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# Sampling Design Plan

**U.S. Army Training Center, Fort Dix, NJ**

PREPARED FOR  
U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY  
ABERDEEN PROVING GROUND, MARYLAND 21010

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EA ENGINEERING,  
SCIENCE, AND  
TECHNOLOGY, INC.

**FINAL**

U.S. ARMY TRAINING CENTER, FORT DIX  
SAMPLING DESIGN PLAN/SAFETY PLAN

CONTRACT NO. DAAA 15-85-C-00 82

Prepared for

U.S. Army Toxic and Hazardous Materials Agency  
Aberdeen Proving Ground, Maryland 21010

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January 1986



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## ABSTRACT

EA Engineering, Science, and Technology, Inc., under Contract No. DAAA15-85-C-0082 to the U.S. Toxic and Hazardous Materials Agency (USATHAMA), is performing an environmental reassessment of the U.S. Army Training Center, Fort Dix, New Jersey. As part of the reassessment, limited onsite sampling and analysis will be completed. The following report summarizes work completed to date, establishes site information, and concludes with the recommended Sampling Design Plan.

The Post, approximately 32,600 acres, is a major training facility, in operation since World War I. Based on a review of available data and onsite investigation of over 40 sites by the Installation Reassessment Team, 14 areas have been chosen for additional sampling. The purpose of this sampling is to confirm or disprove suspected contamination. Because ground-water contamination is suspected at 8 sites, a total of 28 monitoring wells will be installed to sample ground water. Contaminated soils are suspected at one site and 10 soil samples will be collected. Abandoned underground storage tanks are suspected in five areas which are slated for electromagnetic surveys. This report details the available background information on these sites and provides the justification and methodology for drilling, sampling, and sample analysis.



## 1. INTRODUCTION

### 1.1 BACKGROUND

#### Location

Fort Dix is located in central New Jersey approximately 16 miles southeast of Trenton. Figure 1, Regional Location Plan, depicts the location within the state. The post is adjacent to several communities and other military facilities. Wrightstown and New Egypt are to the north. Pemberton, New Lisbon, and Browns Mills are to the south. Mount Holly is six miles west. Lakehurst Naval Air Station, Whiting, and Lebanon State Forest are to the east. McGuire Air Force Base was developed from a wedge-shaped piece of land in the north central area of the post.

#### History of Installation

Camp Dix was established in 1917 from an area of farmland and forest. The post has been used to train infantry for every U.S. conflict since World War I, and has been in continuous use except for a brief period in the 1920s. Over the years, the post has grown to encompass 32,605 acres with 2,611 major buildings. The post presently maintains a steady population of 22,000 while training 20,000 personnel per year.

#### Mission

Fort Dix is a government-owned installation under the jurisdiction of the Training and Doctrine Command (TRADOC). The mission is to conduct Basic Combat Training and Advanced Individual Training, and to provide Combat Support and support to Reserve and National Guard Units.

## 1.2 INVESTIGATIONS TO DATE

### 1.2.1 Pre-Onsite Investigation

Pre-onsite investigations focused on the acquisition and evaluation of all available documentation relative to existing contamination at Fort Dix. The study team reviewed this material and familiarized themselves with the initial assessment, the work done to date on the BOMARC site, the current activities at the Fort Dix Landfill being done by Camp Dresser and McKee, the organizational structure and areas of responsibility within the post command, and the biological, geological, and hydrological environment in which the post exists.

These activities culminated in a pre-onsite briefing and the development of a Plan of Accomplishment and Resource Utilization Plan for the onsite assessment.

### 1.2.2 Onsite Investigation

During the week of 16 November 1985, onsite interviews and a site visit were conducted at Fort Dix. A briefing for post personnel was held as well as an in-briefing and an out-briefing for the Chief-of-Staff. A tour of major sites was conducted by Mr. Howard Kimpton of the Environmental and Natural Resources Division. The personnel who were contacted and interviewed are listed in Table 1. The sites that were visited are identified on Figures 2 and 3, which are the Installation and Post Maps. A helicopter over-flight was conducted to view inaccessible sites and to identify previously unknown sites.

## 1.3 SAMPLING DESIGN PLAN OBJECTIVES

The Sampling Design Plan presented herein describes a sampling and analytical program recommended to be undertaken at this time. This work is part of the overall reassessment being completed under Contract No. DAAA 15-85-C-0082. Consistent with the intent of the installation reassessment program, the recommended sampling is limited in nature.



The sampling program designed for the Installation Reassessment at Fort Dix is planned to address the existence/potential for ground-water or soil contamination. The sampling plan is intended to assess the existence or potential for existence of any contamination and determine the need for remedial investigation. The sampling program is not intended to define the extent or configuration of any contamination. If it is appropriate to implement remediation at the conclusion of the reassessment, it may be necessary to conduct further sampling and/or install additional monitoring wells in conjunction with a remedial investigation.

#### 1.4 REPORT ORGANIZATION

The remainder of this report is organized into two major sections--Site Characteristics and the Sampling Plan. The Site Characteristics section deals with the geology and geohydrology of the entire base and includes a discussion of all of the sites of environmental interest that have been identified. The Sampling Plan section describes the sites, the rationale, and the methodology for sampling. This is followed by a proposed schedule and budget estimate.

## 2. SITE CHARACTERISTICS

### 2.1 GEOLOGY

Fort Dix is located along the southern boundary of the inner coastal plain section of the Atlantic Coastal Plain Physiographic Province. This physiographic division is characterized by low dissected hills and broad sandy plains occurring in a narrow belt some 10-20 miles wide that extends northeast along the Delaware Valley across New Jersey to Raritan Bay. Major features include nearly level plains, gently rolling uplands, extensive surficial dissection, mature streams, and swampy areas. Figure 4 is a geologic map showing the major formation outcrops on the post. The cantonment area is underlain by the Bridgeton Formation and the Cohansey Sand. The training area is underlain by the Kirkwood Sand. The range impact area is largely underlain by the Cohansey Sand. These formations are unconsolidated and consist of sand, gravel, silt, clay, glauconite, marl, and organic materials. The Coastal Plain sediments form a southeasterly dipping wedge.

### 2.2 HYDROLOGY

The Coastal Plain sediments are highly permeable and form several aquifers in the strata under Fort Dix. Figure 5 shows hydrogeologic cross-sections of the major aquifers in New Jersey. These aquifers are recharged by precipitation.

Fort Dix is located in a recharge area for the Cohansey and Kirkwood Formation. Because of the location in a recharge zone, potential discharges to ground water are a great concern. The water table is encountered quite close to the surface, usually within 5-15 feet.

The prevailing direction of deep ground-water flow is southeast. This coincides with the downdip direction of the major geologic units. However, locally the flow of shallow ground water in the surficial aquifer is controlled by surface topography and drainage. Shallow water table flows tend to discharge to surface streams. Thus, a rough indication



of the local ground-water flow can be predicted by surface topography. However, deeper ground-water flows are controlled by the local hydro-geologic formations.

### 2.3 SITES OF INTEREST

During the onsite visit, over 40 sites were visited and evaluated. The sites were identified by the post Environmental and Natural Resources Division (ENR), by the Environmental Photographic Interpretation Center (EPIC), and by our own observations (EA). EPIC identified both major sites and ancillary sites (ANC) which are either of minor environmental significance or not easily interpreted from aerial photographs.

The following sections briefly describe each site and give rationale for the decision to sample or not. This is intended as a brief introduction to all sites of interest. Sites chosen for limited sampling in the Sampling Plan are described more fully in Section 4. The sites can be located by referring to the maps enclosed in the pocket at the back of this report. Sites located within the cantonment area are shown on Figure 3; sites located elsewhere on the post are located on Figure 2.

#### ENR1--Golf Course

This area is located in the cantonment area between the golf course and driving range, north of Pemberton-Wrightstown Road. The area is adjacent to the POL area and EPIC 1 which are discussed later. Previous examinations have uncovered a leaking gasoline tank on this site. This area is one chosen for additional sampling.

#### ENR 2--Area North of Dogwood Lake

This site is located in the cantonment area near the intersection of Maryland Avenue and Saw Mill Road. The area is the site of at least two building phases but is now an open grassed field. One contaminated well (Well 17) previously existed at the site. The source or time frame of

the contamination is not known, but is suspected to be an old leaking underground petroleum product storage tank.

This site has been the subject of extensive investigations. The Army Environmental Hygiene Agency (AEHA) installed 24 wells to a depth of 20-30 feet. These were not permanent monitoring wells, and were later removed. A consulting firm, Iffland, Kavanaugh, Waterbury, P.C. (IKW), made seven test borings, sampling soils and boring fluids. Low levels of total hydrocarbons were detected adjacent to the location of Well 17. This site is one chosen for geophysical survey to detect the presence of an underground tank. If the geophysical survey finds contamination, monitoring wells may be installed to quantify the extent of the contamination.

#### ENR 3--Transportation Motor Pool

This motor park area is bounded by Pennsylvania Avenue, Delaware Avenue, West 1st Street, and Saw Mill Road. The area is used to store fuels and service cars and light trucks. One area has had a leaking pump and known gasoline contamination. This area is one chosen for further sampling.

#### ENR 4--363rd Motor Pool

This motor pool is located southeast of Texas Avenue and Sunrise Road. The area is used to service heavy diesel trucks. The southern end of the site is known to have petroleum contaminated soils. This area is one chosen for further sampling.

#### ENR 5--Paint Shop

The paint shop is located at the northeast corner of Pennsylvania Avenue and Saw Mill Road, in Building 5322. Signs and graphics are prepared for use on the post. Solvents and paints were discharged to a french drain. Specifics on the construction of the drain are not known. The drain was located under a discharge pipe coming from the north end of the building. This area is one chosen for further investigation.

#### ENR 6--Fire Training Tanks

The post fire training tanks are located behind the fire house (Building 5353). There are two open tanks in this area which were used for burning of waste flammables and fire control training. The residual flammables, rainwater, and used fire-fighting materials were discharged to the ground surface from the 1940s until approximately 1980. This area is one chosen for further investigation.

#### ENR 7--POL Area

The petroleum, oil, and lubricant (POL) area is located south of Rancocas Road at the Pennsylvania Railroad, around Building 3164. There are six large underground storage tanks, one large above ground tank, and a storage building. The transfer areas have no spill containment. Surface runoff flows directly to the nearby stream. Three of the underground tanks have recently been found to have leaks. This area is one chosen for further investigation.

#### ENR 8--ARDC Test Site

The Armaments Research and Development Center (ARDC) test site is located west of Brindle Lake and south of Buck Swamp Road. This facility tests and evaluates new small caliber weapons. Wastewater from the photo lab was discharged to the ground surface from about 1982 to 1984. A spill of diesel fuel was cleaned up in 1985. This area is one chosen for further investigation.

#### ENR 9--Hazardous Waste Storage

Hazardous wastes generated on the post are stored in Building 8131 located on Range Road. The building was renovated in 1981 and now conforms with applicable regulations. The building has individual curbed areas to segregate waste types and has safety equipment such as eye wash,



explosion proof electrical system, fire extinguishers, and room ventilation. This is a well maintained, modern facility and no further sampling is required.

#### ENR 10--PCB Transformer Storage

Decommissioned electrical transformers are brought to this building for storage until the PCB content can be tested. The facility is located on Range Road in Building 8432. The building does not conform to applicable storage requirements. There are stains from previous leaks on the concrete floor. The building access and transfer area is inadequate.

There is no evidence of any spills or contamination entering the environment from this building. All spills are contained and cleaned up. The building has been used for transformer storage only for a few years. No further sampling will be conducted at this site.

#### ENR 11--Pathological Waste Landfill

This site is located near Cooks Corner Road and Mount Road in the area of Taylors Mountain. This landfill was used for 3 months during 1976 for disposal of infectious wastes and other hospital waste. The site was chosen by AEHA for use while the pathological incinerator was out of service. The site is located on one of the few topographic high spots on the base. This area is located in an outcrop of the Bridgeton Gravel which contains some ironstone. The cover material is highly erodable and has eroded to expose waste in some cases. Cover vegetation has not remained once seeded. The area is currently used for orienteering.

No sampling is proposed for this area. There is no apparent environmental threat from this type of landfill. The type of waste is limited to hospital waste and infectious wastes were sterilized at the hospital before disposal. There are no apparent routes of contaminant movement. The ground water is expected to be well below the landfill. The pollutants that could come from this type of fill are not expected to be highly mobile. This is not one of the sites recommended for further sampling.



#### EA 1--Solid Waste Transfer Station

This facility is located on New Lisbon-Juliustown Road north of Wrightstown Road. The solid waste transfer station is located in an old magazine area within the 2200 area. Refuse from the post is placed in 30 cubic yard rolloff dumpsters. Approximately four dumpsters are filled per week. Some boiler ash and soot are stored in an open pile awaiting removal. Gas cylinders are also stored in a shed here, awaiting use or refilling.

This area was formerly used for ammunition storage and reclamation. Six old buildings on the site have been removed. This area is not known to have any significant problems. Past or present activities do not appear to present environmental risks. This area is not chosen for further sampling.

#### EA 2--Old Laundry Area

This area is located in the cantonment area in the 4100 area. The post laundry was located in this area until 1975. Several underground fuel storage tanks have been removed from this area. It is suspected that several yet remain. This area is one chosen for electromagnetic survey.

#### EA 3 and EA 4--Former Mess Halls

Two mess halls were located between Bergen Avenue, Passaic Avenue, Rancocas Road, and Concord Street. These were of World War II vintage and have since been removed. Two large buried tanks were known to exist but were never removed. This area is now an open field. Electromagnetic survey methods will be used to locate these tanks.

#### EA 5--Former Hospital

A hospital was located in the northwest sector of the cantonment area. The building has since been removed. However, the underground fuel

storage tanks were not. This area is now an open field. Electromagnetic survey methods will be used to locate the tanks.

#### ANC 1--Old Incinerator

The old incinerator is located on New Lisbon - Juliustown Road, north of the solid waste transfer facility. The incinerator and building were demolished, with only concrete rebar and rubble remaining. EPIC identified mounded material from aerial photography; however, none was found during the inspection. This site is not chosen for further sampling.

#### ANC 2--Old Excavation

This area is located north of Juliustown Road in the 2100 area. There are old excavations with mounded material that may have been a sand pit. Aerial photography shows activity from 1951 to 1974. The area is currently used to store forestry slash. This area is not chosen for sampling.

#### ANC 3--Glen Road

This area is located on the northwest side of the cantonment area in the 3600 area. The area was identified as having large coal piles. One coal pile remains, as does a partially destroyed building. This area is not chosen for further sampling.

#### ANC 4--Bergen Avenue

The area at the intersection of Bergen Avenue and Concord Street was identified as possible coal storage in 1970. This is an area of abandoned barracks. No evidence of coal storage exists on the ground. This area will not be sampled.

#### ANC 5--2nd Brigade Motor Pool

This facility is located on New Jersey Avenue in the 5900 area. It is used for vehicle repair and storage. Dry cleaning solvents and hazardous materials are stored outside with no containment. Empty drums are stored outside. The vehicle washrack drainage is blocked intermittently by litter. Waste oil is stored in three 500-gallon, underground, concrete tanks. These were installed in October 1969 and are currently full awaiting disposal. Gasoline and diesel fuel are stored in two 5,000-gallon underground steel tanks. The tanks have never been tested, but are scheduled for testing in FY 1986. This site appears to require some operational upgrading but not further sampling.

#### ANC 6--Area Near Walston Hospital

An area on the north side of the site that now contains Walston Hospital was identified as having a ground stain from a 1951 aerial photograph. During the construction of the hospital, the soils were disturbed and a parking area was built over the area previously identified. No evidence of contamination exists today. This area will not be sampled.

#### ANC 7--DIO Shops

The Directorate of Industrial Operations (DIO) operates a facility on Texas Avenue near 8th Street. This is used for vehicle and equipment repair and maintenance. There are at least 18 untested underground tanks at this facility. This area is one chosen for further investigation.

#### ANC 8--Boiler Plant

The steam generation plant is located south of South Scott Plaza on Avenue C in Building 5426. This facility houses four large boilers used to generate steam for use on the post. The boilers were built in 1953 and retubed in 1982.



The plant burns #6 fuel oil. This is stored in two bermed tanks, one 300,000 gallons, the other 760,000 gallons. The berms were recently upgraded and lined with high density polyethylene. The unloading transfer points are curbed and drain to an oil/water separator and then to the sanitary sewer. The separators are connected to waste oil tanks.

Blowdown from the boilers went to the storm sewer until about 1979. It is now discharged to the sanitary sewer. This site is not chosen for further sampling.

#### ANC 9--Old Landfill Site

EPIC identified an old landfill off of Juliustown-Browns Mills Road, in the 7000 area. It is north of the post landfill. In a 1940 photograph, ground scars with possible landfill trenches were identified. A 1951 photograph identified this area as being inactive.

The site inspection found four linear trenches, 10-12 feet apart, and 50-60 feet long. The vegetation in the area was determined to be 30-40 years old. An old building foundation with columns was also found.

Since this area appears to have been inactive for at least 35 years, landfill-associated contaminants would most likely have already been purged from the site. This area is not chosen for further sampling.

#### ANC 10--Mounded Material 1951

EPIC identified an area north of Juliustown-Browns Mills Road and south of the post landfill as having mounded material in a 1951 photograph. This was located at a dirt road intersection. The mounds may have been road barriers. The area was not visited during the on-post site visit. No sampling of this area is proposed.



#### ANC 11--Prison Site

EPIC identified an area on Range Road as having open storage and mounded material in 1971. This area is currently a prison facility. No sampling of this area is proposed.

#### ANC 12--Bivouac Areas West of BOMARC Site

EPIC identified probable wash pads in an area west of the BOMARC site. These are bivouac areas 22 and 22A. The structures identified are probably tent bases. The area was not visited. No sampling of this area is proposed.

#### ANC 13--Range Landfill

EPIC identified a possible dump from a 1974 photograph. This area is located north of Old Shore Road and County Highway 539. Ground observations confirmed that this is an abandoned landfill. This area is one chosen for ground-water sampling.

#### ANC 14--Bivouac Areas South of BOMARC Site

EPIC identified possible wash pads in an area south of the BOMARC site. These areas were identified as bivouac area 21. No sampling of this area is proposed.

#### ANC 15--Equipment Storage Area

EPIC identified an area of vehicle storage with a wash rack from a 1974 aerial photograph. This is located in the 4400 area north of the DIO shops on Texas Avenue. This area is still used for vehicle storage. No sampling is proposed for this area. However, three of the wells proposed for the DIO shops will be located in this area.

#### ANC 16--Broidy Avenue

EPIC identified this area as having coal storage in 1951 and 1970 photographs. The coal piles were not observed during the site visit. This area was apparently transferred to the Air Force when the Commissary was built. No sampling is proposed for this area.

#### ANC 17--Union Road

EPIC identified coal storage in an area north of Union Road and Central Road from 1956 to 1963. The coal piles were not apparent during the site visit. No sampling is proposed for this area.

#### ANC 18--Old Laundry Area

EPIC identified coal storage in this area from 1951 to 1974. The area is located off of Argonne Road in the 4100 area. The area is now an open field. The laundry was built in World War II and removed in the 1960s. It is suspected that several abandoned underground storage tanks exist in this area. This area is proposed as part of the geophysical survey.

#### ANC 19--Possible Missile Site

EPIC identified a possible missile site on Range Road from a 1962 photograph. This area is identified as range #39A. Aerial inspection revealed no missile sites. This area is not proposed for sampling.

#### ANC 20--Dump West of WWTP

EPIC identified a possible dump in the area west of the Waste Water Treatment Plant (WWTP). The dump was seen in a 1970 photograph. This area was believed to have a small amount of rubble used for road stabilization. No further sampling is planned.

#### ANC 21--Area West of WWTP

EPIC identified mounded material and ground staining in the area west of the Waste Water Treatment Plant (WWTP) along the post boundary. This was seen in 1956 and 1970 photographs. This area was not visited during the post visit. No sampling is proposed for this area.

#### EPIC 1--Former Coal Storage Area

This site is located north of Pemberton-Wrightstown Road in the area where the driving range, the golf club house, the POL area, and warehouses are located. Coal piles were observed in this area from 1951 to 1971. A layer of coal was observed in an excavation at this site. Two of the sites chosen for further sampling are located within this area. No further sampling is planned in the area of the old coal piles.

#### EPIC 2--Former Range Impact Area

This site is part of what is now the Garden Terrace Housing area. Disturbed vegetation, probable shell impact marks, and vehicle tracks were observed between 1940 and 1951. After 1951 the site was abandoned and housing construction began by 1956. This area is now housing. The area was disturbed and regraded during construction. The area may have been constructed for battlefield simulation. No sampling is planned for this area.

#### EPIC 3--Transportation Motor Pool

This EPIC site is the same as the ENR 3 site. Wash racks and ground staining are visible from 1951 to present. This area is one proposed for further sampling.

#### EPIC 4--Waste Water Treatment Plant (WWTP)

This site is located on the east side of the cantonment area near the McGuire AFB boundary line. The original WWTP was built in 1917 and



modernized in 1938. The second larger plant was constructed before 1951 and has three million gallons per day (MGD) capacity. The post ENR division is currently negotiating with the State concerning the disposition of this site. The area is the subject of several studies. No sampling is proposed for this area.

#### EPIC 5--Inactive Landfill

This area is located north of the post landfill on the southwest corner of Pemerton-Pointville Road and Juliustown Road. Between 1951 and 1970 this area was used for open storage and dumping. A large coal pile exists on the site. There are signs of dumping of household furnishings, demolition debris, and other materials on the ground surface.

It is suspected that this area may have been a general dump. There are ground-water monitoring wells installed to monitor the Fort Dix landfill to the south of this site. These wells happen to be located upgradient and downgradient of this site. The available data will be sufficient to evaluate the potential of this site for contaminating ground water. No further sampling is proposed at this site.

#### EPIC 6--Fort Dix Landfill

This site is located off of Juliustown Road south of Pointville-Pemberton Road. The site began operation after 1951 and operated until 1984. It has been estimated that the landfill received 60 tons of refuse per day. Camp, Dresser and McKee is currently performing a remedial investigation on this site. No sampling is proposed for this area.

#### EPIC 7--Atlantic Disposal Company

This site is located north of Pemberton-Pointville Road on New Jersey Avenue. This area has been used for vehicle and equipment storage with wash pads. The site visit revealed no signs of spillage. No further sampling is proposed for this area.



#### EPIC 8--Former Landfill

This site is located north of the Fort Dix landfill (EPIC 6), closer to Juliustown Road. It was used between 1951 and 1956. The landfill was used for post waste and access was not restricted. The site presently has filled trenches which have subsided and one open trench still present. The area is presently vegetated.

The fill was used for a relatively brief time and has been inactive for at least 30 years. Landfill-associated contaminants will have been purged from the site. No sampling is proposed for this site.

#### EPIC 9--BOMARC Site

This site is located at the far northeastern corner of the base and is presently leased to the Air Force. One missile silo burned in the 1960s with a subsequent release of Pu239. The area is a subject of the McGuire AFB Installation Reassessment Report. No sampling is proposed for this area.

### 3. SAMPLING DESIGN PLAN

The sampling plan for Fort Dix is designed to gain information about potential contamination in the ground water or the soil and to locate abandoned underground tanks. The program involves: installation of ground-water monitoring wells; sampling and analysis of ground water and soils; and a geophysical survey. Additional monitoring wells may be necessitated depending on the results of the geophysical survey. It is not expected that the sampling activities will not interrupt training or any of the other missions of the post.

#### 3.1 GROUND-WATER MONITORING

The purpose of ground-water monitoring at Fort Dix is to confirm suspected contamination at the sites. Monitoring wells will be installed at eight sites. A total of 28 wells are proposed to be installed. Each location is described in Section 3.1.1. The wells will be installed, surveyed, and sampled according to the methods detailed in Sections 3.1.2, 3.1.3, and 3.1.4.

Ground-water samples will be analyzed for parameters which would be expected from the suspected sources. Wells are to be installed at POL sources, solvent sources, and landfills. The contaminants from these sources are expected to be purgeable and extractable organics. These chemicals are listed in Groups B, C, and D of Table 4.

##### 3.1.1 Ground-Water Monitoring Locations

###### POL Area

The petroleum, oil, and lubricant (POL) area is located around Building 3164. The area is shown in Figure 6. The site is identified as ENR 7 on the maps. This facility serves as the warehouse and supply center for all petroleum products used on base. A warehouse stores lubricants, oils, solvents, antifreeze, etc. A 420,000-gallon above-ground tank

stores #2 fuel oil. The site contains steel underground storage tanks as listed below. Installation dates are given in parentheses.

- 10,400 gallon diesel fuel\* (1961)
- 8,100 gallon diesel fuel\* (1961)
- 10,400 gallon dry cleaning solvent\* (1961)
- 10,400 gallon kerosene (1961)
- 25,000 gallon unleaded gasoline (1944)
- 25,000 gallon unleaded gasoline (1944)

These tanks are tested annually for leaks. No ground-water sampling has occurred at this site.

The most recent tank testing determined that three of the underground tanks are leaking. These tanks are indicated with an asterisk in the above table. The ENR division is now taking steps to determine the extent of the leaks.

The area around the dispensing pumps from the underground tanks is pervious and unbermed. There are several dark ground stained areas around the pumps. Any spills or contaminated runoff which does not infiltrate will immediately enter the storm sewer system and surface waters.

The area around the large above-ground fuel oil tank has staining from pump leaks or tank truck overfilling. The curbed filling area has drains which drain directly to the storm sewer system. The ground area around the tank, piping, and pumps is not protected from spills or leaks.

The storage building is clean and well maintained; however, it has a 40-year history of usage which may contain spill or disposal incidents.

The POL area is located north of the golf driving range and golf course. The un-named tributary to Dogwood Lake runs in an easterly direction approximately 500 feet south of the POL area. Runoff enters storm sewers and thereafter enters this surface stream. Oil sheens have been observed



on this stream, which have been attributed to a leaking storage tank at the golf course. It is possible that runoff from the POL area has also contributed to oil sheens on the surface water.

Four ground-water monitoring wells are to be installed at the POL area in full compliance with USATHAMA geotechnical requirements and applicable state laws. One upgradient well would be located north of the underground tank area. Three wells will be placed south of the facility and north of the stream. Well locations are shown on Figure 6. Locations will be field adjusted to suit site conditions.

Each well will be constructed of solid casing to a depth 2 feet above the water table and screened the next 8 feet into the saturated zone. This screening is designed to sample floating product. Ground water is expected at a depth of 5-10 feet. The direction of shallow ground-water flow is expected to be south to southwest. The wells are expected to be about 25 feet deep.

The wells will be sampled for constituent groups B, C, and D (Table 4) at least 14 days after construction and development.

#### DIO Maintenance Shops

The Directorate of Industrial Operations (DIO) Maintenance Shop is located in Buildings 4429 to 4440. The site is shown on Figure 7 and identified as ANC 7 on the maps. The DIO services most equipment used on the base. Serviced equipment ranges from earth movers to typewriters; weapons are repaired elsewhere. These buildings were built in the WW II era.

Wastes from the DIO maintenance area are now disposed of properly. However, there are several potential sources of contamination on this site, any one of which may have caused ground-water contamination. The potential sources include:

1. Areas where solvents are stored, handled or used
2. At least 18, mostly untested, underground storage tanks used to store fuel oil, gasoline, kerosene, waste oil, and solvents (tank sizes, contents and other details are listed in Table 2)
3. Previous waste oil spill excavations which may not have removed all contaminants
4. Outdoor equipment and battery storage
5. A vehicle wash rack, which has not been removed.

Evidence which indicates possible problems includes staining of floors where solvents are used, ground staining, and a previous spill history. No ground-water sampling has previously occurred at this site.

Concern about this site is heightened because of its proximity to certain important resources. First, is the tributary of South Run, which flows from Willow Pond, less than 800 feet north of the site. This stream provides a potential path for pollutants to move offsite, via infiltration of contaminated ground water or inflow of contaminated runoff. Second, the site is adjacent to the post boundary. Ground water or surface water may carry the pollutants off. Third, the site is less than 1,000 feet north of water supply well #1. Although the direction of ground-water flow in the surficial aquifer is suspected to be northerly, the cone of depression due to drawdown from this well could draw pollutants toward this well.

Four ground-water monitoring wells are proposed for the DIO maintenance shops. One upgradient well would be located to the south between the shops and base well #1. Three wells would be located to the north and east between the shops and the stream. Well locations are shown on Figure 7. Locations will be adjusted to suit field conditions.

Each well will be constructed of solid casing to a depth 2 feet above the water table (expected 10-20 feet below surface) and screened at least 8 feet into the saturated zone. This screening is designed to sample floating product. The wells are expected to be less than 30 feet deep.

The wells will be sampled at least 14 days after construction and development. The wells would be sampled for organic pollutants of Groups B, C, and D shown on Table 4.

### Range Landfill

The range landfill is a sanitary landfill located in the 9300 area between Old Shore Road and County Highway 539. It is north of Building 9315 and south of the BOMARC area. The site is shown on Figure 8 and identified as ANC 13 on the map. The landfill covers approximately 21 acres and appears to have been constructed using the standard Army trench method. The site investigation disclosed numerous closed trenches and at least one open trench which contained rubble, old underground storage tanks, metal, and other debris. No sampling has occurred at this site to date. This landfill was probably started in the 1940s and was not used after 1975.

This landfill has reportedly been used for wastes generated in the range area. The fill has no fences or access controls. The area is open to access by the public. Wastes from the range area include rubble and refuse. Other wastes entering the area could include almost any material.

The range landfill is trapezoidal in shape, approximately 2,000 feet east to west and 800 feet north to south. The site is approximately 150 feet above sea level with the slope predominantly towards the southwest. Four wells are proposed for sampling ground water leaving the fill area. The locations of these wells are shown on Figure 8. The wells will be constructed of solid casing to the depth of the water table and screened at least 20 feet into the saturated zone. This screening is designed to sample dissolved products. The water table in this area is expected to



be encountered 20-40 feet below the surface. The wells are expected to be about 60 feet deep. The wells will be sampled at least 14 days after completion and development. The parameters to be analyzed are listed in Table 4. Groups B, C, and D. *1 Mptd + exp.*

### Paint Shop

The post paint shop is located in the cantonment area near Pennsylvania Avenue and Saw Mill Road. The site and sampling locations are shown on Figure 9. The location is shown by ENR 5 on the post map (Figure 3). The building is semi-permanent and built in the 1940s.

Waste solvents and paints from the painting activities were reportedly discharged to a french drain. Solvents presently generated include: screen ink, thinners, aromatic solvents, ketones, and mineral spirits. The french drain was located on the north side of the building, but construction details are not known. Approximately 20 gallons per year are now generated, not including solvents which are recycled. Without the recycle system, it is expected that 50-100 gallons per year were disposed. No previous sampling has occurred at this site. The practice of discharging solvents to the french drain was discontinued around 1975.

Because the source is well known and localized, three wells are proposed to determine if contamination exists. One well would be located on the north side of the building near the french drain. Another well will be located on the south side of the building. The upgradient well would be located to the west of the site. The direction of ground-water flow could be either north or south, depending on the site's exact relationship to the drainage divide.

The wells will be constructed of solid casing to a depth just above the water table which is expected to be encountered at a depth of 20 feet. The wells would be screened from 2 feet above the water table to 18 feet below the water table. The 2 feet above the water table will account for water level fluctuations. The screen design will collect floating products and dissolved products.

The wells will be sampled at least 14 days after development. The parameters to be analyzed are listed in Table 4. Groups B, C, and D.

#### Fire Training Tanks

The fire training tanks are located behind the fire house in the cantonment area and are identified as ENR 6 on Figure 3. The site is shown in Figure 10. The two tanks are 15 feet in diameter by 4 feet deep. The tanks are now bermed and the berms are lined, but the liner does not extend under the tanks. The tanks were filled with waste flammables and petroleum products and set afire during fire training exercises. The residual products, rainwater, and fire-fighting products were discharged to the ground surface. It is not known if open pit burning was ever used. The tanks have been in place since the early 1960s. The dumping on the ground surface ceased prior to 1980. The accumulated rainwater, sludge, and oil in the tanks was removed in 1984. The sludge was tested and determined not to be a hazardous waste. The tanks are still open and accumulate rainwater. No other sampling is known to have occurred at this site.

Two wells are proposed for installation at this site. Both wells will be very close to the source of the discharge and should therefore detect any contaminants. The two downgradient wells will be compared with the upgradient well near the paint shop for background level determination. The wells will be constructed of solid casing to a depth 2 feet above the water table. This is expected to be encountered approximately 20 feet below the surface. The wells will be screened 8 feet below the water table. This screen is designed to sample ground water and any floating product. The wells are expected to be approximately 30 feet deep. The wells will be sampled at least 14 days after development. The parameters to be analyzed are listed in Table 4, Groups, B, C, and D.

#### Golf Course

The golf course is located in the cantonment area and is identified as ENR 1 on the post map (Figure 3). The site is also shown on Figure



11. A 1,000-gallon steel tank containing unleaded gas was removed on 19 October 1984. The tank was approximately 24 years old when removed, and was determined to be leaking. The leak was discovered when an oil sheen appeared on a stream approximately 150 feet to the southwest. The excavation from which the tank was removed was open at the time of the site visit. It is not known how much product may have been lost. The area has been investigated by Iffland, Kavanagh, Waterbury, P.C. (IKW). A draft report dated 16 October 1985 details borings and sampling at the site. No monitoring wells have been installed. The data suggest contaminated soils and possible product floating on the water table.

Three wells are proposed for monitoring ground water at this site. The source of the spill is well known. The extent of the contamination was delineated by the IKW report. Two downgradient wells will be enough to determine if contamination still exists at the site. The upgradient well will be located north of the leaking tank site. The wells will be constructed of solid casing to 2 feet above the water table, which is expected to be encountered 10-15 feet below the surface. A 10-foot length of screen will be used. This screen placement is designed to sample ground water and floating product. The wells are expected to be about 25 feet deep. The wells will be sampled at least 14 days after development. The parameters to be analyzed are listed in Table 4, Groups, B, C, and D.

#### Transportation Motor Pool

The Transportation Motor Pool (TMP) is located in the cantonment area and is identified as ENR 3 on Figure 3. Figure 12 is a map of this site. It contains a gasoline and diesel fuel dispensing station, a motor repair shop, and approximately 15 acres of paved parking lot. The facility services cars and light trucks. Petroleum products were detected in an excavation near the fuel dispensing station. Some of the contaminated soil was removed. A leaking pump, the suspected cause of the spill, has been replaced.



The site was investigated by IKW and found to have low levels of total petroleum hydrocarbons near the water table in one well. Contaminated soil was also found. No ground-water monitoring wells were installed. The extent of the contamination has not been determined.

Four wells are proposed to monitor ground water at this site. One well will be upgradient along the fence to the west. Three more wells will be located to the north, east, and northeast of the suspected leak source. The suspected direction of ground-water flow is north or northeast at this site.

A conduit, carrying the discharge from Dogwood Lake, runs under the site. This may have some influence on the movement of pollutants. Pipelines often offer a route of lower permeability for ground-water movement. This may tend to spread the contaminants to the east or west.

The wells will be constructed of solid casing to 2 feet above the water table, which is expected to be encountered 2-8 feet below the surface. A 10-foot length of screen will be used. This screen placement is designed to sample ground water and floating product. The wells are expected to be approximately 25 feet deep. The wells will be sampled at least 14 days after development. The parameters to be analyzed are listed in Table 4, Groups, B, C, and D.

#### 363rd Motor Pool

This site is located in the cantonment area southeast of Texas Avenue and Sunrise Road. The area is identified as ENR 4 on Figure 3. The site and sampling locations are shown in Figure 13.

This area is used for maintenance and mobilization of tractor trailers. The area contains a fuel station, a maintenance shop, and paved parking area.

Excavation for a pipeline, at the southern end of the facility, uncovered petroleum-contaminated soils. In December 1985, 711 tons of soil were excavated. The soils contained 200-400 parts per million petroleum hydrocarbons.

The suspected sources are a truck wash, a steam cleaning machine, and a 550-gallon fuel storage tank. The oil/water separator, connected to the sanitary sewer, was known to have been clogged and overflowing since 1976. The extent of the contamination is not known. The excavation thusfar has removed visible product. The area is approximately 150 feet from a tributary of South Run.

Four wells are proposed for monitoring ground water in this area. Three wells will be placed downgradient between the area where the contaminated soils were found and the stream. One upgradient well will be placed north of the contamination in an area that will not disrupt vehicle traffic. The expected direction of shallow ground-water flow is to the south. The wells will be constructed of solid casing to 2 feet above the water table, which is expected to be encountered 2-10 feet below the surface. A 10-foot length of screen will be used. This screen placement is designed to sample ground water and floating product. The wells are expected to be approximately 25 feet deep. The wells will be sampled at least 14 days after development. The parameters to be analyzed are listed in Table 4. Groups, B, C, and D.

### 3.1.2 Specifications for Wells and Drilling

All drilling, soil sampling, well installation, and well development shall be in accordance with USATHAMA's "Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports," dated May 1983. EA employees or EA-supervised subcontractors will be used.

## EA Responsibilities

An EA Field Geologist will supervise all operations during drilling and well installation to ensure strict adherence to the "Geotechnical Requirements."

### Drilling Subcontractor

Engineering Drilling Inc. of Robbinsville, N.J., was chosen to provide all labor, equipment, and materials necessary to perform drilling, well installation, and well development. The EA Field Geologist will oversee the subcontractor. EA will provide a detailed scope of work to the subcontractor for bidding purposes. The scope of work will include site-specific information, scheduling, and USATHAMA specifications for drilling, well installation, and well development. All drilling, well installation, and well development will strictly adhere to the "Geotechnical Requirements."

#### 3.1.3 Topographic Survey

Coordinates and elevations for each well will be surveyed by a licensed surveyor. Specifications in paragraph III.G of the "Geotechnical Requirements" will be followed. EA will contract a local registered surveyor to provide the above services.

#### 3.1.4 Sample Collection

The ground-water sampling program at Fort Dix is intended to provide data on the ground-water quality both up and downgradient of the suspected sites. EA has incorporated USATHAMA sample collection procedures with EA's Ground-Water Sampling and Sample/Handling Protocol. EA will employ the following sampling acquisition protocol:

- Physical inspection and observation
- Water-level determination
- Well purging



- Field analyses
- Ground-water sampling
- Sample handling

The initial sampling will take place at least 2 weeks following development of the wells. The second sampling round will take place after the results of the first round are known. This will be approximately 6 weeks. Sampling will start at the anticipated least contaminated well and proceed successively to wells with anticipated higher contamination levels.

### Physical Inspection

Upon arrival at each well, the condition of the well and surrounding area will be noted. This will include, but should not be limited to, the following:

- Security
  - Is well locked?
  - Is there evidence of tampering?
  - Is there evidence of physical damage?
- Well integrity
  - Evidence of breakage or heaving of concrete pad, if present
  - Evidence of surface infiltration.

The information gathered will be recorded in the bound field notebook for inclusion in the field sampling report.

### Water Level Measurement

After the physical inspection has been completed, static water levels will be determined. Water level relative to the top of the well casing will be determined in all wells to be sampled at each site, prior to

initiation of purging and sampling activities. All water level determinations will be made to the nearest 0.01 ft.

EA will use electronic sounders to determine water levels in the monitoring wells. This will be done by lowering the precleaned probe of the sounder into the well slowly until the indicator (light or meter) is activated. After an indication of water penetration has been achieved, the probe will be slowly raised and lowered until the indicator accurately registers the water surface. The water level will be referenced to the top of the well casing. Once the water level has been determined, the point on the sounder cable, which is calibrated in 5-ft intervals, will be marked and water level determined to the nearest 0.01 ft with a folding ruler or tape. The water level will be recorded in the field notebook. Figure 16 shows the EA Field Record for well gauging, purging, and sampling.

#### Field Measurements

Field measurements will be made on all samples from the first bailer of purged water and also on the sampled water. A sample of the ground water will be taken using a bailer and put into the appropriate container for field measurement. A separate clean bailer will be used for each well sampled. All equipment will be handled according to the procedures listed in the "Quality Assurance Program Plan for Installation Reassessments." Temperature, conductivity, and pH will be measured and recorded in the sampling logbook.

#### Well Purging

Prior to sample acquisition, it is necessary to purge the well in order to ensure that the sample collected is as representative as possible of the ground water in the aquifer. Failure to purge may result in collection of water that has been isolated from the aquifer in the well casing for an extended period of time and may no longer be representative of the

aquifer. Purging is typically accomplished by pumping or bailing. Pumping is done with submersible pumps, centrifugal pumps, or with peristaltic pumps. Bailing is generally done using a bottom-filling bailer.

The water table aquifer at Fort Dix is generally composed of sand and gravel. Recharge is anticipated to be relatively high. EA therefore proposes to purge the wells by submersible pumps.

Five casing volumes will be purged or until the well is purged to dryness. A casing volume is determined by calculating the volume of standing water. To do this, the well diameter (riser casing ID in inches) is determined and recorded. The height of the standing water in the casing (in feet) is determined next by subtracting the depth to water (water level) from the well depth. The volume of water is then determined according to the following formula:

$$V(\text{ft}^3) = r^2 \pi h$$

where

V = volume of standing water in  $\text{ft}^3$

r = casing inside radius in feet

h = height of water column in feet

$\pi = 3.14$

The volume is converted to gallons by multiplying  $\text{ft}^3 \times 7.48$ . or by:

$$V(\text{gal}) = hF$$



where

h = height of water column in feet  
F = 0.16 for a 2-in. diameter well  
0.65 for a 4-in. diameter well  
1.47 for a 6-in. diameter well  
2.61 for an 8-in. diameter well  
5.87 for a 12-in. diameter well

After this volume has been calculated, it is multiplied by the number of casing volumes to be purged. This represents the volume that must be removed from the well. Under no circumstances should purging be initiated prior to water level determination in ALL wells under observation at the site.

Typically 3- or 4-inch diameter wells with an adequate yield are purged with ac-powered submersible pumps of appropriate diameter powered with a portable generator. These pumps are equipped with a nylon safety line to prevent loss in a well should a pump hose or power cord break and to make retrieval easier should the pump become jammed in the well.

Prior to initiation of purging, the pumps will be tested for functioning by plugging into the generator. The pump will be lowered into the well until it just penetrates the water surface, at which time it will be energized. The pump will be lowered slowly through the water column to the bottom of the well. The pump will then be raised to subsurface and held static for the duration of purging. The pump will be lowered to follow the ground water should drawdown occur. During purging, the pumping rate will be determined by timing the filling of a 5-gallon pail. The volume to be purged (5 static casing volumes) is divided by the pumping rate in gallons per minute to determine the pumping duration required. The pumps discharge will be directed sufficiently downgradient at all times to avoid rapid re-infiltration.

When the required volume of water has been evacuated from the well, the pump will be raised to the surface and allowed to pump for an additional 2 minutes, after which the pump will be removed from the water and allowed to purge itself and the discharge hose. The pump will then be removed from the well and the volume and time purged recorded. After purging has been completed, the water level will be determined and recorded as described above.

In the event a well dewateres prior to evacuation of the required volume, the well will be allowed 15 minutes to recover and pumping re-initiated. If the well again dewateres, the pump will be removed from the well, as above, and the volume purged will be recorded.

#### Cleansing Pumps Between Wells

Because the potential for carryover and therefore cross-contamination is great, it is essential that the pumps used to purge wells be cleaned thoroughly between wells. Submersible pumps will be cleaned by spraying the exterior aspects of the pump proper and associated plumbing with hot water. This will be accomplished with a high-pressure sprayer using distilled water or USATHAMA-approved water. After the exterior of the pump and plumbing has been pressure-cleaned, the pump will be immersed in hot water and hot water pumped through the system to clean the interior. It is generally necessary to pump a minimum of 5-10 gallons to obtain a clean pump. The system will be pumped dry between wells. A foot valve has been installed in the pumps to preclude cross-contamination.

EA developed this procedure as the result of an internal research and development effort and has used it for several years. EA has accumulated a large database documenting the effectiveness of the cleansing protocol. The sampling crews are well aware of the hazards of cross-contamination and have been trained to avoid sampling-related contamination. Prior to purging the wells, the order of purging and sampling will be determined, beginning with the least contaminated well and finishing with the most. The order followed in the first sampling effort will be established based on historical data.



If prior data are available, this order will be determined based on these data; if not, the field team will, at the time of water level measurement, inspect (visually, by odor, and with an OVA survey of the well head space) to determine the sampling order. EA believes this will not result in cross-contamination as the result of purging and well cleansing as outlined above.

### Ground-Water Sampling

Only sampling gear that has been cleaned in accordance with the Quality Assurance Plan will be used. All sampling gear including sampling containers, bailers, and line will be handled so as to prevent contamination. Sampling material will be protected from contacting the ground by spreading a clean plastic protective cover around the well prior to sampling. New protective covers will be used for each well. Covers will not be transported with purging gear due to the potential for contamination. The sampling personnel will take care to ensure that their hands are clean initially and that they are washed between wells. Disposable gloves will be used for handling sampling gear. This will minimize the potential for contamination and also protect sampling personnel from contaminants that may be present in the samples. New gloves will be worn for each well sampled. Care will be exercised to ensure that sample does not contact the gloves, as materials used to fabricate them have the potential to produce artifact contamination.

Ground-water sampling will be accomplished with a bailer. Only clean bottom-filling Teflon bailers will be used. A clean dedicated piece of nylon line is attached to the bailer and the bailer is lowered into the well. Care will be exercised to ensure that the bailer and line do not contact the ground or other sources of contamination. The bailer is lowered into the well until it fills and is retrieved. The water is discarded. This process is repeated three times. The bailer is then filled and the sample is transferred to the sample containers. Each container is first rinsed three times with excess sample water. Preservative will be added as described below. Samples for volatile organics will be collected in a manner that minimizes aeration, and the containers



will be free of bubbles and headspace. After the containers have been filled, they will be labeled, an entry will be made on the chain of custody, and they will be placed immediately in a cooler on ice. All samples will be shipped, at a temperature of 4 C, to the laboratory by air freight (i.e., overnight delivery), if not returned with the sampling crew on an equivalent time scale.

#### Addition of Preservative

Preservatives appropriate for the analysis to be performed on each sample will be added as each sample is collected. The sample containers and appropriate preservatives which will be used at Fort Dix are identified in Table 3. The sample bottles will be placed into a chest containing ice. The Chain-of-Custody Form is completed and the chest prepared for shipment. The Chain-of-Custody Form is shown in Figure 18.

#### Ground-Water Sample Chemical Analyses

Prior to sampling, a request for all necessary sample containers will be submitted to EA's Analytical Laboratory. Figure 17 presents a copy of the Container Request Form. The laboratory will provide the appropriate bottles, preservatives, chain-of-custody forms, and analytical task order forms prior to the sampling activities (Figures 18 and 19).

The suite of parameters which will be analyzed are shown in Table 4, Groups B, C, and D. GC/MS screening methods will be used to detect as wide a range of potential contaminants as possible. Detection limits will be at or below criteria levels where available. All analyses will be accomplished in accordance with the approved Quality Assurance Program Plan and USATHAMA-certified analytical methods.

### 3.2 SOIL SAMPLING

Soil sampling is used to determine if past activities have left pollutants on or near the ground surface. The locations were chosen based on visual inspections and conversations with site personnel. The ARDC test

site has two areas that will be tested. A total of ten samples will be collected. Figure 14 shows the approximate location of the sample points. Sampling methodologies and chemical analyses are discussed in Sections 1.2.2 and 1.2.3.

#### 2.2.1 Soil Sampling Locations

##### ARDC Test Site

The ARDC test site is located west of Brindle Lake and south of Buck Swamp Road. It contains Buildings 9985 through 9997. The facility is used to test weapons. The area has two motor fuel storage tanks, a photo processing lab, and other facilities. Two sites will be sampled on the ARDC test site--the area where photo processing wastewater was discharged and the area of the motor fuel storage tanks.

The photo processing lab uses a micro-flash X-ray technique to analyze weapon accuracy and impact. The wastewater from the process rinse formerly drained onto the ground. The disposal occurred over a period of 2 years at a rate of approximately 5-25 gallons per month. This material is now collected and stored pending reprocessing. The washwater now collected contains 64 ppm silver and is believed to be representative of past discharges. The soils have never been tested and some construction has occurred in the area since the discharge was ceased.

Three samples will be collected at the photo lab. Two samples will be collected from what appears to be undisturbed soil near the discharge. One will be from similar soil at least 25 feet upgradient for comparison with background.

The motor fuel storage pad is a flat pad with no containment. A spill of approximately 25 gallons of diesel fuel occurred here in 1984. The cleanup consisted of removal of approximately 1 foot of soil. This area was then backfilled. A visual inspection of the cleanup area showed several areas of dark colored soil. Shallow soil cores indicated that this staining continued to the east and south of the spill area, but not



on the north side. This indicates the staining follows the drainage from the fuel storage tanks.

Four samples will be collected from the soils near the fuel storage tanks. Three samples will be collected approximately 10 feet south, east, and west of the backfilled spill area. A fourth sample will be taken at least 25 feet north of the spill area for establishment of background.

4  
Pols

The area that was backfilled, near the fuel tanks, contains some blue-green material. This soil is the color of oxidized copper. The extent and nature of the material is not known. Samples of the green soils will be collected where it is observed. It has previously been observed in three locations in the backfilled area.

ABCDE

Sample collection, analysis, and parameters to be analyzed are discussed in the following sections. The approximate sample points are shown in Figure 14.

### 3.2.2 Soil Sample Collection

Soil samples will be collected within designated areas. The sampling locations will be marked with a stake prior to sampling. Prior to sampling, surface vegetation, rocks, pebbles, leaves, twigs, and debris will be removed from the area to be sampled. Soil will be collected with a clean stainless steel hand-driven corer, taken to a depth of 1-10 inches. The entire soil core will be collected for analysis.

As samples are collected, they will be placed in containers of appropriate composition for the parameters to be analyzed. These will include laboratory-cleaned glass containers with Teflon-backed closures for organic parameters and linear polyethylene (Nalgene) containers for trace metals and cyanide. Samples for volatile organics will be placed in wide-mouth, amber glass bottles which are sealed with a Teflon septum. As each sample is collected, the containers will be labeled, security sealed, and placed on wet ice in secured coolers. No preservatives will



be added to soil samples. As each sample is collected, the location will be flagged, the security seal number recorded in the field notebook, pertinent observations (i.e., vegetation stress, depth of soil) noted and recorded, and entries made on the Chain-of-Custody Form shown in Figure 18. The samples will be shipped or transported to EA's laboratory within appropriate holding times.

Decontamination of the sampling equipment will be accomplished between each sample. The sampler will be cleaned by scrubbing with water and rinsing three times with distilled or USATHAMA-approved water prior to use and between each sample.

### 3.2.3 Soil Sample Chemical Analyses

Prior to sampling, a request for all necessary sample containers will be submitted to EA's Analytical Laboratory. Figure 17 presents a copy of the Container Request Form. The laboratory will provide the appropriate bottles, preservatives, chain-of-custody forms, and analytical task order forms prior to the sampling activities (Figures 18 and 19).

Parameters to be analyzed are shown in Table 3, Groups A, B, C, D, and E. GC/MS screening methods will be used to detect as wide a range of potential contaminants as possible. Detection limits will be at or below criteria levels where available. All analyses will be accomplished in accordance with the approved Quality Assurance Program Plan and USATHAMA-certified analytical methods.

## 3.3 GEOPHYSICAL SURVEY METHODS

### 3.3.1 Locations

Electromagnetic profiling is proposed for five locations (Nos. 1, 2, 3, 4, and 5; Figure 15) within the cantonment area of Fort Dix for purposes of locating buried metal storage tanks.

Location 1 (which has previously been identified as ENR 2) has been the site of significant subsurface investigations including emplacement of a large number (~24) of monitoring wells. Only one well showed hydrocarbon contamination, but it is suspected by the Fort Dix environmental staff that one or more fuel storage tanks remain buried at the site.

Location 2 (which has previously been identified as EA 2) is the former site of the post laundry and several underground storage tanks have already been removed from the area. It is suspected that several yet remain. Other historical activities at the site are unclear, but may have involved burying of discarded materials.

Locations 3 and 4 (which have previously been identified as EA 3 and 4) are the former sites of mess halls, since razed. Underground storage tanks associated with these facilities had not been located or removed to the knowledge of post personnel.

Location 5 (which has previously been identified as EA 5) is the site of a former post hospital whose underground storage tanks were not removed according to post personnel.

### 3.3.2 Methods

EA proposes to perform a profiling study using a GEONICS EM34-3L Terrain Conductivity Meter. This instrument is sensitive to reasonably large (larger than 55-gallon drum size) metallic objects and conductive layers within the earth. Utilizing a 10-meter coil spacing and a 10- x 20-meter grid pattern, in both horizontal and vertical dipole modes, it should be possible to reasonably, rapidly profile the areas in question.

As with any geophysical method, the instrument has limitations. The EM34 will respond to large above-ground metal objects such as chain link fence. It will also respond to buried construction rubble containing reinforcing bar. The technique, however, has proven itself capable of rapid, reliable survey results. The data, when plotted and contoured, will provide areal definition of anomalies. The differential between

the horizontal and vertical dipole data will also provide limited depth information on the anomalies.

### 3.3.3 Deliverables

Both the raw and contoured data will be presented on appropriate scale maps of the survey areas. This data will show areas of anomalously high and low conductivity on the sites. A narrative analysis of the results will accompany the maps, describing the most probable interpretation of the data and pointing to the indicated locations of potential underground tanks.



#### 4. PROPOSED SCHEDULE

The proposed schedule for sampling at Fort Dix is presented in Table 5. The first sampling is scheduled to occur immediately subsequent to the EA laboratory certification, which is expected to be complete in March 1986.

## 5. BUDGET FOR SAMPLING AT FORT DIX

The budget has been estimated using EA's "Schedule B: Project Cost Estimate" which is included in Appendix B. The costs are summarized in Table 6.

TABLE 1

## PERSONNEL CONTACTED FOR INTERVIEW

Division Personnel	Name	Phone No.	Subject Area
		(609) 562-xxxx	
Directorate of Facilities Engineering (DFAE), (DEH) Environmental Coordinator	Joseph Haug Howard Kimpton	3050 3050	Hazardous wastes, environmental affairs
DFAE, Buildings and Grounds Division	Stuart Rubin Rich Drayton	2015	Herbicides handling and application
DFAE, Utilities Division	James Wallace	3254	Sewage treatment, potable water treatment, landfills
Directorate of Industrial Operations (DIO)	Daniel White	2264	Industrial activities, motor pools
DFAE, Entomologist	Vito Gallucci	2442	Pesticides handling and storage
Preventative Medicine (PVNTMED) Activity	Randy Marcus Ind. Hygiene	4376	Water quality, laboratory operations
Directorate of Plans and Training (DPT), (DPTSEC) Range Control	Mr. J. Dipierro Sgt. Parrott	2770	Ranges/demolition areas, Interservice Support Agreements
DPT, Nuclear, Biological and Chemical (NBC) School	Cpt. S. Mazur Lt. Green	3389	NBC training areas
Medical Dept. Activity (MEDDAC), Laboratories	Col. Jarotsky	5158	Medical activity chemistry and X-ray laboratory waste
Dental Activity (DENTAC), Laboratories	Cpt. Richard Demarais	2397 2996	Dental activity and X-ray laboratory waste



TABLE 1 (Continued)  
PERSONNEL CONTACTED FOR INTERVIEW (Continued)

Veterinary Activity	LTC. Daniel Lafontaine	5440	Veterinary activity and X-ray laboratory waste
Directorate of Personnel & Community Activities (DPCA), Golf Course	John Huda	5443	Pesticides handling and storage
Defense Property Disposal Office (DPDO)	Mrs J. Wolcott	(609)724-2865	Excess chemicals, polychlorinated biphenyls (PCBs), metal recovery
DFAE, Conservation Officer, Forester, Wildlife Officer	Roger Smith	3050	Biota
Explosive Ordnance Disposal (EOD) Personnel	Ron Hardy Sgt. Mitchell	4250	Demolition Areas/Activities
Real Estate (DFAE)	Ms. Jean Johnson Mr. John Warrick	5396 3690	Leases, Agreements
Post Radiation Protection Officer (RPO)	Cpt. Samuel Murff (Medical)	4067	Radioactive materials handling and storage
Sewage Treatment Plant (STP) Operator	Michael Ruppel	3565 4651	Sewage Treatment Plant
Water Treatment Plant (WTP) Operator	Merlin Ross	5040	Water Treatment Plant
Landfill Equipment Operator	Hubert Mathis (Retired)	(609) 893-3682	Landfill
Public Affairs	Richard Dowling	2359	Leases, agreements, legal claims, post organization

TABLE 1 (Continued)

PERSONNEL CONTACTED FOR INTERVIEW (Continued)

Legal Office	Cpt. David Cleary Cpt. Mark Sposato	6451 6451	Leases, agreements, legal claims,
Post Historian	Dr. Daniel Zimmerman	6983	History
Safety Officer	Dick Campana	2889	
Environmental Office (LUST)	Carleen Houston	3050	Storage Tanks
IR Officer	Keith Buch	3191/3050	

TABLE 2 DIO UNDERGROUND TANKS

<u>Building Number</u>	<u>Contents</u>	<u>Tank Capacity (gal)</u>	<u>Installation Date</u>	<u>Exterior Material</u>	<u>Performance Comments</u>
4429	No. 2 fuel	5,000	JUL 1965	Steel	Never tested
4430	No. 2 fuel	5,000	AUG 1952	Steel	Never tested
4430	Used oil	550	9 AUG 1982	Steel	Never tested
4431	No. 2 fuel	5,000	OCT 1951	Steel	Never tested
4431	Dry cleaning solvent	1,000	1964	Steel	Replaced with 550-gal above ground
4431	Magnusol solvent	1,000	1981	Steel	Never tested - abandoned
4431	Water, oil, kerosene	1,000	1981	Steel	Never tested
4431	Water, oil, grease	225	1970	Concrete	Never tested
4432	No. 2 fuel	5,000	OCT 1951	Steel	Never tested
4433	No. 2 fuel	5,000	OCT 1951	Steel	Never tested
4434	No. 2 fuel	1,000	1967	Steel	Never tested
4434	Gasoline	5,000	1967	Steel	Currently inactive
4436	No. 2 fuel	1,000	1970	Steel	Never tested
4436	Solvent	550	1967	Steel	Never tested
4436	Used oil	1,500	1970	Steel	Integrity tested APR 1982; no leakage



TABLE 2 (Cont.)

<u>Building Number</u>	<u>Contents</u>	<u>Tank Capacity (gal)</u>	<u>Installation Date</u>	<u>Exterior Material</u>	<u>Performance Comments</u>
4436	Used oil	500	1970	Steel	
4439	Used oil	275	1970	Steel	Never tested
4440	No. 2 fuel	1,000	MAR 1966	Steel	Never tested

TABLE 3  
CONTAINERS, PRESERVATION, STORAGE, AND HOLDING TIMES<sup>a</sup>

Parameter	Container <sup>b</sup>		Preservative <sup>c,d</sup>		Maximum Holding Time for all Matrices <sup>e</sup>
	Water	Soil	Water	Soil	
<b>INORGANIC TESTS</b>					
Acidity	P	G	Cool, 4°C	Cool, 4°C	14 days
Alkalinity	P	G	Cool, 4°C	Cool, 4°C	14 days
Ammonia	P	G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH <2	Cool, 4°C	28 days
Asbestos	P	G	Cool, 4°C	Cool, 4°C	48 hours <sup>f</sup>
Bicarbonate	P	G	None Required	None Required	Analyze Immediately
Biochemical Oxygen Demand (BOD) and Carbonaceous BOD	P	G	Cool, 4°C	Cool, 4°C	48 hours
Bromide	P	G	None Required	None Required	28 days
Carbonate	P	G	None Required	None Required	Analyze Immediately
Chemical Oxygen Demand (COD)	P	G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH <2	Cool, 4°C	28 days
Chloride	P	G	None Required	None Required	28 days
Chlorine, Total Residual	P	N/A	None Required	N/A	Analyze Immediately
Color	P	N/A	Cool, 4°C	N/A	48 hours

TABLE 3 (page 2 of 8)

Parameter	Container <sup>b</sup>		Preservative <sup>c,d</sup>		Maximum Holding Time for all Matrices <sup>e</sup>
	Water	Soil	Water	Soil	
Cyanide, Total and Amenable to Chlorination	P	G	Cool, 4°C NaOH to pH >12 0.6 g Ascorbic Acid <sup>g</sup>	Cool, 4°C	14 days <sup>h</sup>
Dissolved Oxygen Probe	G Bottle and Top	N/A	None Required	N/A	Analyze Immediately
Winkler	G Bottle and Top	N/A	Fix On Site Store in Dark	N/A	8 hours
Fluoride	P	G	None Required	None Required	28 days
Hardness	P	N/A	HNO <sub>3</sub> or H <sub>2</sub> SO <sub>4</sub> to pH < 2	N/A	6 months
Hydrazine	P	G	If not analyzed immediately, collect under acid. Add 90 ml of sample to 10 ml HCl.	Cool, 4°C	7 days
Iodide	P	G	Cool, 4°C	Cool, 4°C	24 hours
Iodine	P	G	None Required	None Required	Analyze Immediately
Kjeldahl and Organic Nitrogen	P	G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH < 2	Cool, 4°C	28 days



TABLE 3 (page 3 of 8)

Parameter	Container <sup>b</sup>		Preservative <sup>c,d</sup>		Maximum Holding Time for all Matrices <sup>e</sup>
	Water	Soil	Water	Soil	
<b>Metals<sup>f</sup></b>					
Chromium VI	P	G	Cool, 4°C	Cool, 4°C	24 hours
Mercury	P	G	HNO <sub>3</sub> to pH <2	Cool, 4°C	28 days
Others	P	G	HNO <sub>3</sub> to pH <2	Cool, 4°C	6 months
Nitrate	P	G	Cool, 4°C	Cool, 4°C	48 hours
Nitrate plus Nitrite	P	G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH <2	Cool, 4°C	28 days
Nitrite	P	G	Cool, 4°C	Cool, 4°C	48 hours
Oil and Grease	G	G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH <2	Cool, 4°C	28 days
Orthophosphate	P	G	Filter Immediately Cool, 4°C	Cool, 4°C	48 hours
pH	P	G	None Required	None Required	Analyze Immediately
Phenols	G	G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH <2	Cool, 4°C	28 days
Phosphorous, Elemental	G	G	Cool, 4°C	Cool, 4°C	48 hours
Phosphorous, Total	P,G	G	Cool, 4°C H <sub>2</sub> SO <sub>4</sub> to pH <2	Cool, 4°C	28 days
Silica, Dissolved or Total	P	G	Cool, 4°C	Cool, 4°C	28 days

TABLE 3 (page 4 of 8)

Parameter	Container <sup>b</sup>		Preservative <sup>c,d</sup>		Maximum Holding Time for all Matrices <sup>e</sup>
	Water	Soil	Water	Soil	
Residue					
Filterable	P	N/A	Cool, 4°C	N/A	7 days
Settleable	P	N/A	Cool, 4°C	N/A	48 hours
Nonfilterable (TSS)	P	N/A	Cool, 4°C	N/A	7 days
Total	P	N/A	Cool, 4°C	N/A	7 days
Volatile	P	N/A	Cool, 4°C	N/A	7 days
Specific Conductance	P	G	Cool, 4°C	Cool, 4°C	28 days
Sulfate	P	G	Cool, 4°C	Cool, 4°C	28 days
Sulfide	P	G	Cool, 4°C Add Zinc Acetate plus NaOH to pH >9	Cool, 4°C	7 days
Sulfite	P	G	None Required	None Required	Analyze Immediately
Surfactants	P	G	Cool, 4°C	Cool, 4°C	48 hours
Temperature	P	G	None Required	None Required	Analyze Immediately
Turbidity	P	N/A	Cool, 4°C	N/A	48 hours
<u>ORGANIC TESTS<sup>j</sup></u>					
Acrolein and Acrylonitrile	S	S	Cool, 4°C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>g</sup> Adjust pH to 4-5 <sup>k</sup>	Cool, 4°C	14 days <sup>k</sup>

TABLE 3 (page 5 of 8)

Parameter	Container <sup>b</sup>		Preservative <sup>c,d</sup>		Maximum Holding Time for all Matrices <sup>e</sup>
	Water	Soil	Water	Soil	
Benzidines <sup>1</sup>	G	G	Cool, 4°C <sup>m</sup> 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>g</sup> pH 2-7	Cool, 4°C	7 days until extraction <sup>n</sup>
Chlorinated Hydrocarbons <sup>1</sup>	G	G	Cool, 4°C	Cool, 4°C	7 days until extraction 40 days after extraction
Haloethers <sup>1</sup>	G	G	Cool, 4°C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>g</sup>	Cool, 4°C	7 days until extraction 40 days after extraction
Nitroaromatics and Isophorone	G	G	Cool, 4°C Store in Dark	Cool, 4°C Store in Dark	7 days until extraction 40 days after extraction
Nitrosamines <sup>1,0</sup>	G	G	Cool, 4°C Store in Dark 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>g</sup>	Cool, 4°C Store in Dark	7 days until extraction 40 days after extraction
PCBs	G	G	Cool, 4°C	Cool, 4°C	7 days until extraction 40 days after extraction
Pesticides <sup>1</sup>	G	G	Cool, 4°C pH 5-9 <sup>p</sup>	Cool, 4°C	7 days until extraction 40 days after extraction
Phenols <sup>1</sup>	G	G	Cool, 4°C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>g</sup>	Cool, 4°C	7 days until extraction 40 days after extraction
Phthalate Esters <sup>1</sup>	G	G	Cool, 4°C	Cool, 4°C	7 days until extraction 40 days after extraction



TABLE 3 (page 6 of 8)

Parameter	Container <sup>b</sup>		Preservative <sup>c,d</sup>		Maximum Holding Time for all Matrices <sup>e</sup>
	Water	Soil	Water	Soil	
Polynuclear Aromatic Hydrocarbons	G	G	Cool, 4°C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>g</sup> Store in dark	Cool, 4°C Store in Dark	7 days until extraction 40 days after extraction
Purgeable Aromatic Hydrocarbons	S	S	Cool, 4°C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>g</sup> HCl to pH < 2 <sup>q</sup>	Cool, 4°C	14 days <sup>q</sup>
Purgeable Halocarbons	S	S	Cool, 4°C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>g</sup>	Cool, 4°C	14 days
TCDD <sup>l</sup>	G	G	Cool, 4°C 0.008% Na <sub>2</sub> SO <sub>3</sub> <sup>g</sup>	Cool, 4°C	7 days until extraction 40 days after extraction
Total Organic Carbon	G	G	Cool, 4°C HCl or H <sub>2</sub> SO <sub>4</sub> to pH < 2	Cool, 4°C	28 days
Total Organic Halogen	G	G	Cool, 4°C 1 ml of 0.1 M sodium sulfite	Cool, 4°C	7 days

Analytes not listed should be preserved at 4°C and held not longer than 7 days before analysis.

<sup>a</sup>Preservatives and holding times are from Federal Register, Vol. 49, No. 209, Friday, October 26, 1984, Page 43260 and Characterization of Hazardous Waste Sites: A Methods Manual -- Volume II, Sampling Methods, Second Edition, EPA-600/4-84-076. Container requirements are consistent with these references.

<sup>b</sup>p = Polyethylene

G = Amber Glass with Teflon-lined cap

S = Glass Vial with Teflon-lined septum cap

<sup>c</sup> Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automatic sampler makes it impossible to preserve each aliquot, samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

<sup>d</sup> When any sample is to be shipped by common carrier or sent through the U.S. Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements in this table, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation, has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO<sub>3</sub>) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.3 or less).

<sup>e</sup> Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the laboratory has data on file to show that the specific types of samples under study are stable for the longer time. Some samples may not be stable for the maximum time period given in the table. A laboratory is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample integrity.

<sup>f</sup> If samples cannot be filtered within 48 hours, add 1 ml of a 2.71% solution of mercuric chloride to inhibit bacterial growth.

<sup>g</sup> Should only be used in the presence of residual chlorine.

<sup>h</sup> Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustment in order to determine if sulfide is present. If sulfide is present, it can be removed by addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

<sup>i</sup> For dissolved metals, filter immediately on site before adding preservative.

- <sup>j</sup>Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
- <sup>k</sup>The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within three days of sampling.
- <sup>l</sup>When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times must be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and 40 days after extraction. Exceptions to this optimal preservation and holding time procedure are noted in footnotes g, m, and n.
- <sup>m</sup>If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to  $4.0 \pm 0.2$  to prevent rearrangement to benzidine.
- <sup>n</sup>Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
- <sup>o</sup>For the analysis of diphenylnitrosamine, add 0.008%  $\text{Na}_2\text{S}_2\text{O}_3$  and adjust pH to 7-10 with NaOH within 24 hours of sampling.
- <sup>p</sup>The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008%  $\text{Na}_2\text{S}_2\text{O}_3$ .
- <sup>q</sup>Sample receiving no pH adjustment must be analyzed within 7 days of sampling.



TABLE 4 SAMPLE ANALYSES FOR FORT DIX

<u>Group A - Metals</u>	<u>Group C - Base/Neutral Extractables<sup>(b)</sup></u>
Antimony	N-Nitrosodimethylamine
Arsenic	Bis(2-chloroethyl)ether
Beryllium	1,3-Dichlorobenzene
Cadmium	1,4-Dichlorobenzene
Chromium - Total	1,2-Dichlorobenzene
Copper	Bis(2-chloroisopropyl)ether
Lead	Hexachloroethane
Mercury	N-Nitroso-di-n-propylamine
Nickel	Nitrobenzene
Selenium	Isophorone
Silver	Bis(2-chloroethoxy)methane
Thallium	1,2,4-Trichlorobenzene
Zinc	Naphthalene
Cyanides - Total	Hexachlorobutadiene
	Hexachlorocyclopentadiene
	2-Chloronaphthalene
<u>Group B - Purgeable Organics(a)</u>	Acenaphthylene
Acrolein	Dimethyl phthalate
Acrylonitrile	2,6-Dinitrotoluene
Benzene	Acenaphthene
Carbon tetrachloride	2,4-Dinitrotoluene
Chlorobenzene	Fluorene
1,2-Dichloroethane	Diethyl phthalate
1,1,1-Trichloroethane	4-Chlorophenyl phenyl ether
1,1-Dichloroethane	N-Nitrosodiphenylamine
1,1,2-Trichloroethane	1,2-Diphenylhydrazine
1,1,2,2-Tetrachloroethane	4-Bromophenyl phenyl ether
Chloroethane	Hexachlorobenzene
2-Chloroethylvinyl ether	Phenanthrene
Chloroform	Anthracene
1,1-Dichloroethene	Di-n-butyl phthalate
trans-1,2-Dichloroethene	Fluoranthene
1,2-Dichloropropane	Benzidine
1,3-Dichloropropene	Pyrene
Ethylbenzene	Butyl benzyl phthalate
Methylene chloride	Benzo(a)anthracene
Chloromethane	3,3'-Dichlorobenzidine
Bromomethane	Chrysene
Bromoform	Bis(2-ethylhexyl)phthalate
Bromodichloromethane	Di-n-octyl phthalate
Fluorotrichloromethane	Benzo(a)pyrene
Chlorodibromomethane	Indeno(1,2,3-cd)pyrene
Tetrachloroethene	Dibenzo(a,h)anthracene
Toluene	Benzo(g,h,i)perylene
Trichloroethene	Benzo(b)fluoranthene+
Vinyl chloride	benzo(k)fluoranthene

TABLE 4 (Cont.)

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Group D - Acid Extractables<sup>(b)</sup>

Phenol  
2-Chlorophenol  
2-Nitrophenol  
2,4-Dimethylphenol  
2,4-Dichlorophenol  
p-Chloro-m-cresol  
2,4,6-Trichlorophenol  
2,4-Dinitrophenol  
4-Nitrophenol  
4,6-Dinitro-o-cresol  
Pentachlorophenol

Group E

Total Petroleum Hydrocarbons

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(a) EPA Method 624 by GC/MS.

(b) EPA Method 625 by GC/MS.

TABLE 5 SAMPLING SCHEDULE

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Installation: Fort Dix

Date Prepared: 12 December 1985

Revision: 1

<u>Activity</u>	<u>Date(s)</u>
Sampling Design Plan (Draft)	16 December 1985
USATHAMA (Sampling Design Plan Briefing)	2 January 1986
Revised Sampling Design Plan	16 January 1986
Geophysical Survey	3-28 February 1986
Well Installation	17 February - 21 March 1986
Sample Collection	7-11 April 1986
Follow-on Visit	26-30 May 1986



TABLE 6 BUDGET ESTIMATE FOR FORT DIX SAMPLING

Task No.	Activity	Labor Hours	Direct Labor and Overhead (\$)	Direct Costs (\$)	Subcontractor or Lab Fees (\$)	Travel (\$)	Total Work for Element (\$)
2D	Well Installation	360	\$ 17,600	\$ 1,925	\$ 46,875	\$ 3,420	\$ 69,820
2E	Sampling/Analysis Data Management	240	6,171	2,260	41,165	1,261	50,857
2F	Follow-on Sampling	152	4,243	2,260	26,535	1,261	34,299
2G	Geophysical Survey	378	10,121	2,448	--	2,908	15,477
	Total	1,130	\$ 38,135	\$ 8,893	\$ 114,575	\$ 8,850	\$ 170,453

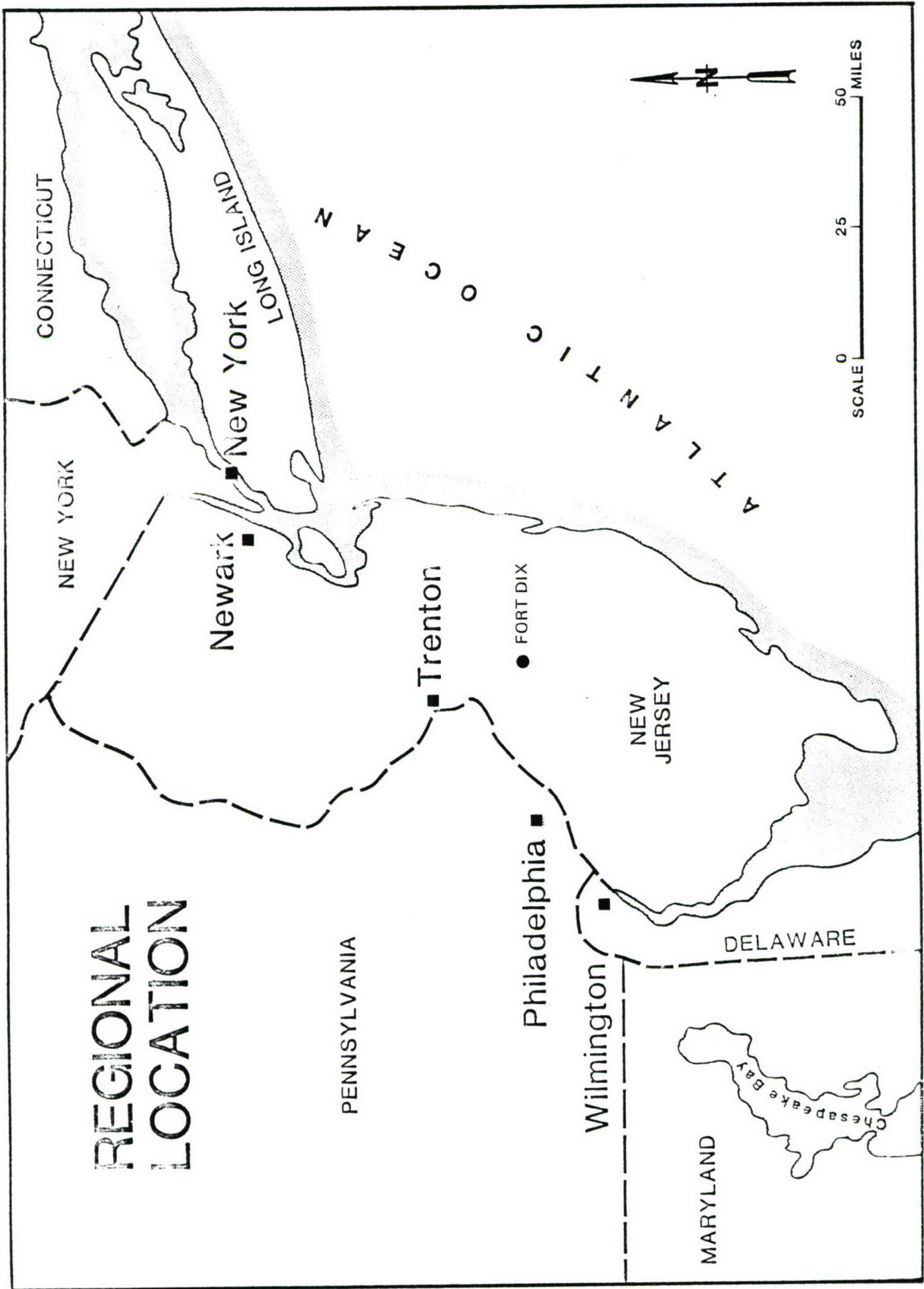


Figure 1. Regional location.



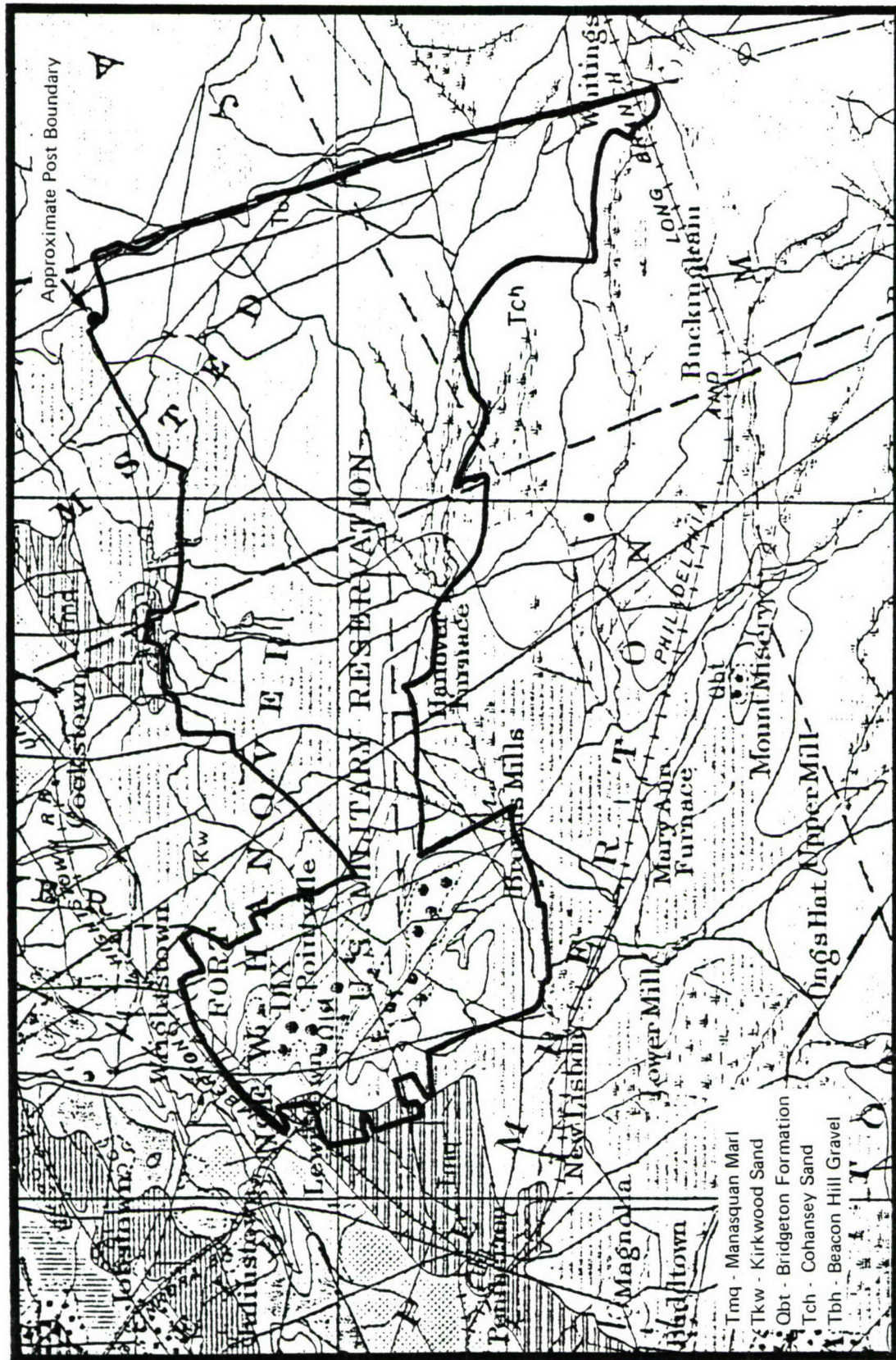


Figure 4. Geologic map.



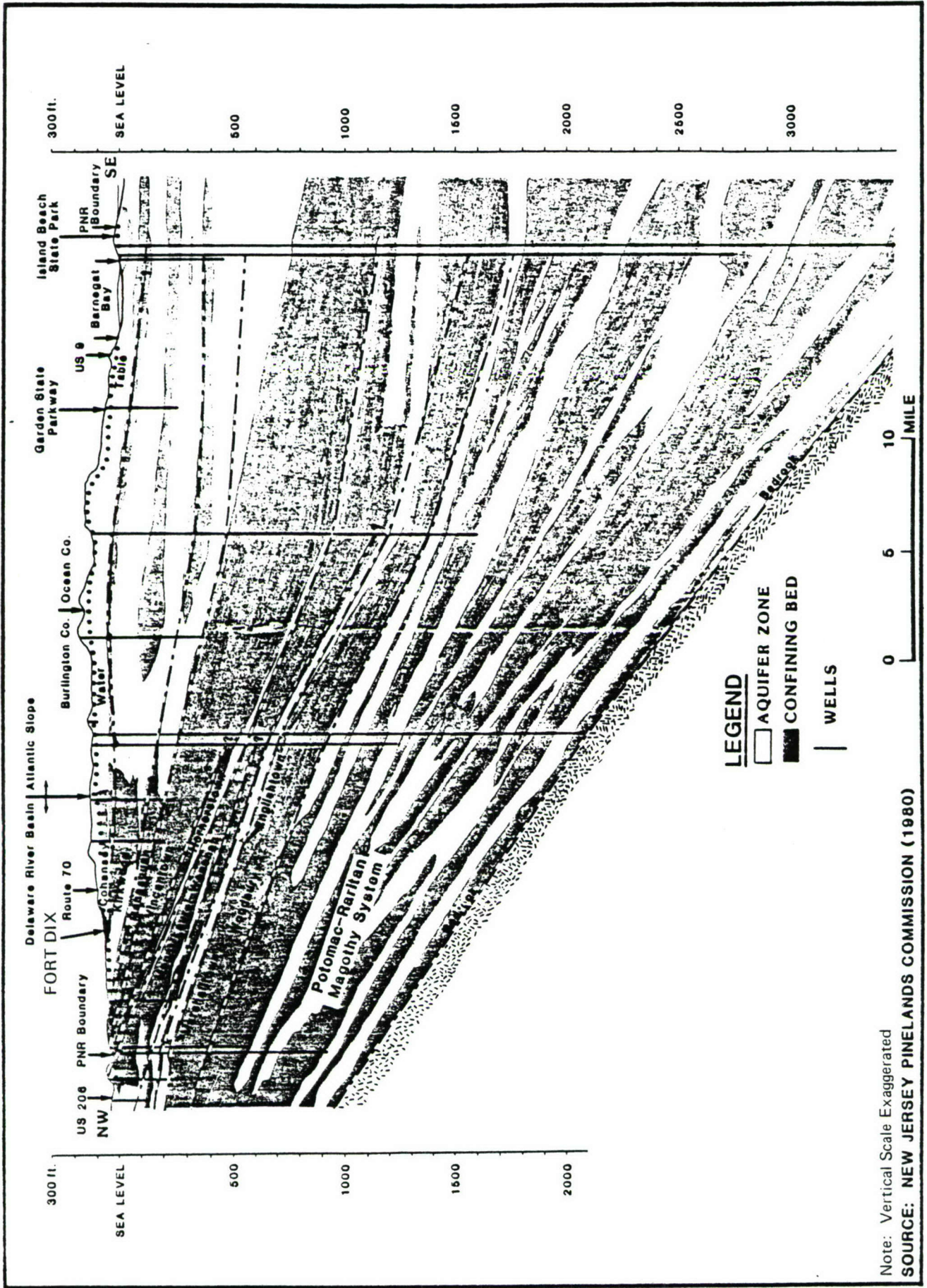


Figure 5. Generalized hydrogeologic cross section of New Jersey.



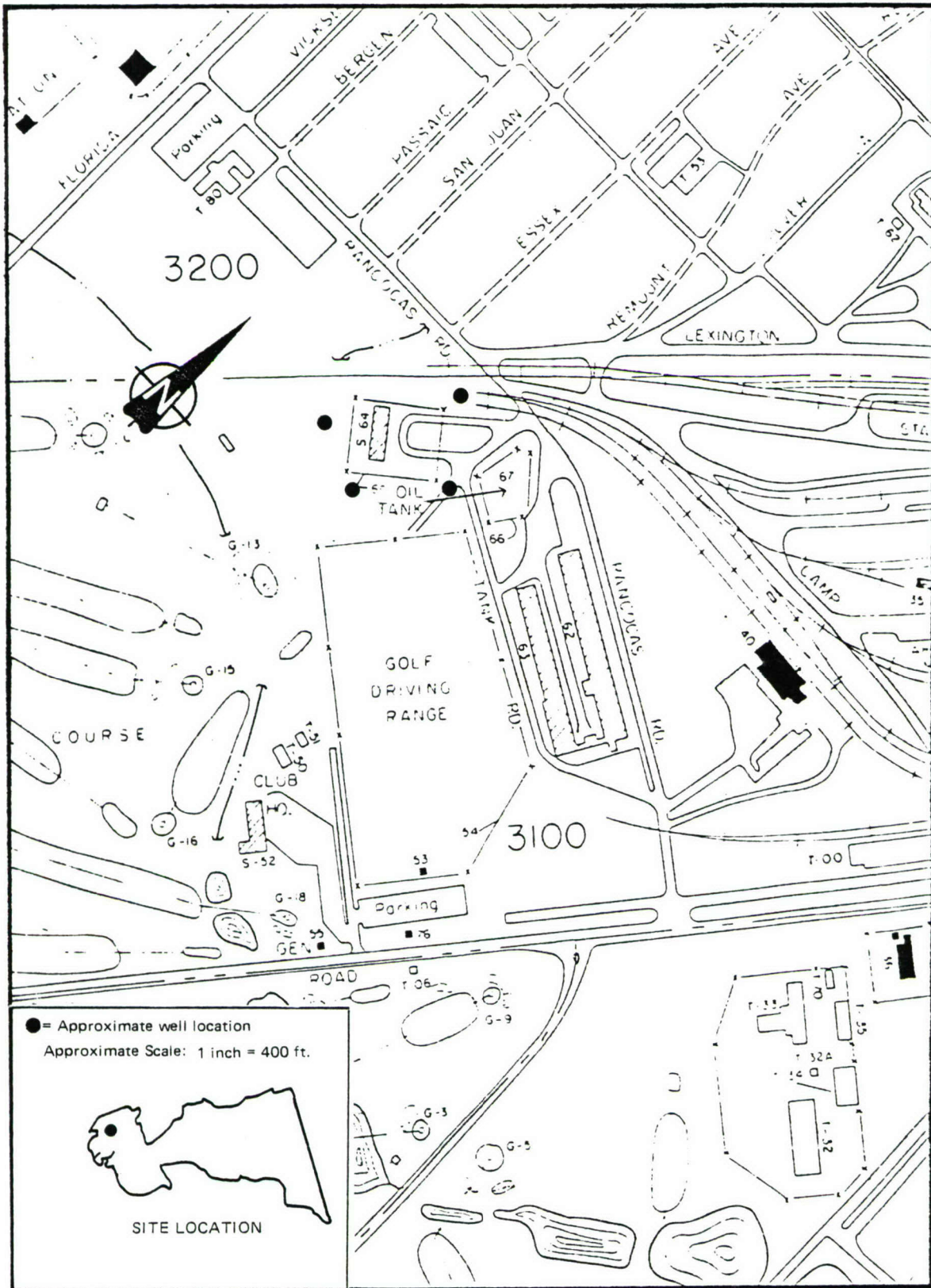


Figure 6. POL area

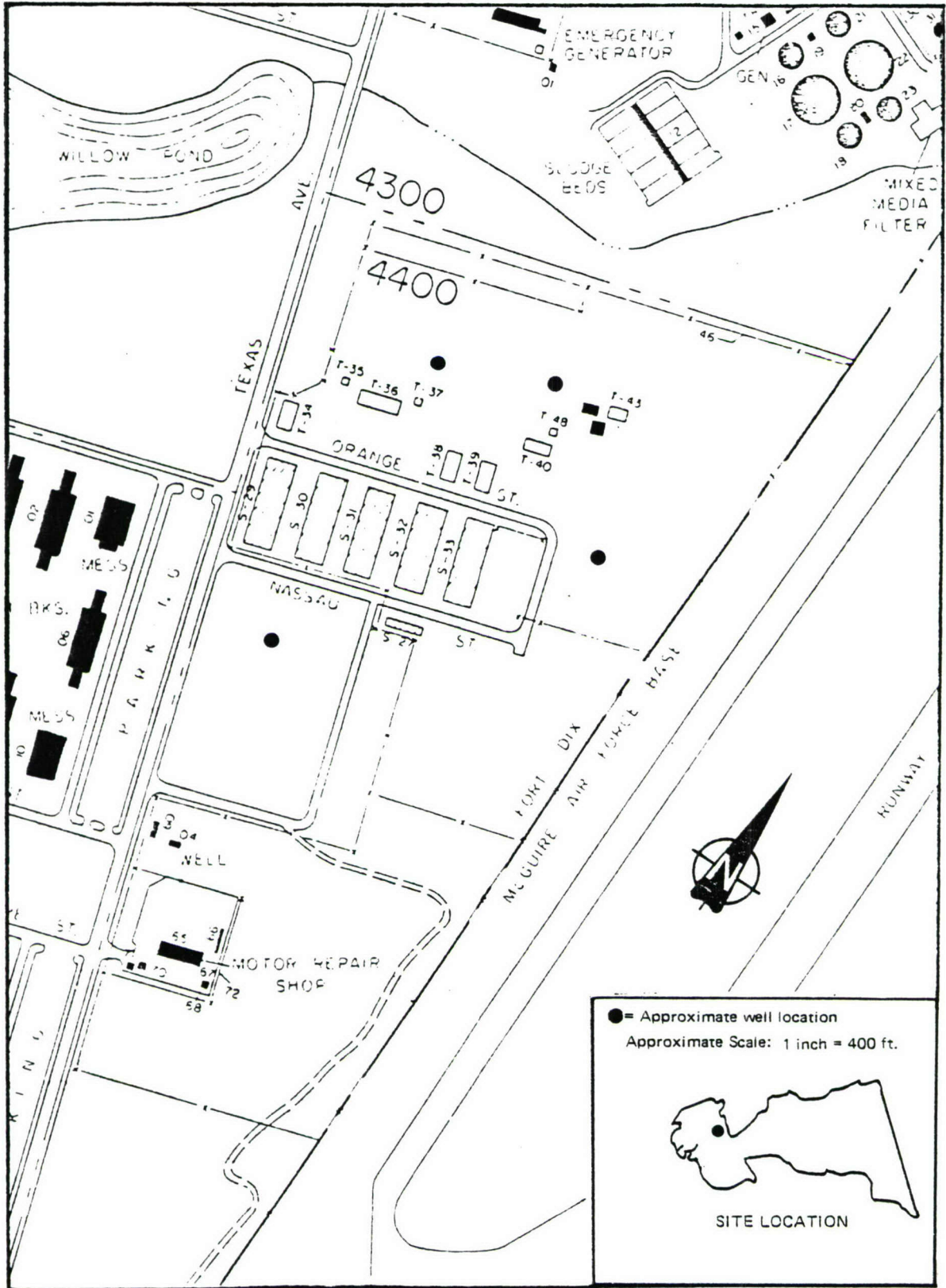


Figure 7. DIO maintenance shops.





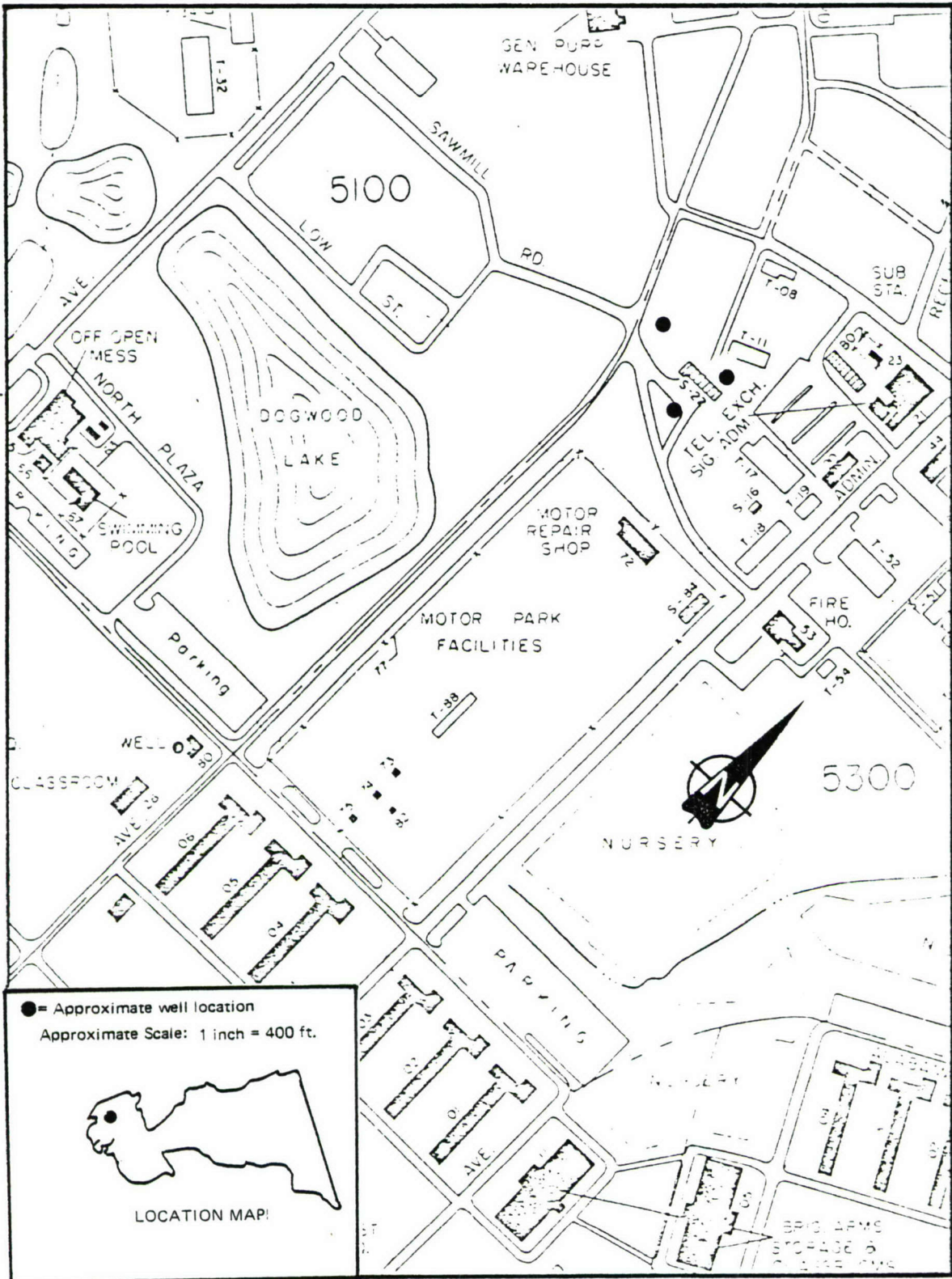


Figure 9. Paint shop.



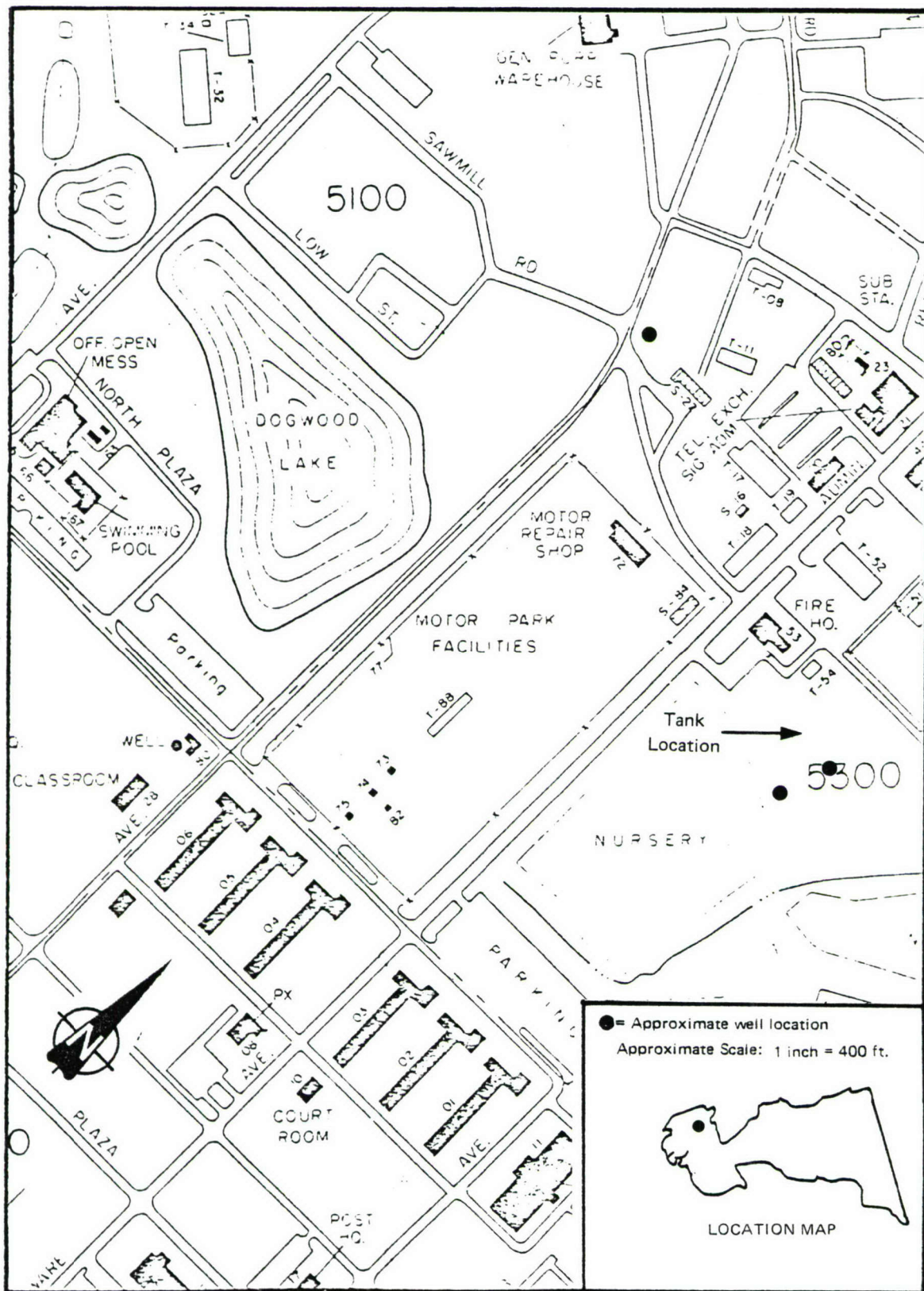


Figure 10. Fire training tanks.



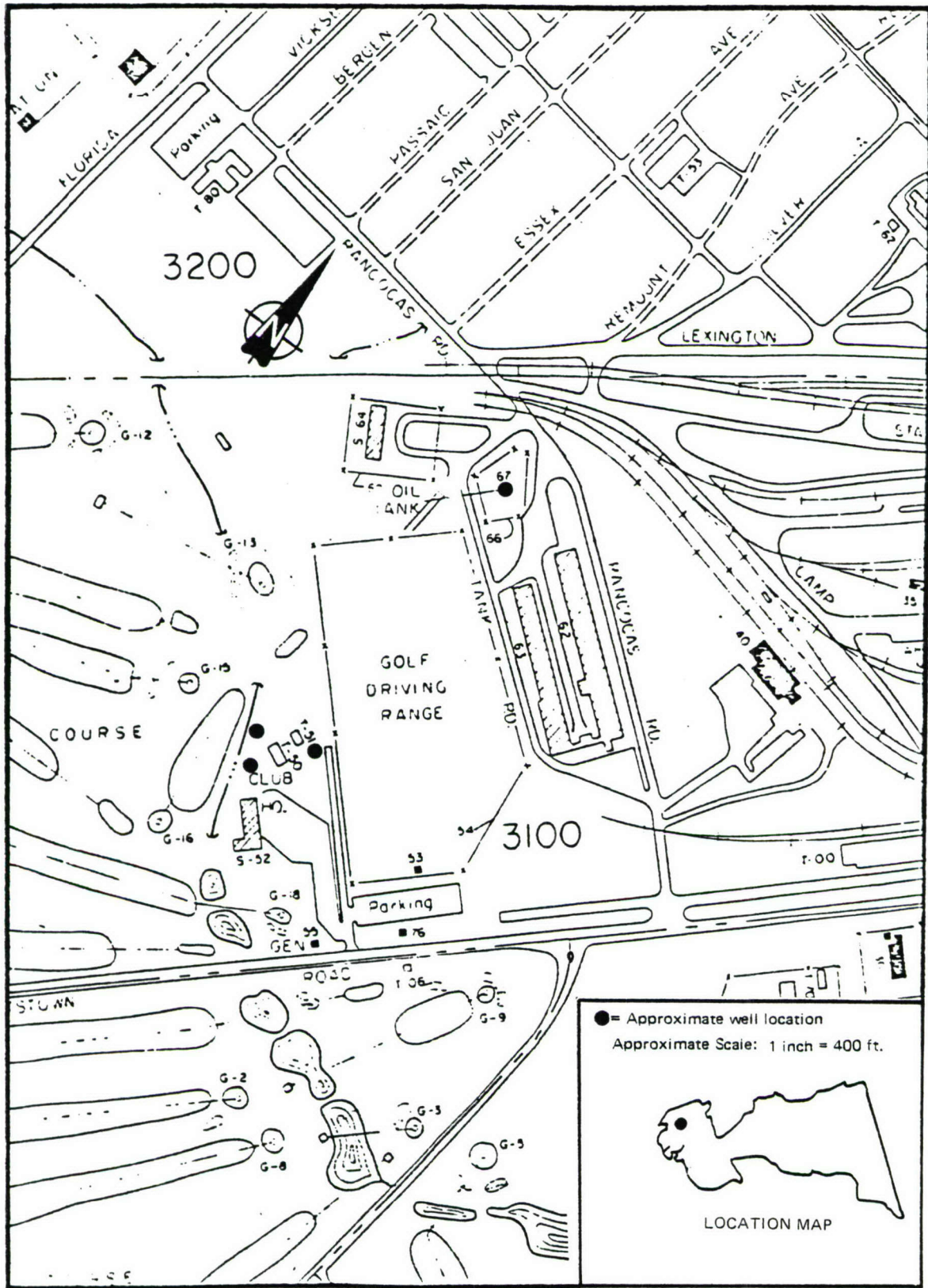


Figure 11. Golf course area.

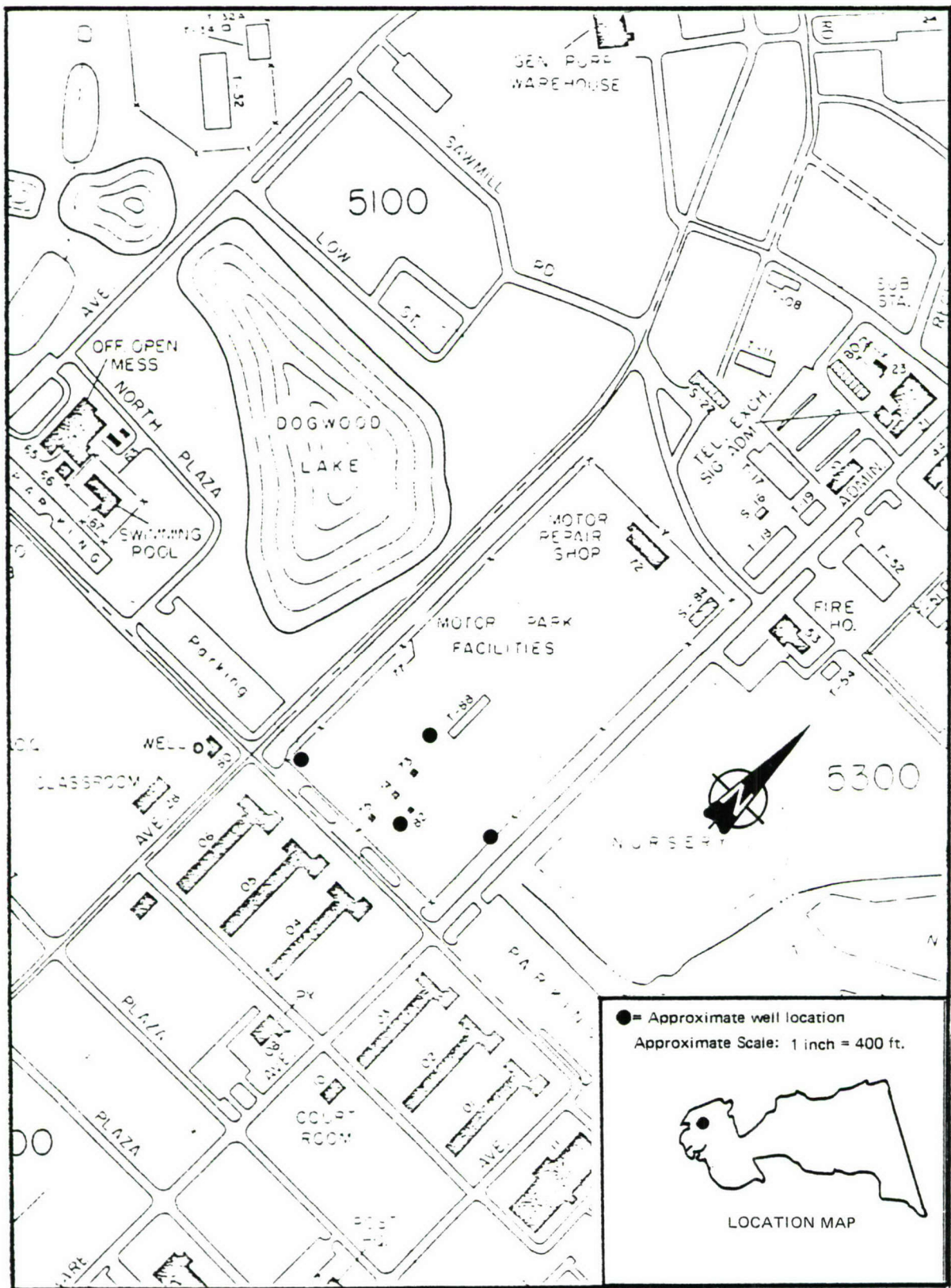


Figure 12. Transportation motor pool.



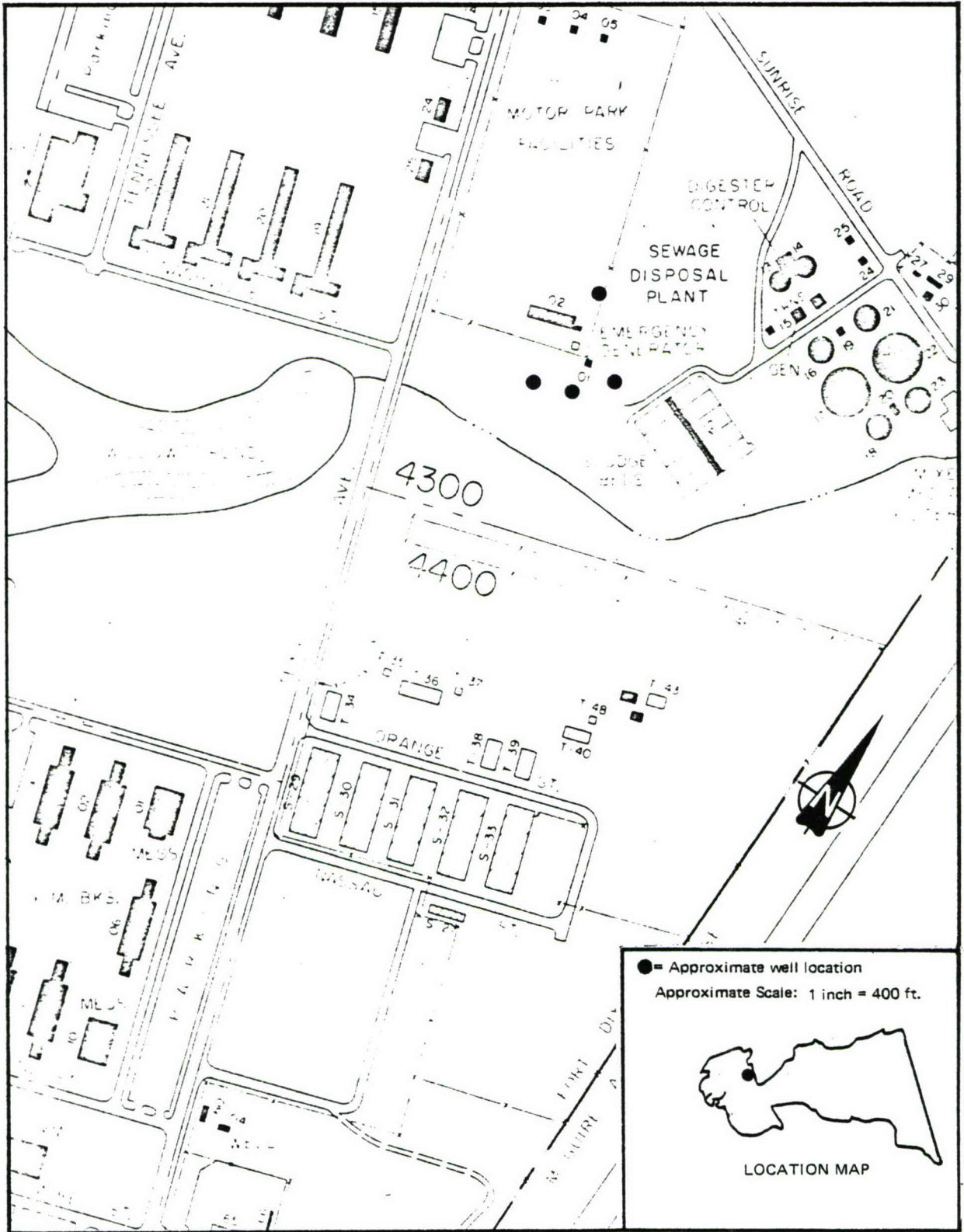


Figure 13. Three-hundred sixty-third motor pool.



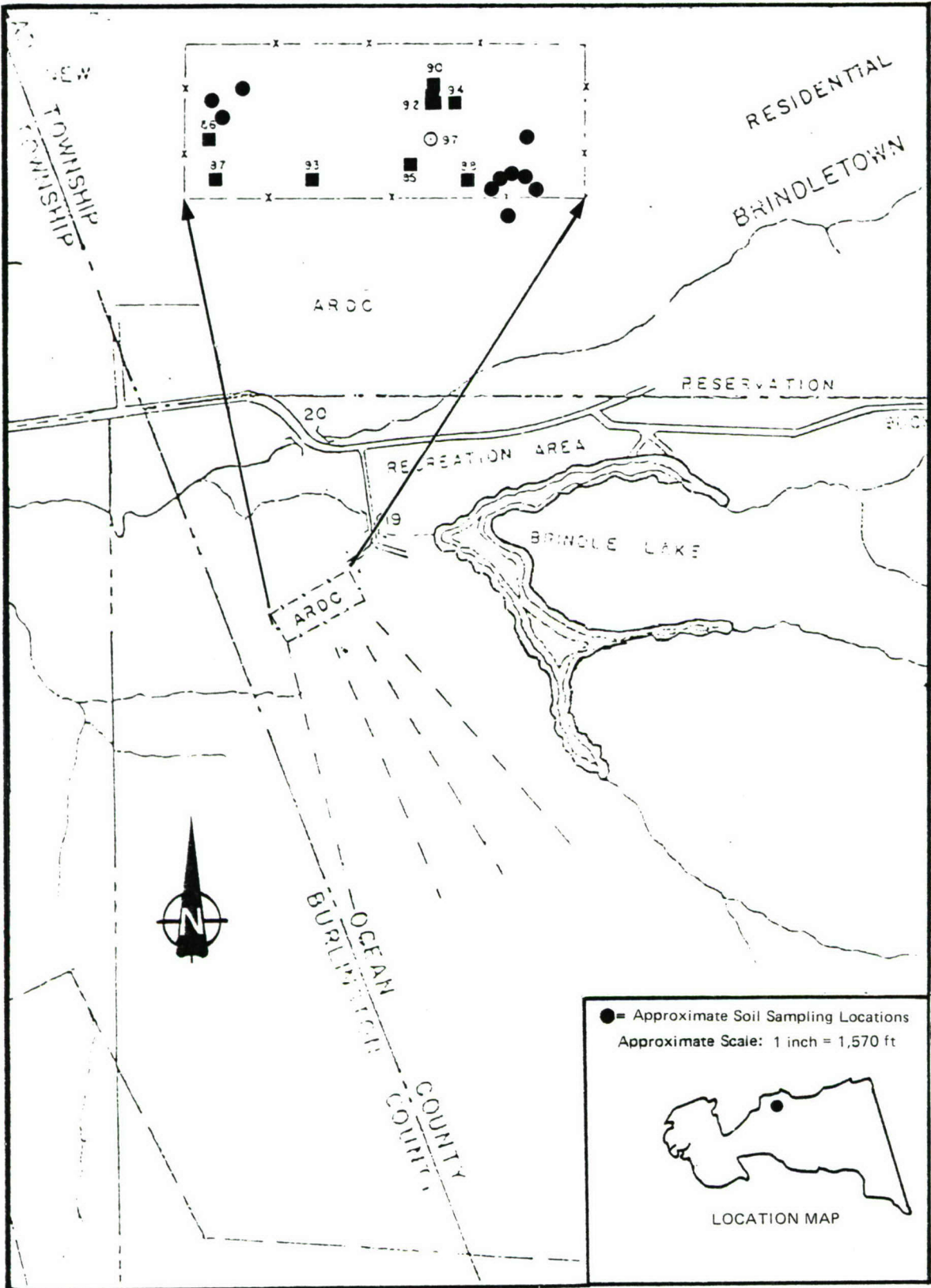


Figure 14. ARDC test facility.







FIELD RECORD OF WELL GAUGING, PURGING AND SAMPLING

Site: \_\_\_\_\_

Well No: \_\_\_\_\_ Gauge Date: \_\_\_\_\_ Time: \_\_\_\_\_

Weather: \_\_\_\_\_

Well Condition: \_\_\_\_\_

Well Diameter (inches): \_\_\_\_\_

Odor (describe): \_\_\_\_\_

Sounding Method: \_\_\_\_\_ Measurement Reference: \_\_\_\_\_

Stick up/down (ft): \_\_\_\_\_

(1) Well Depth (ft): \_\_\_\_\_ Purge Date: \_\_\_\_\_ Time: \_\_\_\_\_

(2) Depth to Liquid (ft): \_\_\_\_\_ Purge Method: \_\_\_\_\_

(3) Depth to Water (ft): \_\_\_\_\_ Purge Rate (gpm): \_\_\_\_\_

(4) Liquid Depth [(1)-(2)]: \_\_\_\_\_ Purge Time (min): \_\_\_\_\_

(5) Liquid Volume [(4)xF] (gal): \_\_\_\_\_ Purge Volume (gal): \_\_\_\_\_

Did Well Pump Dry? Describe: \_\_\_\_\_

Samplers: \_\_\_\_\_

Sampling Date: \_\_\_\_\_ Time: \_\_\_\_\_

Sample Type: \_\_\_\_\_ Splic? \_\_\_\_\_ With Whom: \_\_\_\_\_

Comments and Observations: \_\_\_\_\_

\*Conversion: Liquid Depth to Volume Conversion Inches to Fractional Feet

Well Diameter	Gallon/ft	1	.08	5	.42	9	.75
		1 1/2	.12	5 1/2	.46	9 1/2	.79
2"	0.16	2	.16	6	.50	10	.83
4"	0.65	2 1/2	.21	6 1/2	.54	10 1/2	.87
6"	1.47	3	.25	7	.58	11	.91
8"	2.51	3 1/2	.29	7 1/2	.62	11 1/2	.95
12"	5.37	4	.33	8	.66		
		4 1/2	.37	8 1/2	.70		

\* Multiply liquid depth by gallons/ft.

Figure 16. Field record of well gauging, pumping and sampling.



**CHEMISTRY CONTAINER REQUEST**

DATE: \_\_\_\_\_ DATE CONTAINERS MUST BE READY: \_\_\_\_\_

PROJECT: \_\_\_\_\_ PROJECT MANAGER: \_\_\_\_\_

TYPE AND NUMBER OF CONTAINERS REQUESTED:

<u>Type</u>	<u>Number</u>
A	
B	
C	
F	
G	
H	
I	
J	
Pest	
VQA	
Bailers	
Blank Vacar	

CHAIN OF CUSTODY:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	METHOD OF SHIPMENT:
FIELD BLANKS:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	OVERNIGHT _____
TRIP BLANKS:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	2-DAY _____
PRESERVATIVES:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	GROUND _____
TO BE SHIPPED:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	

IF YES, SHIPPING ADDRESS:

IF NO, NAME OF PERSON WHO WILL PICK UP CONTAINERS:

---

CONTAINERS PREPARED BY:

DATE MAILED OR PICKED UP:

NUMBER OF COOLERS SHIPPED:

Figure 17. Chemistry container request.







APPENDIX A  
SITE HEALTH AND SAFETY PLAN

## APPENDIX A

EA Engineering, Science, and Technology, Inc.

Site Health and Safety Plan  
for  
U.S. Army Training Center and Fort Dix

### 1. GENERAL INFORMATION

Client: U.S. Army Toxic and Hazardous Materials Agency

Program Manager: Charles Stratton/Ken Kilmer

Site Safety and Health Coordinator: John Hendrick

Location: Wrightstown, New Jersey

Purpose of Field Investigations: To determine the potential for environmental contamination resulting from past and ongoing testing, storage, disposal, and training operations.

Scheduled Date: February through May 1986

### 2. SITE DESCRIPTION

The U.S. Army Training Center, Fort Dix (Fort Dix) is a government-owned installation under the command jurisdiction of the U.S. Army Training and Doctrine Command (TRADOC). The mission of the installation is to conduct Basic Combat Training and Advanced Individual Training, and to provide Combat Support and support to Reserve and National Guard Units. The post encompasses 32,000+ acres of land and is divided into three main areas. From west to east they are: the built-up cantonment area; the training

area; and the range firing and impact area. A site map is included in Figure A-1; also see Figures 2 and 3 of this report.

The site is characterized by relatively flat topography, sandy soils, and pine barren vegetation. The site is drained by tributaries of Crosswick Creek and the North Branch of Rancocas Creek, both of which flow westward to the Delaware River. Numerous catchment lakes and cranberry bogs occur on the base.

Fort Dix is located on the Kirkwood-Cohansey geologic formations. These formations are composed of water-bearing sand layers alternating with confining clay layers. These are used locally for water supply.

Fourteen sites will be investigated during this phase of the installation reassessment. Twenty-eight ground-water monitoring wells will be installed at eight of the sites. One site will be sampled for contaminated soils. Five sites will be surveyed using geophysical methods. The sites are identified on the maps attached to this report and activities at the sites are described in Section 3. Site-specific maps are found in Figures 6 through 15.

### 3. HAZARD EVALUATION

The hazard evaluation rating is developed from the level of contaminants expected to be encountered at the site. The expected levels are developed from knowledge of activities at the site or from previous samplings.

Previous sampling has occurred at the Golf Course area and the Transportation Motor Pool. This sampling has detected low levels (less than 100 ppm in soil) of petroleum hydrocarbons. Visual observations indicate that similar levels could be encountered at the POL area, the DIO shops, the ARDC test site, the Fire Training Tanks, and the 363<sup>rd</sup> Motor Pool. Similar levels of organic solvents are expected at the wells drilled near the paint shop.



The concentrations of contaminants are not expected to be high. Therefore, exposure of site personnel to unsafe levels of hazardous materials is not expected to occur. However, precautions must be taken to minimize personnel exposure to contaminated soil and water during site operations. This operation will require Level D protective equipment. This equipment and other precautions are described in the following sections.

#### 4. SITE SAFETY AND HEALTH WORK PLAN

Twenty-eight monitoring wells will be installed at eight sites. Ground-water samples will be collected. Ten soil samples will be collected at various locations at the site. Five areas will be geophysically surveyed.

##### Air Monitoring

Periodic air monitoring with a photo-ionization detector (PID) will be conducted by the Site Safety and Health Coordinator (John Hendrick). Levels will be recorded at least every 30 minutes during drilling operations, or whenever conditions change.

IMPORTANT: If PID readings in the breathing zone exceed background levels, the level of protection must be increased to Level C (below). If readings in the breathing zone exceed 5 units above background level, all personnel must withdraw from the site. The Corporate Safety and Health Officer must be notified as soon as possible if site conditions require other than Level D protection.

## Protective Clothing

WELL DRILLING: Entry Level of Protection D

Cotton/polyester or Tyvek coveralls  
Chemical-resistant overalls (especially when using air  
surging/pumping to develop wells and pressure-washing  
equipment)  
Respirator with particulate filter cartridges (during  
dust-producing operations)  
Nitrile or solvex gloves (where contact with soil- or  
water-contaminated surfaces is anticipated)  
Steel toe/shank boots  
Boot covers  
Safety glasses  
Hard hat

ALL OTHER ACTIVITIES: Entry Level of Protection D

Cotton/polyester or Tyvek coveralls  
Nitrile gloves (where contact with contaminated soil  
or water is anticipated)  
Steel toe/shank boots  
Boot covers

Whenever PID readings exceed background levels:

Level of Protection C

Saran-coated Tyvek coverall  
Full facepiece respirator with organic vapor cartridges  
(in combination with particulate cartridges during dusty  
operations)  
Nitrile gloves  
Steel toe/shank boots  
Boot covers

### Equipment and Materials

The following list of equipment and materials will be present at the site during the entire investigation:

First aid kit

Eye wash kit

Fire extinguisher

HNU photo-ionization detector with 10.2 eV probe or Photovac

TIP photo-ionization detector

Potable water for drinking and washing hands/face

Polyethylene bags for disposal/storage of protective clothing  
and equipment

Detergent

### Work Zones

The Exclusion Zone is defined as any area within 100 feet of an active drill site or soil sampling operation. The Contamination Reduction Zone is the decontamination area established just outside the Exclusion Zone. This Exclusion Zone is not expected to interfere with ongoing installation work.

### Decontamination

Decontamination will consist of placing contaminated boots, clothing, and equipment in polyethylene bags for removal and decontamination at a later date. Reuseable coveralls are not to be washed with other non-contaminated items of clothing. All decontamination procedures will follow those described in the Quality Assurance Plan.

Heavy equipment will be steam cleaned before leaving the site.



## Safe Work Practices

Standard operating procedures which incorporate good safe working practices will be followed at all times.

No personnel will be permitted onsite unless they have proof of having passed the required medical examination.

First aid treatment will only be administered by trained personnel. The Site Safety and Health Coordinator will provide first aid treatment onsite.

No eating, drinking, chewing gum or tobacco, or smoking is permitted in the Exclusion Zone. Hands and face must be washed before eating, drinking, or smoking.

Prescription drugs must not be taken unless specifically approved by a physician who is familiar with the nature of the work exposure.

When respirators are required, facial hair that interferes with the face-to-facepiece fit of the respirator will not be permitted.

Contact lenses will not be permitted to be worn on the site during drilling or when full facepiece respirators are required.

Contact with contaminated or potentially contaminated surfaces must be avoided, where possible.

Personnel onsite must use the buddy system, especially when wearing respirator equipment.

Visual contact must be maintained between team members at all times.

Morning Safety Meetings will be conducted by the Site Safety and Health Coordinator prior to commencing work.

If explosive contamination or unexploded ordnance is discovered at the site, the location must be marked and operations immediately stopped in the area. Site Safety and Health Coordinator will contact the Project Manager, who will notify the contracting officer to make arrangements for disposal.

## 5. EMERGENCY PROCEDURES

All accidents, including personal injury, property damage, fire, explosion, spill or exposure to hazardous materials, must be reported immediately to the Site Safety and Health Coordinator, who will direct the appropriate action and notify the Corporate Safety and Health Officer. The Corporate Safety and Health Officer will maintain a record of injuries and illnesses that occur at the site.

- A. Military Police (609) 562-6001
- B. Fire (609) 723-1117
- C. Ambulance (609) 562-3621 or 3622
- D. Hospital Walston Army Hospital (609) 562-2695

### Directions to Hospital from Fort Dix, New Jersey

Report to Walston Army Hospital which is located in the cantonment area, between New Jersey and Maryland Avenues, west of Scott Plaza. The hospital is located in the west central end of the base. See Figures A-1 and A-2.

Other Emergency Contacts

- |  |                       |
|--|-----------------------|
| 1. EA Corporate Safety and Health Officer                      | (301) 771-4950 (work) |
| Linda J. Rubin   | (301) 771-4817 (home) |
| 2. EA Medical Services   | (301) 338-3704        |
| Wyman Park Center for Occupational and<br>Environmental Health | (301) 338-3500        |
| 3. EA Program Managers   | (301) 771-4950 (work) |
| Charles Stratton   | (301) 343-1061 (home) |
| Ken Kilmer   | (301) 374-4640 (home) |



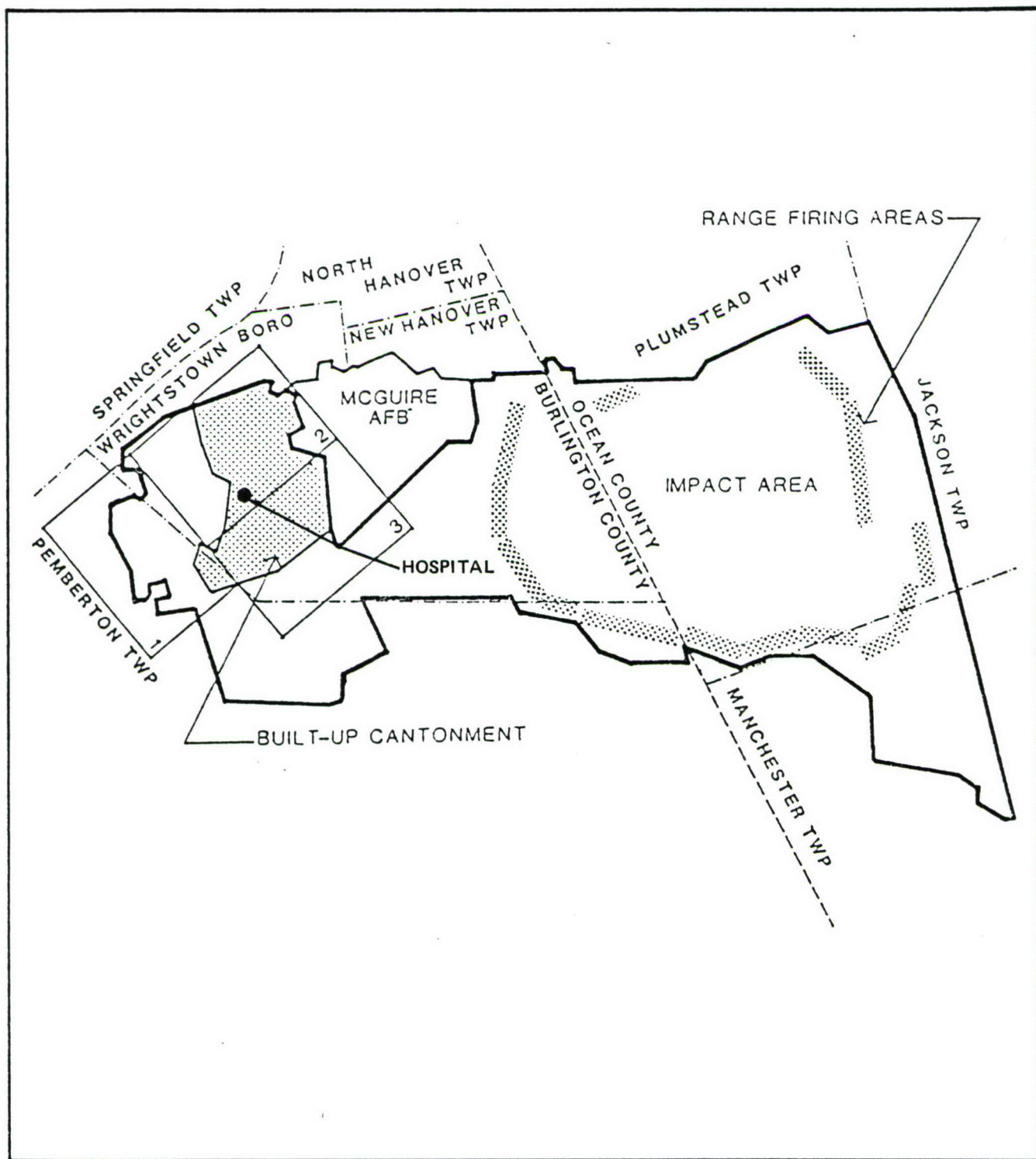


Figure A-1. Fort Dix map.

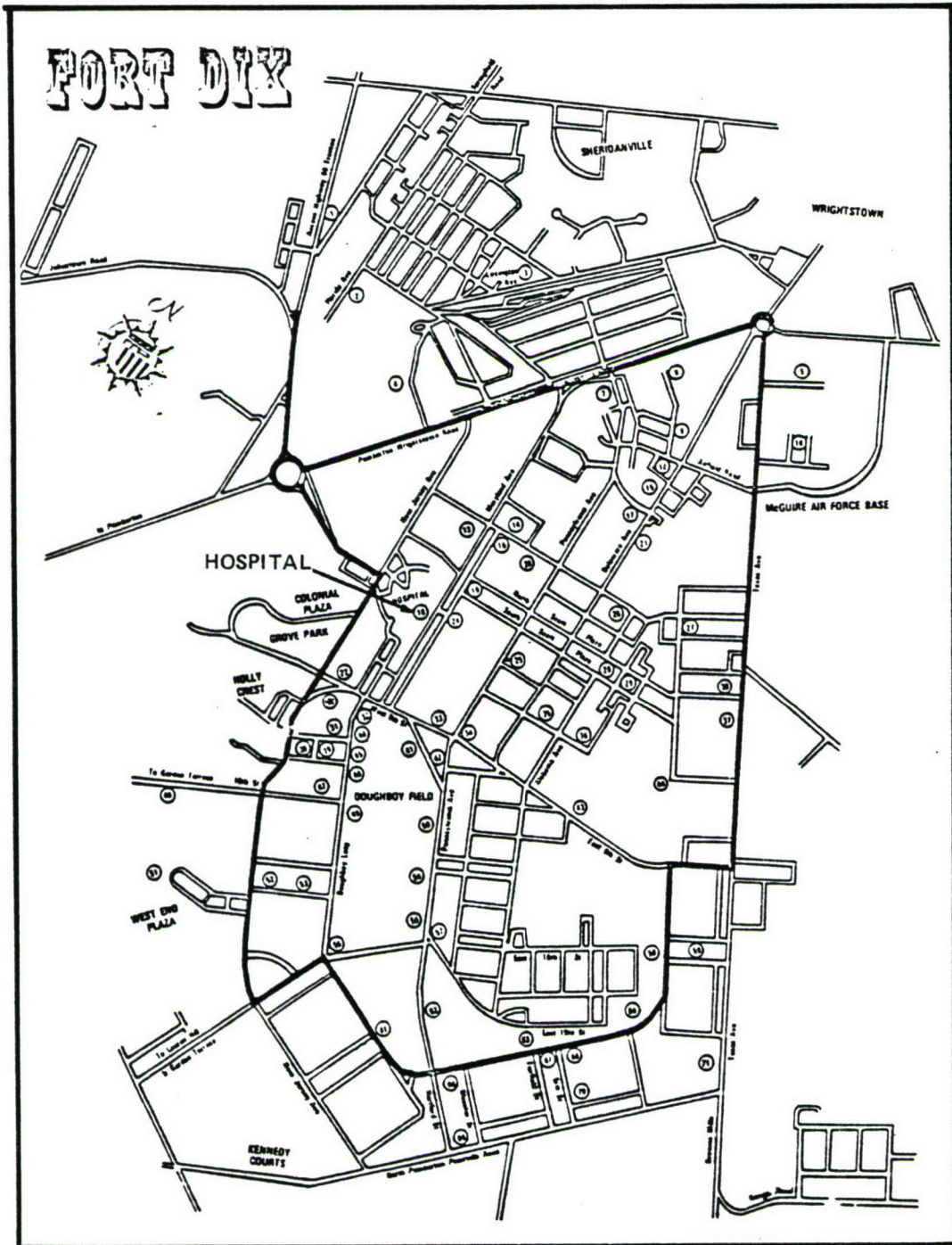


Figure A-2. Walston Medical Center.

APPENDIX B  
PROJECT COST ESTIMATE



Project No.: THA 51C  
 Task/Phase No.: 2D

**SCHEDULE B: PROJECT COST ESTIMATE**

Client: USATHAMA Task/Phase: WELL INSTALLATION  
 Preparer: JOHN HENDRICK Date: 1/14/86 Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

**DIRECT LABOR:**

Name/Title	Grade No.	Rate/Hour	Hours	Amount (\$)
		<input type="checkbox"/> Actual <input checked="" type="checkbox"/> Grade		
Principal	19	28.77		
Senior Scientist/Engineer	11-17	20.80	50	1040
Associate Scientist/Engineer	7-10	13.51	240	3242
Technical Support	1-6	7.01	70	491

TOTAL 360 \$ 4773 Line 1

**DIRECT EXPENSES (From Schedule B-1)**

Usage . . . . . \$ 1625  
 Travel and Subsistence . . . . . \$ 3420  
 Subcontractor(s)/Consultant(s) (\$ \_\_\_\_\_ cost) 46875  
 Other . . . . . \$ 300

TOTAL \$ 52220 Line 2

**INDICULATIONS**

Overhead Cost (Line 1 X 112 % OH Rate) . . . . . \$ 5346 Line 3  
 Direct Costs Plus Overhead (Lines 1 + 2 + 3) . . . . . \$ 62339 Line 4  
 General and Administrative Cost (Line 4 X 12 % G&A Rate) . . . . . \$ 7481 Line 5  
 Full Cost to EA (Lines 4 + 5) . . . . . \$ 69820 Line 6  
~~FEARLESS~~ . . . . . \$ 00000000 Line 7

**SAMPLE CHARGE(S) (From Schedule 3-3)**

\$ \_\_\_\_\_ Line 8

**NET AMOUNT (Lines 6 + 7 + 8)**

\$ 69820 Line 9

Attached Schedules:  3-1  3-2  3-3

**SCHEDULE B-1: DIRECT EXPENSE DETAIL**

Project No.: THASIC  
 Task/Phase No.: 2D

Client: USATHAMA Task/Phase: WELL INSTALLATION  
 Preparer: JOHN HENDRICK Date: 1/14/86 Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

USAGE	Item	Usage Units	Rate/Unit	Amount(\$)
	Computer		\$0.795/SRU	—
	WATER LEVEL INDICATOR	25 DAYS	\$10/DAY	250
	PH METER	25 DAYS	\$5/DAY	125
	SC&T METER	25 DAYS	\$5/DAY	125
	HNUMETER	25 DAYS	\$45/DAY	1125
TOTAL \$				<u>1625</u>

**TRAVEL AND SUBSISTENCE**

Trip Description:  
 1. SPARKS MD TO FT DIX NJ  
 2. 5 TRIPS - 1 WEEK EACH  
 3. \_\_\_\_\_  
 4. \_\_\_\_\_  
 5. \_\_\_\_\_

Item	Trip Number					Amount (\$)
	1	2	3	4	5	
Air Fare	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____
Car Rental	<u>935</u>	_____	_____	_____	_____	<u>935</u>
Vehicle Mileage	<u>1200</u>	_____	_____	_____	_____	<u>1200</u>
Other Transp.	_____	_____	_____	_____	_____	_____
Tolls	<u>35</u>	_____	_____	_____	_____	<u>35</u>
LODGING, Meals & Tips	<u>1250</u>	_____	_____	_____	_____	<u>1250</u>
TOTAL	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____
No. Trips	<u>5</u>	_____	_____	_____	_____	_____
GRAND TOTAL	\$ <u>3420</u>	\$ _____	\$ _____	\$ _____	\$ _____	\$ <u>3420</u>

**SUBCONTRACTOR(S)/CONSULTANT(S)**

Name	Activity	Amount (\$)
<u>ENGINEERING DRILLING INC</u>	<u>WELL DRILLING</u>	<u>42075</u>
<u>TO BE SELECTED</u>	<u>SURVEY</u>	<u>4,800</u>
TOTAL \$		<u>46875</u>

**OTHER DIRECT EXPENSES**

Item	Quantity	Unit Cost	Amount(\$)
Photocopy	<u>100</u>	<u>10¢</u>	<u>10</u>
Telephone/Communications	<u>30</u>	<u>\$3</u>	<u>90</u>
Postage/Shipping / <u>FIELD SUPPLIES</u>	_____	_____	<u>200</u>
TOTAL \$			<u>300</u>

Project: THASIC  
Proposal No.:  
Task/Phase No.: 2D

SCHEDULE B-2: SCOPE AND SCHEDULE ASSUMPTIONS

Client: USATHAMA Task/Phase: WELL INSTALLATION  
Preparer: HENDRICK Date: 1/14/86 Reviewer: Date:

TRAVEL

5 WK RENTAL OF 4 WD SUBURBAN = 935  
2500 MI @ 48¢/MI 1200.  
TOLLS: MD, DE, BRIDGE, NJ  
25 DAYS @ \$50 PER DIEM 1250

SUB CONTRACTORS

WELLS  
28 WELLS / 8 SITES / 935 FT <sup>TOTAL</sup> DEPTH  
@ 45 \$/FT \$ 42075

SURVEYS

\$600/SITE · 8 SITES 4800

OTHER: CALLS TO OFFICE & USA THAMA





Project No.: THA51C  
 Task/Phase No.: 2E

**SCHEDULE B-1: DIRECT EXPENSE DETAIL**

Client: USATHAMA Task/Phase: SAMPLING  
 Preparer: HENDRICK Date: 1/14 Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

USAGE	Item	Usage Units	Rate/Unit	Amount(\$)
	Computer		\$0.795/SRT	
	M-SCOPE	8 DAYS	\$10/DAY	80
	PH METER	8 DAYS	\$5/DAY	40
	S-C-T METER	8 DAYS	\$5/DAY	40
	BAILERS	56	\$5/EACH	280
	OVA	8 DAYS	\$50/DAY	400
TOTAL \$				840

**TRAVEL AND SUBSISTENCE**

- Trip Descriptions:
- SPARKS MD TO FT, DIX FOR
  - GROUND WATER & SOIL SAMPLING
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_

Item	Trip Number					Amount (\$)
	1	2	3	4	5	
Air Fare	\$	\$	\$	\$	\$	\$
Car Rental	376					376
Vehicle Mileage	480					480
Other Transp.						
Tolls	5					5
LODGING Meals & Tips	400					400
TOTAL	\$	\$	\$	\$	\$	\$
No. Trips						
GRAND TOTAL	\$ 1261	\$	\$	\$	\$	\$ 1261

SUBCONTRACTOR(S)/CONSULTANT(S)		Activity	Amount (\$)
Name			
_____			
_____			
_____			
TOTAL \$			_____

OTHER DIRECT EXPENSES	Item	Quantity	Unit Cost	Amount(\$)
	Photocopy			
	Telephone/Communications (CONNECT TIME)			1000
	Postage/Shipping SAMPLES	14	30	420
TOTAL \$				1420









Project: THASIC  
 Task/Phase No.: 2F

**SCHEDULE B-1: DIRECT EXPENSE DETAIL**

Client: USATHAMA Task/Phase: FOLLOW ON SAMPLING  
 Preparer: HENDRICK Date: 1/14 Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

**USAGE**

Item	Usage Units	Rate/Unit	Amount (\$)
<del>Computer</del> <u>M SCOPE</u>	<u>8 DAYS</u>	<u>\$10/DAY</u>	<u>80</u>
<u>PH METER</u>	<u>8 DAYS</u>	<u>\$5/DAY</u>	<u>40</u>
<u>S-C-T METER</u>	<u>8 DAYS</u>	<u>\$5/DAY</u>	<u>40</u>
<u>BAILERS</u>	<u>56</u>	<u>\$5 EACH</u>	<u>280</u>
<u>OVA</u>	<u>8 DAYS</u>	<u>\$50/DAY</u>	<u>400</u>

TOTAL \$ 840

**TRAVEL AND SUBSISTENCE**

- Trip Descriptions:
- SPARKS MD TO FT DIX NJ FOR
  - GROUNDWATER SAMPLING
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_

Item	Trip Number					Amount (\$)
	1	2	3	4	5	
Air Fare	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____
Car Rental	<u>376</u>	_____	_____	_____	_____	<u>376</u>
Vehicle Mileage	<u>480</u>	_____	_____	_____	_____	<u>480</u>
Other Transp.	_____	_____	_____	_____	_____	_____
Tolls	<u>5</u>	_____	_____	_____	_____	<u>5</u>
LODGING	<u>400</u>	_____	_____	_____	_____	<u>400</u>
Meals & Tips	_____	_____	_____	_____	_____	_____
TOTAL	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____
No. Trips	_____	_____	_____	_____	_____	_____
GRAND TOTAL	\$ <u>1261</u>	\$ _____	\$ _____	\$ _____	\$ _____	\$ <u>1261</u>

**SUBCONTRACTOR(S)/CONSULTANT(S)**

Name	Activity	Amount (\$)
_____	_____	_____
_____	_____	_____
_____	_____	_____
TOTAL \$		<u>_____</u>

**OTHER DIRECT EXPENSES**

Item	Quantity	Unit Cost	Amount (\$)
<u>Photocopy</u>	_____	_____	_____
<u>Telephone/Communications</u> <u>CONNECT TIME</u>	_____	_____	<u>1000</u>
<u>Postage/Shipping</u> <u>SAMPLE</u>	<u>14</u>	<u>30</u>	<u>420</u>
TOTAL \$			<u>1420</u>



Project: THA 51 C  
Proposal No.: \_\_\_\_\_  
Task/Phase No.: 2F

SCHEDULE B-2: SCOPE AND SCHEDULE ASSUMPTIONS

Client: USATHAMA Task/Phase: FOLLOW ON SAMPLING  
Preparer: HENDRICK Date: 1/14/86 Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

LABOR

GRADE	FIELD	DATA	TOTAL
11-17	8	4	12
7-10	48	10	58
6-1	32	50	82
			<u>152</u>

TRAVEL

4WD SUBURBAN 3 DAYS @ 47<sup>¢</sup>/DAY 376

1000 MI @ 48<sup>¢</sup>/MI 480

TOLLS

8 DAYS @ \$50 PER DIEM 400

OTHER









Project: THASIC  
Proposal No.: \_\_\_\_\_  
Task/Phase No.: 20

SCHEDULE B-2: SCOPE AND SCHEDULE ASSUMPTIONS

Client: USATHAMA Task/Phase: GEO PHYSICAL SURVEY  
Preparer: HENDRICK Date: 1/15/86 Reviewer: \_\_\_\_\_ Date: \_\_\_\_\_

FIVE SITES

1 - 24 ACRES	- 8 DAYS
2 - 18.8 "	5 "
3 - 2.75 "	1 "
4 - 2.3 "	1 "
5 - 2.4 "	1 "
<u>50.25</u>	<u>16 DAYS</u>

10 METER SPACING  
ALONG TRAVERSES

20 METER BETWEEN  
TRAVERSE LINES

1-2 HR SET UP  
& STAKE OUT

LABOR

16 DAYS ON-SITE • 2 MAN  
36 HR TRAVEL TIME  
30 HR GRAPHICS SUPPORT (CONTOURING PLOTTING)