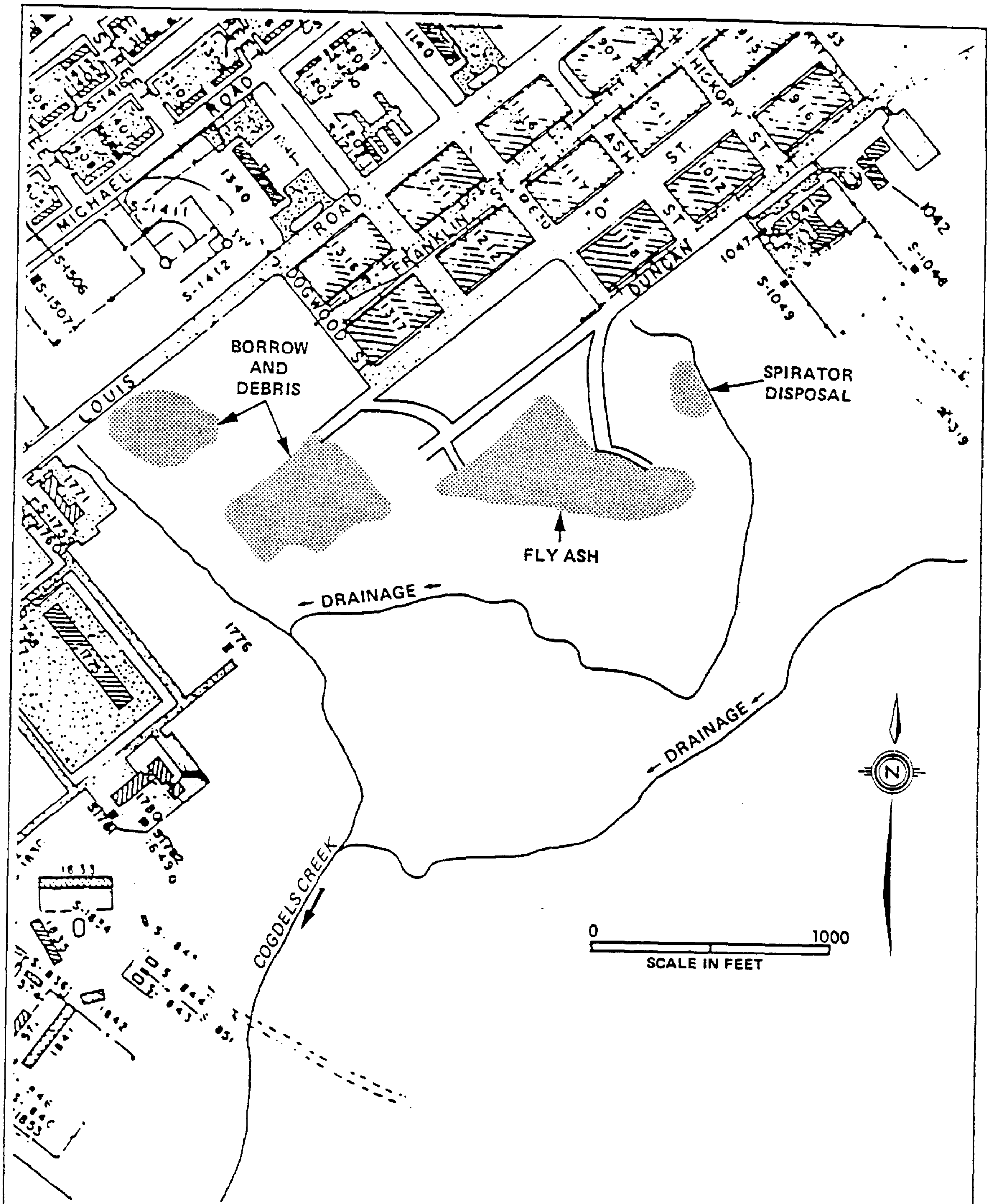


FIGURE 6–14
Detail of Site No. 24, Industrial Area Fly Ash Dump

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 10 OF 24, JUNE 30, 1979.

Site No.: 28

Name: Hadnot Point Burn Dump

Location: PWDM Coordinates 10, Q13-14/R13-14; east of Mainside Sewage Treatment Plant on both sides of Cogdels Creek.

Figures and Photos: 2-1, 6-3, 6-15, 6-16a

Size: Area is approximately 23 acres.

Previously Reported: Yes EPA Form 8900-1 MC Bul 6280

Activity: This large disposal area received a variety of solid waste. The site is now closed. The surface has been graded, grass has been planted and is now a recreational area with fishing pond. When site was active, wastes were burned and covered with dirt.

Materials Involved: Mixed industrial type waste, refuse, trash, oil-based paint, garbage

Quantity: Volume of fill is estimated at 185,000 to 370,000 cubic yards. The volume of waste is based on a surface area of 23 acres and a depth ranging from 5 to 10 feet. Because waste was burned, no approximation of remaining amount of specific substances can be reasonably made. However, approximate size of the site provides order of magnitude guidance.

When: Approximately 1946 to 1971

Comments: Reports of leachate and oily seepage to Cogdels Creek. Site is on a former wetland.

Note: Size estimates are based on map and photograph information. Field estimates may have been made, but no field measurements have been performed. Estimates are provided for general guidance only.

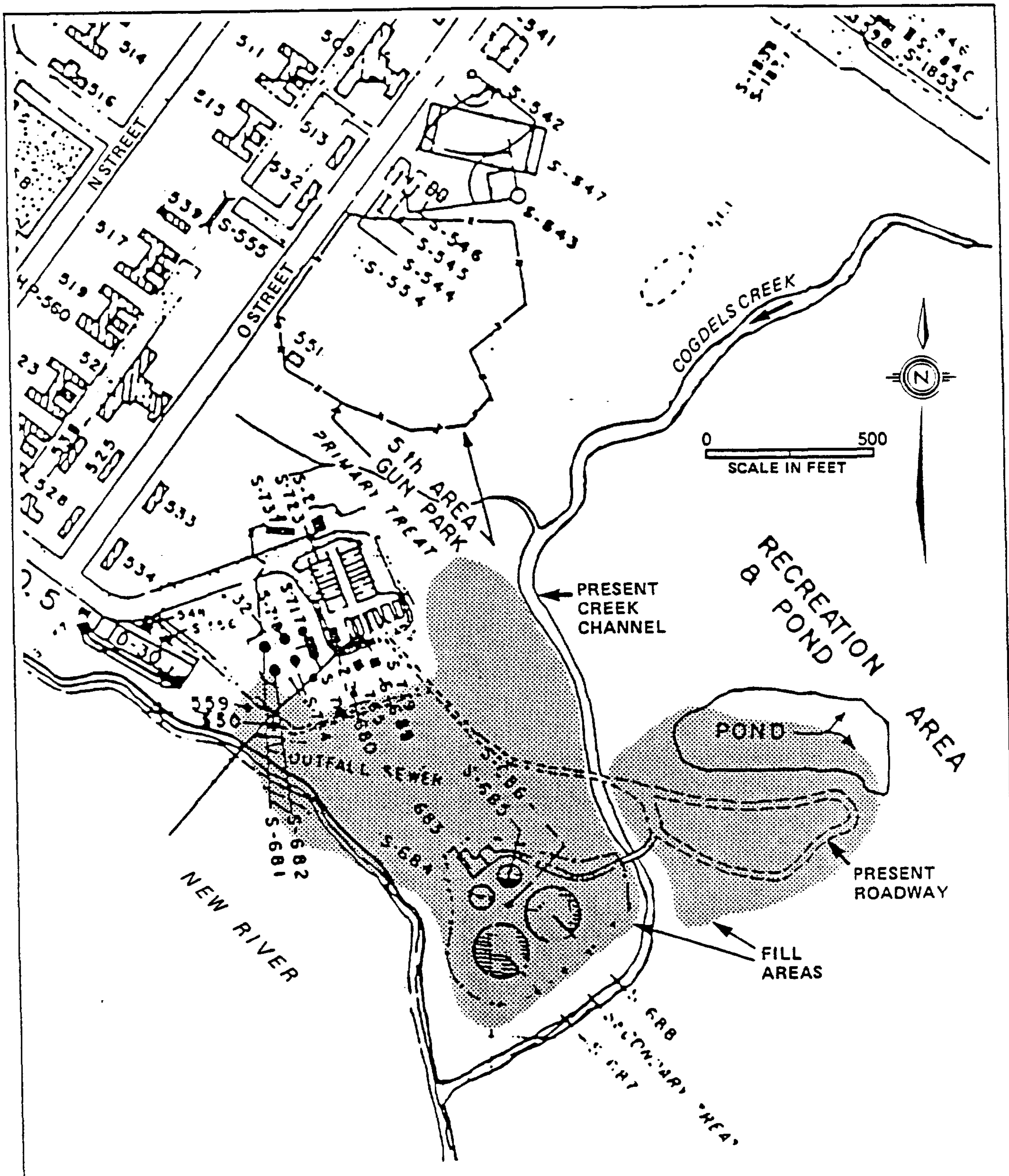


FIGURE 6–15
Detail of Site No. 28, Hadnot Point Burn Dump

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 10 OF 24, JUNE 30, 1979.

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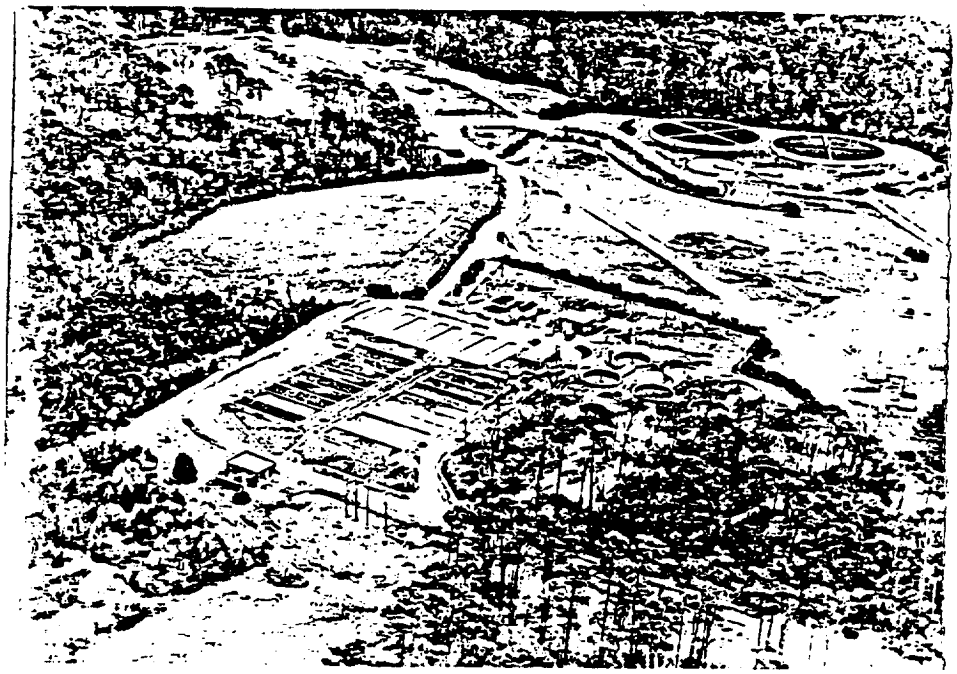

FIGURE 6–16a
Site No. 28 – Hadnot Point Burn Dump

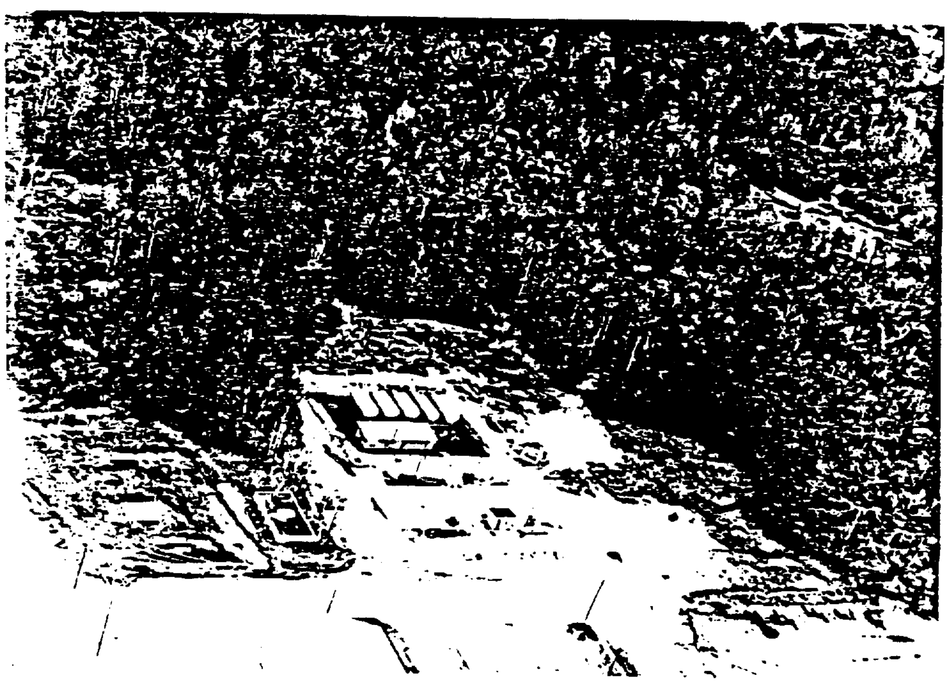

FIGURE 6–16b
Site No. 35 – Camp Geiger Area Fuel Farm

Site No.: 30

Name: Sneads Ferry Road--Fuel Tank Sludge Area

Location: PWDM Coordinates 18, G12; along a tank trail which intersects Sneads Ferry Road from west, about 6,000 feet south of intersection with Marines Road.

Figures and Photos: 2-1, 6-17

Size: Exact location along trail unknown. See comments below.

Previously Reported: No

Activity: One-time disposal of sludge pumped from fuel tank storing leaded gasoline

Materials Involved: Sludge from fuel storage tank, especially tetraethyl lead and related compounds; tank washout waters.

Quantity: About 600 gallons of tank bottom deposits. See comments below.

When: 1970

Comments: Soils conducive to migration. The hydraulic gradient in the water table aquifer is toward French Creek. A private contractor disposed of the sludge along the tank trail as an expedient measure. Trail alignment is parallel to groundwater gradient.

As yet no records (including contract documents) have been found to indicate amount of sludge disposed of at this site. Two 12,000-gallon tanks were involved. Tanks were pumped out while changing the type of fuel stored. Based on knowledge of tank capacity below tank outlfow ports, about 600 gallons of sludge or tank bottoms were dumped. Additional washout water may have been present. There is additional information to suggest that the site has been used for similar wastes from other tanks. Therefore the 600 gallon amount must be considered a minimum. Composition of sludge and/or washout is unknown and may vary from containing substantial amounts of tetraethyl lead to containing mostly cleaning compounds.

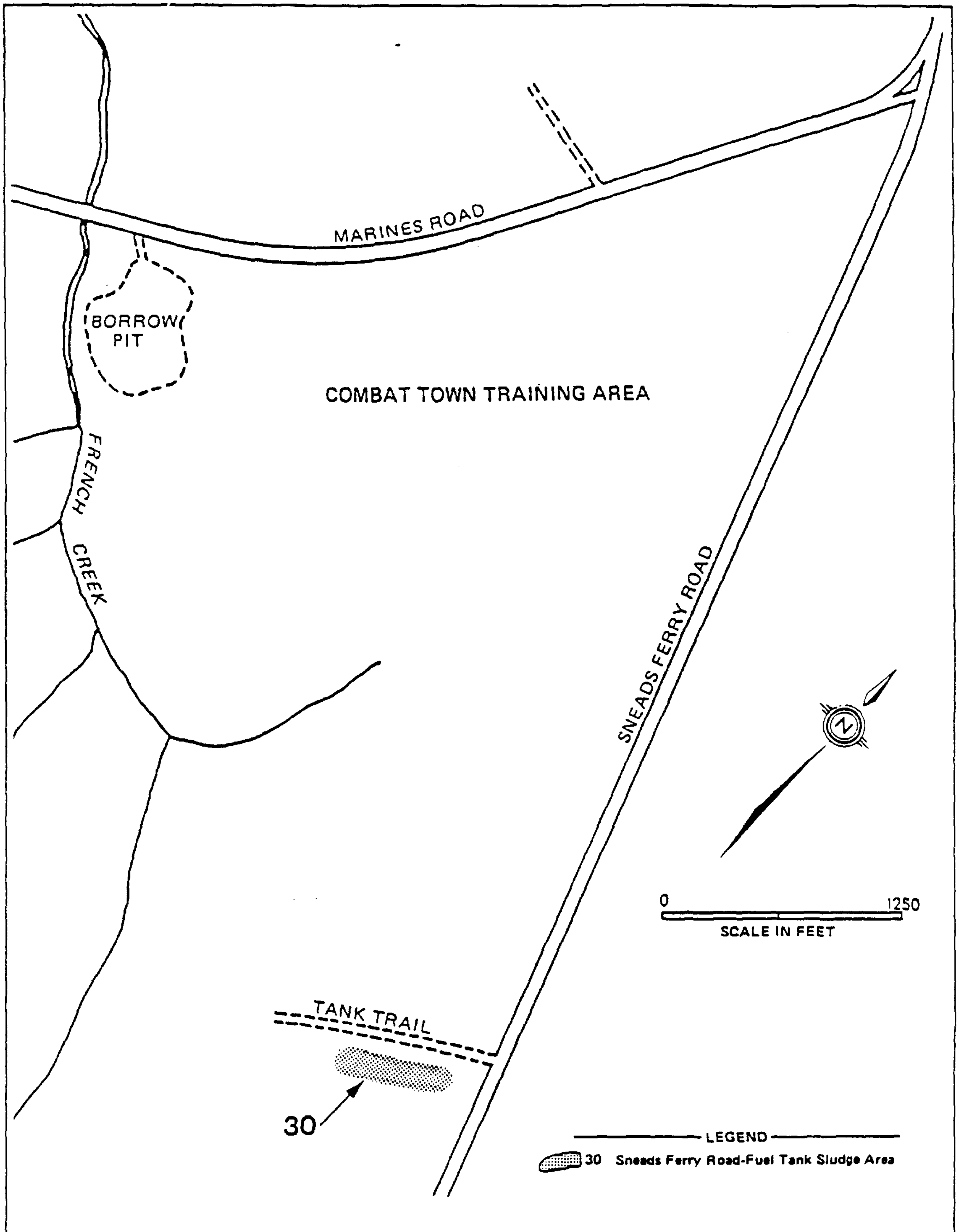

FIGURE 6—17
Location of Site No. 30 at Combat Town Training Area

Site No.: 35

Name: Camp Geiger Area Fuel Farm

Location: PWDM Coordinates 12, C11; north of intersection of G and Fourth Streets.

Figures and Photos: 2-1, 6-16b, 6-18, 6-19

Size: Area estimated at about 2,500 square feet.

Previously Reported: No

Activity: Area used for storing and pumping fuel. Mogas released to soil through a leak or leaks in underground line near above-ground storage tank and tank pad.

Materials Involved: Mogas

Quantity: The amount of fuel is estimated by Chief Padgett, Camp Lejeune Fire Department, to be in the thousands of gallons. Exact estimates cannot be made as these records were destroyed.

When: 1957 to 1958

Comments: Spill reported to have migrated east and northeast toward and into creek. Spilled fuel at the surface of the shallow aquifer was disposed of by digging holes near the leak and igniting the gas. Fuel that contaminated Brinson Creek was also burned off near the leak.

Note: Size estimates are based on map and photograph information. Field estimates may have been made, but no field measurements have been performed. Estimates are provided for general guidance only.

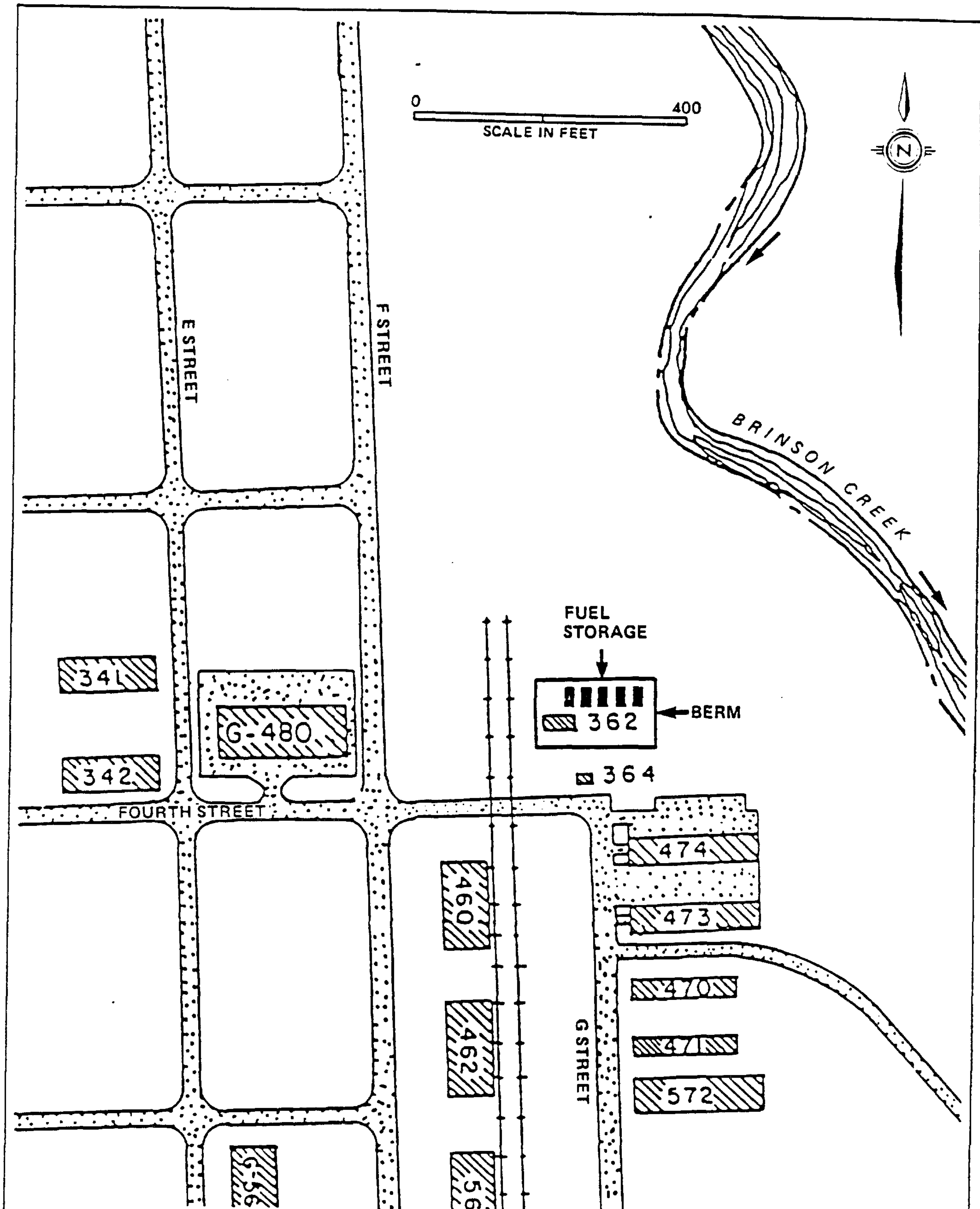

FIGURE 6–18
Detail of Site No. 35, Camp Geiger Area Fuel Farm

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 12 OF 24, JUNE 30, 1979.

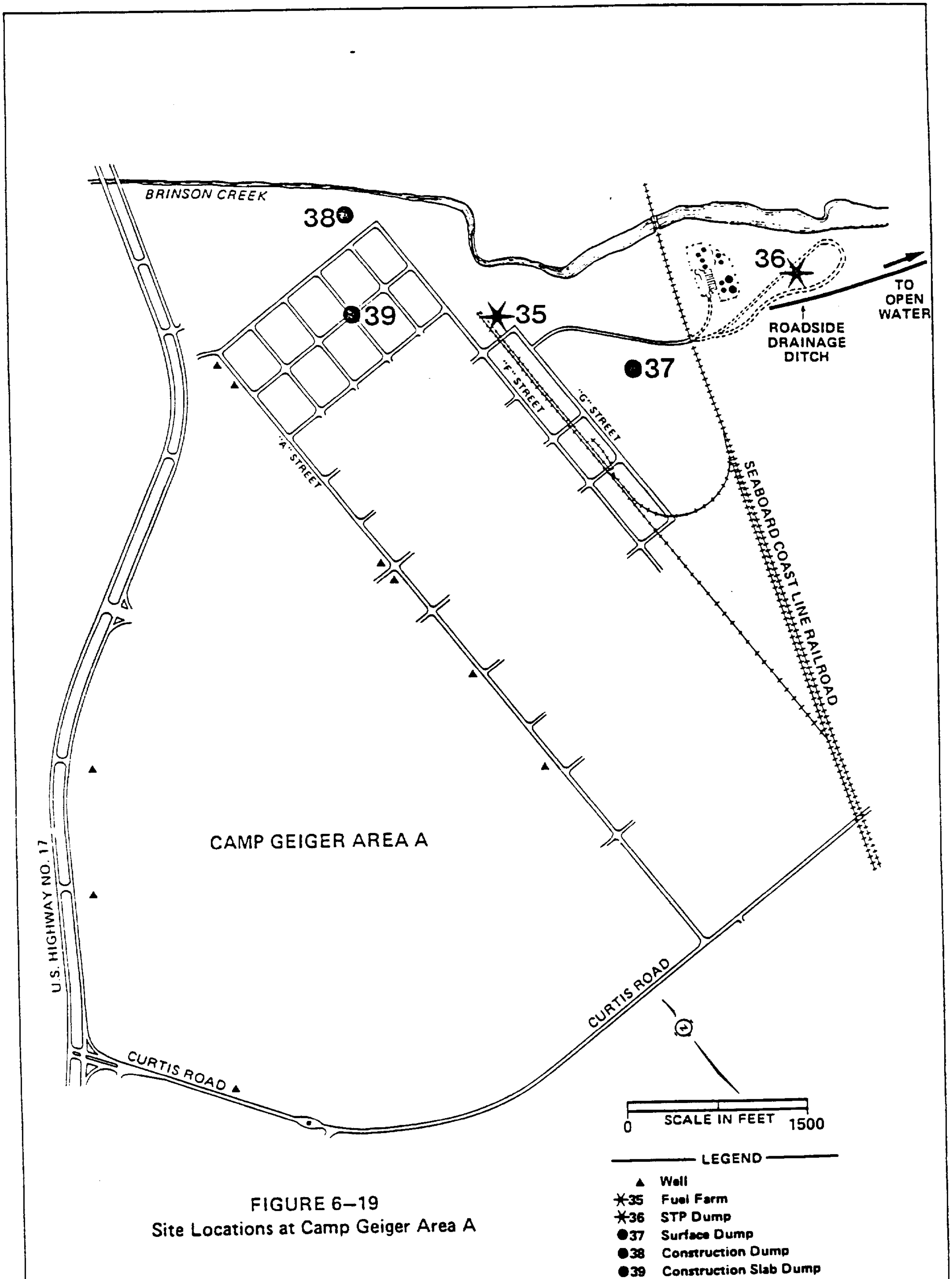

FIGURE 6–19
Site Locations at Camp Geiger Area A

Site No.: 36

Name: Camp Geiger Area Dump

Location: PWDM Coordinates 12, D13, E13; east of Camp Geiger Area Sewage Treatment Plant on south side of Brinson Creek

Figures and Photos: 2-1, 6-19, 6-20

Size: Area is about 25,000 square feet.

Previously Reported: No

Activity: Site was used for disposal of municipal wastes and mixed industrial waste from the air station. Most material was burned and buried, but some unburned material was buried.

Materials Involved: Garbage, trash, waste oils, solvents, hydraulic fluids

Quantity: According to interviews, less than 5 percent of all hydrocarbons used at the air station were disposed of in dumps. The rest was used for dust control on roads or went directly into storm drains. Based on interviews, a conservative estimate is that 700 to 1,000 gallons per week were used on roads. A smaller but undetermined amount was washed into the storm drains. Using a 5-percent estimate for dumping over 9 years, about 25,000 gallons of material could have been dumped into storm drains. Assuming this amount was split between this site and the trailer park dump (Site No. 41), an estimated 10,000 to 15,000 gallons of solvent and oil were placed here. Most probably were burned.

When: Late 1940s to late 1950s

Comments: Movement of contaminants via water table aquifer and surface runoff will be toward Brinson Creek or roadside drainage ditch south of dump. The site covers about 25,000 square feet and rises 10 to 12 feet above grade. Estimated volume is 14,000 cubic yards, based on an average depth of fill of 15 feet.

Note: Size estimates are based on map and photograph information. Field estimates may have been made, but no field measurements have been performed. Estimates are provided for general guidance only.

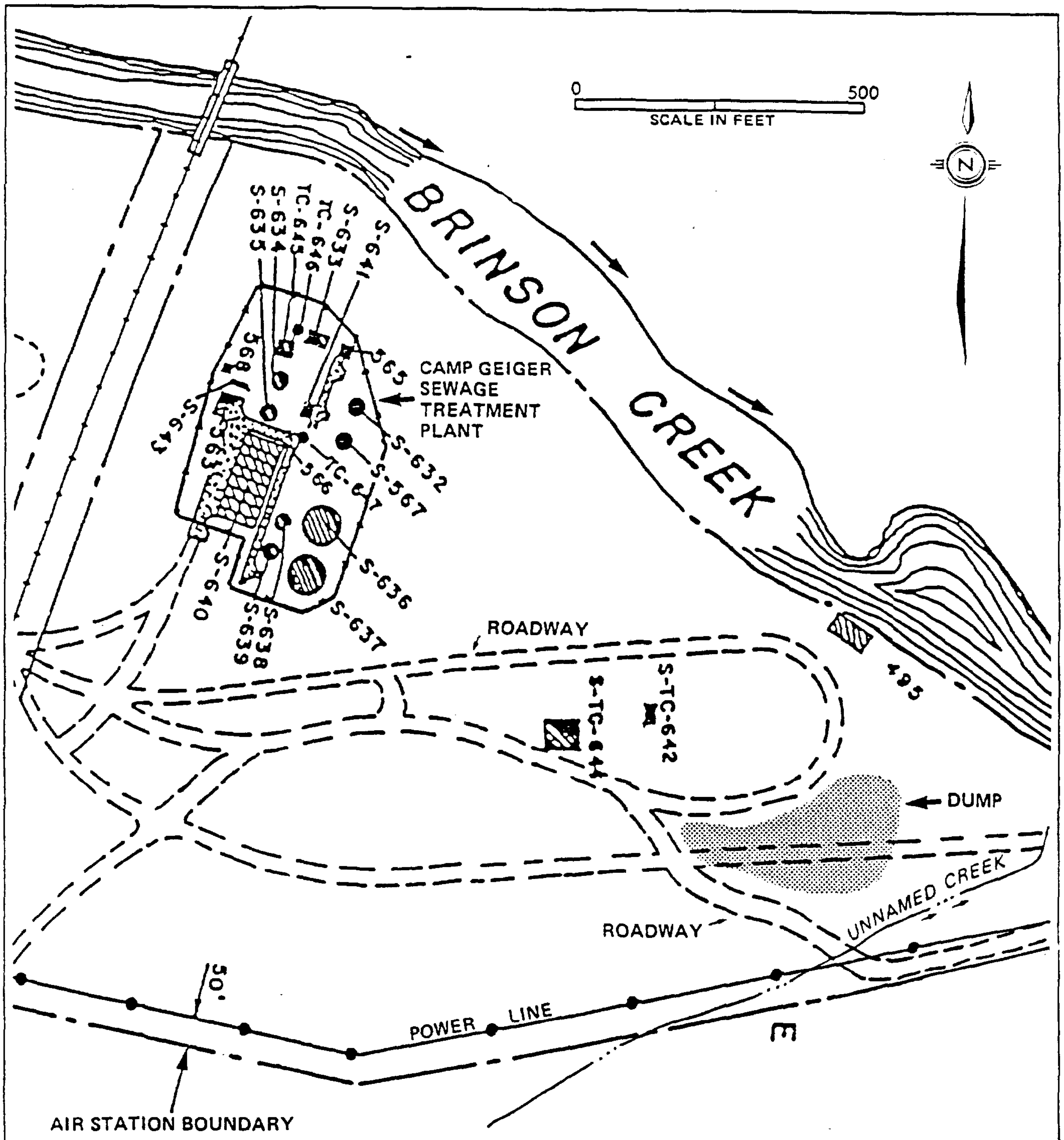

FIGURE 6–20
Detail of Site No. 36, Camp Geiger Area Dump (near STP)

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 12 OF 24, JUNE 30, 1979.

Site No.: 41

Name: Camp Geiger Dump

Location: PWDM Coordinates 13, E2-3; south of end of Robert L. Wilson Boulevard, Camp Geiger Trailer Park (abandoned).

Figures and Photos: 2-1, 6-21, 6-22, 6-23a

Size: Area is approximately 30 acres.

Previously Reported: Yes EPA Form 8900-1 MC Bul 6280

Activity: Site was used as an open dump. It received industrial and municipal wastes, as well as construction debris.

Materials Involved: Waste oils, solvents from air station, garbage, asphalt, concrete, old batteries, Mirex, ordnance

Quantity: 10,000 to 15,000 gallons of waste POL and solvents are estimated to have been disposed of (refer to Site No. 36). Most probably were burned. Number of old batteries is believed to be very small. Tons of Mirex in bags. Ordnance was estimated to include thousands of mortar shells; at least one case of grenades and one 105mm cannon shell were also reported.

When: Approximately 1946 to 1970; Mirex in 1964.

Comments: Site was operated as a burn dump. Based on an estimated fill depth of 5 feet, total volume of the site is about 110,000 cubic yards.

In the mid-1960s over a 1- to 2-year period, at least two waste disposal incidents occurred, during which two truckloads of drummed wastes were unloaded. At such times, a fire truck was present. These wastes were described as being similar to those disposed of at the Rifle Range Chemical Landfill (see Site No. 69). No better information regarding drum contents was obtained.

Note: Size estimates are based on map and photograph information. Field estimates may have been made, but no field measurements have been performed. Estimates are provided for general guidance only.

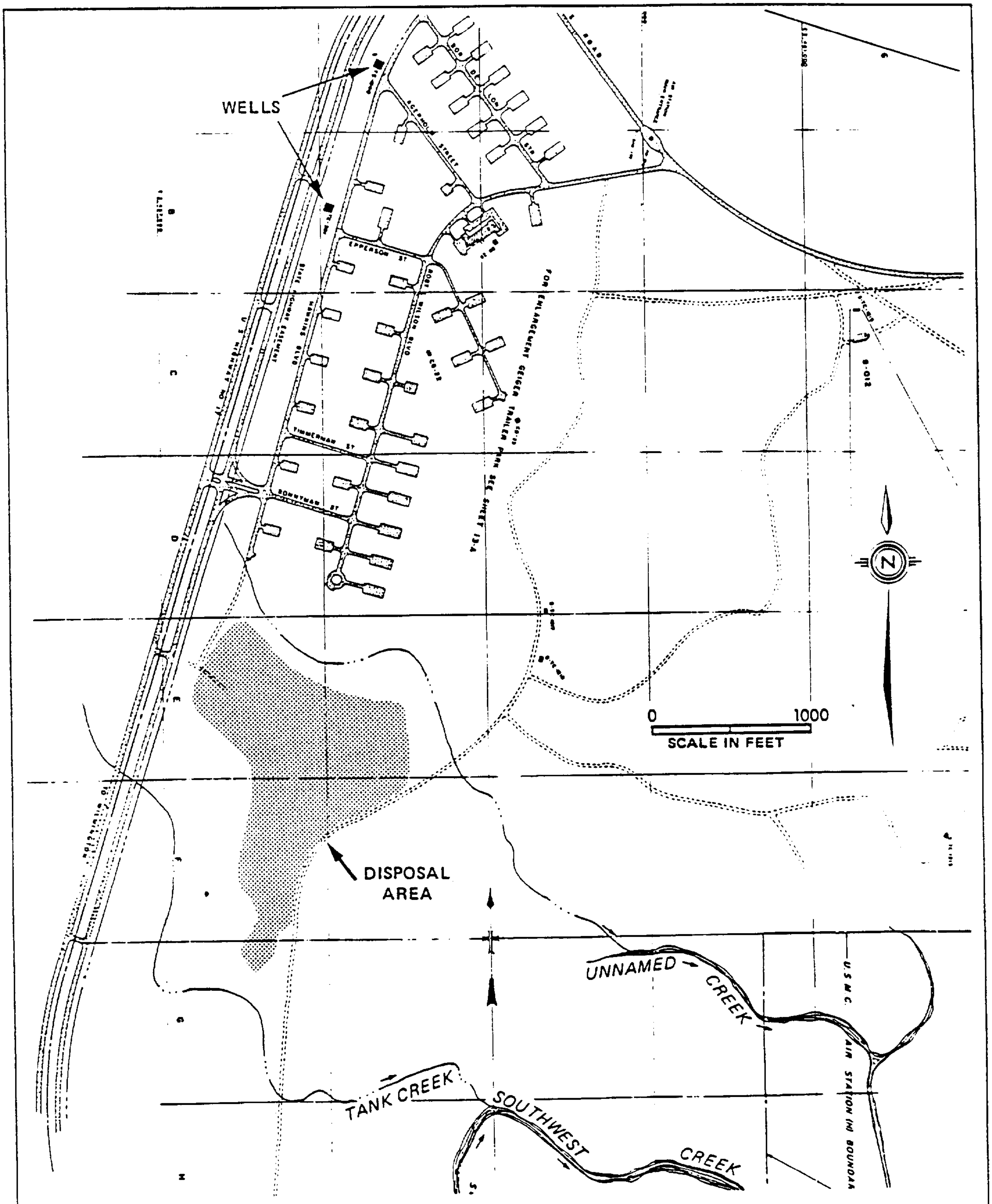

FIGURE 6–21
Detail of Site No. 41, Camp Geiger Dump
(near former trailer park)

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 13 OF 24, JUNE 30, 1979 AND CAMP LEJEUNE, SPECIAL MAP, STOCK NO. V7425CP LEJEUNE, 5th Ed., SEPT. 24, 1976.

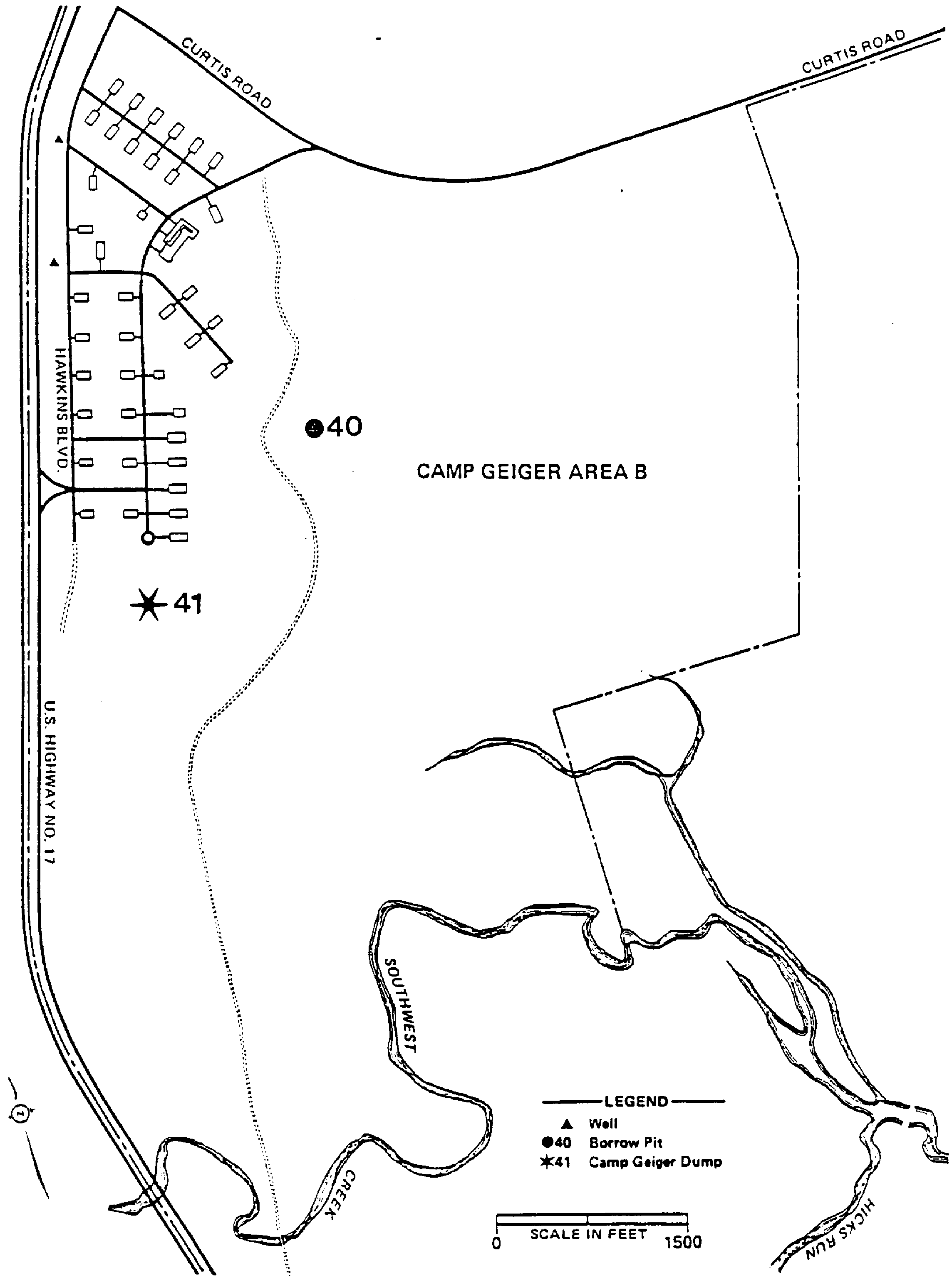

FIGURE 6–22. Site Locations at Camp Geiger Area B

FIGURE 6–23a
Site No. 41 – Camp Geiger Dump Near the Trailer Park

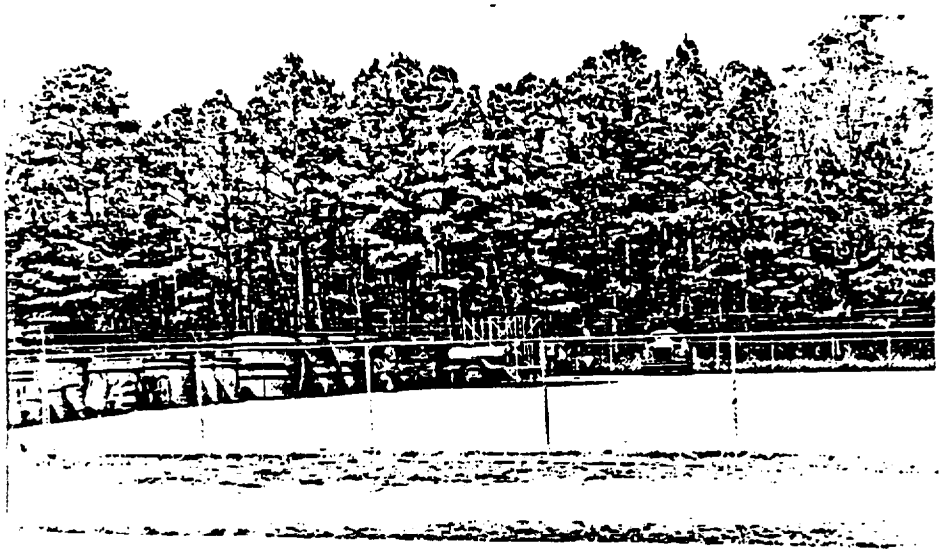

FIGURE 6–23b
Site No. 45 – Campbell Street Underground Fuel Storage Area

Site No.: 45

Name: Campbell Street Underground Avgas Storage and Adjacent JP Fuel Farm at Air Station

Location: PWDM Coordinates 23, 013-14/P13-14; Campbell Street at White Street (JP Fuel Farm) and approximately 250 feet east of White Street (Avgas).

Figures and Photos: 2-1, 6-23b, 6-24, 6-25

Size: The underground storage area is approximately 40,000 square feet. The JP Fuel Farm covers approximately 6 acres.

Previously Reported: No

Activity: Underground tank (or tanks) leaked at the fuel storage area during 1978. At the JP Fuel Farm, extensive leakage from underground connecting lines was discovered in about 1981. Southeastern one-third of area (i.e., approximately 2 acres) is generally affected.

Materials Involved: Avgas and JP fuel

Quantity: 200 to 300 gallons of Avgas. Assuming soils overlying groundwater are generally saturated with oil over about 2 acres, about 600,000 gallons of oil may be involved (i.e., using 20-percent porosity and 5 feet to groundwater). Therefore, estimates are that more than 100,000 gallons of JP fuel have leaked.

When: 1978

Comments: These two storage areas are close together and are considered as one site. Most recent leaks were JP-4 and JP-5 from underground pipes. These pipes have been replaced by an above-ground system in which leaks can be readily detected. An oil-water separator has been installed on the south boundary of the fuel farm, which now shows a substantial amount of oil. Drainage ditch and canal parallel Campbell Street, then flow southward.

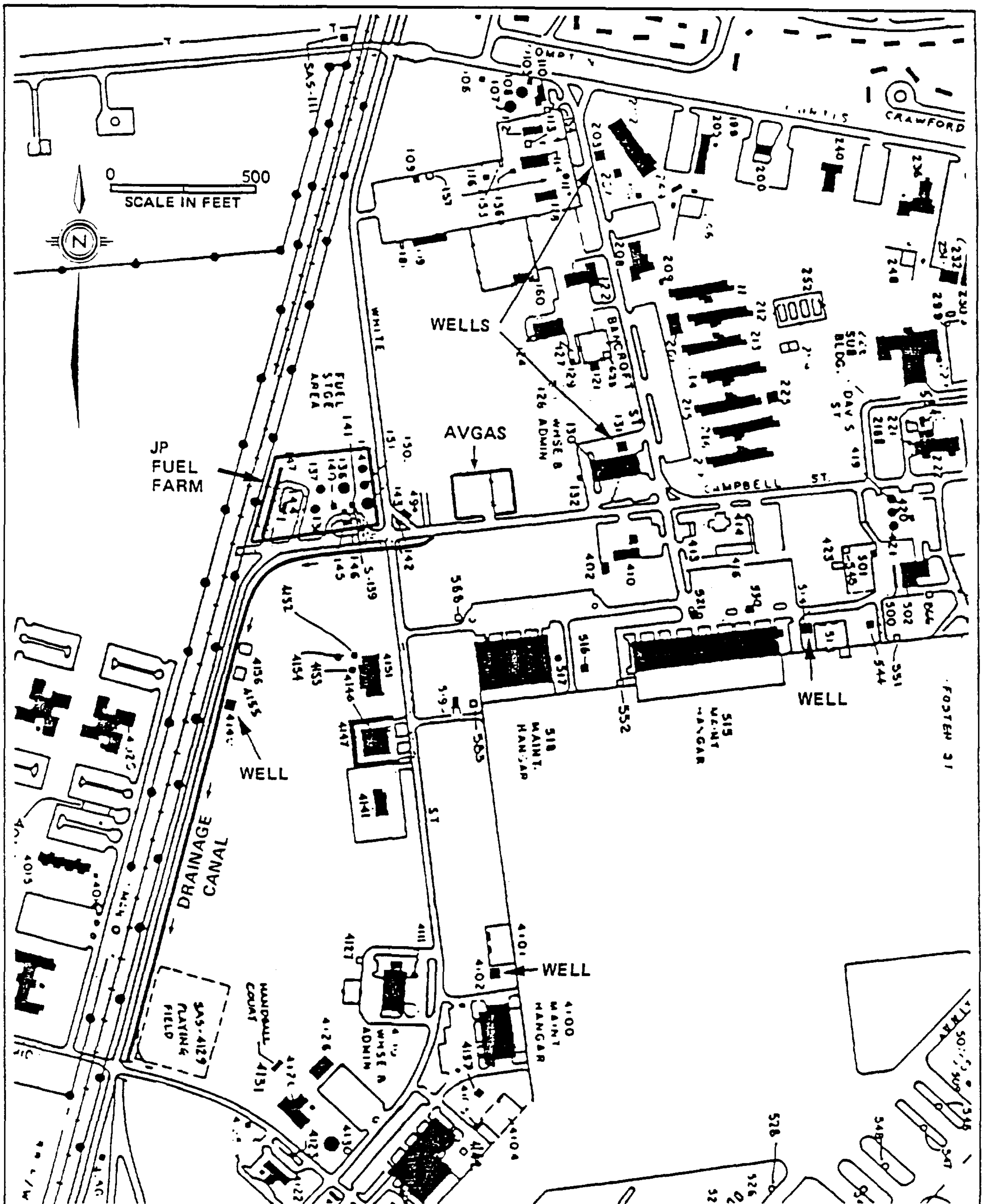

FIGURE 6–24

Detail of Site No. 45, Campbell Street Underground Avgas Storage and Adjacent JP Fuel Farm

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 23 OF 24, JUNE 30, 1979.

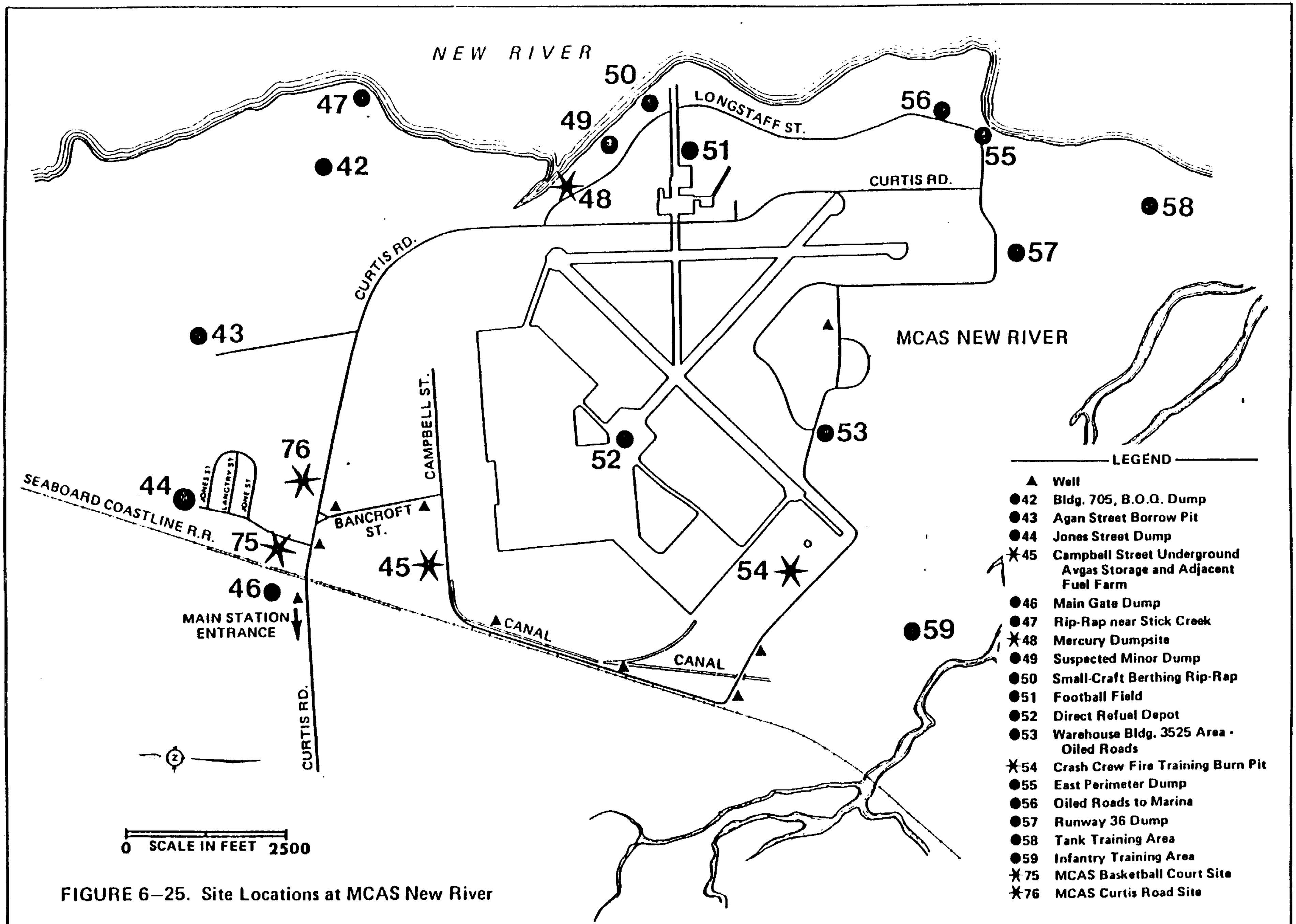

FIGURE 6–25. Site Locations at MCAS New River

Site No.: 48

Name: MCAS New River Mercury Dump Site

Location: PWDM Coordinates 23, D17/E17; Building 804 on Longstaff Road

Figures and Photos: 2-1, 6-26

Size: The disposal area is in a 100- x 200-foot corridor extending from the rear of Buiding 804 to the river.

Previously Reported: No

Activity: Mercury was drained from radar units periodically and disposed in woods near photo lab (Building 804).

Materials Involved: Metallic mercury

Quantity: Approximately 1 gallon per year over 10 years, i.e., more than 1,000 pounds total.

When: 1956 to 1966

Comments: Best information indicates that material was carried by hand, probably to area between building and river, and dumped or buried in small quantities at randomly selected spots. The solubility of metallic mercury is about 25 ppb, at 25°C, although this may increase due to chloride or hydride complex formation under the proper environmental conditions. The biological transformations of mercury in the aquatic environment (water and sediment) are complex and can enhance bioaccumulation in the food chain. The EPA drinking water standard for mercury is 2 ppb. One thousand pounds (454 kg) of mercury could contaminate about 184,000 acre-feet (227×10^6 m^3) of water to this level.

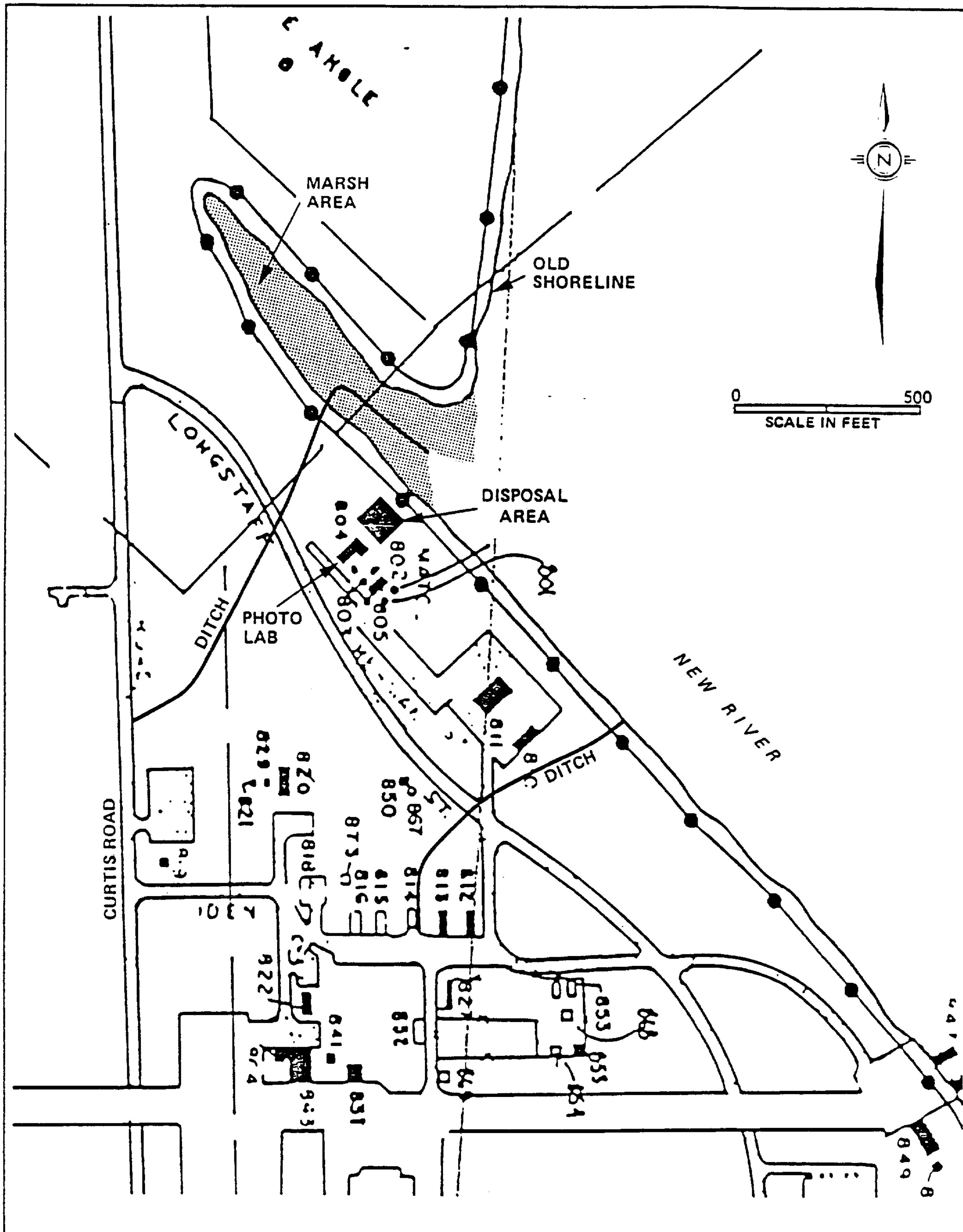

FIGURE 6–26
Detail of Site No. 48, MCAS New River Mercury Dump Site

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 23 OF 24, JUNE 30, 1979.

Site No.: 54

Name: Crash Crew Fire Training Burn Pit at Air Station

Location: PWDM Coordinates 23, O24-25/P24-25; adjacent to southwest end of Runway 5-23 near Building 3614.

Figures and Photos: 2-1, 6-27, 6-28

Size: Affected area is approximately 1.5 acres.

Previously Reported: Yes EPA Form 8900-1 MC Bul 6280

Activity: Pit used in crash crew training at air station. Waste oils and solvents were burned.

Materials Involved: Contaminated fuels (principally JP-type, although leaded fuel may also have been used), waste solvents

Quantity: Based on present usage of 15,000 gallons of POL annually, nearly 1/2 million gallons of these compounds have been used at this site. If only 1 percent of solvents and POL soaked into ground before lining, then 3,000 to 4,000 gallons would have entered the soils. Caution: Reliable data have not been found from which to quantify soil contamination. The above estimating procedure is used to provide order of magnitude guidance only.

When: First use is believed to have been in mid-1950s.

Comments: Burn pit was lined around 1975. According to some reports, site was used unlined a number of years before this. However, 1964 aerial photographs reveal a very "clean" looking area; no large fuel stains are apparent.

Note: Size estimates are based on map and photograph information. Field estimates may have been made, but no field measurements have been performed. Estimates are provided for general guidance only.

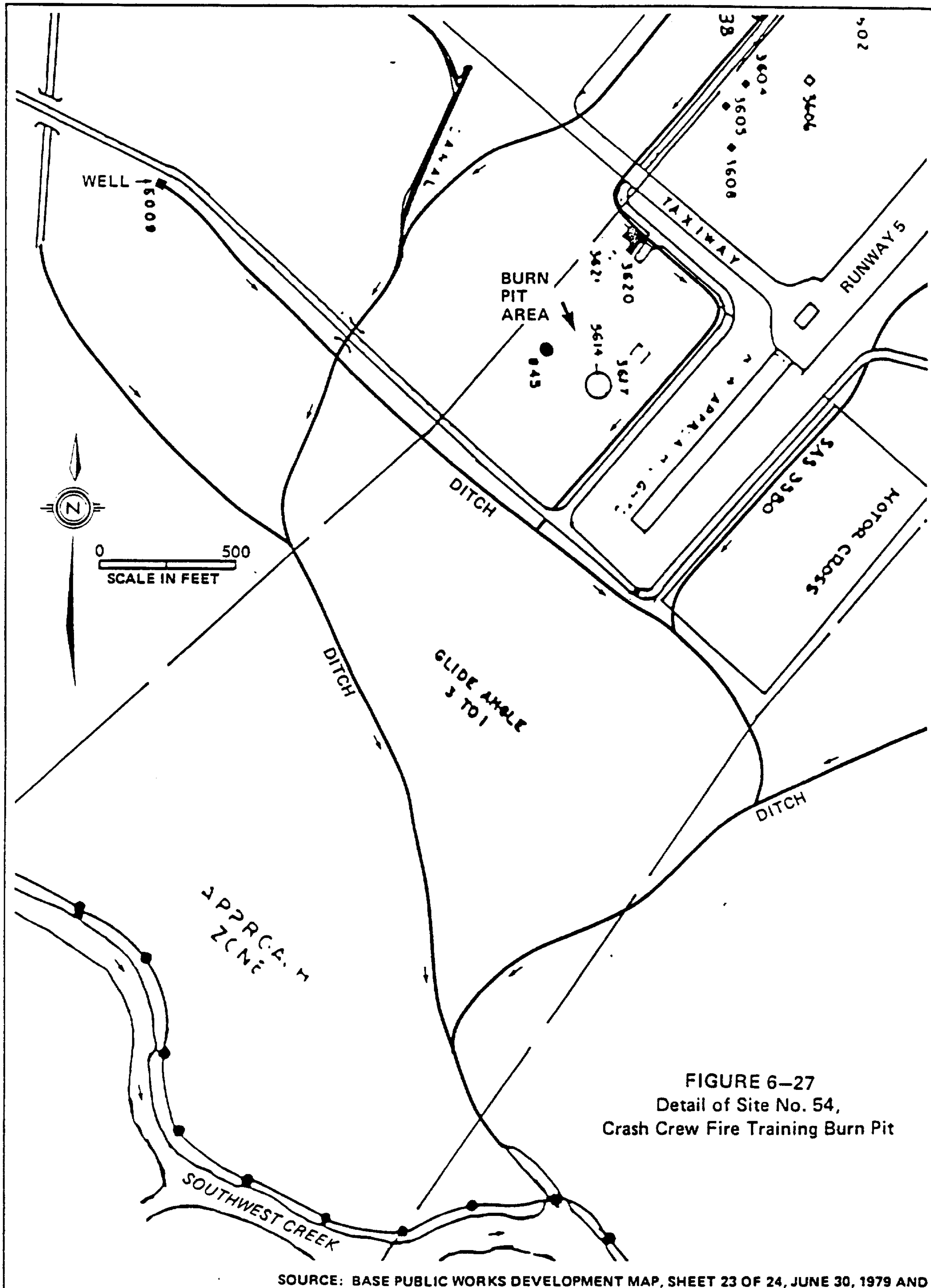

FIGURE 6–27
Detail of Site No. 54,
Crash Crew Fire Training Burn Pit

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 23 OF 24, JUNE 30, 1979 AND MCAS DRAINAGE – PUBLIC WORKS DRAWING 13377.

FIGURE 6–28
Site No. 54 — Crash Crew Fire Training Burn Pit

Site No.: 68

Name: Rifle Range Dump

Location: PWDM Coordinates 16, H6-8/I6-7; west of Range Road, about 2,000 feet west of Rifle Range water treatment, about 800 feet east of Stone Creek.

Figures and Photos: 2-1, 6-29, 6-30, 6-31

Size: Estimated area is 3 to 4 acres of primary disposal area within an originally disturbed area of approximately 35 to 40 acres.

Previously Reported: No

Activity: Operated as a dump for materials from Rifle Range activities

Materials Involved: Construction debris, WTP sludge, solvents (see comments below)

Quantity: Using 3 to 4 acres as area and assuming 10 feet of fill, volume is estimated at 50,000 cubic yards. Solvent amounts are estimated to be 1,000 to 2,000 gallons, based on period of use and quantities noted in comments (below).

When: 1942 to 1972

Comments: Sandy soils in area make site favorable for migration of contaminants. Although site is downgradient from Potable Well Nos. RR-47 and RR-97, heavy pumping may allow contaminants to move upgradient and cause the contamination found in these wells. However, this dump may not be the source of the contamination because total amounts of solvents in the dump cannot be accurately determined.

The report of solvent waste being disposed at the Rifle Range Dump has not been substantiated by follow-up interviews. Although the number of personnel qualifying with weapons at the rifle range apparently has decreased to 20,000 to 30,000 per year (range use has been higher during war years), weapon cleaning practices are probably unchanged for at least the last 20 years. Typically, weapon cleaning occurs at the "parent organization" and does not occur in the rifle range area except for the relatively small number of people working there. Dry cleaning solvent waste used for weapon cleaning does not exceed 20 to 30 gallons per year. Some discrepancy exists as to whether or not "bore cleaner" is presently used, but if it is, quantities used are expected to be similar to the amounts of dry cleaning solvents. No other unusual or specialized activity that uses solvents has been identified in this area.

Note: Size estimates are based on map and photograph information. Field estimates may have been made, but no field measurements have been performed. Estimates are provided for general guidance only.

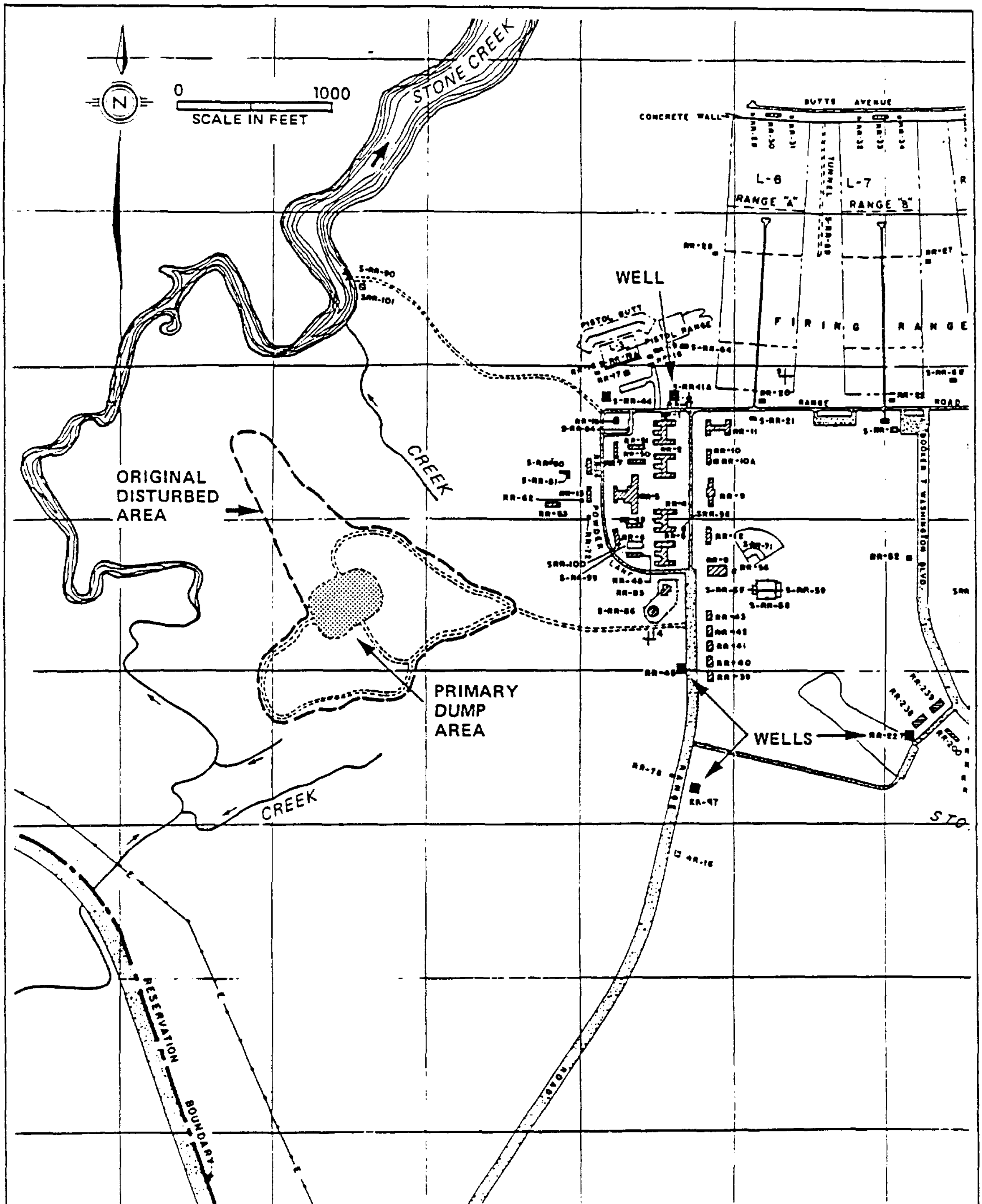

FIGURE 6–29
Detail of Site No. 68, Rifle Range Dump

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 16 OF 24, JUNE 30, 1979.

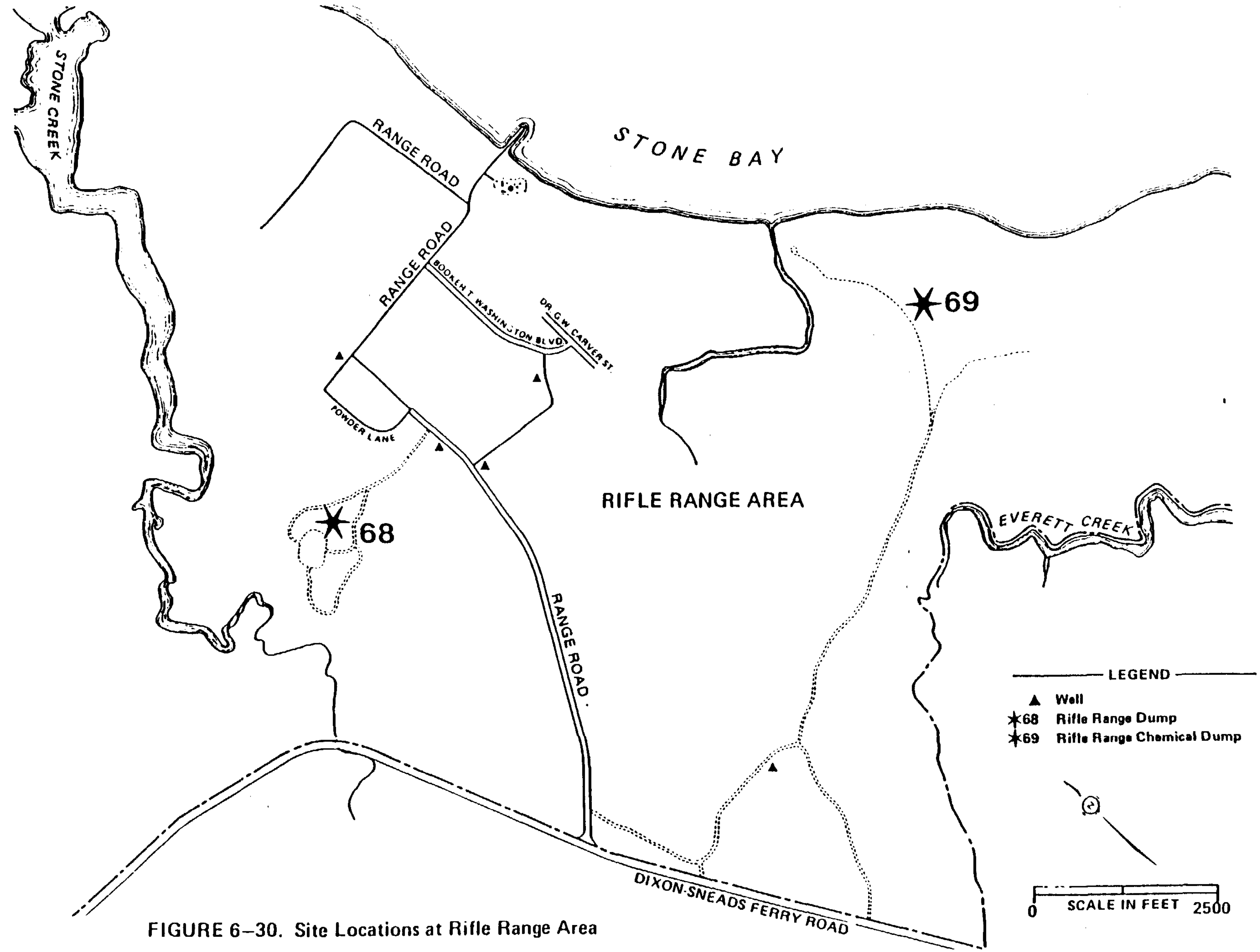

FIGURE 6–30. Site Locations at Rifle Range Area

FIGURE 6–31
Site No. 68 – Rifle Range Dump

Site No.: 69

Name: Rifle Range Chemical Dump

Location: PWDM Coordinates 16, L14-15/M14-15; about 8,000 to 9,000 feet due east of intersection of Range and Sneads Ferry Roads, north of Everett Creek.

Figures and Photos: 2-1, 6-30, 6-32, 6-33

Size: Estimated area is about 6 acres.

Previously Reported: Yes EPA Form 8900-1 MC Bul 6280

Activity: Former site for chemical wastes, including various pesticides, PCBs, fire retardants

Materials Involved: Pentachlorophenol, DDT, TCE, Malathion, Diazinon, Lindane, gas cylinders, HTH, PCBs, drums of "gas" that were probably a training agent containing chloroacetophenone (CN), all other hazardous materials generated or used on base, chemical agent test kits for chemical warfare, which contain no agent substances. See Table 2-3 for reported contaminant levels in surface and groundwater at or near this site.

Quantity: Overall volume may be 93,000 cubic yards. This is based on an area of approximately 6 acres and an assumed depth of 10 feet.

When: Approximately 1950 to about 1976

Comments: The former base safety officer prepared a list of what and where chemicals were buried in the landfill. This list has been lost, but some information is known from an interview.

Disposal was in pits/trenches between 6 to 20 feet deep. At least 12 different dumpings have been documented.

(Continued)

Site No.: 69 (Continued)

This site is at a higher elevation than surrounding terrain. Subsurface contaminant migration could be in many directions. Groundwater seeps were observed in the surrounding area.

Two reports of atmospheric emissions were noted. One incident occurred possibly as a result of meteorological conditions; the second incident was caused by accidental disturbance of the ground at the site by grading/disking machinery.

Some PCBs, sealed in cement septic tanks, are reported to be buried here.

Both fired and unfired blank rifle cartridges were found on the ground within the boundaries of this site. The presence of these cartridges indicate that troop training exercises may have extended into this area, possibly at night when warning signs might not have been seen.

The chemical agent test kits were a type called "Kit, Chemical Agent Detector, M9" for detecting mustards, nitrogen mustards, arsenicals and phosgene. The following is a contents listing of the kit from the kits' "General Directions."

1 Kit Carrier with Carrying Strap
1 Air Sampling Pump, with Flashlight
36 Mustards Detector Tubes
20 Nitrogen Mustards Detector Tubes
20 Arsenicals Detector Tubes
20 Phosgene Detector Tubes
20 Sampling Tubes
2 Aluminum Bottles of Liquid Reagent
1 Blue Bottle of Liquid Reagent
1 Red Bottle of Liquid Reagent
1 Aluminum Vial of Solid Reagent
1 Protective Cover
1 Set of General Directions for Use of Kit, Chemical Agent Detector, M9
1 Pack of Envelopes and Report Forms
1 Pencil

One disposal incident occurred in 1953 or 1954. About 50 drums of what is believed to be training agent were delivered on rubber padded trucks and were buried in two trenches (see Figure 6-32). The drums were described as being "not nearly as heavy as if filled with oil". These drums were placed in the pit one at a time and laid side by side. These two pits were up to 20 feet deep and the drums were stacked so

(Continued)

Site No.: 69 (Continued)

that the top layer was five or six feet below ground level when the drums were covered. Gas masks with some type of absorption cannister and other protective clothing were worn by those people present. The heavy equipment operator reported that he itched after working at this site. The drums were light blue or bluish-green and unmarked.

In 1970, another burial incident took place during which 5-gallon cans and 55-gallon drums of DDT, trichloroethylene (TCE), and calcium hypochlorite were placed together in a common pit. When earth was being placed over the containers, an explosion and fire occurred which caused a forest fire and blew drums from the pit into the forest about 40 yards from the pit. A fire truck and base safety personnel were present. Some of those present possessed gas masks.

Note: Size estimates are based on map and photograph information. Field estimates may have been made, but no field measurements have been performed. Estimates are provided for general guidance only.

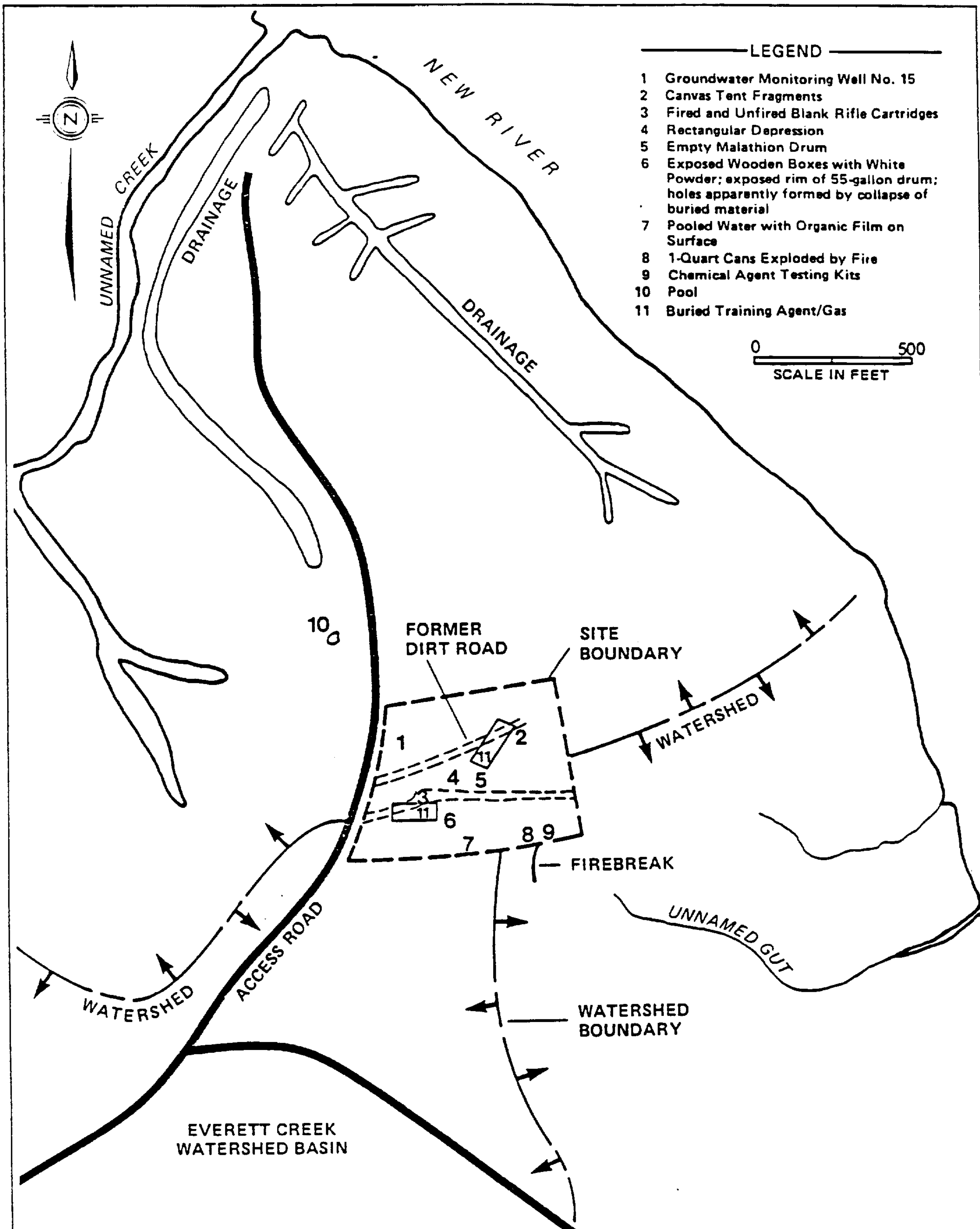

FIGURE 6–32
Physical Features and Locator Map For Site No. 69

SOURCE: USGS, 7.5 MINUTE SERIES, SNEADS FERRY, N.C., 1971.
VARIOUS AERIAL PHOTOGRAPHS, PERSONAL OBSERVATIONS, 1982.

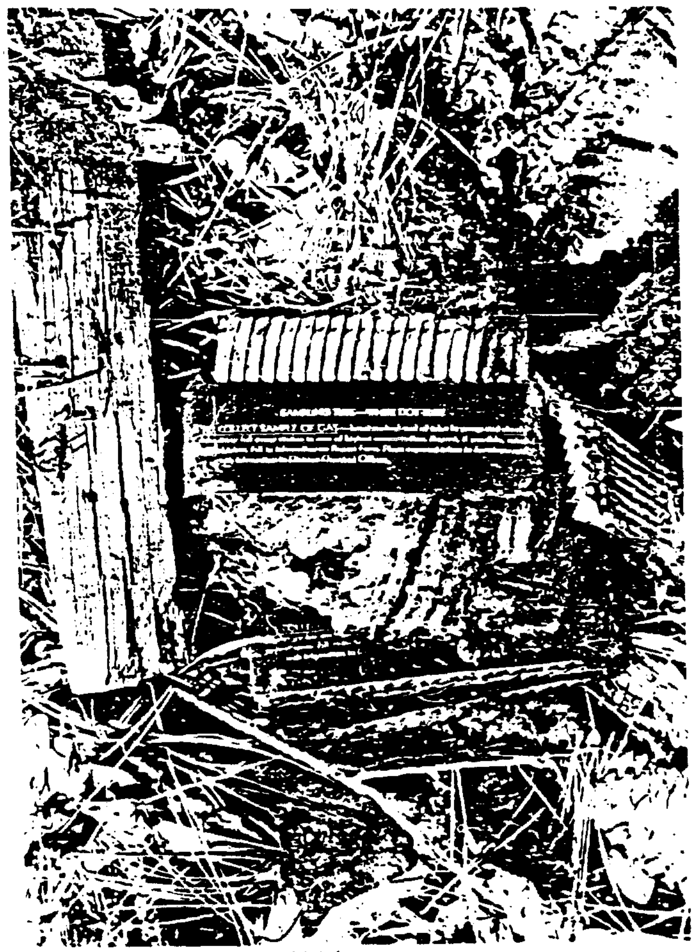

FIGURE 6–33
Site No. 69 – Rifle Range Chemical Dump
Showing Discarded Gas Detection Kits

Site No.: 73

Name: Courthouse Bay Liquid Disposal Area

Location: PWDM 17, I11-12; area surrounding Buildings A2, A3, A8, and A9, and surrounding the southern one-third of Courthouse Road

Figures and Photos: 2-1, 6-34, 6-35

Size: Acid and POL disposal area is about 1 acre. Disposal area for POL exclusively is about 12 acres.

Previously Reported: Yes Sanitary Engineering Survey FY77

Activity: Waste battery acid and motor oil were drained onto soil.

Materials Involved: Used vehicle battery acid containing sulfuric acid, lead, and possibly antimony; waste motor oil possibly containing phenol, barium, cadmium, chromium, copper, lead, nickel, silver, and zinc

Quantity: About 10,000 to 20,000 gallons of used battery acid were poured out at this site at an estimated rate of 60 gallons per month for a minimum of 27 years. The amount of lead dissolved in the used acid is expected to be small. (The solubility constant for lead sulfate is 2×10^{-8}; new battery acid is about 12 normal sulfuric acid); however, lead sulfate debris may have been suspended in the acid. Antimony sulfate or dissolved antimony may be present in used acid. The acid content of fresh battery acid is about 6 molar sulfuric acid. Using fresh acid molarity, between 60,000 and 120,000 moles of sulfuric acid was dumped at this site. This amount of sulfuric acid would consume about 13 tons of calcium carbonate during neutralization. Over a 32-year period, as much as 400,000 gallons of waste motor oil has been disposed of at this site. Presently, the 208 amphibious vehicles at this site require four oil changes of 15 gallons each per year. If the constituent concentrations listed in Table 6-4 are representative of this waste oil, the following amounts of material would be present in the soil or ground water: lead, 1,300 pounds; zinc, 1,600 pounds; and phenol, 70 pounds.

When: 1946 to 1977

Comments: Acid disposal occurred periodically by manually digging small holes in the ground, pouring in battery wastes, and then replacing soil. Oil wastes were disposed of by driving vehicle into wooded area, draining oil onto ground, replacing it with new oil, and driving away. Acid was disposed of by hand-carrying the battery or acid from the maintenance area, so the disposal area for acid is smaller than for the oil.

The acid disposal area is approximately 200 feet from Courthouse Bay. The disposal area for POL only is within just tens of feet from the shoreline.

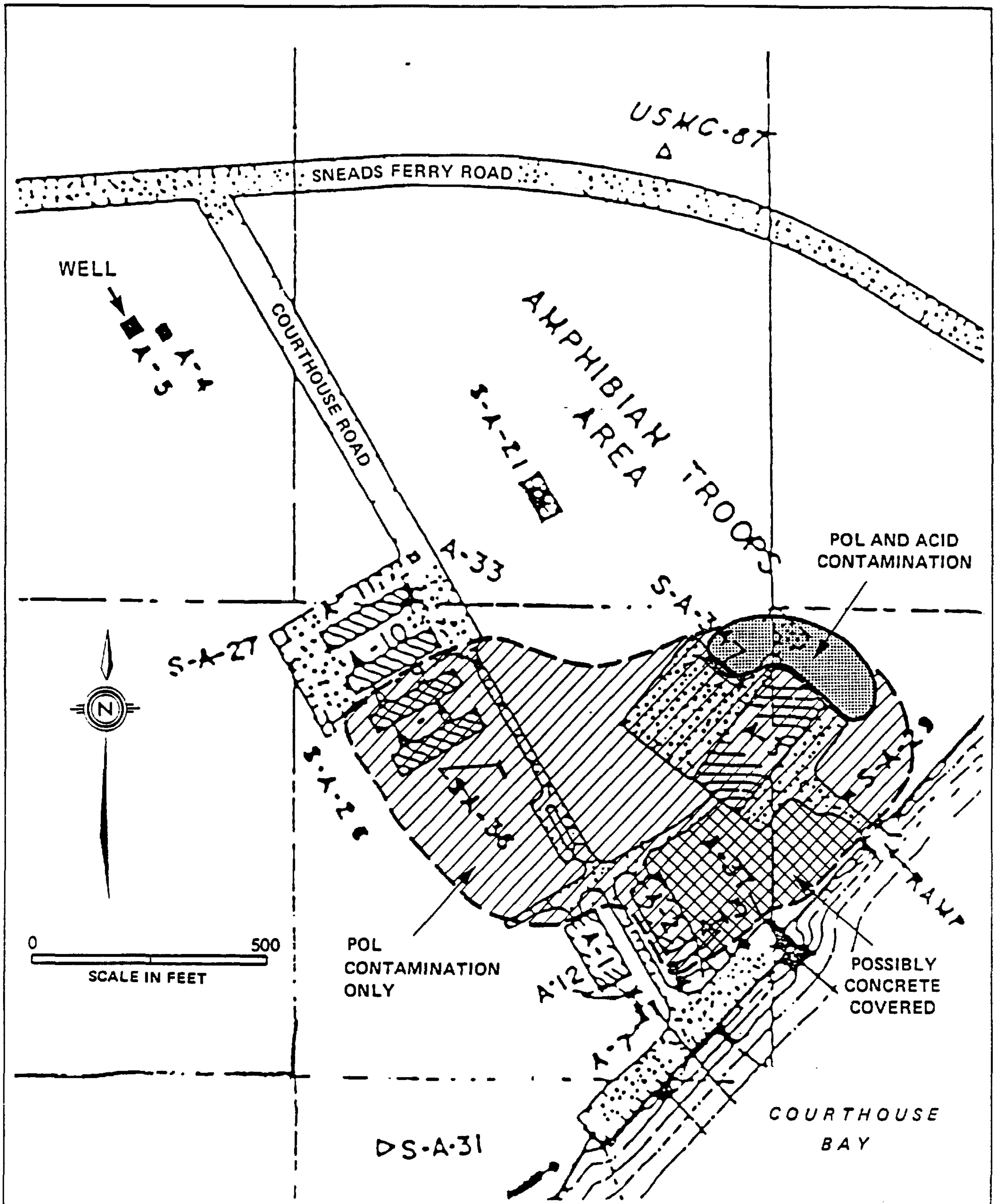

FIGURE 6–34
Detail of Site No. 73, Courthouse Bay Liquid Disposal Area

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAPS, SHEET 17 OF 24, JANUARY 1, 1977.

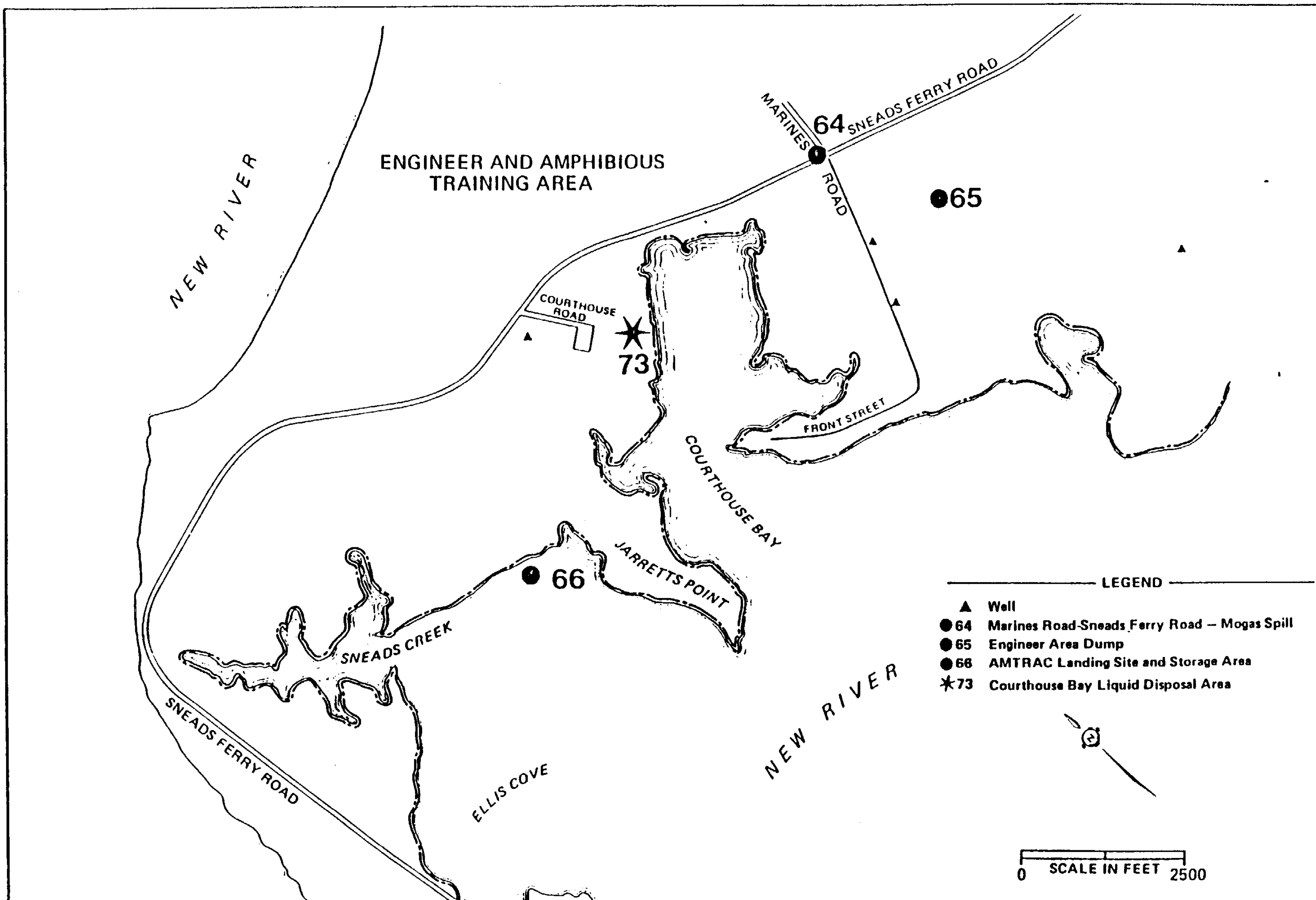

FIGURE 6–35. Site Locations at Engineer and Amphibious Training Area

Site No.: 74

Name: Mess Hall Grease Pit Area

Location: PWDM Coordinates 5, N13/014; grease pit located 0.4 miles east of railroad tracks - road intersection (at old sawmill site, Site No. 3) and north of dirt road; pest control usage area was 20-50 yards south of dirt road and about 75 yards east of Building 617.

Figures and Photos: 2-1, 6-5

Size: Grease pit 100-135 feet long by 30 feet wide by 10-12 feet deep; assume each drum burial pit was 30 feet long by 6 feet wide - total area north of dirt road approximately 2-3 acres; pest control area of about 100 feet by 100 feet is assumed.

Previously Reported: No

Activity: Three separate activities occurred in this area:

1. Grease from mess halls was deposited in a large pit;
2. Burials of 55-gallon drums, possibly containing PCB transformer oil and pesticides occurred near the grease pit; and
3. Burlap bags of sawdust were soaked in a DDT solution and then later deposited in wetland areas for mosquito control.

Materials Involved: PCBs, DDT, possibly other pesticides and drummed wastes.

Quantity: Pesticide contamination from pest control activities would have resulted from dripping sawdust bags, small spills, washout and excess disposal. It is reasonable to assume that at least several gallons per year were released. Therefore, over about 10 years, the quantity involved is estimated on the order of 50 to 500 gallons.

One or more truck loads of pesticides in 55-gallon drums were disposed of at this site. Assuming two truck loads of 20 full drums each, a quantity of 2,200 gallons of pesticides was buried here.

About 20 drums of PCB containing transformer oil, or 1,100 gallons, are buried here.

Mess hall grease at this site will not be considered a waste of concern (see Comments below).

Other wastes: See comment section below.

(Continued)

Site No.: 74 (Continued)

When: Sawdust bag soakings: 1950-1958; Pesticide drum burial: early 1950s; PCB burial: about 1963; grease pit activities: early 1950s.

Comments: The grease pit was used in the early 1950s as a disposal site for mess hall grease and some food wastes. At least one unsuccessful attempt to burn the grease using more flammable material failed. In 1954 Hurricane Hazel passed through the area and washed/floated the grease from the pit; pit use was then discontinued.

Drum burials occurred near but not in the grease pit. Detailed information regarding drum contents is not available because most data were provided by equipment operators involved only with burial and not with transportation or custody of the drums.

Some drums may have been left over from a burial/disposal incident at the Rifle Range Chemical Landfill (Site No. 69).

Aerial photographs show extensive activity at the grease pit area in 1956 with evidence of perhaps four separate burial trenches. Some activity is evident in 1949 and this area remained partially denuded as late as 1970. It is likely that other waste disposal events took place at this site although no other evidence or reports were discovered during the course of this study.

A sand mining site was used in the Sawmill-Grease Pit area concurrently with the grease pit operations.

Site No.: 75

Name: MCAS Basketball Court Site

Location: PWDM Coordinates 23, 08-9/P8-9; north of Curtis Road to the vicinity of the basketball court (Structure No. 1005) and between railroad tracks and housing area.

Figures and Photos: 2-1, 6-25, 6-36

Size: Pit was oval shaped, 90 feet long by 70 feet wide, at least 6 feet deep.

Previously Reported: No

Activity: Burial of drums occurred at this location.

Materials Involved: Material was called "gas" by personnel who unloaded it and is believed to be CN tear compound in solution. Solvents might include any one or more of the following: chloroform, carbon tetrachloride, benzene, and chloropicrin (PS).

Quantity: 75 to 100 55-gallon drums or 4,100 to 5,500 gallons

When: Early 1950s

Comments: Some conflicting data from former heavy equipment operators exist about this site. At least one disposal operation took place during which 75 to 100 55-gallon drums were buried. A crane was used to dig an oval hole about 70 feet by 90 feet and deep enough to cut into the groundwater table. The drum contents were called "gas" by the people delivering and unloading it but this was not intended to indicate automotive or airplane fuels. No fire department equipment or personnel were present. The drums may have contained a yellow or brown liquid. Tops of the drums may have had 8 feet of earth covering them.

There are three potable wells within 1,000 feet. No basements or shallow wells are known to exist in the vicinity. Recycled filter backwash water is pumped through a buried pipe between the water treatment plant and a storage pond north of the site. This pipe runs north-south immediately west of the site. Relatively high permeability fill surrounding the pipe may provide an opportunity for groundwater movement from the site to and into the pond.

Aerial photographs for years 1949, 1954, 1956 and 1964 did not reveal a conclusive location for this site.

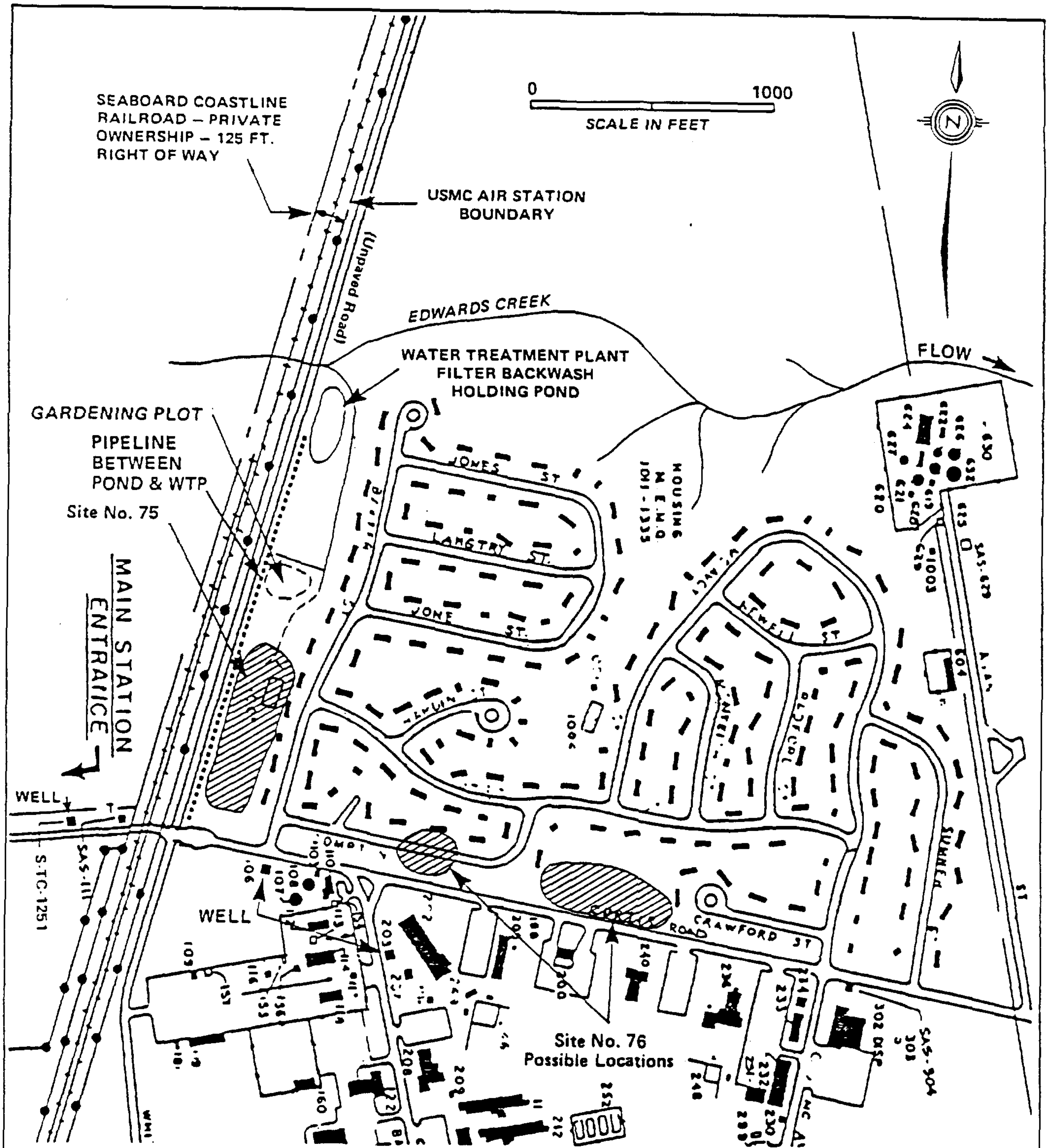

FIGURE 6–36
Detail of Site No.s 75 and 76, MCAS Basketball Court Site
and MCAS Curtis Road Site, Respectively

SOURCE: BASE PUBLIC WORKS DEVELOPMENT MAP, SHEET 23 OF 24, JUNE 30, 1979.

Site No.: 76

Name: MCAS Curtis Road Site

Location: PWDM Coordinates 23, L10/M10/N10; adjacent to and north of Curtis Road and west of terminus circle of Crawford Street. Precise location cannot be ascertained (see Comments below).

Figures and Photos: 2-1, 6-25, 6-36

Size: Probably about 1/4 acre; assuming two 50 feet by 100 feet areas placed beside each other.

Previously Reported: No

Activity: Burial of drums occurred here on two separate occasions.

Materials Involved: Possibly chloroacetophenone (CN) tear compound/ training agent because similar transporting and unloading procedures as those used at the MCAS Basketball Court Site (Site No. 75) were followed. Chloroform, carbon tetrachloride and benzene may be present as solvents and also chloropicrin (PS).

Quantity: At least 25 and possibly as many as 75 55-gallon drums, i.e., 1,400 to 4,100 gallons.

When: 1949

Comments: Material was delivered to the burial site on a padded truck and was unloaded by people who wore some protective clothing (perhaps only rubber gloves).

In 1949, this area was relatively undeveloped and lacked permanent landmarks. A large pecan tree cited as a landmark could not be located during the site visit. Features on a 22 October 1949 aerial photo indicate that the disposal site might be located 200 to 300 yards west of the area identified during the interview with a former heavy equipment operator. Since neither data source was considered unquestionable both areas are indicated on Figure 6-36. The exact site cannot be conclusively located at either one or the other of these two suggested locations. However, these sites are the most probable based on available data.

This site is different and distinct from the MCAS Basketball Court Site (Site No. 75).

6.7.3 Sites Not Requiring Confirmation. The majority of identified waste disposal sites have been judged not to require further assessment. This is because the potential for adverse impact to public health and/or the environment is relatively small. These sites are described in this section.

Site No.: 3

Name: Old Creosote Plant

Location: PWDM Coordinates 5, N11-12/011-12

Figures and Photos: 2-1, 6-5

Size: Several acres

Activity: Lumber cutting and creosoting when railroad was being built

Materials and Quantity Involved: Trash and general debris

When: 1951 to 1952

Comments: Creosote plant operated only a few months when railroad was being built. The other operation was as a sawmill which made railroad ties and rough cut lumber. Plant later sold and removed.

Site No.: 4

Name: Sawmill Road Construction Debris Dump

Location: PWDM Coordinates 5, N14-15/014-15

Figures and Photos: 2-1, 6-5

Size: Along roadway about 0.3 miles in length

Activity: General surface disposal area for construction debris

Materials and Quantity Involved: Asphalt, old bricks, and cement

When: Unknown

Comments: Distance to nearest well is about 100 feet (Well Building 641). No hazardous wastes involved.

Site No.: 5

Name: Piney Green Road

Location: PWDM Coordinates 6, G4/H4

Figures and Photos: 2-1, 6-7

Size: Presumably along entire length of road which is about a mile

Activity: Waste oil from central heating plant was put on crushed clinkers and spread on road.

Materials and Quantity Involved: Waste oil for dust control

When: Unknown

Comments: Minor contamination potential

Site No.: 7

Name: Tarawa Terrace Dump

Location: PWDM Coordinates 3, F4

Figures and Photos: 2-1

Size: A few acres

Activity: Disposal site for waste material

Materials and Quantity Involved: Construction debris, STP filter sand, and household trash

When: 1972 (this is date closed)

Comments: No hazardous waste involved.

Site No.: 8

Name: Flammable Storage Warehouse Bldg TP-451 and TP-452

Location: PWDM Coordinates 6, K3

Figures and Photos: 2-1, 6-7

Size: About 1 acre

Activity: Storage facilities for flammable materials

Materials and Quantity Involved: Assorted flammables.

When: Current

Comments: Building TP-452 burned in 1977

Site No.: 10

Name: Original Base Dump

Location: PWDM Coordinates 6, G2/H2

Figures and Photos: 2-1, 6-7

Size: 5 to 10 acres

Activity: Waste disposal landfill

Materials and Quantity Involved: Construction debris

When: Pre-1950

Comments: First dump on base. Received mainly construction debris. Also a burn dump.

Site No.: 11

Name: Pest Control Shop

Location: PWDM Coordinates 10, F10

Figures and Photos: 2-1, 6-3

Size: A few acres

Activity: Formerly used as a Naval Research Laboratory where metabolic studies using Iodine 131 occurred; presently the Pest Control Shop

Materials and Quantity Involved: Pesticide storage (current), beta buttons (previously dissolved and removed), animal carcasses contaminated with low-level radioactive materials

When: 1976 to 1982

Comments: Previously reported as a site by base environmental personnel and cleaned. Residual radioactivity low due to short half-life of Iodine 131

Site No.: 12

Name: EOD (G-4)

Location: PWDM coordinates 20, G8-10/H8-10/I8-10

Figures and Photos: 2-1

Size: About 300 acres

Activity: Ordnance is disposed of by burning or exploding when found to be inert, unserviceable or defective

Materials and Quantity Involved: Ordnance, burned or exploded, colored smokes, and white phosphorus

When: Early 1960s

Comments: Any undestroyed residues are typically less than 1 pound.

Site No.: 13

Name: Golf Course Construction Dump Site

Location: PWDM Coordinates 7, G12-13

Figures and Photos: 2-1

Size: About 10 acres

Activity: Surface disposal of materials

Materials and Quantity Involved: Clippings, branches, and some asphalt

When: 1944

Comments: No hazardous wastes involved

Site No.: 14

Name: Knox Area Rip-Rap

Location: PWDM Coordinates 2, L16-17/M16-17

Figures and Photos: 2-1, 6-10

Size: Along about 700 feet of shoreline

Activity: Shoreline stabilization

Materials and Quantity Involved: Broken concrete and asphalt

When: 1973

Comments: No hazardous wastes involved

Site No.: 15

Name: Montford Point Dump Site (1948-1958)

Location: PWDM Coordinates 2, M9-10

Figures and Photos: 2-1, 6-10

Size: About 4 acres

Activity: Disposal area for trash and construction debris

Materials and Quantity Involved: Litter, asphalt, STP sludge, and sand

When: 1948 to 1958

Comments: No hazardous wastes involved

Site No.: 17

Name: Montford Point Area Rip-Rap

Location: PWDM Coordinates 2, N9/09

Figures and Photos: 2-1, 6-10

Size: Along about 800 feet of shoreline

Activity: Shoreline stabilization

Materials and Quantity Involved: Concrete rubble

When: 1968 to Unknown

Comments: No hazardous wastes involved

Site No.: 18

Name: Watkins Village (E) Site

Location: PWDM Coordinates 7, L21

Figures and Photos: 2-1

Size: 0.5 to 1 acre

Activity: Landfill burial of debris

Materials and Quantity Involved: Construction materials and debris

When: 1976 to 1978

Comments: No hazardous wastes involved

Site No.: 19

Name: Naval Research Lab Dump

Location: PWDM Coordinates 10, E10/F10

Figures and Photos: 2-1, 6-3

Size: About 2 to 3 acres

Activity: Waste disposal site for Naval Research Laboratory

Materials and Quantity Involved: Radioactive contaminated animals, empty tanks, and scrap metals

When: 1956 to 1960

Comments: Animal bodies were buried in deep pits. No residuals expected due to short half-life of Iodine 131.

Site No.: 20

Name: Naval Research Lab Incinerator

Location: PWDM Coordinates 10, F10

Figures and Photos: 2-1, 6-3

Size: Less than 0.5 acre

Activity: Incineration of burnable wastes

Materials and Quantity Involved: Some ash and debris

When: 1956 to 1960

Comments: Minor quantities of wastes and residuals

Site No.: 23

Name: Roads and Grounds, Building 1105

Location: PWDM Coordinates 10, J15

Figures and Photos: 2-1, 6-3

Size: 4,400 square feet

Activity: Formerly administration and storage area for Pest Control Shop

Materials and Quantity Involved: Pesticide and herbicide storage

When: 1957 to 1977

Comments: Site of former pesticide and herbicide storage and handling. Storage Lot 140 (Site No. 21) at that time was used for pesticide mixing. No spills reported.

Site No.: 25

Name: Base Incinerator

Location: PWDM Coordinates 10, G8

Figures and Photos: 2-1, 6-3

Size: Less than 0.5 acres

Activity: Waste incineration, classified material incineration

Materials and Quantity Involved: Burned trash and melted glass

When: 1940 to 1960

Comments: No hazardous wastes involved

Site No.: 26

Name: Coal Storage Area

Location: PWDM Coordinates 10, L12

Figures and Photos: 2-1, 6-3

Size: About 3 acres

Activity: Fuel storage for Central Heating Plant

Materials and Quantity Involved: Coal storage runoff

When: Present

Comments: Runoff control should be considered for this site.

Site No.: 27

Name: Naval Hospital Area Rip-Rap

Location: PWDM Coordinates 10, H5

Figures and Photos: 2-1, 6-3

Size: About 500 feet of shoreline

Activity: Shoreline stablization

Materials and Quantity Involved: Concrete, granite rip-rap

When: 1970 to Unknown

Comments: No hazardous wastes involved

Site No.: 29

Name: Base Sanitary Landfill

Location: PWDM Coordinates 11, A12/B12-13/C12-13/D13

Figures and Photos: 2-1

Size: About 30 acres

Activity: Sanitary waste disposal

Materials and Quantity Involved: Garbage, construction debris, and general trash

When: 1972 to present

Comments: Previously reported by base environmental personnel. However, this site is a current site and permitted.

Site No.: 31

Name: Engineering Stockade--G4 Range Road

Location: PWDM Coordinates 20, G7-8/H3-8/I1-7/J1-5

Figures and Photos: 2-1

Size: About 1.5 miles of roadway

Activity: Dust control

Materials and Quantity Involved: Waste oils

When: 1950 to early 1970s

Comments: Minor amounts of wastes involved

Site No.: 32

Name: Frenchs Creek

Location: PWDM Coordinates 11, F3/G3-4/H4

Figures and Photos: 2-1

Size: About 2,300 feet of shoreline

Activity: Shoreline stablization

Materials and Quantity Involved: Rip-rap dumped

When: 1973 to 1979

Comments: No hazardous wastes involved

Site No.: 33

Name: Onslow Beach Road

Location: PWDM Coordinates 19, G11-12/H11-12/I12-13/J12-13

Figures and Photos: 2-1

Size: Approximately 1/2 mile

Activity: Dust control

Materials and Quantity Involved: Waste oil and cinders for dust control

When: Unknown

Comments: Minor quantities of wastes involved

Site No.: 34

Name: Ocean Drive

Location: PWDM Coordinates 19, L16-17/M15-16/N14-15/O13-14/P12-13
Q10-12

Figures and Photos: 2-1

Size: About 2.5 miles of roadway

Activity: Dust control

Materials and Quantity Involved: Waste oil

When: Unknown

Comments: Minor quantities of wastes involved

Site No.: 37

Name: Camp Geiger Area Surface Dump

Location: PWDM Coordinates 12, D11-12

Figures and Photos: 2-1, 6-19

Size: About 4 acres

Activity: Surface disposal of wastes

Materials and Quantity Involved: Motor parts, garbage, wood

When: 1950 to 1951

Comments: No hazardous wastes involved

Site No.: 38

Name: Camp Geiger Construction Dump

Location: PWDM Coordinates 12, B10

Figures and Photos: 2-1, 6-19

Size: Less than 0.5 acre

Activity: Surface disposal of waste materials

Materials and Quantity Involved: Construction debris, branches

When: Present

Comments: Appeared to be a recent dumping of materials. No known hazardous wastes involved.

Site No.: 39

Name: Camp Geiger Construction Slab Dump

Location: PWDM Coordinates 12, B9-10/C9-10

Figures and Photos: 2-1, 6-19

Size: 1 to 2 acres

Activity: Bulldozing of building foundations, etc.

Materials and Quantity Involved: Concrete slabs

When: Unknown

Comments: No hazardous wastes involved

Site No.: 40

Name: Camp Geiger Area Borrow Pit

Location: PWDM Coordinates 13, D4

Figures and Photos: 2-1, 6-22

Size: 4 to 5 acres

Activity: Waste disposal

Materials and Quantity Involved: Auto parts, metal

When: 1969 to Unknown

Comments: No hazardous wastes involved

Site No.: 42

Name: Building 705, BOQ Dump

Location: PWDM Coordinates 23, D10

Figures and Photos: 2-1, 6-25

Size: Several acres

Activity: Surface disposal of material

Materials and Quantity Involved: Trees, tree stumps, boards

When: 1950 to 1960

Comments: No hazardous wastes involved

Site No.: 43

Name: Agan Street Dump

Location: PWDM Coordinates 23, H6-7/I6-7

Figures and Photos: 2-1, 6-25

Size: About 20 acres

Activity: Surface disposal of materials

Materials and Quantity Involved: Boards, trash, WTP sludge, fiberglass

When: Unknown

Comments: Mostly inert material

Site No.: 44

Name: Jones Street Dump

Location: PWDM Coordinates 23, L6-7/M6-7

Figures and Photos: 2-1, 6-25

Size: Several acres

Activity: Waste disposal

Materials and Quantity Involved: Debris, cloth, boards, old paint cans

When: 1950s

Comments: Minor quantities of potentially hazardous wastes

Site No.: 46

Name: MCAS Main Gate Dump

Location: PWDM Coordinates 23, Q8-9

Figures and Photos: 2-1, 6-25

Size: Less than 1 acre

Activity: Waste disposal

Materials and Quantity Involved: Construction and demolition debris

When: 1958 to 1962

Comments: No present evidence of dump site. No hazardous wastes involved.

Site No.: 47

Name: MCAS Rip-Rap Near Stick Creek

Location: PWDM Coordinates 23, B11

Figures and Photos: 2-1, 6-25

Size: About 1,000 feet of shoreline

Activity: Shoreline stablization

Materials and Quantity Involved: Construction and demolition debris

When: Unknown

Comments: No hazardous wastes involved

Site No.: 49

Name: MCAS Suspected Minor Dump

Location: PWDM Coordinates 23, C18-19

Figures and Photos: 2-1, 6-25

Size: About 800 feet of shoreline

Activity: Possible waste disposal

Materials and Quantity Involved: Paint cans

When: Unknown

Comments: Minor quantities of potential hazardous wastes

Site No.: 50

Name: MCAS Small-Craft Berthing Rip-Rap

Location: PWDM Coordinates 23, A19-20/B19-20

Figures and Photos: 2-1, 6-25

Size: About 1,000 feet of shoreline

Activity: Shoreline stablization

Materials and Quantity Involved: Demolition debris, asphalt, concrete

When: Unknown

Comments: No hazardous wastes involved

Site No.: 51

Name: MCAS Football Field

Location: PWDM Coordinates 23, C21-22/D21-22

Figures and Photos: 2-1, 6-25

Size: 20 to 30 acres

Activity: Empty container disposal site

Materials and Quantity Involved: Paint cans, hydraulic fluid cans

When: Approximately 1967 to 1968

Comments: Minor quantities of hazardous materials

Site No.: 52

Name: MCAS Direct Refuel Depot

Location: PWDM Coordinates 23, L19-20/M19-20

Figures and Photos: 2-1, 6-25

Size: About 25 acres

Activity: Refueling of military aircraft for about 1 year

Materials and Quantity Involved: Aviation fuel spill, JP fuels

When: 1971

Comments: Only used 1 year. Quantities minor.

Site No.: 53

Name: MCAS Warehouse Building 3525 area. Oiled roads.

Location: PWDM Coordinates 23, H-Q23-26

Figures and Photos: 2-1, 6-25

Size: About 3 miles of roadway

Activity: Dust control

Materials and Quantity Involved: Crankcase waste oils, JP fuels, paint thinners

When: 1970 to 1975

Comments: Minor quantities of residuals expected

Site No.: 55

Name: Air Station East Perimeter Dump

Location: PWDM Coordinates 23, C29-30

Figures and Photos: 2-1, 6-25

Size: Several acres

Activity: Site presently used as a marina and recreation area by MCAS

Materials and Quantity Involved: Barrels, tires, trash, metal planking, and telephone poles

When: 1950s to 1960

Comments: No hazardous wastes involved

Site No.: 56

Name: MCAS Oiled Roads to Marina

Location: PWDM Coordinates 23, C28-30

Figures and Photos: 2-1, 6-25

Size: About 1,500 feet of roadway

Activity: Dust control

Materials and Quantity Involved: Crankcase and waste oils and contaminated fuels

When: 1975 to unknown

Comments: Roads oiled with listed materials for dust control

Site No.: 57

Name: Runway 36 Dump

Location: PWDM Coordinates 23, E-G/30-32

Figures and Photos: 2-1, 6-25

Size: About 40 to 50 acres

Activity: Possible disposal site for material removed for runway construction

Materials and Quantity Involved: Debris

When: Unknown

Comments: No hazardous wastes involved

Site No.: 58

Name: MCAS Tank Training Area

Location: PWDM Coordinates 23, D33-39/G33-39

Figures and Photos: 2-1, 6-25

Size: About 50 acres

Activity: Training exercises for tanks and other armored vehicles

Materials and Quantity Involved: Tank parts and miscellaneous trash

When: Unknown

Comments: No hazardous wastes involved

Site No.: 59

Name: MCAS Infantry Training Area

Location: PWDM Coordinates 23, P-T/26-30

Figures and Photos: 2-1, 6-25

Size: About 70 acres

Activity: Land clearing debris disposal

Materials and Quantity Involved: Stumps

When: 1950s

Comments: No hazardous waste involved

Site No.: 60

Name: EOD K-326 Range

Location: PWDM Coordinates 15, 09

Figures and Photos: 2-1

Size: 2 to 4 acres

Activity: Burning or detonation of live ordnance for disposal purposes

Materials and Quantity Involved: Burn pits for explosives

When: 1974 to present

Comments: Site located 500 meters north of Rhodes Point Road, adjacent to New River. Minor amounts of residuals only.

Site No.: 61

Name: Rhodes Point Road Dump

Location: PWDM Coordinates 15, I9

Figures and Photos: 2-1

Size: 8 to 10 acres

Activity: Disposal site for wastes generated during bivouac exercise

Materials and Quantity Involved: Bivouac waste

When: Unknown

Comments: Area restricted due to war games. No hazardous wastes involved.

Site No.: 62

Name: Race Course Area Dump

Location: PWDM Coordinates 14, D8

Figures and Photos: 2-1

Size: 1 to 2 acres

Activity: Disposal site for wastes generated during bivouac exercise

Materials and Quantity Involved: Bivouac waste

When: Unknown

Comments: Area restricted due to war games. No hazardous wastes involved.

Site No.: 63

Name: Vernon Road Dump

Location: PWDM Coordinates 14, H5

Figures and Photos: 2-1

Size: 3 to 4 acres

Activity: Disposal site for wastes generated during bivouac exercises

Materials and Quantity Involved: Bivouac waste

When: Unknown

Comments: Area restricted due to war games. No hazardous wastes involved.

Site No.: 64

Name: Marines Road--Sneads Ferry Road Mogas Spill

Location: PWDM Coordinates 17, I15/J15

Figures and Photos: 2-1, 6-35

Size: 1 acre

Activity: Fuel spilled in roadside ditch after vehicle accident

Materials and Quantity Involved: Mogas (spillage removed)

When: February 28, 1975

Comments: Spill immediately remediated

Site No.: 65

Name: Engineer Area Dump

Location: PWDM Coordinates 17, K16

Figures and Photos: 2-1, 6-35

Size: 4 to 5 acres

Activity: Burn dump

Materials and Quantity Involved: Burn area dump construction debris

When: Pre-1958 to 1972

Comments: No hazardous wastes involved

Site No.: 66

Name: AMTRAC Landing Site and Storage Area

Location: PWDM Coordinates 17, IM/611

Figures and Photos: 2-1, 6-35

Size: About 1 square mile

Activity: Vehicle maintenance during training exercises

Materials and Quantity Involved: Oil spill, POL, and battery acid

When: 1950s to present

Comments: Minor amounts of wastes

Site No.: 67

Name: Engineers TNT Burn Site

Location: PWDM Coordinates 23, A19-20/B19-20; located approximately 200 meters southeast of Building SBB-159 and about 50 feet from the water.

Figures and Photos: 2-1

Size: Less than 1 acre

Activity: TNT burning

Materials and Quantity Involved: TNT disposal

When: 1951

Comments: 2- to 3-foot pits were dug and unwanted TNT was opened and burned. Complete consumption of all TNT was reported during these procedures.

Site No.: 70

Name: Oak Grove Field--Surface Dump

Location: PWDM Coordinates 24, H2/I2, approximately 1400 ft. northwest of the western end of Runway 9-27

Figures and Photos: 2-1, 6-37

Size: About 3 acres

Activity: General dumping of all sorts of garbage

Materials and Quantity Involved: Cans, bottles, drums (i.e., paint thinner cans, brake fluid cans, cleaning compound)

When: Early to mid-1940s

Comments: No hazardous wastes involved

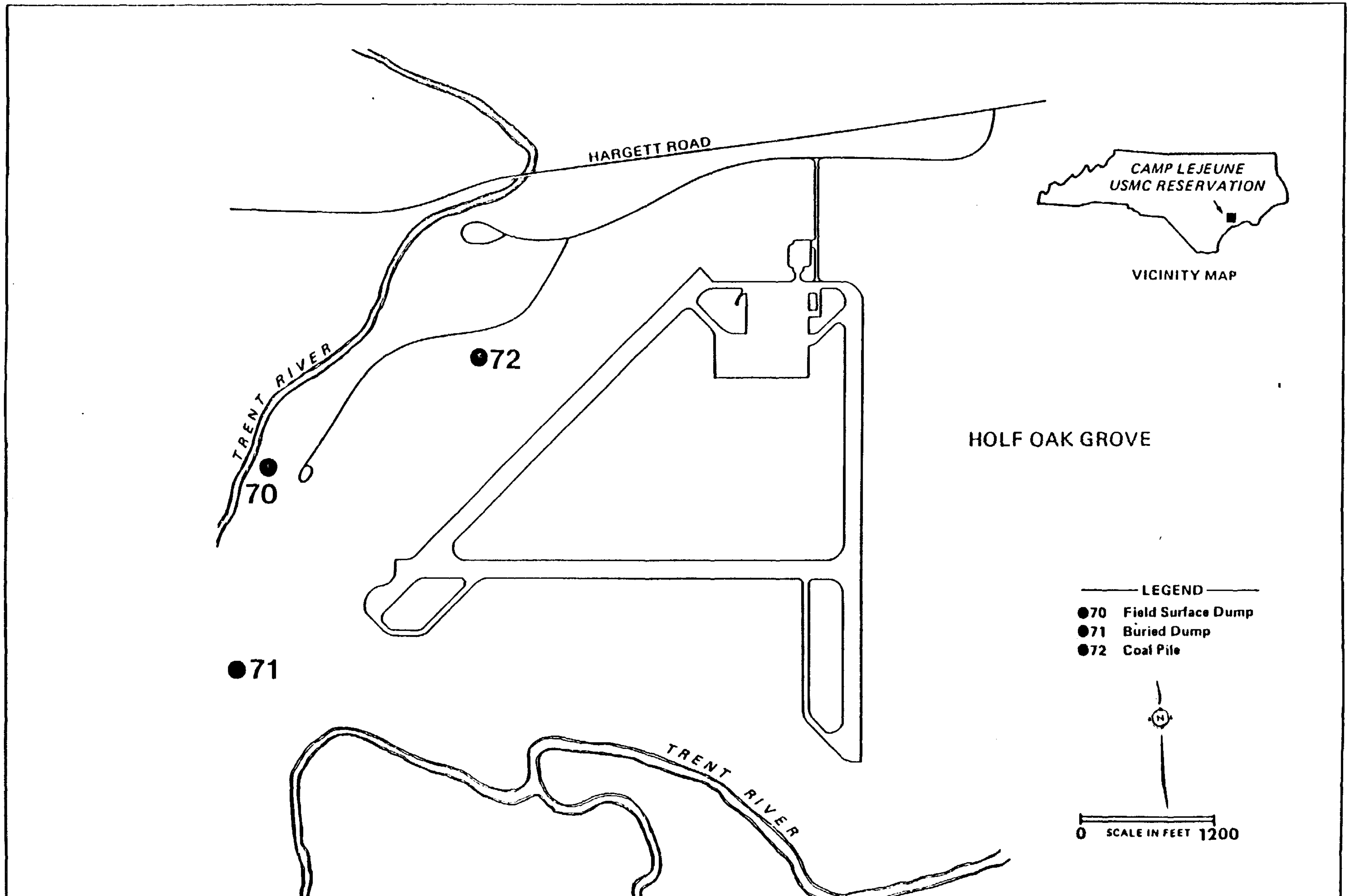

FIGURE 6–37. Site Locations at HOLF Oak Grove

Site No.: 71

Name: Oak Grove Buried Dump

Location: PWDM Coordinates 24, L1; about 1600 feet west/southwest of the southwest end of Runway 5-23

Figures and Photos: 2-1, 6-37

Size: 5 to 10 acres

Activity: Disposal site for all municipal and industrial type wastes

Materials and Quantity Involved: Paint thinner, brake fluid and cleaning compound cans, bottles, and drums

When: 1940s to 1950s

Comments: Site also apparently used as a war game training area. Various cartridge casings found on-site. Minor quantities of potentially hazardous wastes involved.

Site No.: 72

Name: Oak Grove Coal Pile

Location: PWDM Coordinates 24, F6

Figures and Photos: 2-1, 6-37

Size: About 1 acre

Activity: Coal storage for heating purposes

Materials and Quantity Involved: Coal

When: 1940

Comments: Insignificant potential residuals

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APPENDIXES

APPENDIX A

MONITORING-WELL CONSTRUCTION

APPENDIX A--MONITORING WELL CONSTRUCTION

A-1. RECOMMENDATIONS FOR GROUNDWATER MONITORING

A-1.1 Monitoring Well Inventory. Wells that have been improperly abandoned or that have been out of service for a long period are potential conduits for contamination from the water table aquifer to those deeper. Many of the wells at Camp Lejeune have been abandoned or are no longer in service, but there is not a complete inventory of the location or abandonment procedure.

It is recommended that the status of wells at the installation be clarified by determining the location of all the wells that have ever been drilled at the base. A comparison of the complete list of wells with the wells now in use will show those that have been abandoned or that are out of service. If these wells are close to and downgradient of a confirmed hazardous waste site, a further assessment of the wells' status should be made. This assessment should include the reason for abandonment or nonuse, the date when the well was last used, how it was abandoned (if applicable), future plans for the well (if not yet abandoned), and a review of any chemical/physical data available.

A satisfactory abandonment procedure involves filling the well and gravel pack with grout so that contaminants cannot migrate between aquifers.

A-1.2 Monitoring Well Installation. Each monitoring-well should be constructed so that it has both an efficient hydraulic connection to the surrounding water table aquifer and an effective seal against the migration of surface waters into the borehole.

The following techniques and materials are recommended to accomplish these two aims (Figure A-1):

1. Drill an 8-inch borehole to 10 feet below the water table, as noted during drilling. Collect representative lithologic samples every 5 feet during drilling for preparation of the lithologic log.
2. Install a string of threaded, flush-joint, 2-inch, schedule 40 PVC well casing and well screen. Set the top of a 10-foot length of PVC well screen at the water table if the water table is within approximately 5 feet of land surface. If the water table is encountered at greater depths, some portion of the well screen should be set above the water table. The recommended well-screen slot size is 0.010 inch. The top of the casing should extend approximately 12 to 18 inches above ground level.
3. After the well casing and screen have been installed in the borehole, place a filter pack of fine- to medium-grained quartz sand in the annular space from the bottom of the hole to approximately 2 feet above the top of the screen.

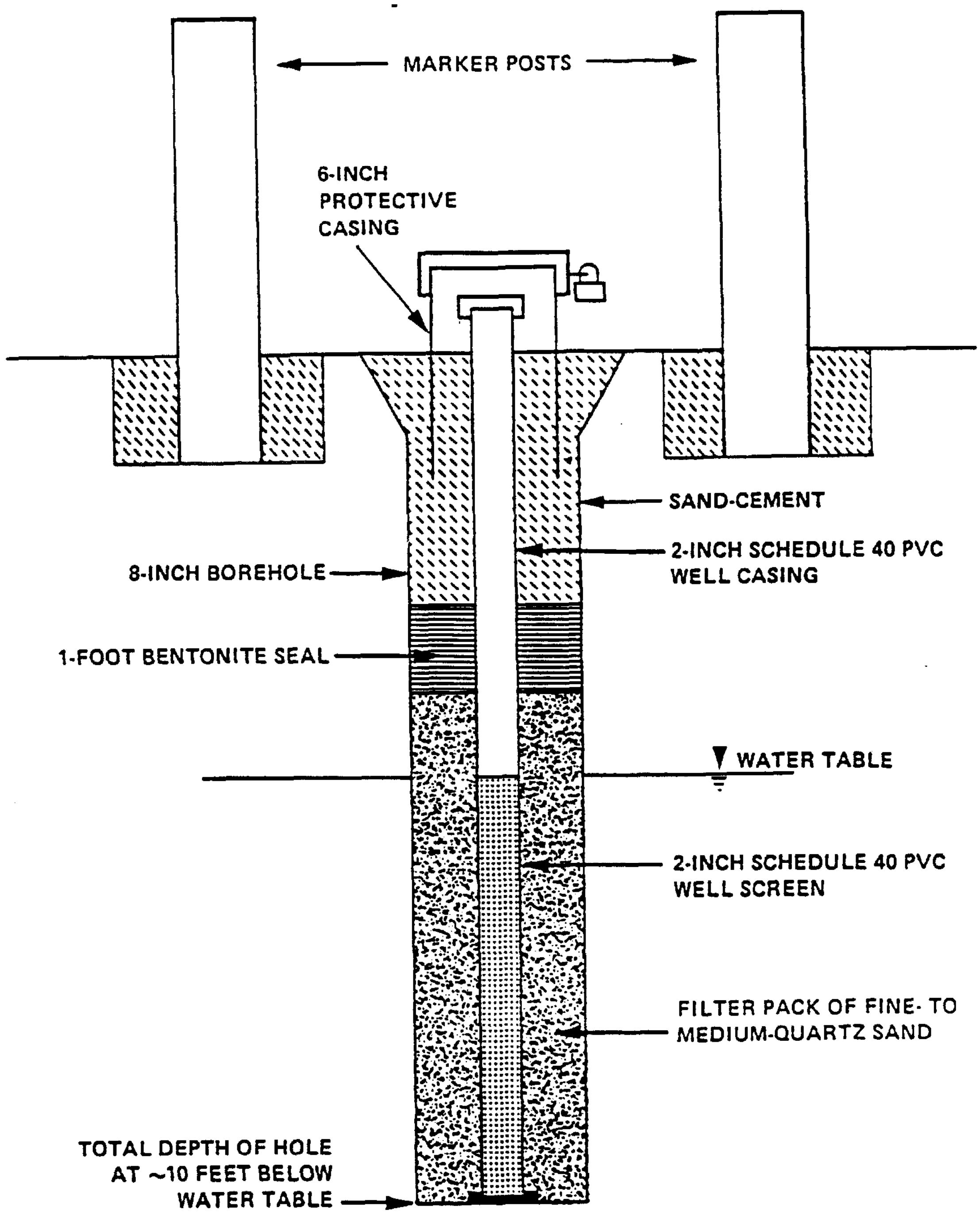


FIGURE A–1. Recommended Monitoring-Well Construction

4. Place a 1-foot seal of bentonite pellets in the annular space on top of the filter pack.
5. Fill the remainder of annular space with a sand-cement grout composed of two parts dry weight of sand to one part of cement with not more than 6 gallons of clean water per bag of cement (94 pounds or 1 cubic foot).
6. Install a 5-foot-long, 6-inch diameter, steel protective casing 3 feet into the grout. The protective casing should have a lockable steel cap and a padlock. The above-ground portions of both the protective casing and the PVC well casing should be vented with a 1/8-inch hole to permit the water in the well to fluctuate freely.
7. Install two 8-foot-long, 4-inch diameter, black steel marker posts adjacent to each well. Bury each marker post 3 feet and set it in sand-cement. Paint the upper 2 feet of each marker post day-glo orange.
8. Establish the vertical elevation and horizontal coordinates of the top of the casing (cap removed) to second order accuracy.

It may be necessary to vary the placement of the top of the screen and the thickness of the bentonite seal and the sand-cement grout if the water table is less than 5 feet below land surface.

APPENDIX B

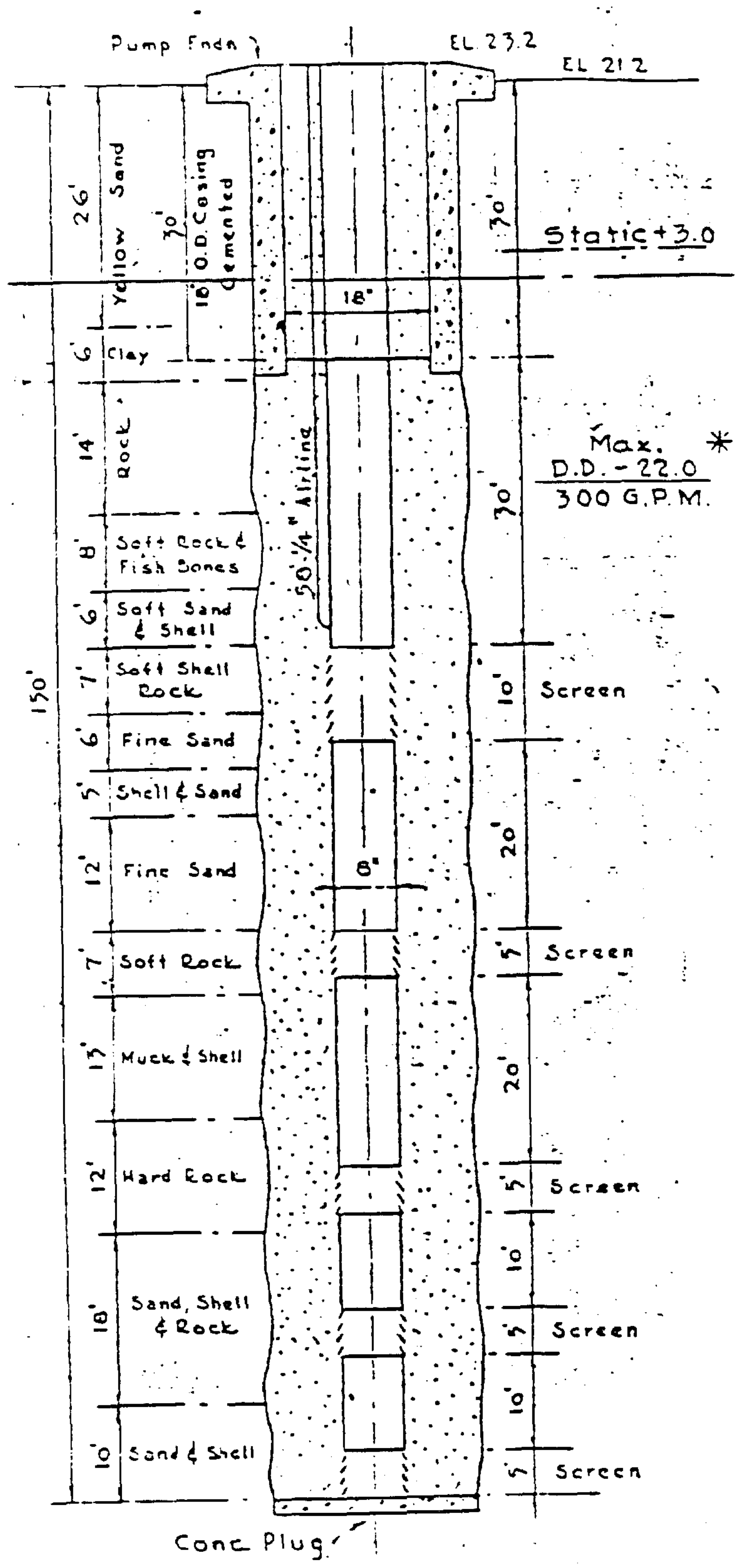
ABBREVIATIONS LIST

APPENDIX B--ABBREVIATIONS LIST

Abbreviation	Term
AID	Accident Incident Data Bank
AMTRAC(s)	Amphibious Tractor(s)
BAT	Best Available Technology
BT	Bombing Target
CIA	Controlled Industrial Area
CMC	Commandant Marine Corps
COD	Chemical Oxygen Demand
CNO	Chief of Naval Operations
CSRS	Confirmation Study Ranking System
DPDO	Defense Property Disposal Office
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
FMF	Fleet Marine Force
FSSG	Force Services Support Group
GWCI	Ground Water Contamination Indicators
HOLF(s)	Helicopter Outlying Landing Field(s)
IAS	Initial Assessment Study
IWTP	Industrial Waste Treatment Plant
LANTNAVFACENGCOM	Atlantic Division, Naval Facilities Engineering Command
MACS	Marine Air Control Squadron
MAG	Marine Aircraft Group
MCALF	Marine Corps Auxiliary Landing Field
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MC Bul	Marine Corps Bulletin
MCOLF	Marine Corps Outlying Landing Field
MEK	Methyl Ethyl Ketone
NACIP	Navy Assessment and Control of Installation Pollutants
NAVAIREWORKFAC	Naval Air Rework Facility
NAVFACENGCOM	Naval Facilities Engineering Command
NBC	Nuclear, Biological, Chemical
NCBC	Naval Construction Battalion Center
NEESA	Naval Energy and Environmental Support Activity
NCIC	National Cartographic Information Center
NREA	Natural Resources and Environmental Affairs
NSWC	Naval Surface Weapons Center
OESO	Ordnance Environmental Support Office
OLF(s)	Outlying Landing Fields
POL	Petroleum, Oil, Lubricant(s)
PWDM	Public Works Development Map
RCRA	Resource Conservation Recovery Act
SAFEORD	Safety Ordnance File
STP	Sewage Treatment Plant
TCE	Trichloroethylene
THM	Trihalomethane(s)
WAR	Water and Air Research, Inc.
WTP	Waste Treatment Plant
2d FSSG	Second Force Service Support Group

APPENDIX C

LOGS OF WELL NOS. HP-613 and HP-616



Pump Fndn
EL 23.2
EL 21.2
26'
Yellow Sand
30'
18" O.D. Casing Cemented
30'
Static +3.0
18"
6'
Clay
14'
Rock
50'-1/4" Airline
Max. D.D. - 22.0
300 G.P.M.
30'
8'
Soft Rock & Fish Bones
6'
Soft Sand & Shell
7'
Soft Shell Rock
10'
Screen
150'
6'
Fine Sand
5'
Shell & Sand
12'
Fine Sand
8"
20'
7'
Soft Rock
5'
Screen
13'
Muck & Shell
20'
12'
Hard Rock
5'
Screen
10'
18'
Sand, Shell & Rock
5'
Screen
10'
10'
Sand & Shell
5'
Screen
Conc. Plug

HP-613

Site	SC status	SA status	
903	F 25 Aug 93	Trueman has not ruled; contam. GW	
1115	Draft only ?	Field work done	
A-47-3	F 21 May 93	Field work done	
AS-114	F 21 May 93	negotiate for closure	N
AS-118	F 21 May 93 Add 5-well SC to Wright	pending 5-well SC results	
AS-410N	F 21 May 93	Field work done	
AS-410S	F 7 Jun 93 Add 5-well SC to GTI	pending 5-well SC results	
AS-522	F 21 May 93	work ordered	
AS-804	F 26 May 93	negotiate for closure	N
AS-822	F 21 May 93	work ordered	
AS-843	Draft only 6 Aug 93	pending final SC	
AS-849	F 26 May 93	negotiate for closure	N
AS-3000	F 9 Jul 93	negotiate for closure	N
AS-3504	F 23 Jul 93	negotiate for closure	N
AS-4158	F 26 May 93	Field work done	
BB-9	F 25 Aug 93	Field work done	
BB-51	F 23 Sep 93	Work ordered	
BB-71	F 23 Sep 93	pending add soil + water analysis	
BB-177	F 14 Oct 93	Trueman has not ruled; contam. GW	
FC-102	F 16 Jul 93 Add 5-well SC to Wright	pending 5 well SC results	
FC-120	F 9 Jul 93	pending add soil + water analysis	
FC-201E	F 23 Jul 93	Work ordered	
FC-201W	F 6 Jul 93	negotiate for closure	N
H-30	F 25 Aug 93	Trueman has not ruled; contam GW	
LCH-4022	F 9 Jul 93	Work ordered	
STT-39A	F 30 Jul 93	Work ordered	
STT-69	F 30 Jul 93	Work ordered	
TT-2455	F 6 Jul 93	Field work done	
TT-2477-3	F 14 Oct 93	Trueman has not ruled; clean	

STATUS REPORT - Underground Storage Tanks (UST)

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
91	S143H		LAW		MCB LEJ	Camp Geiger	SA	Compl	Compl		29-Sep-91	25-Jul-91	6-Nov-91	8-Feb-92		
92	S143H	4	90-7625		MCB LEJ	Camp Geiger FF	SA	18-Feb-92	18-Feb-92		28-Sep-92		22-Feb-93		Draft Report Under Review	2086
94	S143H	1			MCB LEJ	Camp Geiger FF		Moved to IR Program							Memo 9 Sep 93	
91	S143H		BAKER	13	MCB LEJ	Campbell St. FF	SA	Compl	Compl		27-Sep-91	4-Dec-91	20-Feb-92	13-Jul-92		
92	S143H	4	BAKER	13	MCB LEJ	Campbell St. FF	SA	6-Apr-92	6-Apr-92		9-Nov-92		15-Feb-93		Draft Report Under Review	9559
94	S143H	2	Activity		MCB LEJ	Campbell St. FF	LTR									
94	S143G	2	93-4020		MCB LEJ	Campbell St. FF	DES								Scope Due 1 Mar 94	
95	S143G	1	93-3033		MCB LEJ	Campbell St. FF	RA									25000
96	S143G				MCB LEJ	Campbell St. FF	OP									7500
92	S143H	3	BAKER	122	MCB LEJ	AS4151 Pipe	SA	8-Apr-92	8-Apr-92		6-May-92	3-Jun-92	3-Aug-92		Hold For Added SA & Draft No. 2	6073
93	S143H	2	BAKER		MCB LEJ	AS4151 Pipe	SA	18-Nov-92	18-Nov-92		8-Dec-92	7-Jan-93	16-Mar-93		Draft Report Under Review	63834
94	S143H	3	Activity		MCB LEJ	AS4151 Pipe	LTR									
95	S143G	2	93-4020		MCB LEJ	AS4151 Pipe	DES									20000
96	S143G		93-3033		MCB LEJ	AS4151 Pipe	RA									150000
97	S143G				MCB LEJ	AS4151 Pipe	OP									75000
91	S143H		VERSAR		MCB LEJ	Marina	SA	Compl	Compl		30-Sep-91	30-Oct-91	26-Feb-92	9-Apr-92		71716
92	S143H	3	VERSAR		MCB LEJ	Marina	CAP	5-Dec-91	6-Jan-92	#######	17-Jan-92		22-Jun-92	2-Nov-92		10573
93	S143G	4	93-4020		MCB LEJ	Marina	DES	23-Feb-93	23-Feb-93						Due 20 May 94	25000
94	S143G	3	93-3033		MCB LEJ	Marina	RA									150000
95	S143G	3			MCB LEJ	Marina	OP									37000

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
	STATUS REPORT - Underground Storage Tanks (UST)															
91	S143H		OBG		MCB LEJ	Tanks 889-891	SA	Compl	Compl		30-Sep-91	31-Oct-91	7-Jan-92	14-Apr-92		
92	S143H	4	OBG		MCB LEJ	Tanks 889-891	SA	24-Feb-92	24-Feb-92		3-Nov-92		14-Dec-92		Hold comm's/final-new soil regs	23463
94	S143H	3	Activity		MCB LEJ	Tanks 889-891	LTR									
95	S143G	2	93-4020		MCB LEJ	Tanks 889-891	DES									25000
96	S143G		93-3033		MCB LEJ	Tanks 889-891	RA									150000
91	S143H		OBG		MCB LEJ	Tank S781	SA	Compl	Compl		30-Sep-91	8-Nov-91	12-Feb-92	2-Jun-92		
92	S143H	4	OBG		MCB LEJ	Tank S781	SA	27-Mar-92	27-Mar-92		30-Sep-92		2-Nov-92	17-May-93		27035
94	S143H	1			MCB LEJ	Tank S781		LEJ MOVED TO IR PROGRAM								
91	S143H		OBG		MCB LEJ	Tank STT-61	SA	Compl	Compl		30-Sep-91	25-Nov-91	18-Feb-92	17-Apr-92		
92	S143H	4	OBG		MCB LEJ	Tank STT-61	SA	28-Feb-92	28-Feb-92		3-Nov-92		22-Jan-93	7-Jun-93		46447
94	S143H	1			MCB LEJ	Tank STT-61		(Try Going Passive With Monitoring)								
94	S143G	3			MCB LEJ	Tank STT-61	MON									
95	S143G	1			MCB LEJ	Tank STT-61	MON									
91	S143H		OBG		MCB LEJ	Camp Johnson	SA	Compl	Compl		30-Sep-91	17-Oct-91	13-Dec-91	21-Jan-92	Tanks M232-M236	
92	S143H	4	OBG		MCB LEJ	Camp Johnson	SA	5-May-92	5-May-92		3-Nov-92		3-Feb-93	15-Jul-93		19849
94	S143H	1	93-4020		MCB LEJ	Camp Johnson	SA								Retest GW EPA 610	

STATUS REPORT - Underground Storage Tanks (UST)																
Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
92	S143G				MCB LEJ	Hadnot Pt. FF	RA	N/A	N/A	To Code 05/Op's Thru FY 92					$50,000 via OA 29 Apr 92	
92	S143G				MCB LEJ	Hadnot Pt. FF	RA	15-Jan-92	15-Jan-92		7-Apr-92				Air Permit	
93	S143G	1	91-7421		MCB LEJ	Hadnot Pt. FF	OP								Request to 183 5 & 17 Nov 92	52444
93	S143G	1	91-7421		MCB LEJ	Hadnot Pt. FF	OP								Request to 183 1 Mar 93	17000
93	S143G	1	91-7421		MCB LEJ	Hadnot Pt. FF	OP								FSC IDQ Portion	5000
94	S143G	1	91-7421		MCB LEJ	Hadnot Pt. FF	OP								Req To 183 on 8 Oct 93	51050
95	S143G	1	91-7421		MCB LEJ	Hadnot Pt. FF	OP									75000
91	S143G		Allen		MCB LEJ	Tar. Ter. Serv. Sta.	RA								Const Award 23 Sept 91	
92	S143G		OBG		MCB LEJ	Tar. Ter. Serv. Sta.	ATC	15-Jan-92	15-Jan-92		7-Apr-92				ATC & Air Permit	
94	S143G	1			MCB LEJ	Tar. Ter. Serv. Sta.	OP								Req To 183 on 8 Oct 93	49954
95	S143G	1			MCB LEJ	Tar. Ter. Serv. Sta.	OP									75000
91	S143G		Allen		MCB LEJ	JP-5 Pipe (AS 4141)	RA								Const Award 23 Sept 91	
92	S143G		OBG		MCB LEJ	JP-5 Pipe (AS 4141)	ATC	15-Jan-92	15-Jan-92		7-Apr-92				ATC & Air Permit	
94	S143G	1			MCB LEJ	JP 5 Pipe(AS 4141)	OP								Req To 183 on 8 Oct 93	49954
95	S143G	1			MCB LEJ	JP 5 Pipe(AS 4141)	OP									75000
92	S143G		OBG		MCB LEJ	Rapid Refueler	ATC	15-Jan-92	15-Jan-92		7-Apr-92				ATC & Air Permit	
93	S143G	1	MCON		MCB LEJ	Rapid Refueler	RA									275000
94	S143G	1	MCON		MCB LEJ	Rapid Refueler	OP								To MCON 1 Jun 94	25000
95	S143G	1	MCON		MCB LEJ	Rapid Refueler	OP									25000

STATUS REPORT - Underground Storage Tanks (UST)

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
94	S143H	2	93-4020		MCB LEJ	Rapid Refueler	SA								Scope Due 1 Mar 94	100000
95	S143H	1	93-4020		MCB LEJ	Rapid Refueler	SA									
95	S143H	4	Activity		MCB LEJ	Rapid Refueler	LTR									
96	S143G	2	93-4020		MCB LEJ	Rapid Refueler	DES									
97	S143G	1	93-3033		MCB LEJ	Rapid Refueler	RA									
92	S143H	4	90-7625		MCB LEJ	Tank 941,Bldg 45	SA	28-Feb-92	28-Feb-92		28-Sep-92	27-Nov-92	5-Apr-93		Draft Report Under Review	50570
93	S143H	4	93-4020		MCB LEJ	Tank 941,Bldg 45	SA	7-Apr-93	7-Apr-93						Added Field Work	50794
94	S143H	2	Activity		MCB LEJ	Tank 941,Bldg 45	LTR									
94	S143G	2	93-4020		MCB LEJ	Tank 941,Bldg 45	DES								Scope Due 1 Mar 94	
95	S143G	2	93-3033		MCB LEJ	Tank 941,Bldg 45	RA									150000
96	S143G				MCB LEJ	Tank 941,Bldg 45	OP									75000
92	S143H	3	BAKER	111	MCB LEJ	Tank H-28, Hosp Pt	SA	27-Feb-92	27-Feb-92		26-Mar-92		15-Jun-92	18-Dec-92		48982
94	S143H	2	Activity		MCB LEJ	Tank H-28, Hosp Pt	LTR									
94	S143G	2	93-4020		MCB LEJ	Tank H-28, Hosp Pt	DES								Scope Due 1 Mar 94	25000
94	S143G	4	93-3033		MCB LEJ	Tank H-28, Hosp Pt	RA								Design Due 1 Jul 94	150000
92	S143H	4	90-7625		MCB LEJ	Tank 820,Berk Man	SA	28-Feb-92	28-Feb-92		28-Sep-92	2-Nov-92	29-Apr-93		Draft Report Under Review	53320
93	S143H	4	93-4020		MCB LEJ	Tank 820,Berk Man	SA	14-May-93	14-May-93						Added Field Work	80695
94	S143H	3	Activity		MCB LEJ	Tank 820,Berk Man	LTR									
95	S143G	2	93-4020		MCB LEJ	Tank 820,Berk Man	DES									
96	S143G		93-3033		MCB LEJ	Tank 820,Berk Man	RA									150000
97	S143G				MCB LEJ	Tank 820,Berk Man	OP									75000

STATUS REPORT - Underground Storage Tanks (UST)

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
92	S143H	3	BAKER	110	MCB LEJ	Bldg 21, WWTP	SA	27-Feb-92	27-Feb-92		26-Mar-92		6-Jul-92	12-Jan-93		82537
93	S143H	2	BAKER	110	MCB LEJ	Bldg 21, WWTP	SA	16-Dec-92	16-Dec-92		26-Jan-93	3-Feb-93	14-Jul-93		Draft Report Under Review	46409
94	S143H	2	Activity		MCB LEJ	Bldg 21, WWTP	LTR									
94	S143G	2	93-4020		MCB LEJ	Bldg 21, WWTP	DES								Scope Due 1 Mar 94	
95	S143G	1	93-3033		MCB LEJ	Bldg 21, WWTP	RA									150000
96	S143G				MCB LEJ	Bldg 21, WWTP	OP									75000
92	S143H	4	90-7625		MCB LEJ	Bldg 912,Mini-C	SA	28-Feb-92	28-Feb-92		28-Sep-92	2-Nov-92	8-Mar-93		Draft Report Under Review	51674
93	S143H	4	93-4020		MCB LEJ	Bldg 912,Mini-C	SA	22-Mar-93	22-Mar-93						Added Field Work	35707
94	S143H	2	Activity		MCB LEJ	Bldg 912,Mini-C	LTR									
94	S143G	2	93-4020		MCB LEJ	Bldg 912,Mini-C	DES								Scope Due 1 Mar 94	
95	S143G	2	93-3033		MCB LEJ	Bldg 912,Mini-C	RA									150000
96	S143G	2			MCB LEJ	Bldg 912,Mini-C	OP									75000
92	S143H	3	BAKER	108	MCB LEJ	Bldg 72, Rifle Range	SA	27-Feb-92	27-Feb-92		26-Mar-92		15-Jun-92	12-Oct-92		46765
93	S143H	2	BAKER	108	MCB LEJ	Bldg 72, Rifle Range	SA	20-Nov-92	20-Nov-92		22-Jan-93	7-Jan-93	17-Mar-93		Draft Report Under Review	60512
94	S143H	3	Activity		MCB LEJ	Bldg 72, Rifle Range	LTR									
95	S143G	2	93-4020		MCB LEJ	Bldg 72, Rifle Range	DES									
96	S143G		93-3033		MCB LEJ	Bldg 72, Rifle Range	RA									150000
97	S143G				MCB LEJ	Bldg 72, Rifle Range	OP									75000
92	S143H	3	BAKER	109	MCB LEJ	Bldg A-47 Diesel	SA	27-Feb-92	27-Feb-92		26-Mar-92		19-Jun-92	14-Oct-92		63589
93	S143H	2	BAKER		MCB LEJ	Bldg A-47 Diesel	SA	20-Nov-92	20-Nov-92		22-Jan-93	12-Jan-93	1-Apr-93		Draft Report Under Review	77268
94	S143H	3	Activity		MCB LEJ	Bldg A-47 Diesel	LTR									
95	S143G	1	93-4020		MCB LEJ	Bldg A-47 Diesel	DES									
96	S143G		93-3033		MCB LEJ	Bldg A-47 Diesel	RA									150000
97	S143G				MCB LEJ	Bldg A-47 Diesel	OP									75000

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
	STATUS REPORT - Underground Storage Tanks (UST)															
92	S143H	3			MCB LEJ	Tar Ter Bldg 2478	SC							25-Nov-92		
93	S143H	4	91-6656		MCB LEJ	Tar Ter Bldg 2478	SA	9-Dec-92	9-Dec-92			21-Sep-93				82110
94	S143H	2	Activity		MCB LEJ	Tar Ter Bldg 2478	SA								Add SA Scope Due 1 Mar 94	50000
94	S143H	3	Activity		MCB LEJ	Tar Ter Bldg 2478	LTR									
95	S143G	1	93-4020		MCB LEJ	Tar Ter Bldg 2478	DES									
96	S143G		93-3033		MCB LEJ	Tar Ter Bldg 2478	RA									150000
97	S143G				MCB LEJ	Tar Ter Bldg 2478	OP									75000
92	S143H	3			MCB LEJ	Geiger Heat Plant	SC						9-Jul-92	28-Sep-92		
93	S143H	4	93-4020		MCB LEJ	Geiger Heat Plant	SA	23-Mar-93	23-Mar-93							75000
94	S143H	2	93-4020		MCB LEJ	Geiger Heat Plant	SA								Add SA Scope Due 1 Mar 94	50000
94	S143H	4	Activity		MCB LEJ	Geiger Heat Plant	LTR									
95	S143G	2	93-4020		MCB LEJ	Geiger Heat Plant	DES									25000
96	S143G		93-3033		MCB LEJ	Geiger Heat Plant	RA									150000
97	S143G				MCB LEJ	Geiger Heat Plant	OP									75000
92	S143H	2	GTI		MCB LEJ	Bldg A-47 F Pumps	SC						8-Apr-93	2-Jun-93		
93	S143H	4	93-4020C		MCB LEJ	Bldg A-47 F Pumps	SA	12-Apr-93	12-Apr-93			8-Oct-93				75000
94	S143H	3	93-4020		MCB LEJ	Bldg A-47 F Pumps	SA								Add SA Scope Due 15 Jun 94	50000
95	S143H	1	Activity		MCB LEJ	Bldg A-47 F Pumps	LTR									
95	S143H		93-4020		MCB LEJ	Bldg A-47 F Pumps	DES									
96	S143H		93-3033		MCB LEJ	Bldg A-47 F Pumps	RA									
97	S143H				MCB LEJ	Bldg A-47 F Pumps	OP									

	STATUS REPORT - Underground Storage Tanks (UST)															
Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
92	S143H	2	GTI		MCB LEJ	Bldg BB-9	SC						24-May-93	25-Aug-93		
93	S143H	3	93-4020C		MCB LEJ	Bldg BB-9	SA	3-Jun-93	3-Jun-93			21-Sep-93				7505
94	S143H	4	Activity		MCB LEJ	Bldg BB-9	LTR									
95	S143H	1	93-4020		MCB LEJ	Bldg BB-9	DES									
96	S143H		93-3033		MCB LEJ	Bldg BB-9	RA									
97	S143H				MCB LEJ	Bldg BB-9	OP									
92	S143H	2			MCB LEJ	Bldg H-30	SC						7-Jun-93	25-Aug-93		
93	S143H	4			MCB LEJ	Bldg H-30	SC	16-Jul-93						29-Sep-93	High EPA 610 hits	
94	S143H				MCB LEJ	Bldg H-30	SA									
92	S143H	2	GTI		MCB LEJ	Bldg FC-102	SC						19-Apr-93	16-Jul-93		
93	S143H	3	GTI		MCB LEJ	Bldg FC-102	SC	5-May-93						1-Sep-93	Mod EPA 610 hits	
93	S143H	4			MCB LEJ	Bldg FC-102	SC		Added 5-Well Site Check						Req to CH on 2 Sep 93	
92	S143H	2	GTI		MCB LEJ	Bldg AS-410 North	SC						5-Apr-93	2-Jun-93		
93	S143H	4	93-4020C		MCB LEJ	Bldg AS-410 North	SA	12-Apr-93	12-Apr-93			8-Oct-93				79647
94	S143H	3	93-4020C		MCB LEJ	Bldg AS-410 North	SA								Add SA Scope Due 15 Jun 94	50000
95	S143H	1	Activity		MCB LEJ	Bldg AS-410 North	LTR									
95	S143H		93-4020		MCB LEJ	Bldg AS-410 North	DES									
96	S143H		93-3033		MCB LEJ	Bldg AS-410 North	RA									
97	S143H				MCB LEJ	Bldg AS-410 North	OP									
92	S143H	2	GTI		MCB LEJ	Bldg AS-410South	SC						5-Apr-93	7-Jun-93		
93	S143H	3	GTI		MCB LEJ	Bldg AS-410South	SC	5-May-93						1-Sep-93	Low EPA 610 hits	
93	S143H	4			MCB LEJ	Bldg AS-410South	SC		Added 5_Well Site Check						Req to CH on 2 Sep 93	

STATUS REPORT - Underground Storage Tanks (UST)

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
92	S143H	2	GTI		MCB LEJ	Bldg AS-3504	SC						19-Apr-93	23-Jul-93		
93	S143H	3	GTI		MCB LEJ	Bldg AS-3504	SC	5-May-93						19-Aug-93	Clean-Try Site Closure	
92	S143H	2	GTI		MCB LEJ	Bldg AS-118	SC						5-Apr-93	2-Jun-93		
93	S143H	3	GTI		MCB LEJ	Bldg AS-118	SC	5-May-93						1-Sep-93	Low EPA 610 hits	
93	S143H	4			MCB LEJ	Bldg AS-118	SC		Added 5_Well Site Check						Req to CH on 2 Sep 93	
92	S143H	2	GTI		MCB LEJ	Bldg TT-2455	SC						22-Apr-93	6-Jul-93		
93	S143H	3	93-4020C		MCB LEJ	Bldg TT-2455	SA	27-Apr-93	27-Apr-93			21-Sep-93				72057
94	S143H	3	93-4020		MCB LEJ	Bldg TT-2455	SA								Add SA Scope Due 15 Jun 94	50000
95	S143H	1	Activity		MCB LEJ	Bldg TT-2455	LTR									
95	S143H		93-4020		MCB LEJ	Bldg TT-2455	DES									
96	S143H		93-3033		MCB LEJ	Bldg TT-2455	RA									
97	S143H				MCB LEJ	Bldg TT-2455	OP									
92	S143H	2	GTI		MCB LEJ	Bldg LCH -4022	SC						28-Apr-93	9-Jul-93		
93	S143H	3	93-4020		MCB LEJ	Bldg LCH -4022	SA	30-Apr-93	30-Apr-93			21-Oct-93				82171
94	S143H	4	Activity		MCB LEJ	Bldg LCH -4022	LTR									
95	S143H	1	93-4020		MCB LEJ	Bldg LCH -4022	DES									
96	S143H		93-3033		MCB LEJ	Bldg LCH -4022	RA									
97	S143H				MCB LEJ	Bldg LCH -4022	OP									

	STATUS REPORT - Underground Storage Tanks (UST)															
Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
92	S143H	2	GTI		MCB LEJ	Bldg AS-4158	SC						19-Apr-93	7-Jun-93		
93	S143H	3	93-4020		MCB LEJ	Bldg AS-4158	SA	23-Apr-93	23-Apr-93			18-Oct-93				
94	S143H	3	93-4020		MCB LEJ	Bldg AS-4158	SA								Add SA Scope Due 15 Jun 94	50000
95	S143H	1	Activity		MCB LEJ	Bldg AS-4158	LTR									
95	S143H		93-4020		MCB LEJ	Bldg AS-4158	DES									
96	S143H		93-3033		MCB LEJ	Bldg AS-4158	RA									
97	S143H				MCB LEJ	Bldg AS-4158	OP									
92	S143H		GTI		MCB LEJ	Bldg AS-849	SC						8-Apr-93	18-Jun-93		
93	S143H		GTI		MCB LEJ	Bldg AS-849	SC	5-May-93						30-Aug-93	Clean-Try Site Closure	
92	S143H	2	GTI		MCB LEJ	Bldg AS-114	SC						5-Apr-93	2-Jun-93		
93	S143H	3	GTI		MCB LEJ	Bldg AS-114	SC	5-May-93						1-Sep-93	Clean-Try Site Closure	
92	S143H	2	GTI		MCB LEJ	Bldg FC-201 East	SC						29-Apr-93	23-Jul-93		
93	S143H	3	93-4020		MCB LEJ	Bldg FC-201 East	SA	6-May-93	6-May-93							83364
95	S143H	1	Activity		MCB LEJ	Bldg FC-201 East	LTR									
95	S143H		93-4020		MCB LEJ	Bldg FC-201 East	DES									
96	S143H		93-3033		MCB LEJ	Bldg FC-201 East	RA									
97	S143H				MCB LEJ	Bldg FC-201 East	OP									
92	S143H	2	GTI		MCB LEJ	Bldg FC-201 West	SC						3-May-93	6-Jul-93		
93	S143H	3	GTI		MCB LEJ	Bldg FC-201 West	SC	5-May-93						1-Sep-93	Clean-Try Site Closure	

STATUS REPORT - Underground Storage Tanks (UST)

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
92	S143H	2	GTI		MCB LEJ	Bldg AS-822	SC						13-Apr-93	2-Jun-93		
93	S143H	3	93-4020		MCB LEJ	Bldg AS-822	SA	22-Apr-93	22-Apr-93							75000
94	S143H	3	93-4020		MCB LEJ	Bldg AS-822	SA								Add SA SCope Due 15 Jun 94	50000
95	S143H	1	Activity		MCB LEJ	Bldg AS-822	LTR									
95	S143H		93-4020		MCB LEJ	Bldg AS-822	DES									
96	S143H		93-3033		MCB LEJ	Bldg AS-822	RA									
97	S143H				MCB LEJ	Bldg AS-822	OP									
92	S143H	2	GTI		MCB LEJ	Bldg AS-522	SC						5-Apr-93	2-Jun-93		
93	S143H	3	GTI		MCB LEJ	Bldg AS-522	SC	5-May-93						19-Aug-93		
93	S143H	4	93-4020		MCB LEJ	Bldg AS-522	SA	1-Sep-93	1-Sep-93							72304
94	S143H	4	Activity		MCB LEJ	Bldg AS-522	LTR									
95	S143H		93-4020		MCB LEJ	Bldg AS-522	DES									
96	S143H		93-3033		MCB LEJ	Bldg AS-522	RA									
97	S143H				MCB LEJ	Bldg AS-522	OP									
92	S143H	2	GTI		MCB LEJ	Bldg AS-3000	SC						19-Apr-93	9-Jul-93		
93	S143H	3	GTI		MCB LEJ	Bldg AS-3000	SC	5-May-93						18-Aug-93	Clean-Try Site Closure	
92	S143H	2	GTI		MCB LEJ	Bldg AS-804	SC						19-Apr-93	18-Jun-93		
93	S143H	3	GTI		MCB LEJ	Bldg AS-804	SC	5-May-93						1-Sep-93	Clean-Try Site Closure	

STATUS REPORT - Underground Storage Tanks (UST)

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
92	S143H	2	GTI		MCB LEJ	Bldg STT-39A	SC						29-Apr-93	30-Jul-93		
93	S143H	3	GTI		MCB LEJ	Bldg STT-39A	SC	5-May-93						1-Sep-93	High EPA 610 hits	
93	S143H	4	93-4020		MCB LEJ	Bldg STT-39A	SA	7-Sep-93	7-Sep-93							71238
94	S143H	4	Activity		MCB LEJ	Bldg STT-39A	LTR									
95	S143H		93-4020		MCB LEJ	Bldg STT-39A	DES									
96	S143H		93-3033		MCB LEJ	Bldg STT-39A	RA									
97	S143H				MCB LEJ	Bldg STT-39A	OP									
92	S143H	2	GTI		MCB LEJ	Bldg STT-69	SC							30-Jul-93		
93	S143H	3	93-4020		MCB LEJ	Bldg STT-69	SA	28-Apr-93	28-Apr-93			16-Nov-93				82127
94	S143H	4	Activity		MCB LEJ	Bldg STT-69	LTR									
95	S143H		93-4020		MCB LEJ	Bldg STT-69	DES									
96	S143H		93-3033		MCB LEJ	Bldg STT-69	RA									
97	S143H				MCB LEJ	Bldg STT-69	OP									
92	S143H		GTI		MCB LEJ	Bldg FC-120	SC						19-Apr-93	9-Jul-93		
93	S143H		GTI		MCB LEJ	Bldg FC-120		5-May-93						13-Sep-93	Clean-try site closure	
93	S143H	2	GTI		MCB LEJ	Bldg 903	SC						19-May-93	25-Aug-93		
93	S143H	3	GTI		MCB LEJ	Bldg 903	SC							30-Sep-93	Low EPA 610 hits	
93	S143H	2	GTI		MCB LEJ	Bldg BB-71	SC						24-May-93			
93	S143H	3	GTI		MCB LEJ	Bldg BB-71	SC								Req to CH/Do EPA 610	

STATUS REPORT - Underground Storage Tanks (UST)

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
93	S143H	2	GTI		MCB LEJ	Bldg BB-51	SC						24-May-93	23-Sep-93		
93	S143H	3	93-4020		MCB LEJ	Bldg BB-51	SA	3-Jun-93	3-Jun-93							74468
94	S143H	4	Activity		MCB LEJ	Bldg BB-51	LTR									
95	S143H		93-4020		MCB LEJ	Bldg BB-51	DES									
96	S143H		93-3033		MCB LEJ	Bldg BB-51	RA									
97	S143H				MCB LEJ	Bldg BB-51	OP									
93	S143H	2			MCB LEJ	BLDG AS 843	SC						6-Aug-93			
93	S143H	2			MCB LEJ	Bldg BB-177	SC						25-Aug-93			
94	S143H	1			MCB LEJ	Bldg BB-177	SA									
93	S143H	3	GTI		MCB LEJ	Bldg 1115	SC						16-Jul-93			
93	S143H	4	93-4020		MCB LEJ	Bldg 1115	SA	12-Aug-93	12-Aug-93			21-Oct-93				84679
94	S143H	4	Activity		MCB LEJ	Bldg 1115	LTR									
95	S143H		93-4020		MCB LEJ	Bldg 1115	DES									
96	S143H		93-3033		MCB LEJ	Bldg 1115	RA									
97	S143H				MCB LEJ	Bldg 1115	OP									
93	S143H	3			MCB LEJ	Bldg TT-2477	SC						24-Sep-93	14-Oct-93	Low TPH-try site closure	
93	S143H	4			MCB LEJ	UST 1310	SC									
93	S143H	4			MCB LEJ	UST 1607	SC									
93	S143H	4			MCB LEJ	AS 2804	SC									

STATUS REPORT - Underground Storage Tanks (UST)

Yr	PCR#	Qr	A/E Cont	CTO	Activity	Description		SCOPE	GCE	NEGOT	Award	P. Reps	Dr. Rep	Fin Rep	Remarks	Cost
93	S143H	4			MCB LEJ	BA 130	SC									
93	S143H	4			MCB LEJ	M 101	SC									
93	S143H	4			MCB LEJ	UST 61	SC									
93	S143H	4			MCB LEJ	AS 840	SC									
93	S143H	4			MCB LEJ	AS 4146	SC									
93	S143H	4			MCB LEJ	M 90	SC									
93	S143H	4			MCB LEJ	SLCH 4019	SC									
93	S143H	4			MCB LEJ	HP 645	SC									
93	S143H	4			MCB LEJ	TT 246	SC									
94	S143H				MCB LEJ	Dummy SA	SA									147000
94	S143H				MCB LEJ	Dummy RA	RA									274042