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February 1984

INITIAL ASSESSMENT STUDY (
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX and
YORKTOWN FUELS DIVISION

NEESA 13-046

NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY
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INITIAL ASSESSMENT STUDY

NAVAL SUPPLY CENTER (NORFOLK)

CHEATHAM ANNEX UIC:N60138
YORKTOWN FUELS DIVISION SPECIAL AREA OF UIC:N00189

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NAVY ASSESSMENT AND CONTROL
OF INSTALLATION POLLUTANTS (NACIP) DEPARTMENT
Naval Energy and Environmental Support Activity (NAVENENVSA)
Port Hueneme, California 93043

February, 1984

EXECUTIVE SUMMARY

This report presents the results of an Initial Assessment Study (IAS) conducted at the Naval Supply Center (Norfolk) Cheatham Annex and the Yorktown Fuels Division. The purpose of an IAS is to identify and assess the sites that may pose a potential threat to human health or to the environment due to contamination from past hazardous waste disposal.

A total of 32 potentially contaminated sites were identified at the two activities, based on information from historical records, aerial photographs, field inspections, and personnel interviews. Each site was evaluated for the waste characteristics, migration pathways, and pollutant receptors.

The study concludes that four of the twelve sites at Cheatham Annex may pose a sufficient threat to human health or to the environment to warrant Confirmation Studies. Confirmation Studies involve actual sampling and monitoring of the four sites to confirm or deny the existence of the suspected contamination and to quantify the extent of any problems which may exist. None of the sites, however, poses an immediate threat to human health or the environment. The four sites recommended for Confirmation Study at Cheatham Annex are:

1. Site 1, Landfill Near Incinerator,
2. Site 9, Transformer Storage Area,
3. Site 10, Decontamination Agent Disposal Area Near First Street,
4. Site 11, Bone Yard.

The study also concluded that sixteen of the twenty sites at Yorktown Fuels Division warrant Confirmation Studies under the NACIP program. The sites recommended for Confirmation Study at Yorktown Fuels Division are:

1. Site 13, Sludge Farm,
2. Sites 14-26, Tank Bottoms Disposal Areas,
3. Site 27, Fuel Pit at Building YK 215,
4. Site 31, Abandonded NSFO Tanks.

Sites 14-26 were grouped as one site because of their proximity and similarity of waste types and disposal practices.

The results of the Confirmation Studies will be used to evaluate the necessity to implement mitigative actions and/or clean up operations.

Naval
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FOREWORD

The Department of the Navy developed the Navy Assessment and Control of Installation Pollutants (NACIP) program to identify and control environmental contamination from past use and disposal of hazardous substances at Navy and Marine Corps installations. The NACIP program is part of the Department of Defense Installation Restoration Program, and is similar to the Environmental Protection Agency's Superfund Program authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

In the first phase of the NACIP program, a team of engineers and scientists conducts an Initial Assessment Study (IAS). The IAS team collects and evaluates evidence of contamination that may pose a potential threat to human health or the environment. The IAS includes a review of archival and activity records, interviews with activity personnel, and an on-site survey of the activity. This report documents the findings of an IAS at the Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division.

Confirmation studies under the NACIP program were recommended for four sites at Cheatham Annex and sixteen sites at the Yorktown Fuels Division. Atlantic Division of the Naval Facilities Engineering Command (LANTNAVFACENGCOM) will assist Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division in implementing recommendations.

Questions regarding this report should be referred to NAVENENVSA 112N at AUTOVON 360-3351, FTS 799-3351, or commercial 805-982-3351. Questions concerning confirmation work or other follow-on efforts should be referred to LANTNAVFACENGCOM 114 at AUTOVON 564-9566, FTS 954-9566, or commercial (804)/444-9566.

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Environmental Officer
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ACKNOWLEDGEMENTS

The Initial Assessment Study team commends the support, assistance and cooperation provided by personnel at the Naval Energy and Environmental Support Activity (NAVENENVSA), the Atlantic Division, Naval Facilities Engineering Command (LANTNAVFACENGCOM): and the Naval Supply Center (Norfolk) Virginia (NAVSUPCEN).

In particular the team acknowledges the outstanding effort provided by the following people, who aided in the coordination and successful completion of this study.

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CHAPTER 1. INTRODUCTION

1.1 PROGRAM BACKGROUND. Past hazardous waste disposal methods, although acceptable at the time, have often caused unexpected long-term problems through release of hazardous pollutants into the soil and ground water. In response to increasing national concern regarding these problems, Congress directed the Environmental Protection Agency (EPA) to develop a comprehensive national program to manage past disposal sites. The program is outlined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of December 1980.

1.1.1 DOD Program. Department of Defense (DOD) efforts in this area preceded the nationwide CERCLA program. In 1975, the U.S. Army developed for DOD a pilot program to investigate past disposal sites at military installations. DOD defined the program as the Installation Restoration Program in 1980, and instructed the services to comply with program guidelines.

1.1.2 Navy Program. The Navy manages its part of the program, the Navy Assessment and Control of Installation Pollutants (NACIP), in three phases. Phase one, the Initial Assessment Study (IAS), identifies potential threats to human health or the environment caused by past hazardous substance storage, handling, or disposal practices at naval activities. Phase two, the Confirmation Study, analyzes contaminants present at sites of concern and determines their migration paths. Phase three, Remedial Action, provides the required corrective measures to mitigate or eliminate confirmed problems.

1.2 AUTHORITY. The Chief of Naval Operations (CNO) initiated the NACIP program in OPNAVNOTE 6240 of 11 September 1980, superceded by OPNAVINST 5090.1 of 26 May 1983. The Naval Facilities Engineering Command (NAVFACENGCOM) manages the program within the existing structure of the Naval Environmental Protection Support Service (NEPSS). Thus, the Naval Energy and Environmental Support Activity (NAVENENVSA) conducts the program's phase one IAS in coordination with NAVFACENGCOM Engineering Field Divisions (EFDs). Activities are selected for an IAS by the CNO, based on recommendations by NAVFACENGCOM, the regional EFDs, and NAVENENVSA. CNO specifically approved the Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division for an IAS by CNO letter 451/391407 of 31 March 82.

1.3 SCOPE

1.3.1 Past Operations. The NACIP program focuses attention on past hazardous substance storage, use, and disposal practices on Navy property. Current practices are regularly surveyed for conformity to state and federal regulations and, therefore, are not included in the scope of the NACIP program. The IAS report addresses operational non-hazardous disposal and storage areas only if they were hazardous waste disposal or storage areas in the past. Current operations are investigated solely to infer what types and quantities of chemicals were used, and what disposal methods were practiced in the past.

1.3.2 Results. An IAS recommends, if necessary, mitigating actions to be performed by the activity or EFD, or sampling and monitoring (Confirmation Studies) to be administered by the EFD under the NACIP Program. Based on these recommendations, NAVFACENGCOM schedules Confirmation Studies for those sites determined by scientific and engineering judgement to be potential hazards to human health or to the environment.

1.4 INITIAL ASSESSMENT STUDY

1.4.1 Records Searches. The IAS begins with records searches at various government agencies: including EFDs, national and regional archives and records centers, and U.S. Geological Survey offices. In this integral step, study team members review records to assimilate information about the activity's mission, industrial processes, waste disposal records, and known environmental contamination. Typical examples of records include activity master plans and histories, environmental impact statements, cadastral records, and aerial photographs. Appendix A lists the agencies contacted during this study.

1.4.2 On-Site Survey. After the records searches, the study team conducts an on-site survey to complete documentation of past operations and disposal practices to identify potentially-contaminated areas. With the assistance of an activity point of contact, the team inspects the activity during ground and aerial tours, and interviews long-term employees and retirees. The on-site survey for the Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division was conducted from 18 to 22 July 1983: information in this report is current as of those dates.

Information obtained from interviews is verified by data from other sources before inclusion in the report. If information for certain sites is conflicting or inadequate, the team may collect samples for clarification.

1.4.3 Confirmation Study Ranking System. With information collected during the study, team members evaluate each site for its potential hazard to human health or to the environment. A two-step Confirmation Study Ranking System (CSRS), developed at NAVENENVSA, is used to systematically evaluate the relative severity of potential problems. As the first step, a flow chart based on type of waste, type of containment, and hydrogeology eliminates innocuous sites from further consideration. If the flow chart indicates a site has potential contamination, a rating model is applied. The rating model assigns a numerical score from 0 to 100 to each site. The score reflects the characteristics of the wastes, the potential migration pathways from the site, and possible contaminant receptors on and off the activity.

1.4.4 Site Ranking. After rating a site, engineering judgement is applied to determine the need for a Confirmation Study or an immediate mitigating action. At sites recommended for further work, CSRS scores are used to develop a priority list for scheduling projects. For a more detailed description, refer to NAVENENVSA Confirmation Study Ranking System (NEESA 20.2-042).

1.4.5 Confirmation Study Criteria. A Confirmation Study is recommended for sites at which (1) sufficient evidence exists to indicate the presence of contamination, and (2) the contamination poses a potential threat to human health or to the environment.

1.5 CONFIRMATION STUDY. The EFD conducts the Confirmation Study which has two steps--verification and characterization. In the verification step, short-term analytical testing and monitoring determines whether specific toxic and hazardous materials, identified in the IAS are present in concentrations considered to be hazardous. If required, a characterization step, using longer-term testing and monitoring, provides more detailed information concerning the extent of contamination migrating from sites, as well as hydrogeology. If sites require remedial actions or additional monitoring programs, the Confirmation Study recommendations include the necessary planning information for the work, such as design parameters.

1.6 IAS REPORT CONTENTS. In this report, the significant findings and conclusions from the IAS are presented in Chapter 2. Recommendations are presented in Chapter 3. Chapter 4 describes general activity information, history, physical features, and biology. Chapters 5 through 8 trace the use of chemicals and hazardous materials, from storage and transfer, through manufacturing and operations, to waste processing and disposal. The remaining chapters provide detailed documentation to support the findings and conclusions in chapters 2 and 3. Figure 1-1 shows the locations of the Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division.

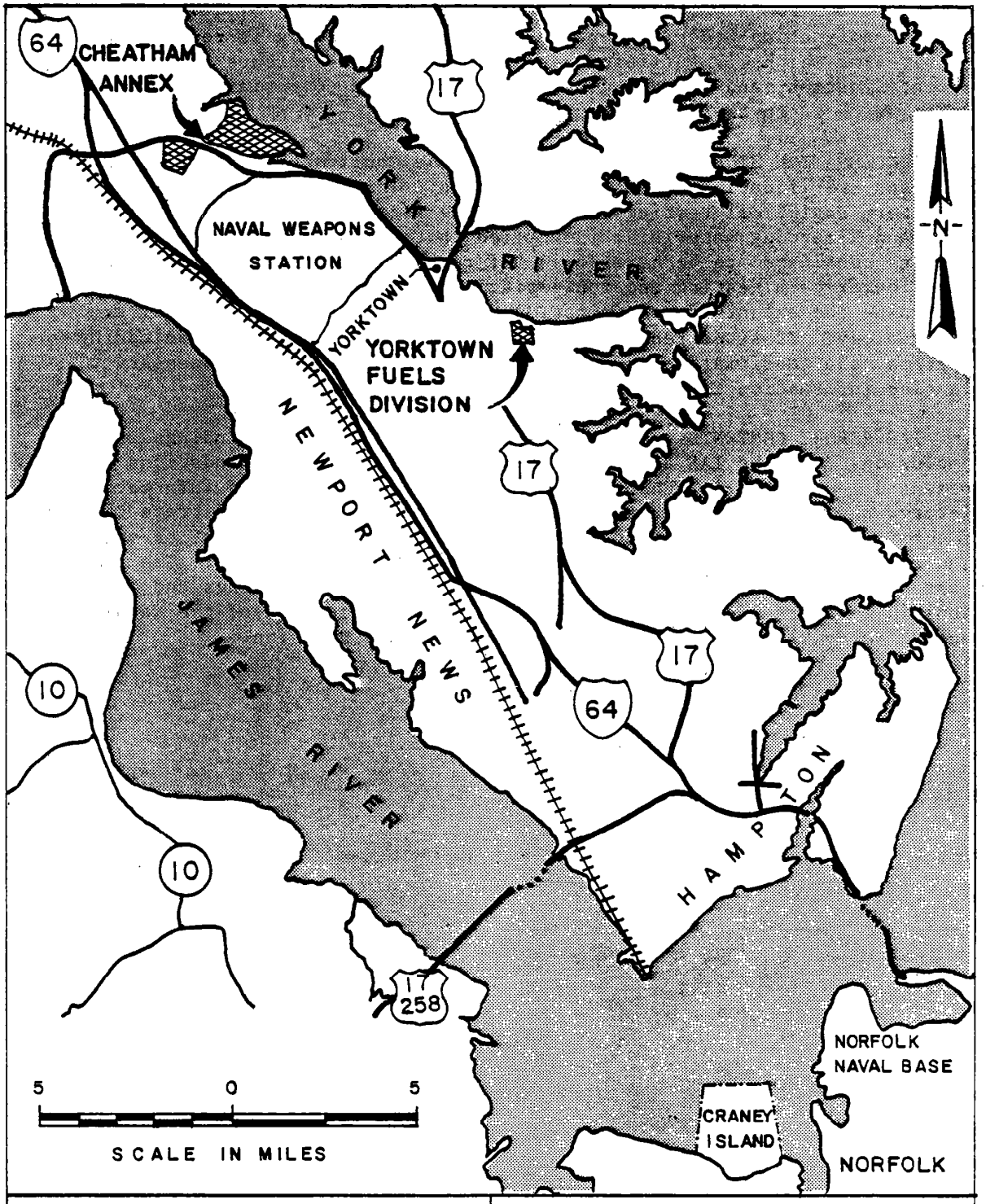

FIGURE 1-1
VICINITY MAP
CHEATHAM ANNEX
YORKTOWN FUELS DIVISION

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX
YORKTOWN FUELS DIVISION

CHAPTER 2. SIGNIFICANT FINDINGS AND CONCLUSIONS

2.1 INTRODUCTION. This chapter is a summary of the significant findings and conclusions of the Initial Assessment Study (IAS) for the Naval Supply Center (Norfolk), Cheatham Annex and Yorktown Fuels Division. The hydrogeology and potential receptors at each activity are identified along with the characteristics of the waste disposal sites.

Sites recommended for Confirmation Study are discussed first, followed by those sites not recommended for further study. Table 2-1 lists the identified sites and summarizes their characteristics.

2.2 NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX. All of the disposal sites and potential contamination areas identified at Cheatham Annex are shown in Figure 2-1. Four of the twelve sites identified at Cheatham Annex are recommended for Confirmation Study.

2.2.1 Hydrogeology and Migration Potential. Cheatham Annex lies within the York River Basin near the mouth of the river. Main tributaries to the York River on Cheatham Annex are King Creek on the northeastern boundary, Cheatham Lake on the western boundary and Jones Pond in the southwestern section of the Annex. Cheatham Lake is the main drainage feature of the activity. Penniman Lake, located in the northeastern section of the activity, drains to King Creek. Wetlands are located along the tidal creeks draining the activity and some of the York River shoreline. The York River in the vicinity of Cheatham Annex is classified as shellfish waters.

Surface runoff may take place through storm water systems, open surface ditches, and drains. In many cases, these discharges enter wetlands, creeks and the York River, possibly contaminating shellfish waters.

The potential for contamination of the water-table aquifer is enhanced by the presence of well-drained soils in the area. Several private wells in this aquifer are located within 1/4 mile from the southeastern boundary of the site in the Springfield Road and Jones Drive areas. There is also some possibility that the contaminants could migrate downward to the upper and principal artesian systems via leakage through the confining layers. The upper artesian aquifer is not used within a three-mile radius of the activity, while the principal artesian aquifer provides water, through private water companies, to several subdivisions within approximately three miles of the activity.

2.2.2 Sites Recommended for Confirmation Study.

2.2.2.1 Site 1, Landfill Near Incinerator (Figure 2-2). This site is approximately 2 acres in size and located along the York River behind the old incinerator (Building CAD 129). The landfill was in use from 1942 to 1951 as a disposal area for incinerator burning residues, and from 1951 to 1972 as a general landfill. A variety of wastes including empty paint and

TABLE 2-1

AREAS OF CONTAMINATION - NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION

AREA OF CONCERN	PERIOD OF OPERATION	TYPES OF WASTES DISPOSED OF OR SPILLED	GENERAL DEVELOPMENT MAP COORDINATES	COMMENTS
CHEATHAM ANNEX				
Site 1 Landfill Near Incinerator	1942-1982	Incinerator residues, empty paint and paint thinner cans, cartons of ether and other unspecified drugs (burned), lumber, plywood, tar paper, sheet rock, concrete, cans, glasses, wooden boxes, tree debris, sawdust, metal objects, containers, rags, paper box containers, old mattresses, railroad ties, lockers.	E-15	From 1942 to 1951, the site was used as a disposal area for incinerator burning residues; from 1951 to 1972 as a general landfill; and from 1972 to 1982 as an occasional disposal site for masonry and wood.
Site 2 Contaminated Food Disposal Area	Approximately 1970	Ammonia-contaminated frozen food.	G-11	Site is now overgrown.
Site 3 Submarine Dye Disposal Area	Early 1970s	Fluorescein	E-12	Dye was stored in leaking drums until their removal.
Site 4 Medical Supplies Disposal Area	1968 or 1969	Syringes, I.V. bottles, 1-inch metal banding	D-12, 13	Some of these materials were removed.
Site 5 Photographic Chemicals Disposal Area	1967 or 1968	Photographic developers and fixers.	I-12	Wastes were disposed of into a marl pit.
Site 6 Spoiled Food Disposal Area	Approximately 1970	Spoiled food.	I-11	Site is now overgrown.
Site 7 Old DuPont Disposal Area	Early 1900s	Unknown.	C-13	Wastes disposed of were from the old City of Penniman and the DuPont Company.

TABLE 2-1 (CONTINUED)

AREAS OF CONTAMINATION - NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION

AREA OF CONCERN	PERIOD OF OPERATION	TYPES OF WASTES DISPOSED OF OR SPILLED	GENERAL DEVELOPMENT MAP COORDINATES	COMMENTS
CHEATHAM ANNEX				
Site 8 Landfill near Warehouse 14	Various times since 1940s	Spoiled meat, candy, clothing	D-11	Disposal site for non-hazardous wastes.
Site 9 Transformer Storage Area	1973-1980	PCBs	E-11	No information was available on the number of leaking transformers and associated spill volumes.
Site 10 Decontamination Agent Disposal Area Near First Street	Unknown	DS-2 decontamination agent	J-12	Appoximately 75 to 100 gallons of DS-2 decontamination agent were disposed of here.
Site 11 Bone Yard	1940-1978	Oil, asphalt, gasoline, liquid wastes in barrels and large square tanks.	H-12	Part of the site is presently used for storage and is managed by Public Works Department.
Site 12 Disposal Site Near Water Tower	Unknown	Scrap metal.	J-5	No hazardous materials were disposed at this site.
YORKTOWN FUELS DIVISION				
Site 13 Sludge Farm	1980-1981	NSFO	D-3	Sludge from three abandoned NSFO tanks (nos. 192, 197 and 198) was disced into the ground along with lime, fertilizer and seed.
Sites 14-26 Tank Bottoms Disposal Areas	Early 1950s to 1980	Aviation gas, motor gas JP-4 and JP-5 sludges	C-2, D-2, D-3, E-2, E-3	Sludge/water mixture was pumped into pits which were later covered.
Site 27 Fuel Pit at Building YK 215	1983	NSFO	C-4	Fuel pit was ruptured during repairs to oil-water separator or NSFO leaked from tanks west of the site.

TABLE 2-1 (CONTINUED)

AREAS OF CONTAMINATION - NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION

AREA OF CONCERN	PERIOD OF OPERATION	TYPES OF WASTES DISPOSED OF OR SPILLED	GENERAL DEVELOPMENT MAP COORDINATES	COMMENTS
YORKTOWN FUELS DIVISION				
Site 28 Surface Disposal Area Southeast of Building YK 215	Unknown	Concrete foundations, cast iron pipe.	C-4	Site was probably a one-time disposal area.
Site 29 General Disposal Area East of Building YK 139	Unknown	Wood, 5-gallon buckets, fire hose, wooden pallets, trash buckets, car seat.	D-4	No hazardous wastes present.
Site 30 Disposal Area West of Building YK 208	Unknown	Rubber hose, wood, flexible piping, empty, flushed out chemical and JP-4 drums.	D-1	No hazardous wastes present.
Site 31 Abandoned NSFO Tanks	1955, 1982	NSFO	B,C-3	Tank nos. 192, 196 and 197 were abandoned due to leakage.
Site 32 NSFO Sludge Disposal Area	1953	NSFO	C-3	Sludge was disposed of into pit.

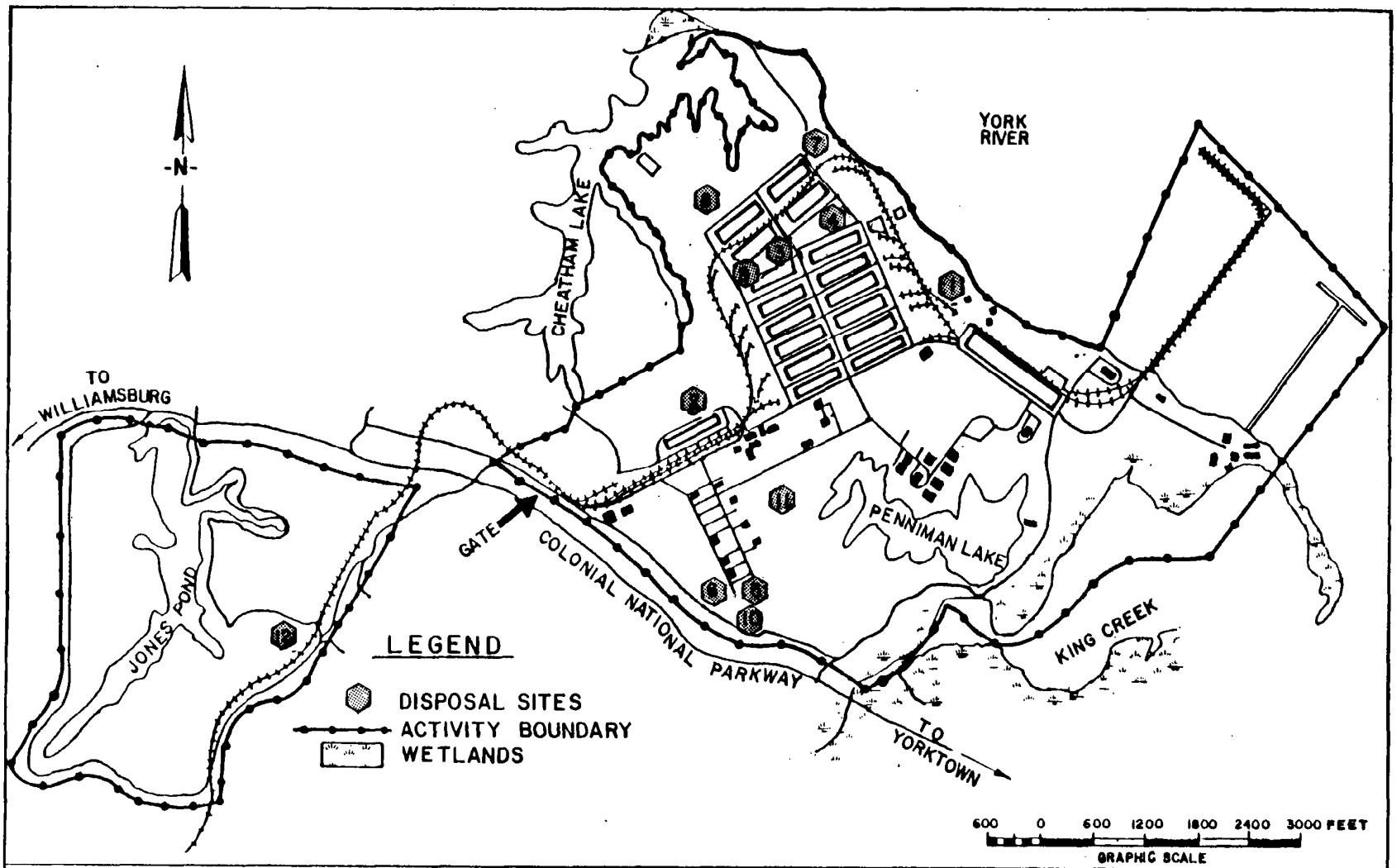

FIGURE 2-1

CHEATHAM ANNEX

LOCATION OF DISPOSAL SITES AND POTENTIAL CONTAMINATION AREAS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

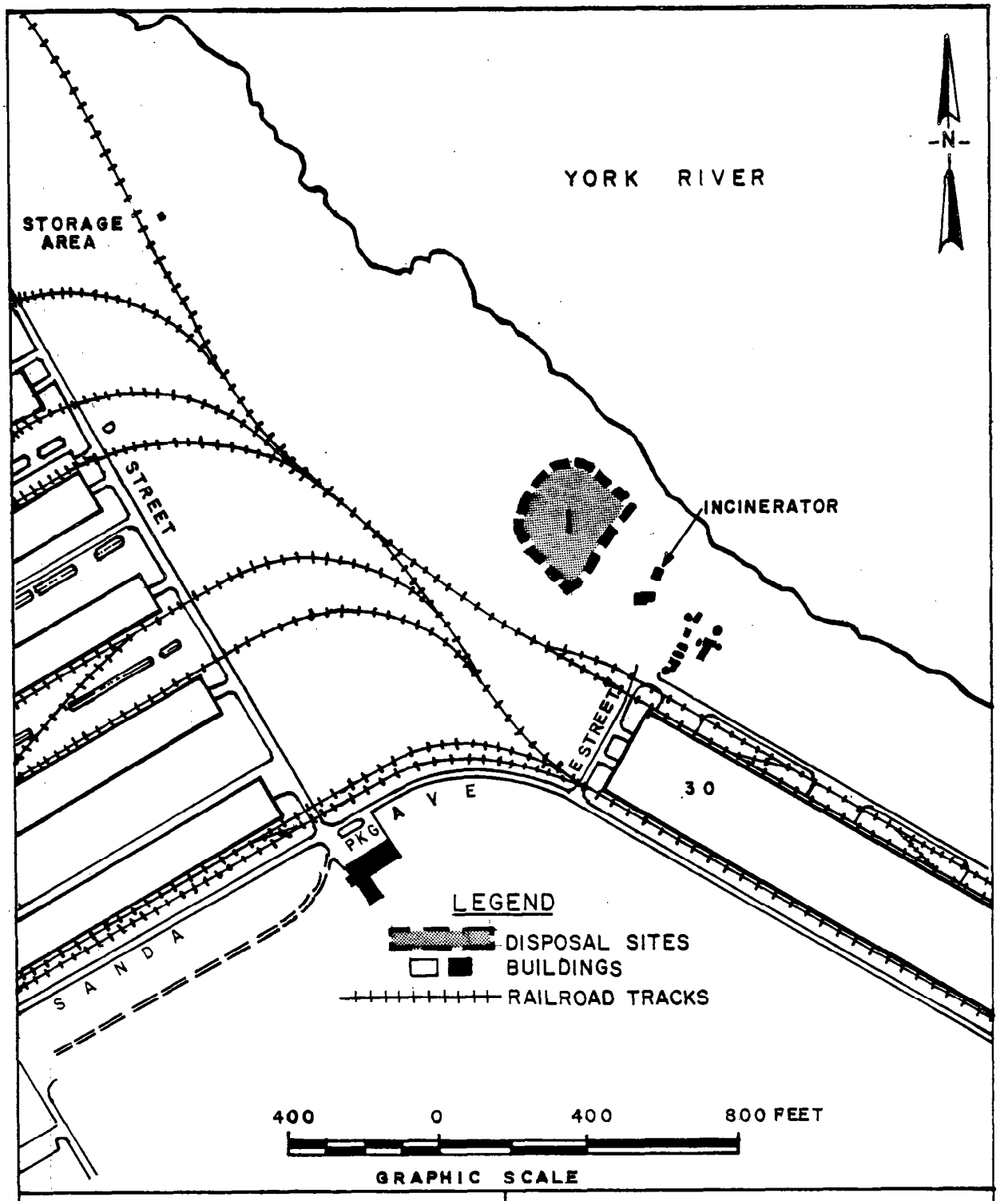

FIGURE 2-2

SITE 1-LANDFILL NEAR INCINERATOR

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

paint thinner cans, cartons of ether and other unspecified drugs which were burned, railroad ties, tar paper, sawdust, rags, concrete and lumber were disposed in the landfill until its closure in 1981. The site was also a disposal area for masonry and wood. Approximately 34,500 tons of domestic/industrial/commercial solid waste was buried in the landfill. The percentage breakdown of types of wastes is unknown. Contaminants could enter the water-table aquifer, and eventually the York River which is designated as shellfish propagation waters.

Based on the nature of the wastes disposed at the site, including paints, paint thinners, ether and unspecified drugs, and the possible contamination of ground water and the York River, a Confirmation Study is recommended.

2.2.2.2 Site 9, Transformer Storage Area (Figure 2-3). This site is approximately 7,000 square feet and is located at the northwest corner of Building CAD 16. Available information indicates that Site 9 was used for the storage of electrical transformers including those containing polychlorinated biphenyls (PCBs). The area was used for storage from 1973 through 1980. Information on the volume of PCB oil stored at Site 9 over the seven-year period and the number of leaking transformers and associated spill volumes is not known. After 1980, transformers were no longer stored at this location, and the site was graded and covered with gravel.

Because the soils are well drained, the potential for ground water contamination exists. The direction of surface runoff from the site at this time is unclear due to the lack of detailed site plans. Based on the potential for PCB contamination of local soils, surface water, and ground water, Site 9 is recommended for Confirmation Study.

2.2.2.3 Site 10, Decontamination Agent Disposal Area Near First Street (Figure 2-4). Site 10 is an estimated one acre site located south of First Street in the southernmost part of the old DuPont munitions plant. The history of the site is unknown. No information is available on when the wastes were buried, but the general appearance of the site indicates that at least two years have elapsed since initial burial. Available information indicates that an estimated 75 to 100 gallons of DS-2 decontamination agent were buried at the site. The chemical composition of DS-2 is: 70 percent diethylene triamine, 28 percent ethylene glycol monomethyl ether, and 2 percent sodium hydroxide.

Permeable soils are present at this site. Therefore ground water contamination is possible. King Creek is located approximately 1,500 feet down gradient of the site. Based on the possible presence of DS-2 decontamination agent and the potential for local surface water and ground water contamination, Site 10 is recommended for Confirmation Study.

2.2.2.4 Site 11, Bone Yard (Figure 2-4). Site 11 encompasses approximately eight acres, south of Atrim Road, behind the public works facility. The site is reported to have been in use from 1940 to 1978. Wastes believed to be deposited at the site include oil, asphalt, and gasoline. These wastes are contained in 15 barrels and large above-ground tanks. It was reported that unspecified wastes may also be buried at the site.

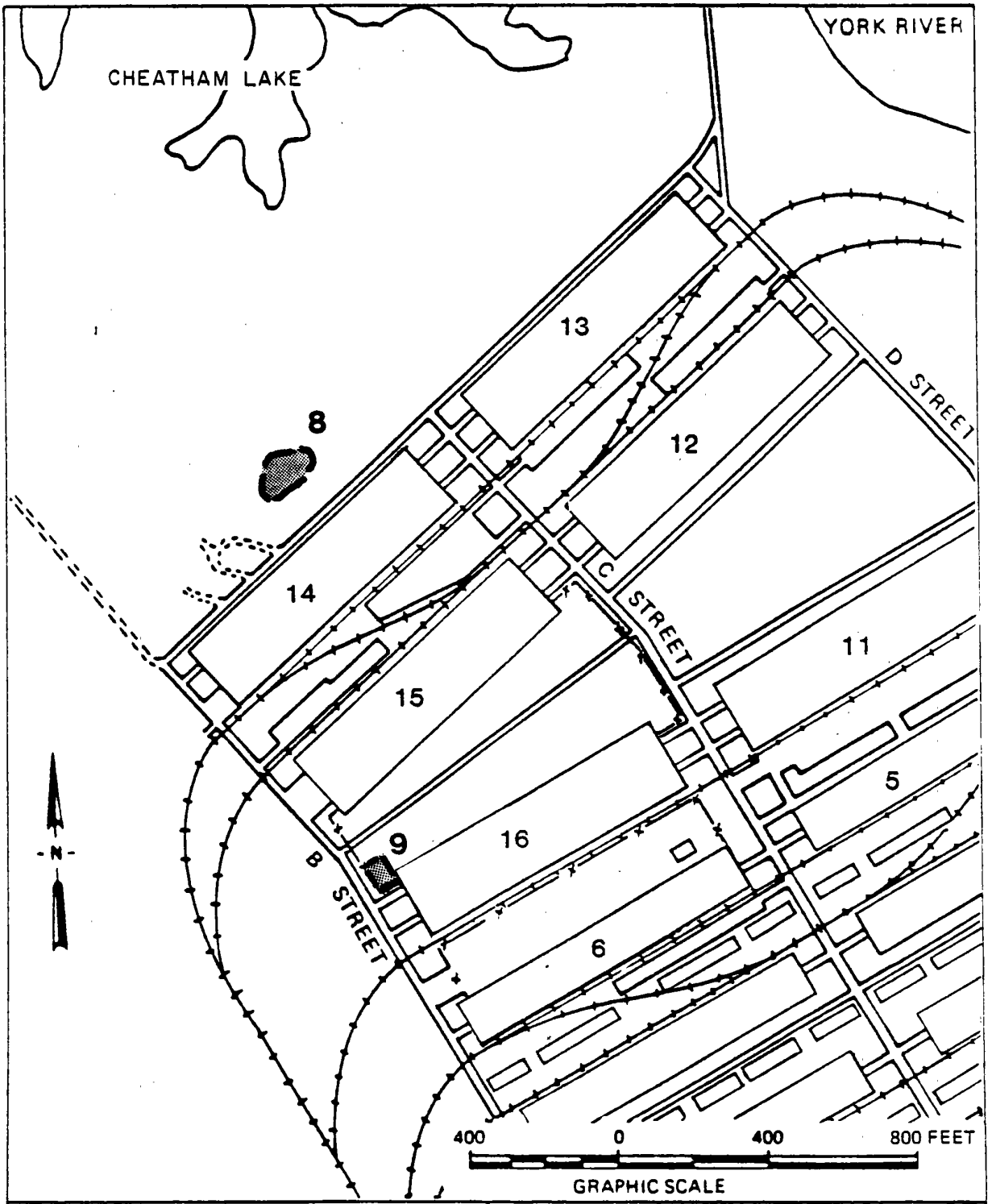

FIGURE 2-3

SITE 8 - LANDFILL NEAR BUILDING CAD 14

SITE 9 - TRANSFORMER STORAGE AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

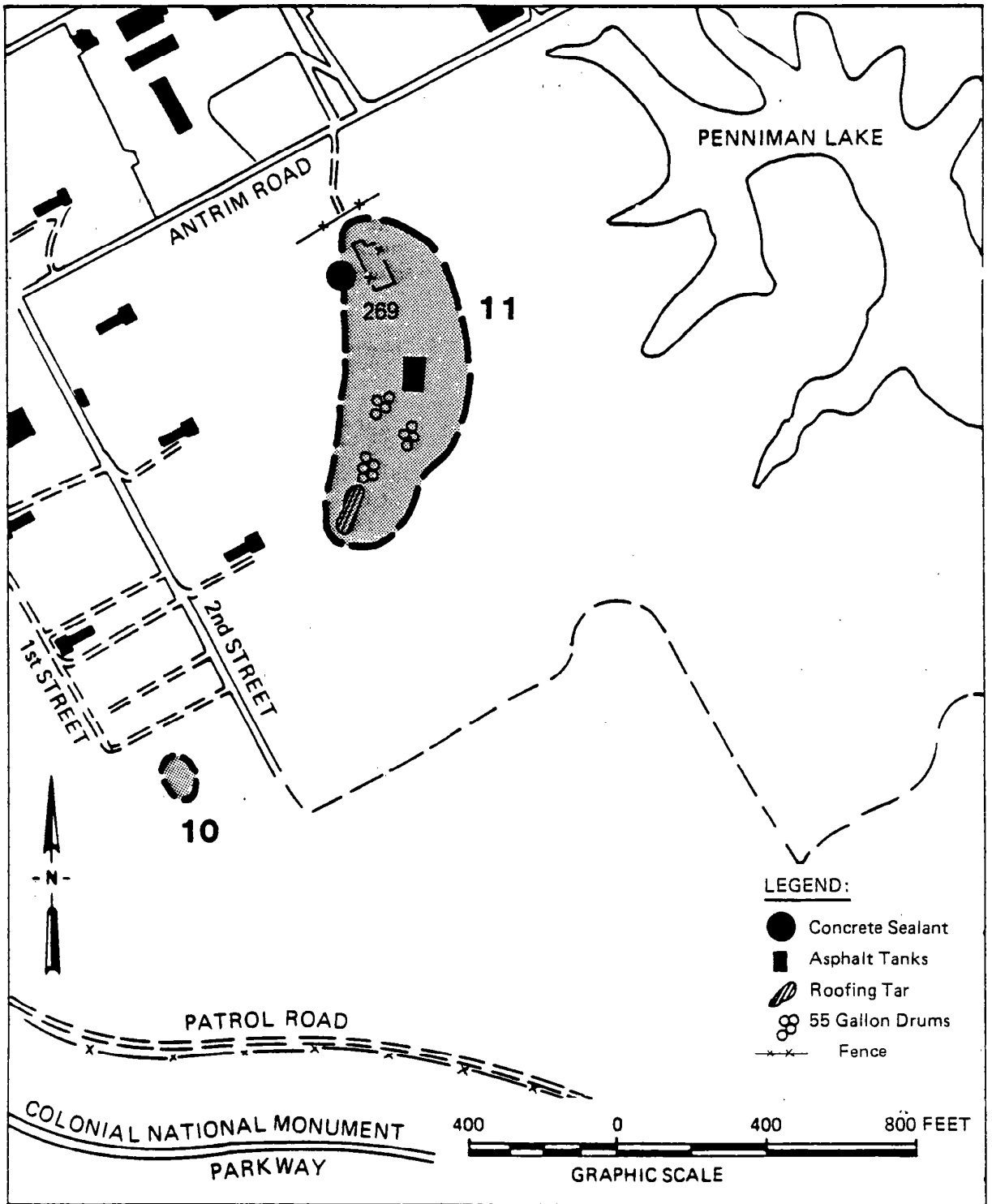

FIGURE 2 - 4
SITE 10 - DECONTAMINATION AGENT DISPOSAL AREA NEAR FIRST STREET
SITE 11 - BONEYARD

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

Surface drainage from the site could contaminate Penniman Lake and King Creek, a wetland area. The ground water migration pathway is through permeable sediments that underlie the site. Based on the observed presence of oil and gasoline, and reported presence of surface spills and buried wastes at the site, a Confirmation Study is recommended.

2.2.3 Sites Not Recommended for Confirmation Study.

2.2.3.1 Site 2, Contaminated Food Disposal Area (Figure 2-5). This site is located in the west central portion of Cheatham Annex behind the cold storage warehouse (Building CAD 40). The disposal pit measured approximately 50 feet in diameter and was 12 to 15 feet deep. Ammonia contaminated food was buried there in 1970.

Based on the decomposable nature of the wastes buried at this site, it is not recommended for Confirmation Study.

2.2.3.2 Site 3, Submarine Dye Disposal Area (Figure 2-6). This site is located at the northeast corner of Building CAD 15, and is presently used as a storage lot by the Defense Property Disposal Office (DPDO). In the early 1970s, the dye was stored on several pallets in 55-gallon drums. The drums became corroded and the dye, which was described as a fluorescein dye, leaked into the storm drain leading to the York River. The drums were removed for disposal.

Based on the fact that the dye no longer poses an environmental hazard, this site is not recommended for Confirmation Study.

2.2.3.3 Site 4, Medical Supplies Disposal Area (Figure 2-6). Site 4 is located behind the pond between Buildings CAD 11 and CAD 12. In 1968 or 1969, medical supplies (syringes and empty I.V. bottles) and one-inch metal banding were unloaded down a bank in this area and covered with earth. It was reported that as much as 7,000 cubic yards of material was disposed at this site.

Based on the fact that these materials, due to their inert nature would pose no threat to the environment, this site is not recommended for Confirmation Study.

2.2.3.4 Site 5, Photographic Chemicals Disposal Area (Figure 2-7). This site is located southeast of the Old DuPont ammunitions area. Outdated photographic developers and fixers, approximately 20 to 40 gallons, (one pallet full) were disposed of into a marl pit of unknown dimensions in 1967 or 1968.

Based on the small quantity of chemicals disposed of here, and their non-hazardous nature, the site is not recommended for Confirmation Study.

2.2.3.5 Site 6, Spoiled Food Disposal Area (Figure 2-7). The site is located west of the old DuPont ammunition area, and is an area where food spoiled in cold storage was buried around 1970. Approximately 750 cubic yards of food were buried in a pit about 12 to 15 feet deep.

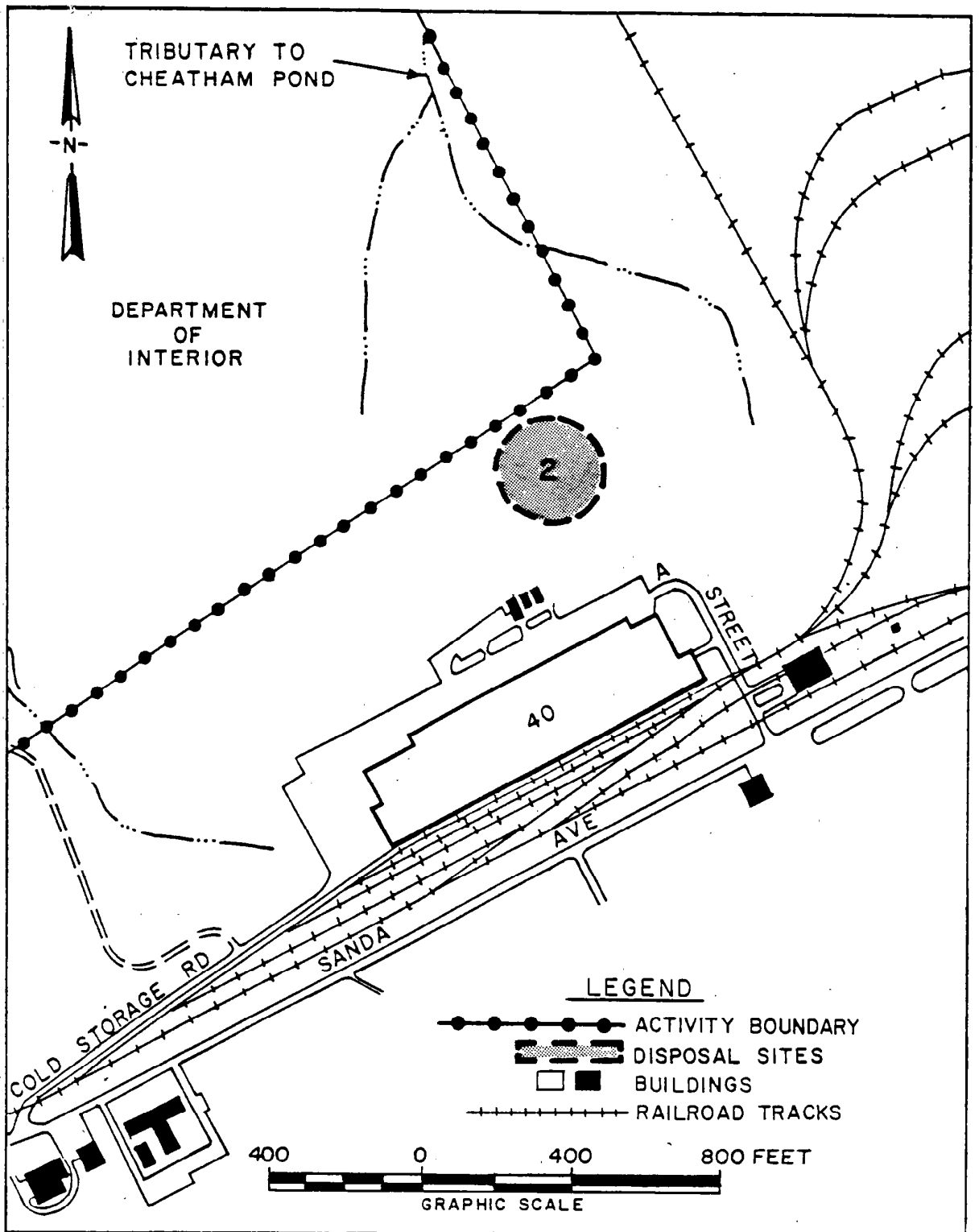

FIGURE 2-5
SITE 2 - CONTAMINATED FOOD DISPOSAL AREA.

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

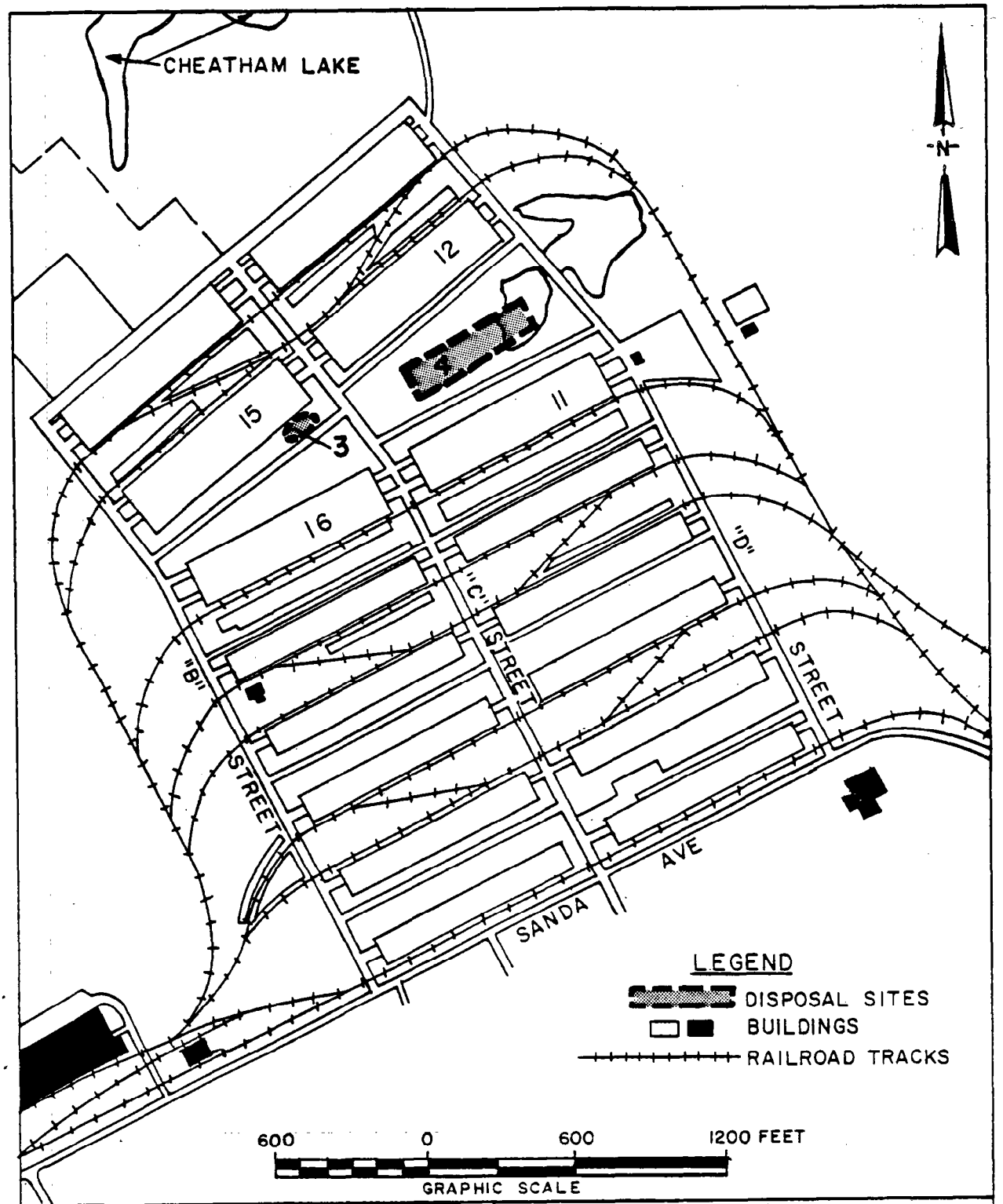

FIGURE 2-6

SITE 3 - SUBMARINE DYE DISPOSAL AREA

SITE 4 - MEDICAL SUPPLIES DISPOSAL AREA.

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

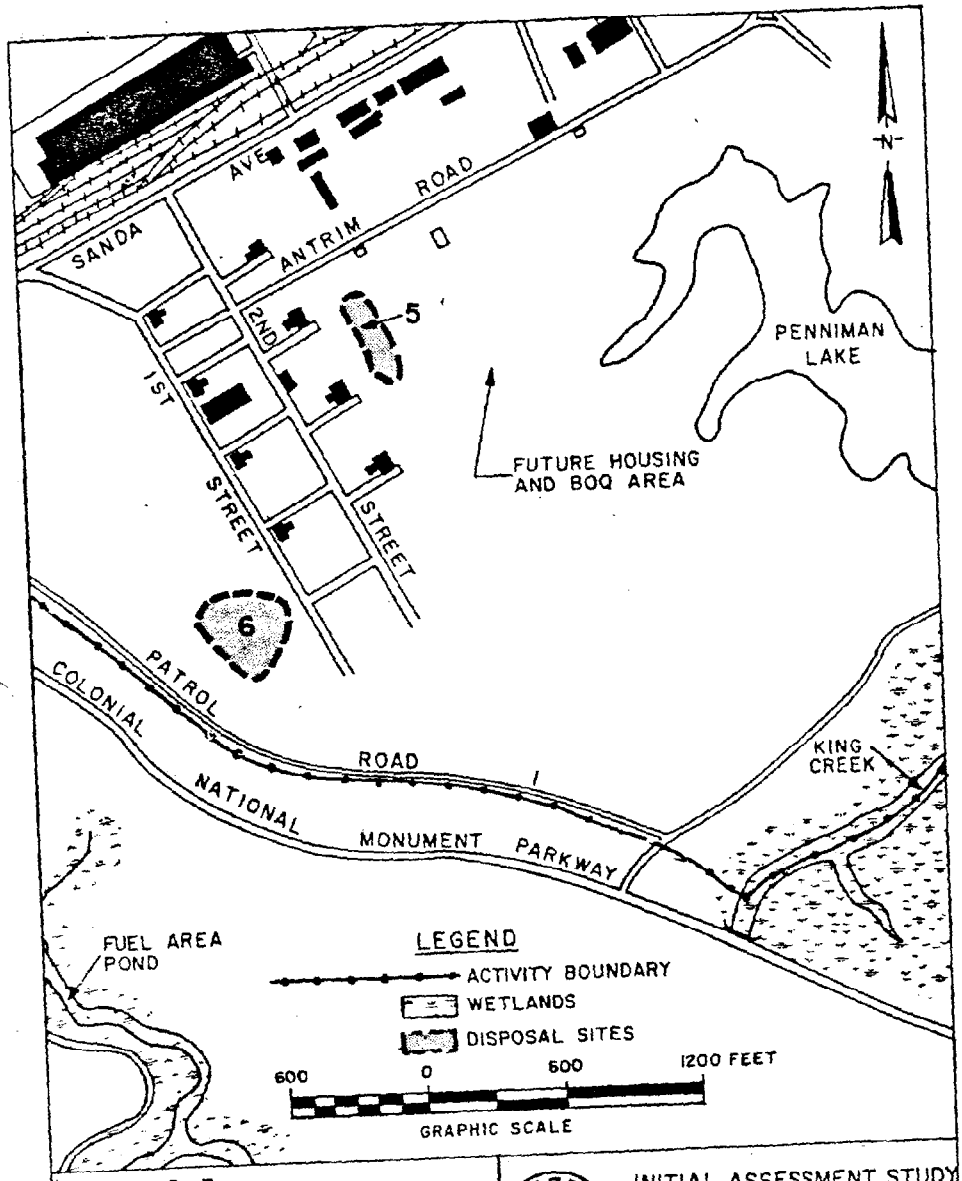

FIGURE 2-7

SITE 5 - PHOTOGRAPHIC CHEMICALS DISPOSAL AREAS

SITE 6 - SPOILED FOOD DISPOSAL AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

Based on the non-hazardous nature of decomposed food, this site is not recommended for Confirmation Study.

2.2.3.6 Site 7, Old DuPont Disposal Area (Figure 2-8). The site is located along the York River in the northwestern section of the activity. During the early 1900s, it was reported that wastes from the City of Penniman and the DuPont Company were disposed of at Site 7. The wastes disposed at the site were reported to be non-hazardous and/or inert. However, specific information documenting the types and quantities of waste disposed at the site was not available for this study.

Based on the non-hazardous nature of the wastes disposed there, Site 7 is not recommended for Confirmation Study.

2.2.3.7 Site 8, Landfill Near Building CAD 14 (Figure 2-3). Site 8 is located in the northwestern section of the activity. Available information indicates that Site 8 has been used at various times as a disposal area for non-hazardous wastes since the 1940s. The wastes identified as being disposed at Site 8 included spoiled meat, spoiled candy, and clothing. It was reported that the materials disposed of were buried in a series of trenches.

Based on the non-hazardous nature of the wastes disposed there, Site 8 is not recommended for Confirmation Study.

2.2.3.8 Site 12, Disposal Site Near Water Tower (Figure 2-9). The site is located east of Jones Pond between Patrol Road and the railroad tracks. Based on available information, Site 12 was a surface disposal area for scrap metal. No hazardous materials were reported to have been disposed at this site.

Based on the non-hazardous nature of the wastes disposed there, Site 12 is not recommended for Confirmation Study.

2.3 NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION. Sixteen of the twenty-one sites identified at the Yorktown Fuels Division are recommended for Confirmation Study. The 13 tank bottoms disposal sites are discussed as a group. Site locations are shown on Figure 2-10.

2.3.1 Hydrogeology and Migration Potential. Yorktown Fuels Division is located in the York River Basin. The West Branch of Wormley Creek surrounds the activity on the eastern, southern and western boundaries, and drains into the York River. Wetlands are located along the shores of West Branch and the York River. The York River in this area is classified as shellfish waters.

Three major aquifers, from uppermost to deepest, are found in the area: the water-table aquifer, the upper artesian aquifer, and the principal artesian aquifer. Information regarding these aquifers is found in Section 2.2.1.

Contamination from the sites is possible via surface runoff to the nearby West Branch of Wormley Creek and the York River, and/or by infiltration to the ground water. The potential for contamination of the water-table aquifer is enhanced by the presence of well-drained soils in the area.

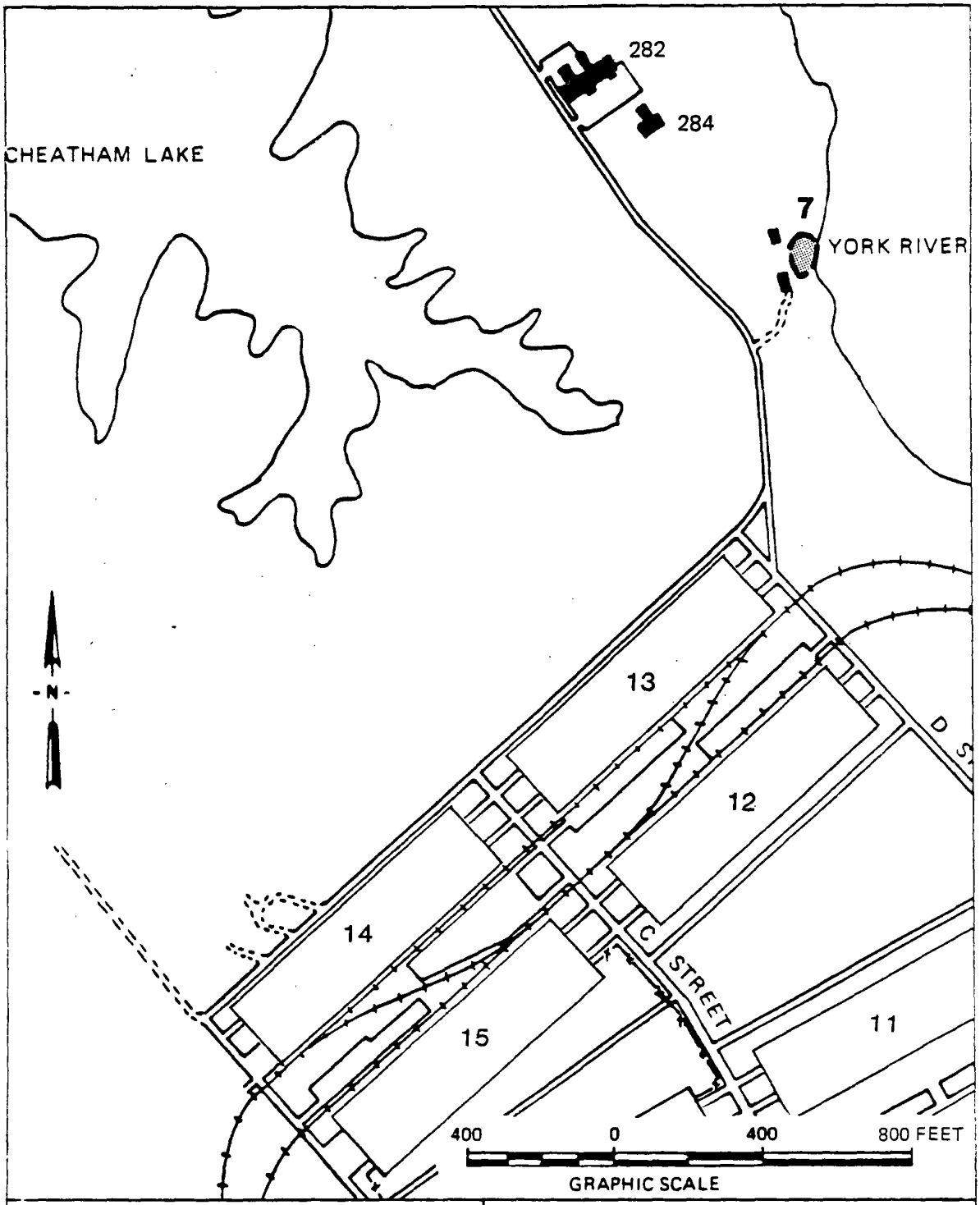

FIGURE 2 - 8
SITE 7 - OLD DUPONT DISPOSAL AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

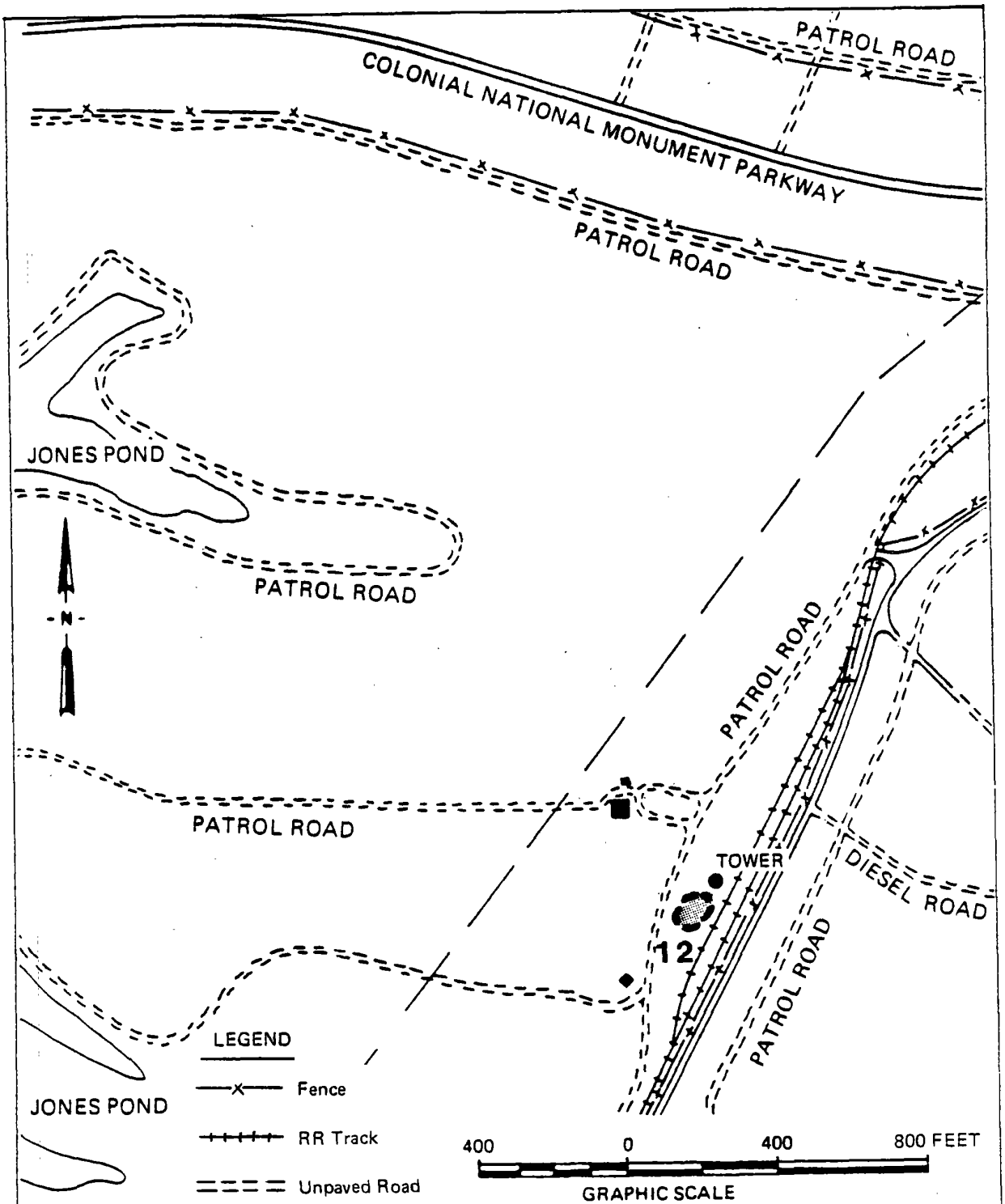

FIGURE 2 - 9
SITE 12 - DISPOSAL SITE NEAR WATER TOWER

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

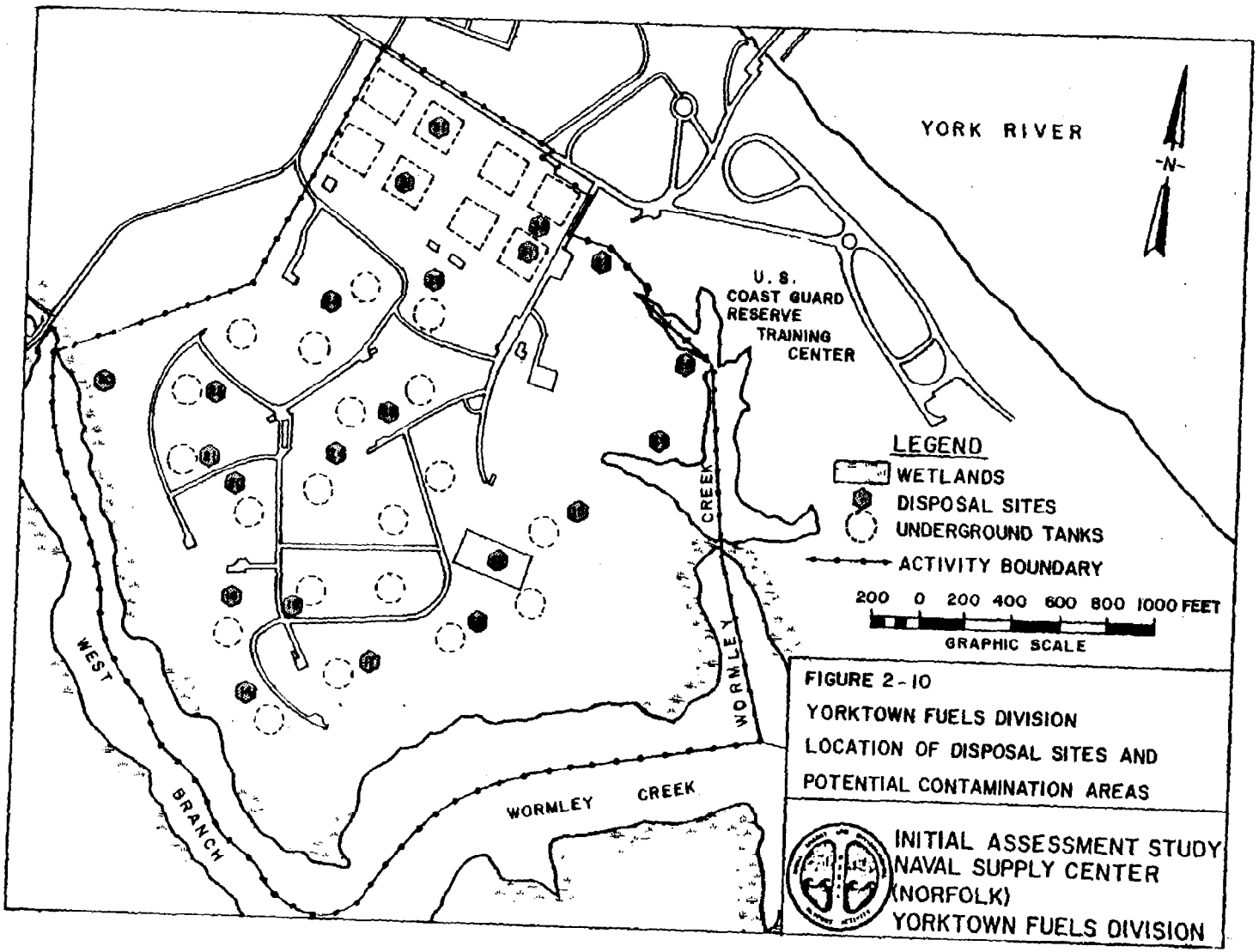

FIGURE 2-10
YORKTOWN FUELS DIVISION
LOCATION OF DISPOSAL SITES AND POTENTIAL CONTAMINATION AREAS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

There is also some possibility of contamination entering the upper and principal artesian aquifers due to leakage through the confining layers. However, this is likely to be of much less significance because of the thickness of confining beds of the artesian systems.

2.3.2 Sites Recommended for Confirmation Study.

2.3.2.1 Site 13, Sludge Farm (Figure 2-11). This site is located in the eastern part of the activity inside the circle of tanks 186-191. The sludge farm is approximately three acres in size and was operated from 1980 to 1981. Approximately 1000 cubic yards of Navy Special Fuel Oil (NSFO) sludge was disced into the ground. Compounds of concern include anthracene and other polynuclear aromatic hydrocarbons (PAHs). Many PAHs, including anthracene, are recognized carciogens (Sax, 1979).

Soils at this site are loamy sands that are excessively drained. Ground water movement is probably towards Wormley Creek, eventually entering the York River. Surface water runoff would be in the same direction.

Based on the hazardous nature of the wastes and the potential contamination of ground water and surface water, this site is recommended for Confirmation Study.

2.3.2.2 Sites 14-26, Tank Bottoms Disposal Areas (Figure 2-11). These sites are located around the aviation gas, JP-4, JP-5 and motor gas storage tanks in the southern portion of the activity. The disposal pits range from 15 to 30 feet in diameter and were used between 1955 and 1980 for the disposal of tank bottoms (sludge) from the periodic cleaning of the storage tanks. The pits are approximately six-feet deep and are contaminated with the various fuels listed above. Approximately 1,960 to 2,830 cubic feet of sludge was disposed of from each tank per cleaning. Therefore, a total of about 134,100 cubic feet of sludge was disposed of at the 13 sites. Contaminants in the fuels include lead (JP-5, aviation and motor gas), and metal deactivators, icing inhibitors, corrosion and conductivity additives, and antioxidants in the jet fuels. Toxicities of these compounds range from moderate to high via ingestion. JP-4 generally contains 40% by weight n-paraffins, 35% by weight naphthenes and 25% by weight 1-ring aromatics. JP-5 is similar in composition (Hess, 1979). The semi- and fully-refined paraffins are experimental carcinogens. Naphthene (cyclohexane) is moderately toxic via inhalation and ingestion routes, and is a skin irritant. One-ring aromatics include toluene and ethyl benzene. Toluene is moderately toxic via ingestion and inhalation routes, while ethyl benzene poisoning occurs most often through inhalation of vapor.

Soil drainage at the sites is good to excessive with ground water flow likely towards Wormley Creek and the York River. Surface water runoff is towards the same water bodies.

Based on the hazardous characteristics of the wastes and the potential contamination of ground water and the shellfish waters in the York River, these sites are recommended for Confirmation Study.

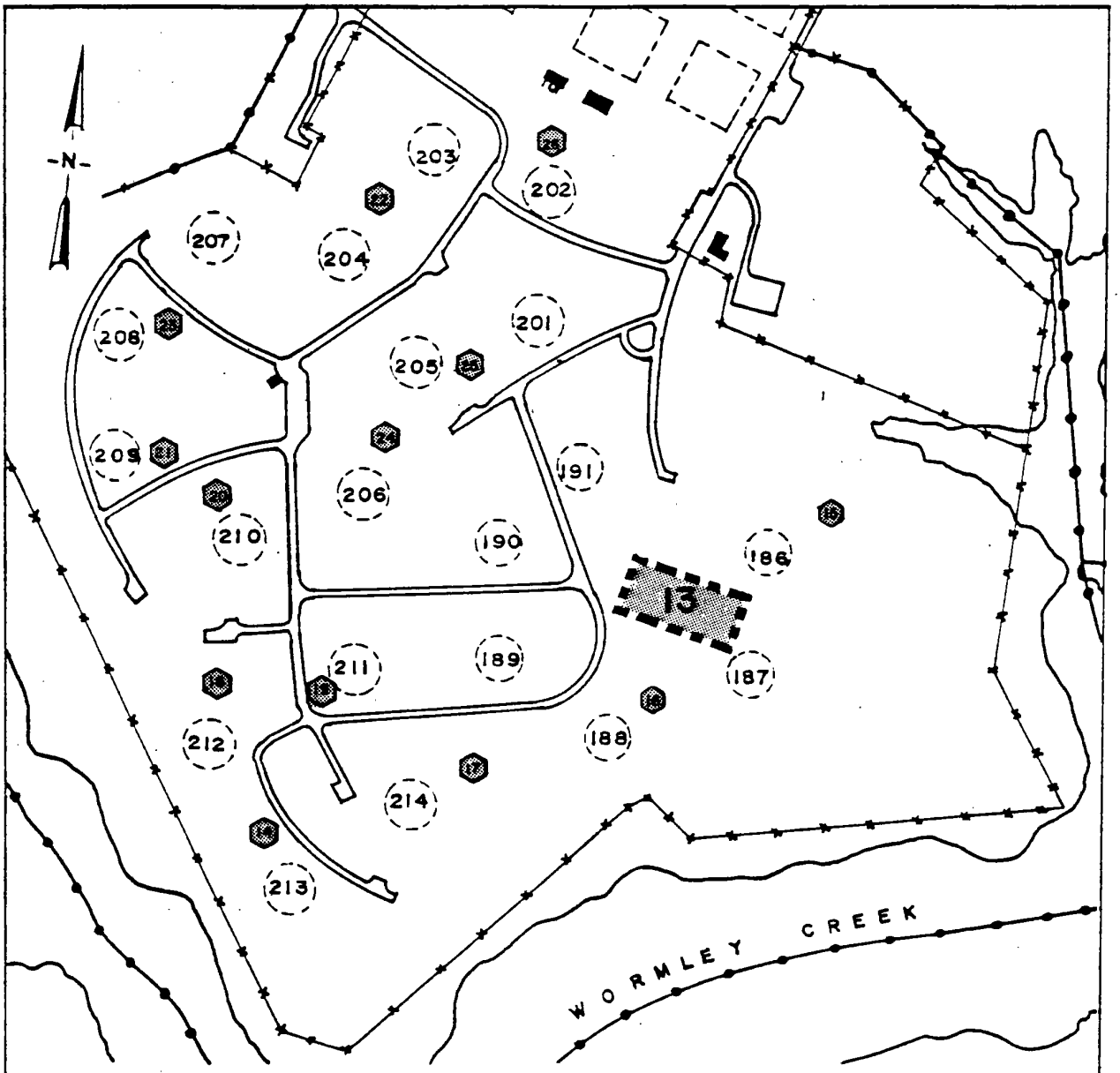

FIGURE 2-11
SITE 13 - SLUDGE FARM
SITES 14 - 26 TANK BOTTOMS DISPOSAL AREAS.

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

2.3.2.3 Site 27, Fuel Pit at Building YK 215 (Figure 2-12). This site is an area of approximately 100 feet by 25 feet where NSFO has saturated the soil near Building YK 215 in the northeastern section of the activity. It was reported that the oil was spilled during the 1983 construction improvements to the nearby oil-water separator. Another report stated that the oil was from leaking NSFO tanks upgradient of the site. Estimated quantities of oil in the soil ranged from 30 gallons associated with the construction spill report to several hundred gallons associated with the leaking NSFO tanks and the oil saturation of the soil. Lead and other fuel additives are not used in NSFO. Compounds of concern in NSFO include anthracene and other PAHs. Many PAHs, including anthracene, are recognized carcinogens (Sax, 1979).

Migration of the buried fuel oils is likely to take place to the water-table aquifer of the area.

Based on the potential for ground water contamination and the hazardous nature of NSFO, Site 27 is recommended for Confirmation Study.

2.3.2.4 Site 31, Abandoned NSFO Tanks (Figure 2-13). This site is located in the northern portion of the activity, and involves tanks 192, 196 and 197 which have been removed from service due to leakage. Tanks 196 and 197 were withdrawn from service in 1955 and tank 192 in 1982. NSFO leakage from the tanks were estimated at 144 barrels. Compounds of concern in NSFO are anthracene and other PAHs. Many PAHs, including anthracene, are recognized carcinogens (Sax, 1979).

Lead and other fuel additives are not used in NSFO. Ground water leakage into the tanks has also occurred. Soils in the area are highly permeable and may have been contaminated.

Based on the hazardous nature of NSFO and the potential for ground water contamination, this site has been recommended for Confirmation Study.

2.3.3 Sites Not Recommended for Confirmation Study.

2.3.3.1 Site 28, General Disposal Area Southeast of Building YK 215 (Figure 2-12). This disposal site is located in the northern section of the activity and covers an area of approximately 85 feet by 25 feet. Dates of use are unknown. Wastes present include concrete foundations and cast iron pipe.

Based on the inert nature of the waste, a Confirmation Study is not recommended.

2.3.3.2 Site 29, Surface Disposal Area East of Building YK 139 (Figure 2-12). This site is located in the northern portion of the activity, east of Building YK 139. The site measures 100 feet by 25 feet and contains mostly wood, several five gallon buckets, fire hose, wooden pallets, trash buckets, and a car seat. Dates of disposal are unknown.

Based on the non-hazardous nature of the wastes, a Confirmation Study is not recommended.

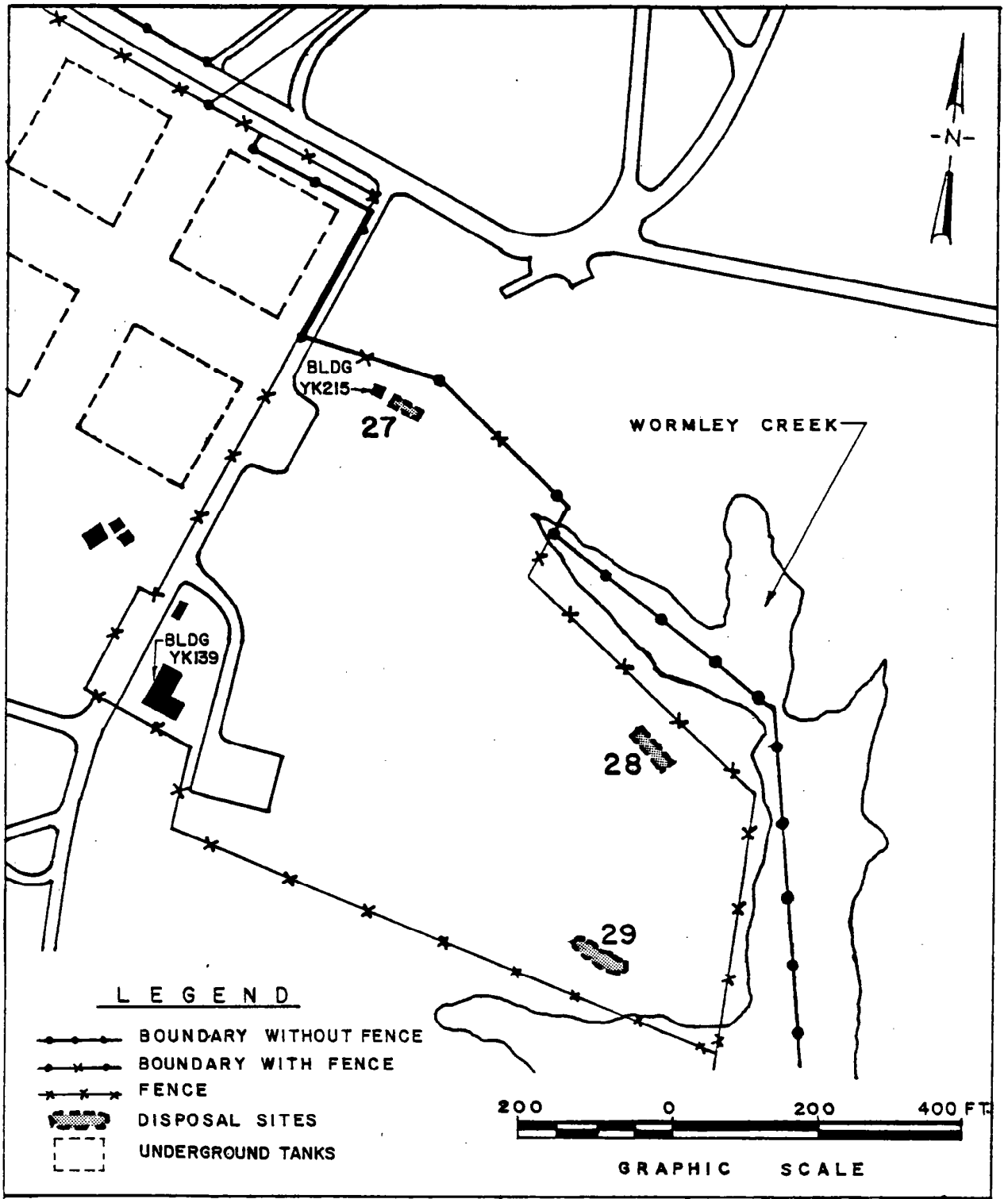

FIGURE 2-12
SITE 27-FUEL PIT AT BUILDING YK 215.
SITE 28-SURFACE DISPOSAL AREA SOUTH EAST OF BUILDING YK 215.
SITE 29 - GENERAL DISPOSAL AREA EAST OF BUILDING YK 139.

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

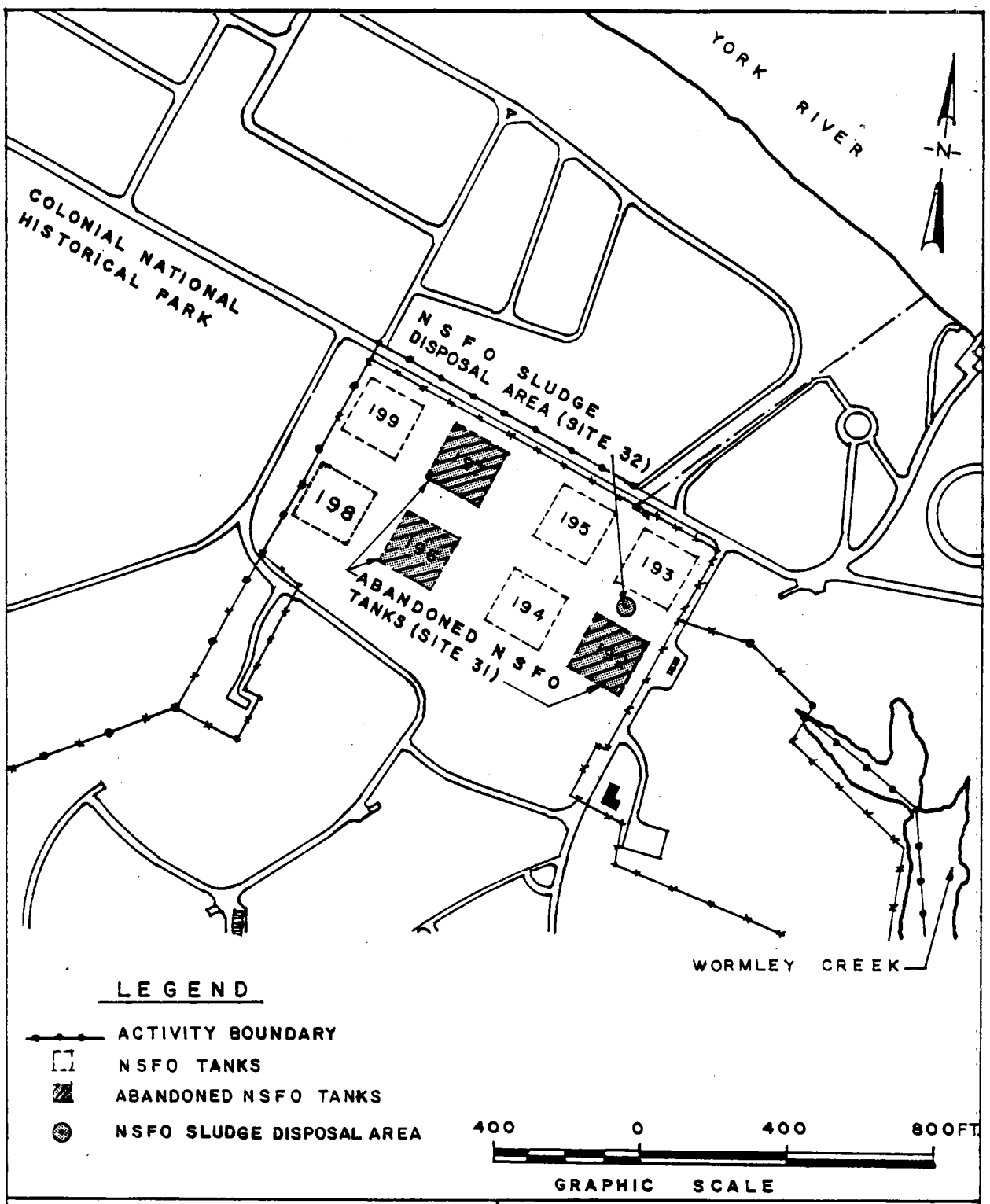

FIGURE 2-13
SITE 31 - ABANDONED NSFO TANKS
SITE 32 - NSFO SLUDGE DISPOSAL AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

2.3.3.3 Site 30, Disposal Area West of Building YK 208 (Figure 2-14). This site is located in a clearing in a wooded area behind Building YK 208. The area is approximately 15 feet by 10 feet. Dates of disposal are unknown. Wastes at the site include inert materials such as rubber hose, wood, piping, and empty flushed-out drums which previously contained chemicals and JP-4 fuel.

Because of the non-hazardous nature of these wastes, a Confirmation Study is not recommended.

2.3.3.4 Site 32, NSFO Sludge Disposal Area (Figure 2-13). This site is located between tanks 192 and 193 in the northern section of the activity. An estimated quantity of somewhat less than 72 cubic feet of NSFO sludge was disposed of around 1953 in a pit six feet by six feet by two feet in size. Compounds of concern in NSFO include anthracene and other PAHs. Many PAHs, including anthracene are recognized carcinogens (Sax, 1979). No lead or fuel additives are present in NSFO.

Based on the small quantity of sludge disposed of at this site, a Confirmation Study is not recommended.

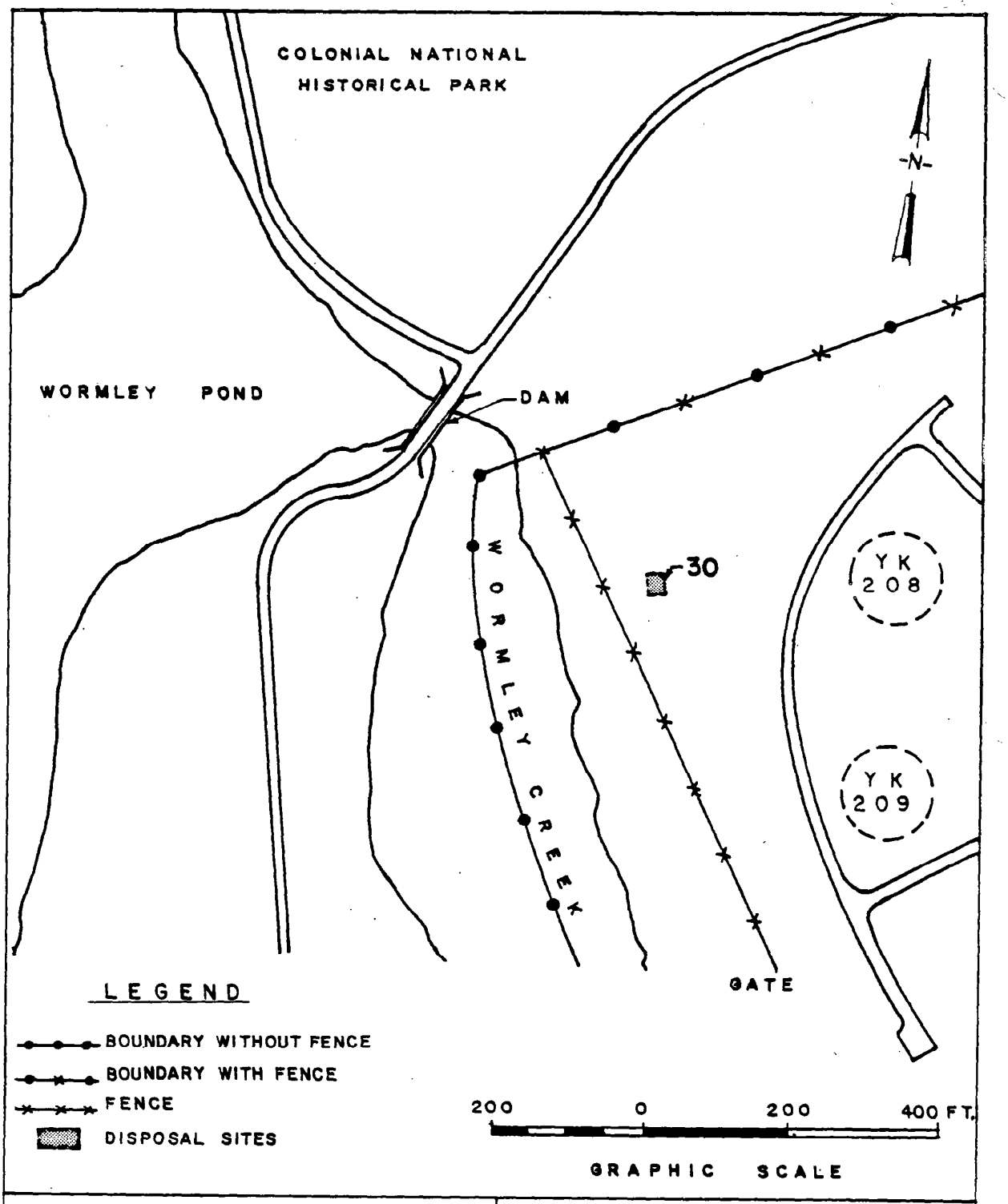

FIGURE 2-14

SITE 30-DISPOSAL AREA WEST OF BUILDING YK 208

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

CHAPTER 3. RECOMMENDATIONS

3.1 INTRODUCTION. Recommendations for possible courses of action are provided for areas of potential contamination identified in this report. Confirmation Studies, under the NACIP program, are recommended for sites posing a potential danger to human health or to the environment. Eight areas comprising 20 sites have been recommended for further action (see Table 3-1). The EFD, LANTNAVFACENGCOM, will conduct the Confirmation Study which has two steps--verification and characterization. In the verification steps, short-term analytical testing and monitoring determines whether specific toxic and hazardous materials, identified in the IAS, are present in concentrations considered to be hazardous. If required, a characterization step will define horizontal and vertical extent of contamination, rate of migration and health and environmental impact. If sites require remedial actions or additional monitoring programs, the Confirmation Study recommendations include the necessary planning information for the work, such as design parameters.

3.2 NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX.

3.2.1 Landfill Near Incinerator (Site 1), Figure 3-1.

Monitoring Wells:	Two wells, one upgradient and one downgradient of the landfill site. Well completion recommendations are set out in Appendix B.
Types of Samples:	Ground water.
Number of Samples:	Eight, four from each well.
Frequency:	Four times at quarterly intervals (Verification step).
Testing Parameters:	Water level, specific conductance, pH, oil and grease, zinc, cadmium, iron, lead, TOC, TOX, phenols, volatile organics and ethers.
Remarks:	Continue monitoring the four existing wells at the landfill site on a semi-annual basis. The two new wells should be drilled to 15 to 18 feet below the water table (Appendix B). The testing parameters were primarily based on the results and recommendations of the report resulting from: Engineering Service Request U-3052, Ground Water Monitoring at Closed Sanitary Landfill, Cheatham Annex, Naval Supply Center, Norfolk, Virginia (Naval Facilities Engineering Command, 1983a).

TABLE 3-1

RECOMMENDATIONS, NAVAL SUPPLY CENTER (NORFOLK)
CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION

			CONFIRMATION STUDY - VERIFICATION STEP						
Site Number	Site Name	CSRM Score	Number of Soil Samples	Number of Sediment Samples	Number of Water Samples	Testing Parameters	Number of Wells	Number of Samples	Testing Parameters
	CHEATHAM ANNEX								
1	Landfill Near Incinerator	10	0	0	0	N/A	2	2	Water level, specific conductance pH, oil and grease, zinc, cadmium, iron, lead, TOC, TOX, phenols, volatile organics, ether
9	Transformer Storage Area	12	10	3	0	PCB	0	0	N/A
10	Decontamination Agent Disposal Area near First Street	8	0	0	0	N/A	0	0	Magnetometer Survey
11	Bone Yard	11	20*	0	1	Soil: Oil & Grease, Lead, TOX, TOC Drum: Lead, TOX	0	0	N/A
	YORKTOWN FUELS DIVISION								
13 14-26	Sludge Farm Tank Bottoms Diposal Area	12 8	5	0	0	Navy Special Fuel Oil, Jet fuels JP-4, JP-5, Aviation Gas, Motor Gas Combat Type 1, Lead	5	5	Water levels, Navy Special Fuel Oil, jet fuels JP-4 JP-5, aviation gas, motor gas combat type 1, lead. Results of gas chromatography analysis of each sample will be compared to those of known compounds (CH2M Hill, Montgomery, Alabama, 1983).

* = 20 soil samples and 20 samples from drums.

TABLE 3-1

RECOMMENDATIONS, NAVAL SUPPLY CENTER (NORFOLK)
CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION

			CONFIRMATION STUDY - VERIFICATION STEP						
Site Number	Site Name	CSRM Score	Number of Soil Samples	Number of Sediment Samples	Number of Water Samples	Testing Parameters	Number of Wells	Number of Samples	Testing Parameters
	YORKTOWN FUELS DIVISION								
27	Fuel Pit at Building YK 215	13	4	0	0	Navy Special Fuel Oil	4	4	Water levels, Navy Special Fuel Oil
31	Abandoned NSFO Tanks	13							

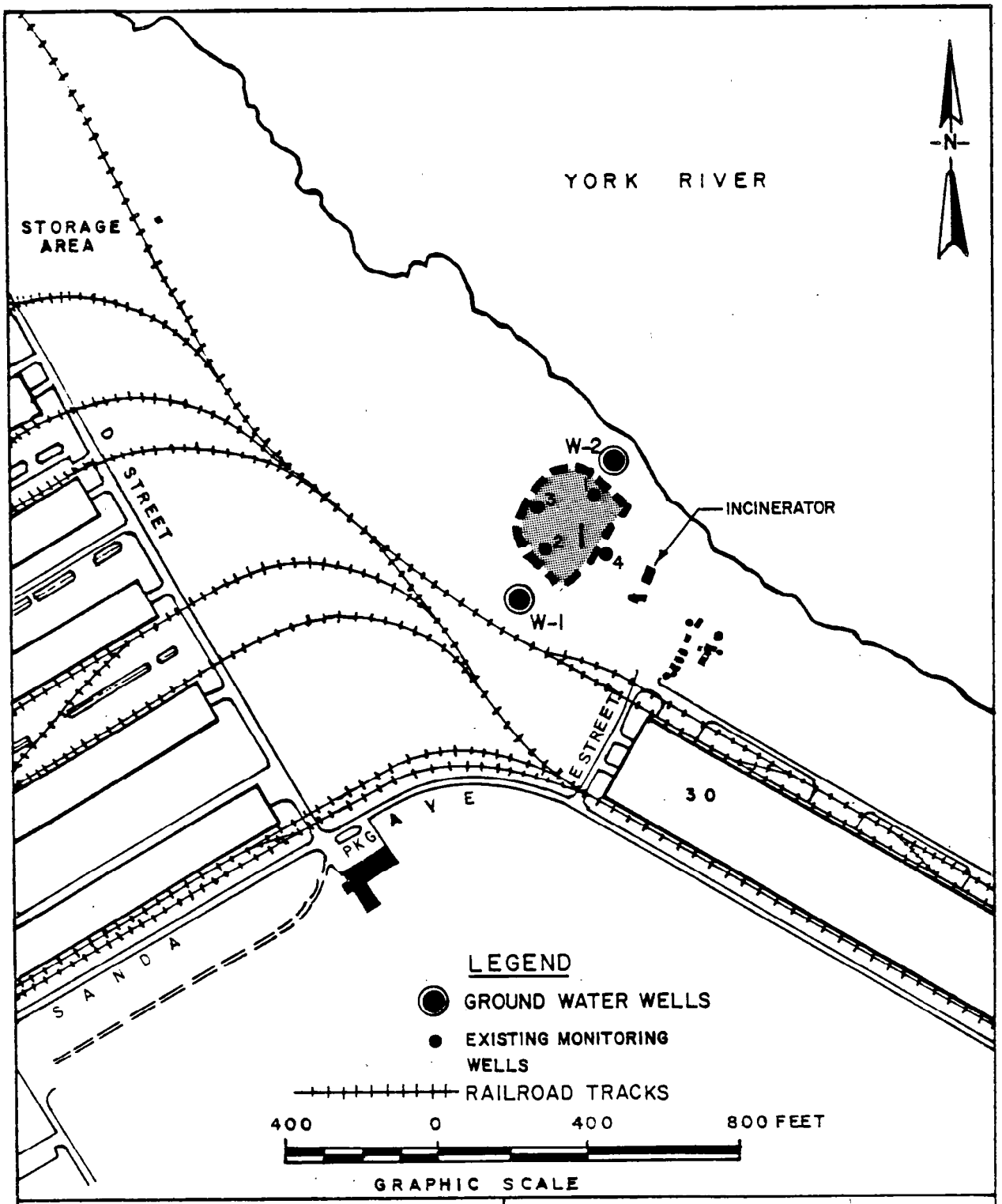

FIGURE 3-1
SITE 1-LANDFILL NEAR INCINERATOR
RECOMMENDED SAMPLING POINTS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

3.2.2 Transformer Storage Area (Site 9), Figure 3-2.

Types of Samples: Soil, sediment.

Number of Samples: 10 soil; 3 sediment.

Frequency: Once.

Testing Parameters: PCBs.

Remarks: Since the site is now covered with gravel, the gravel will have to be removed prior to collecting soil samples. The verification samples will be collected using a hand auger to a depth of approximately six inches. The locations of the samples will be field determined using a surface grid of the site to ensure proper coverage. If PCB contamination is detected in the verification step, additional soil samples should be collected during the characterization step.

3.2.3 Decontamination Agent Disposal Area Near First Street (Site 10), Figure 3-3.

Type of Samples: None.

Magnetometer Survey: A magnetometer survey is recommended during the verification step to confirm the existence of buried containers at the site and their respective locations. The entire area shown in Figure 3-3 as Site 10 should be covered in the magnetometer survey. The survey will consist of moving the magnetometer over the ground to obtain electromagnetic readings indicating the presence of the metal containers of DS-2. This approach will eliminate unnecessary digging at the site to recover the buried materials.

Remarks: Once the existence and location of the containers have been confirmed, the cans should be excavated, and their contents determined. It should be noted whether the cans have been ruptured or contaminants released to the environment. If the magnetometer survey reveals the presence of containers and they have leaked, the characterization step should involve groundwater sampling.

3.2.4 Bone Yard (Site 11), Figure 3-4.

Type of Samples: Soil and Drum.

Number of Samples: A maximum of 20.

Frequency: Once.

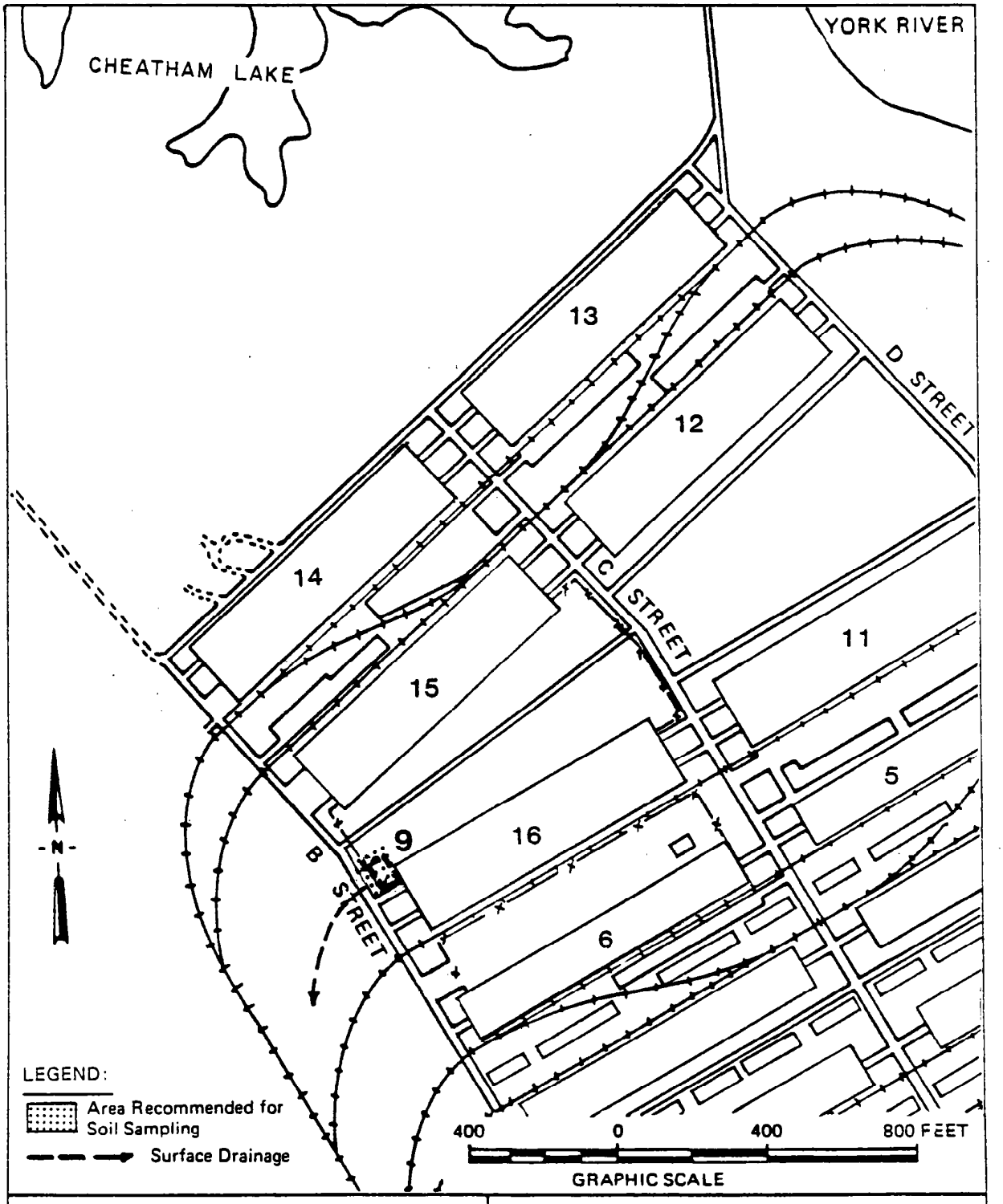

FIGURE 3-2
SITE 9 - TRANSFORMER STORAGE AREA
AREA RECOMMENDED FOR SOIL SAMPLING

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

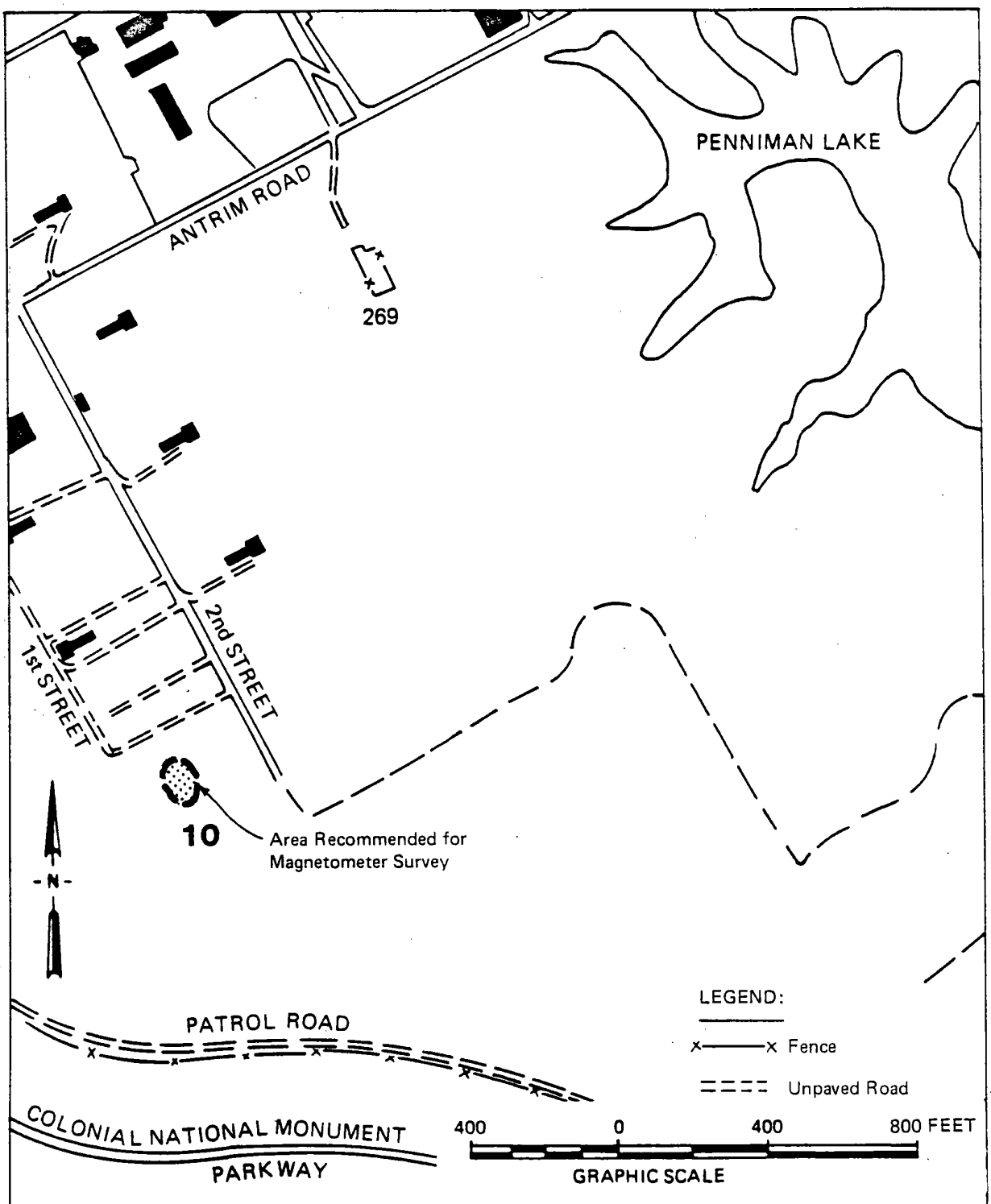

FIGURE 3-3
SITE 10 - DECONTAMINATION AGENT DISPOSAL AREA NEAR FIRST STREET AREA RECOMMENDED FOR MAGNETOMETER SURVEY

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

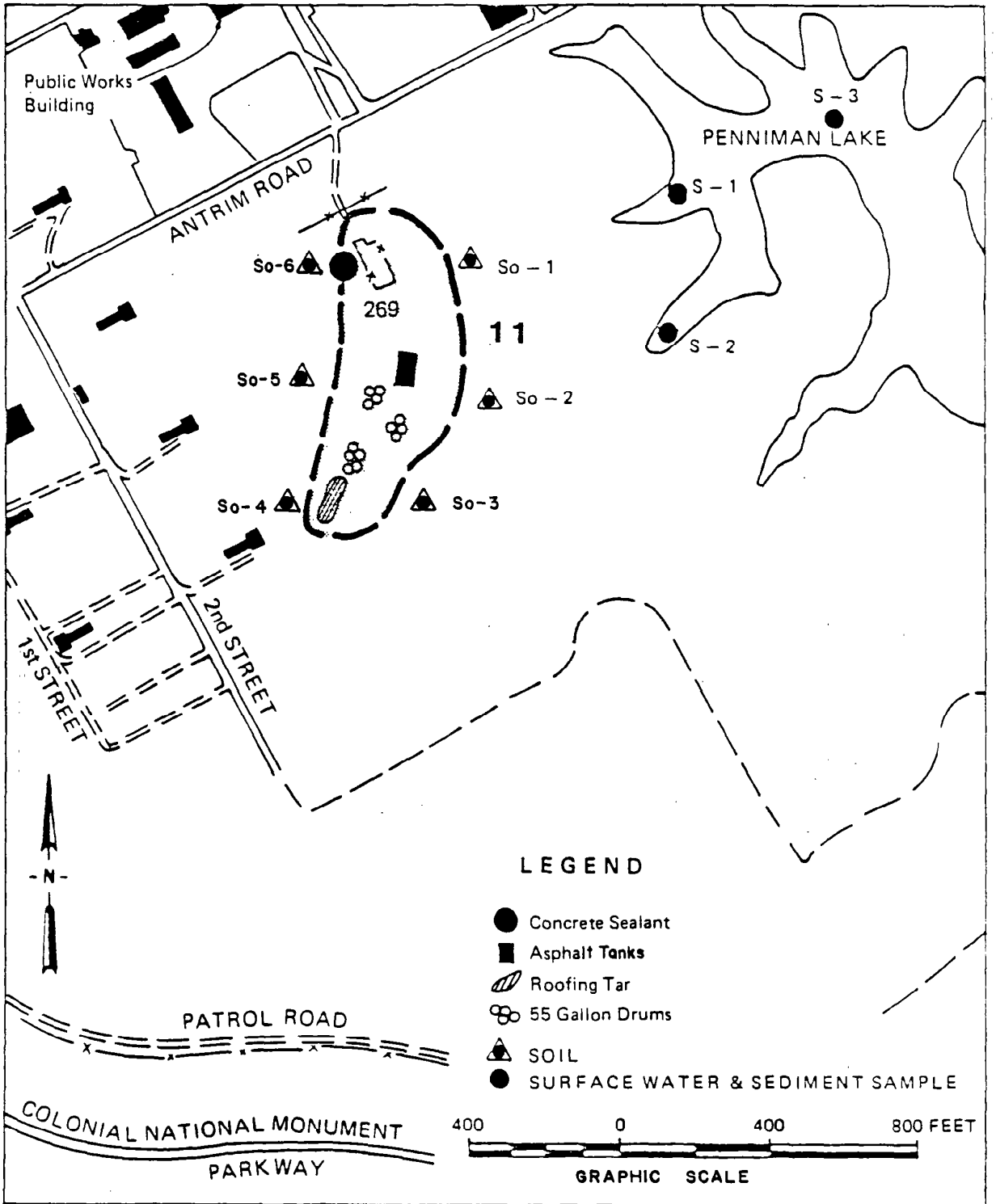

FIGURE 3-4
SITE 11 - BONE YARD
RECOMMENDED SAMPLING POINTS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

Testing Parameters: Soil: Oil and grease, lead, TOX, TOC.
Drum: Lead, TOX.

Remarks: Actual locations of many of the soil and drum samples will be determined in the field. Drums and cans containing similar types of wastes should be grouped and consolidated for disposal. If contamination is detected in either the various soil samples or drum samples described above (verification), it is recommended that surface water and sediment samples be obtained from downgradient sources (characterization).

3.3 NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION.

3.3.1 Sludge Farm (Site 13) and Tank Bottoms Disposal Areas (Sites 14-26), Figure 3-5.

Monitoring Wells: Eight wells.

Types of Samples: Ground water; and soil taken at 5-foot intervals, formation changes during well drilling and at the water table.

Number of Samples: Thirty-two water, four from each well, and eight composite soil samples.

Frequency: Ground water: four times at quarterly intervals.
Soil: once.

Testing Parameters: Water level; Navy Special Fuel Oil; jet fuels JP-4, JP-5; aviation gas; motor gas, combat type 1; lead.

Remarks: Eight wells are recommended around sites 13-26 with W-1 being the upgradient well and the others downgradient wells. Other proposed well locations for sites 27 and 31 (Section 3.3.2) may be used for sampling if more detailed hydrogeological work indicates that these are downgradient from sites 13-26. The wells will extend 15 to 18 feet below the water table and be screened from the bottom to the water table.
The tests for the various fuels will be performed using a gas chromatograph. The size and location of the peaks produced by known samples of fuel will be compared to those from samples collected in the verification step. The presence of the fuels in the samples could thus be determined. Depending on the results of the sampling, the characterization step would involve more sampling but the analyses would be for specific components of the fuels. The soil samples at 5-foot intervals would be performed to identify any fuel migration throughout the soil.

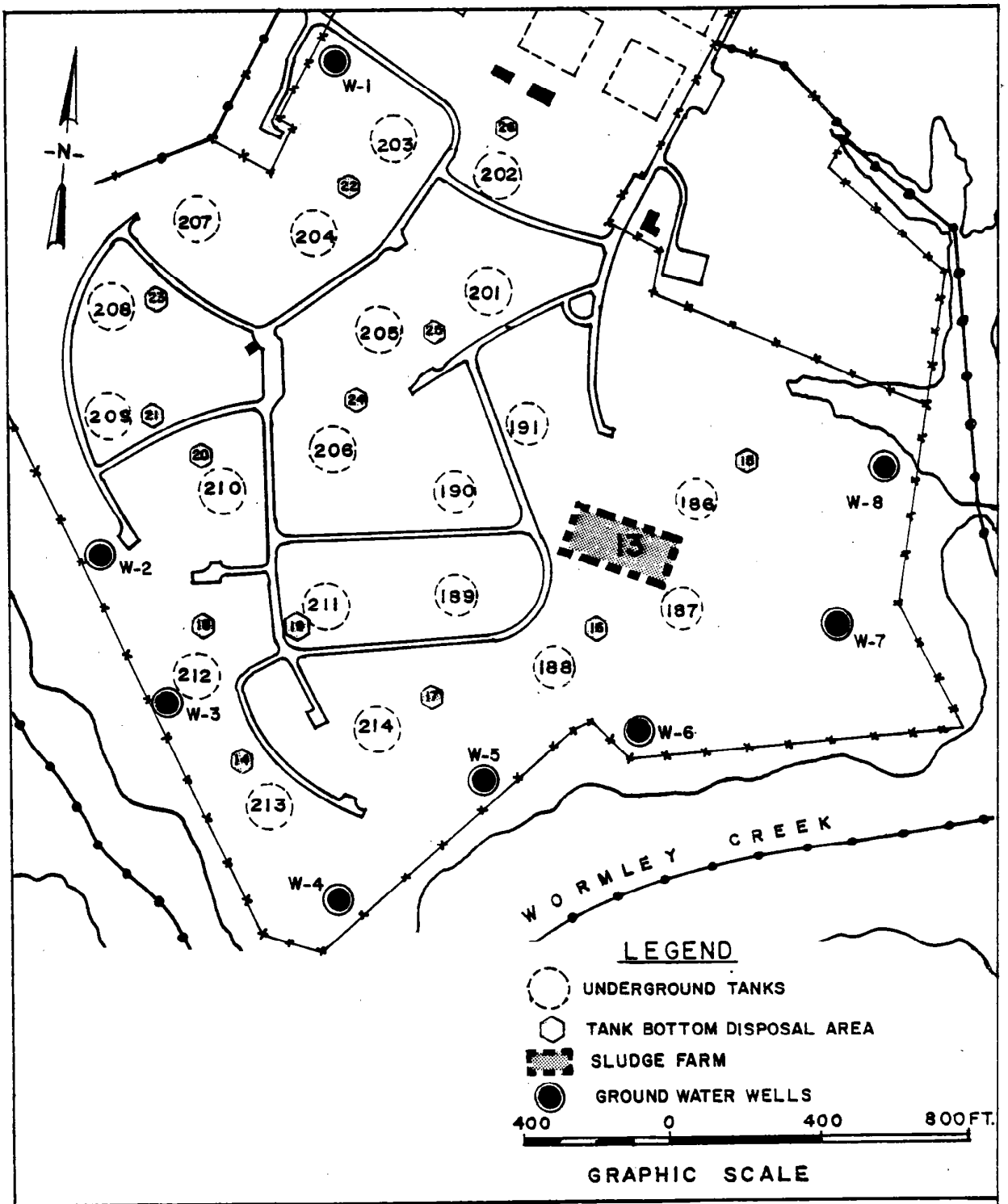

FIGURE 3-5
SITE 13 - SLUDGE FARM
SITES 14 Thru 26 - TANK BOTTOMS DISPOSAL AREA
RECOMMENDED SAMPLING POINTS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

3.3.2 Fuel Pit at Building YK 215 (Site 27), Abandoned NSFO Tanks (Site 31), Figure 3-6.

Monitoring Wells: Four wells.

Type of Samples: Ground water: and soil taken at 5-foot intervals, formation changes during well drilling, and at the water table.

Number of Samples: Sixteen water, four from each well and four composite soil samples, one from each well.

Frequency: Ground water: four times at quarterly intervals. Soil: once.

Testing Parameters: Water level: Navy Special Fuel Oil.

Remarks: Well W-9 is the likely upgradient well for sites in this group. W-10 and W-11 are the downgradient wells for Site 31. Well 11 is also an upgradient well for Site 27 and W-12 the downgradient well for that site. All twelve recommended wells are shown together in Figure 3-7. Soil samples taken at 5-foot intervals will be taken to identify migration of fuel throughout the soil. Note that wells W-9 and W-10 are outside the activity boundaries but are positioned in order to obtain representative background and downgradient samples respectively.

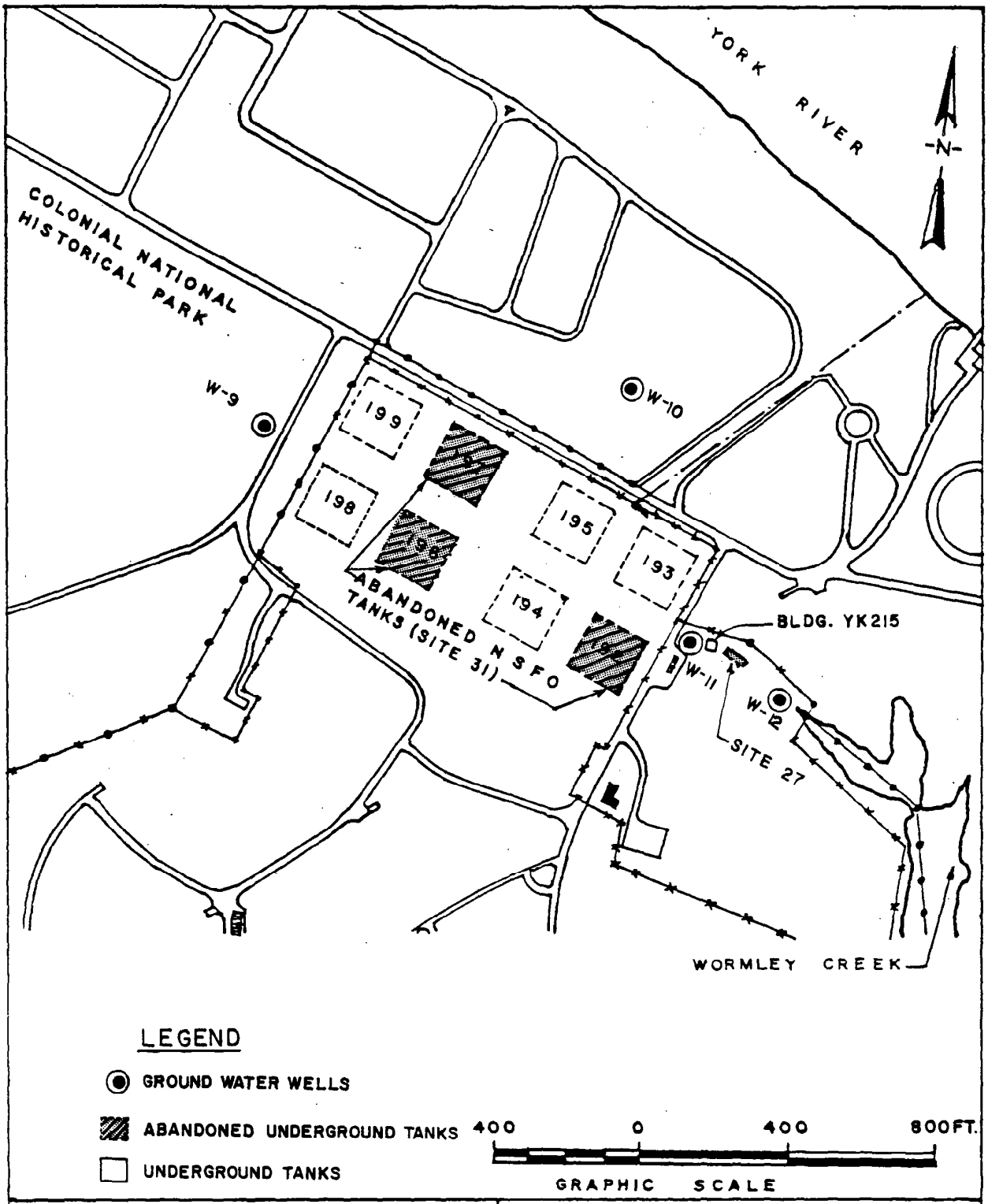

FIGURE 3-6
SITE 27 - FUEL PIT AT BUILDING YK 215
SITE 31 - ABANDONED NSFO TANKS

RECOMMENDED SAMPLING POINTS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

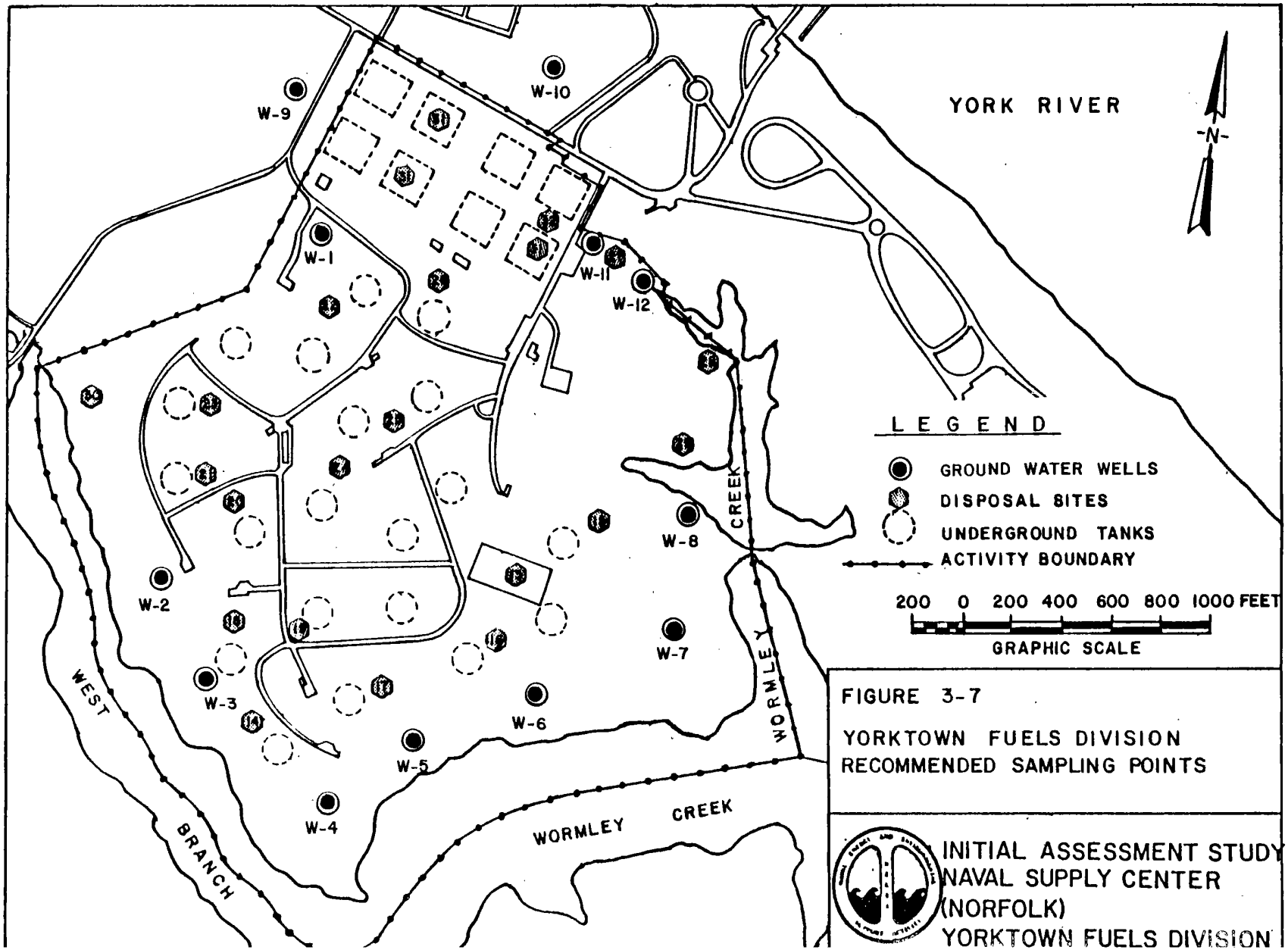

FIGURE 3-7

YORKTOWN FUELS DIVISION
RECOMMENDED SAMPLING POINTS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

CHAPTER 4. BACKGROUND

4.1 NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX

4.1.1 General Information. The mission of Cheatham Annex is "to maintain and operate a material handling stockpoint for receiving, storing, packing, and shipping of material under the cognizance of the Naval Supply Center (Norfolk) and perform all other functions as assigned" (Naval Facilities Engineering Command, 1983).

4.1.1.1 Location. Cheatham Annex is a 1,579-acre facility in York County on the peninsula formed by the James and York rivers. It is located on the York River, close to the Chesapeake Bay and the Tidewater Naval Complex in Norfolk. The location is shown in Figure 4-1. The activity is near the historic towns of Williamsburg and Yorktown and is about 80 miles east of Richmond, Virginia, 180 miles south of Washington, D.C., and 40 miles northwest of Norfolk, Virginia. Cheatham Annex is bounded on the north by the York River, on the west by Department of Interior land, on the south by Colonial Parkway, and on the east by Naval Weapons Station, Yorktown.

4.1.1.2 Mission. The primary mission of Cheatham Annex is receiving, storing, packing and shipping of materials to federal facilities on the east coast and major distribution centers in Europe. The activity also stores and transports other materials, including machine parts too large to store and move by conventional methods. Cheatham Annex supplies most of its own services, such as water supply, waste water treatment, pest control, and maintenance. It also houses several tenant activities which assist in fulfilling its mission. A more complete description of activities at Cheatham Annex is given below, including a description of the tenant activities.

4.1.1.2.1 Material Division. The Material Division includes the Storage Branch, Traffic Branch, and General Supply Branch. Non-perishable items handled by the Storage Branch are stored in 17 general warehouses and include Navy stock material, materials for other shore activities and ten ships, household goods for military personnel and items for the naval museum. Large items such as generators, periscopes, diesel engines, radar antennas, propellers, and anchors are also stored in some of the warehouses, as well as in outdoor storage areas.

The Traffic Branch is responsible for planning the movement of materials from Cheatham Annex. This may involve arranging the method of transportation and the necessary clearances. The General Supply Branch provides materials necessary for operation of the activity. This includes gasoline, motor fuels, maintenance materials, office supplies, janitorial supplies and supplies for land and wildlife management programs.

4.1.1.2.2 International Logistics Division. The International Logistics Division receives, stores, stages and ships materials for foreign Navies including programs of Spain, Kuwait, and Saudi Arabia. It is totally supported by payment from those countries to the United States. Materials are supplied for foreign destroyers, frigates, minesweepers, and A-4 aircraft.

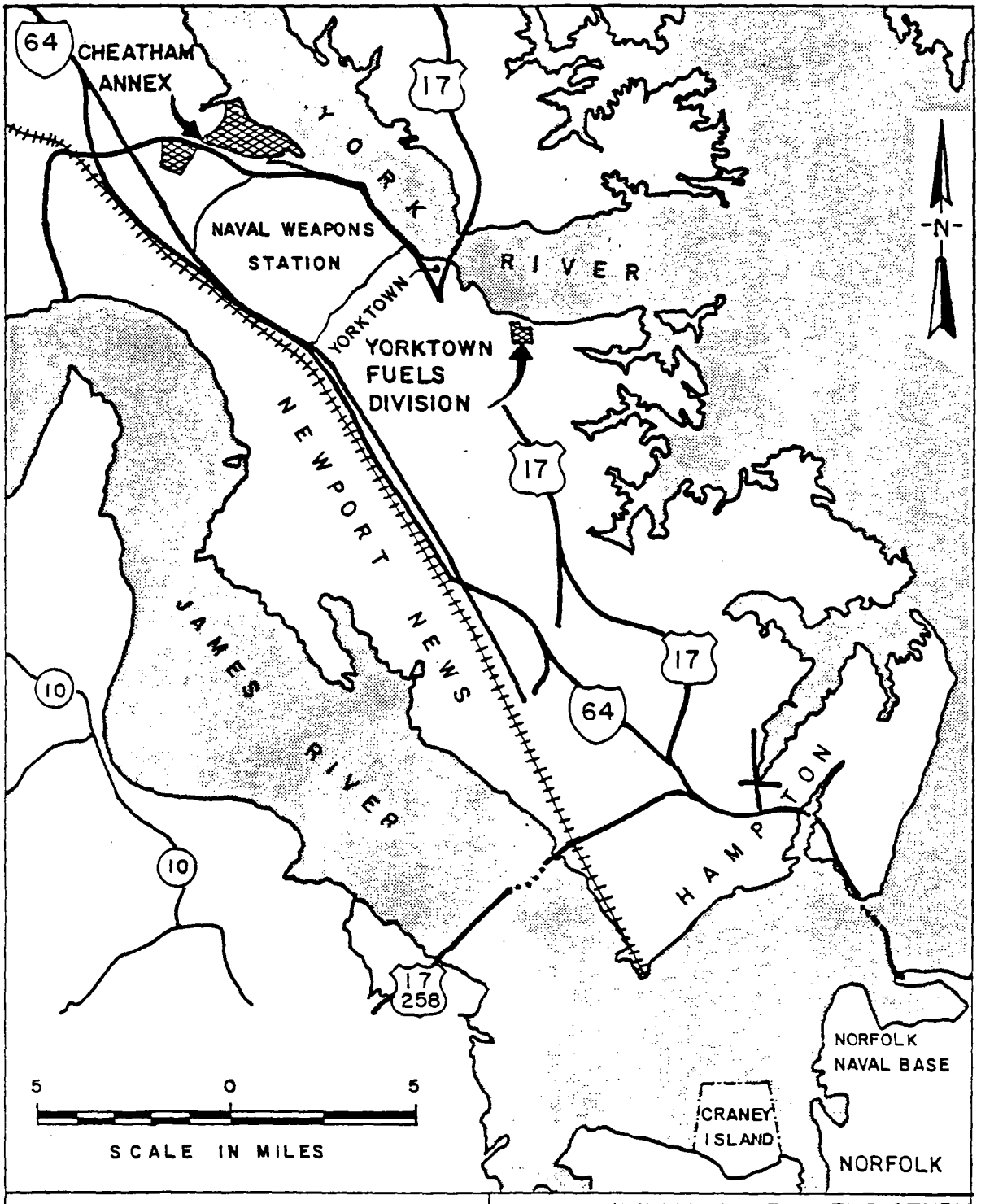

FIGURE 4-1
VICINITY MAP
CHEATHAM ANNEX
YORKTOWN FUELS DIVISION

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX
YORKTOWN FUELS DIVISION

4.1.1.2.3 Administrative and Planning Division. The Administrative and Planning Division includes the Management Programs Office, Budget and Statistical Branch, and Administrative Services/Personnel Branch. This division is responsible for administration at Cheatham Annex, overall planning, budget and financial accounting, and all personnel matters.

4.1.1.2.4 Public Works Division. Maintenance of Cheatham Annex facilities is the responsibility of the Public Works Division. Most of the installation's shops are operated by the Division for maintenance of warehouses, pier, family quarters, office buildings, ten miles of railroad, 11 miles of power lines, and 17 miles of paved road. It also maintains and operates the emergency power plant, water treatment plant, water storage tanks, and waste water treatment plant at Cheatham Annex.

4.1.1.2.5 Security Division. The Security Division oversees security and safety at Cheatham Annex. Security services which are provided by a contractor include patrolling the activity, guarding the main gate, and issuing passes to visitors. The fire department is staffed and equipped to protect personnel and property from fires. Its activities include training, building inspections, equipment testing and controlling fires.

4.1.1.2.6 The Defense Property Disposal Office (DPDO) at Cheatham Annex is responsible for administering the reuse or disposal of excess or waste government property. It also provides temporary storage of materials until they can be sold or disposed of.

4.1.1.2.7 Navy Cargo Handling and Port Group (NAVCHAPGRU) is one of the largest tenant activities at Cheatham Annex. It conducts research and development of cargo handling techniques and trains cargo handling personnel for fleet requirements in other locations.

4.1.1.2.8 Defense Subsistence Office (DSO) provides inventory management for chill and freeze provisions stored at Cheatham Annex. DSO responsibilities include processing requisitions, procurement, scheduling of receipts and deliveries, and material transportation. Cold storage, which is part of the Defense Subsistence Office (DSO), handles perishable food destined for armed forces in the United States and Europe. This branch handles the largest volume of materials at Cheatham Annex, averaging 9,620 tons of food each month. Most food is received by truck but some also arrives by rail car. Food is sent to other naval activities on the east coast by refrigerated trucks. Overseas shipments are sent via either the Norfolk International or Portsmouth Marine Terminals in refrigerated sea containers. Food quality is checked by inspectors from the U.S. Army Veterinary Corps and the U.S. Department of Agriculture.

4.1.1.2.9 Emergency Ships Salvage Material (ESSM) provides emergency ship salvage operations in the event vessels run aground or sink or equipment is lost overboard. It also provides equipment and expertise for oil pollution control.

4.1.1.2.10 Naval Sea Systems Command (NAVSEASYSCOM) Material Representative (East Coast) provides management of materials for the modification and repair of naval vessels. NAVSEASYSCOM materials are stored in buildings CAD 13 and CAD 14. Large ship parts are stored outside.

4.1.1.2.11 U.S. Army Veterinary Food Inspection Branch conducts quality inspections of perishable food items at the cold storage building.

4.1.1.2.12 The Navy Exchange Annex sells goods for the personal use of personnel working at Cheatham Annex. Facilities include a gasoline service station for automobiles as well as personal items, food service and vending areas.

4.1.1.2.13 J.L. Associates is a private contractor to the Navy which recently assumed responsibility for operation of the cold storage facilities at Cheatham Annex.

4.1.1.2.14 Military Sea Lift Command hires commercial vessels to support Navy ships at sea. Support activities include supplying cables, ammunition and repair services.

4.1.2 History. Cheatham Annex was commissioned in June 1943 as a satellite unit of the Naval Supply Depot to provide bulk storage facilities. During World War I, prior to the establishment of the activity, the site had been the location of a large powder and shell-loading plant operated by DuPont. During that time, the area included a city of 10,000 people and was named Penniman. The DuPont plant operated for about three years, closing at the end of World War I. Between 1918 and 1942, the land was used for farming or left idle. In 1942 work was begun for the new supply facility. This included ten warehouses, a cold storage building, a power plant, barracks, and other operation and support facilities.

The mission of Cheatham Annex has remained essentially the same since its commissioning. Additional storage facilities have been constructed to accommodate the Navy's increased supply needs. Other minor changes include the addition of an outside source of electrical power from the Virginia Electric and Power Company (VEPCO), excessing some unused lands on the activity to the State of Virginia and the Department of the Interior, and delegation of some operations to tenant activities.

4.1.3 Physical Features.

4.1.3.1 Climate. The York-James Peninsula has a moderate continental climate with mild winters and long, warm summers. As shown on Table 4-1, average monthly temperatures in the area range from about 41°F in January to 79°F in July. Precipitation is well distributed throughout the year, with heaviest rains occurring in July and August. Prevailing winds are usually from the southwest; however, northeasterly winds are common in September and October. The average wind speed is 10.6 mph.

4.1.3.2 Topography. The topography of Cheatham Annex (Figure 4-2) is characterized by gently rolling terrain dissected by ravines and stream valleys. The entire area slopes toward the York River.

Surface elevations range from five feet along the York River to 90 feet above mean sea level on a few scattered hills in the western portion of the activity.. Valleys consisting of 40-to 60-foot ravines with steep slopes occur along the creeks draining the activity.

Table 4-1

Climatological Data near the Virginia Pennisula[1]

Month	Temperature (°F) Daily Maximum	Daily Minimum	Monthly	Precipitation (inches) Normal Total	Maximum Monthly	Year	Minimum Monthly	Year	Wind (mph) Mean Speed	Prevailing Direction	Pct. of Possible Sunshine	Mean Sky Cover Sunrise to Sunset	Mean Number of Days Thunder-storms
J	50.2	32.2	41.2	3.33	6.40	1954	1.60	1949	11.7	SW	57	6.3	*
F	51.0	32.2	41.6	3.21	5.72	1956	0.86	1950	12.1	NNE	58	6.2	1
M	57.2	38.7	48.0	3.45	6.41	1958	1.34	1967	12.5	SW	63	6.0	2
A	68.0	47.9	58.0	3.16	7.77	1961	1.48	1963	11.8	SW	66	5.9	3
M	77.3	57.7	67.5	3.36	7.77	1961	1.48	1965	10.3	SW	67	6.1	5
J	84.9	66.3	75.6	3.61	9.72	1963	0.37	1954	9.5	SW	68	5.7	6
J	87.9	69.6	78.8	5.92	12.83	1950	1.69	1961	8.7	SW	65	6.0	9
A	86.2	68.8	77.5	5.97	11.19	1967	1.60	1972	8.7	SW	65	5.8	7
S	80.9	64.3	72.6	4.22	12.26	1964	0.36	1958	9.7	NE	64	5.7	3
O	70.9	53.1	62.0	2.92	10.12	1971	0.93	1967	10.5	NE	60	5.4	1
N	61.0	41.8	51.4	3.05	7.01	1951	0.49	1965	10.8	SW	60	5.4	1
D	51.8	33.1	42.5	2.74	4.84	1967	1.08	1965	11.1	SW	57	6.0	*
YR	68.9	50.5	59.7	44.94	12.83	JUL. 1950	0.36	SEP. 1958	10.6	SW	63	5.9	37

[1]Source: Local Climatological Data, Norfolk, Virginia, 1972

Period of Record: 1931-1961

*Thunderstorms generally do not occur in these months.

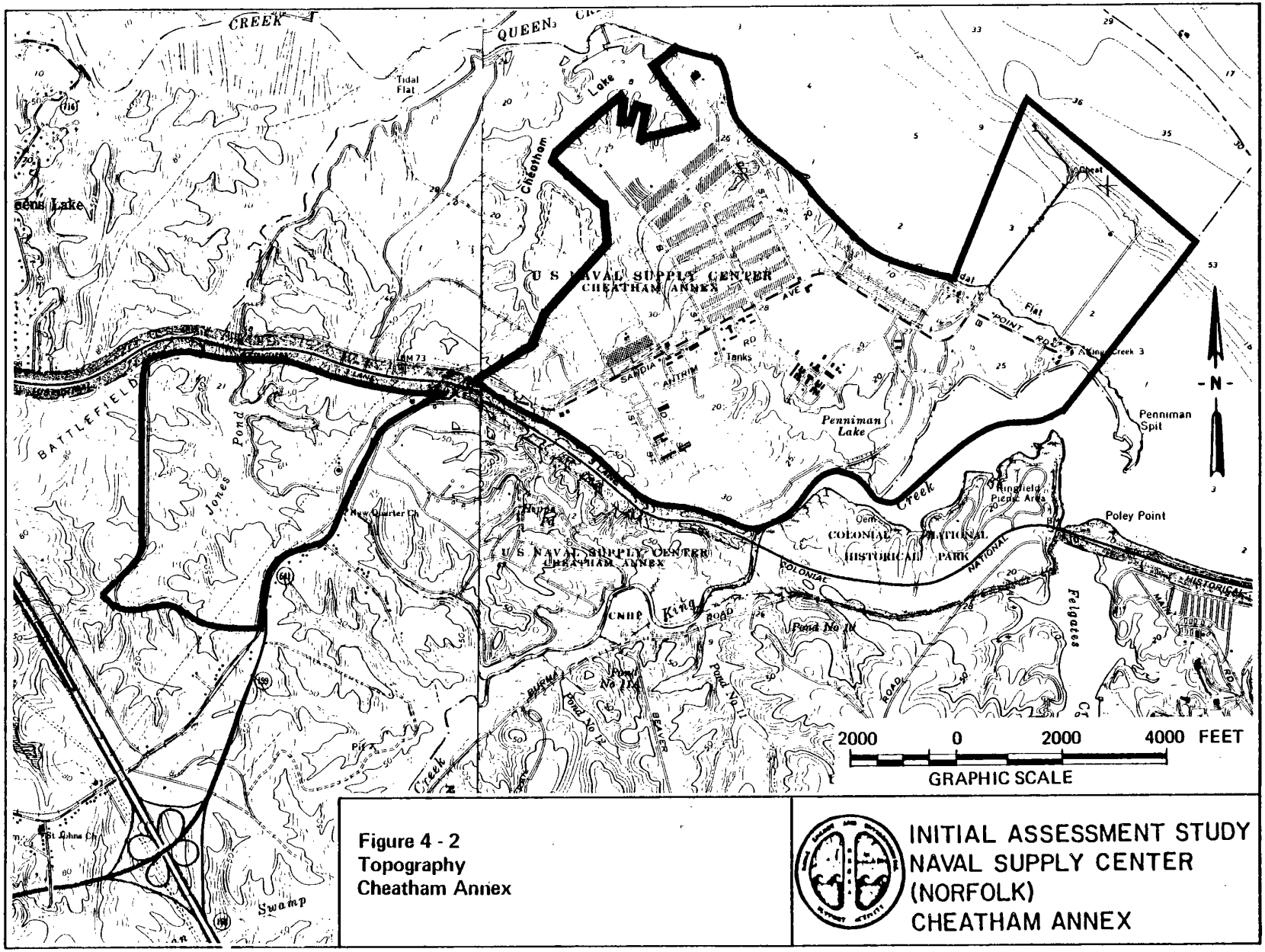

Figure 4 - 2
Topography
Cheatham Annex

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

4.1.3.3 Geology. Cheatham Annex is located in the York-James Peninsula which lies wholly within the embayed section of the Atlantic Coastal Plain Province. The area is underlain by more than 1,500 feet of unconsolidated sediments that dip gently and thicken eastward to the sea, and rest upon the Pre-Cretaceous basement-rock complex, consisting of crystalline rock and scattered Triassic sedimentary rocks. The unconsolidated sediments are of the Cretaceous, Tertiary and Quarternary ages, and the bedrock of the Pre-Cretaceous age. The general characteristics of the geologic formations of the area are summarized in Table 4-2.

4.1.3.3.1 Unconsolidated Sediments. The surficial unconsolidated sediments at Cheatham Annex have been mapped as the Windsor Formation of the Pleistocene series. This formation is comprised of a series of sands and silts deposited in marine and estuarine environments. Underlying this formation are the Miocene deposits of the Yorktown, St. Mary's, and Calvert formations. The Miocene deposits extend from approximately 100 feet below sea level to 200 feet below sea level in the vicinity of Cheatham Annex. The top part of these deposits consists of shells and shell fragments cemented with calcite. The deposits grade transitionally downward into fine-grained, subround to round quartz grain sand, with a decrease in shell fragment content. At greater depth, the sand becomes more poorly sorted and characteristically dark in color (St. Mary's). Throughout most of the area there is a basal sand with scattered fossil fragments (Calvert) (Virginia State Water Control Board, 1973).

The Eocene deposits, underlying the Miocene deposits, consist of the Chickahominy and Nanjemoy (Claiborne age) formations. The Eocene consists of fine to medium grained sand with varying concentrations of glauconite. The thickness of the Eocene deposits in the vicinity of Cheatham Annex is approximately 70 feet (Virginia State Water Control Board, 1973).

Paleocene deposits of the Nanjemoy (Wilcox age), Aquia and Mattaponi formations underlie the Eocene deposits. The Paleocene consists of fine to medium grained sands, interbeded with dark-colored silts and clays (Virginia State Water Control Board, 1973).

Cretaceous deposits of the Mattaponi (Lower) and Potomac Group formations underlie the Paleocene deposits and constitute the unconsolidated basal sediments of the area. The Cretaceous deposits are subdivided into Unit F comprising the upper portion of the Potomac Group and lower portion of the Mattaponi Formation, and units G and H comprising the classical Potomac Group. The deposits are characterized by discontinuous sand bodies interbedded with silts and clays. The Cretaceous of the York-James Peninsula was deposited in a fluvial-deltaic environment. The fluvial deposits are characteristically channel sand bodies which are coarse-grained at the base and become finer-grained upward. The deltaic deposits are medium-grained, moderately sorted sands. The Cretaceous deposits in the vicinity of Cheatham Annex extend from approximately 400 feet below sea level to 1,800 feet below sea level (Virginia State Water Control Board, 1973).

TABLE 4-2

GEOLOGIC UNITS AND WATER-BEARING CHARACTERISTICS
OF THE YORK-JAMES PENINSULA

System	Series	Age	Formation	Approximate Thickness	Lithologic Character	Hydrologic Comments
Quaternary	Post-Miocene		Windsor Norfolk Sand Ridge Sedley Bacons Castle	20 - 100	Mostly sands and gravels of fluvial and terrace deposits.	Supplies ground water to low-yield water table wells throughout the area
Tertiary	Miocene	Late Miocene Middle Miocene	Yorktown	0 - 150	Fossiliferous sands, marls, and coquinas	Supplies ground water to water table wells in parts of the area
			St. Mary's	0 - 150	Dark-colored sands, silts and clays; often referred to as "blue sand" and "blue clay"	Acts as a confining bed for the upper artesian aquifer system
			Calvert	0 - 60	Fossiliferous silts and sands, poorly to moderately sorted, occasionally glauconitic	Upper artesian aquifer; yields sufficient water for domestic, subdivision and light agricultural and industrial purposes
	Eocene	Jackson	Chickahominy	0 - 30	Fine to medium grained sands, poorly to moderately sorted, occasionally glauconitic	
		Claiborne	Nanjemoy (Claiborne Age)	0 - 80		
	Paleocene	Midway	Nanjemoy (Wilcox Age) Aquia Mattaponi (Glauconitic Member)	0 - 100	Highly glauconitic sands, silts and clays; often referred to as "greensand" or "black sand"	Generally an aquitard; confining layer for principal aquifer system; basal sand is part of principal aquifer system
Cretaceous	Lower Cretaceous	F G H	Mattaponi (Lower) Potomac Group	0 - 1500	Interbedded sands, silts and clays of fluvial and detaic origin; some thin mrginal marine beds; unit F dominantly silts and clays of interdelta region in extreme eastern part of the area	Capable of high yield with proper development in most areas of York-James Peninsula; mostly undeveloped at present time
Triassic					Predominantly soft red and brown shales; some thin beds of hard red shale and sandstone	Supplies ground water to a few low-yield water table wells in Ashland Area
Pre-Triassic Crystalline Rock					Highly variable rock types	Supplies moderate quantities of ground water to deep wells near Fall Zone

Source: Virginia State Water Control Board - BWCM

4.1.3.3.2 Bedrock. The Pre-Cretaceous bedrock complex of the York-James Peninsula consists of red and brown Triassic sandstones and shales, and a variety of crystalline rocks including diorite and granite. Information on the specific nature of the bedrock complex east of Williamsburg (including the Cheatham Annex vicinity) is limited to data from one well at Fort Monroe in which crystalline rock was found at a depth of 2,243 feet below sea level (Virginia State Water Control Board, 1973).

4.1.3.4 Soils. The soils on Cheatham Annex are of Coastal Plain (marine) origin, having been deposited at the bottom of the sea as sediments (U.S. Department of Agriculture, 1955a). These soils are generally grouped into three major associations (Figure 4-3). The Emporia-Bohicket-Slagle association occupying the northern half of the activity consists of deep, well drained, very poorly drained and moderately well drained soils that have a loamy subsoil or clayey substratum. The southern half of Cheatham Annex contains the Emporia-Craven-Uchee association consisting of deep, well-drained and moderately well-drained soils that usually have a loamy subsoil. The Slagle-Emporia-Uchee association at the southern tip of Cheatham Annex consists of deep, moderately well-drained and well-drained soils that usually have a loamy subsoil (York County Planning Commission, 1983).

Additionally, these associations are further sub-divided into a wide variety of soil types.

Soils in the Sassafras classification are slightly to severely eroded, have a sandy clay loam subsoil and substratum with moderately rapid permeability of subsoil. These well drained soils are found in the central section of the activity between Cheatham Lake and Penniman Lake.

Along the York River are the Kempsville soils. They are well drained soils, differing from the Sassafras as they are paler in color in the subsoil and have a heavier substratum. The Kempsville soils have a moderately rapid permeability of subsoil and slow permeability of substratum.

The Matapeake is a well drained soil similar to the Sassafras but it is a little heavier textured in the subsoil. The Matapeake soils are found along the boundaries of Cheatham Lake and Penniman Lake.

The Evesboro Loamy Sand is an excessively drained soil with light textured loamy fine sand to a depth of about three and one-half feet where it grades into sand. There is no subsoil development. The Evesboro soils are found on the northeastern section of the site.

Other soil types found on the activity include the Coastal Beach and the Mixed Alluvial Land. The Coastal Beach is a narrow strip of Saline Sand along the York River which is flooded often by high tide. The Mixed Alluvial Land is poorly drained and is found along the narrow bottoms of the small streams. These soils also flood frequently.

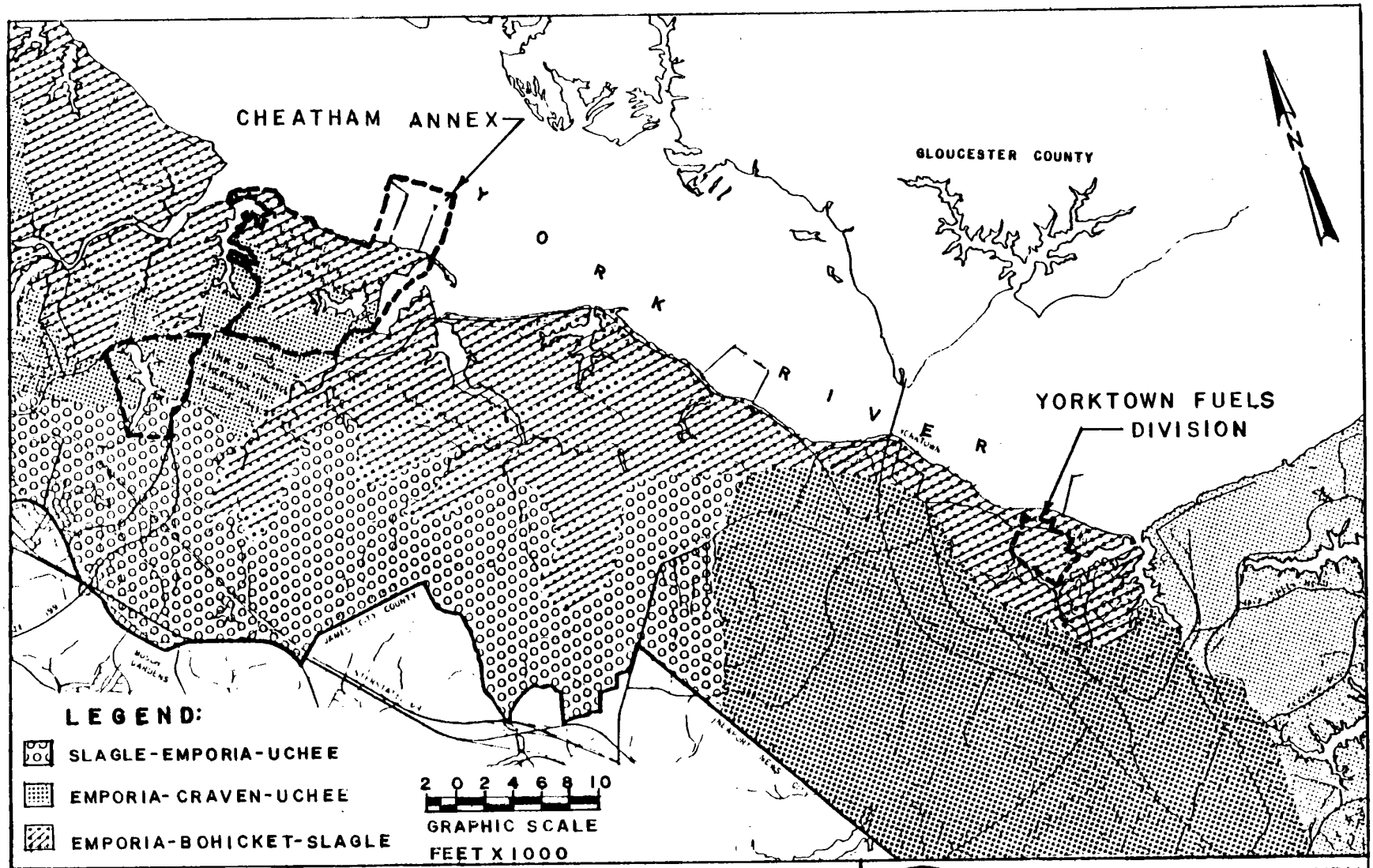

FIGURE 4-3

SOILS MAP

SOURCE: U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX
YORKTOWN FUELS DIVISION

4.1.3.5 Hydrology and Migration Potential. Although Cheatham Annex is characterized by gently rolling terrain, the entire area slopes towards the York River. This slope along with the close proximity to the York River increases the potential for migration of pollutants through surface water.

All of the three major soil associations contain some soils which are considered well drained. The well drained soils and a fairly shallow depth to ground water (approximately 10 to 25 feet) produce a situation that is conducive to potential pollution migration through ground water.

4.1.3.6 Water Resources.

4.1.3.6.1 Surface Water Hydrology. Cheatham Annex lies entirely within the York River Basin. The York River Basin lies in the central and eastern sections of Virginia and is located between the Rappahannock River Basin to the north and the James River Basin to the south. The headwaters of the York River Basin rise in Orange County and flow approximately 120 miles in a southeasterly direction to the Chesapeake Bay. Cheatham Annex is located near the mouth of the river where the basin is approximately five miles wide.

The main tributaries of the York River at Cheatham Annex are King Creek on the southeastern boundary of the Annex, and Cheatham Lake on the western boundary. Queen Creek, which is fed by Jones Pond, is another major tributary west of Cheatham Annex.

Wetlands are found along both of the creeks which drain the station, and also along some shoreline areas of the York River. The tidal reaches of the York River extend throughout Cheatham Annex, upstream through the entire 30-mile length of the river itself, and another 30 miles up both of its tributaries, the Mattaponi and Pamunky rivers. The tributary creeks draining Cheatham Annex are also tidal up to a mile inland from the river bank. The tidal reaches of the York River, including those in the vicinity of Cheatham Annex, are classified as shellfish waters. The mouth of the York River off Cheatham Annex is also an important shipping channel.

4.1.3.6.2 Flood Hazard. The York River poses the major flooding threat to Cheatham Annex during hurricanes or severe northeast storms. The Regional Flood Level for the area is 8.5 to 9 feet above mean sea level. This is the level associated with the 100-year flood used in the location of flood hazard areas (Figure 4-4). The Standard Project Flood Level (the highest flood level projected) is 13 feet above mean sea level.

4.1.3.6.3 Ground Water Hydrology. Ground water occurs in three major aquifer systems in the York-James Peninsula: the water-table aquifer, the upper artesian aquifer, and the principal artesian aquifer. The water-table aquifer, the uppermost of the three, consists of deposits of the Windsor and the Yorktown formations of the Pleistocene and Miocene ages, respectively (see Section 4.1.3.3.1). The deposits range in thickness from 20 feet at the western end of the peninsula to about 150 feet at the seaward end in the vicinity of Cheatham Annex. The aquifer is the dominant source of domestic (individual home) water supplies in many parts of Charles City, New Kent, James City, and York counties. Limited data exist on the depth to water table, flow direction and hydraulic characteristics of the aquifer (Virginia State Water Control Board, 1973).

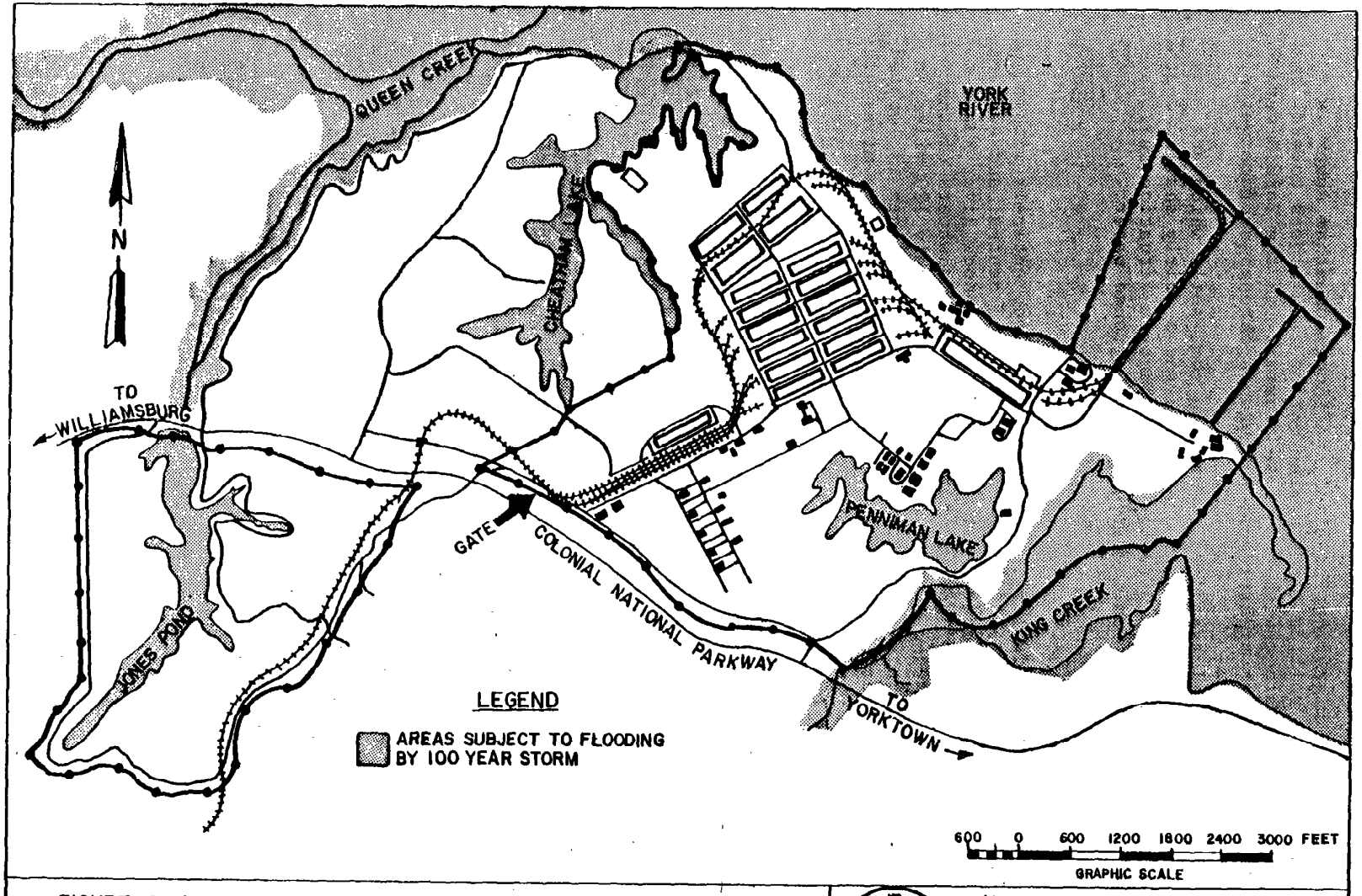

FIGURE 4-4

LOCATION OF FLOOD HAZARD AREAS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

However, data from borings on Naval Weapons Station Yorktown, which is located east of and immediately adjacent to Cheatham Annex, indicate that the depth to the water table ranges from 10 to 30 feet (Atec Associates, 1981). Ground water flow direction in the aquifer is likely to be from higher ground towards the drainage creeks and the York River.

The upper artesian aquifer, the next deeper aquifer, consists of deposits of the Calvert Formation (Miocene Series), and the Chickahominy and Nanjemoy formations of the Eocene Series (see Sections 4.1.3.3.1). The clayey St. Mary's Formation, which is approximately 100 feet thick, functions as an aquiclude between the upper artesian aquifer and the water-table aquifer. The upper artesian aquifer is generally 50 to 80 feet thick, and comprised of medium-grained sand, moderately to poorly sorted with glauconite, usually called green sand or black sand. Depth to the aquifer varies from about 60 feet above mean sea level in eastern Hanover County to 340 feet below mean sea level in Newport News, and is about 250 feet below mean sea level in the vicinity of Cheatham Annex. The aquifer is a reliable source of domestic and subdivision water supplies (see Section 4.1.3.6.4) Much of the recharge to the aquifer is probably derived from vertical leakage from the water-table aquifer through the confining silts and clays of the St. Mary's Formation. Based on the little available hydrogeologic information, the transmissibility of the aquifer is estimated to range from 5,000 gallons per day per foot to 15,000 gallons per day per foot. Specific capacities of wells completed in this system range from 1 to 10 gallons per minute per foot (Virginia State Water Control Board, 1973).

The principal artesian aquifer, the deepest of the three aquifers, consists of deposits of the Mattaponi and Potomac Group formations of the Lower Cretaceous Series (see Section 4.1.3.3.1). The aquifer contains a very large potential ground water supply in the York-James Peninsula although it is not presently developed in many areas. The aquifer consists of several discontinuous sand bodies interbedded with silt and clay. The top of the aquifer system ranges from 90 feet above mean sea level at its western end in Henrico County to 540 feet below mean sea level in Newport News. The top of the aquifer is approximately 450 feet below mean sea level in the vicinity of Cheatham Annex. Recharge to the aquifer occurs through the outcrop in Henrico, Hanover, and western King William counties. However, substantial recharge also occurs east of these areas from vertical leakage between the adjacent aquifers through the confining layers, and has been estimated at 30,500 gallons per day per square mile. Transmissibilities in the central and eastern part of the aquifer (including Cheatham Annex) vary from 15,000 gallons per day per foot to 50,000 gallons per day per foot. Transmissibilties are high in the eastern section of the aquifer, despite the low sand content (low permeability), because of the great thickness of the aquifer. Specific capacities of wells vary greatly from as low as 0.17 gallons per minute per foot in Henrico County to 30 gallons per minute per foot in West Point, 20 gallons per minute per foot near Williamsburg, and 5.2 gallons per minute per foot in Newport News. Flow direction is generally easterly towards the Chesapeake Bay. The most extensive development of the aquifer has occurred in the Richmond metropolitan

area. Dissolved solids in the water increase with depth in an easterly direction and result in the limited use of the aquifer east of Williamsburg where total dissolved solids range from 1,500 parts per million to 9,000 parts per million and chlorides may exceed 1,000 parts per million (Virginia State Water Control Board, 1973).

4.1.3.6.4 Ground Water at Cheatham Annex. The closest wells to Cheatham Annex are private wells located approximately one half mile south of the main gate. These wells serve a population of approximately forty people. It is estimated that there are 13 wells serving this area along Springfield Road (based on population density of 3.1 people per dwelling). Although insufficient data exist on the depths and hydraulic characteristics of the wells, they are reported to be within the water-table aquifer. Measurements to the ground water from monitoring wells at the landfill near the incinerator (Section 8.2.1) were taken on July 8, 1983. The results indicate an average ground water elevation of approximately 31 feet MSL.

There are two wells at Cheatham Annex, both part of an emergency backup water supply system, and presently inactive. One well is located in Pumphouse CAD 102A off Antrim Road. When needed the water is pumped into a 400,000 gallon below ground reservoir and then into the activity's distribution system. The other well is located outside of, and is connected to, Building CAD 134, the water filtration plant.

4.1.3.6.7 Migration Potential. Contaminants may migrate from disposal sites by surface runoff to creeks and rivers or by infiltration to the aquifers. Surface runoff may take place through open surface ditches and drains near many disposal sites. In many cases, these surface water drains discharge into wetland areas of creeks which flow into the York River. King Creek, which forms the Annex's eastern boundary can be affected in this way. Contaminated discharges may affect the shellfish waters of the York River.

The potential for contamination of the water-table aquifer is enhanced by the presence of well drained soils in the area. There is also some possibility that contaminants could migrate downward from the shallow ground water system to the upper and principal artesian systems. This potential is not as great because of the low permeability of beds confining the artesian systems. Contaminants entering the aquifers may be transported, possibly off-site, by the ground water flow. Such migration in the water-table aquifer is likely to be mainly in the direction towards the York River. Pumpage from wells in this aquifer is unlikely to have a significant effect because of the low extraction rates of the domestic wells, the nearest of which is about a mile from the sites.

4.1.4 Biological Features. Cheatham Annex covers an area of approximately 1,579 acres. While the majority of the area is covered with woodlands (about 1,198 acres), the remainder is comprised of fields, marshes, lakes and tidal creeks. The York River forms the northern boundary of the activity. The diversity of ecosystems within the activity and its surroundings provide habitat for a wide variety of plants and animals.

4.1.4.1 Ecology, Terrestrial and Aquatic Flora and Fauna. Cheatham Annex lies within the Piedmont area of the Eastern Deciduous Forest. Woodlands are the predominant terrestrial ecosystem. Approximately 80 acres of the activity are planted with wheat, milo and other crops for wildlife feed. Major wetlands are found along Queen and King creeks. The former wetland borders the western edge of the Department of Interior's property west of Cheatham Lake, while the latter forms the eastern boundary of Cheatham Annex. Penniman Lake (43 acres) and Jones Pond (69 acres) are the major water bodies on the activity, along with the York River on the northern boundary.

4.1.4.1.1 Terrestrial Flora and Fauna. Terrestrial vegetation at Cheatham Annex is predominantly woodland species with three types of tree stands present: pine stands composed mainly of Loblolly and Virginia pine, mixed hardwood stands, and mixed pine and hardwood stands. These wooded areas are important in reducing soil erosion and providing wildlife habitat. A list of tree species expected to be found at Cheatham Annex is presented in Appendix C.

The woodland's understory is composed of various seedling trees and vines such as Virginia creeper, briars, and honeysuckle. Ferns are found in moist, shaded areas.

Deer make up the largest wildlife population on the activity. A carrying capacity of 325 to 350 deer is maintained through controlled hunting each fall. Other wildlife found on Cheatham Annex include wild turkeys, ducks, osprey, red and grey fox, raccoons, skunks, beaver, bobcat and pheasant. Songbirds common to eastern Virginia are found at the activity, including the indigo bunting and gold finch. Raptors include small hawks and owls. A listing of species common to the area is found in Appendix D.

4.1.4.1.2 Aquatic Flora and Fauna. Cheatham Annex has many small intermittent streams and creeks which drain into tidal creeks and eventually into the York River. Queen and King creeks are the major tidal creeks in the area. King Creek forms the eastern activity boundary, while Queen Creek is west of the activity, across the Department of Interior's property that borders Cheatham Annex. Several lakes, including Cheatham Lake, Jones Pond, and Penniman Lake, are also found on Cheatham Annex.

The habitat of aquatic floral species is generally determined by water salinity and bottom types. Table 4-3 lists species found in this area of the York River and their associated salinity ranges in parts per thousand (ppt).

These species are commonly found growing at depths of 0.5 to 3 meters in soft bottom muds. Waterweed and water milfoil have been plant pests at times due to increased nutrient loading. Eelgrass is most often found growing in soft mud. Widgeon grass is sensitive to both increased water temperature and turbidity.

Oysters, blue crabs, and hard and soft shell clams are found in the York River off-shore of Cheatham Annex. This area of the York River is designated as a crab pot fishery for 75 percent of the year (spring, summer, fall). Additionally, the river south of Queen Creek is a spawning and nursery ground for blue crabs (Virginia Institute of Marine Science, undated).

TABLE 4-3
Aquatic Floral Species of the York River
in the Vicinity of Cheatham Annex and
Yorktown Fuels Division

Species Name	Common Name	Habitat Salinity
Ceratophyllum demersum	Hornwort	Freshwater only
Vallisneria americana	Water-celery	Freshwater only
Potamogeton crispus	Pondweed	Fresh to 5 ppt
Zannichellia palustris	Horned pondweed	Fresh to 5 ppt
Elodea canadensis	Waterweed	Fresh to 10 ppt
Myriophyllum spicatum	Watermilfoil	Fresh to 10 ppt
Potamogeton perfoliatus	Pondweed	5 to 25 ppt
Zostera marina	Eelgrass	10 to 35 ppt
Ruppia maritima	Widgeon grass	5 to 40 ppt

Important fish species found in the York River include: hogchoker (Trinectes maculatus), white perch (Morone americana), white catfish (Ictalurus catus), channel catfish (Ictalrus punctatus), bay anchovy (Anchoa mitchilli), oyster toadfish (Ospanus tau), striped bass (Morone saxatilis), atlantic croaker (Micropogan undulatus), weakfish (Cynoscion regalis), spotted hake (Urophycis regius), spot (Leiostomus xanthurus) and silver perch (Bairdiella chrysura). Markle (1976) found that these 12 species comprised over 92 percent of a total catch of 98 species. The first seven of the listed species are considered resident species, while the remaining five inhabit the waters only seasonally.

4.1.4.1.3 Wetlands. Wetlands are found mainly along King Creek, the activity's eastern boundary, and along the York River shoreline. Two major marsh types exist on the activity:

Type I	Saltmarsh Cordgrass Community
Type XII	Brackish Water Mixed Community

A description of the environmental value of these marsh types is shown in Appendix E. For management purposes, the wetlands have been grouped into classifications based on their estimated environmental value per acre (Virginia Marine Resources Commission, undated). Group One marshes, of which Type I and Type XII are a part, have the highest productivity and use for wildfowl and wildlife, as well as a close association with fish spawning and nursery areas. They are also important to the shellfish industry and as shoreline erosion inhibitors. These wetlands merit the highest order of protection.

The King Creek marsh, along the mainstem, is a mixed brackish water type (Type XII) since no one plant community dominates. Black Needlerush, a common saline rush typical of this type of marsh is absent. The entire marsh is 180 acres, although only those on the northern bank are on Cheatham Annex. The marshes along the York River shoreline are mainly grass-dominated brackish water marshes with abundant stands of saltmarsh cordgrass (Type I).

The activity's wetlands and adjacent creeks provide nursery areas for striped bass, white perch and other species (Virginia Institute of Marine Science, 1974). Migratory waterfowl are common to the wetlands and include those species listed in Appendix D.

4.1.4.2 Rare, Threatened and Endangered Species, Critical Habitat. The environment of Cheatham Annex supports no federal or state designated plant species on the endangered list. No theatened or endangered fish or invertebrates have been found on the activity or nearby.

Several species of endangered sea turtles, namely the Green (Chelonia mydas), Hawkbill (Erectmochelys imbricata), Leatherback (Dermochelys coriacea), Loggerhead (Caretta caretta), and Atlantic Ridley (Lepidochelys kempii) are known to feed in the Chesapeake Bay and occasionally swim up the York River during the summer. The southern bald eagle (Haliaeetus levcocephalus), on the federal endangered list, is known to nest at Camp Peary, approximately three miles northwest of the activity (by letter, Glenn Kinser, U.S. Fish and Wildlife Service, June 21, 1983). Suitable habitat exists for roosting and

perching on the activity, but only occasional sightings have been made. Infrequent sightings of several endangered/threatened avian species, including the Peregrine falcon (Falco peregrinus), Brown Pelican (Pelecanus occidentalis), and Bachman's (Vermivora bachmanii) and Kirtland's warblers (Dendroica kirtlandii) and the Red Cockaded Woodpecker (Picoides borealis), have been made in the general area (Naval Facilities Engineering Command, Atlantic Division, 1983b).

4.1.4.3 Impacts on Habitats. A brief ground tour of the disposal areas and a helicopter fly-over of the activity revealed no signs of vegetative stress related to the presence or migration of hazardous wastes.

Tidal marshes are found along the creeks and shoreline of Cheatham Annex. These communities are highly productive, due in part to their ability to trap nutrients. However, this characteristic also makes them highly susceptible to pollution. The interaction of wetlands with the nearby tidal creek expands the contamination possibilities.

4.1.5 Water Quality. All waters of the State of Virginia, in accordance with the General Standard of the State's Water Quality Standards, "shall be maintained at such quality as will permit all reasonable, beneficial uses and will support the propagation and growth of all aquatic life, including game fish, which might reasonably be expected to inhabit them" (Virginia State Water Control Board, 1982). In addition, there are specific water quality standards which are applicable to identified surface water stream segments and ground waters. These are discussed as they relate to the waters of the York River Basin and its surroundings.

4.1.5.1 Surface Water Quality. The York River basin in the vicinity of Cheatham Annex is classified by the State of Virginia as Class II waters (estuarine) to be additionally protected for shellfish propagation. The requirements for shellfish protection include fecal coliform concentrations not to exceed a bacterial density by Most Probable Number of 14 per 100 milliliters of sample and the shellfish area is not to be so contaminated by radionuclides, pesticides, herbicides, or fecal material that the consumption of shellfish might be hazardous. Water quality requirements of Class II waters are: dissolved oxygen - 4.0 milligrams per liter minimum, and 5.0 milligrams per liter daily average; and pH - 6.0 to 8.5.

4.1.5.2 Ground Water Quality. Ground water in the vicinity of Cheatham Annex is subject to two sets of water quality standards: the standards of the Coastal Plain Physiographic Province include pH - 6.5 to 9.0; ammonia nitrogen and nitrite nitrogen - 0.025 milligrams per liter; and nitrate nitrogen - 5.0 milligrams per liter. The statewide standards cover inorganic constituents, chlorinated hydrocarbon insecticides, chlorophenoxy herbicides, and radioactivity.

Water quality data on the water-table aquifer is generally lacking. Water from the upper artesian aquifer is generally hard but otherwise of good quality with total dissolved solids of about 200 parts per million. Water quality in the principal artesian aquifer varies considerably with location.

Dissolved solids content increases in an easterly direction and with depth. East of Williamsburg, available data show total dissolved solids to range from 1500 parts per million to 9000 parts per million and chlorides to exceed 1000 parts per million.

4.1.6 Water Supply. In addition to potable water, Cheatham Annex uses water for cooling, boiler makeup, golf course watering, firefighting, and pier water line freeze prevention. All of these needs are filled by potable water from the Annex's on-site supply and treatment facility.

Raw water for the Annex is taken from Jones Pond, a spring-fed water body with an area of 69 acres. Treatment of this water consists of pressure filtration and chlorination at the Annex's on-site water treatment facility (CAD 139). The capacity of the treatment plant is 500,000 gallons per day and average daily production is approximately 100,000 gallons. Because of this excess capacity, potable water is used for non-potable applications and additional facilities for fire fighting are not deemed necessary. In addition, it has been determined that installing such facilities would be less cost effective than maintaining the present system. Finished water from the plant is stored in a 500,000-gallon clear well and a 100,000-gallon elevated tank. Filter backwash from the water treatment plant is discharged into a settling pond and then back into Jones Pond. Alterations of this system are planned which will eliminate such discharges to Jones Pond. Water from the plant is checked daily for turbidity and chlorine residual by on-site personnel. Fecal coliform counts are made once a week by a Navy laboratory in the Norfolk area.

Two wells, one in Building CAD 102A and the other outside of Building CAD 134, make up an emergency backup water supply system at Cheatham Annex. The wells are presently inactive. Raw water from the former well is stored in a 400,000-gallon below ground reservoir, and pumped to the activity's distribution system when needed. Water from the latter well is connected to the water filtration plant (CAD 134) and is treated here before distribution.

In the past, overflows of untreated sewage from a small private wastewater treatment plant (James County Sewer Plant #8) near Cheatham Annex have been discharged into Jones Pond. Although the potential for these discharges still exists, the State of Virginia now requires this private plant to notify both the State and Cheatham Annex prior to such a discharge. Such notification enables the water treatment plant operator at Cheatham Annex to take appropriate measures to protect the health of the Annex's potable water supply users.

4.1.7 Adjacent Land Use. Cheatham Annex is located in York County. As a result of some areas of the station being excessed, it presently consists of two parcels of land: the operational part of the activity, and the area surrounding Jones Pond. The main part of the activity is bounded on the northeast by the York River and by Queen and King creeks to the north and south, respectively. Cheatham Annex is bounded on the northwest by the Camp Peary Armed Forces Experimental Training Activity. West of the main annex and north of the Jones Pond area, excessed land is owned by the U.S. Department of the Interior. An excessed fuel storage area currently owned by the State of Virginia, is southwest of the main annex and east of Jones Pond. The U.S.

Naval Weapons Station is immediately southeast of Cheatham Annex. The Jones Pond area is surrounded by privately owned land to the northwest, west, south, and southeast. Most of this land is sparsely developed. The nearest developed areas are the Queens Lake residential development and the York Terrace, Jones Terrace, Nelson Park and Charleston Park developments to the west.

4.1.8 Legal Actions. No legal actions have been reported at Cheatham Annex concerning contamination incidents at the activity.

4.2 NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION.

4.2.1 General Information. The Naval Supply Center, Norfolk, Yorktown Fuels Division is engaged in the transfer and storage of fuel oils.

4.2.1.1 Location. The Yorktown Fuels Division is a 110 acre facility located on the York River, close to the Chesapeake Bay. The activity is approximately two miles southeast of the Town of Yorktown, Virginia and about 80 miles east of Richmond, Virginia; 180 miles south of Washington, D.C.; and 30 miles northwest of Norfolk, Virginia (see Figure 4-1). The facility is bounded on the northeast by the U.S. Coast Guard Reserve Training Center, on the northwest and west by the Colonial National Historic Park, on the southeast and southwest by the West Branch of Wormley Creek, and on the east by a cove projecting north from the West Branch of Wormley Creek (Figure 4-5).

4.2.1.2 Mission. The Fuels Division is engaged in the transfer and storage of fuel oils. Fuel is stored in 26 major underground storage tanks. The fuel transfer operation takes place at a pier in the York River and a tank truck loading station. The pierhead is engaged in receiving and issuing fuel to government vessels, while the truck loading station is used for issuing fuel to other naval installations.

4.2.2 History. Yorktown Fuels Division was activated in 1918 with the construction of underground fuel tanks 192-198, and a fuel pier. Six additional tanks, numbers 186-191 were constructed in 1941. Development continued with increases in storage capacity until 1954, when the current 1,900 foot fuel pier was constructed along with 14 additional tanks, numbers 201-214, establishing the terminal's existing configuration.

4.2.3 Physical Features. Yorktown Fuels Division is located on the York River side of the Virginia Peninsula. The proximity of two major tidal tributaries of Chesapeake Bay is an important influence on the natural environment of the activity.

4.2.3.1 Climate. The Virginia Peninsula enjoys a moderate continental climate with mild winters and long, warm summers. As shown on Table 4-1, average monthly temperatures in the area range from about 41°F in January to 79°F in July. Precipitation is well distributed throughout the year, with heaviest rains occurring in July and August. Prevailing winds are usually from the southwest but northeasterly winds are common in some months. The average wind speed in 10.6 miles per hour.

4.2.3.2 Topography. The topography of the Yorktown Fuels Division (Figure 4-5) is characterized by gently rolling terrain sloping downward from the center of the activity toward Wormley Creek. The entire site drains to Wormley Creek and eventually to the York River.

Surface elevations range from sea level along Wormley Creek to 60 feet above mean sea level on a few hills near the center of the site. The steepest slopes in the area are found along the banks of Wormley Creek.

4.2.3.3 Geology. The geology at Yorktown Fuels Division is essentially the same as that of Cheatham Annex (Section 4.1.3.3). However, the thickness of the unconsolidated sediments at Yorktown Fuels Division is a little greater than that at Cheatham Annex due to the eastward dip of the different formations.

4.2.3.4 Soils. The soils at Yorktown Fuels Division are of the Coastal Plain (marine) origin similar to those found at Cheatham Annex. These soils have been disturbed in the areas where tanks have been installed. Unlike those at Cheatham Annex, the soils at Yorktown Fuels Division are only of the Emporia-Bohicket-Slagle association (Figure 4-3).

The soil association at Yorktown Fuels Division is divided into several soil types. Along the West Branch of Wormley Creek are the Sassafras soils while the Loamy Sands occur on level to gently sloping topography which covers most of the activity. These soil types are described in Section 4.1.3.4. On the southwestern section of the activity is the Caroline Very Fine Sandy Loam. It is a well-drained soil, heavily textured, and has a heavier substratum than the Sassafras soil. The Caroline is a very erodible soil usually found on slopes (U.S. Department of Agriculture, 1955b).

4.2.3.5 Hydrology and Migration Potential. Natural drainage from the Yorktown Fuels Division is towards the Western Branch of Wormley Creek which flows into the York River. The potential, therefore, exists for migration of pollutants through surface waters. Soils at the activity are considered well-drained.

4.2.3.5.1 Surface Water Hydrology. Yorktown Fuels Division lies entirely within the York River Basin. The York River Basin lies in the central and eastern sections of Virginia (see Section 4.1.3.6.1). Yorktown Fuels Division is located near the mouth of the York River where the basin is approximately 5 miles wide.

The main tributaries of the York River at Yorktown Fuels Division are the Western Branch of Wormley Creek, which forms the southern boundary of the division, and Wormley Pond which is located along the eastern boundary of the division.

4.2.3.5.2 Flood Hazard. The York River poses the major flooding threat to the Yorktown Fuels Division during hurricanes or severe northeast storms (see Section 4.1.3.6.2). The only areas in danger of flooding in this area are along the shores of the York River, and along the Western Branch of Wormley Creek (Figure 4-6).

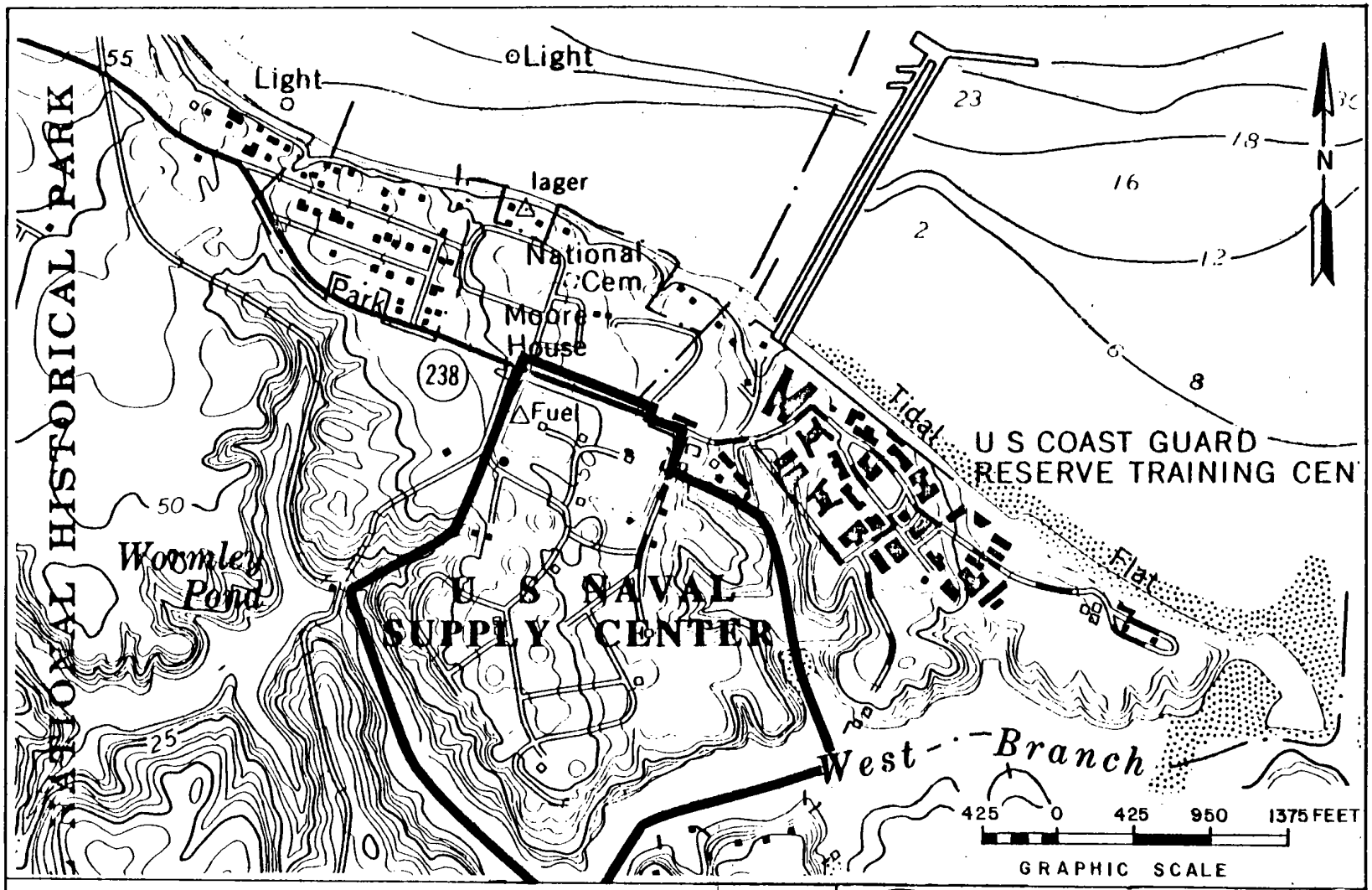

FIGURE 4-5
TOPOGRAPHY
YORKTOWN FUELS DIVISION

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

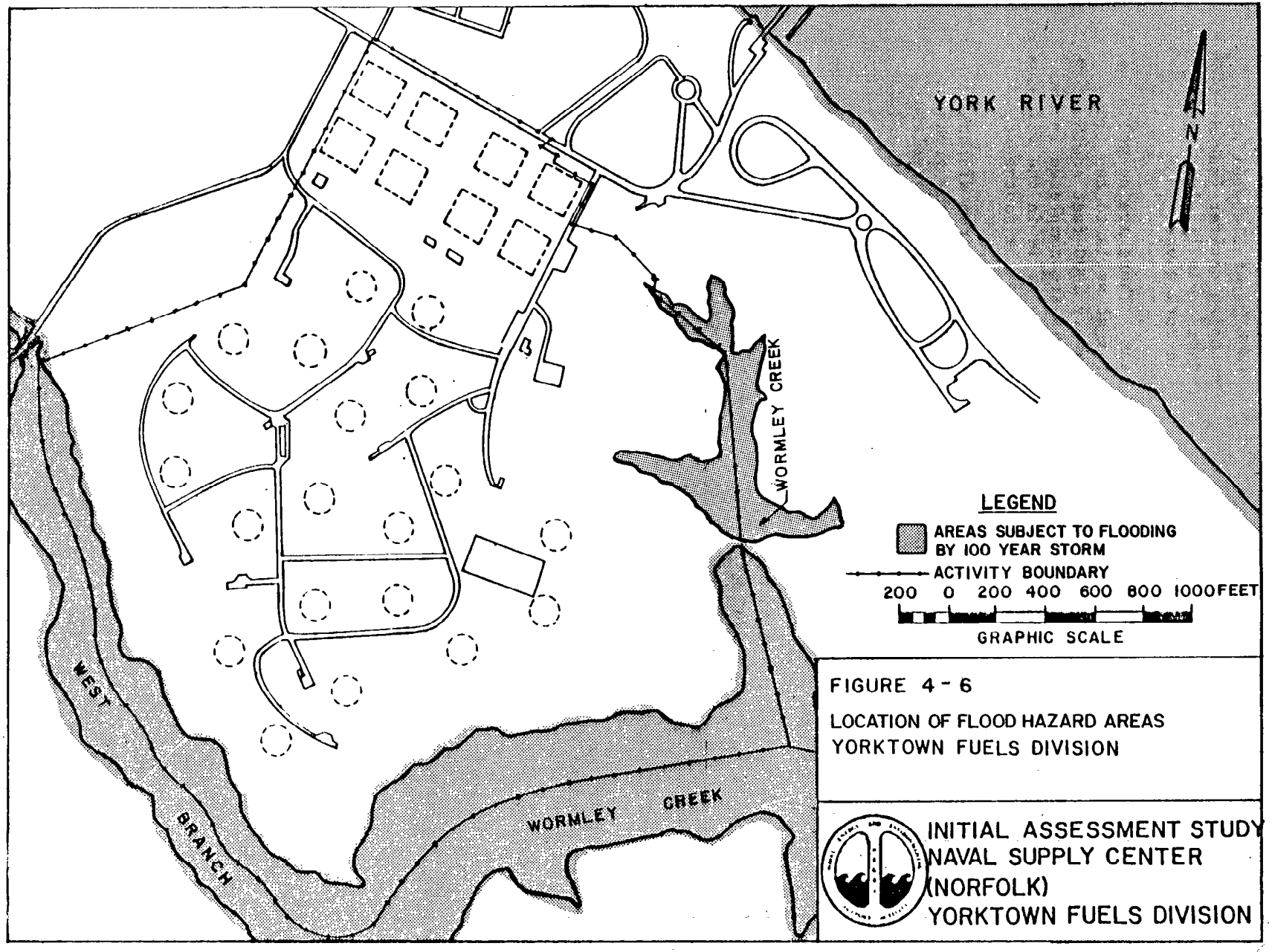

FIGURE 4 - 6

LOCATION OF FLOOD HAZARD AREAS
YORKTOWN FUELS DIVISION

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

4.2.3.5.3 Ground Water Hydrology. Ground water occurs in three major aquifer systems in the York-James Peninsula: the water-table aquifer, the upper artesian aquifer, and the principal artesian aquifer (see Section 4.1.3.6.3). Flow direction in the water-table aquifer is likely to be from higher ground towards the drainage creeks and the York River.

4.2.3.5.4 Ground Water at Yorktown Fuels Division. There are no wells on the property at Yorktown Fuels Division. The closest wells to the site are in the Village of Marlbank which is approximately 2000 feet south of the site on the west side of Wormley Creek. These wells are completed in the water-table aquifer. Additionally, there are shallow wells in the villages of Hornsbyville and Harris Grove approximately one mile to the southeast.

4.2.3.5.5 Migration Potential. Contaminants may migrate from disposal sites at Yorktown Fuels Division by means of infiltration to the ground-water aquifers. Migration of contaminants is also possible by overland runoff to surface water lakes, creeks, wetlands and the York River. Such migration may contaminate the shellfish waters in the area.

The potential for contamination of the water-table aquifer is enhanced by the presence of well-drained soils in the area (see Section 4.1.3.6.7). Contaminants entering this aquifer may be transported generally in the direction of the West Branch of Wormley Creek, possibly off-station. The direction and rate of ground water flow, as well as the rate of pumpage from nearby wells would influence the movement and dispersion of the contaminants in the aquifers.

4.2.4 Biological Features. The central area of the activity is predominantly grasses, with a mixed pine and hardwood forest surrounding. The activity is bordered by Wormley Creek to the south and east.

4.2.4.1 Ecology, Terrestrial and Aquatic Flora and Fauna. The Yorktown Fuels Division is within the Piedmont area of the Eastern Deciduous Forest. Approximately two-thirds of the site is covered by grassland with surrounding woodlands.

4.2.4.1.1 Terrestrial Flora and Fauna. The central area of the activity consists of low ground cover which is routinely mowed. The surrounding wooded area is composed of mixed hardwoods and evergreens. Tree species expected to be found on the activity are listed in Appendix C.

The wildlife population of the Yorktown Fuels Division reportedly includes red and grey foxes, raccoons, skunks, and a variety of songbirds common to eastern Virginia. A listing of other species common to this area of the state, and possibly found on the activity is found in Appendix D.

4.2.4.1.2 Aquatic Flora and Fauna. The York River is directly north of the U.S. Coast Guard Reserve Training Center which borders on the activity's property. Aquatic floral and faunal species of the York River would be simliar to those listed in Section 4.1.4.1.2 for Cheatham Annex.

4.2.4.1.3 Wetlands. Wetlands at the Yorktown Fuel Terminal are found along the shoreline of the West Branch of Wormley Creek (Figure 2-10). All of these wetlands are Type I, Saltmarsh Cordgrass Community and are narrow fringing marshes of saltmarsh cordgrass, varying from 3 to 20 feet wide. The largest of these extends continuously for more than a mile along the shoreline of the York River bordering the fuel depot and the Coast Guard facility.

A description of the environmental value of this marsh type is shown in Appendix D. For management purposes, the wetlands have been grouped into classifications based on their estimated environmental value per acre (Virginia Marine Resources Commission, undated). The marshes at Yorktown Fuel Division are Group One Type I. This marsh type has the highest productivity and use for wildfowl and wildlife, as well as a close association with fish spawning and nursery areas. They are also important to the shellfish industry and as shoreline erosion inhibitors. Group One wetlands merit the highest order of protection.

4.2.4.2 Rare, Threatened and Endangered Species, Critical Habitats. No federal or state designated plant, fish or invertebrate species are found at the Yorktown Fuels Division. Several species of endangered sea turtles, listed in Section 4.1.4.2, occasionally swim up the York River offshore of the activity, during the summer. The southern bald eagle (Haliaeetus lecvocephalus), on the federal endangered list, is known to nest at Camp Peary, approximately ten miles northwest of the activity. Infrequent sightings of several endangered/threatened avian species, including the Peregrine falcon (Falco perigrinus), and Bachman's (Vermivora bachmanii) and Kirtland's warblers (Dendroica kirtlandii) have been made in the general area (Naval Facilities Engineering Command, 1983b).

4.2.4.3 Impacts on Habitats. A brief ground tour of the disposal areas and a helicopter fly-over of the activity revealed three areas of stressed vegetation in areas adjacent to the fuel tanks. However, the wooded areas showed no signs of stress.

Tidal marshes found along the shoreline of Wormley Creek could possibly be susceptible to contamination from nearby disposal sites. The interaction of wetlands with the nearby tidal creek would expand the limit of possible contamination, eventually to the York River.

4.2.5 Water Quality. All waters of the State of Virginia, in accordance with the General Standard of the State's Water Quality Standards, "shall be maintained at such quality as will permit all reasonable, beneficial uses and will support the propagation and growth of all aquatic life, including game fish, which might reasonably be expected to inhabit them" (Virginia State Water Control Board, 1982). In addition, there are specific water quality standards which are applicable to identified surface water stream segments and ground waters. These are discussed as they relate to the waters of the York River Basin and its surroundings.

4.2.5.1 Surface Water Quality. The York River Basin in the vicinity of the Yorktown Fuel Depot is classified by the State of Virginia as Class II waters (estuarine) to be additionally protected for shellfish propagation. The requirements for shellfish protection include fecal coliform concentrations not to exceed a density of 14 per 100 milliliters of sample by Most Probable Number and the shellfish area is not to be so contaminated by radionuclides, pesticides, herbicides, or fecal material that the consumption of shellfish might be hazardous. Water quality requirements of Class II waters are: dissolved oxygen - 4.0 milligrams per liter minimum, and 5.0 milligrams per liter daily average; and pH - 6.0 to 8.5.

4.2.5.2 Ground Water Quality. Ground water in the vicinity of the Yorktown Fuel Depot is subject to two sets of water quality standards: The standards of the Coastal Plain Physiographic Province which include pH - 6.5 to 9.0; ammonia nitrogen and nitrite nitrogen - 0.025 milligrams per liter; and nitrate nitrogen - 5.0 milligrams per liter. The statewide standards cover inorganic constituents, chlorinated hydrocarbon insecticides, chlorophenoxy herbicides, and radioactivity.

Water quality data for the water-table aquifer is generally lacking. Water from the upper artesian aquifer is generally hard but otherwise of good quality with total dissolved solids of about 200 parts per million. Water quality in the principal artesian aquifer varies considerably with location. Dissolved solids content increases in an easterly direction and with depth. East of Williamsburg, available data show total dissolved solids to range from 1,500 parts per million to 9,000 parts per million and chlorides to exceed 1,000 parts per million.

4.2.6 Water Supply. The Fuels Division obtains all potable water from the adjacent Coast Guard Reserve Training Center which operates a water system including storage facilities. The Coast Guard obtains its water from Newport News Water District. The Newport News Water District obtains raw water from the Chickahominy River and the Diascund and Little Creek reservoirs, all of which are located in New Kent County, Virginia. Water from these sources is pumped to the Lee Hall and Skiffes Creek reservoirs in the City of Newport News and to the Harwood Mill Reservoir in York County. The Lee Hall Filtration Plant treats raw water from the Lee Hall and Skiffes Creek reservoirs while raw water from the Harwood Mill Reservoir is treated in the Harwood Mill Filtration Plant.

There is a 100,000 gallon potable water tank on the northwestern section of the Fuels Division. Additionally, there is a 500 gallons per minute pumping station near Wormley Pond which is used as the source of non-potable water. This system is used primarily for fire fighting purposes. Additional fire fighting facilities at the fuel depot site are not deemed necessary.

4.2.7 Adjacent Land Use. The Naval Supply Center (Norfolk) Yorktown Fuels Division is located in York County, Virginia. The fuel depot is bounded on the north, northwest and southwest by the Colonial National Historical Park. The depot is separated from the national park by the Western Branch of Wormley Creek along its southwestern border. Wormley Creek also flows along the southeastern boundary of Yorktown Fuels Division, separating it from the Town of Marlbank, a community consisting predominantly of single family homes. The U.S. Coast Guard Reserve Training Center borders Yorktown Fuels on the

east where the two areas are separated by a cove extending northward from the Western Branch of Wormley Creek. The Coast Guard Facility also shares part of the fuel depot's northeastern border along with the Colonial National Historical Park. With the exception of the Town of Marlbank, across Wormley Creek to the southeast, all of the areas bordering Yorktown Fuels are nonresidential, government-owned properties.

No off-site sources of contamination migrating into Yorktown Fuels have been identified.

4.2.8 Legal Actions. No legal actions have been reported at Yorktown Fuels Division concerning contamination incidents at the activity.

CHAPTER 5. WASTE GENERATION

5.1 NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX

5.1.1 General. Cheatham Annex supplies perishable food to armed forces in the United States and Europe and handles a variety of machine parts, including those too large to store and move in conventional warehouses. The activity also provides most of its own support services, such as water supply, pest control, waste water treatment, planning, maintenance, and security. Many operations at Cheatham Annex are carried out by tenant activities, discussed in Chapter 6.

5.1.2 Routine Pier Maintenance. The pier at Cheatham Annex is maintained by the Public Works Department. Maintenance consists of replacing old braces and decking. A 40-foot work boat and two jack boats are used in pier maintenance. Sources reported no accidents have occurred at the pier resulting in the release or generation of wastes. No significant quantities of waste are generated in these operations.

5.1.3 Machine and Woodworking Shops. The machine and woodworking shops are located in Building CAD 114. The machine shop is used for making parts to repair equipment and machines at Cheatham Annex. Wastes primarily consist of scrap metal which is placed in a specially designated container and transported to DPDO for sale or disposal off base.

Approximately seven cubic yards of scrap metal from the machine shop and other public works shops are generated each month. About ten gallons of an oil and water cutting solution are used each year in the machine shop. This is primarily lost in machine use and not disposed of.

The woodworking shop is also located in Building CAD 114. No wastes other than sawdust and scrap lumber are generated there. Small amounts of penetrating and lubricating oils are used for rust prevention and machine maintenance. No wood treatment chemicals are used. It is reported that the machine and woodworking shops have always been located in Building CAD 114. Waste generation and disposal practices have historically been similar to existing procedures.

5.1.4 Paint Shops. The Cheatham Annex painting operations are located in buildings CAD 114 and CAD 17. The paint shop is operated for painting the outside and inside of buildings, forklifts, and some maintenance vehicles. The maintenance of painted lines in parking lots at the facility is also handled by the paint shop. Paints are stored in two areas in Building CAD 17 to separate water- and oil-based paints. Turpentine and paint thinners are used for cleaning brushes. These substances reportedly evaporate during use and therefore are not disposed of. Empty paint and thinner cans are placed in a special container at Building CAD 17, where they are removed off base by a contractor. It is estimated that about 400 empty paint cans are disposed of each year. Ten to 15 years ago, paint cans were disposed of at Site 1, the landfill near the incinerator. The number of cans disposed of in this way is unknown, but based on the larger number of painters working at the base in the past, the number of paint cans generated is thought to be higher than at present. Assuming that twice the current numbers of empty paints cans

are representative of past waste production levels, a total of 24,000 cans may have been disposed of at Site 1 from 1942 to 1972. Paint stripping operations consist of mechanical scraping with no chemicals being used. The small amount of waste generated is placed in general refuse containers and disposed of off the activity.

5.1.5 Air Conditioning and Refrigeration. Air conditioning and refrigeration units are maintained by Cheatham Annex personnel, while repairs are made by contractors. Maintenance is carried out either at the cold storage facility (Building CAD 40), where refrigeration units are located, or at the electrical shop in Building CAD 150. Old machine parts are disposed of to DPDO or refuse containers for removal off base. Spent oil from refrigeration units is placed outdoors, open to the air to allow ammonia gas to escape. It should then be placed in one of the base's spent oil storage tanks for contractor removal.

5.1.6 Electrical Shop. The electrical shop is, and is reported to have always been, located in Building CAD 150. It is operated for maintenance of wiring, light fixtures, and power lines at the activity. Waste generated by the electrical shop includes old parts that are replaced and empty cleaning solvent cans. It is estimated that about three 12 ounce cans of aerosol solvent are used over a one year period. Therefore, no appreciable quantities of waste solvent are generated. Empty solvent cans are currently placed in general refuse containers for disposal off base. In the past, empty solvent cans were disposed of in Site 1, the landfill near the incinerator. Assuming that current numbers of empty solvent containers are representative of past waste production levels, a total of about 90 cans may have been disposed of at Site 1 from 1942 to 1972.

5.1.7 Transformer Repair. Transformer repair at Cheatham Annex is part of the activities of the electrical shop located in Building CAD 150. Transformer repair, however, is conducted at Building CAD 120, the power plant. Once each quarter, all transformers on the activity are inspected for leaks. Leaking transformers are brought to Building CAD 120 for repair. Minor repairs are made by electrical shop personnel. Major repairs are contracted out. Transformers that cannot be repaired are currently stored in a containment area at Building CAD 120 until they can be disposed of. In the past, inactive PCB transformers were held at Site 9, an outside storage area at the northwest corner of Building CAD 16 and the boneyard (Site 11). Inactive transformers and waste oil are reported to have always been disposed of off base through DPDO.

5.1.8 Pest Control Shop. The pest control shop is presently located in Building CAD 393. It was located in Building CAD 232 from 1972 to 1981, and in Building CAD 19 from 1965 to 1972. No information is available on pest control activities prior to 1965. The pest control shop maintains supplies of a variety of pesticides for weed, insect, bird, and reptile control. A list of pesticides and quantities used at Cheatham Annex is given in Table 5-1. Pesticides are primarily used to control vegetation and insects. Non-toxic control methods are generally used in food storage areas. These include glue traps and mechanical traps for rodents and decoy owls to repel birds. The only wastes generated at the pest control shop are wash water from cleaning equipment and empty pesticide containers. Equipment is cleaned at the wash-rack at Building CAD 393 and wash water is collected in an underground holding

TABLE 5-1

PESTICIDES USED AT CHEATHAM ANNEX

Pesticide	Use	Annual Use
Bromacil	Vegetation Control	300 lbs.
Baygon (1.5%)	Hornets, Wasps, Roaches	8 gal.
Diazinon (47%)	Roaches	8 gal.
Diazinon (.2% dust)	Roaches	25 lbs.
d-Phenothrin	Roaches, Flying Insects	2 gal.
Avitrol	Birds	*
Polyisobutylenes	Birds	3 gal.
Carbaryl (80%)	Mosquitoes, Moles, Ticks	80 lbs.
Chlordane	Insects	2 gal.
Ficam	Spiders, Ants	*
Anticoagulant	Rodents	30 lbs.
Warfarin	Rodents	12 lbs.
Pyrethrin ULV Fogg	Roaches	3 gal.
Pyrethrin (0.6%)	Roaches	10 lbs.
Stickem (glue traps-non-chemical)	Rodents	*
Talon-G	Rats	*
Diquat	Aquatic Weeds	10 gal.
Roundup	Grass	*
Malathion (Wet Powder)	Gnats, Wasps	50 lbs.
Malathion (95%)	Insects	110 gal.
Malathion (57%)	Insects	55 gal.

*Annual quantities unknown.

tank. In the two years since its installation, this 1,000 gallon tank has not required emptying. Therefore, it can be assumed that washwater is generated at a rate of less than 500 gallons per year. Empty pesticide containers are washed three times with soap and water, perforated to prevent reuse, and placed in trash containers for disposal off base. When the pest control shop was located at Building CAD 232, wash water was discharged into storm drains or onto the ground near the building. Building CAD 232 is no longer standing; it had been located between buildings CAD 224 and CAD 113. At this time, wash water was also discharged into an area east of Building CAD 13 known as the "sand pit." From 1965 to 1972, pesticide wash water was discharged to storm drains at Building CAD 19 and to drainage ditches outside the building. Empty containers were buried, but the location is not known.

5.1.9 Power Plant. The Cheatham Annex power plant, contained in Building CAD 120, was constructed in 1943 to provide backup power for the facility. Electric power is usually supplied by VEPCO. During temporary loss of power, the power plant is used. The power plant operates on diesel fuel which is stored in a buried 5,000-gallon storage tank. It is cooled with water from the base potable water system. Spent lubrication oil from the plant is placed in oil storage tanks to be collected by a contractor and reused. The fuel tank is cleaned as needed. It is reported that cleaning has not been undertaken in fifteen years. When fuel tank maintenance is necessary, contractors clean the tank and dispose of the sludge off site.

5.1.10 Boiler Plants. Approximately 25 boilers are located throughout Cheatham Annex to provide heat to buildings. Each boiler has a buried fuel tank containing between one and ten thousand gallons of fuel. Once a year, all 25 boilers are cleaned and inspected. Waste generated in boiler maintenance, such as old filters, oils, and solvents remaining in cans are placed in general refuse containers for disposal off base. Sludges from fuel tank cleaning are reported to have been disposed of off station. The heating system is fully enclosed, so no boiler blowdown is normally generated. Emergency blowdown valves allow excess cooling water to be released as steam. Water is occasionally added to the system, along with caustic soda to prevent scaling.

5.1.11 Laboratory Operation. The laboratory at Cheatham Annex maintains facilities for testing wastewater treatment plant effluent, drinking water, and boiler water. The laboratory generates non-hazardous liquid wastes which are deposited to the activity's sanitary sewer system. Chemicals used at the laboratory at a rate of less than one gallon per year include stannous chloride and hydrochloric acid (3 Normal). Chemicals used at a rate of between one and five gallons per year include standard iodide-iodate reagent, comparator molybdate reagent, causticity reagent numbers one and two (made by Masters, Inc.), starch solution, and phenylarsine oxide.

5.1.12 Motor Vehicle Maintenance. Motor vehicle maintenance areas are located in buildings CAD 115 and CAD 116, as well as that which is under the Navy Cargo Handling and Port Group (Section 6.1.8). Vehicles maintained at Cheatham Annex include automobiles, lawn mowers, cranes, forklifts, and two locomotives. Spent crankcase oil is stored in an underground tank at Building CAD 116 until sold to a waste hauler for reuse off base. Vehicles are cleaned

at the washrack at Building CAD 116. Wash water drains to a sump and passes through an oil/water separator. The oil storage tank, washrack, oil/water separator, and sanitary sewer connection were installed in 1980 as part of a pollution abatement project at Cheatham Annex. Prior to that, oil and solvents were discharged to storm and sanitary sewers or trash collection containers. Other wastes generated at the vehicle maintenance area, such as old parts, tires, and batteries are turned over to DPDO for sale or disposal off base. It is estimated that about 30 batteries are disposed of in this way each year.

5.1.13 Fire Fighting. The fire station is located in Building CAD 119, and houses two single-engine trucks. Twelve persons make up the Cheatham Annex staff, with mutual aid available from the surrounding counties of York and James City. General duties of the station's personnel include maintenance of fire hydrants and sprinker systems on the activity, and daily training sessions. Instruction is in accordance with the International Fire Service Training Association Manual. Hazardous material handling is taught by a staff group from the Naval Supply Center (Norfolk). Training fires are set in the net-and boom area, and use old pallets, wood, and paper as their fuel. The activity has no permit, but notifies the State Air Pollution Control Board Regional Office in Virginia Beach when a burning session is anticipated. However, burning only occurs once or twice a year.

5.2 NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION.

5.2.1 General. Yorktown Fuels Division is engaged in the transfer and storage of fuel oils. Fuel is stored in 25 major underground storage tanks. A pierhead is used for issuing fuel to government vessels, while a truck loading station is used for issuing fuel to other naval installations.

5.2.2 Industrial Operations. The loading, unloading and storage of various types of fuel are the only major industrial operation at Yorktown Fuels Division. Fuel is received from ships and barges at the pier where it is unloaded and pumped to appropriate underground storage tanks. Fuel is shipped in barges or tank trucks. No waste is generated by the loading, unloading, and storage operations at the fuel depot. It was reported that no major accidents have occurred at Yorktown Fuels Division for at least the past 35 years. All major maintenance required at Yorktown Fuels Division is performed by the Cheatham Annex Public Works Department. The seven civilians operating the Yorktown Fuels facilities perform minor maintenance operations such as greasing valves, repairing vents, replacing gaskets, and similar tasks. Small quantities of lubricating oil, grease and solvents ("nut-buster") are stored at Yorktown Fuels and used during the minor maintenance operations conducted there. Tank cleaning operations, required infrequently, generate oily tank bottoms. Such operations have been performed every 20 to 40 years on the older tanks but much more frequently on the tanks constructed in 1953 and 1954. Currently, this task is performed by a contractor who cleans the tanks by sandblasting and is responsible for off base disposal of all wastes generated. Prior to 1980, for a period of about 30 years, the tanks were cleaned by Yorktown Fuels personnel. During those past operations, tanks were drained and tank bottoms were buried in on site pits ranging in depth from 12 to 15 feet. Other than tank cleaning procedures, operations at Yorktown Fuels have not changed significantly since operations began.

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CHAPTER 6. MATERIAL HANDLING: STORAGE AND TRANSPORTATION

6.1 NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX.

6.1.1 General. Cheatham Annex has numerous industrial operations and tentant activities and a long list of industrial materials used in conjunction with its everyday activities. Many of the Cheatham Annex shops and activities handle or store small quantities of a variety of materials. Storage and transportation of materials at Cheatham Annex are briefly described in the sections below.

6.1.2 Material Storage: Defense Property Disposal Office. The Defense Property Disposal Office (DPDO) at Cheatham Annex, established in 1982, is responsible for administering the reutilization and/or disposal of excess or aged government property from the Navy's York-James Peninsula activities or ships visiting Cheatham Annex. Prior to establishment of DPDO at Cheatham Annex, excess property from the activity was disposed of by DPDO in Norfolk. Disposal practices for property from Cheatham Annex have not changed since the activity's establishment. DPDO receives a large variety of different items. The following procedure is employed for equipment reuse or disposal: check for possible utilization within the Department of Defense (DOD); check for possible utilization by state or federal government agencies other than the DOD; attempt to sell by auction or other means; or dispose of properly. Proper disposal includes either depositing waste in one of Cheatham Annex's dumpsters or, in the case of hazardous materials, arranging for removal by an outside contractor. DPDO operates out of Building CAD 16 and employs 22 civilian workers.

DPDO does not accept physical custody of hazardous waste materials such as waste oil, waste solvent, and old batteries containing acid. However, unused containers of solvent, oil, paint, photographic chemicals and similar usable materials are received.

Sorting and storage activities are conducted in DPDO's warehouse. Additional outdoor storage space is available on both sides of the building. A small tin shed and a small covered area are located near Building CAD 16 for storage of flammables and corrosives, respectively.

6.1.3 Supply Storage. All supplies and materials required for operation of Cheatham Annex and its tenant activities are shipped to a central receiving area in Building CAD 1. About 90 percent of the deliveries to the Annex are made by truck, with the remainder being delivered by rail. Following delivery, supplies are sorted in Building CAD 1 and delivered to the areas of the Annex where they will be used. It was reported that the procedure for receiving, storing, and distributing supplies at Cheatham Annex has not changed significantly over the past 30 years.

6.1.4 Chemical and Hazardous Materials Storage. Included among deliveries are hazardous materials such as oils, lubricants, solvents and degreasers. These materials are delivered in small quantities and are generally exhausted and replenished within 90 days. Gasoline is

delivered by truck and stored in four tanks at the Annex. It was reported that chemical and hazardous material storage procedures employed for the past 30 years are very similar to those used currently.

Small quantities (gallons) of waste oil, solvent, paint, and thinner are generated by activities at Cheatham. Waste oil is stored in two centrally located tanks as well as in smaller tanks connected to oil separators on drain lines. Waste solvent, generated in very small quantities, is stored in drums as is waste paint and paint thinner. Employees from the Public Works Center, Norfolk inspect these containers to make sure they are safely packaged. Once inspected, the waste materials are removed from the site by a private contractor for proper disposal.

6.1.5 Pier Operations: Loading and Unloading Supplies from Ships. The pier at Cheatham Annex is approximately 2,400 feet long and 42 feet wide with about 1,200 feet of berthing space. Water depth on the outboard side of the pier ranges from 33 to 46 feet and water on the inboard side of the pier is about 18 feet deep. Pier operations are directed from a small building located on the pier; no other buildings are associated with pier operations. A project is currently underway which will strengthen the pier and enable larger loads to be handled. All staff and equipment needed for loading and unloading operations at the pier are supplied by the Public Works Department or by the warehouse that items are being shipped to or from. Two 50-ton capacity cranes, operated by the Public Works Department, are used for loading and unloading. Pier operations do not produce any waste except for the non-hazardous waste generated by operation of the piermaster's office and sewage from ships. Generally, the sewage is trucked to the activity's treatment plant, or it may be off loaded to pier-side sewers at NAVBASE Norfolk. Design authorization has been given for pier-side sewers at Cheatham Annex to tie into the Hampton Roads Sanitation District collection system.

6.1.6 Storage Lots and Scrap Yards. There are two major storage lots at Cheatham Annex associated with DPDO. One is between buildings CAD 15 and CAD 16 and stores mainly cars, trucks, propellers and other large items. The other, between buildings CAD 16 and CAD 6, is a scrap yard where old tires, empty barrels, scrap metal and batteries are stored. Flammable materials are stored in a tin shed between buildings CAD 16 and CAD 6 near C Street. Corrosive materials are also stored separately at a covered area in the same lot. It was reported that no serious accidents or material spills have occured in either of these two areas.

Another area, commonly called the Bone Yard, is used to store old cars and other miscellaneous items. Presently, items such as chain link fence, pipes, railroad ties, cable and telephone poles are stored here. The yard is operated by the Public Works Department.

6.1.7 Materials and Waste Transportation. The majority of waste generated at Cheatham Annex is domestic solid waste which is placed in dumpsters and removed by a refuse disposal contractor. Wood, metal, and other salvageable materials are collected and sold by DPDO. In the past, from about 1940 to about 1970, all such waste was either incinerated with ash burial at Site 1 or buried directly at Site 1. During the early 1900s waste from the City of Penniman and the DuPont Company was disposed at

Site 7. Occasionally some of the shops on station generate small quantities of hazardous wastes, such as solvents, paint, and batteries. Cheatham Annex solicits the service of Public Works Center, Norfolk in the packaging of wastes which are then transported off station by private waste haulers for proper disposal.

6.1.8 Navy Cargo Handling and Port Group. The Navy Cargo Handling and Port Group is the largest tenant activity based at Cheatham Annex. Their principal mission is to provide cargo handling capability overseas although during an emergency, they will respond anywhere they are needed. Generally, they are called into action when the Navy cannot find a contractor to load or unload its ships in foreign ports or remote areas. In addition, the cargo handling and port group may be called upon to handle hazardous cargos. The group has a staff of 145 stationed at Cheatham Annex, all Navy personnel, and occupies 12 buildings at the Annex. The group is responsible for servicing and maintaining its own equipment, including forklifts. In addition to other activities, training exercises are regularly conducted.

The only activity of the Navy Cargo Handling and Port Group which could potentially generate waste, other than that normally removed in the Annex's dumpsters, is vehicle maintenance. Small quantities of lubricants, motor oil, solvents (Dry Cleaning Solvent - Octagon Process Inc., GS #07S-08011) and degreasers are often stored and used for servicing and maintaining equipment. Waste oil from maintenance of forklifts and other equipment, generated at a rate of about 20 gallons/month, is stored in containers behind Building CAD 292 and periodically removed for recycling by a private contractor. Present practices do not differ significantly from those used in the past.

6.1.9 Defense Subsistence Office. The Defense Subsistence Office (DSO) is responsible for procurement, inspection, acceptance, transportation, storage, and inventory management of all Navy chill and freeze provisions. In addition, DSO determines customer requirements, processes customer requisitions and schedules deliveries of chill and freeze provisions. At Cheatham Annex, DSO is responsible for the operation of Building CAD 40 which is the largest cold storage facility (CSF) operated by DOD. This CSF receives chill and freeze provisions along with fresh fruits and vegetables purchased all over the country by DSO, and distributes them to 21 DOD installations in the Eastern United States and two distribution points in Germany. Nearly all food is received by truck and all in-country deliveries are also made by truck. Provisions destined for Germany are trucked to Portsmouth or Norfolk where they are packed into refrigerated containers and loaded onto ships for transport overseas.

The actual operation of Building CAD 40 is performed by J & L Associates, Inc. a private contractor recently hired by DSO. Prior to contracting of J & L's services, actual warehouse operations were performed by civil servants working for the Navy Department. Cold storage facility operations are discussed in Section 6.1.14 of this report. Other than Building CAD 40, the only facilities at Cheatham Annex used by DSO are offices which generate small quantities of non-hazardous solid waste which are deposited in the activity's dumpsters. The DSO's mission and operational procedures used at Cheatham Annex have changed very little since the early 1950s.

6.1.10 Emergency Ships and Salvage Material. The mission of the Emergency Ships and Salvage Material Group is to provide technical expertise and equipment for oil spill control. They also provide equipment for ship and overboard salvage operations. The group at Cheatham Annex is one of four in the world which is ready to respond on short notice with personnel and equipment to clean up an oil spill wherever one may occur. The Emergency Ships Salvage Material Group also maintains the capability to transfer ship salvage equipment (generators, welders, etc.) for use by Navy personnel anywhere in the world. The group at Cheatham Annex consists of nine civilian employees and operates out of Building CAD 12.

When the group responds to an oil spill, equipment is cleaned at the spill site before shipment back to Cheatham Annex. Major activities occurring in Building CAD 12 include overhaul and reconditioning of spill cleanup and salvage equipment. Materials used in Building CAD 12 include 55 gallons per year of each of two solvents (Dry Cleaning Solvent - Type 1 - FSN 6850-00-285-8012 and ZEP Total - small parts cleaner solvent) as well as degreasers, lubricants, and other materials used in a typical heavy equipment workshop. These materials are normally used in small quantities during reconditioning activities and are either evaporated or absorbed in rags and deposited in dumpsters at the Annex.

6.1.11 Naval Sea Systems Command (NAVSEASYCOM) Material Representative (East Coast). The Naval Sea Systems Command has large and varied responsibilities related to naval operations and projects. At Cheatham Annex, NAVSEASYSCOM utilizes storage space in buildings CAD 13 and CAD 14. NAVSEASYSCOM controls the contents of these buildings by issuing shipping and receiving orders but does not perform actual warehouse operations. A wide variety of materials are stored in these warehouses and no disposal activities take place. NAVSEASYSCOM employs a single civilian employee whose office is located in Building CAD 13. No waste is currently or was previously generated by the activites of NAVSEASYSCOM at Cheatham Annex other than solid waste generated by normal office operations.

6.1.12 U.S. Army Veterinary Food Inspection Branch. The mission of this tenant activity at Cheatham Annex is to inspect arriving provisions at the cold storage facility, to train personnel on updated inspection techniques, to ensure that food meets terms of contracts, and to see that food is properly stored and transported to ships. The inspection branch employs three civilians; the remaining 18 staff members are Army personnel. The group uses space in buildings CAD 40, CAD 359 and CAD 219 at the activity. The only waste generated, other than normal solid waste, by the activities of the inspection branch are small samples of food used during inspection.

6.1.13 Navy Exchange. The Navy Exchange at Cheatham Annex operates a small variety store, a self service gasoline station, and a number of vending machines. The exchange employs two civilian workers and its activities do not generate any waste other than non-hazardous solid waste which is deposited in dumpsters.

6.1.14 J & L Associates. J & L Associates is contracted by DSO to receive, store, and issue provisions from Building CAD 40, CSF at Cheatham Annex. CSF has about 177,000 square feet of storage space and receives and ships a total of 20,000,000 pounds of food per month. Maintenance is performed by the Public Works Department. J & L Associates has been operating CSF since January 1983 and employs about 50 workers. J & L Associates also supplies their own equipment, including electric forklifts.

The only waste generated by J & L Associates' operation of Building CAD 40 is domestic-type solid waste and occasionally some spoiled food. The spoiled food comprises less than one-half of one percent of the total quantity handled. One instance each of large-scale food spoilage and food contamination occurred about 1970 during operations at Building CAD 40 before J & L Associates took over. The contamination incident occurred as a result of an ammonia leak in the building's refrigeration system. The resulting contaminated food was buried at Site 2, Contaminated Food Disposal Area (Figure 8-3). The spoiled food was burned and buried at Site 6, Spoiled Food Disposal Area (Figure 8-5). For more information see sections 8.2.2 and 8.2.6.

6.1.15 Military Sea Lift Command. The mission of the Military Sea Lift Command is to support a fleet of commercial vessels which support naval ships performing their duties at sea. These commercial vessels include tankers, cable repair ships, and cargo ships carrying ammunition, combat stores and fleet stores. The Navy contracts for the use of these ships which carry civilian crews. Although the support vessels are under the authority of the Commander of the naval fleet they are supporting, the Sea Lift Command oversees their service and maintenance.

The entire Sea Lift Command has about 145 ships at its disposal, five of which operate out of Cheatham Annex. These ships spend about 85 percent of their time at sea and use Cheatham Annex as a base because of the storage space available. This space includes 158,000 square feet of warehouse space, 130,000 feet of covered storage space, 23,000 square feet of improved open storage area, and 5,000 square feet of unimproved open storage space. The only potential hazardous materials carried by the five ships operating out of Cheatham Annex are oil and lubricants. No hazardous wastes are generated by any of the ships operated by the Military Sea Lift Command out of Cheatham Annex.

6.1.16 Petroleum, Oil, Lubricants Storage. The majority of petroleum products at Cheatham Annex are used in heating and power generation. The fuel most commonly used for heating is number 2 fuel oil contained in storage tanks associated with the boilers. The power plant on the installation also operates on number 2 fuel oil, although it is used only for emergency power generation. The location and types of fuel storage facilities at Cheatham Annex are summarized in Table 6-1. Total kerosene and number 2 fuel use in 1980 were 36,179 and 261,260 gallons, respectively. The 5,000-gallon regular gasoline tank at the Navy Exchange Station was reported to be leaking in January 1979 (Naval Facilities Engineering Command, 1979a). It was leaking an estimated 250 gallons per month for approximately three months. No other accidents or leaks on the base were reported.

Table 6-1
CHEATHAM ANNEX FUEL TANK LOCATIONS

Tank Location Building Number	Above/Below Ground	Capacity (Gallons)	Fuel Type	In Use
215	above	550	#1 fuel oil	yes
120	below	550	#2 fuel oil	yes
119	below	1,000	#2 fuel oil	yes
40	below	1,000	#2 fuel oil	yes
115	below	3,000	#2 fuel oil	yes
114	below	5,000	#2 fuel oil	yes
112	below	5,000	#2 fuel oil	yes
1	above	550	#2 fuel oil	yes
261	below	550	#2 fuel oil	yes
284	below	1,000	#2 fuel oil	yes
130	below	1,000	#2 fuel oil	yes
391	below	550	#2 fuel oil	yes
200	below	2,000	#2 fuel oil	yes
201	below	1,000	#2 fuel oil	yes
202	below	1,000	#2 fuel oil	yes
203	below	1,000	#2 fuel oil	yes
233	below	1,000	#2 fuel oil	yes
230	below	1,000	#2 fuel oil	yes
223	below	1,000	#2 fuel oil	yes
222	below	1,000	#2 fuel oil	yes
221	below	1,000	#2 fuel oil	yes
292	below	1,000	#2 fuel oil	yes
298	below	1,000	#2 fuel oil	yes
160	below	1,000	#2 fuel oil	yes
243	below	1,000	#2 fuel oil	yes
244	below	1,000	#2 fuel oil	yes
236	below	5,000	#2 fuel oil	yes
297	below	5,000	#2 fuel oil	yes
295	below	1,000	#2 fuel oil	yes
70	below	100,000	#2 fuel oil	yes
69	below	100,000	#1 fuel oil	yes
118	below	5,000	#2 fuel oil	no
12	below	7,500	#2 fuel oil	no
106	below	1,000	#2 fuel oil	no
273	below	5,000	no lead gasoline	yes
	below	5,000	regular gasoline	yes
117	below	10,000	gasoline	yes
	below	10,000	gasoline	yes
6	below	12,000	gasoline	yes
	below	2,000	gasoline	yes
115	below	12,000	diesel	yes
101	above	275	kerosene	yes
134	above	275	kerosene	yes
21	above	150	kerosene	yes
19a	above	275	kerosene	yes

19b	above	275	kerosene	yes
19c	above	275	kerosene	yes
18a	above	275	kerosene	yes
18b	above	275	kerosene	yes
215	above	550	kerosene	yes
132a	above	275	kerosene	yes
132b	above	275	kerosene	yes
132c	above	274	kerosene	yes
10	above	275	kerosene	yes
8	above	275	kerosene	yes
6a	above	275	kerosene	yes
6b	above	275	kerosene	yes
6c	above	275	kerosene	yes
282	above	275	kerosene	yes
4a	above	275	kerosene	yes
4b	above	275	kerosene	yes
3	above	275	kerosene	yes
2	above	275	kerosene	yes
1a	above	275	kerosene	yes
1b	above	275	kerosene	yes
293	above	275	kerosene	yes
9	above	275	kerosene	yes
69	above	100,000	kerosene	emergency supp

Source: Cheatham Annex Public Works Department

6.1.17 Pesticide Storage. Pesticides at Cheatham Annex are stored at the pest control shop in Building CAD 393. A list of pesticides used is given in Table 5-1. These are stored in relatively small quantities, sufficient to satisfy short-term needs, and are restocked as need dictates. During the site visit, it was observed that most pesticides were stored in relatively small quantities of one to five pounds.

6.1.18 PCB Storage. An area near the emergency power generating station has been modified for storage of out-of-service PCB transformers planned for contractor removal. DPDO arranges for transformer handling and disposal but does not actually handle the transformers or accept physical custody of them. From 1973 through 1980, transformers were stored outside of Building CAD 16 as described in Section 8.2.9.

PCB transformers still in use on the activity are located at the cold storage engine room at Building CAD 40 (scheduled for replacement), the supply pier, Building CAD 120 at the power generating station, and the water plant in Building CAD 134. The PCB inventory for the year ending July 1982 indicates that a total of nine transformers were in use and three of these were leaking. These transformers have either been replaced or are scheduled to be replaced along with three intact transformers at CSF.

6.1.19 Nuclear, Biological, Chemical (NBC) Decontamination Agents Storage. No NBC decontamination agents are currently stored at Cheatham Annex. Some of these materials, such as DS-2 or super tropical bleach, may have been kept on the facility in the past as part of its disaster control program. Such materials may have been buried in some areas of the activity.

6.1.20 Ordnance. No ordnance is currently stored at Cheatham Annex. Ordnance was presumeably stored in the area during World War I when DuPont operated a munitions manufacturing plant there, but the location, amounts, and disposition of those materials is not known (E.I. DuPont de Nemours and Company, 1983a, b and c).

6.1.21 Radiological. The only radiological items stored at Cheatham Annex are watch and instrument dials, which have very low radiation levels. These are disposed of with other scrap metal objects through DPDO.

6.2 NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION

6.2.1 Supply Storage. All supplies and materials required for operation of Yorktown Fuels Division are delivered by truck from the Norfolk Naval Complex to a central receiving area. Following delivery, supplies are sorted and delivered to the area of the fuel depot where they will be used. Buildings YK 114 and YK 101 are used for storage.

6.2.2 Pier Operations: Loading and Unloading Supplies from Ships. The pier at the Yorktown Fuels Division is approximately 1900 feet long and 30 feet wide with about 1000 feet of berthing space. Water depth at the end of the pier ranges from 36 to 38 feet. The pier is equipped with two 14-inch pipelines, a 16-inch line, and an 18-inch line for fuel loading

and unloading. Fuel pumps are located at the fuel storage tanks. No waste is generated by normal ship loading and unloading operations at the fuel pier. Pier operations have not changed significantly over the years.

Measures taken to prevent spills at the pier include the placement of large pans under hose connections to contain oil which may be spilled. In addition, oil which may be spilled on the pier is collected by a drainage collection system and conveyed to a waste oil storage tank at the pier. One oil spill incident was reported at the pier. Approximately four years ago, a U.S. Coast Guard vessel spilled 15 to 25 gallons of oil into the harbor. It was reported that Coast Guard personnel responded quickly and were able to contain and remove the spilled oil.

6.2.3 Storage Lots and Scrap Yards. Some items such as old pipe and valves are stored in an outdoor storage lot at the activity. No flammable or hazardous materials are stored in this area. Currently, temporary outdoor storage space is also used by a contractor hired to clean the fuel storage tanks. Current outdoor storage practices do not differ significantly from past practices.

6.2.4 Materials and Waste Transportation. All waste generated at the Yorktown Fuels Division is domestic solid waste which is placed in dumpsters and removed by a refuse disposal contractor. Occasionally, very small quantities of oil, solvent or grease are disposed. These materials are generally absorbed in rags and thrown into dumpsters with other solid waste. The activity does not store waste oils or waste solvents separately for pickup and disposal.

It was reported that prior to contract disposal, domestic solid waste from Yorktown Fuels Division was trucked to a landfill off the activity property. No domestic solid waste has been deposited at Yorktown Fuels Division.

6.2.5 Petroleum, Oil, Lubricants Storage. Supplies for the Yorktown Fuels Division are delivered by truck from the Norfolk Naval Complex. Included among supplies received, stored, and used, are lubricating oil, valve grease, and solvent (several small cans of "nut buster"). These materials are stored in the workshop and are used completely with little or no waste being generated. No gasoline storage tanks for fueling vehicles are available at Yorktown Fuels. The activity's two pickup trucks are driven to Naval Weapons Station Yorktown for refueling. Fuels stored in the 26 major underground storage tanks at Yorktown Fuels are discussed in 4.2.1.2.

6.2.6 Pesticide and Hazardous Materials Storage. In addition to the materials discussed in Section 6.2.5, spray paint and wasp killer are the only hazardous materials used at Yorktown Fuels. Paint is stored in a paint locker in the storage building; wasp killer is also stored in the storage building. No other hazardous materials are stored at Yorktown Fuels Division.

CHAPTER 7. WASTE PROCESSING

7.1 NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX

7.1.1 Wastewater Treatment. Most of the domestic wastewater generated at Cheatham Annex is collected in sewers and conveyed to one of the base's five pump stations. Sewage is pumped from the stations to a small trickling filter plant, completed in 1947, where it is treated and eventually discharged to the York River. The remaining domestic wastewater, generated in outlying areas, is treated in septic tanks and discharged to drain fields.

Four of Cheatham Annex's five pump stations are the pneumatic ejector type. The pump station at Building CAD 40, CSF is the wet well type. All of the pump stations are provided with high water level alarms. Cheatham Annex has a central emergency power system which supplies back-up power to all of the pump stations as well as other key facilities on the base.

The wastewater treatment plant consists of a bar screen; a primary clarifier, two trickling filters; a secondary clarifier; a chlorine contact tank; an aerobic digester; and two sludge drying beds. The plant has a design capacity of 120,000 gallons per day and an approximate average flow of 40,000 gallons per day. Discharges from the treatment plant are regulated by NPDES Permit Number VA0024287. Production of digested, dried sludge is estimated at less than 1 cubic foot per day. This dried sludge is periodically removed by a private contractor and taken to an approved landfill for disposal. Long range plans call for the closure of the treatment plant and connection of the activity's collection system to the Hampton Roads Sanitation District during the late 1980s.

Small quantities of industrial wastewater are generated at Cheatham Annex; waste streams include cooling water, boiler blowdown and swimming pool filter backwash. All of these waste streams are either discharged directly to the sanitary sewer system or trucked to the treatment plant.

7.1.2 Recycling. Except for materials such as scrap wood and scrap metal, which may be sold by DPDO, waste oil and waste solvent are the only materials generated at Cheatham Annex which are recycled. Recycling was initiated within the past three years. Most of the waste oil generated at Cheatham Annex results from motor vehicle and heavy equipment maintenance. Small quantities are generated by a variety of other Annex operations and tenant activities, including that accumulated in oil/water separator tanks. Periodically, this oil is picked up by a private contractor and hauled away for recycling.

Small quantities of solvent and degreaser are also used at a variety of locations at Cheatham Annex. Most of these materials commonly used in cleaning operations, either evaporate or are absorbed by cleaning rags and deposited in dumpsters. Some waste solvent, however, is generated and stored in drums. Personnel from Public Works Center, Norfolk

inspect these containers to make sure they are properly packaged. Following this inspection, drums are removed by private waste haulers for subsequent recycling.

7.2 NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION

7.2.1 Wastewater Treatment. There are no central wastewater treatment plants at Yorktown Fuels Division. Two septic systems are provided to treat domestic sewage from the site. These systems are reported to be adequate and will continue to serve the activity.

An oil/water separator (NPDES Permit No. VA-0031836) is used to collect ground water contaminated by drainage from the fuel storage tanks. An outdoor wash rack used to clean oil spill control equipment is also connected to the oil/water separator. An estimated 20,000 gallons per day are discharged to the York River via a drainage ditch. The limits of the permit have not yet been finalized by EPA. The proposed limits are:

Oil	10 parts per million (average)	15 parts per million (maximum)
Suspended Solids	30 parts per million (average)	60 parts per million (maximum)
pH	6.0 - 9.0	

An upgrade of the oil/water separator, to ensure more consistent compliance with the limits of the NPDES permit, is presently in the planning stages.

7.2.2 Recycling. No materials suitable for recycling are generated by operations at Yorktown Fuels Division, mainly because all major maintenance and repair jobs are performed by the Public Works Department from Cheatham Annex, including motor vehicle maintenance, a common source of recyclable waste oil. Lubricating oils and solvents are used at the workshop at Yorktown Fuels Division, however, quantities used are small and are generally used completely, not wasted or recycled.

CHAPTER 8. DISPOSAL SITES AND POTENTIALLY CONTAMINATED AREAS

8.1 INTRODUCTION. This chapter describes each of the disposal sites or potentially contaminated areas identified at Cheatham Annex at the time of the IAS. The locations of the sites are found on Figure 8-1 with more detailed maps following site descriptions.

8.1.1 Site Identification. The sites described were identified through several sources including Cheatham Annex and Yorktown Fuels Division records, correspondence, and maps; interviews with activity personnel; examination of aerial photographs; and field examination. For all sites, efforts were made to confirm data through multiple sources.

8.2 NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX

8.2.1 Site 1, Landfill Near Incinerator (Figure 8-2). This site is an open, flat area of approximately two acres behind the old incinerator along the York River. The site was in use from 1942 to 1951 as a disposal area for incinerator burning residues. From 1951 to 1972, the site was a general landfill. Since 1972, occasional disposal of masonry and wood took place until the landfill's closure in 1981 (Naval Facilities Engineering Command, 1979b). The landfill is presently closed, covered, and grassed.

The primary types of vegetation on the site are grasses and other herbaceous plants. There was no noticeable vegetative stress nor any visible wastes at the site at the time of the IAS visit in July 1983. There are four active monitoring wells on the site, which were installed in 1981.

At the time when the site was used as a burning residue landfill, station garbage disposal personnel brought burnable trash to the incinerator, burned the material and threw the ashes into an adjacent pit. In ensuing years, the site was operated as a landfill until its useful life was exhausted.

Approximately 34,500 tons of domestic/industrial/commercial solid waste were buried at the landfill. The percentages of types of wastes are unknown. Specific wastes mentioned include empty paint and paint thinner cans, two or three truckloads of cartons of ether and other unspecified drugs which were burned, railroad ties, and lockers. In addition to these wastes, a 1979 Environmental Engineering Survey reported the following materials lying exposed to the environment: lumber, plywood, tar paper, sheet rock, concrete, cans, glasses, wooden boxes, tree debris (limbs, stumps and trunks), sawdust, metal objects and containers, rags, paper box containers, and old mattresses.

The landfill is along the York River at the northern boundary of the activity. Surface water drainage is towards the river. Some channelization was noted during the on-site visit. The soil is sandy clay with the water table at approximately 15 feet. Ground water flow is toward the York River.

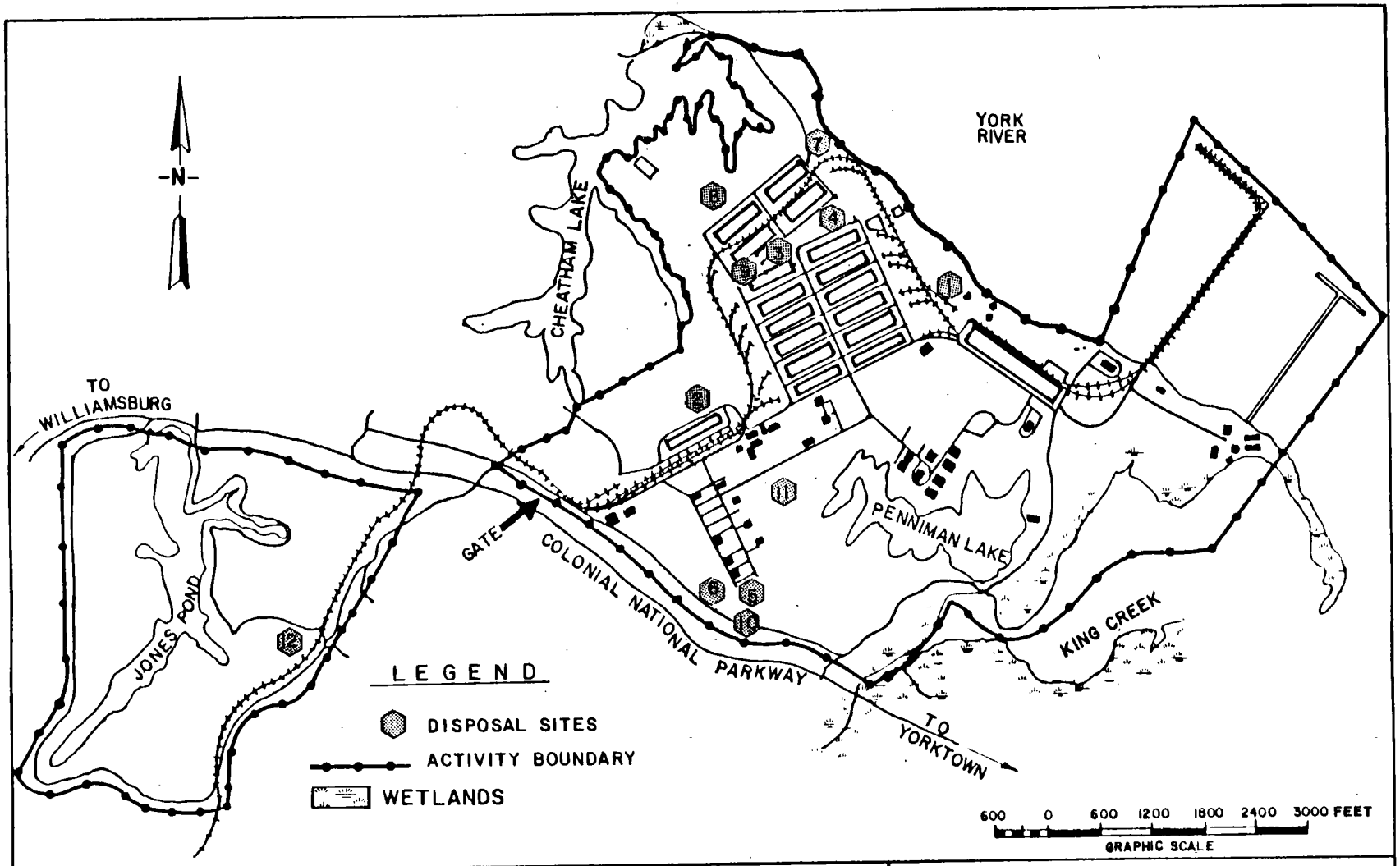

FIGURE 8-1

CHEATHAM ANNEX

LOCATION OF DISPOSAL SITES AND POTENTIAL CONTAMINATION AREAS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

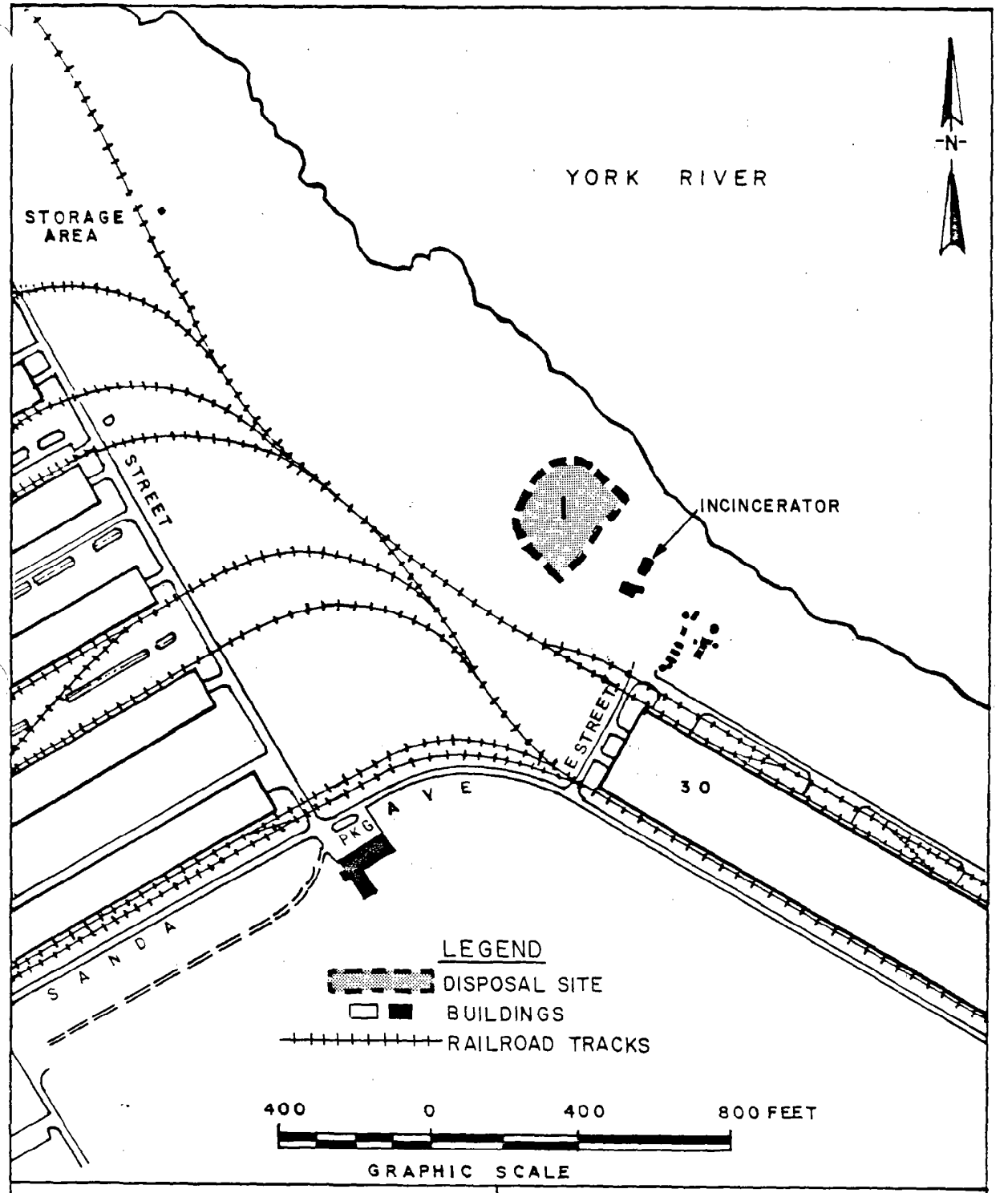

FIGURE 8-2
SITE 1 - LANDFILL NEAR INCINERATOR

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

8.2.2 Site 2, Contaminated Food Disposal Area (Figure 8-3). This site is located in a grassy area in the woods behind the cold storage warehouse (Building CAD 40) in the west central portion of the activity. Frozen food was contaminated when an ammonia leak developed in one of the cold storage rooms. The food was buried with cellophane wrappers and boxed intact in a pit 12 to 15 feet deep and about 50 feet in diameter. The contamination incident occurred around 1970. It was reported that approximately 100 cubic yards of food, worth approximately $300,000, were tainted. The burial area was chosen by the Cheatham Annex ranger, and used only to bury food contaminated on this occasion.

Soil in this area is sandy loam and is moderately well-drained. Surface water drainage from the site is towards Cheatham Lake.

8.2.3 Site 3, Submarine Dye Disposal Area (Figure 8-4). This site is located at the northeastern corner of Building CAD 15. At the present time, the area is used as a storage lot for DPDO. The dye was stored in 55-gallon drums on two to three pallets between the warehouses. The drums had corroded and dye would leak onto the ground and to the storm drain system. During rains, puddles containing a green fluorescein dye were observed. At times, the dye would leak into the storm sewer leading to the York River, turning the river green. The Coast Guard brought this to the attention of the activity and the drums were removed. The reported date of the incidence is sometime in the early 1970s.

Soils at the site are well drained with loamy subsoil and clayey substratum. Depth to ground water is about 20 feet and direction of flow is towards the York River.

8.2.4 Site 4, Medical Supplies Disposal Area (Figure 8-4). The site is located behind the pond between buildings CAD 11 and CAD 12, and is an area where out-of-date medical supplies and metal banding were disposed. GSA medical supplies (e.g., syringes in plastic bags and empty I.V. bottles), quantities as much as 7000 cubic yards, and one-inch metal banding were unloaded down a bank in front of the pond between buildings CAD 11 and CAD 12. No drugs were disposed of on the site. The materials were covered with a small amount of earth. This disposal occurred in 1968 or 1969. A considerable amount of these materials were removed because deer were getting the needles from the syringes in their hooves. After a heavy rain, syringes could sometimes be seen floating in the waters of the pond in front of the disposal site, and the pond across D Street.

8.2.5 Site 5, Photographic Chemicals Disposal Area (Figure 8-5). This site was originally a marl pit located behind (southeast of) the old DuPont ammunitions factory area. The photographic chemicals (developers and fixers) were disposed in the pit of unknown size around 1967 or 1968. Quantities mentioned were approximately 20 to 40 gallons, one pallet full, which was about six months accumulation.

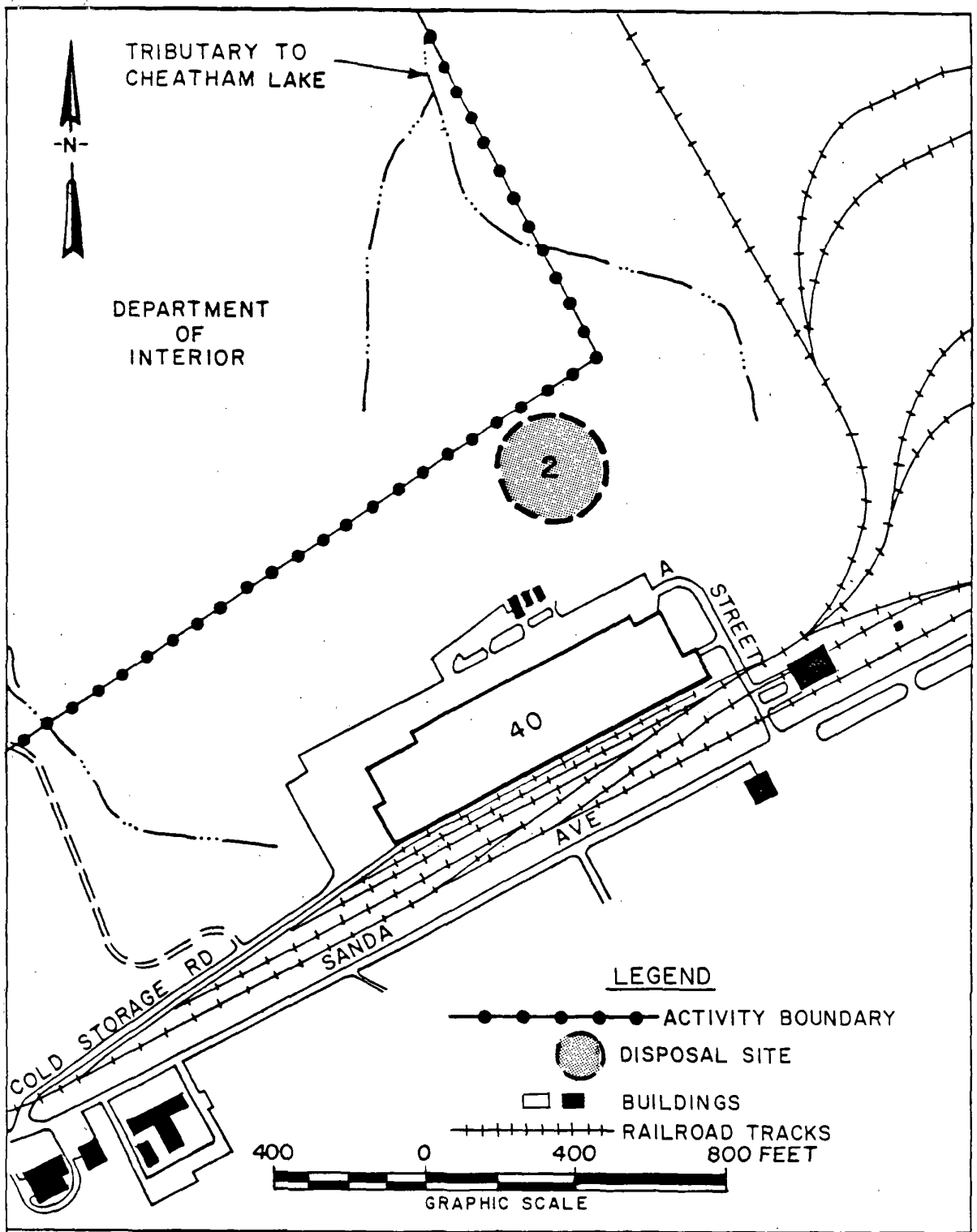

FIGURE 8-3

SITE 2 - CONTAMINATED FOOD DISPOSAL AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

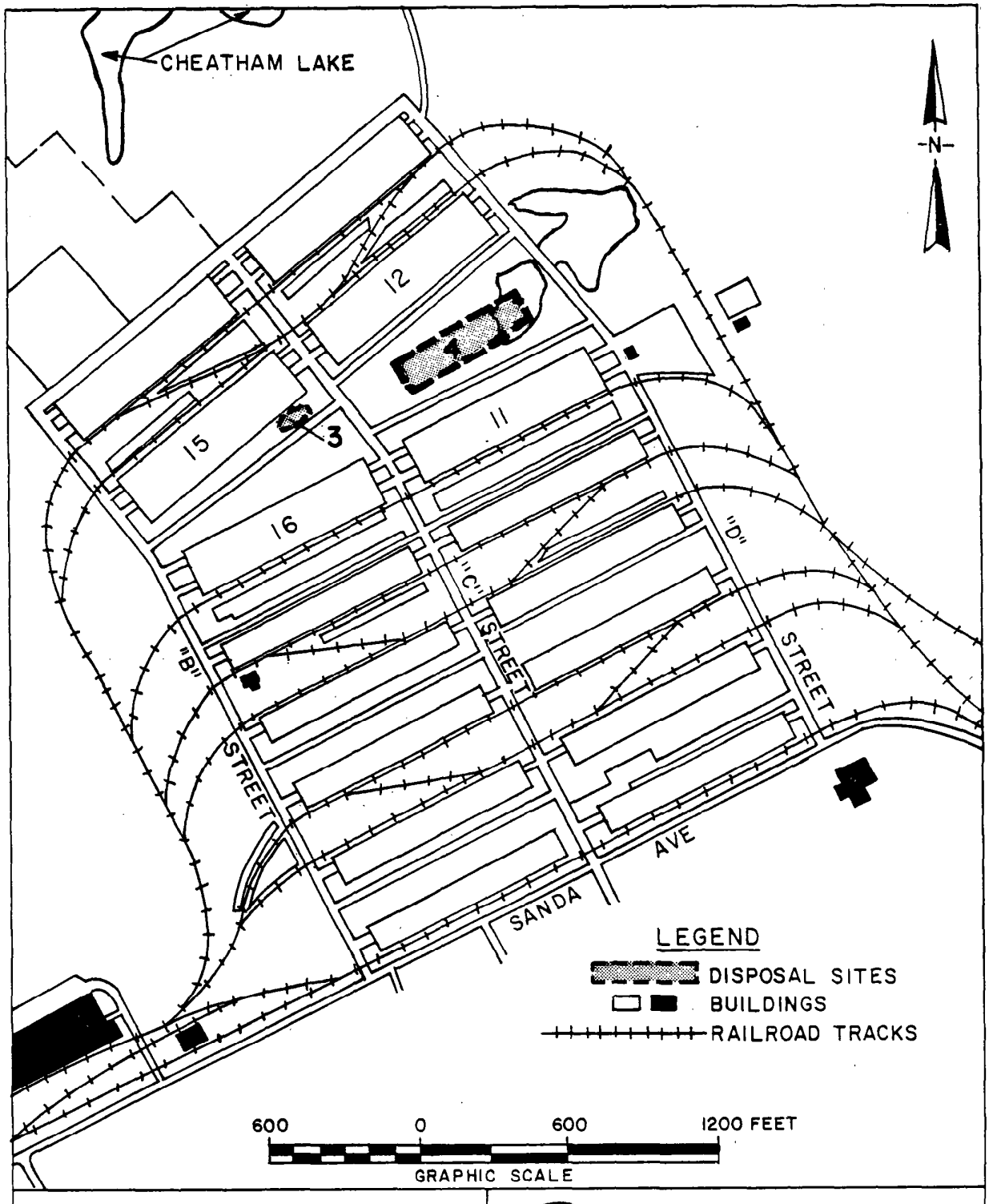

FIGURE 8-4
SITE 3 - SUBMARINE DYE DISPOSAL AREA
SITE 4 - MEDICAL SUPPLIES DISPOSAL AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

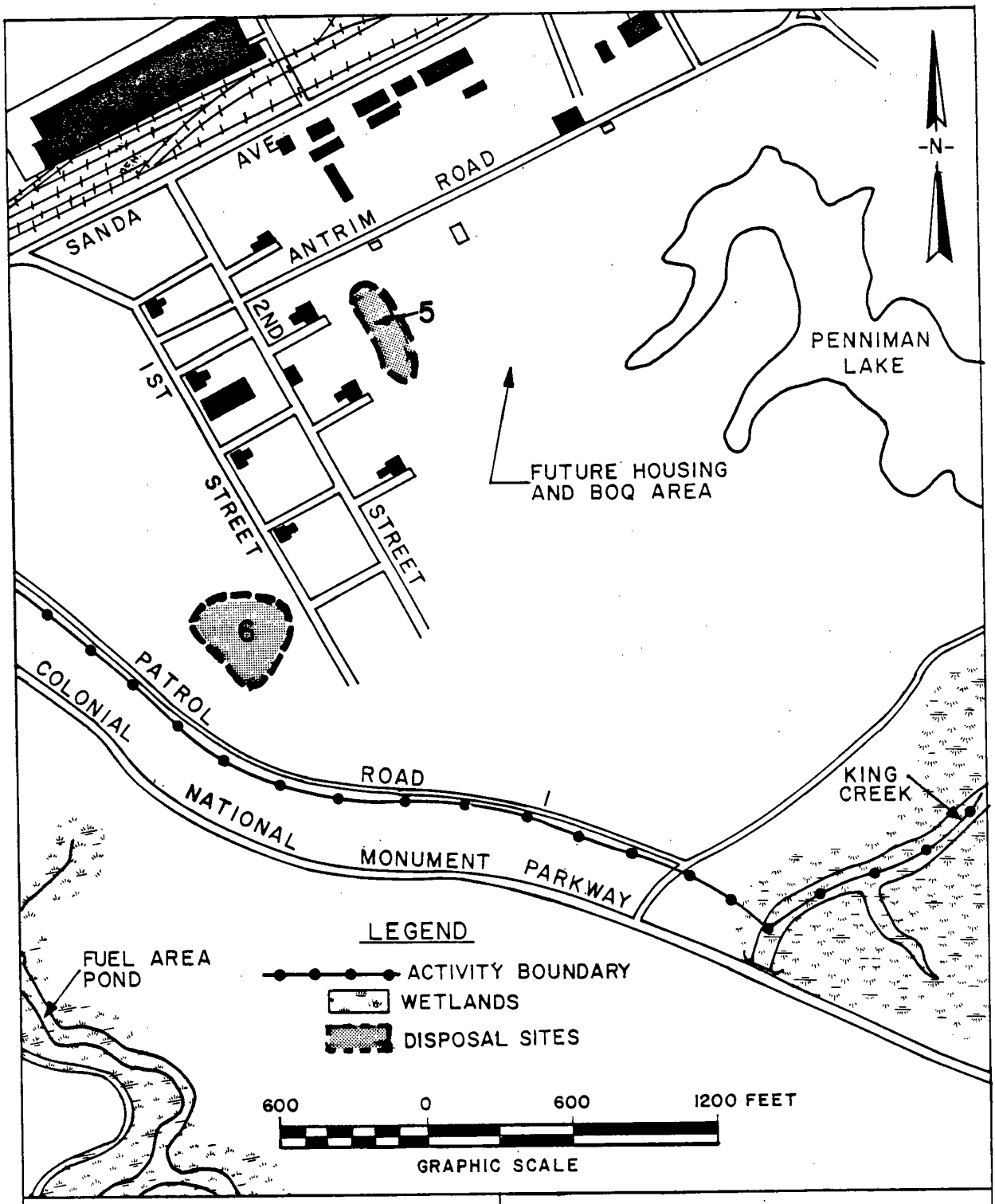

FIGURE 8-5
SITE 5 - PHOTOGRAPHIC CHEMICALS DISPOSAL AREA
SITE 6 - SPOILED FOOD DISPOSAL AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

Ground water drainage is probably towards Penniman Lake, a recreational area, and eventually the York River. Soils in the area are moderately well-drained with a clay substratum. It is possible that the bottom of the pit rests in this clay layer, diminishing the likelihood of ground water contamination.

8.2.6 Site 6, Spoiled Food Disposal Area (Figure 8-5). The site is located behind (west of) the old DuPont ammunition factory and is an area where food spoiled in cold storage was buried around 1970. Approximately 750 cubic yards of spoiled food were buried in a pit 12 to 15 feet deep. The spoiled food had no hazardous properties. The site was a one-time disposal operation. The area is presently overgrown with grasses and other herbaceous plants.

Soils in this area have a loamy subsoil and clayey substratum. Ground water drainage is probably towards King Creek.

8.2.7 Site 7, Old DuPont Disposal Area (Figure 8-6). Site 7 is located northeast of the Cheatham Annex warehouse complex, approximately 300 feet east of D Street and approximately 150 feet west of the York River. The area of concern encompasses an estimated one acre parcel of land believed to have been used as a disposal site in the early 1900s. It was reported that the site was used for waste disposal by the City of Penniman and the DuPont Company during the period of 1915 through 1918. Along the eastern boundary of the site is debris containing materials which had been manufactured and subsequently disposed at the site since the early 1900s. This indicates that the site has also been used more recently than 1918 for waste disposal.

Information documenting disposal practices at the site by either the City of Penniman or the DuPont Company was not available (E.I. DuPont de Nemours and Company, 1983a, b and c). Estimates of waste depth, quantity or characteristics were also not available. It was reported, however, that ammunition waste was disposed of at the site. It is not known if this waste was burned before burial. Assuming an average waste depth of five to ten feet on the one acre site, a total waste volume of 217,800 to 435,600 cubic feet of waste can be roughly estimated.

The surface of the site is level and supports a variety of grasses. There was no evidence of stressed vegetation during the site visit in July 1983. The western, northern, and eastern boundaries of the site are clearly defined by steep banks rising an estimated 10-20 feet in elevation from the surface of the site.

8.2.8 Site 8, Landfill Near Building CAD 14 (Figure 8-7). Site 8 is located approximately 300 feet north of Building CAD 14 and is estimated to be less than a quarter of an acre in size. Sources have described the site as a disposal area consisting of a series of trenches with typical surface areas of 2,000 feet and depths of 10 feet. Cheatham Lake is located about 1,000 feet north of the site.

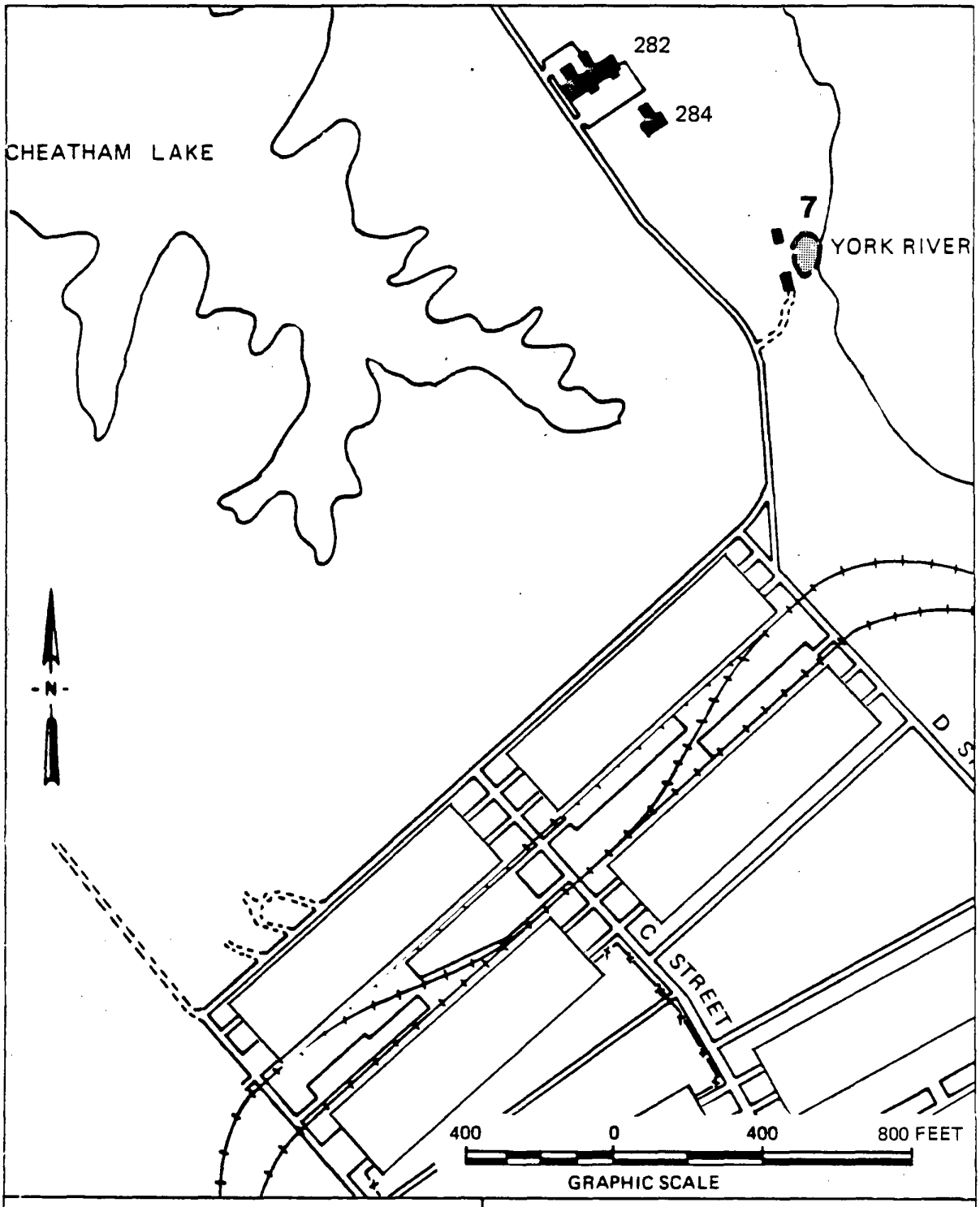

FIGURE 8 - 6
SITE 7 - OLD DUPONT DISPOSAL AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

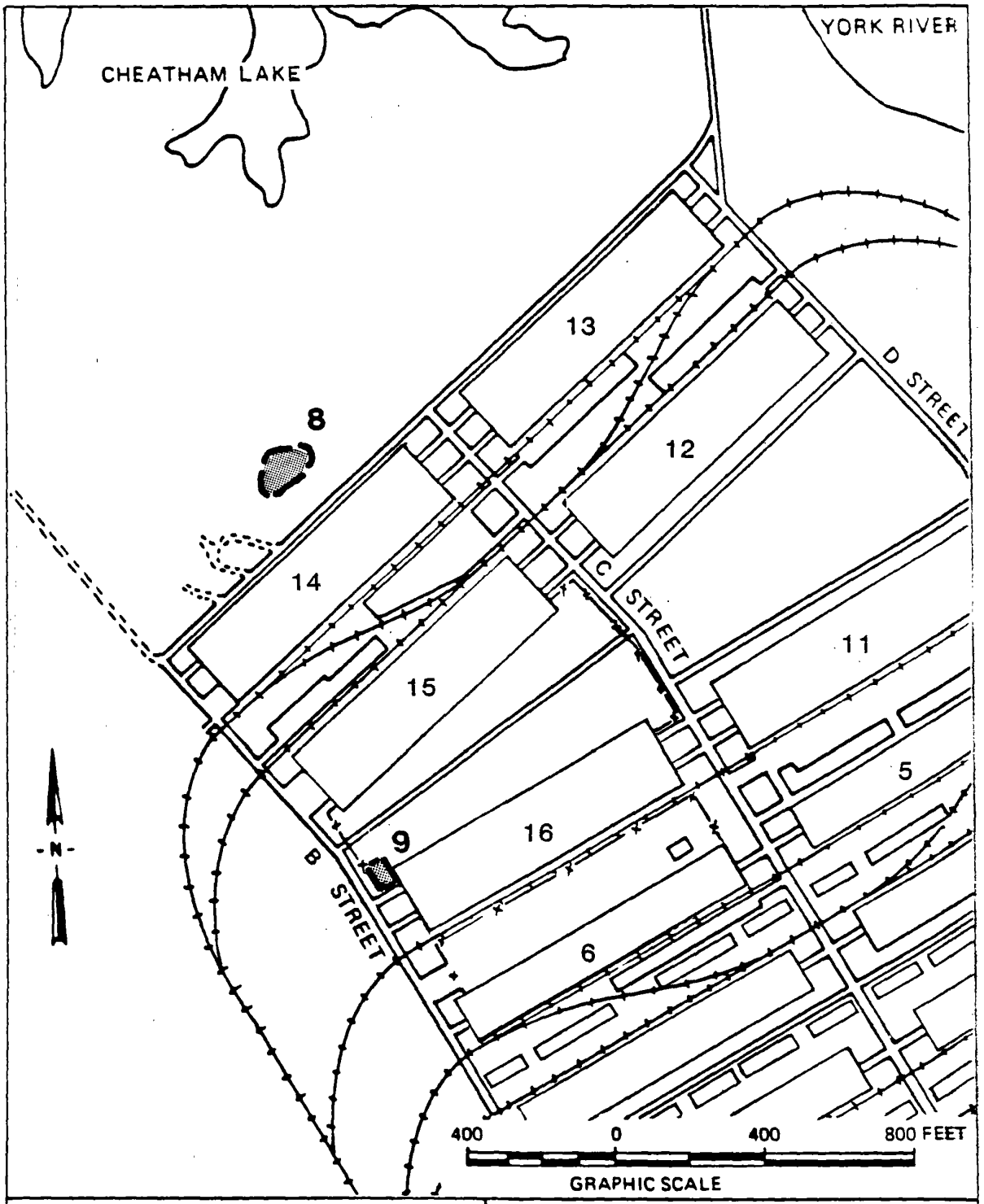

FIGURE 8-7

SITE 8 - LANDFILL NEAR BUILDING CAD 14.

SITE 9 - TRANSFORMER STORAGE AREA.

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

Available information indicates that the site has been used for waste disposal at various times since the early 1940s. The site was most active during the period prior to the opening of the landfill near the incinerator. It was reported that the site has been used for waste disposal as recently as 1980.

Specific information documenting historic disposal practices at the site was not available for this study. Available information indicates that only non-hazardous materials including spoiled meat, spoiled candy and clothing have been disposed at the site. No specific information was available documenting the quantity of wastes disposed at this location.

The surface of the site is level and overgrown with tall grasses. There was no evidence of wastes at the surface of the site or stressed vegetation during the site visit in July 1983. The surrounding area is densely wooded.

Because the soil at the site is well-drained, the potential for migration to ground water exists. Runoff from the site is conveyed to Cheatham Lake via natural drainage channels.

8.2.9 Site 9, Transformer Storage Area (Figure 8-7). Site 9 is located within the warehouse complex at the northwest corner of Building CAD 16. Of concern is a 70 by 100 square-foot area once used for the storage of electrical transformers.

Reportedly, transformers awaiting repair or disposal were stored at Site 9 from 1973 through 1980. The number of transformers stored at any one time varied from six to thirty. During this period, the surface of the storage area consisted of exposed soil that was enclosed with an earthern containment wall. After 1980, transformers were no longer stored at this location and the site was regraded and covered with gravel. The condition of stored transformers is not known. If the transformers had small leaks, the total volume of transformer oil leaked was likely to be less than one gallon. If, however, oil was spilled, the total volume could be considerably greater. The site is in an open area with a level surface comprised of gravel. At the time of the site visit in July 1983, there appeared to be no evidence of surface contamination.

Because the soils of the site are well-drained, the potential for ground water contamination exists. The direction of overland flow from the site appears to be toward the southwest. Surface flow would probably be contained between the railroad track embankments and percolate downward.

8.2.10 Site 10, Decontamination Agent Disposal Area Near First Street (Figure 8-8). Site 10 is located south of First Street in the southern most part of the old DuPont munitions plant. An estimated 75 to 100 gallons of decontamination agent (DS-2) have reportedly been buried at the site. No information was available specifying the time wastes were buried, however, the general appearance of the site indicates that at least two years have elapsed since initial burial. DS-2 is toxic to humans and corrosive to metals,

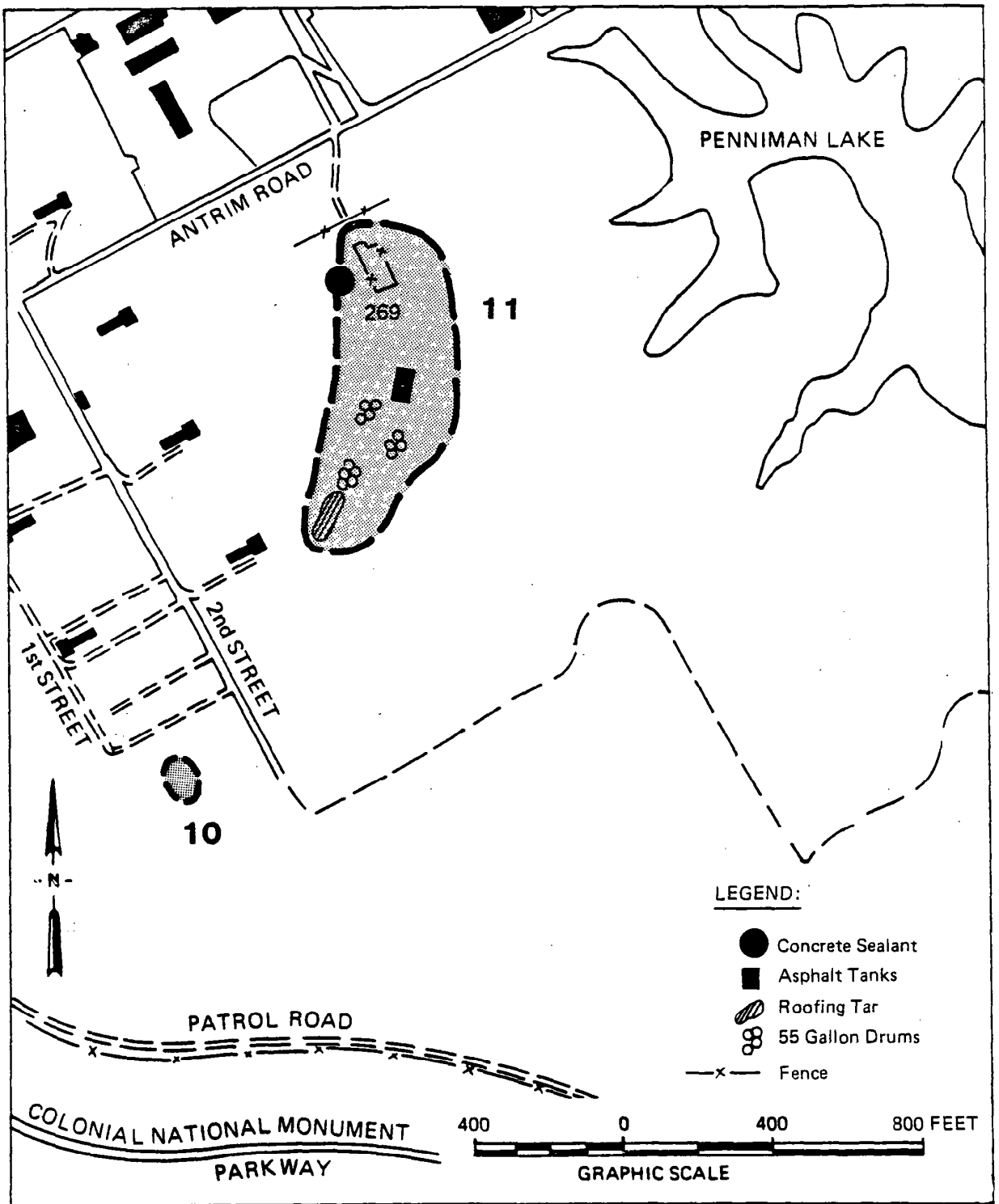

FIGURE 8 - 8
SITE 10 - DECONTAMINATION AGENT DISPOSAL AREA NEAR FIRST STREET
SITE 11 - BONEYARD

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

and is used for decontaminating equipment contaminated with nerve or blister agents. The chemical composition of DS-2 is:

70% Diethylene triamine
28% Ethylene glycol monomethyl ether
2% Sodium hydroxide

It is not known if DS-2 disposed at the site was neutralized prior to disposal.

The surface of the site was overgrown with a variety of grasses. There was no evidence of stressed vegetation. Off-site migration to local surface and ground water is possible, however, surrounding vegetation and animal life showed no visible adverse affects during the field visit in July 1983.

8.2.11 Site 11, Bone Yard (Figure 8-8). Site 11 encompasses an estimated eight acre area that is located approximately 250 feet south of Antrim Road behind the public works facility. Access is from the northern end of the site through a secured gate. Immediately inside the gate is an estimated one acre cleared area on which is deposited numerous pieces of scrap metal, old containers (fuel oil containers, mixing tanks, etc.) fence posts and abandoned cars. Also scattered around this area are various discarded clamshell buckets and other surplus metal objects used in heavy construction. There were also approximately ten, 5-gallon cans labeled "Paraplastic" (concrete sealant) in this area.

South of the one acre area described above are numerous barrels containing petroleum products as well as several 500 gallon square tanks which reportedly contain asphalt or oil used in making asphalt.

It was reported that they have leaked in the past. At the end of the road were deposited numerous tar cylinders used for roofing. The cylinders had apparently been there for quite a while as their initial cardboard containers had decomposed and the tar had melted. Numerous pieces of scrap metal and surplus construction equipment were scattered along the path. It was also reported that wastes may be buried in this area, but this was not evident by stressed vegetation nor confirmed by other reports.

It is not known how long the site had been used for waste disposal, as no records are available regarding its operation. Available information indicates that the site was active from the World War II era until as recently as 1978. Based on visual observations and other reports, the wastes deposited at this site include oil, possibly from automobile maintenance and/or fuel oil sludge, gasoline, and asphalt oil from road maintenance supplies.

Approximately 15 barrels and two 500 gallon tanks containing petroleum products were noted during the site visit. There are no other records quantifying the wastes on-site.

While the surrounding vegetation show no visible adverse effects from any waste present, any spill could easily migrate from the site. It is about 500 feet west of Penniman Lake. The land surface slopes towards the lake, making overland transport to surface water a possible migration path. Permeable soils are present in this area and therefore ground water migration is also possible.

8.2.12 Site 12, Disposal Site Near Water Tower (Figure 8-9). Site 12 is located in the southwest portion of Cheatham Annex, 2,000 feet west of Jones Pond. Buildings near the site include CAD 157, CAD 139, CAD 134, and CAD 265. The site was used for the surface disposal of scrap metal, primarily old automobile parts, and iron pipe. Based on a visual inspection of the site, approximately 70 to 110 cubic feet of metal were disposed of at the site.

It was reported that the site was used for the disposal of only non-hazardous materials. No evidence of stressed vegetation was observed. The land slopes west toward Jones Pond. Probable paths of migration would be by overland flow and infiltration to ground water.

8.3 NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION. The following sites were identified at Yorktown Fuels Division at the time of the IAS. The site locations are shown on Figure 8-10 with more detailed maps following the individual site descriptions.

8.3.1 Site 13, Sludge Farm (Figure 8-11). This site is approximately three acres in size and is located in the southeastern section of the activity. The operation of the sludge farm began in October 1980 and ended in 1981. Sludge from the three abandoned NSFO tanks (tanks 192, 196 and 197) was applied to the land and worked into the soil along with lime, fertilizer and seed. Approximately 1,000 cubic yards of oil sludge was applied to the site. NSFO contains PAHs such as anthracene. Many PAHs, including anthracene, are recognized carcinogens (Sax, 1979). No lead or other fuel additives are found in NSFO.

Soils at the site are loamy sands that have been disturbed during past grading operations when tanks 186-191 were installed. Drainage through these soils is excessive. Surface water drainage is towards Wormley Creek, eventually reaching the York River.

8.3.2 Sites 14-26, Tank Bottoms Disposal Areas (Figure 8-11). These sites are small areas, approximately 15 to 30 feet in diameter and 6 feet deep, where residues from tank cleanings were disposed of. The sites are located around the circular tanks found in the southern portion of the activity.

The dates of tank cleanings and types of fuel stored in the tanks are shown on Table 8-1. Tanks were cleaned at the time of fuel changes. Approximately 1,960 to 2,830 cubic feet of sludge was disposed of from each tank per cleaning. Therefore, based on information concerning dates of tank cleanings, approximately 134,100 cubic feet of sludge were disposed of at these sites. Table 8-1 lists approximate sludge quantities at each site.

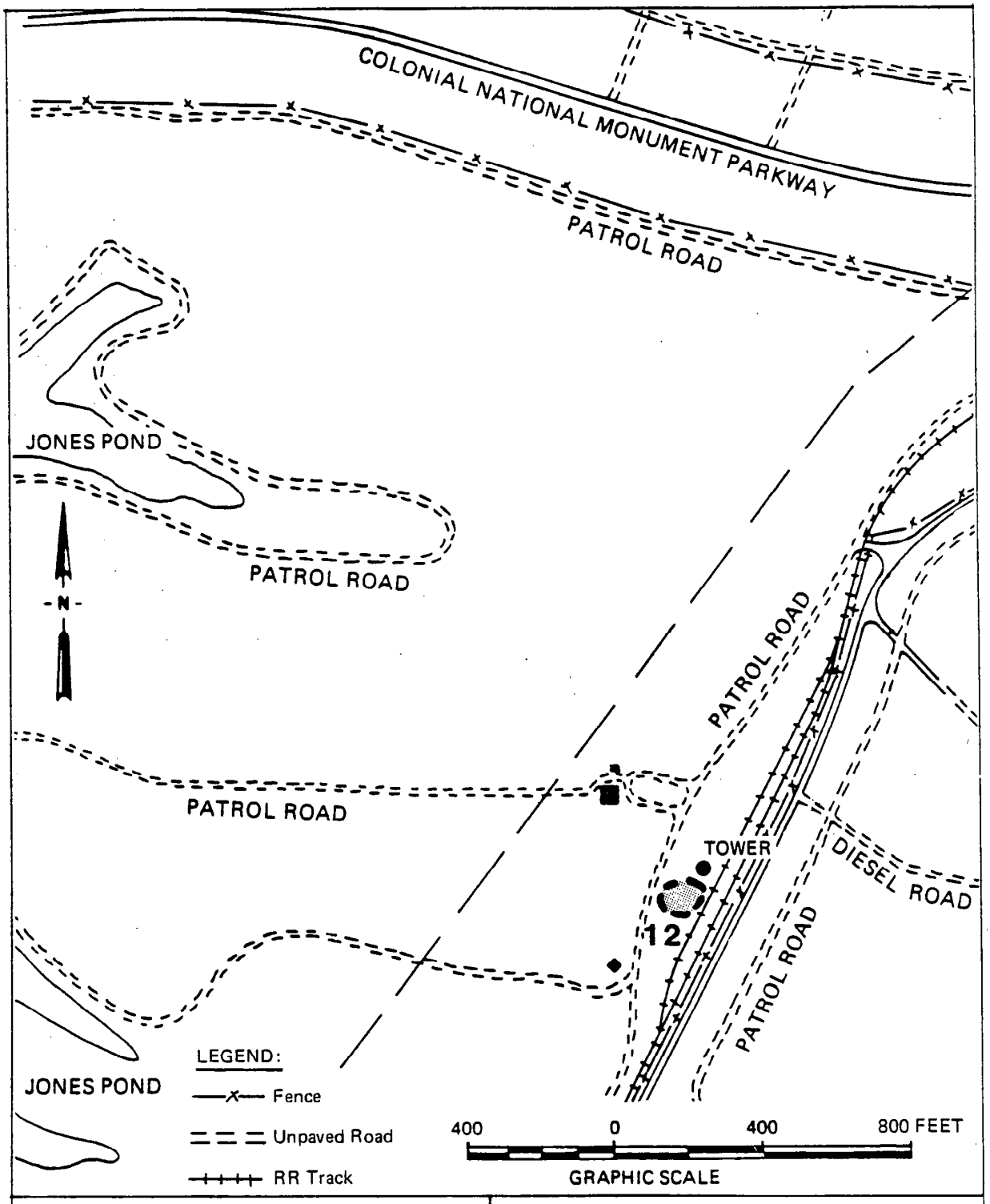

FIGURE 8 - 9
SITE 12 - DISPOSAL SITE NEAR WATER TOWER

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
CHEATHAM ANNEX

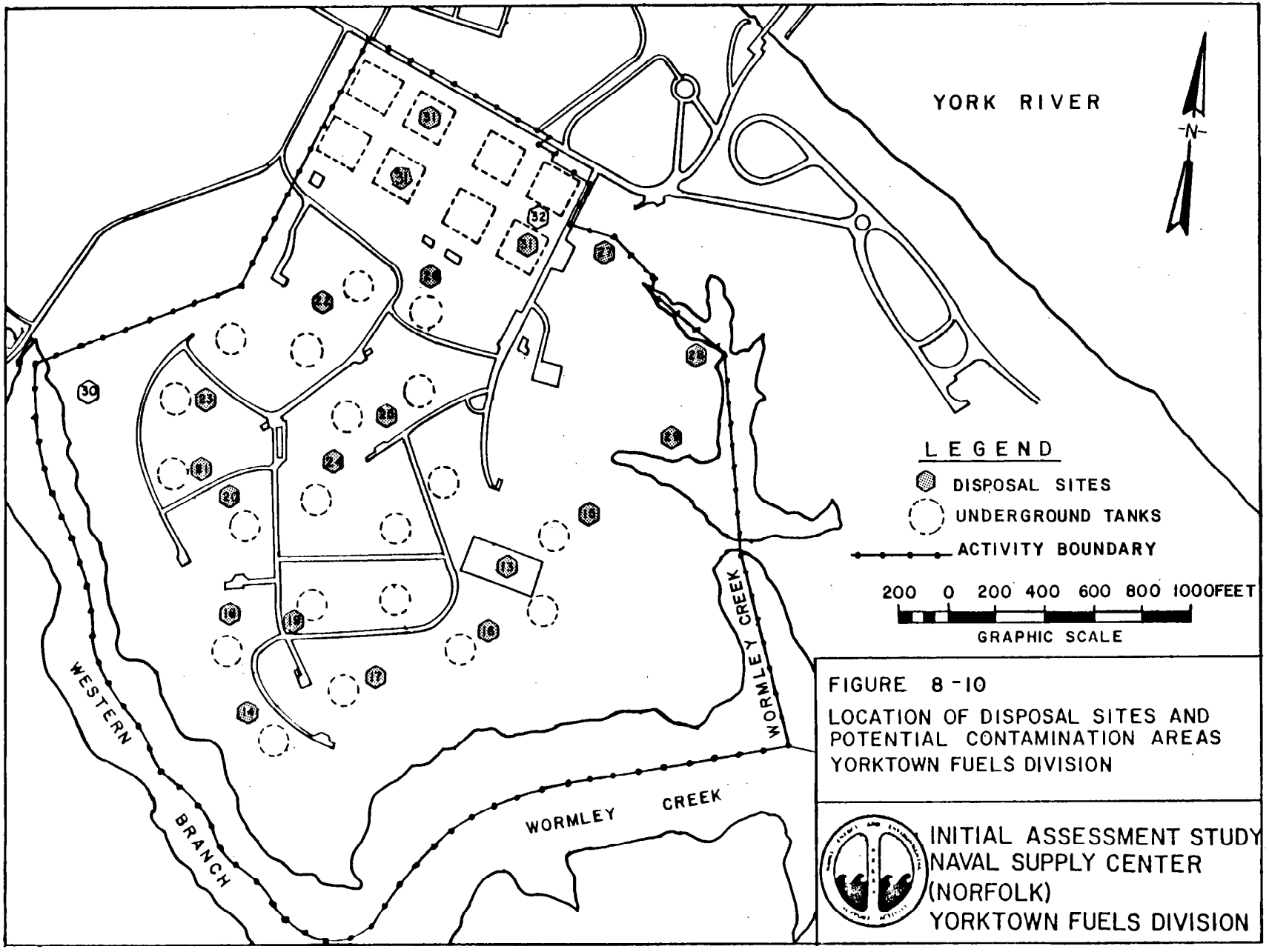

FIGURE 8-10
LOCATION OF DISPOSAL SITES AND POTENTIAL CONTAMINATION AREAS
YORKTOWN FUELS DIVISION

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

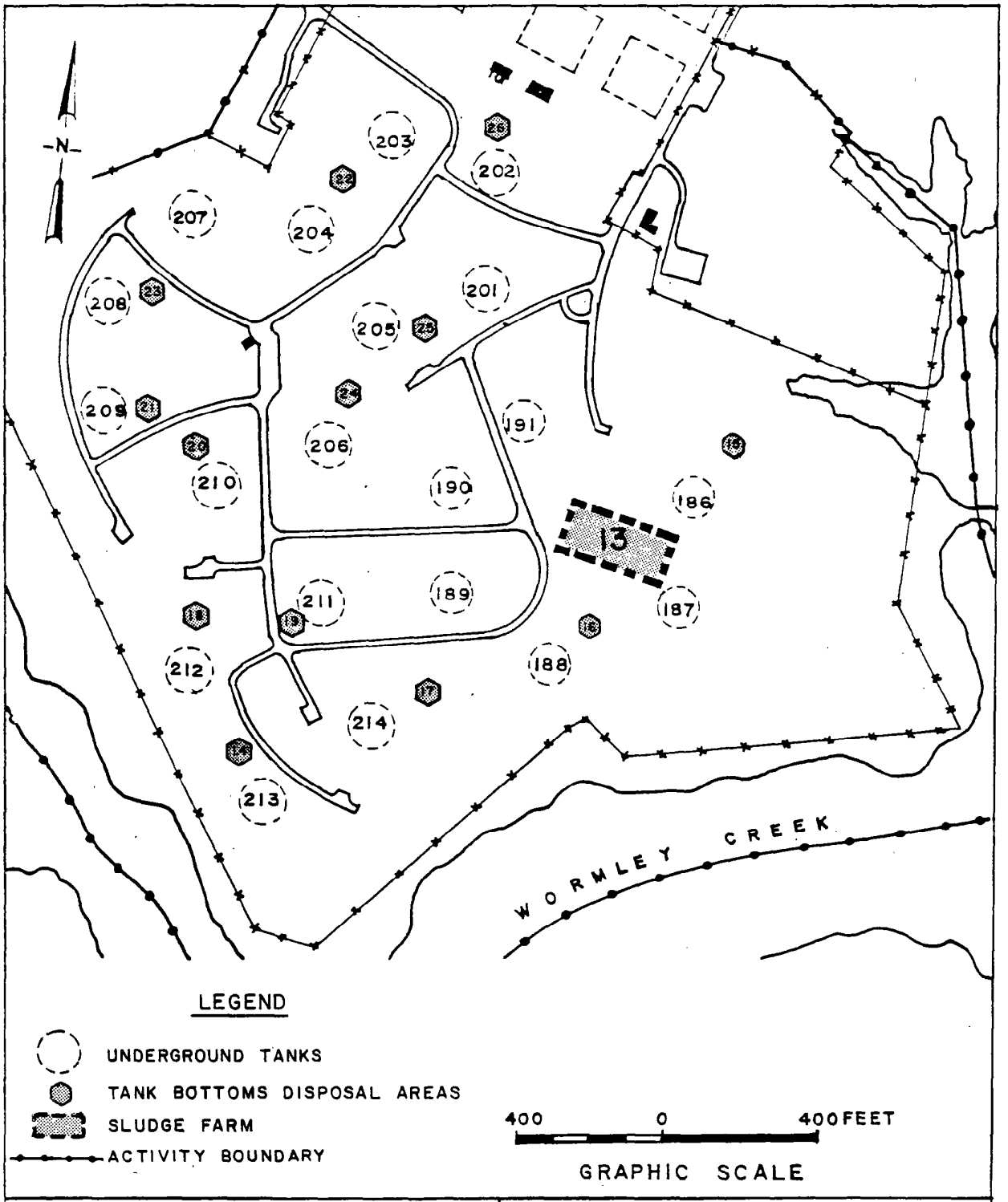

FIGURE 8-11
SITE 13- SLUDGE FARM
SITE 14-26-TANK BOTTOMS DISPOSAL AREAS

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

TABLE 8-1
TANK BOTTOMS DISPOSAL AREAS AND TANK HISTORIES,
NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION

Site	Associated Tanks	Year Constructed	Type of Fuel Previously	Type of Fuel Currently	Year Cleaned	Approx. Sludge Quantities (c
14	213	1954	Aviation Gas	JP-4	Late 1950's* 1970, 1974 1980, 1982	11,320
15	186	1941	Aviation Gas	Motor Gas	1971*, 1983	1,960
16	188	1941	Aviation Gas	Motor Gas	1978*, 1982	1,960
17	214	1954	JP-5	JP-4	1970, 1974, 1977*, 1983	8,490
18	212	1954	Aviation Gas	JP-5	1958*, 1970 1974, 1978 1982	11,320
19	211	1954	Aviation Gas	JP-5	1958*, 1970 1974, 1983	8,490
20	210	1954	Aviation Gas	JP-5	Late 1950's,* 1970, 1974, 1982	8,490
21	209	1954	Aviation Gas	JP-5	Late 1950's* 1970, 1974	8,490
22	203	1953	Aviation Gas	JP-5	1959*, 1970 1974, 1982	8,490
	204	1954	Aviation Gas	JP-5	1958*, 1970, 1974, 1982	8,490
23	207	1954	Aviation Gas	JP-5	Late 1950's* 1970, 1974, 1982	8,490
	208	1954	Aviation Gas	JP-5	Late 1950's* 1970, 1974 1982	8,490

*Year fuel type was changed.
**Approximate sludge quantities are total amounts.

Note: Sludges from 1982 and 1983 cleanings were disposed of off-site (by a contract
and are therefore not included in estimate of sludge quantities disposed of i

TABLE 8-1 (CONTINUED)
TANK BOTTOMS DISPOSAL AREAS AND TANK HISTORIES,
NAVAL SUPPLY CENTER (NORFOLK) YORKTOWN FUELS DIVISION

Site	Associated Tanks	Year Constructed	Type of Fuel Previously	Type of Fuel Currently	Year Cleaned	Approx. Sludg Quantities (c
24	205	1954	Aviation Gas	JP-5	Late 1950's* 1970, 1974, 1980, 1982	11,320
	206	1954	Aviation Gas	JP-4	Late 1950's* 1970, 1974, 1980, 1982	11,320
25	201	1953	Aviation Gas	JP-4	Late 1950's* 1970, 1974, 1982	11,320
26	202	1953	Aviation Gas	JP-5	1958*, 1970 1974, 1983	8,490

*Year fuel type was changed.
**Approximate sludge quantities are total amounts

Note: Sludges from 1982 and 1983 cleanings were disposed of off-site (by a contracto and are therefore not included in estimate of sludge quantities disposed of in

Tank bottoms disposed of at these sites originated from storage tanks containing the following fuels: aviation gas, motor (combat) gas, JP-4 and JP-5 jet fuels. Aviation gas and motor gas contain lead while the jet fuels do not. Lead is highly toxic via the oral route. No other fuel additives are found in aviation or motor gas. JP-4 and JP-5 contain several additives including metal deactivators, icing inhibitors, corrosion inhibitors, antioxidants and conductivity additives. The majority of these exhibit moderate toxicity, except for several of the antioxidants which are highly toxic via oral routes (Sax, 1979). Other components of JP-4 and JP-5, including n-paraffins, naphthenes and aromatic compounds, are generally moderately toxic via inhalation and ingestion.

Soils at the sites are sandy loams (sites 14 and 17 to 26) and loamy sands (sites 15 and 16). Drainage through these soils is good and excessive, respectively, with ground water flow towards Wormley Creek and eventually to the York River.

The procedure for tank cleaning, in the past, was to empty the fuel tank to be cleaned by pumping its contents into another tank, next flooding the tank with water, and then pumping the water/sludge mixture into a pit near the tank that was dug with a backhoe. The pits were filled, allowed to drain, and the process completed until the tank was emptied. When the process was completed, the pits were filled with earth. Grass now covers most of these areas.

8.3.3 Site 27, Fuel Pit at Building YK 215 (Figure 8-12). This site is an area of oil saturated soil near Building 215, approximately 100 feet by 25 feet in size. It is alledged that the fuel pit containing oil was ruptured while improvements were being made to an oil-water separator in 1983. Another report stated that the oil had leaked from NSFO tanks that had been abandonded. These tanks are located directly west of Site 27. Soils around the tanks and to the west of the fuel pit are loamy sands and Wayside fine sandy loam, respectively. Rapid permeability is a characteristic of both of these soils. Estimated quantities of oil in the soil ranged from 30 gallons associated with the construction spill report to several hundred gallons associated with the leaking NSFO tanks and the oil saturation of the soil.

An arm of Wormley Creek is approximately 200 feet east of the site, and down gradient. Oil could reach the waterway through surface runoff.

NSFO contains anthracene and other PAHs. Many PAHs, including anthracene, are recognized carcinogens (Sax, 1979). No lead or other fuel additives are found in NSFO. Soils at the site of the spill are mixed alluvial lands that are poorly drained and often flooded with surface runoff.

8.3.4 Site 28, Surface Disposal Area Southeast of Building YK 215 (Figure 8-12). This disposal site is located in the northern section of the activity, approximately 600 feet southeast of Building YK 215. It covers an area of approximately 85 feet by 25 feet. Concrete foundations (10-12 inches thick) and 6-inch cast iron pipe were disposed here. Dates of disposal are unknown. No migration of hazardous wastes would occur due to the inert nature of the materials.

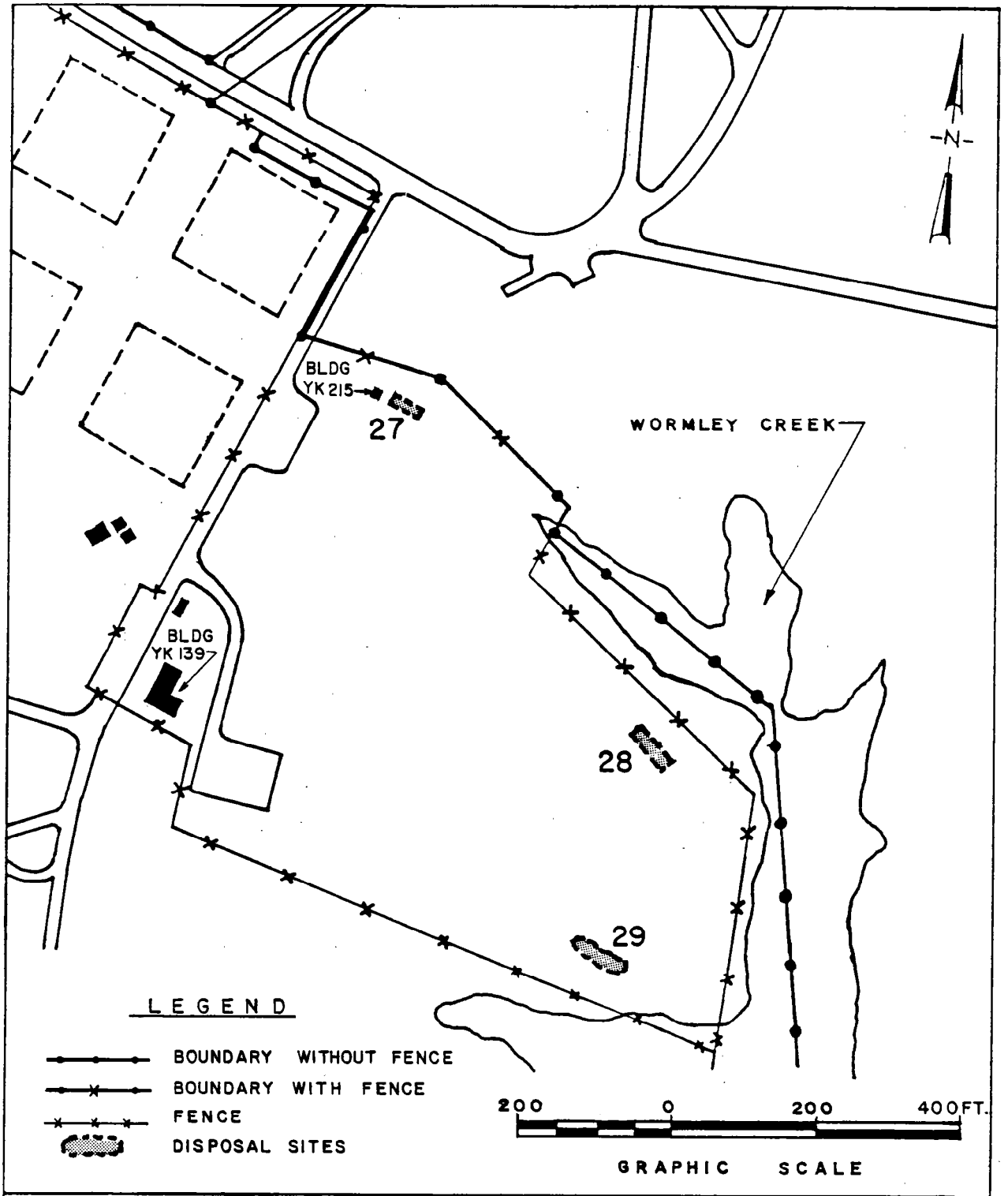

FIGURE 8-12
SITE 27-FUEL PIT AT BUILDING YK 215
SITE 28-SURFACE DISPOSAL AREA SOUTH EAST OF BUILDING YK 215
SITE 29-GENERAL DISPOSAL AREA EAST OF BUILDING YK 139

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

8.3.5 Site 29, General Disposal Area East of Building YK 139 (Figure 8-12). This site is approximately 600 feet east of Building YK 139. The disposal area measures approximately 100 feet by 25 feet. Materials disposed of at the site include mostly wood, several 5-gallon buckets, fire hose, wooden pallets, trash buckets and a car seat in the nearby ravine. Dates of use are unknown. No hazardous wastes are present at the site, therefore no adverse impact to the environment is expected.

8.3.6 Site 30, Disposal Area West of Building YK 208 (Figure 8-13). This site is located behind Building YK 208 in a clearing in a wooded area. The disposal area is approximately 15 feet by 10 feet, and reportedly contains inert materials such as rubber hose, old wood, flexible piping, empty chemical and JP-4 drums, and other debris. Dates of disposal are unknown.

8.3.7 Site 31, Abandoned NSFO Tanks (Figure 8-14). This site is located in the northern portion of the Fuel Terminal and is a tank storage area for NSFO. Each of the eight concrete tanks were constructed in 1918, and each are capable of holding 90,000 barrels of fuel.

Three of them, tanks 192, 196 and 197, have been removed from service due to leakage. Tanks 196 and 197 developed leaks in 1955, and were no longer used for oil storage. Tank 192 was taken out of service in 1982. Based on records of product loss for a one year period, it was estimated that approximately 144 barrels (6,048 gallons) of NSFO leaked from these tanks. Hazardous components of NSFO include anthracene and other PAHs. Many PAHs, including anthracene, are recognized carcinogens (Sax, 1979). The tanks are presently partially filled with water. Ground water leakage into the tanks has been a greater problem in the past than oil leaking out. Soils in this area are highly permeable leading to the possibility of ground water migration from the tanks.

8.3.8 Site 32, NSFO Sludge Disposal Area (Figure 8-14). This site is located in the NSFO fuel storage area between tanks 192 and 193. Approximately 30 years ago (1953) a six feet by six feet by two-feet pit was filled with sludge and covered over with a bulldozer. Waste sludge containing about 80 percent water, was pumped from the tanks and drained into the pit. The water was allowed to seep out through the ground and the sludge remained. Quantities of sludge are approximated at somewhat less than 72 cubic feet. It was reported that the pit was used for only a short period of time.

NSFO sludge contains anthracene and other PAHs. Many PAHs, including anthracene are recognized carcinogens (Sax, 1979). NSFO contains no lead or other fuel additives.

Soils in this area are loamy sands, excessively drained. Migration of waste could occur through the ground water.

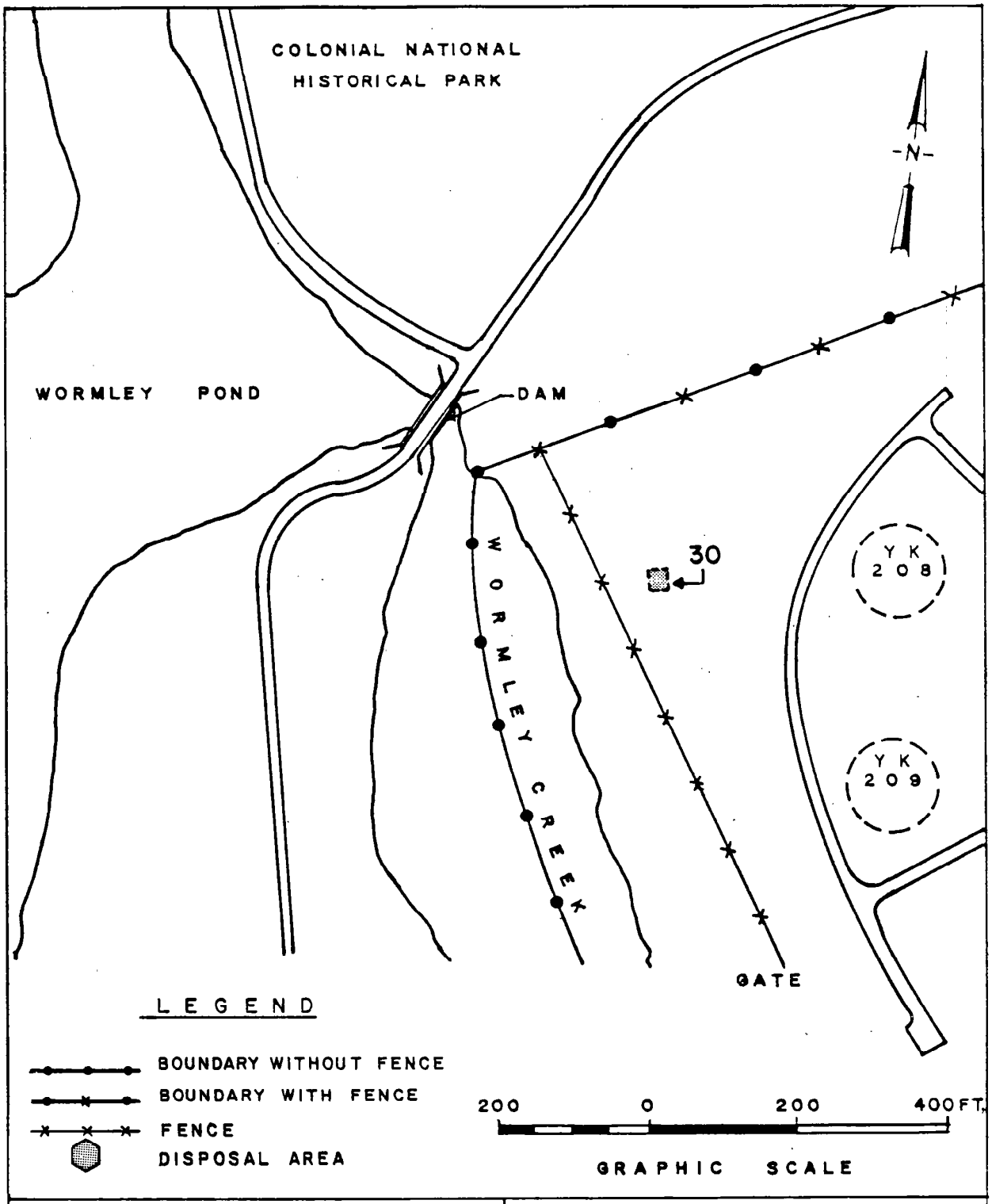

FIGURE 8-13

SITE 30-DISPOSAL AREA WEST OF BUILDING YK 208.

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

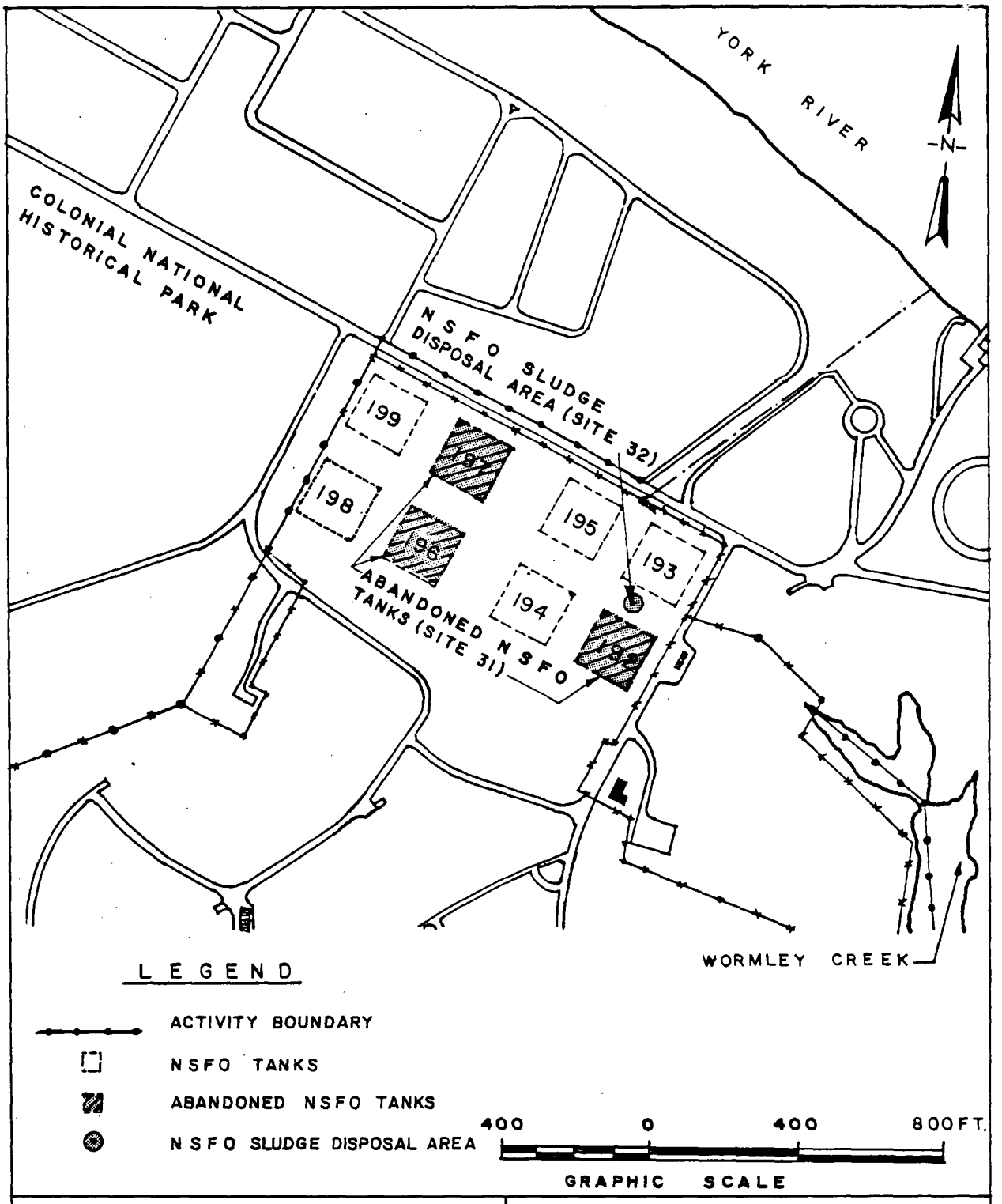

FIGURE 8-14
SITE 31 - ABANDONED NSFO TANKS
SITE 32 - NSFO SLUDGE DISPOSAL AREA

INITIAL ASSESSMENT STUDY
NAVAL SUPPLY CENTER
(NORFOLK)
YORKTOWN FUELS DIVISION

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APPENDIX A

AGENCIES CONTACTED DURING THE IAS

1. NAVENENVSA Information Management Department

2. Naval Facilities Engineering Command Historian, Naval Construction Battalion Center, Port Hueneme, California

3. Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia including:

   (a) Environmental Quality Branch
   (b) Soil Mechanics and Paving Branch
   (c) Installation Planning Division

4. Naval Historical Center, Washington Navy Yard, Washington, D.C.

5. National Archives, Washington, D.C. and Suitland, Maryland

   (a) Cartographic Branch
   (b) Navy and Old Army Branch

6. Washington National Records Center, Suitland, Maryland

7. Ordnance Environmental Support Office, Indian Head, Maryland

8. DOD Explosives Safety Board, Alexandria, Virginia

9. Naval Sea Systems Command, Alexandria, Virginia

10. U.S. Geological Survey, Public Inquiries Office, Reston, Virginia

11. Naval Facilities Engineering Command, Headquarters, Alexandria, Virginia.

12. Federal Property Resource Service of GSA, Arlington, Virginia

13. Defense Mapping Agency, Office of Distribution Services, Washington, D.C.

14. State Water Control Board, Virginia Beach, Virginia

15. Navy Public Works Center, Norfolk, Virginia

APPENDIX B

MONITORING WELL INSTALLATION, CONSTRUCTION AND SAMPLING RECOMMENDATIONS

Well Installation. The wells should be drilled to 15 to 18 feet below the top of the water table. The preferred drilling method utilizes a hollow stem auger with material samples collected at standard intervals (every 5 feet or with every change in formation). Hollow stem auger drilling is preferred because this method does not introduce fluid into the well. The suggested well constructon is described below.

MINIMUM WELL CONSTRUCTION RECOMMENDATIONS

Item	Descriptions
Casing	PVC with nonglue fittings
Minimum casing diameter	Two inches
Screen	PVC wound with nonglue connectors and bottom cap.
Screen length	Continuous slotting from the bottom of the well to the water table.
Gravel pack	2 feet above top of the screen
Bentonite seal	A 2-foot bentonite seal should be placed above the gravel pack.
Grout	6 to 1 bentonite/cement mix to 2 feet below surface. Grout emplaced with a grout pipe. Grout pumped through pipe to the bottom of the open annulus (above the seal).
Protective cover	5-foot length of black iron pipe extending 3 feet above the ground surface and set in cement grout. Pipe diameter must be at least 2 inches greater than casing diameter.

Cap	A secure locking cap should be provided with lock and common key.
Survey	Locations and elevations of all wells should be surveyed.

After the wells are completed, locations and elevations should be surveyed. Detailed well logs should be compiled during drilling. Completion forms should be completed for each well and placed in a permanent file at the installation.

Water Elevations. After surveying well elevations and allowing a suitable time for stabilization, a ground water contour map should be prepared based on water levels measured at the time of sampling. This will allow the determination of ground water flow direction and provide confirmation of upgradient and downgradient well locations.

Sampling Procedures. The depth of the water in each well should be checked prior to sampling. Prior to sampling, each well should be pumped and four to six volumes of water from the well should be removed. A stainless steel bailer should be used to collect the samples. Care should be taken to minimize aeration of the sample. All sampling equipment must be thoroughly cleaned with a final rinse of distilled deionized water between sampling of each well. Sampling and decontamination procedures should meet the U.S. EPA requirements (Scalf, M.R. et al., 1981).

APPENDIX C

TREE SPECIES EXPECTED TO OCCUR IN THE VICINITY OF
NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION

Hardwoods

Beech	*Fagus grandifolia*
Black Cherry	*Prunus serotina*
Black Gum	*Nyssa sylvatica*
Black Locust	*Robinia psuedo-acacia*
Black Walnut	*Juglans nigra*
Dogwood	*Cornus* species
Eastern Redbud	*Cercis canadensis*
Elm	*Ulmus* sp.
Hackberry	*Celtis occidentalis*
Hickory	*Carya* sp.
Holly	*Ilex opaca*
Hop Hornbeam	*Carpinus caroliniana*
Hornbeam	*Ostrya virginiana*
Persimmon	*Diospyros virginiana*
Red Bay	*Persea borbonia*
Red Maple	*Acer rubrum*
Red Mulberry	*Morus rubra*
Red Oak Species	*Quercus rubra*
Sassafrass	*Sassafras albidum*
Sourwood	*Oxydendrum arboreum*
Sweetbay	*Magnolia virginiana*
Sweet Gum	*Liquidambar styraciflua*
Sycamore	*Platanus occidentalis*
Waxmyrtle	*Myrica cerifera*
White Ash	*Fraxinus americana*
White Oak Species	*Quercus alba*
Yellow Poplar	*Liriodendron tulipifera*

Softwoods

Eastern Redcedar	*Juniperus virginiana*
Loblolly Pine	*Pinus taeda*
Virginia Pine	*Pinus virginiana*

APPENDIX D

REPRESENTATIVE MAMMAL, BIRD. REPTILE, AND AMPHIBIAN SPECIES EXPECTED TO OCCUR IN THE VICINITY OF NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION

(A) Game and fur-bearing species indigenous to the installation:

Striped skunk	Mephitis mephitis nigra
Eastern cottontail	Sylvilagus floridanus mallurus
Grey squirrel	Sciurus carolinesis carolinensis
Muskrat	Ondatra zibethicus macrodon
Grey fox	Urocyon cinereoargenteus
White-tail deer	Odocoileus virginianus
Opossum	Didelphis marsupialis virginiana
Red fox	Vulpes fulva fulva
Raccoon	Procyon lotor lotor
Bobcat	Lynx rufus

Land and Shore Birds

Woodcock	Philohela minor
Snipe	Capella gallinago
Mourning dove	Zenaidura macroura
Bobwhite quail	Colinus virginianus

Waterfowl

Canada goose	Branta canadensis
Brant	Branta bernicla
Mallard	Anas platyrhynchos
Black duck	Anas rubripes
Gadwall	Anas strepera
Pintail	Anas acuta

Blue-winged teal	Anas discors
American widgeon	Marcea americana
Shoveler	Spatula clypeata
Wood duck	Aix sponsa
Redhead	Aythya americana
Ring-necked duck	Aythya collaris
Canvasback	Aythya valisineria
Greater scaup	Aythya marila
Lesser scaup	Aythya affinis
Goldeneye	Bucephala clangula
Bufflehead	Bucephala albeola
Oldsquaw	Clangula hyemalis
Common eider	Somateria mollissima
King eider	Somateria spectabilis
White-winged scoter	Melanitta deglandi
Surf scoter	Melanitta perspicillata
Common scoter	Oidemia nigra
Ruddy duck	Oxyura jamaicensis
Hooded merganser	Lophodytes cucullatus
American merganser	Mergus merganser
Red-breasted merganser	Mergus serrator
King rail	Rallus elegans
Clapper rail	Rallus longirostris
Virginia rail	Rail limicola
Sora	Forzana carolina
Common gallinule	Gallinula chloropus
American coot	Fulica americana

(b) Non-Game Species Indigenous to the Installation (Partial listing)

Mammals

Southeastern shrew	Sorex longirostris longirostris
Least shrew	Cryptotis parva parva
Short-tailed shrew	Blarina brevicanda carolinensis

Eastern mole	Scalopus aquaticus aquaticus
Little brown bat	Myotis lucifugus lucifugus
Keen's bat	Myotis keenii septentrionalis
Silver-haired bat	Lasionycteris noctivigans
Eastern pipistrelle	Pipistrellus subflavus subflavus
Big brown bat	Eptesicus fuscus fuscus
Red bat	Lasiurus borealis borealis
Southern flying squirrel	Glaucomys volans volans
Harvest mouse	Reithrodontomys humedis virginianus
White-footed mouse	Peromyscus leucopus leucopus
Rice rat	Oryzomys palustris palustris
Meadow vole	Microtus pennsylvanicus pennsylvanicus
Norway rat	Rattus norvegicus
House mouse	Mus musculus brevirostris

Birds

Flicker	Colaptes auratus
Red-bellied woodpecker	Centurus carolinus
Downy woodpecker	Dendrocopos pubescens
Tree swallow	Iridoprocne bicolor
Blue jay	Cyanocitta cristata
Carolina chickadee	Parus carolinensis
Tufted titmouse	Parus bicolor
White-breasted nuthatch	Sitta carolinensis
House wren	Thryothorus aedon
Carolina wren	Thryothorus ludovicianus
Common crow	Corvus brachyrhynchos
Fish crow	Corvus ossifragus
Ruby-throated hummingbird	Archilochus colubris
Mockingbird	Minus polyglottos
Catbird	Dumetella carolinensis
Brown thrasher	Taxostroma rufum
Robin	Turdus migratorius
Hermit thrush	Hylocichla guttata

Veery	Hylocichla fuscescens
Golden-crowned kinglet	Regulus satrapa
Ruby-crowned kinglet	Regulus calendula
Cedar waxwing	Bombycilla cedrorum
Black and White warbler	Mniotilta varia
Myrtle warbler	Dendroica coronata
Louisiana waterthrush	Seiurus motacilla
Yellowthroat	Geothlypis trichas
American redstart	Setophaga ruticilla
Rusty blackbird	Euphagus carolinus
Common grackle	Quiscalus quiscula
Brown-headed cowbird	Molothrus ater
Cardinal	Richmondena cardinalis
American goldfinch	Spinus tristis
Rufous-sided towhee	Pipilo erythrophthalamus
Savannah sparrow	Passerculus sandwichensis
Field sparrow	Spizella pusilla
White-throated sparrow	Zonotrichia albicollis
Swamp sparrow	Melospiza georgiana
Song sparrow	Melospiza melodia
Brown-headed nuthatch	Sitta pusilla
Brown creeper	Certhia familiaris
Parula warbler	Parula americana
Yellow-throated warbler	Dendroica dominica
Pine warbler	Dendroica pinus
Palm warbler	Dendroica palmarum
Cattle egret	Bubulcus ibis
Snowy egret	Egretta thula
Glossy ibis	Plegadis falcinellus
Louisiana heron	Hydranassa tricolor
Blue-gray gnatcatcher	Polioptila caerulea
White-eyed vireo	Vireo griseus
Great blue heron	Ardea herodias
Little blue heron	Florida caerulea

Fulvous tree duck	Dendrocygna bicolor
Red-tailed hawk	Buteo jamaicensis
Marsh hawk	Circus cyaneus
Sparrow hawk	Falco sparverius
Golden plover	Pluvialis dominica
Buff-breasted sandpiper	Tryngites subruficollis
Common egret	Casmerodius albus
Killdeer	Charadrius vociferus
Herring gull	Larus argentatus
Yellow-bellied sapsucker	Sphyrapicus varius
Eastern kingbird	Tyrannus tyrannus
Purple martin	Progne subis
Starling	Sturnus vulgaris
House sparrow	Passer domesticus
Eastern meadowlark	Sturnella magna
Red-winged blackbird	Agelaius phoeniceus
Slate-colored junco	Junco hyemalis
Wild turkey	Meleagris gallapovo
Ringed-neck pheasant	Pasianus colchicus

Reptiles and Amphibians

Red-backed salamander	Plethodon cinereus cinereus
Slimy salamander	Plethodon glutinosus glutinosus
Eastern spadefoot toad	Scaphiopus holbrooki
Fowler's toad	Bufo woodhousei fowleri
Southern toad	Bufo terrestris
Northern spring peeper	Hyla crucifer crucifer
Pinewoods treefrog	Hyla femoralis
Eastern gray treefrog	Hyla versicolor versicolor
Green treefrog	Hyla cinerea
Upland chorus frog	Pseudacris triseriata feriarum
American frog	Bufo americanus
Snapping turtle	Chelydra serpentina
Stinkpot	Sternothaerus odoratus
Mud turtle	Kinosternon subrubrum subrubrum

Box turtle	Terrapene carolina carolina
Northern diamondback terrapin	Malaclemye terrapin terrapin
Eastern fence lizard	Sceloporus undulatus hyacinthinus
Glass snake lizard	Ophisaurus attenuatus longicaudus
Six-lined racerunner	Cnemidophorus sexlineatus
Five-lined skink	Eumeces fasciatus
Broad-headed skink	Eumeces laticeps
Ground skink	Lygosoma laterale
Eastern ringneck snake	Diadophis punctatus
Eastern garter snake	Thamnophis sirtalis sirtalis
Northern black racer	Coluber constrictor constrictor
Black rat snake	Elaphe obsoleta obsoleta
Eastern kingsnake	Lampropeltis getulus getulus
Southern copperhead	Agkistrodon contortrix contortrix

Fish

Blueback herring	Alosa aestivalis
Alewife	Alosa pseudoharengus
American shad	Alosa sapidissima
Striped anchovy	Anchoa hepsetus
Bay anchovy	Anchoa mitchilli
American eel	Anguilla rostrata
Four spine stickleback	Apeltes quadracus
Silver perch	Bairdiella chrysura
Black sea bass	Centropristic striatus
Banned blenny	Chasmodes bosquianus
Spotted sea trout	Cynoscion nebulosis
Weak fish	Cynoscion regalis
Smallmouth flounder	Etropus microstomus
Cling fish	Gobiesox strumosus
Naked gobie	Gobiosoma bosci
Common american seahorse	Hippocampus hudsonius
Feather blenny	Hypsoblennius hentizi

White catfish	Ictalurus catus
Spot	Leiostomus xanthurus
Pumpkinseed	Lepomis gibbusus
Bluegill	Leopmis macrochirus
Silver side	Menidia menidia
Southern king fish	Menticirrhus americanus
Northern king fish	Menticirrhus saxatilis
Clown goby	Microgobius thalassinus
Croaker	Micropogon undulatus
White perch	Morone americana
Striped bass	Morone saxatilis
Spottail shiner	Notropis hudsonius
Oyster toad	Opsanus tau
Summer flounder	Paralichthys dentatus
Butter fish	Peprilus alepidotus
Yellow perch	Perca flavescens
Winter flounder	Pseudopleuronectes americanus
Northern sea robbin	Prionotus carolinus
Striped sea robbin	Prionotus evolans
Window pane	Scophthalmus aquosus
Northern puffer	Sphoeroides maculatus
Hog choker	Trinectes maculatus
Spotted hake	Urophycis regirs
Largemouth bass	Micropterus salmoides

APPENDIX E

MARSH TYPES AT NAVAL SUPPLY CENTER (NORFOLK) CHEATHAM ANNEX AND YORKTOWN FUELS DIVISION AND THEIR ENVIRONMENTAL CONTRIBUTIONS

(Edited from Guidelines for Activities Affecting Virginia Wetlands)

Type I Saltmarsh Cordgrass Community

a. Average yield 4 tons per acre per annum. (Optimum growth up to 10 tons per acre.)
b. Optimum availability of detritus to the marine environment.
c. Roots and rhizomes eaten by waterfowl and stems used in muskrat lodge construction. Also serves as nesting material for various birds.
d. Deterrent to shoreline erosion.
e. Serves as sediment trap and assimilates flood waters.

Type XII Brackish Water Mixed Community

a. Provides 3-4 tons per acre annually.
b. Wide variety of wildlife foods and habitat.
c. Deterrent to shoreline erosion.
d. Serves as sediment trap and assimilates flood waters.
e. Known spawning and nursery grounds for fish.