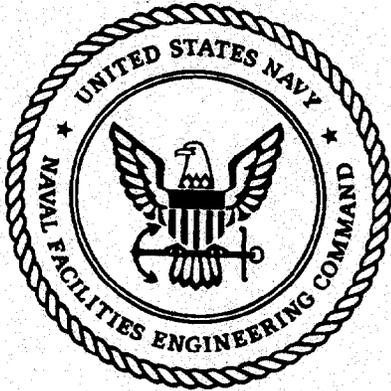


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FINAL REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AND TECHNICAL  
MEMORANDUM 1 GEOLOGIC ASSESSMENT NAS WHITING FIELD FL  
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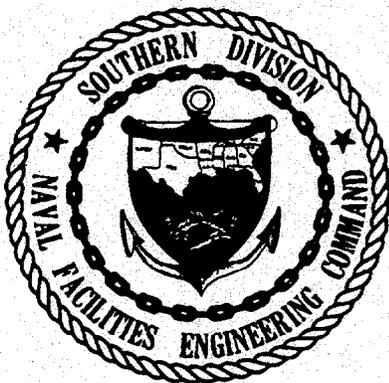
**FINAL**

**REMEDIAL INVESTIGATION AND  
FEASIBILITY STUDY**

**TECHNICAL MEMORANDUM NO. 1  
GEOLOGIC ASSESSMENT**

**NAVAL AIR STATION  
WHITING FIELD  
MILTON, FLORIDA**

**MAY 1992**



**SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
CHARLESTON, SOUTH CAROLINA  
29411-0068**

FINAL  
RELEASE OF THIS DOCUMENT REQUIRES THE  
PRIOR NOTIFICATION OF THE COMMANDING OFFICER  
OF NAVAL AIR STATION WHITING FIELD  
MILTON, FLORIDA

**REMEDIAL INVESTIGATION AND FEASIBILITY STUDY**

**PHASE I**

**NAVAL AIR STATION, WHITING FIELD  
MILTON, FLORIDA**

**Technical Memorandum No. 1  
Geologic Assessment**

**UIC: N60508**

**Contract No. N62467-88-C-0382**

**Prepared by:**

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**May 1992**

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## GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ASTM	American Society for Testing and Materials
AVGAS	aviation gasoline
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/sec	centimeter per second
CFR	Code of Federal Regulations
ES&E	Environmental Science and Engineering
FDER	Florida Department of Environmental Regulation
GTGS	Geotechnical Graphics Software™
HRS	Hazard Ranking System
IAS	Initial Assessment Study
ID	inner diameter
IR	Installation Restoration
msl	mean sea level
NAS	Naval Air Station
NCP	National Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NGVD	National Geodetic Vertical Datum
NPL	National Priorities List
OVA	organic vapor analyzer
PA	Preliminary Assessment
PCBs	polychlorinated biphenyls
PCPT	piezocone penetrometer
PVC	polyvinyl chloride
RI/FS	Remedial Investigation and Feasibility Study
SARA	Superfund Amendments Reauthorization Act
SI	Site Inspection
SOUTHNAVFACENCOM	Southern Division, Naval Facilities Engineering Command
SPT	standard penetration test
TRAWING FIVE	Training Air Wing Five
USEPA	U.S. Environmental Protection Agency
UST	underground storage tanks
VOC	volatile organic compound

## 1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), under contract to the Department of Navy, is submitting Technical Memorandum No. 1 for the Phase I Remedial Investigation and Feasibility Study (RI/FS) for Naval Air Station (NAS) Whiting Field located in Milton, Florida, to the Department of Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM). The RI/FS is being conducted under contract number N62467-88-C-0382.

Technical Memorandum No. 1, Geologic Assessment, is the first in a series of six technical memoranda that summarizes the results and transmits data gathered during the Phase I RI. The Phase I RI field program was carried out during the period December 1990 to May 1991. These technical memoranda form the supporting basis for scoping a Phase II RI Sampling and Analysis Plan for NAS Whiting Field.

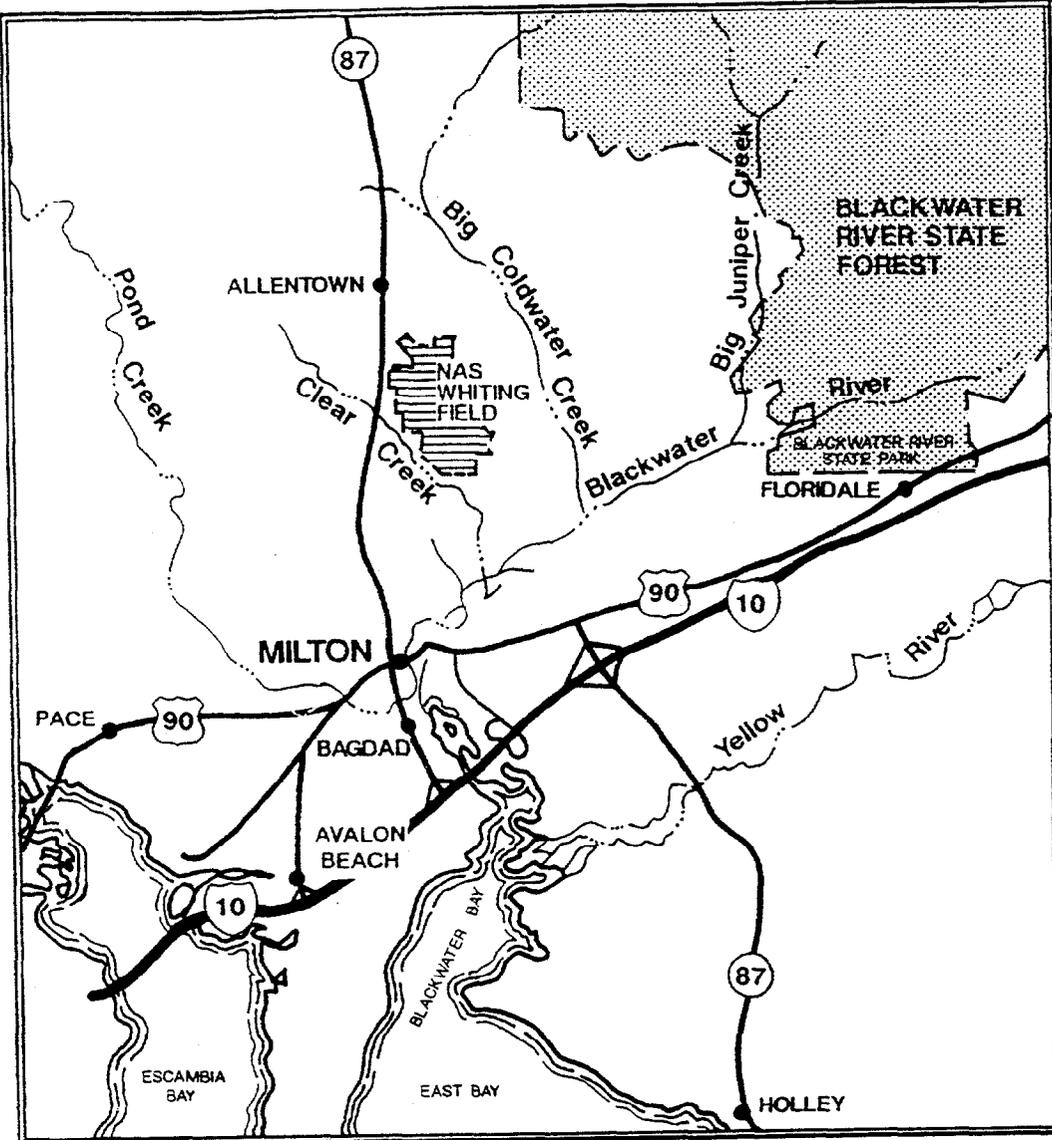
NAS Whiting Field is located in Florida's northwest coastal area approximately 7 miles north of Milton and 20 miles northeast of Pensacola (Figure 1-1). NAS Whiting Field presently consists of two air fields separated by an industrial area and covers approximately 2,560 acres in Santa Rosa County. Figure 1-2 presents the installation layout.

NAS Whiting Field, home of Training Air Wing Five (TRAWING FIVE), was constructed in the early 1940's. It was commissioned as the Naval Auxiliary Air Station Whiting Field in July 1943 and has served as a naval aviation training facility ever since. The field's mission has been to train student naval aviators in basic instruments, formation and tactic phases of fixed-wing, and propeller-driven aircraft, and in the basic and advanced portions of helicopter training.

NAS Whiting Field lies within the Western Highlands physiographic division of Santa Rosa County in the Coastal Plain Province. The Western Highlands are characterized by a well drained, southward sloping, plateau with numerous streams. Land surrounding NAS Whiting Field primarily consists of agricultural land to the northwest, residential and forested areas to the south and southwest, and forested land around the remaining boundaries. This land use distribution is shown in Figure 1-3.

Located on an upland area, elevations at Whiting Field range from 150 to 190 feet above sea level. The facility is bounded by low-lying receiving waters; Clear Creek to the west and south and Big Coldwater Creek to the east. These two streams are tributaries of the Blackwater River, which discharges to the estuarine waters of the East Bay of the Escambia Bay coastal system.

1.1 PURPOSE AND BACKGROUND. The purpose of the NAS Whiting Field RI/FS is to identify a range of remedial alternatives to address any identified risks to public health and the environment posed by toxic or hazardous chemicals present as a result of past waste disposal practices or spills. To achieve this objective, the RI must collect data sufficient to assess the nature and distribution of chemicals associated with each site. The data collected in the RI will be used in the FS to screen, evaluate, and select remedial alternatives to provide permanent, feasible solutions to environmental contamination problems at NAS Whiting Field.



**SITE MAP**



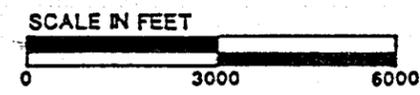
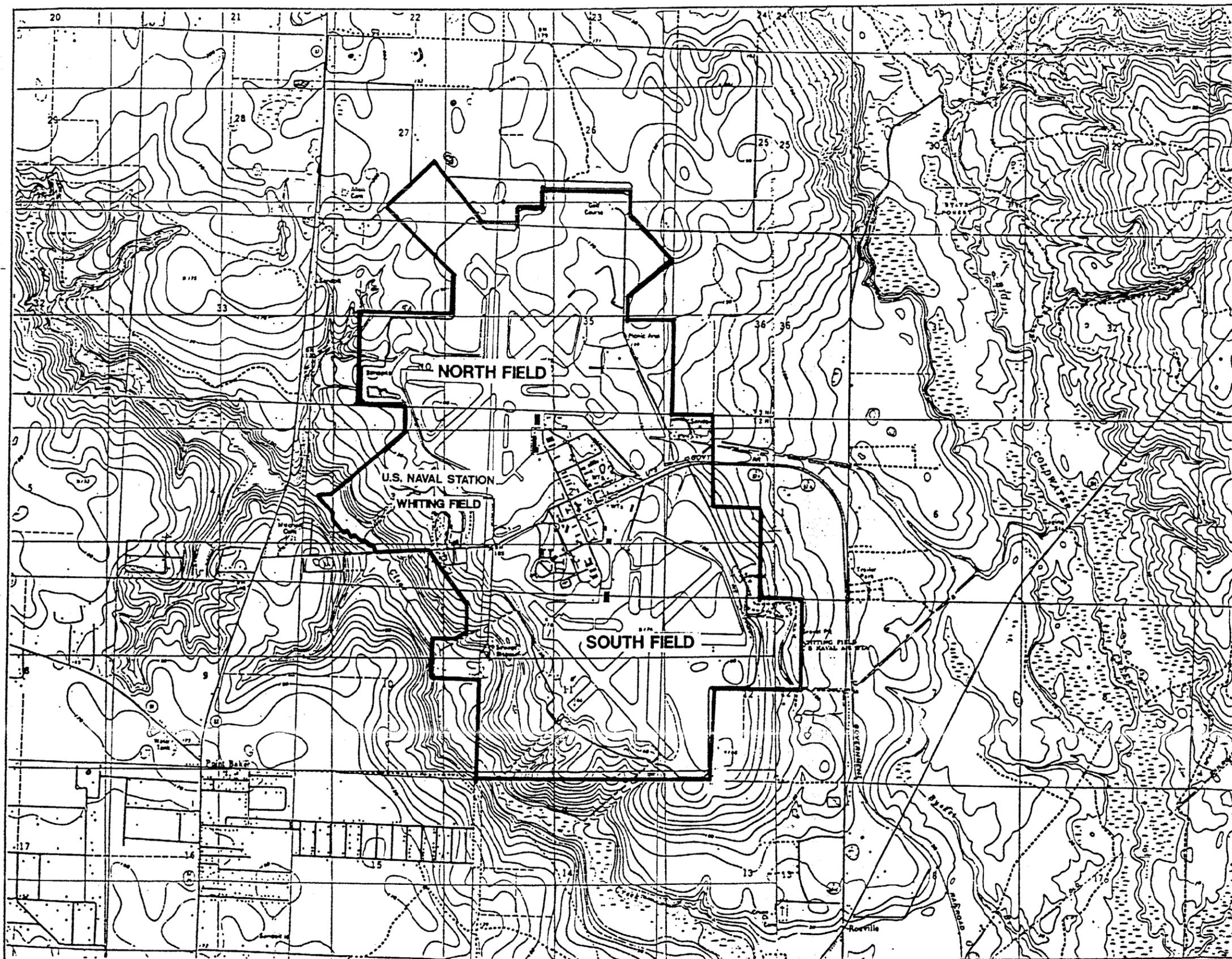
**MAP LOCATION**

SOURCE: ABB ENVIRONMENTAL SERVICES, INC., 1991

**FIGURE 1-1  
FACILITY LOCATION MAP**



**RI/FS PROGRAM  
NAS WHITING FIELD  
MILTON, FLORIDA**

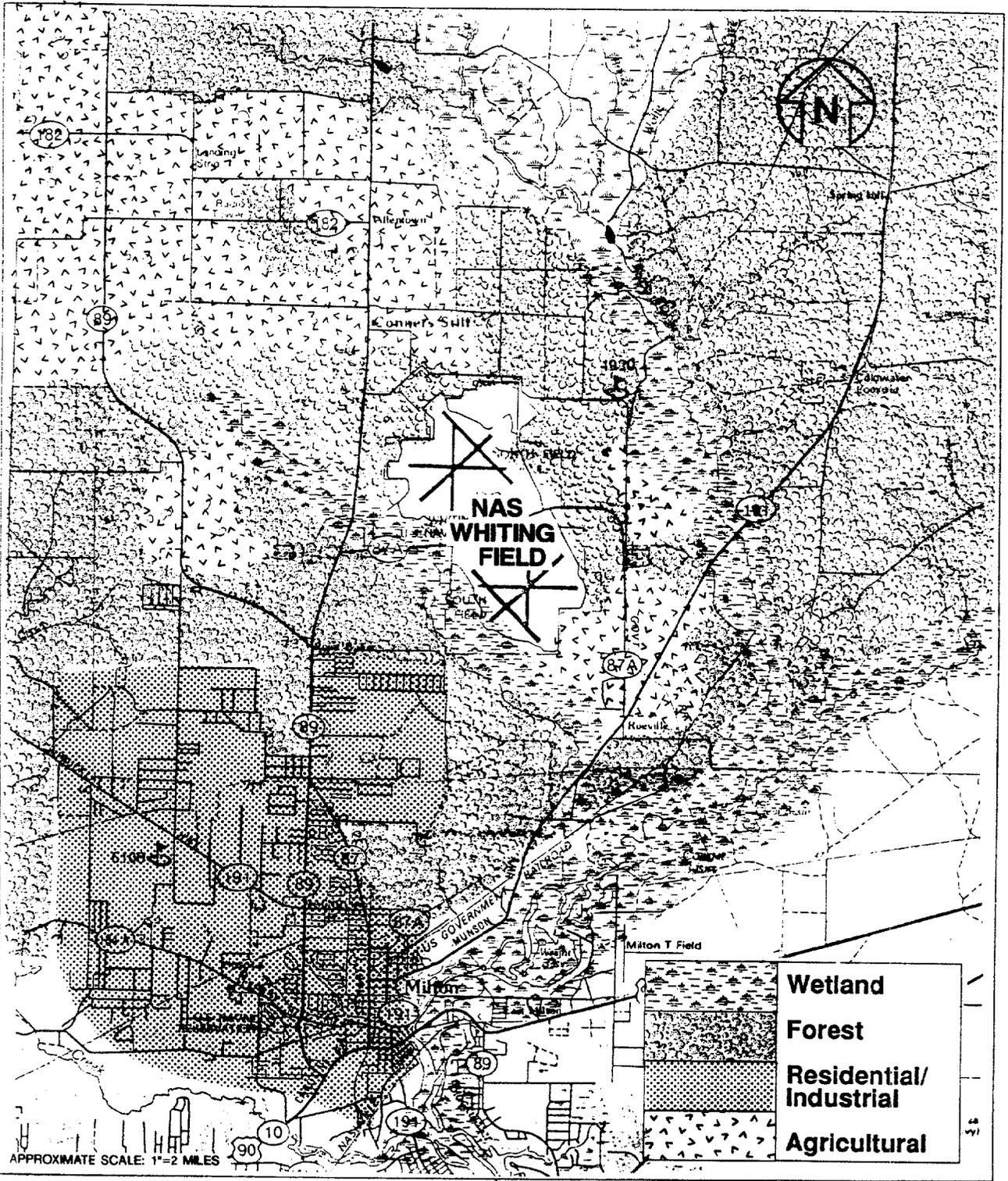


SOURCE:  
USGS QUADRANGLE MILTON NORTH, FLORIDA  
PHOTOREVISED 1987  
AND USGS QUADRANGLE HAROLD, FLORIDA 1973.

FIGURE 1-2  
NAS WHITING FIELD



RI/FS PROGRAM  
NAS WHITING FIELD  
MILTON, FLORIDA



**FIGURE 1-3**  
**Land Use Distribution in the**  
**Vicinity of NAS Whiting Field**



**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**

The Navy Installation Restoration (IR) program was designed to identify and abate or control contaminant migration resulting from past operations at Naval installations. The IR program is the Navy response authority under Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and Executive Order 12580. CERCLA requires that Federal facilities comply with the act, both procedurally and substantively. SOUTHNAVFACENGCOM is the agency responsible for the Navy IR program in the Southeastern United States. Therefore, SOUTHNAVFACENGCOM has the responsibility to process NAS Whiting Field through Preliminary Assessment (PA), Site Inspection (SI), priority listing, RI/FS, and remedial response selection in compliance with the guidelines of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300].

Section 105(a)(8)(A) of SARA required the U.S. Environmental Protection Agency (USEPA) to develop criteria in order to set priorities for remedial action based on relative risk to public health and the environment. To meet this requirement, USEPA has established the Hazard Ranking System (HRS) as Appendix A to the NCP. The HRS is a scoring system designed to assess relative threat due to documented or potential releases at a site. First promulgated in 1982, the HRS was amended in December 1990, effective March 14, 1991 (55 Federal Register No. 241:51532-51667), to comply with requirements of Section 105(c)(1) of SARA to increase the accuracy of the assessment of relative risk. The newly promulgated HRS II has been substantially revised and is designed to prioritize sites after the SI phase of the CERCLA process. The SI or extended SI is used to present the required data to expeditiously perform an HRS II ranking. At NAS Whiting Field, the SI was conducted as a Contamination Study, Verification Phase.

The RI/FS conducted at NAS Whiting Field is a component of the Navy IR program. The preliminary HRS score for NAS Whiting Field indicates that it may qualify for the National Priorities List (NPL). As such, the RI/FS for NAS Whiting Field follows the requirements of the NCP, as amended by SARA, and guidance for conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, October 1988).

Prior to the implementation of the Phase I RI/FS Program, a PA and two sampling and analysis programs had been conducted at NAS Whiting Field. The PA, conducted as an Initial Assessment Study (IAS), was performed by Envirodyne Engineers in 1984 and published in 1985 (Envirodyne Engineers, 1985). Based on historical data, aerial photographs, field inspections, and personnel interviews, 16 disposal or spill sites of potential contamination and/or contaminant migration were initially identified at NAS Whiting Field by the IAS team. These are sites where waste disposal or accidents have occurred in the past.

The May 1985 IAS concluded that 15 of the 16 sites warranted further investigation, under the Navy's IR Program, to assess potential long-term impacts. Only Site 2, the Northwest Open Disposal Area, was judged to not warrant further consideration. A Confirmation Study, including sampling and monitoring of the sites, was recommended to confirm or deny the existence of the suspected contamination and to quantify the extent of any problems that may exist. The results of the Confirmation-Verification Study would then be used to evaluate the necessity of conducting mitigating actions or cleanup operations.

In November 1985, Geraghty & Miller, Inc., prepared for the Navy a plan of action entitled *Naval Assessment and Control of Installation Pollutants, Verification Study, NAS Whiting Field*, which was subsequently submitted to the Florida Department of Environmental Regulation (FDER). This plan contained details of the proposed scope of work for the Verification Study. During discussion with FDER in December 1985, two additional sites (17 and 18) were added to the Verification Study. Both were active sites at that time where waste oils and fuels were burned in firefighting training exercises.

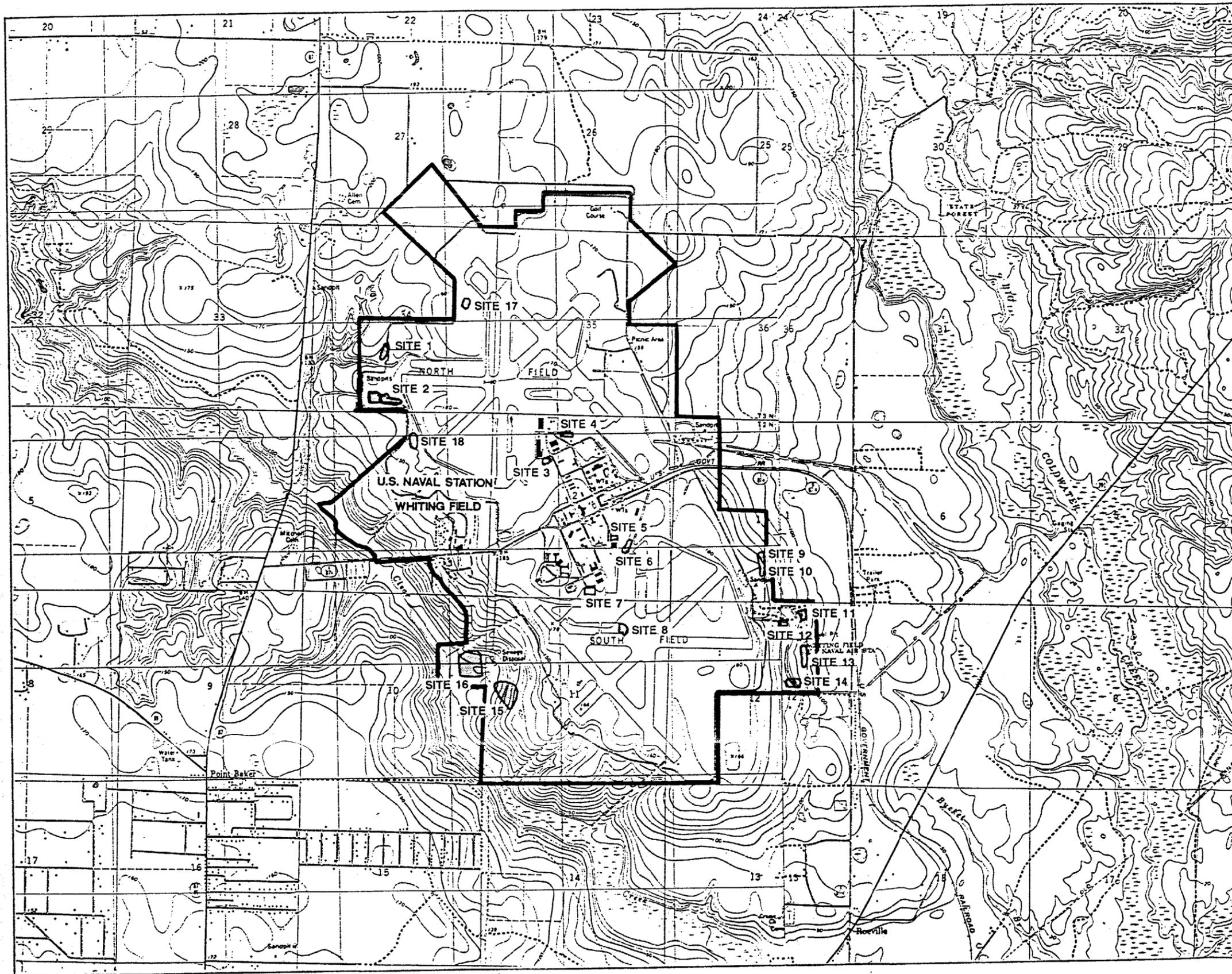
In addition, during 1985 one of the sites (Site 5, Battery Acid Seepage Pit) was investigated under a Consent Order with the FDER. Data from this investigation has been compiled in a report entitled *Detection and Monitoring Program, Battery Shop Site, NAS Whiting Field, Florida* (Geraghty & Miller, November 1985a).

The location of the 18 sites are shown in Figure 1-4. Each of the sites was evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors. Table 1-1 summarizes the information collected on these sites.

Work conducted during the course of the Verification Study began with the collection and assimilation of existing data and literature pertinent to the project and included the findings from the IAS. The field work was performed in May and June of 1986. Sixteen monitor wells were installed at locations around the facility. One surface water, 16 groundwater, and 46 soil samples were then collected for chemical analyses.

Historical records indicate that throughout the years of operation, NAS Whiting Field has generated a variety of wastes related to pilot training, the operation and maintenance of aircraft along with ground support equipment, and the station's facility maintenance activities. Prior to the establishment of hazardous waste management programs and programs to recycle waste oil, most of the hazardous wastes were reportedly disposed of onsite. Waste materials were disposed either in dumpsters that were emptied into onsite disposal areas or they went into waste oil bowlers, which probably were used for firefighting training. Envirodyne Engineers (1985) estimated that thousands of gallons of wastes including waste paints, paint thinners, solvents, waste oils, waste gasoline, hydraulic fluids, aviation gasoline (AVGAS), tank bottom sludges, polychlorinated biphenyls (PCBs) transformer fluids, and paint stripping wastewater were potentially dumped into onsite disposal areas. These disposal areas consisted of natural or man-made depressions located within the confines of the air station. In addition to the waste materials routinely disposed of onsite in the disposal areas, additional materials were reportedly released onsite as the result of accidents or equipment failure.

The results of the Verification Study reported to SOUTHNAVFACENGCOCM by Geraghty & Miller (*Verification Study: Assessment of Potential Ground-Water Pollution at Naval Air Station Whiting Field*, December 1986) provided an incomplete assessment of the physical as well as the chemical conditions currently existing at NAS Whiting Field. Groundwater contamination was detected at some sites and not at others. The study concluded that many of the monitoring wells were not located downgradient of the intended study site and that additional work was needed to characterize the hydrogeologic conditions and the chemical contamination condi-



SOURCE:  
 USGS QUADRANGLE MILTON NORTH, FLORIDA  
 PHOTOREVISED 1987  
 AND USGS QUADRANGLE HAROLD, FLORIDA 1973.

**FIGURE 1-4**  
**Location of Sites at**  
**NAS Whiting Field**



**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**

**Table 1-1 (Continued)**  
**Summary of Potential Disposal Sites**

Technical Memorandum No. 1  
 NAS Whiting Field  
 Milton, Florida

Site No.	Site Name and Type	Location	Period of Operation	Types of Material Disposed	Comments
1	Northwest Disposal Area (landfill)	North Field, west side	1943-1965	Refuse, waste paints, thinners, solvents, waste oils, and hydraulic fluids.	Secondary disposal area during this period; site covers 5 acres.
2	Northwest Open Disposal Area (landfill)	North Field, west side	1976-1984	Construction and demolition debris, tires, and furniture.	Former borrow pit location, commonly referred to as the "Wood Dump."
3	Underground Waste Solvent Storage Area (tank)	North Field, south of Building 2941	1980-1984	Waste solvents, paint stripping residue, and 120-gallon spill.	Wastes generated by paint stripping operations.
4	North AVGAS Tank Sludge Disposal Area	North Field, north of Tow Lane	1943-1968	Tank bottom sludge containing tetraethyl lead.	Sludge disposal in shallow holes near tanks.
5	Battery Acid Seepage Pit (contaminated soil)	South Field, near Building 1478	1964-1984	Waste electrolyte solution containing heavy metals and waste battery acid.	Pits located 110 feet from potable supply well (W-S2).
6	South Transformer Oil Disposal Area (contaminated soil)	South Field, Building 1478	1940's-1960's	PCB-contaminated dielectric fluid.	Disposal in "0-2" drainage ditch.
7	South AVGAS Tank Sludge Disposal Area (landfill and tanks)	South Field, west of Building 1406	1943-1968	Tank bottom sludge containing tetraethyl lead.	Sludge disposed in shallow holes near tanks.
8	AVGAS Fuel Spill Area (contaminated soil)	South Field, south of Building 1406	Summer 1972	AVGAS containing tetraethyl lead.	Fuel spill of about 25,000 gallons on an area of about 2 acres.
9	Waste Fuel Disposal Pit (landfill)	South Field, east side	1950's-1960's	Waste AVGAS containing tetraethyl lead.	Fuel disposed in former borrow pit.
10	Southeast Open Disposal Area (A) (landfill)	South Field, southeast area	1965-1973	Construction and demolition debris, waste solvents, paint, oils, hydraulic fluid, PCBs, pesticides, and herbicides.	Secondary disposal area during this period; site covers about 4 acres.

See notes at end of table.

**Table 1-1 (Continued)  
Summary of Potential Disposal Sites**

Technical Memorandum No. 1  
NAS Whiting Field  
Milton, Florida

Site No.	Site Name and Type	Location	Period of Operation	Types of Material Disposed	Comments
11	Southeast Open Disposal Area (B) (landfill)	South Field, southeast area	1943-1970	Construction and demolition debris, waste solvents, paint, oils, hydraulic fluid, and PCBs.	Secondary disposal area during this period; site covers about 3 acres.
12	Tetraethyl Lead Disposal Area (waste pile)	South Field, southeast area	May 1, 1968	Tank bottom sludge and fuel filters contaminated with tetraethyl lead.	Disposal area posted with warning; site consists of two earth covered mounds; 25 foot by 25 foot area.
13	Sanitary Landfill (landfill)	South Field, southeast area	1979-1984	Refuse, waste solvents, paint, hydraulic fluids, and asbestos.	Primary sanitary landfill, potentially received hazardous wastes the first year of operation.
14	Short-Term Sanitary Landfill (landfill)	South Field, southeast area	1978-1979	Refuse, waste solvents, oils, paint, and hydraulic fluids.	Primary sanitary landfill for brief period; relocated due to drainage problems.
15	Southwest Landfill (landfill)	South Field, southwest area	1965-1979	Refuse, waste paints, oils, solvents, thinners, asbestos, and hydraulic fluid.	Primary landfill for this time period; covers about 15 acres.
16	Open Disposal and Burning Area (landfill)	South Field, southwest area	1943-1965	Refuse, waste paints, oils, solvents, thinners, PCBs, and hydraulic fluid.	Primary disposal area for this time period; covers about 10 acres.
17	Crash Crew Training Area (contaminated soil)	North Field, west side	1951-Present	JP-4.	Waste fuels and some solvents ignited, then extinguished.
18	Crash Crew Training Area (contaminated soil)	North Field, west side	1951-Present	JP-4.	Waste fuels and some solvents ignited, then extinguished.

Notes: AVGAS = aviation gasoline.  
PCB = polychlorinated biphenyls.

tions that exist at NAS Whiting Field. The Verification Study is the former IR program counterpart to the SI.

Of the 18 sites identified to date, 13 are scheduled for further study under the Navy's IR program. Due to the fact that it only received construction and demolition debris, Site 2, the Northwest Open Disposal Area, was judged to warrant no further consideration early in the IR program. Site 5, the Battery Acid Seepage Pit, was extensively studied in 1985 (Geraghty & Miller, 1985a) in response to an FDER Consent Order (84-0253). Results indicated no significant contamination resulting from past activities at the Battery Acid Shop and the Consent Order was recommended to be rescinded on April 15, 1987. However, the presence of benzene in the existing monitoring wells surrounding the seepage pit warrants further consideration. As such, the investigation of benzene contamination around Site 5 is coupled with the field and laboratory investigation proposed for production well W-S2. Sites 4, 7, and 8 are slated for investigation and remediation, if necessary, under the Navy's Underground Storage Tank (UST) program and, therefore, are not incorporated in the Navy's IR program. Table 1-2 presents a summary of past and projected investigative programs for the 18 sites within the RI/FS and UST programs.

The Jordan Phase I RI Workplan (June 1990) provides a summary of the regional and installation-specific environmental setting, current and historical industrial operations, and summary of the verification study and the Site 5, Battery Shop data, which will not be repeated in the technical memorandum. As appropriate, data from these sources will be incorporated into the assessment.

**1.2 OBJECTIVES OF GEOLOGIC INVESTIGATION.** The objectives of the RI Phase I geologic investigation and assessment included the following:

- characterizing the soils of the vadose and saturated zones underlying the installation,
- installing piezometers and observation wells to support aquifer testing in the Industrial Area of NAS Whiting Field,
- installing upgradient monitoring wells for background characterization and to confirm groundwater flow direction,
- providing a qualitative guide for lithologic correlation to govern additional subsurface exploration, and
- determining whether a continuous subsurface confining clay layer is present throughout NAS Whiting Field.

Several subsurface exploration techniques were used to evaluate and characterize the stratigraphy at the installation. Exploration techniques included: soil boring, monitoring well and piezometer installation, borehole geophysics, and piezocone penetrometer (PCPT) soundings. Details and results of the geologic investigation are presented in the following sections. Geologic information from the soil borings drilled for the monitoring well and piezometer installation provides support for the hydrogeologic assessments presented in Technical Memorandum No. 2.

**Table 1-2  
Summary of Site Investigations**

Technical Memorandum No. 1  
NAS Whiting Field  
Milton, Florida

Site Number	Site Name	Previous Studies			Ongoing RI/FS	Navy's UST Program
		IAS	Verification Study	Consent Order		
1	Northwest Disposal Area	*	*		*	
2	Northwest Open Disposal Area	*				
3	Underground Waste Solvent Storage Area	*	*		*	
4	North AVGAS Tank Sludge Disposal Area	*	*			*
5	Battery Acid Seepage Pit	*		*		
6	South Transformer Oil Disposal Area	*	*		*	
7	South AVGAS Tank Sludge Disposal Area	*	*			*
8	AVGAS Fuel Spill Area	*	*			*
9	Waste Fuel Disposal Pit	*	*		*	
10	Southeast Open Disposal Area (A)	*	*		*	
11	Southeast Open Disposal Area (B)	*	*		*	
12	Tetraethyl Lead Disposal Area	*	*		*	
13	Sanitary Landfill	*	*		*	
14	Short-Term Sanitary Landfill	*	*		*	
15	Southwest Landfill	*	*		*	
16	Open Disposal and Burning Area	*	*		*	
17	Crash Crew Training Area		*		*	
18	Crash Crew Training Area		*		*	

Notes: IAS = Initial Assessment Study.  
RI/FS = Remedial Investigation/Feasibility Study.  
UST = underground storage tank.  
AVGAS = aviation gasoline.

## 2.0 FIELD PROGRAM SUMMARY

2.1 SOIL BORINGS, MONITORING WELL, AND PIEZOMETER INSTALLATION. Six monitoring wells (WHF-3-3, WHF-9-2, WHF-11-2, WHF-16-2, WHF-5-OW-1, and WHF-5-OW-2) and two piezometers (WHF-5-PZ-1 and WHF-5-PZ-2) were installed between November 1990 and March 1991 by Williams and Associates of Clearwater, Florida, under the supervision of an ABB-ES geologist. The monitoring wells and piezometers were installed at Sites 3, 5, 9, 11, and 16 to obtain geologic and hydrogeologic data for the characterization of the lithology and aquifer system. Details of the well installations and subsurface exploration program are presented in the Sampling and Analysis Plan (Jordan, 1990), which is Volume II of the NAS Whiting Field RI/FS Workplan.

The mud rotary wash drilling technique was used to advance the borehole for monitoring well and piezometer installation. Standard penetration tests (SPT) were conducted at 5-foot intervals and at stratigraphic changes throughout the overburden boring. A 2-foot long, split-spoon sampler (capable of collecting a 1.5-foot soil sample) was used to collect soil samples during the SPT. An ABB-ES geologist logged the soil lithology in the drilling fieldbook for each split-spoon sample collected. Soil samples were screened onsite for volatile organic compound (VOC) contamination using an organic vapor analyzer (OVA). OVA results are presented in Appendix A on the boring logs for each of the wells and piezometers. Also in Appendix A are logs of the wells installed during the Verification Study by Geraghty and Miller (1986).

Total depth of the monitoring wells and piezometers installed ranged from 70 to 175 feet below land surface (bls). Monitoring well and piezometer construction details are summarized in Table 2-1 and are graphically displayed on the boring logs in Appendix A.

Where a confining or semi-confining clay layer was confirmed to be present during advancement of the monitoring well boreholes, a Shelby™ tube sample was collected within this upper clay layer. A total of four Shelby™ tube samples were collected; one each from boreholes for monitoring wells WHF-3-3, WHF-5-OW-1, WHF-9-2, and WHF-11-2. Samples were taken to Williams and Associates geotechnical laboratory for measurement of vertical permeability.

Shelby™ tube samples were collected in accordance with American Society for Testing and Materials (ASTM) Designation: D1587-83, *Standard Practice for Thin-Walled Tube Sampling of Soils*. Test method and calculations were based on *Laboratory Falling Head Parameter* (Lambe and Whitman, 1969).

Shelby™ tube sampling intervals and permeability rates are summarized in Table 2-2. The sample with the highest permeability ( $1.19 \times 10^{-5}$  centimeters per second [cm/sec]) was collected from WHF-11-2 and lowest permeability ( $9.26 \times 10^{-9}$  cm/sec) was from WHF-5-OW-1. The calculated permeabilities fall within the range typically found in clayey sand to clay sediments ( $10^{-4}$  to  $10^{-9}$  cm/sec; Fetter, 1980), which is representative of soils collected at the four locations.

Double-cased wells and piezometers were installed at Sites 3, 5, 9, and 11. To prevent interconnection of any perched water or the surficial aquifer with the sand-and-gravel aquifer below the clay, an outer casing was installed into the

**Table 2-1**  
**Monitoring Well and Piezometer Construction Details**

Technical Memorandum No. 1  
NAS Whiting Field  
Milton, Florida

Site Number (see Table 1-1)	Well or Piezometer Number	Total Depth (feet bls)	Screen Interval (feet bls)	Surface Casing Total Depth (feet bls)
<b>Monitoring wells</b>				
3	WHF-3-3	151	146-151	118
9/10	WHF-9-2	120	115-120	85
11/14	WHF-11-2	125	120-125	80
15/16	WHF-16-2	70	65-70	Not installed
5	WHF-5-OW-1	175	170-175	126
5	WHF-5-OW-2	123	118-123	126
<b>Piezometers</b>				
5	WHF-5-PZ-1	134	133-134	126
5	WHF-5-PZ-2	150	149-150	126

Note: bls = below land surface.

**Table 2-2**  
**Summary of Shelby™ Tube Collection and Analysis**

Technical Memorandum No. 1  
NAS Whiting Field  
Milton, Florida

Sample Number	Sample Depth (feet bls)	Permeability Rate Falling Head (cm/sec)
WHF-3-3	111.5 to 112.7	$3.9 \times 10^{-6}$
WHF-5-OW-1	122.0 to 124.0	$9.26 \times 10^{-9}$
WHF-9-2	82.0 to 83.6	$2.62 \times 10^{-7}$
WHF-11-2	77.0 to 79.0	$1.19 \times 10^{-5}$

Notes: bls = below land surface.  
cm/sec = centimeter per second.

clay layer that was identified during the SPTs. The outer casing was installed several feet into the clay layer. No clay layer was present at Site 16. The outer casing at Sites 3, 9, and 11 was constructed of 8-inch, Schedule 40 polyvinyl chloride (PVC) and 8-inch steel casing at Site 5. Due to geologic complications, steel casing was used at Site 5 so it could be driven through the swelling clays and sloughing sands and gravels encountered in the borehole.

The monitoring well inner casing was constructed of 4-inch, flush threaded, Schedule 40 PVC. The well screen consisted of a 5-foot section of No. 10 (0.01-inch) matching-slotted screen. The annulus around the screen was filled with 20/30 grade silica sand to a maximum of 2 feet above the screen followed by 2 feet of bentonite slurry. A mixture of Portland Type I cement and bentonite was tremie grouted into the remaining annular space to the ground surface to prevent leakage down the borehole.

An aboveground protective steel casing was installed and cemented into the ground over each well riser. The steel casing is equipped with locking covers and brass padlocks. A concrete pad with four steel posts at the corners was placed around the protective casing to prevent surface runoff from entering the borehole and to protect the well from vehicular traffic.

Piezometers at Site 5 were constructed of 1.5-inch, inner diameter (ID) Schedule 40 PVC. The piezometer screen (0.01-inch slots) was 1-foot long and covered with a filter sock. The steel outer casing was 4 inches ID. The remaining construction details (e.g., sandpack and bentonite seal) are identical to the monitoring wells.

**2.2 BOREHOLE GEOPHYSICS.** Natural gamma and epithermal neutron geophysical logging was conducted on November 6 and 7, 1990, by Environmental Science and Engineering, Inc. (ES&E), of Tampa, Florida, and supervised by an ABB-ES geologist.

The geophysical logging was conducted on 16 existing monitoring wells at NAS Whiting Field. Four monitoring wells at Site 5 were not logged due to the presence of dedicated groundwater sampling devices in the wells.

The geophysical logs were used for lithologic correlation and to aid in determining the depth and areas of interest for additional subsurface explorations. Specifically, the depth to clay layers or lenses was initially defined by geophysical logs and correlated to the PCPT explorations and soil borings. These logs are contained in Appendix B.

**2.3 PIEZOCONE PENETROMETER (PCPT) EXPLORATIONS.** A PCPT exploration program was conducted at NAS Whiting Field to provide downgradient stratigraphic data at each site. A total of 35 piezocone soundings were conducted by Williams and Associates at 13 sites and in a radial pattern in the area of the south and west production wells. Depths of the piezocone soundings are summarized in Table 2-3. Locations of the PCPT explorations are shown in Figures 2-1 through 2-6.

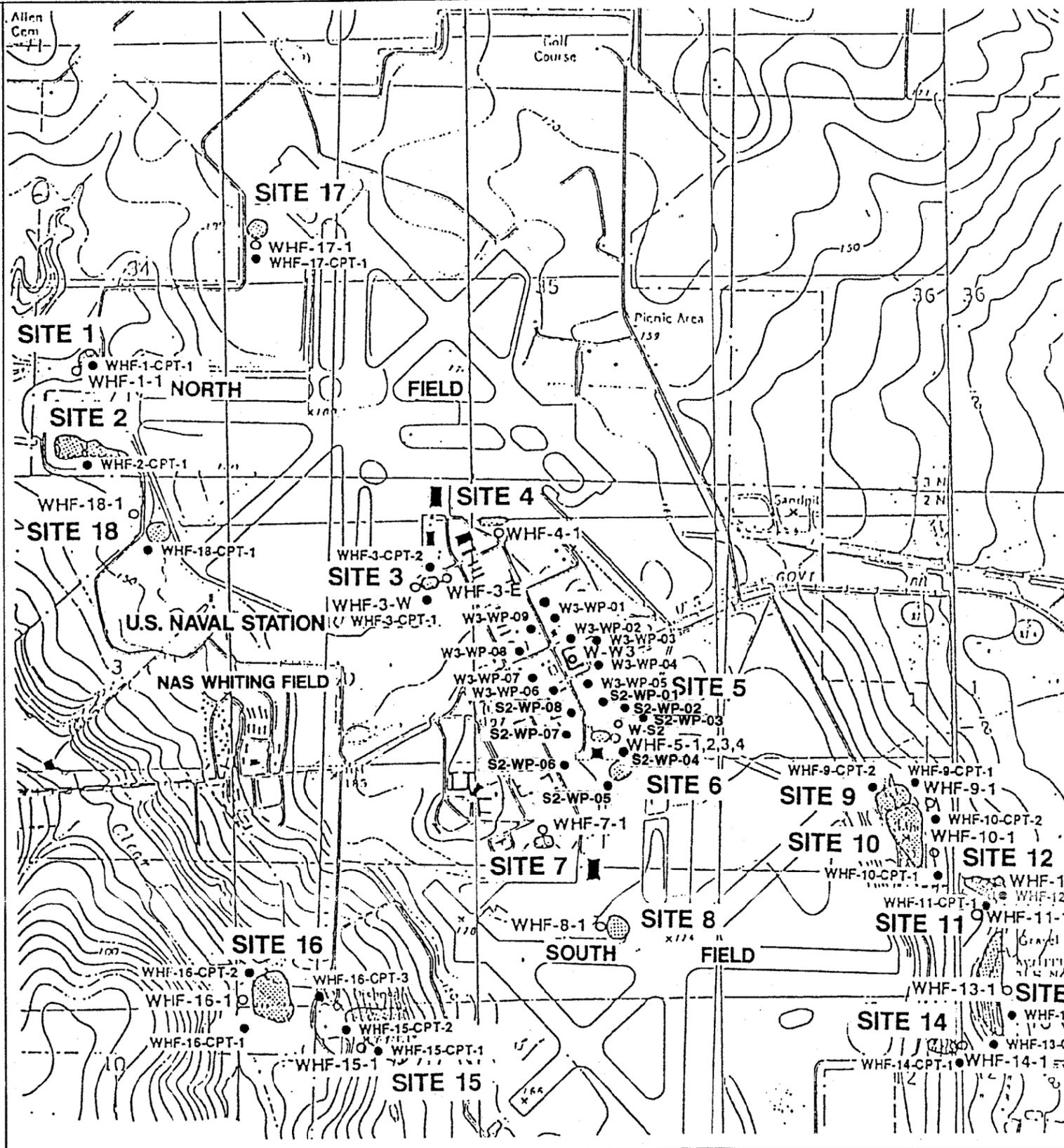
PCPT explorations were performed in accordance with ASTM Designation: D3441-86 *Standard Test Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soils*. Specifically, a stainless-steel cone tip (equipped with elec-

**Table 2-3  
Summary of Piezocone Penetrometer (PCPT) Sounding Depths  
RI Phase I**

Technical Memorandum No. 1  
NAS Whiting Field  
Milton, Florida

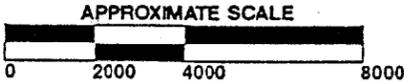
PCPT Sounding	Total Depth (feet bls)	PCPT Sounding	Total Depth (feet bls)
WHF-1-CPT-1	138	WHF-S2-WP-01	144
WHF-2-CPT-1	152	WHF-S2-WP-02	116
WHF-3-CPT-1	103	WHF-S2-WP-03	138
WHF-3-CPT-2	100	WHF-S2-WP-04	157
WHF-9-CPT-1	100	WHF-S2-WP-05	133
WHF-10-CPT-1	123	WHF-S2-WP-06	168
WHF-10-CPT-2	100	WHF-S2-WP-07	157
WHF-11-CPT-1	100	WHF-S2-WP-08	133
WHF-12-CPT-1	107	WHF-W3-WP-01	118
WHF-13-CPT-1	130	WHF-W3-WP-02	120
WHF-13-CPT-2	130	WHF-W3-WP-03	140
WHF-14-CPT-1	153	WHF-W3-WP-04	140
WHF-15-CPT-1	98	WHF-W3-WP-05	132
WHF-15-CPT-2	100	WHF-W3-WP-06	156
WHF-16-CPT-1	80	WHF-W3-WP-07	132
WHF-16-CPT-2	80	WHF-W3-WP-08	124
WHF-17-CPT-1	165	WHF-W3-WP-09	113
WHF-18-CPT-1	178		

Notes: PCPT = piezocone penetrometer test.  
bls = below land surface.



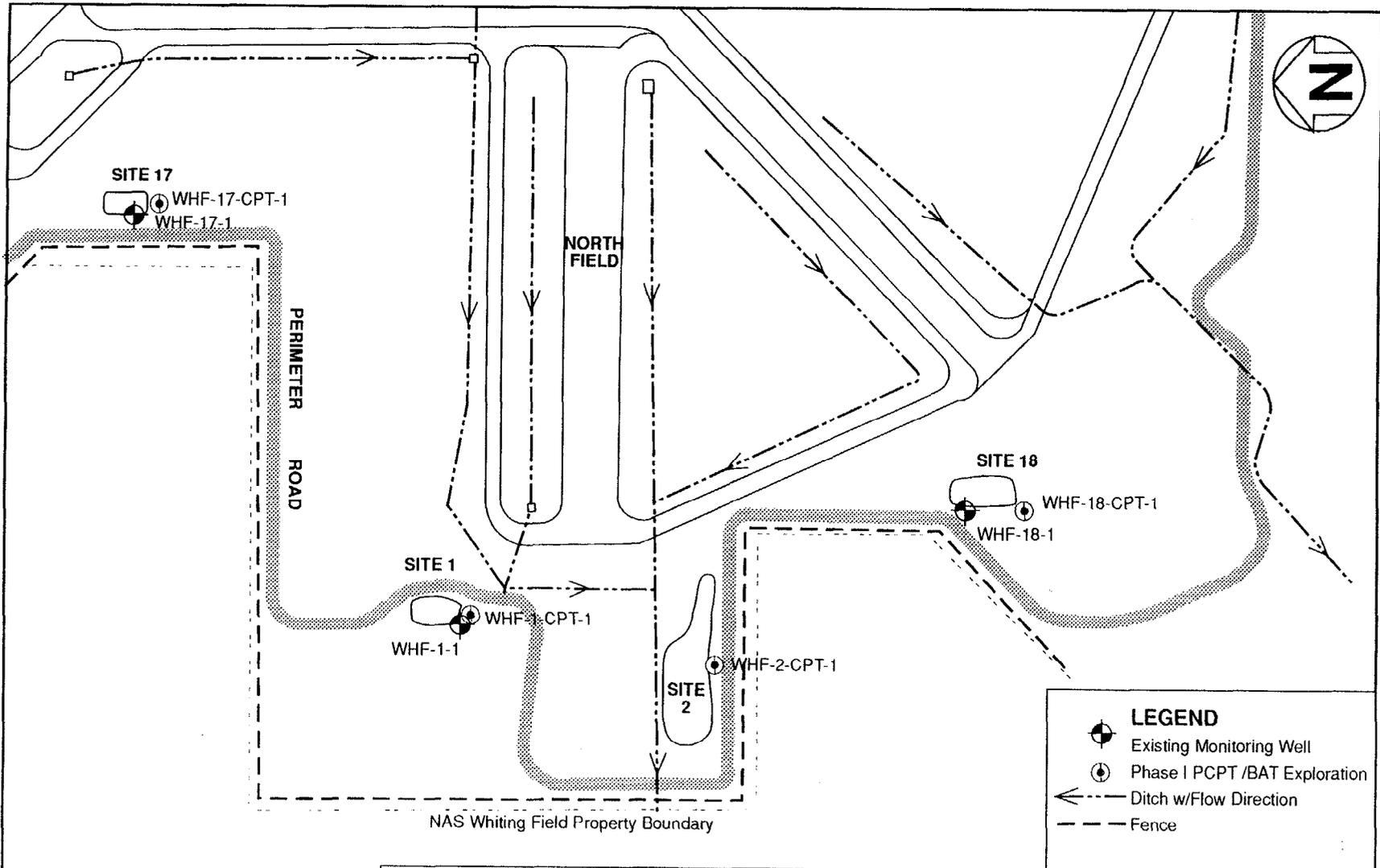
**LEGEND**

- Monitoring Well / Production Well
- PCPT Exploration



**FIGURE 2-1**  
**LOCATION OF MONITORING WELLS**  
**AND PCPT LOCATIONS AT**  
**NAS WHITING FIELD**

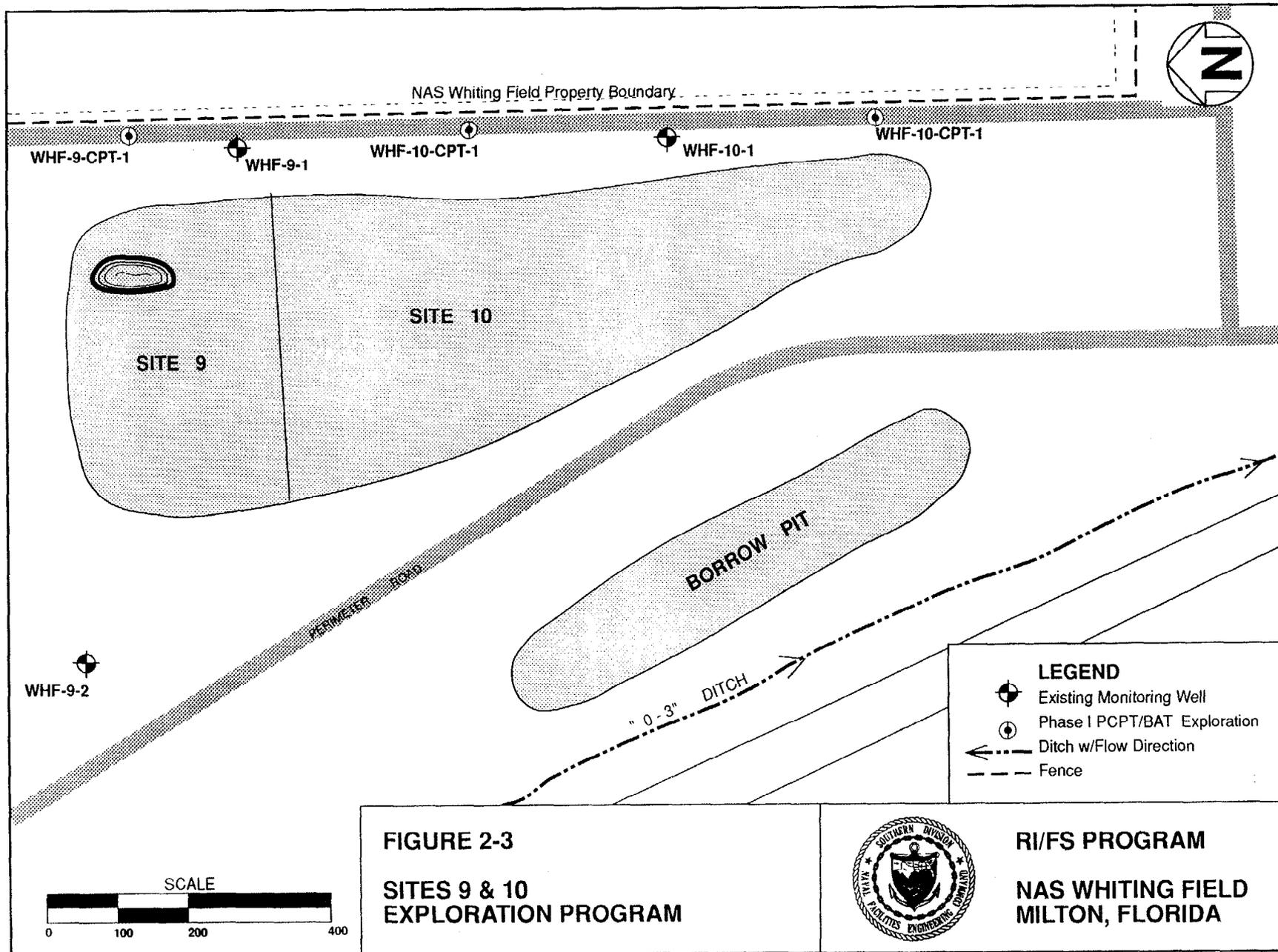
**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**



**FIGURE 2-2**  
**SITES 1, 2, 17, & 18**  
**EXPLORATION LOCATIONS**



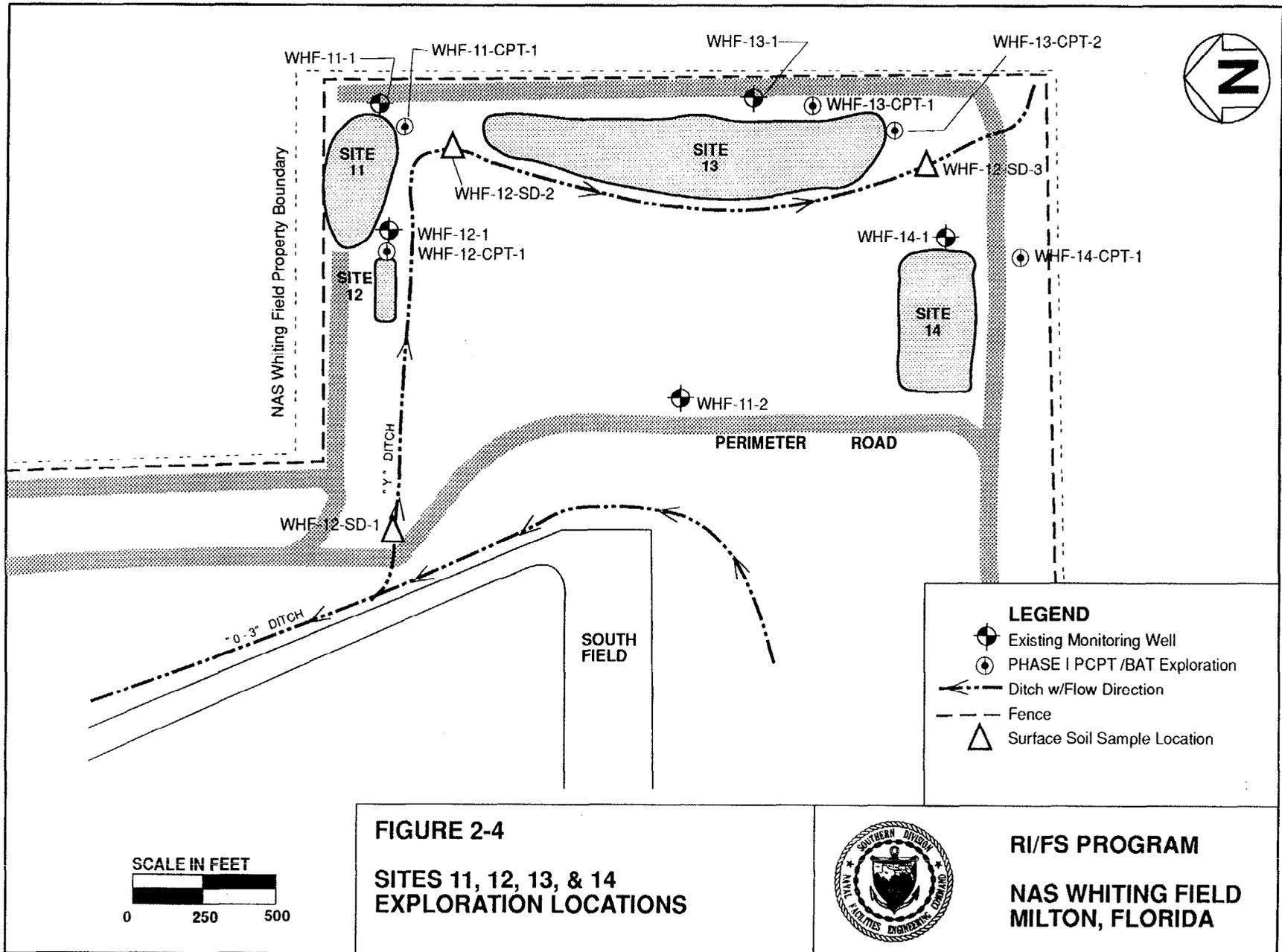
**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**

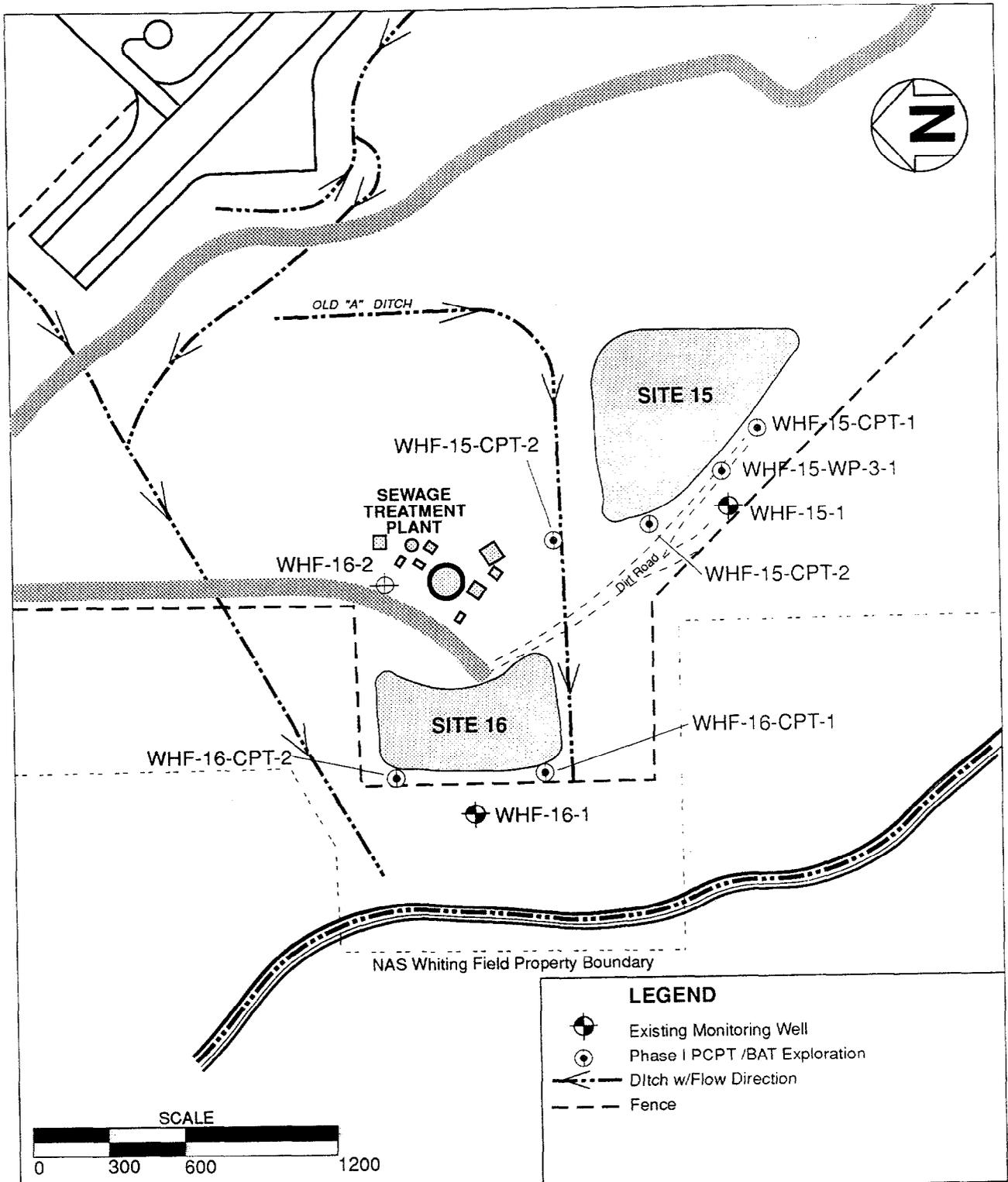


**FIGURE 2-3**  
**SITES 9 & 10**  
**EXPLORATION PROGRAM**



**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**

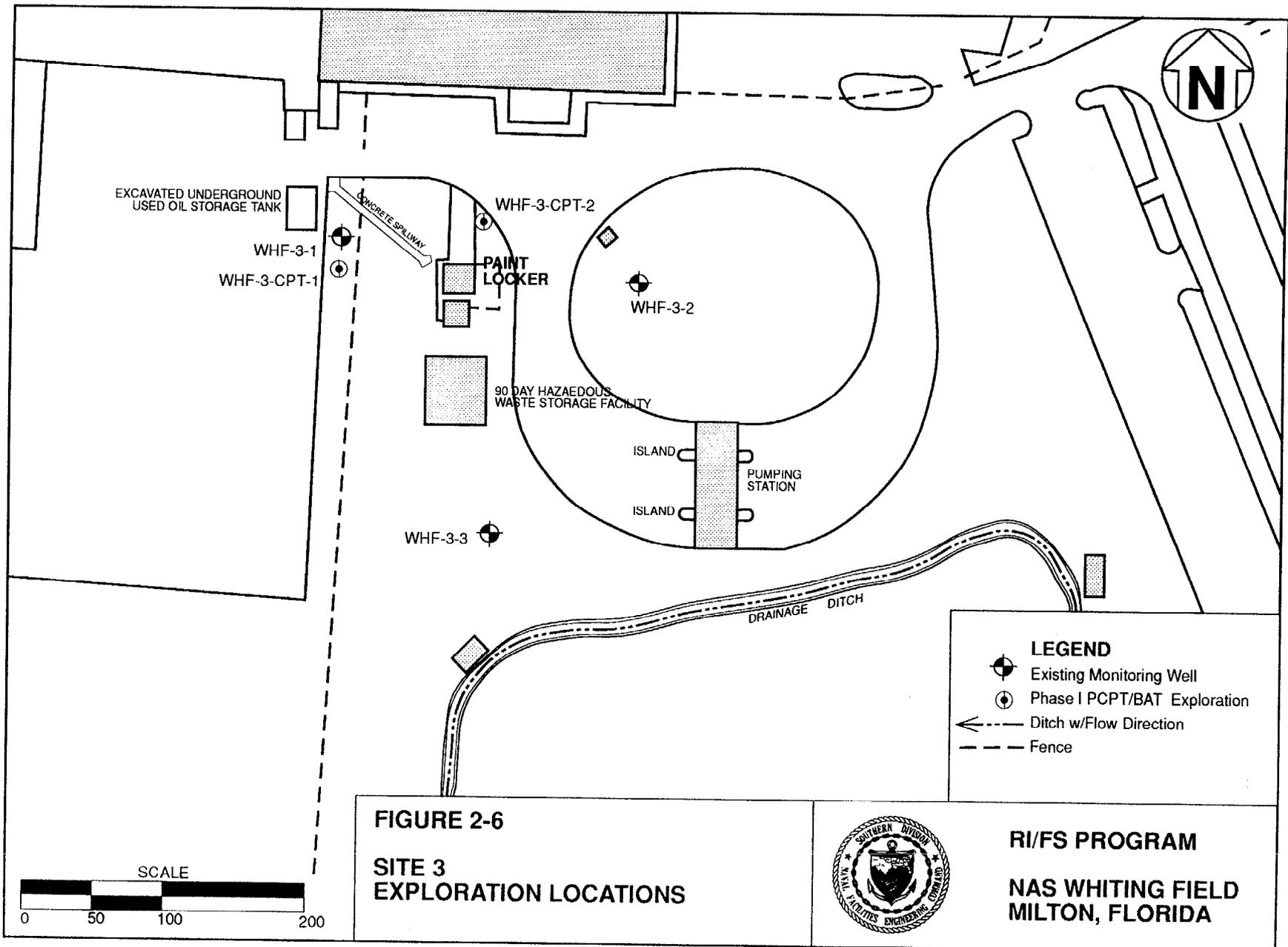




**FIGURE 2-5**  
**SITES 15 & 16**  
**EXPLORATION LOCATIONS**



**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**



**FIGURE 2-6**  
**SITE 3**  
**EXPLORATION LOCATIONS**



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**NAS WHITING FIELD**  
**MILTON, FLORIDA**

tronic sensors) connected to stainless-steel rods was hydraulically driven into the overburden soils. Measurements of end-bearings resistance, friction resistance, and pore pressure were made throughout each sounding to define the lithology and locate the water table(s).

Analog signals from four sensors in the cone tip were digitized for data logging. Analysis of the digital data was done by Williams and Associates in the field through a data acquisition software system. Based on the cone readings a lithologic description of the soils was computed with the aid of the software package. Piezocone sounding lithologic logs are presented in Appendix C.

During the PCPT exploration program, the cone tip met refusal in the very dense sands at various depths throughout the installation. In order to gain lithologic data beyond the dense sands, a drill rig bored through the dense sand collecting split-spoon samples at 5-foot intervals until less dense (less than 30 blows per 6 inches) material was encountered. Once the less dense material was found, 2-inch ID steel casing was placed into the borehole to provide additional support for the piezocone rod. The PCPT sounding continued until refusal. If sufficient lithologic data had been collected at the time of the second refusal, the PCPT sounding was terminated. If additional information was needed to characterize the lithology, the process was repeated.

### 3.0 RESULTS AND INTERPRETATION

3.1 REGIONAL GEOLOGY. NAS Whiting Field is underlain by a thick sequence of Tertiary sedimentary formations. A generalized geologic column of these formations is presented in Figure 3-1. The regional geologic characterization presented in this section has been taken from the RI Workplan, Volume I (Jordan, 1990), the Verification Study (Geraghty and Miller, 1986), the IAS (Envirodyne Engineers, 1985), and Marsh, (1966).

The oldest formation studied in the panhandle area (Escambia and Santa Rosa Counties) is the Hatchetigbee Formation of the early Eocene series. This formation is composed of silty clay with beds of glauconitic shale and shaly limestone. The average thickness of the Hatchetigbee Formation is 315 feet (Marsh, 1966).

Overlying the Hatchetigbee is the Tallahatta Formation of middle Eocene, which consists of shale and siltstone deposits interbedded with gray limestone and well sorted sand.

Above the Tallahatta is the Lisbon equivalent that has been correlated with the Lisbon Formation of Alabama. The Lisbon is approximately 500 feet thick and consists of a shaly limestone.

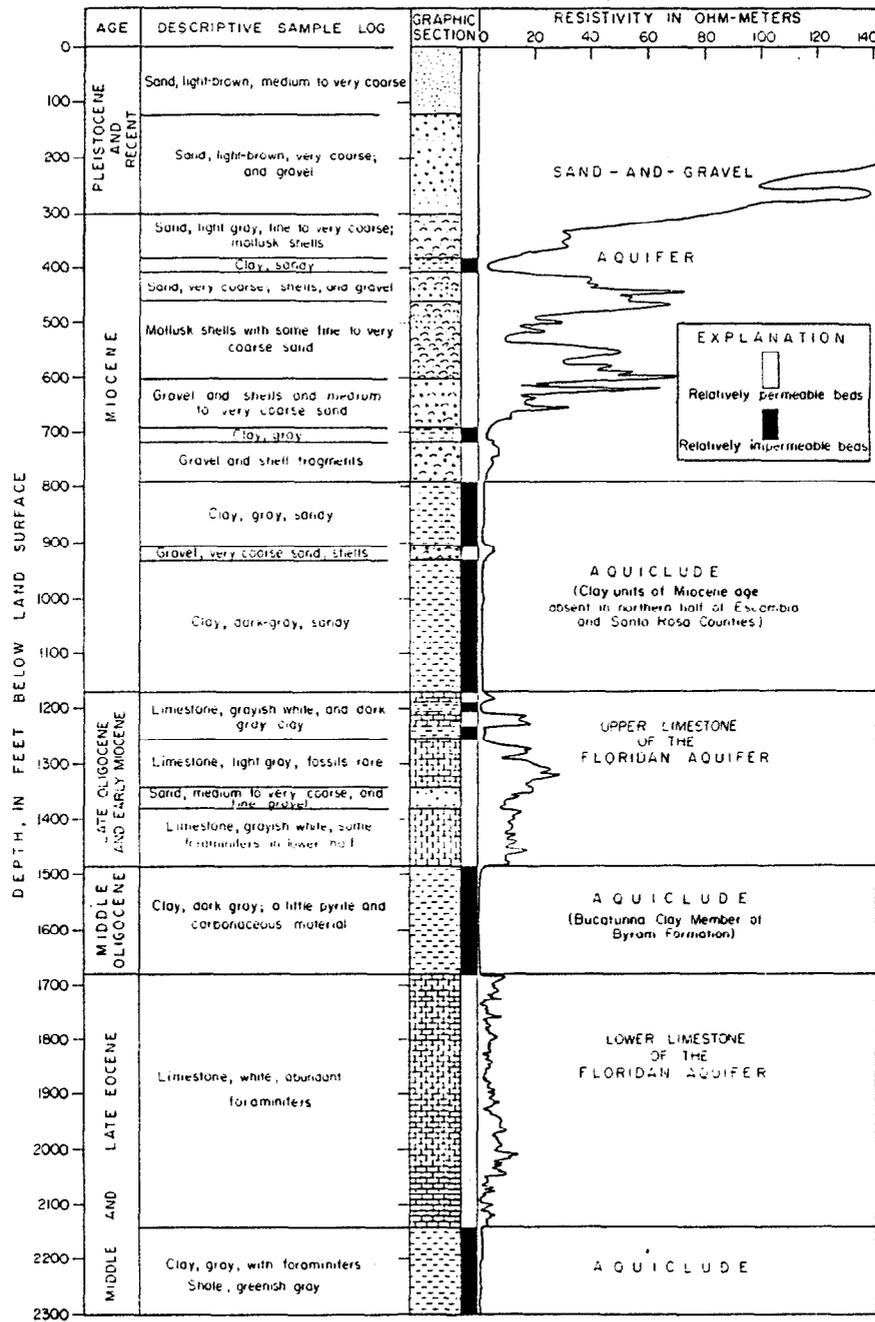
The upper Eocene series is represented by the Ocala group. The Ocala is a light-gray limestone and averages 165 feet in thickness. Fifty-seven species of Foraminifera were identified in this group. Unconformably overlying the Ocala is the Bucatunna Clay Member of the Byram Formation. The Bucatunna is a dark gray soft clay averaging 125 feet in thickness throughout the western Florida Panhandle.

The Chickasawhay Limestone and Tampa Formation are so similar in the western Panhandle that they are presented as undifferentiated on the geologic column. The Chickasawhay is a gray dolomitic limestone and the Tampa is a light gray to white hard limestone (generally not dolomitic). These undifferentiated sediments range in thickness from 30 to 270 feet.

Above the Chickasawhay-Tampa Formation lies the Pensacola clay which consists of an upper and lower member of dark to light gray sandy clay. These two members are separated by the Escambia sand member of gray fine to coarse sand. The upper member of the Pensacola clay is not present in the immediate vicinity of NAS Whiting Field and the lower member pinches out east of Big Coldwater Creek and is also not below NAS Whiting Field.

Miocene coarse clastics, however, are present throughout the western Florida Panhandle. These coarse clastics are described as brown to gray, poorly sorted sand and gravel with thick lenses of clay. These sediments overlie the Chickasawhay Limestone in the vicinity of NAS Whiting Field.

The Citronelle Formation of Pleistocene age overlies the Miocene clastics and is very similar in composition. The two units are differentiated by the abundance of shells in the Miocene clastics. The thickness of the Citronelle ranges from 40 to 800 feet in westernmost Florida. The Citronelle also contains layers of



**EXPLANATION**

☐ Relatively permeable beds

■ Relatively impermeable beds

**FIGURE 3-1**

**Generalized Hydrogeological Section of Santa Rosa County**



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**NAS WHITING FIELD  
MILTON, FLORIDA**

fossil wood, hardpan, shells, and kaolinitic burrows of aquatic animals (Marsh, 1966).

Three marine shorelines can be recognized from existing topographic profiles across Escambia and Santa Rosa Counties. The shoreline at 30 feet above National Geodetic Vertical Datum (NGVD) of 1929 is represented by the Pimlico terrace, the Penholoway terrace has a relic shoreline at 70 feet NVGD, and the third shoreline is a seaward-sloping upland surface ranging from 70 to 270 feet above NVGD.

The geologic structure of the western Florida Panhandle is a simple homocline with a few faults and folds present in northern Santa Rosa County where the Pollard graben is located.

**3.2 SITE-SPECIFIC GEOLOGY.** Geologic data from the individual sites at NAS Whiting Field were obtained from existing boring logs, and from RI Phase I subsurface explorations including monitoring well borings, PCPT soundings, and geophysical logging.

Boring logs for wells WHF-1-1, WHF-17-1, WHF-18-1, WHF-3-1, WHF-4-1, WHF-7-1, WHF-8-1, WHF-9-1, WHF-10-1, WHF-11-1, WHF-12-1, WHF-13-1, WHF-14-1, WHF-15-1, and WHF-16-1 were developed by Geraghty & Miller, Inc. (1986), from data collected during the Verification Study. These logs were recorded only as intervals of major lithologic units. Lithologic data were collected from the RI Phase I monitoring well installation program at 5-foot intervals. Because of the lack of definition of the geologic data from the Geraghty & Miller logs, the Geraghty & Miller logs were supplanted by RI Phase I data for interpretation of geological cross sections. PCPT explorations were logged continuously throughout the sounding and geophysical logging was conducted to total depth of the existing monitoring wells.

To tie together the various forms of geologic data collected from the above methods, the data were input to a geotechnical software package called Geotechnical Graphics Software™ (GTGS™). Information (if available) entered into the GTGS borelogs included depth, soil recovery, OVA readings, soil description, unified soil classification, and soil symbols code.

By creating a large lithologic column database through GTGS™, geologic cross sections across the installation and the individual site groups could be developed. Interpretation of the geologic cross sections will verify the existence of any confining clay unit, the orientation (e.g., direction of dip) and thickness of the unit, potential contaminant migration pathways, and relationship to the potentiometric surface.

The potentiometric surface on the cross sections was developed by connecting water level measurements for monitoring wells in the geologic profiles. Depth to the water table in the PCPT profiles could not be accurately determined and the potentiometric surface was extrapolated through the profile.

The lithology at NAS Whiting Field generally consist of sands and gravels with interbedded silt and clay layers, suggesting a low to moderate energy fluvial depositional environment. The sands ranged from very fine to coarse in grain size, with moderate to very high densities and they were generally poorly graded.

The gravels were typically encountered in lenses of thicknesses of less than 1 foot or in little to trace amounts along with coarse sands.

Clay and silt layers were found at variable depths throughout NAS Whiting Field. Commonly, clays occurred with varying amounts of silt and fine sand. Moderate to highly plastic clay layers were encountered at thicknesses of up to 30 feet. Silt layers were found less frequently than clay layers and often contained small amounts of clay and very fine sand. Prior to the RI Phase I field program, a continuous semi-confining to confining clay layer was believed to be present beneath NAS Whiting Field. Based on the interpretation of the geologic data, no continuous clay layer is present. However, locally confining conditions may be present where clay layers are present.

**3.2.1 Industrial Area** The geology of the industrialized area at NAS Whiting Field was interpreted from geologic data collected from Sites 3, 4, 5, 7, 8, and the production well subsurface explorations.

Lithology of the soils consistently followed the pattern of sands with interbedded silts and clays found throughout the installation. Massive sand units up to 140 feet thick (WHF-S2-WP-04) were encountered below the industrial area. The interbedded clay and silt layers were found at depths ranging from ground surface to 200 feet bls with variable thicknesses ranging from approximately less than 1 foot to 20 feet.

Using the lithologic profiles developed from GTGS™, geologic sections through the industrial area were generated (Figures 3-2 through 3-4). Cross section locations in plan view are presented in Figure 3-5. All of the cross sections are similar with respect to the interbedded stratigraphic units but little correlation between clay layers within adjacent profiles can be made.

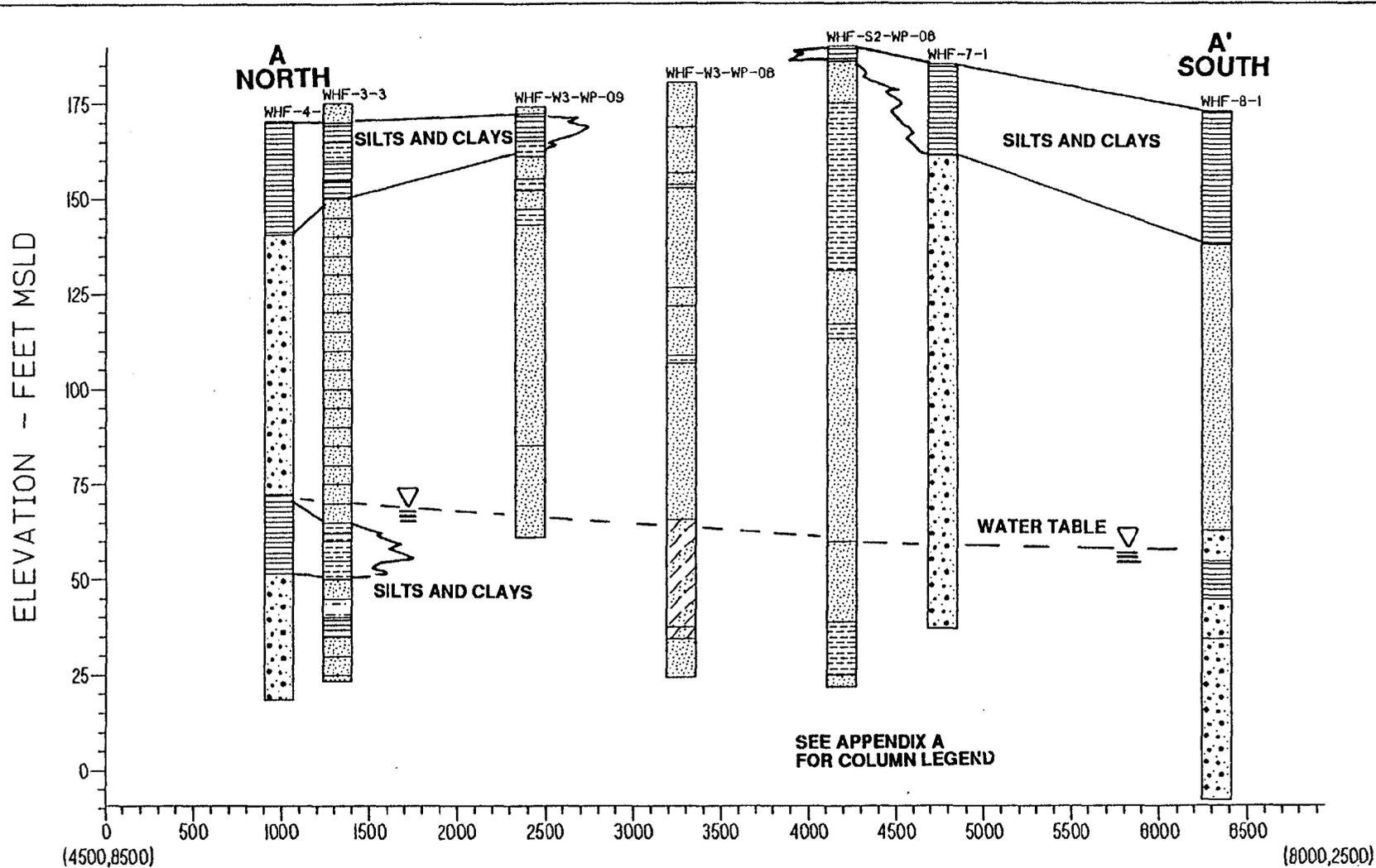
**3.2.2 Southwestern Disposal Areas** Data collected from subsurface explorations conducted at Sites 15 and 16 were used to characterize the geological setting at the southwestern disposal areas. The geological data set consisted of logs from a total of three monitoring well borings and four PCPT explorations. Figure 3-6 shows a geological cross section through Sites 15 and 16. The location of the cross section is presented in Figure 3-7.

Clay and clayey sand layers were primarily located at depths of less than 40 feet bls. The thickest of these layers was approximately 20 feet at PCPT exploration WHF-15-CPT-2.

Similar to the geological conditions of the Industrial Area, no significant laterally extensive clay layer is present to impede migration of contaminants from the disposal areas to groundwater.

**3.2.3 Northwestern Disposal and Firefighting Training Areas** Geological data from three monitoring well borings and four PCPT explorations were used to evaluate the geologic conditions present at Sites 1, 2, 17, and 18.

The only highly plastic clay layer that had a thickness of greater than 5 feet at any of the four sites was encountered at the Site 17 PCPT exploration WHF-17-CPT-1 (approximately 30 feet thick). Such a clay layer, if laterally extensive,

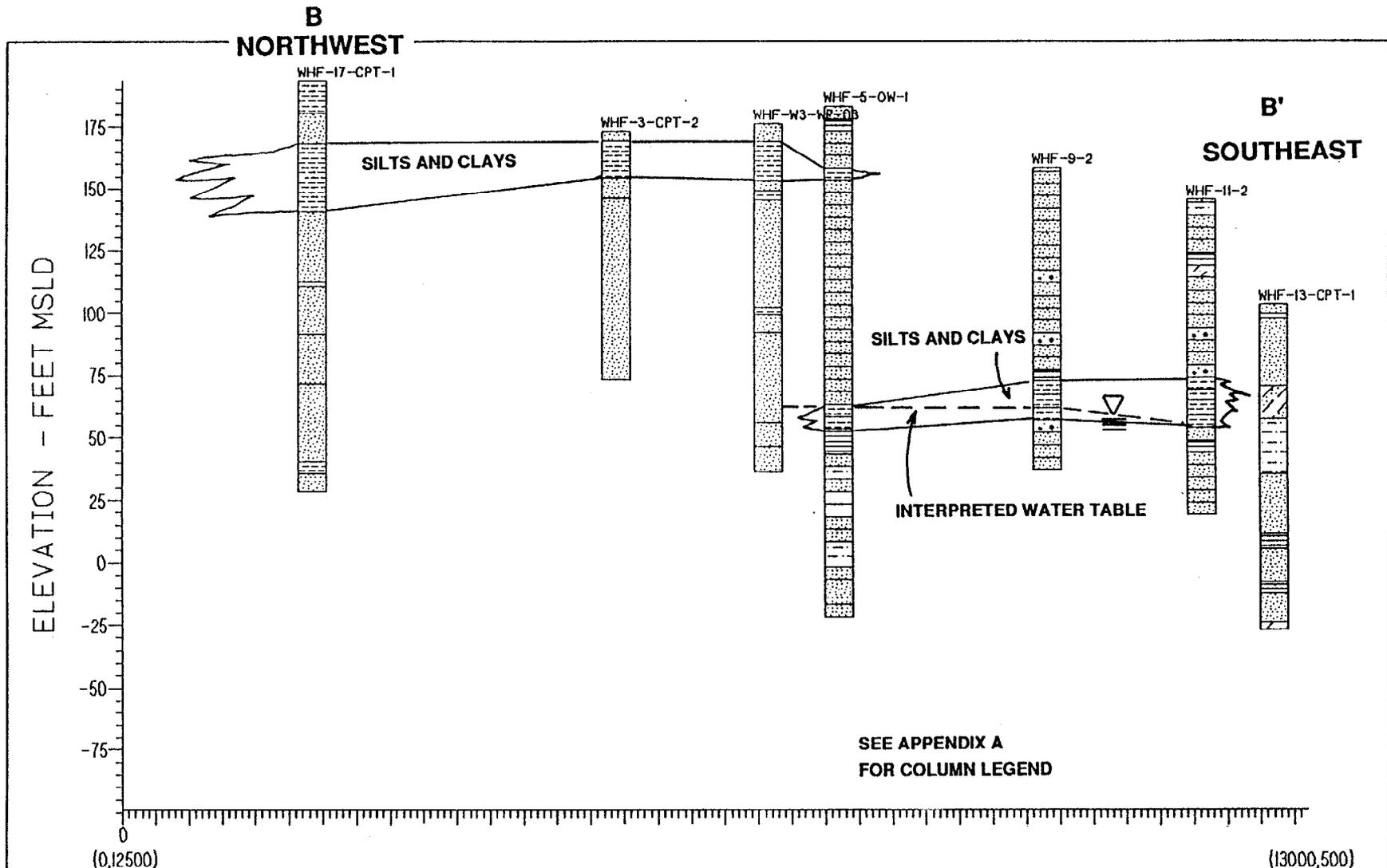


**FIGURE 3-2**  
**INTERPRETED CROSS SECTION A-A'**  
**THROUGH THE INDUSTRIAL AREA**  
**(SEE FIGURE 3-5 FOR PLAN VIEW)**



**RI/FS PROGRAM**

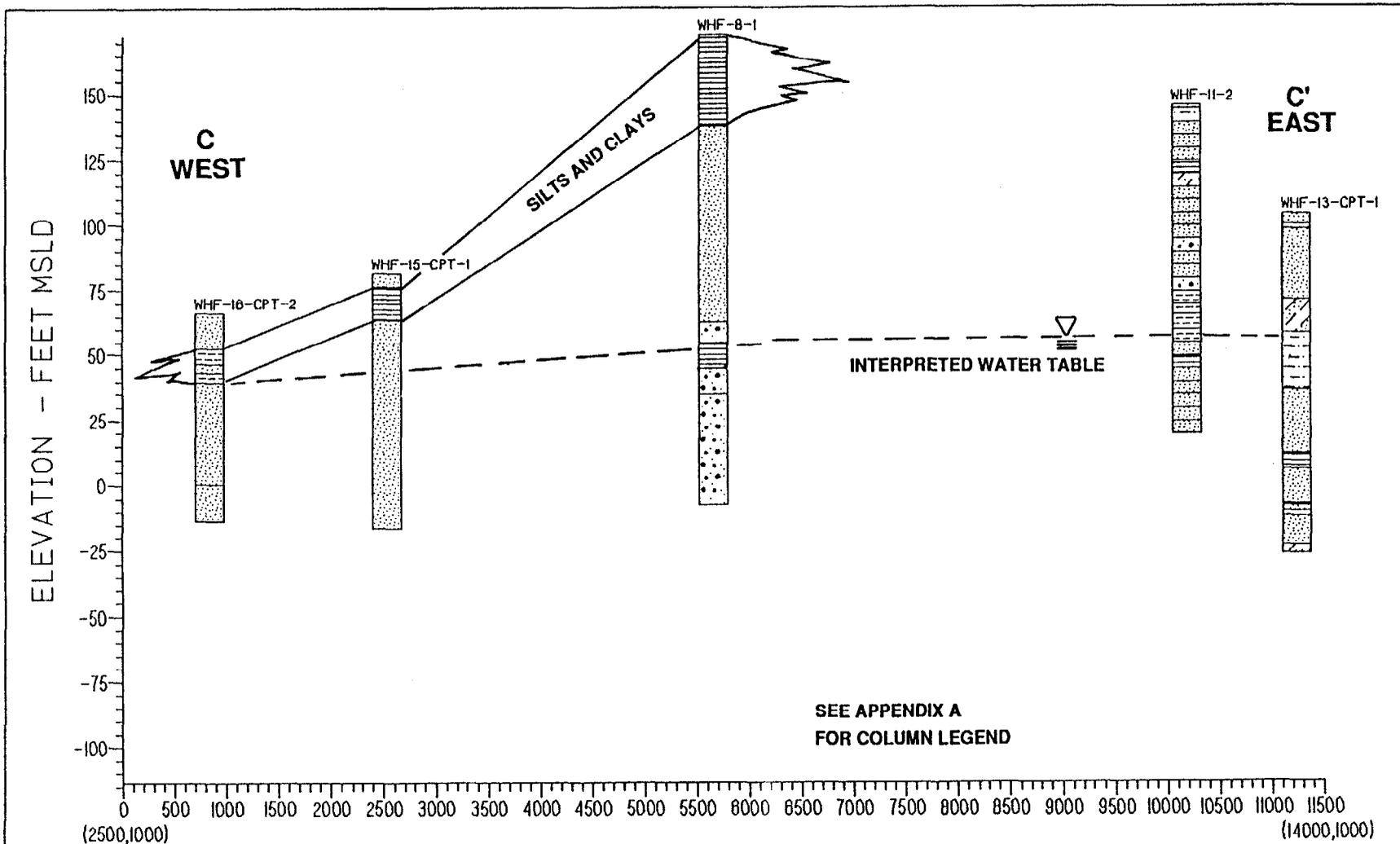
**NAS WHITING FIELD**  
**MILTON, FLORIDA**



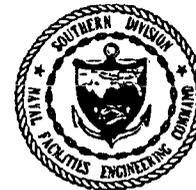
**FIGURE 3-3**  
**INTERPRETED CROSS SECTION B-B'**  
**NORTHWEST TO SOUTHEAST,**  
**NAS WHITING FIELD**  
**(SEE FIGURE 3-5 FOR PLAN VIEW)**



**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**

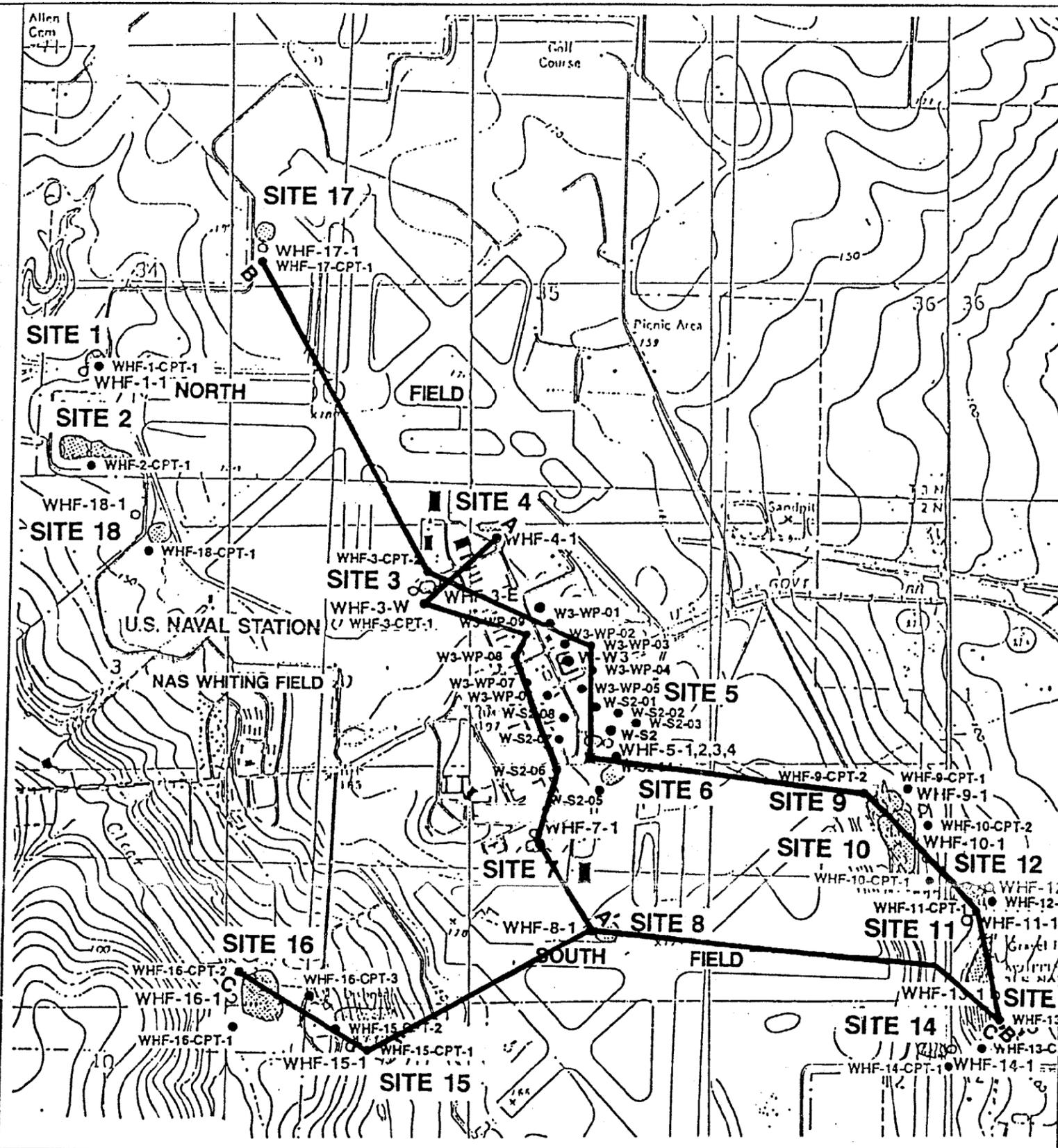


**FIGURE 3-4**  
**INTERPRETED CROSS SECTION C-C'**  
**WEST TO EAST, SOUTH OF THE**  
**INDUSTRIAL AREA**  
**(SEE FIGURE 3-5 FOR PLAN VIEW)**



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**NAS WHITING FIELD**  
**MILTON, FLORIDA**



**LEGEND**

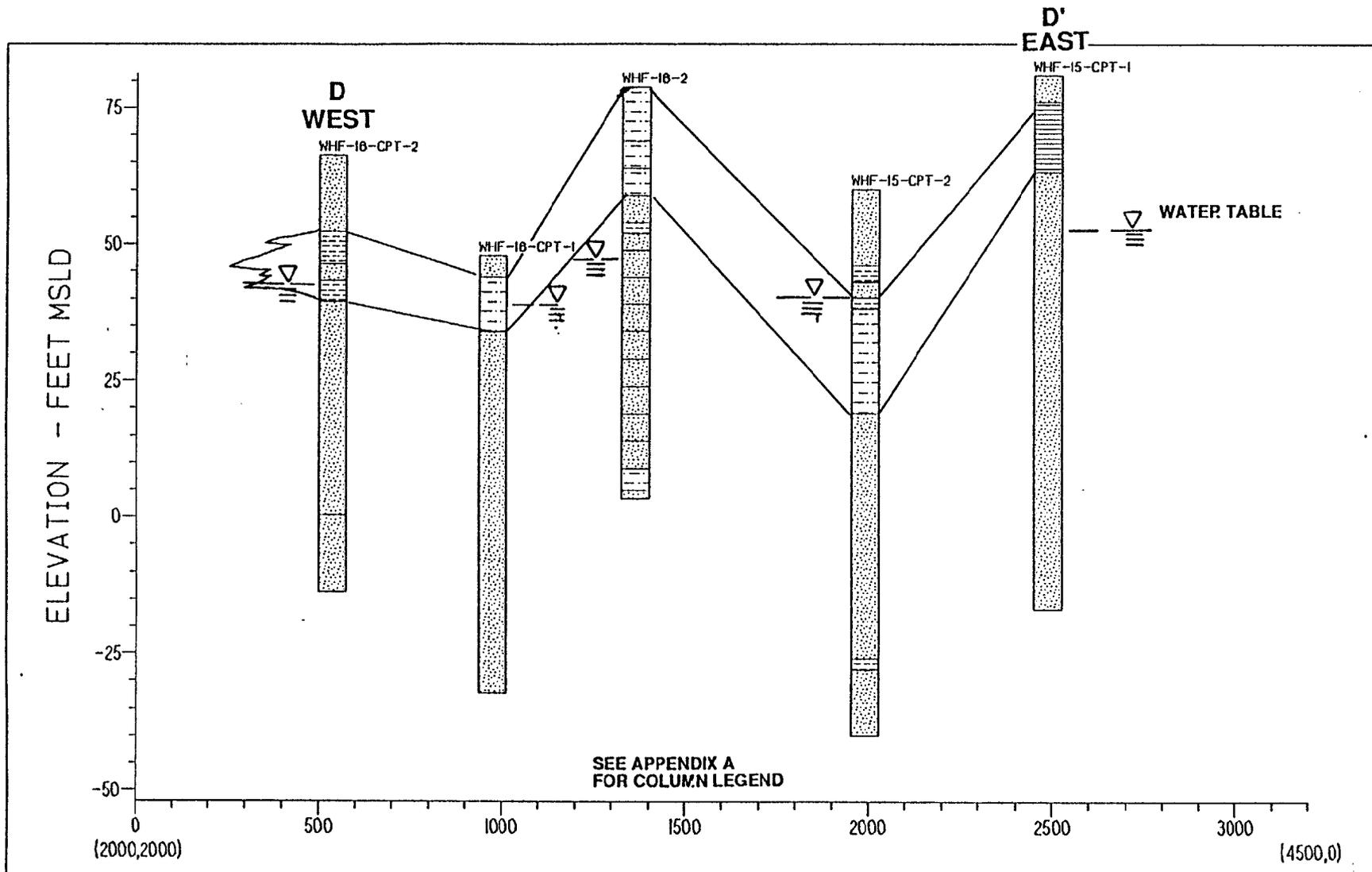
- Existing Monitoring Well
- PCPT/BAT Exploration



**FIGURE 3-5**  
**PLAN VIEW OF GEOLOGIC CROSS**  
**SECTIONS ACROSS INDUSTRIAL**  
**AREA, NAS WHITING FIELD**



**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**

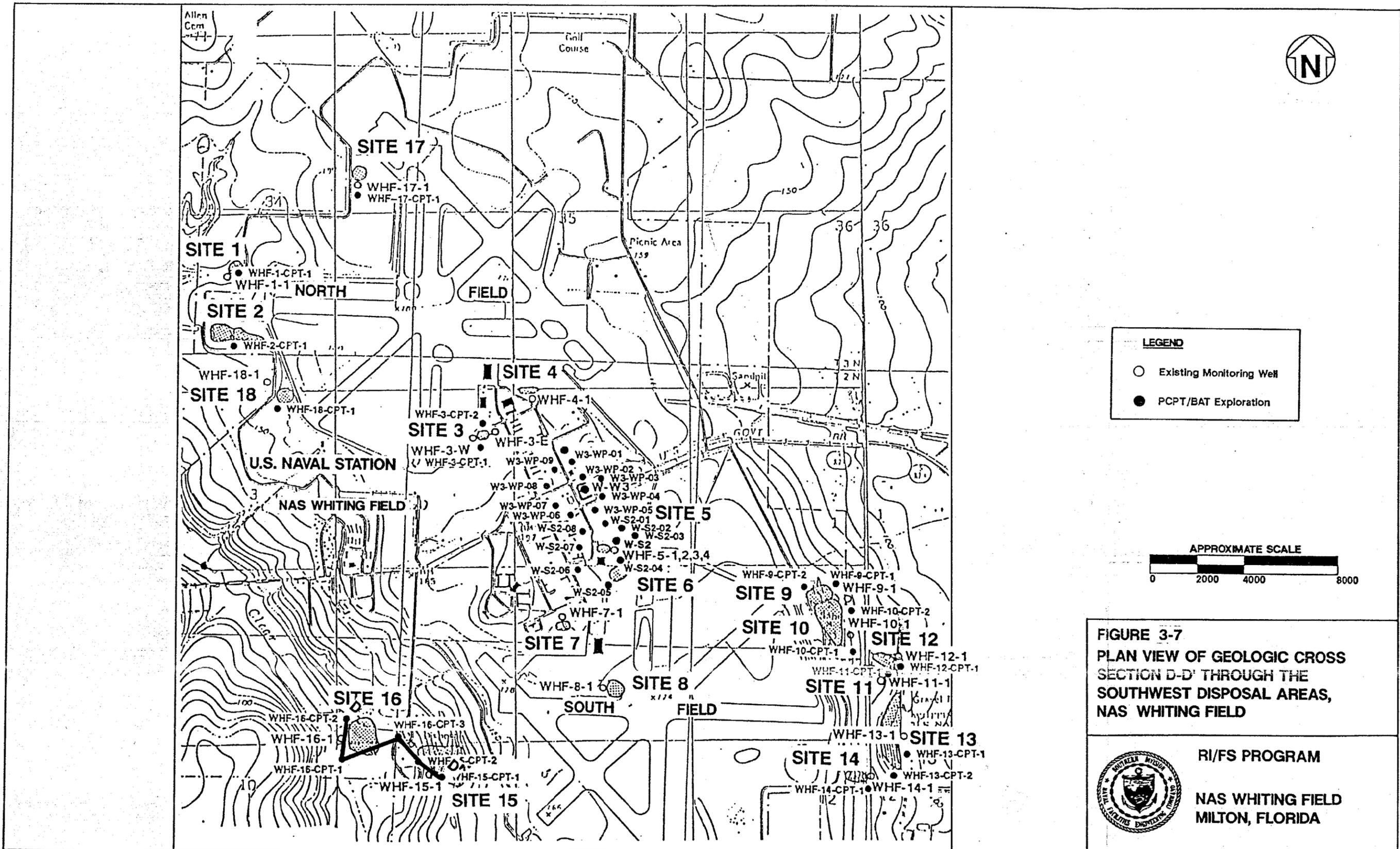


**FIGURE 3-6**  
**INTERPRETED CROSS SECTION D-D'**  
**THROUGH THE SOUTHWEST**  
**DISPOSAL AREAS, NAS WHITING FIELD**  
**(SEE FIGURE 3-7 FOR PLAN VIEW)**



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**NAS WHITING FIELD**  
**MILTON, FLORIDA**



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would provide an ideal confining unit, but due to the limited amount of geological data at Site 17 the presence of a continuous clay layer cannot be determined.

A geologic cross section through Sites 1, 2, 17, and 18 is presented in Figure 3-8. Once again correlation of lithologic units is virtually nonexistent. Plan view of this cross section is shown in Figure 3-9.

**3.2.4 Southeastern Disposal Areas** A total of eight monitoring well borings and seven PCPT explorations provided geological data for Sites 9, 10, 11, 12, 13, and 14. Subsurface soil types at the above sites included low to high plasticity clays, inorganic silts, fine- to coarse-grained sands, and gravel.

Clay layers were encountered more frequently and at a greater thickness below the southeastern disposal areas than at any of the other site groupings. Thickness of the clay layers was approximately 30 feet. The most laterally extensive clay layer beneath all of the site groupings was present at the southeastern disposal area site grouping. Figure 3-10 presents a geologic cross section from Site 9 to Site 13. Two distinct clay layers appear to be present, one at approximately 125 feet mean sea level (msl) and the other at approximately 75 to 50 feet msl. Clay layers containing various amounts of silt and sand that were located at similar elevations were considered to be of the same depositional unit. It would not be uncommon in a fluvial depositional environment to find varying amounts of silt and sand in a lithologic unit predominantly composed of clay. Plan view of this cross section is shown in Figure 3-11.

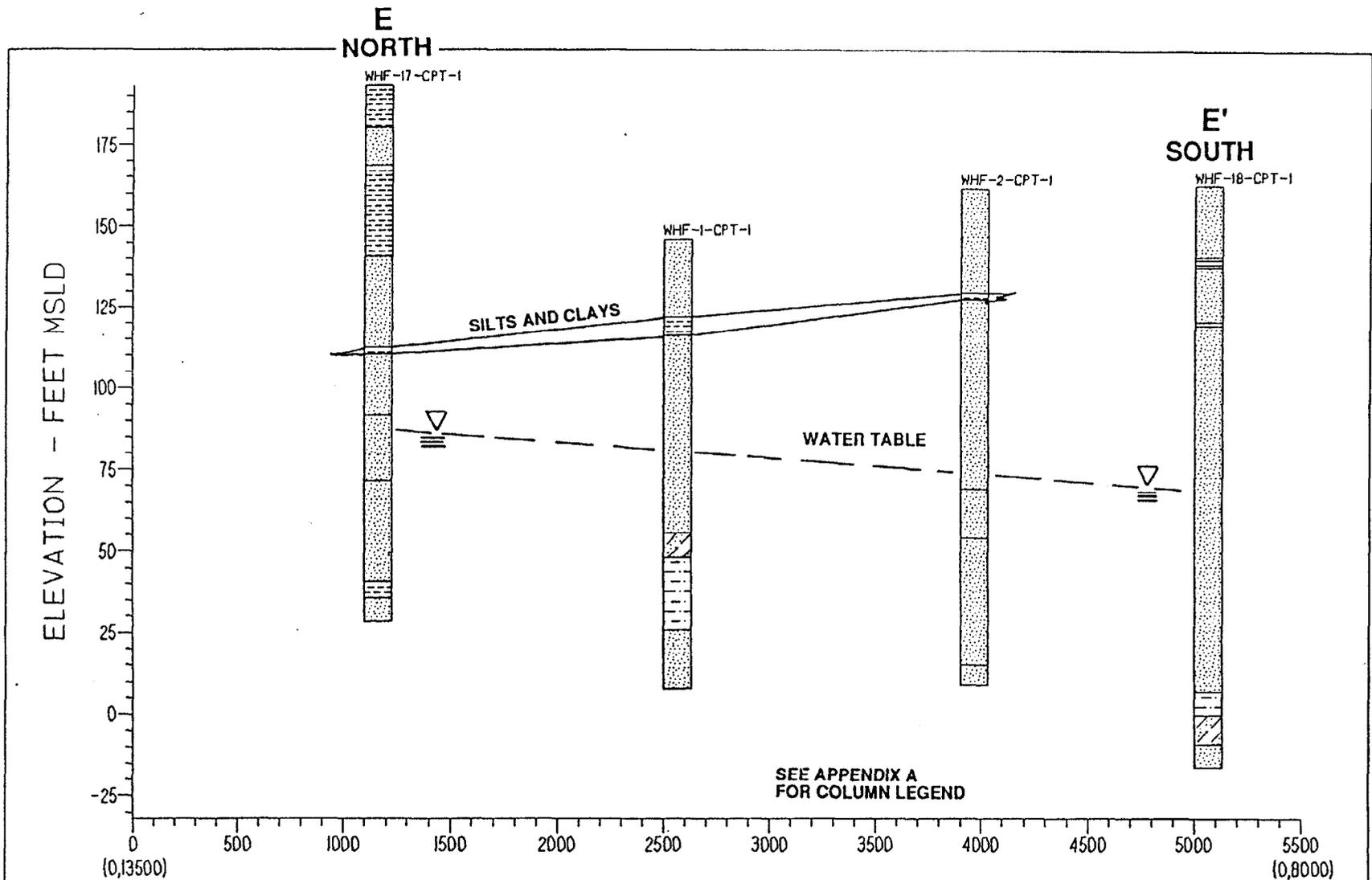
**3.2.5 Installation Wide Interpretation** Based on data collected from subsurface explorations including monitoring well borings, PCPT soundings, and geophysical logging, the following interpretations of the geologic conditions at NAS Whiting Field were made.

The soils encountered during the subsurface explorations generally consisted of massive, very fine- to coarse-grained sand with interbedded clay, silt, and clayey sand layers. Clay layers were often as much as 30 feet thick and typically contained varying amounts of silt and fine sand. Silt layers were encountered less frequently than clay layers and usually contained small amounts of clay and very fine sand.

Sand units were generally composed of poorly graded sands ranging from very fine to coarse in grain size. Occasional layers of gravels, typically less than 1 foot thick, were found at depths greater than 40 feet bls. Gravel more commonly occurred in small amounts with coarse sands rather than in distinct layers. Lithologic logs with soil descriptions and other pertinent data collected from the subsurface explorations are presented in Appendices A and C.

Lithologic logs from various sites that have been adjusted to relative mean sea level elevations were combined to create geologic cross sections through the installation and the site groupings.

Figure 3-3 shows a geologic cross section that runs through the entire installation from the northwestern area of Site 17 to the southeastern part of Site 13. Limited correlation between the clay layers appears to be present and due to the large distance (up to 4,000 feet) separating the explorations, the

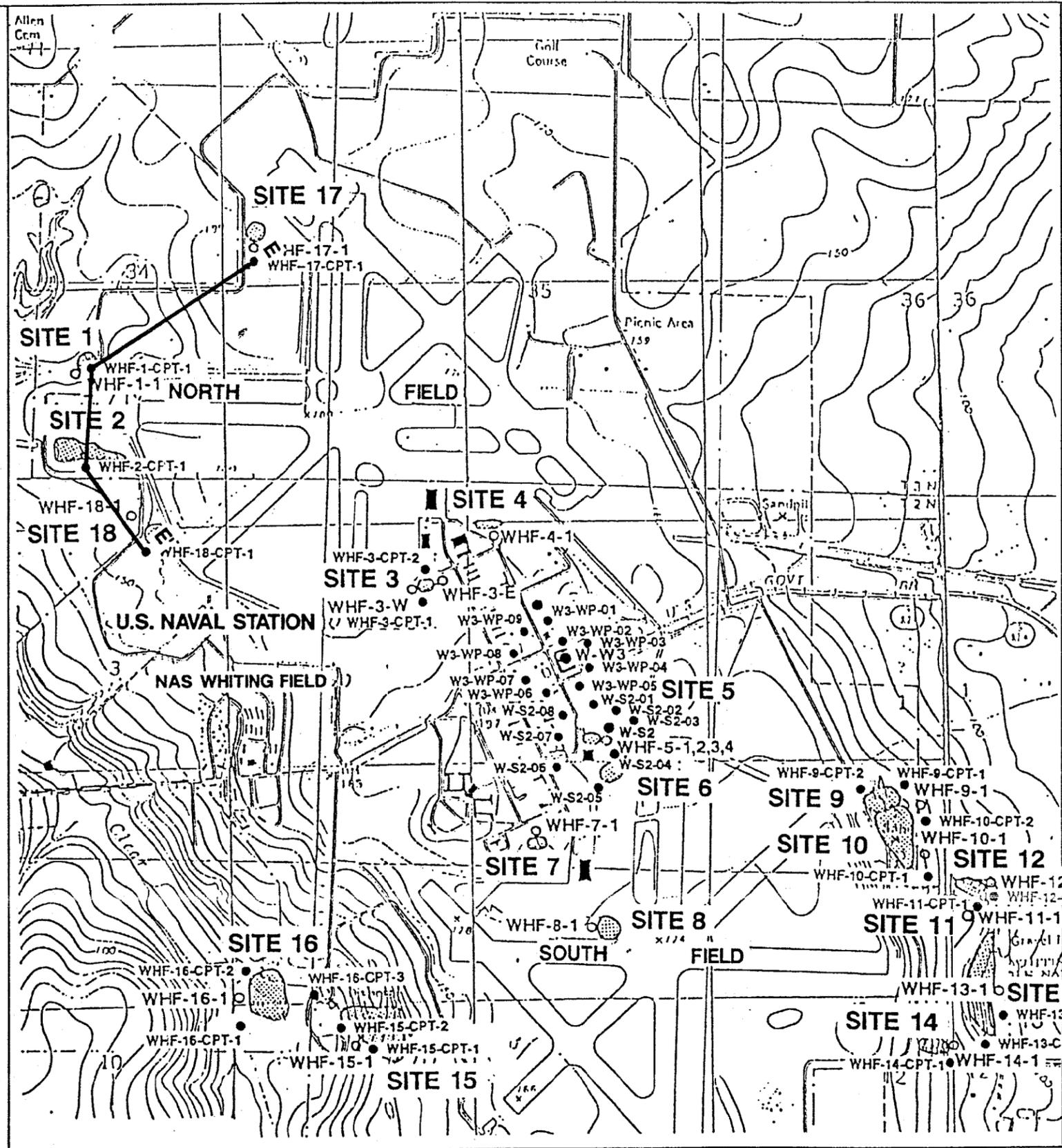


**FIGURE 3-8**  
**INTERPRETED CROSS SECTION E-E'**  
**THROUGH THE NORTHWEST AREA,**  
**NAS WHITING FIELD**  
**(SEE FIGURE 3-9 FOR PLAN VIEW)**



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**NAS WHITING FIELD**  
**MILTON, FLORIDA**



**LEGEND**

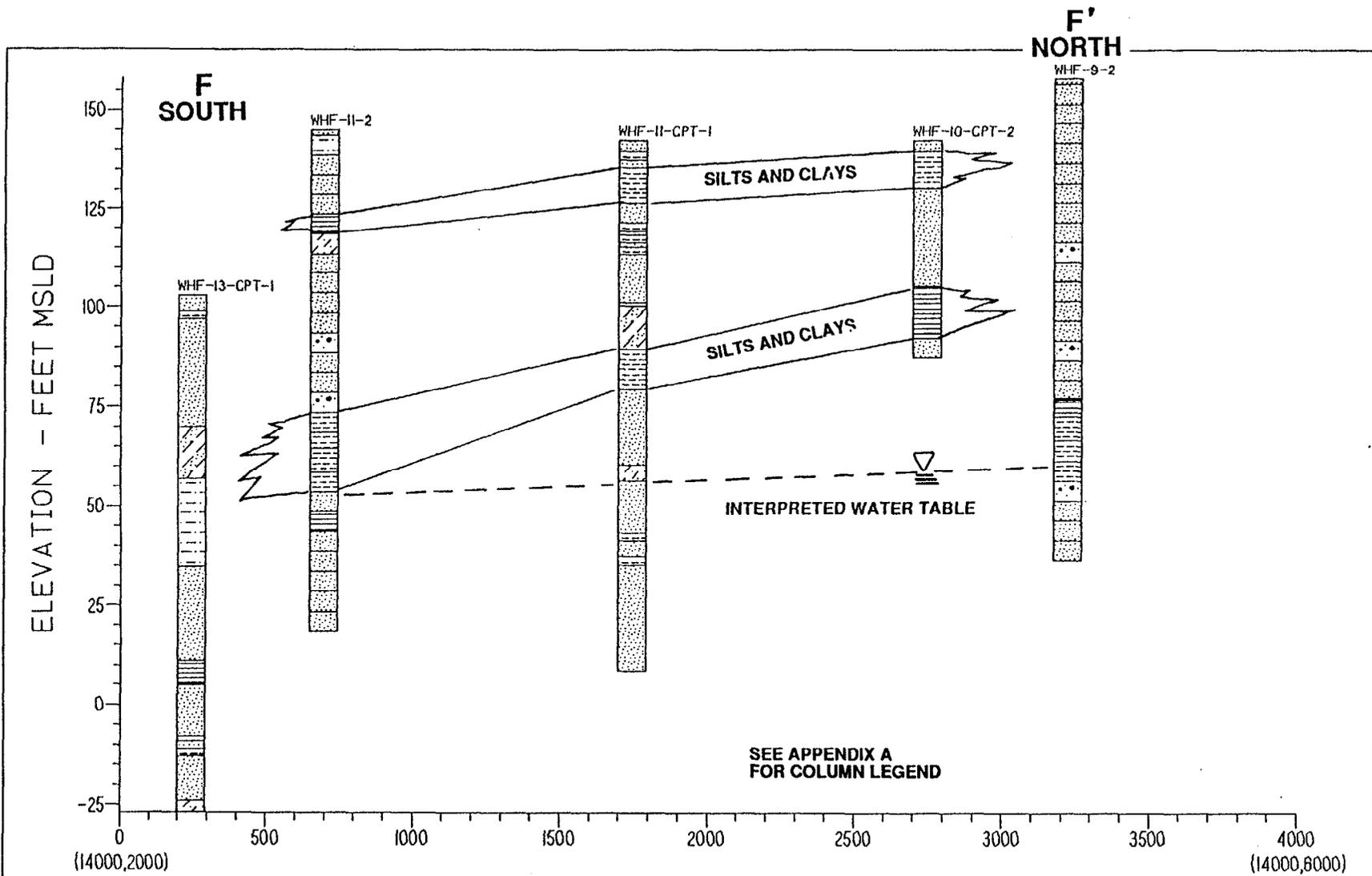
- Existing Monitoring Well
- PCPT/BAT Exploration



**FIGURE 3-9**  
**PLAN VIEW OF CROSS SECTION E-E'**  
**THROUGH NORTHWEST AREA,**  
**NAS WHITING FIELD**

**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**

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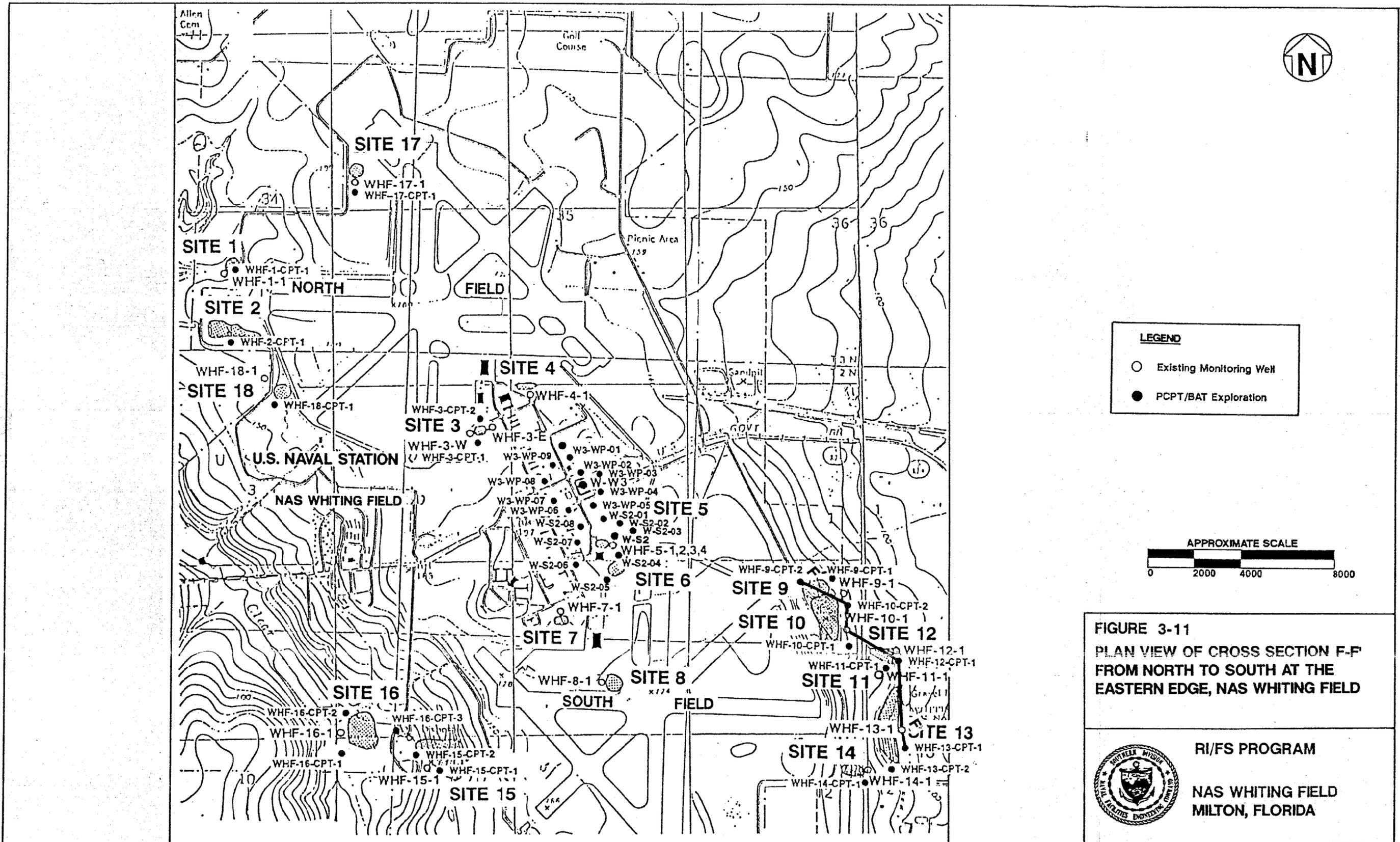


**FIGURE 3-10**  
**INTERPRETED CROSS SECTION F-F'**  
**FROM NORTH TO SOUTH AT THE**  
**EASTERN EDGE, NAS WHITING FIELD**  
**(SEE FIGURE 3-11 FOR PLAN VIEW)**



**RI/FS PROGRAM**

**NAS WHITING FIELD**  
**MILTON, FLORIDA**



**FIGURE 3-11**  
**PLAN VIEW OF CROSS SECTION F-F'**  
**FROM NORTH TO SOUTH AT THE**  
**EASTERN EDGE, NAS WHITING FIELD**

**RI/FS PROGRAM**  
**NAS WHITING FIELD**  
**MILTON, FLORIDA**



interpretation of contiguous clay layers that are not measured at intervals more closely spaced than at NAS Whiting based solely on the elevation of the layers may not be reliable. In depositional environments like those found at NAS Whiting Field, it is difficult to correlate specific lithologic units over large distances because it is uncertain if they are associated with the same depositional event. With additional lithologic information between the existing explorations a more accurate interpretation of continuous clay layers could be made.

The lithologies of the four site groupings: industrial area (Sites 3, 4, 5, 7, 8, and production well areas), southwestern disposal area (Sites 15 and 16), northwestern disposal and fire fighting training areas (Sites 1, 2, 17, and 18), and the southeastern disposal areas (Sites 9, 10, 11, 12, 13, and 14) were similar in that they contained massive sand units with interbedded clay and silt layers. Only thickness, depth, and frequency of the interbedded clays and silts differentiated the site groupings from one another.

At depths of approximately 50 feet bls, the lithologies of the southwestern disposal areas and northwestern disposal and fire fighting training areas are primarily composed of poorly graded sand with an occasional clay, silt, or clayey sand layer. In contrast, the southeastern disposal areas and the industrial area appear to have a greater number of clay and silt layers that are commonly found at depths of greater than 100 feet bls.

Overall, no continuous confining clay layer is interpreted to be present at NAS Whiting Field. However, clay layers are present and laterally continuous at some areas of the installation and locally confining conditions may be present. Based on the cross sections developed by GTGS™, the areas of the installation that may exhibit locally confining to semi-confining conditions would include the following list. At these general locations a substantial clay or silty clay layer is present at the elevations shown.

<u>Site Grouping</u>	<u>Elevation of Clay Layer (feet NGVD)</u>
Sites 10 and 11	Approximately 125 feet
Site 9, 10, 11, and 12	Approximately 50 to 75 feet
Site 17	Approximately 130 to 160 feet
Sites 15 and 16	Approximately 30 to 60 feet

#### 4.0 GEOLOGIC CONCLUSIONS

Based on the evaluation of the geologic data collected during Phase I of the RI the following conclusions can be made.

- The subsurface soils at NAS Whiting Field generally consist of massive sand units interbedded with clay, silt, and gravel layers.
- The clay layers ranged in thickness from less than 1 foot to 30 feet and were encountered at depths ranging from land surface to 200 feet below land surface.
- The clay layers were composed of low to high plasticity mottled clay with low plasticity clays containing small to moderate amounts of silt and fine- to medium-grained sand.
- The silt layers were encountered less frequently than clay layers and often contained small amounts of clay and very fine sand.
- The sand units were commonly composed of poorly graded sand of very fine to coarse grain size.
- The gravel, when encountered, was most frequently encountered with coarse sand at depths greater than 50 feet bls and in layers less than 1 foot thick.
- Based on geologic cross sections developed from subsurface exploration data, no laterally continuous confining clay layer is present beneath NAS Whiting Field.
- Clay layers that were found to be partially continuous or continuous below the southeastern and northwestern disposal areas site groupings may create locally semi-confining or confining conditions.

Geologic data gaps exist in that an insufficient amount of the lithology was characterized to determine if local confining conditions present at several sites are present in the areas between sites to imply that overall confining zones exist over large areas of the installation.

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**APPENDIX A**

**BORING LOGS, MONITORING WELL AND PIEZOMETER CONSTRUCTION DIAGRAMS**

# UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS	GTGS CODE		
<b>COARSE GRAINED SOILS</b>  <small>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE</small>	<b>GRAVEL AND GRAVELLY SOILS</b>  <small>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE</small>	<b>CLEAN GRAVELS</b>  <small>(LITTLE OR NO FINES)</small>		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURE, LITTLE OR NO FINES	25		
			<b>GRAVELS WITH FINES</b>  <small>(APPRECIABLE AMOUNT OF FINES)</small>		GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	26	
			<b>GRAVELS WITH FINES</b>  <small>(APPRECIABLE AMOUNT OF FINES)</small>		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	28	
			<b>GRAVELS WITH FINES</b>  <small>(APPRECIABLE AMOUNT OF FINES)</small>		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	28=43	
	<b>SAND AND SANDY SOILS</b>  <small>MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE</small>	<b>CLEAN SAND</b>  <small>(LITTLE OR NO FINES)</small>		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	1		
			<b>CLEAN SAND</b>  <small>(LITTLE OR NO FINES)</small>		SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	22	
			<b>SANDS WITH FINES</b>  <small>(APPRECIABLE AMOUNT OF FINES)</small>		SM	SILTY SANDS, SAND-SILT MIXTURES	37	
			<b>SANDS WITH FINES</b>  <small>(APPRECIABLE AMOUNT OF FINES)</small>		SC	CLAYEY SANDS, SAND-CLAY MIXTURES	36	
		<b>FINE GRAINED SOILS</b>  <small>MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE</small>	<b>SILTS AND CLAYS</b>  <small>LIQUID LIMIT LESS THAN 50</small>			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	39
						CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	33
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	22=14		
<b>SILTS AND CLAYS</b>  <small>LIQUID LIMIT GREATER THAN 50</small>				MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	19		
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	34		
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	40		
<b>HIGHLY ORGANIC SOILS</b>				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT	20		

## SOIL CLASSIFICATION CHART

**NOTE:**  
 WHEN SHOWN ON THE BORING LOGS, THE FOLLOWING TERMS ARE USED TO DESCRIBE THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE COMPACTNESS OF COHESIONLESS SOILS.

### COHESIVE SOILS

(APPROXIMATE SHEARING STRENGTH IN KSF)

VERY SOFT	LESS THAN .25
SOFT	0.25 TO 0.5
MEDIUM STIFF	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

### COHESIONLESS SOILS

VERY LOOSE	THESE ARE USUALLY BASED ON AN EXAMINATION OF SOIL SAMPLES, PENETRATION RESISTANCE AND SOIL DENSITY DATA
LOOSE	
MEDIUM DENSE	
DENSE	
VERY DENSE	

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-1-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 142.80 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 122.5FT.	<b>DPTH TO ∇:</b> 82.18 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH F.T.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-buff fine to coarse sand w/ some gravel, organics (0-5)		SW		
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85				SAND-buff fine to coarse sand w/ some gravel		SW		
90								
95				CLAY-buff/brown/tan clay w/ some fine to coarse sand and gravel		CL		
100								
105								
110				SAND-buff fine to coarse sand w/ some gravel		SW		
115								
120				CLAY-yellow/buff/brown clay w/ some fine to coarse sand		CL		
125								
130								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-3-E	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 175.42 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 152.5FT.	<b>DPTH TO <math>\nabla</math>:</b> 103.55 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-red clay w/ some fine to medium sand		CL		
10								
15								
20				SAND-buff fine to coarse sand w/ some gray clay		SW		
25								
30								
35								
40								
45				SAND-buff fine to coarse sand		SW		
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105				CLAY-gray w/ some fine sand		CL		
110								
115								
120								
125				SAND-buff fine to coarse sand w/ some gravel		SW		
130								
135								
140								
145								
150								
155								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-3-W	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 174.90 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 152.5FT.	<b>DPTH TO <math>\nabla</math>:</b> 103.10 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				CLAY-red clay w/ some fine to medium sand		CL		
10								
15								
20								
25				SAND-buff fine to coarse sand w/ some gray clay		SW		
30								
35								
40								
45				SAND-buff fine to coarse sand		SW		
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110				CLAY-gray w/ some fine sand		CL		
115								
120								
125								
130				SAND-buff fine to coarse sand w/ some gravel		SW		
135								
140								
145								
150								
155								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-3-3	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b> 12-16-90	<b>COMPLTD:</b> 1-7-91
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 178.26 FT.	<b>MONITOR INST.:</b> OVA	<b>TOT DPTH:</b> 151.2FT.	<b>DPTH TO <math>\nabla</math>:</b> 108.78 FT.
<b>LOGGED BY:</b> A. DESANDRO		<b>WELL DEVELOPMENT DATE:</b> 1-9-91	<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
		1.5/1.5		SAND-brown/red fine sand w/ trace clay		SP		
5	2	1.2/1.5	0	SAND & CLAY-lt brown/tan very fine sand and clay		CL	3-4-10	
10	3	1.3/1.5	0.2	CLAY-brown/red/tan clay, mottled, good plasticity		CH	11-20-30	
15	4	1.4/1.5	0	CLAY-red/tan clay w/ some sand, mottled, moderate plasticity		CL	8-10-10	
20	5	1.2/1.5	0	CLAY-red/lt brown/tan clay, mottled, good plasticity		CL	8-8-9	
25	6	1.0/1.5	0.2	SAND-tan/white/pink fine to medium sand		SP	20-38-55	
30	7	0.8/1.5	0.2	SAND-white/tan coarse sand		SP	10-11-14	
35	8	1.0/1.5	0.4	SAND-white/pink medium to coarse sand		SP	9-11-15	
40	9	0.8/1.5	0.8	SAND-tan/brown medium to coarse sand		SP	12-12-18	
45	10	0.8/1.5	0.2	SAND-white/tand medium sand		SP	10-15-24	
50	11	0.7/1.5	0.8	SAND-red/pink medium to fine sand		SP	18-23-28	
55	12	0.8/1.5	0.4	Same as above		SP	18-23-33	
60	13	0.8/1.5	0.4	SAND-lt red/pink medium to fine sand		SP	23-29-40	
65	14	0.6/1.5	0.2	Same as above		SP	12-20-20	
70	15	1.0/1.5	0	SAND-pink/tan medium to coarse sand		SP	10-24-35	
75	16	0.9/1.5	0.2	SAND-tan/lt brown very fine sand		SP	20-31-45	
80	17	0.2/1.5	1.0	Same as above		SP	31-50-	
85	18	0.8/1.5	0.4	SAND-lt brown/tan medium to coarse sand		SP	50-50-	
90	19	1.0/1.5	2.0	SAND-lt brown/pink coarse sand		SP	15-40-50	
95	20	0.9/1.5	0.4	SAND-tan/lt brown fine to very fine sand		SP	31-50-	
100	21		4.6			SP	35-50-	

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-3-3	<b>BORING NO.</b>
<b>CLIENT:</b> SOIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b> 12-16-90	<b>COMPLTD:</b> 1-7-91
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA:</b> 10-INCH	<b>PROTECTION LEVEL:</b> 0
<b>TOC ELEV.:</b> 178.26 FT.	<b>MONITOR INST.:</b> OVA	<b>TOT DPTH:</b> 151.2FT.	<b>DPTH TO <math>\nabla</math>:</b> 108.78 FT.
<b>LOGGED BY:</b> A. DESANDRO		<b>WELL DEVELOPMENT DATE:</b> 1-9-91	<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY SAMPLE	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
				Continued from PAGE 1				
		0.5/1.5		SAND-lt brown/pink medium sand		SP		
105	22	0.8/1.5	0	Same as above		SP	24-37-35	
110	23	1.5/1.5	0	CLAY-red/lt gray clay, mottled, good plasticity		CH	5-11-15	
	24	1.5/1.5	0	Same as above		CH	10-19-20	
115						CH		
120	25	1.5/1.5	0	CLAY-purple/tan/gray clay, mottled, good plasticity		CH	7-14-15	
125	28	1.3/1.5	0	SAND-tan/white coarse sand and gravel		SP	25-50-	
130	27	0.5/1.5	0.4	SAND-lt brown/tan coarse to medium sand w/ some gravel and clay		SC	43-50-	
135	28	0.8/1.5	0	CLAY-tan/purple clay, mottled, low plasticity, some gravel		CL	40-50-	
140	29	0.8/1.5	0.2	SAND-brown very fine sand		SP	45-50-	
145	30	1.2/1.5	0	SAND-brown/lt brown medium to coarse sand		SP	20-35-38	
150	31	1.0/1.5	0.4	Same as above CLAY-yellow/buff/brown clay w/ some fine to coarse sand		SP	24-29-30	
155								
180								
185								
170								
175								
180								
185								
190								
195								
200								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-5-OW-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 6500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED: 1-8-91	COMPLTD: 3-4-91
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA.: 10-INCH	PROTECTION LEVEL: 0
TOC ELEV.: 185.80 FT.	MONITOR INST.: OVA	TOT DPTH: 201.5FT.	DPTH TO $\nabla$ 121.38 FT.
LOGGED BY: A. DESANDRO	WELL DEVELOPMENT DATE: 3-8-91		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY SAMPLE	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5	2	1.2/1.5	0	SAND-dk brown very fine sand		SP		
						CL	8-15-20	
10	3	1.3/1.5	0	CLAY-white/red brown clay w/ some sand, mottled, moderate plasticity				
						SP	17-20-25	
15	4	1.0/1.5	1	SAND-red brown fine to medium sand				
						SP	9-17-28	
20	5	0.5/1.5	1	SAND-white/lt pink very fine sand				
						SP	18-22-22	
25	6	1.0/1.5	0	Same as above				
						CH	6-15-29	
30	7	1.0/1.5	0	CLAY-gray/red brown, mottled, good plasticity				
						SP	19-37-40	
35	8	1.0/1.5	0	SAND-white very fine sand				
						SP	19-25-32	
40	9	1.0/1.5	0	Same as above				
						SP	20-25-31	
45	10	0.3/1.5	0	SAND-white fine sand				
						SP	25-40-50/5	
50	11	0.8/1.5	1	SAND-white/lt pink fine to medium sand				
						SP	12-20-28	
55	12	1.0/1.5	0	SAND-lt gray/white fine to very fine sand				
						SP	16-20-21	
60	13	1.0/1.5	2.4	Same as above				
						SP	16-20-21	
65	14	1.0/1.5	0	SAND-white/lt brown coarse sand to gravel				
						SP	8-18-22	
70	15	0.8/1.5	0	SAND-lt brown medium to coarse sand				
						SP	19-28-30	
75	16	1.2/1.5	0	SAND-lt red/gray fine sand				
						SP	15-20-24	
80	17	1.0/1.5	0	SAND-lt red/red fine to very fine sand w/ trace gravel				
						SP	17-25-32	
85	18	0.5/1.5	0	SAND-lt gray very fine sand				
						SP	19-27-35	
90	19	1.0/1.5	1	SAND-lt gray/red very fine sand				
						SP	23-33-48	
95	20	0.3/1.5	0	SAND-tan medium to fine sand				
						SP	38-50/5	
100	21	0.4/1.5	0	Same as above				
						SP	32-50/8	
105	22	0.2/1.5	0	SAND-tan coarse to medium sand				
						SP	38-50/5.5	
110	23	1.0/1.5	0	SAND-tan/pink coarse sand w/ little gravel				
						SP	29-31-50/5	
						SP	42-50/5	

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-5-OW-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b> 1-8-91	<b>COMPLTD:</b> 3-4-91
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 185.80 FT.	<b>MONITOR INST.:</b> OVA	<b>TOT DPTH:</b> 201.5FT.	<b>DPTH TO ∇:</b> 121.38 FT.
<b>LOGGED BY:</b> A. DESANDRO	<b>WELL DEVELOPMENT DATE:</b> 3-8-91		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
Continued from PAGE 1								
115	24	0.1/1.5	0	SAND-tan medium to fine sand	[Symbol]	SP		
		0.0/1.5	0	NO RECOVERY-blow count indicate sand	[Symbol]	SP	50/5	
120	25	1.5/1.5	0	CLAY-gray/red clay, mottled, good plasticity	[Symbol]	CH	10-11-12	
125				CLAY-SHELBY TUBE SAMPLE	[Symbol]	CH		
130	26	1.4/1.5	0	CLAY-gray/brown clay, mottled, good plasticity	[Symbol]	CL	9-22-50/5	
135	27	0.3/1.5	0	CLAY-gray/brown clay, mottled, low plasticity	[Symbol]		29-32-50/5	
140	28	0.5/1.5	0	SAND-pink/tan very fine sand	[Symbol]	SP	23-35-31	
145	29	1.0/1.5	0.2	SAND and CLAY-pink very fine sand w/ some clay, thin clay lense (4")	[Symbol]	SC	20-23-31	
150	30	0.8/1.5	1	SAND-gray/pink very fine to fine sand, clay lense (2")	[Symbol]	SP	29-40-50	
155	31	0.0/1.5	NA	NO RECOVERY-blow counts indicate sand			48-50/3	
160	32	0.0/1.5	NA	NO RECOVERY-blow counts indicate sand			50/5.5	
165	33		NA	NO RECOVERY-blow counts indicate sand			NA	
170	34	1.2/1.5	0	SAND-tan/white coarse sand to gravel w/ some pebbles	[Symbol]	SP	38-19-28	
175					[Symbol]	SC		
180	35	1.2/1.5	0	SAND-red/tan fine to medium sand w/ some clay	[Symbol]		35-50/5	
185	36	0.0/1.5	NA	NO RECOVERY-blow counts indicat sand	[Symbol]	SP	50/5	
190					[Symbol]	SP		
195	37	0.8/1.5	0	SAND-tan coarse sand and gravel w/ trace clay	[Symbol]		28-34-38	
200	38	0.8/1.5	0	SAND-red/tan coarse sand and gravel w/ trace clay	[Symbol]	SP	34-50/3.5	
205				SAND-buff fine to coarse sand w/ some gravel				
210				CLAY-buff/brown/tan clay w/ some fine to coarse sand and gravel				
215				SAND-buff fine to coarse sand w/ some gravel				
220				CLAY-yellow/buff/brown clay w/ some fine to coarse sand				

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-5-OW-2	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 6500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b> 1-31-91	<b>COMPLTD:</b> 1-31-91
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 188.02 FT.	<b>MONITOR INST.:</b> OVA	<b>TOT DPTH:</b> 123FT.	<b>DPH TO <math>\nabla</math>:</b> 115.64 FT.
<b>LOGGED BY:</b> A. DESANDRO	<b>WELL DEVELOPMENT DATE:</b> 3-8-91		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SEE DESCRIPTION FOR WHF-5-OW-1				
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								

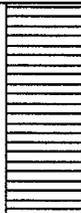
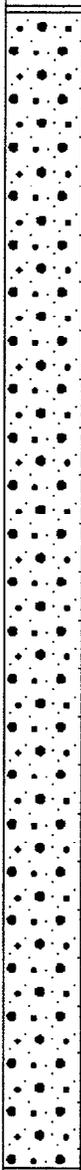
<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-5-PZ-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b> 2-19-91	<b>COMPLTD:</b> 2-20-91
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 1 1/2-INCH	<b>BORING DIA.:</b> 7 7/8-INCH	<b>PROTECTION LEVEL:</b> 0
<b>TOC ELEV.:</b> 188.01 FT.	<b>MONITOR INST.:</b> OVA	<b>TOT DPTH:</b> 134FT.	<b>DPTH TO ∇:</b> 121.87 FT.
<b>LOGGED BY:</b> A. DESANDRO	<b>WELL DEVELOPMENT DATE:</b> 3-8-91		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SEE DESCRIPTION FOR WHF-5-0W-1				
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								

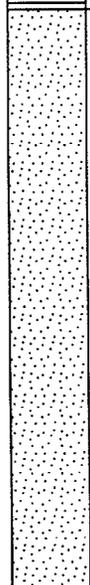
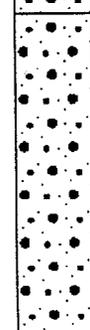
TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-5-PZ-2	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED: 2-17-91	COMPLTD: 2-19-91
METHOD: MUD-ROTARY	CASE SIZE: 1 1/2-INCH	BORING DIA: 7 7/8-INCH	PROTECTION LEVEL: D
TOC ELEV.: 185.90 FT.	MONITOR INST: OVA	TOT DPTH: 150FT.	DPTH TO $\nabla$ : 120.78 FT.
LOGGED BY: A. DESANDRO	WELL DEVELOPMENT DATE: 3-8-91		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SEE DESCRIPTION FOR WHF-5-OW-1				
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								

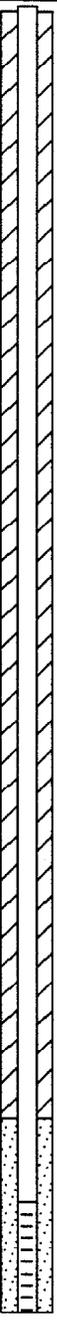
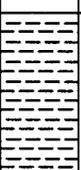
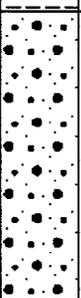
<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-7-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 187.77 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 142.5FT.	<b>DPTH TO <math>\nabla</math>:</b> 128.48 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH F.T.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-red clay w/ some fine to medium sand		CL		
10								
15								
20								
25								
30				SAND-buff fine to coarse sand w/ some gravel		SW		
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-8-1	BORING NO.
CLIENT: SOIV NAVY		PROJECT NO: 6500-01	
CONTRACTOR: GERAGHTY & MILLER		DATE STARTED: NA	COMPLTD: NA
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA.: 10-INCH	PROTECTION LEVEL: D
TOC ELEV.: 172.92 FT.	MONITOR INST.: NA	TOT DPTH: 180.0FT.	DPTH TO $\nabla$ 114.80 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-red clay w/ some fine to medium sand		CL		
10								
15								
20								
25								
30								
35				SAND-buff fine to medium sand w/ clay streaks		SP		
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110				SAND-buff fine to coarse sand w/ some gravel		SW		
115								
120				CLAY-light gray clay w/ some fine to coarse sand		CL		
125								
130				SAND-white fine to coarse sand w/ some gravel		SW		
135								
140				SAND-white fine to coarse sand w/ some light gray clay, streaks		SW		
145								
150								
155								
160								
165								
170								
175								
180								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-9-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 148.80 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 117.5 FT.	<b>DPTH TO <math>\nabla</math>:</b> 82.88 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				CLAY-red/brown clay w/ some red/brown fine to medium sand		CL		
15				CLAY-red/white clay w/ some fine to medium sand		CL		
50				SAND-white fine to medium grained sand w/ some red/white clay		SC		
75				CLAY-red/white clay		CH		
90				SAND-white fine to coarse sand w/ some gravel, streaks of clay		SW		
115				CLAY-red/white clay		CH		

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-9-2	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 6500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED: 11-28-90	COMPLTD: 12-13-90
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA.: 10-INCH	PROTECTION LEVEL: D
TOC ELEV.: 181.19 FT.	MONITOR INST.: OVA	TOT DPTH: 120FT.	DPTH TO $\nabla$ 98.19 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE: 1-9-91		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5	2	1.2/1.5	0.5	SAND-brown/orange brown fine sand w/ little silt, loose		SP	4-4-8	
10	3	1.0/1.5	0	SAND-red orange fine sand w/ little silt, trace clay		SP	3-5-7	
15	4	0.8/1.5	0	SAND-red orange fine sand w/ little silt		SP	7-9-13	
20	5	1.0/1.5	0	SAND-dark red fine sand w/ little silt, trace clay, dense		SP	7-10-12	
25	6	1.1/1.5	0	Same as above		SP	12-18-18	
30	7	1.0/1.5	0	Same as above		SP	8-9-10	
35	8	0.9/1.5	0	SAND-yellow to white		SP	7-10-10	
40	9	1.0/1.5	0	SAND-yellow/white/purple/pink fine sand w/ trace silt, mottled		SP	8-11-12	
45	10	1.2/1.5	0	SAND-maroon/purple/white/yellow sand, w/ trace silt, stratified, mottled		SW	12-17-19	
50	11	1.1/1.5	0	SAND-pink fine to coarse sand, well graded, loose		SP	13-13-13	
55	12	0.6/1.5	0	SAND-white very coarse sand		SP	25-27-37	
60	13	0.6/1.5	0	SAND-pink/white fine sand, dense		SP	22-42-48	
65	14	0.7/1.5	0	Same as above		SP	38-50-50/4	
70	15	0.4/1.5	0	SAND-pink/tan fine to medium sand, dense		SW	24-35-40	
75	16	0.5/1.5	0	Same as above		SP	38-50/5	
80	17	0.3/1.5	0	SAND-pink/tan medium sand w/ some fine sand, dense		SP	22-32-15	
85	18	1.4/1.5	0	SAND-orange/pink fine sand w/ little silt		CL	5-10-15	
90	19	1.5/1.5	0	CLAY-gray clay w/ some silt, low to moderate plasticity		CL	7-13-15	
95	20	1.5/1.5	0	CLAY-purple/gray clay, mottled, good plasticity		CH	9-10-18	
100	21	1.5/1.5	0	CLAY-gray/light brown clay, mottled, good plasticity		CH	35-38-58	
105	22	0.5/1.5	0	CLAY-purple/gray clay, mottled, good plasticity		CH	38-55-	
110	23	0.5/1.5	0	SAND-it brown/lt gray fine to medium sand		SW	18-31-58	
115	24	0.5/1.5	0	SAND-it red/lt gray, very fine sand		SP	29-35-40	
120	25	1.0/1.5	4	SAND-pink/lt brown fine to medium sand w/ trace gravel		SP	25-38-55	
125		1.0/1.5	4	SAND-it brown fine sand				

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-10-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 6500-01	
CONTRACTOR: GERAGHTY & MILLER		DATE STARTED: NA	COMPLTD: NA
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA.: 10-INCH	PROTECTION LEVEL: 0
TOC ELEV.: 148.77 FT.	MONITOR INST.: NA	TOT DPTH: 117.5FT.	DPTH TO $\nabla$ 84.23 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH F.T.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-red/brown clay w/ some red/brown fine to medium sand		CL		
10								
15				CLAY-red/white clay w/ some fine to medium sand				
20								
25								
30								
35								
40						SC		
45								
50				SAND-white fine to medium grained sand w/ some red/white clay				
55								
60								
65								
70								
75				CLAY-red/white clay		CH		
80								
85								
90				SAND-white fine to coarse sand w/ some gravel, streaks of clay				
95								
100						SC		
105								
110								
115				CLAY-red/white clay				
120								
125								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-11-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> 0
<b>TOC ELEV.:</b> 118.70 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 127.5FT.	<b>DPTH TO ∇:</b> 57.15 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-red/gray clay w/ some fine to medium sand		CL		
10								
15								
20								
25								
30								
35				CLAY-red/blue gray/light gray/orange/yellow/white clay		CH		
40								
45								
50								
55								
60								
65								
70								
75				SAND-white fine to coarse sand, clay streaks		SW		
80								
85								
90								
95								
100				SAND-white fine to medium sand, clay streaks		SP		
105								
110								
115				SAND-white fine to coarse sand w/ some gravel, few mafics		SW		
120								
125								
130								
135								

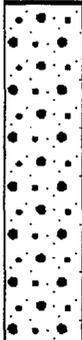
<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-11-2	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b> 11-27-90	<b>COMPLTD:</b> 12-1-90
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> 0
<b>TOC ELEV.:</b> 148.17 FT.	<b>MONITOR INST.:</b> OVA	<b>TOT DPTH:</b> 130FT.	<b>DPTH TO <math>\bar{y}</math>:</b> 89.88 FT.
<b>LOGGED BY:</b> E. BLOMBERG	<b>WELL DEVELOPMENT DATE:</b> 1-8-91		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
		1.1/1.5		SAND-red orange/brown fine sand w/ little silt, trace clay		SP		
5	2	1.2/1.5	0	SAND-dark red fine sand w/ some clay		SC	4-6-7	
10	3	1.0/1.5	0	SAND-dark red fine sand w/ little clay and silt		SP	3-5-5	
15	4	1.0/1.5	0	SAND-dark red to red orange fine sand w/ little silt and clay		SP	9-13-17	
20	5	0.9/1.5	0	SAND-red brown/gray/yellow fine sand w/ little silt and clay, mottled		SP	10-17-18	
25	8	1.1/1.5	0	CLAY-blue gray/dark purple clay w/ some silt, mottled		CL	2-5-7	
30	7	1.4/1.5	0	SAND-dark red to yellow fine sand w/ some silt		SM	3-7-7	
35	8	1.2/1.5	0	SAND-pink/yellow/gray fine sand w/ little silt and clay, mottled		SP	9-8-5	
40	8	1.5/1.5	0	SAND-yellow/pink/maroon/gray fine sand w/ little silt and clay		SP	7-5-5	
45	10	0.7/1.5	0	SAND-red/yellow/gray/pink fine sand w/ trace clay and gravel		SP	10-12-15	
50	11	0.7/1.5	0	SAND-light brown fine to medium sand, dense		SP	18-30-40	
55	12	0.8/1.5	0	SAND-light brown fine to coarse sand, dense, well sorted		SW	19-22-30	
60	13	0.4/1.5	0	SAND-brown coarse sand w/ little medium sand		SP	12-18-20	
65	14		0			SP	13-13-21	

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-11-2	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED: 11-27-90	COMPLTD: 12-1-90
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA: 10-INCH	PROTECTION LEVEL: D
TOC ELEV.: 148.17 FT.	MONITOR INST: OVA	TOT DPTH: 130FT.	DPTH TO $\nabla$ 89.88 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE: 1-8-91		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
Continued from PAGE 1								
70	15	1.0/1.5	0	SAND-brown/purple/gray/yellow fine sand w/ little clay, stratified	SP			
		0.7/1.5	0	SAND-brown/yellow fine sand w/ trace silt and clay	SW		8-11-20	
75	18	1.5/1.5	0	CLAY-purple/light gray clay, moderate plasticity, mottled	CL-CH		8-9-13	
80	17	1.5/1.5	0	CLAY-purple/lt gray/yellow clay, w/ trace silt, moderate plasticity, mottled	CL-CH		7-9-13	
85	18	0.2/1.5	0	CLAY-brown/gray clay	CL-CH		7-14-19	
90	19	1.5/1.5	0	CLAY-brown/gray clay, moderate plasticity	CL-CH		8-8-125	
95	20	1.0/1.5	0	SAND-pink/gray fine to medium sand w/ some clay	SP		20-40-42	
100	21	1.0/1.5	0	CLAY-pink/gray/red clay, low plasticity	CL		20-40-42	
105	22	1.0/1.5	0	SAND-pink/gray medium sand	SP		28-30-30	
110	23	0.5/1.5	0	SAND-lt brown/tan fine sand	SP		50/5	
115	24	1.0/1.5	0	SAND-lt gray/white medium sand w/ some gravel	SP		40-50/50	
120	25	1.0/1.5	0	SAND-lt brown/tan coarse sand w/ some gravel	SP			
125		1.0/1.5		SAND-tan/brown fine to medium sand w/ some coarse sand CLAY-yellow/buff/brown clay w/ some fine to coarse sand	SP			

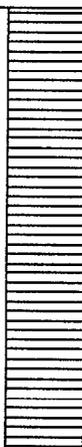
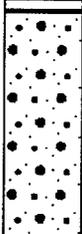
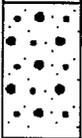
TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-12-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: GERAGHTY & MILLER		DATE STARTED: NA	COMPLTD: NA
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA.: 10-INCH	PROTECTION LEVEL: 0
TOC ELEV.: 138.49 FT.	MONITOR INST.: NA	TOT DPTH: 112.5 FT.	DPTH TO $\nabla$ 78.38 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH F.T.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-brown/red clay w/ some fine to medium sand		CL		
10								
15								
20								
25								
30				SAND-white fine to coarse sand w/ some red/white clay		SW		
35								
40								
45								
50								
55				CLAY-red/white/light gray clay w/ some white fine to coarse sand		CL		
60								
65								
70								
75								
80								
85								
90								
95				SAND-white fine to coarse sand, w/ some gravel and clay streaks		SC		
100								
105								
110								
115								

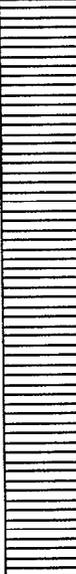
TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-13-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: GERAGHTY & MILLER		DATE STARTED: NA	COMPLTD: NA
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA.: 10-INCH	PROTECTION LEVEL: D
TOC ELEV.: 102.89 FT.	MONITOR INST.: NA	TOT DPTH: 112.5FT.	DPTH TO $\nabla$ 48.89 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				CLAY-red/gray clay w/ some fine to medium sand		CL		
10								
15								
20								
25								
30								
35								
40								
45								
50				CLAY-light gray clay w/ some buff fine sand		CL		
55								
60								
65								
70								
75								
80				SAND-buff fine to coarse sand		SW		
85				CLAY-light gray clay		CH		
90								
95								
100								
105				SAND-buff fine to coarse sand w/ some gravel and light gray clay		SC		
110								
115								
120								
125								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-14-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 139.73 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 152.5FT.	<b>DPTH TO <math>\nabla</math>:</b> 85.03 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-red clay w/ some fine to medium sand		CL		
50				SAND-buff fine to coarse sand		SW		
80				SAND-buff fine to medium sand w/ some orange/yellow/light gray clay		SW		
130				SAND-buff fine to coarse sand w/ some gravel, mafics		SW		

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-15-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: GERAGHTY & MILLER		DATE STARTED: NA	COMPLTD: NA
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA.: 10-INCH	PROTECTION LEVEL: □
TOC ELEV.: 88.21 FT.	MONITOR INST.: NA	TOT DPTH: 72.5 FT.	DPTH TO ∇ 25.18 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-red/gray/tan clay w/ some fine to medium sand		CL		
10								
15								
20								
25								
30								
35								
40								
45				SAND-buff fine to coarse sand w/ some light gray clay		SC		
50								
55								
60								
65				SAND-buff fine to coarse sand w/ some gravel, mafics		SW		
70								
75								
80								
85								
90								
95								
100								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-16-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 6500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA:</b> 10-INCH	<b>PROTECTION LEVEL:</b> 0
<b>TOC ELEV.:</b> 49.89 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 42.5FT.	<b>DPTH TO ∇:</b> 10.70 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-yellow fine to medium sand w/ some yellow clay		SC		
10				CLAY-red/white clay		CH		
15				SAND-white fine to coarse sand w/ some gravel		SW		
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-16-2	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 0500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b> 12-14-90	<b>COMPLTD:</b> 12-15-90
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>SCREEN INT.:</b> 10-INCH	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 82.08 FT.	<b>MONITOR INST.:</b> OVA	<b>TOT DPTH:</b> 70FT.	<b>DPTH TO ∇:</b> 38.22 FT.
<b>LOGGED BY:</b> A. DESANDRO		<b>WELL DEVELOPMENT DATE:</b> 1-8-91	<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5	2	1.0/1.5	0	SAND-brown very fine sand w/ some clay		SC	8-7-7	
10	3	1.0/1.5	0	Same as above		SC	7-8-13	
15	4	1.0/1.5	0	Same as above		SC	9-9-13	
20	5	1.0/1.5	0	SAND-brown/red/tan very fine sand w/ trace clay		SP	8-9-9	
25	6	1.2/1.5	0	CLAY-purple/tan clay w/ some sand, mottled		CH	12-16-18	
	7	1.1/1.5	0	CLAY-brown/gray clay, mottled, good plasticity		SP	9-13-13	
30	7	0.8/1.5	0	SAND-lt gray/white very fine sand		SP	9-13-13	
35	8	0.8/1.5	0	Same as above		SP	9-9-10	
40	9	0.6/1.5	0.2	SAND-lt red/tan coarse to very coarse sand		SP	11-8-8	
45	10	1.0/1.5	0.2	SAND-tan coarse sand w/some gravel		SP	17-23-23	
50	11	1.0/1.5	0.5	SAND-lt brown/tan coarse sand w/ some gravel		SP	14-15-19	
55	12	1.0/1.5	0.4	Same as above		SP	9-10-11	
80	13	0.8/1.5	0.4	Same as above		SP	15-17-18	
85	14	1.0/1.5	0.2	Same as above		SP	20-20-18	
70	15		0.3			SC	10-14-20	

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-17-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> GERAGHTY & MILLER		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> NA
<b>METHOD:</b> MUD-ROTARY	<b>CASE SIZE:</b> 4-INCH	<b>BORING DIA:</b> 10-INCH	<b>PROTECTION LEVEL:</b> 0
<b>TOC ELEV.:</b> 194.88 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 152.5 FT.	<b>DPTH TO <math>\nabla</math>:</b> 108.82 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-red clay w/ some fine to medium sand and cobbles		CL		
10								
15								
20								
25								
30								
35				CLAY-light gray clay w/ some fine sand		CL		
40								
45								
50								
55								
60								
65								
70								
75								
80								
85				SAND-buff fine to coarse sand w/ some gravel		SW		
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-18-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: GERAGHTY & MILLER		DATE STARTED: NA	COMPLTD: NA
METHOD: MUD-ROTARY	CASE SIZE: 4-INCH	BORING DIA: 10-INCH	PROTECTION LEVEL: D
TOC ELEV.: 163.49 FT.	MONITOR INST.: NA	TOT DPTH: 122.5 FT.	DPTH TO $\nabla$ 90.88 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-buff fine to coarse sand w/ some gravel, organics (0-5)		SW		
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85				SAND-buff fine to coarse sand w/ some gravel		SW		
90								
95				CLAY-buff/brown/tan clay w/ some fine to coarse sand and gravel		CL		
100								
105								
110				SAND-buff fine to coarse sand w/ some gravel		SW		
115								
120				CLAY-yellow/buff/brown clay w/ some fine to coarse sand		CL		
125								
130								

**APPENDIX B**  
**GEOPHYSICAL LOGS OF VERIFICATION STUDY WELLS**

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# UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS	GTGS CODE
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS  MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS  (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURE, LITTLE OR NO FINES	25
		GRAVELS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	26
		GRAVELS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	28
	SAND AND SANDY SOILS  MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	CLEAN SAND  (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	1
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	22
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES	37
FINE GRAINED SOILS  MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS  LIQUID LIMIT LESS THAN 50	SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND-CLAY MIXTURES	36
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	39
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	33
	SILTS AND CLAYS  LIQUID LIMIT GREATER THAN 50	SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	22=14
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	19
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	34
HIGHLY ORGANIC SOILS			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	40	
				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT	20

## SOIL CLASSIFICATION CHART

**NOTE:**  
WHEN SHOWN ON THE BORING LOGS, THE FOLLOWING TERMS ARE USED TO DESCRIBE THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE COMPACTNESS OF COHESIONLESS SOILS.

### COHESIVE SOILS (APPROXIMATE SHEARING STRENGTH IN KSF)

VERY SOFT	LESS THAN .25
SOFT	0.25 TO 0.5
MEDIUM STIFF	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

### COHESIONLESS SOILS

VERY LOOSE	THESE ARE USUALLY
LOOSE	BASED ON AN EXAMINATION
MEDIUM DENSE	OF SOIL SAMPLES,
DENSE	PENETRATION RESISTANCE AND
VERY DENSE	SOIL DENSITY DATA

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-1-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> ES&E INC.		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> 11-7-90
<b>METHOD:</b> GEOPHYSICAL LOGGING	<b>CASE SIZE:</b>	<b>BORING DIA.:</b>	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 183.49 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 122.5FT.	<b>DPTH TO</b> ∇ 90.88 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH F.T.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAYEY MATERIAL W/ SAND SEAMS		CL		
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60				SANDY MATERIAL		SP		
65								
70								
75								
80								
85								
90				CLAYEY ZONE		CL		
95								
100								
105								
110				SANDY MATERIAL		SP		
115								
120								
125								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-3W-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED:	COMPLTD: 11-7-81
METHOD: GEOPHYSICAL LOGGING	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 152FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA	SITE: WHITING FIELD	

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY	[Symbol]	CH		
10								
15								
20								
25				CLAYEY MATERIAL W/ SAND SEAMS	[Symbol]	CL		
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100				CLAY	[Symbol]	CH		
105				CLAYEY MATERIAL	[Symbol]	CL		
110								
115				SANDY MATERIAL SLIGHTLY CLAYEY	[Symbol]	SC		
120								
125								
130								
135				SANDY MATERIAL	[Symbol]	SP		
140								
145								
150								
155								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-3E-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED:	COMPLTD: 11-7-91
METHOD: GEOPHYSICAL LOGGING	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 152FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY		CH		
10								
15								
20				CLAYEY MATERIAL W/ SAND SEAMS		CL		
25								
30								
35								
40								
45								
50								
55								
60				CLAYEY MATERIAL W/ INCREASING CLAY		CL		
65								
70								
75								
80								
85								
90								
95								
100				CLAYEY MATERIAL W/ DECREASING CLAY		CL		
105								
110								
115								
120								
125								
130								
135				SANDY MATERIAL		SP		
140								
145								
150								
155								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-4-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-90
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA:	PROTECTION LEVEL: D
TOC ELEV.: 183.49 FT.	MONITOR INST.: NA	TOT DPTH: 152.5FT.	DPTH TO $\nabla$ 90.88 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH F.T.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAYEY MATERIAL		CL		
10								
15								
20				CLAY		CH		
25				CLAYEY MATERIAL W/ SAND SEAMS		CL		
30								
35								
40								
45								
50								
55								
60				CLAYEY MATERIAL		CL		
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135				SANDY MATERIAL		SP		
140								
145								
150								
155								
160								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-7-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> ES&E INC.		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> 11-7-90
<b>METHOD:</b> GEOPHYSICAL LOGGING	<b>CASE SIZE:</b>	<b>BORING DIA.:</b>	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 142.5FT.	<b>DPTH TO <math>\nabla</math> FT.</b>
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAYEY MATERIAL W/ SAND SEAMS	[Horizontal lines symbol]	CL		
10								
15								
20								
25								
30								
35								
40								
45				CLAY	[Dashed lines symbol]	CH		
50				CLAYEY MATERIAL W/ SANDY SEAMS	[Horizontal lines symbol]	CL		
55								
60								
65								
70								
75				CLAYEY MATERIAL W/ SANDY SEAMS	[Horizontal lines symbol]	CL		
80								
85								
90								
95								
100								
105								
110								
115				CLAY	[Dashed lines symbol]	CH		
120								
125								
130				SANDY MATERIAL	[Dotted lines symbol]	SP		
135				SANDY MATERIAL SLIGHTLY CLAYEY	[Horizontal lines symbol]	SC		
140								
145								
150								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-8-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> ES&E INC.		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> 11-7-90
<b>METHOD:</b> GEOPHYSICAL LOGGING	<b>CASE SIZE:</b>	<b>BORING DIA.:</b>	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 183.49 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 122.5FT.	<b>DPTH TO <math>\nabla</math>:</b> 90.88 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY		CH		
10				CLAYEY MATERIAL		CL		
15								
20								
25				CLAYEY MATERIAL W/ SANDY SEAMS		CL		
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105				SANDY MATERIAL W/ CLAYEY SEAMS		SC		
110								
115								
120				CLAYEY MATERIAL		CL		
125				SANDY MATERIAL SLIGHTLY CLAYEY		SC		
130								
135								
140								
145								
150								
155								
160				SANDY MATERIAL		SP		
165								
170								
175								
180								

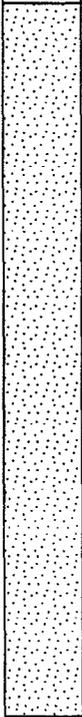
TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-9-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-90
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: NA	TOT DPTH: 117.5FT.	DPTH TO $\nabla$ 82.88 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				CLAYEY MATERIAL		CL		
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60				CLAY		CH		
65				CLAYEY MATERIAL		CL		
70								
75								
80				CLAYEY		CH		
85				CLAYEY MATERIAL		CL		
90								
95				SANDY MATERIAL		SP		
100								
105								
110								
115								
120								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-10-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> ESSE INC.		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> 11-7-90
<b>METHOD:</b> GEOPHYSICAL LOGGING	<b>CASE SIZE:</b>	<b>BORING DIA.:</b>	<b>PROTECTION LEVEL:</b> 0
<b>TOC ELEV.:</b> 148.77 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 117.5FT.	<b>DPH TO <math>\nabla</math></b> 84.23 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAYEY MATERIAL	[Horizontal lines]	CL		
10								
15								
20								
25				CLAY	[Dashed lines]	CH		
30								
35								
40				CLAYEY MATERIAL	[Horizontal lines]	CL		
45								
50								
55								
60								
65				CLAY	[Dashed lines]	CH		
70				CLAYEY MATERIAL	[Horizontal lines]	CL		
75								
80				CLAY	[Dashed lines]	CH		
85								
90				SANDY MATERIAL	[Dotted pattern]	SP		
95								
100								
105				CLAY	[Dashed lines]	CH		
110				SANDY MATERIAL	[Dotted pattern]	SP		
115								
120								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-11-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-90
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA.:	PROTECTION LEVEL: 0
TOC ELEV.: 163.49 FT.	MONITOR INST.: NA	TOT DPTH: 128FT.	DPTH TO $\nabla$ 90.88 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				NO DATA				
10								
15								
20								
25				CLAYEY MATERIAL		SC		
30								
35								
40								
45								
50								
55								
60								
65				SANDY MATERIAL		SP		
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								

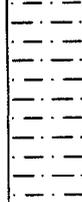
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CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-90
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA.:	PROTECTION LEVEL: D
TOC ELEV.: 183.49 FT.	MONITOR INST.: NA	TOT DPTH: 112FT.	DPTH TO $\nabla$ 90.88 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5					CLAYEY MATERIAL		CL		
10									
15									
20					CLAY				
25					CLAYEY MATERIAL W/ SAND SEAMS				
30									
35									
40									
45							CL		
50									
55									
60					CLAYEY MATERIAL				
65							CH		
70							CL		
75									
80									
85									
90									
95					SANDY MATERIAL		SP		
100									
105									
110									
115									
120									

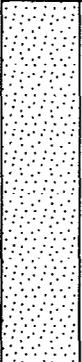
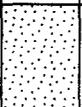
TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-13-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-91
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA.:	PROTECTION LEVEL: 0
TOC ELEV.: 102.89 FT.	MONITOR INST.: NA	TOT DPTH: 112.5FT.	DPTH TO $\nabla$ 48.89 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				CLAY	[Hatched pattern]	CH		
10								
15								
20								
25				CLAY MATERIAL	[Horizontal lines]	CL		
30								
35								
40				CLAY	[Hatched pattern]	CH		
45								
50				CLAYEY MATERIAL	[Horizontal lines]	CL		
55								
60				SANDY MATERIAL	[Dotted pattern]	SP		
65								
70								
75				CLAY	[Hatched pattern]	CH		
80				SANDY MATERIAL	[Dotted pattern]	SP		
85								
90								
95				CLAY	[Hatched pattern]	CH		
100								
105				SANDY MATERIAL	[Dotted pattern]	SP		
110								
115								
120								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-14-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-80
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA:	PROTECTION LEVEL: D
TOC ELEV.: 183.48 FT.	MONITOR INST.: NA	TOT DPTH: 152FT.	DPTH TO $\nabla$ 90.88 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAYEY MATERIAL		CL		
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65				CLAYEY MATERIAL W/ SAND SEAMS		CL		
70								
75								
80				CLAY		CH		
85				CLAYEY MATERIAL		CL		
90								
95								
100								
105								
110				SANDY MATERIAL SLIGHTLY CLAYEY		SC		
115								
120								
125								
130								
135				SANDY MATERIAL		SP		
140								
145								
150								

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-15-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-80
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA.:	PROTECTION LEVEL: 0
TOC ELEV.: 163.49 FT.	MONITOR INST.: NA	TOT DPTH: 72.5FT.	DPTH TO $\nabla$ 28.00 FT.
LOGGED BY: A	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAYEY MATERIAL		CL		
10								
15								
20								
25				SANDY MATERIAL		SP		
30								
35								
40								
45								
50								
55								
60				CLAYEY ZONE		CL		
65				SANDY MATERIAL		SP		
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								

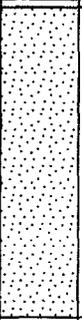
TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-16-1	BORING NO.
CLIENT: SDIV NAVY			PROJECT NO: 8500-01
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-90
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA.:	PROTECTION LEVEL: 0
TOC ELEV.: 183.49 FT.	MONITOR INST.: NA	TOT DPTH: 42.5FT.	DPTH TO $\nabla$ 11.09 FT.
LOGGED BY: A	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SANDY MATERIAL SLIGHTLY CLAYEY		SC		
10								
15								
20								
25								
30				SANDY MATERIAL		SP		
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>LOG of WELL:</b> WHF-17-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> ES&E INC.		<b>DATE STARTED:</b> NA	<b>COMPLTD:</b> 11-7-91
<b>METHOD:</b> GEOPHYSICAL LOGGING	<b>CASE SIZE:</b>	<b>BORING DIA.:</b>	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 194.88 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 152.5FT.	<b>DPH TO <math>\nabla</math>:</b> 108.82 FT.
<b>LOGGED BY:</b> NA	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH Ft.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5					CLAYEY MATERIAL		CL		
10					CLAYEY MATERIAL W/ SOME SAND SEAMS		CL		
15									
20									
25									
30									
35									
40					CLAY		CH		
45					CLAYEY MATERIAL		CL		
50									
55					CLAY		CH		
60					CLAYEY MATERIAL W/ SAND SEAMS		CL		
65									
70					CLAY		CH		
75					CLAYEY MATERIAL		CL		
80									
85									
90									
95									
100									
105					SANDY MATERIAL		SP		
110									
115									
120									
125									
130									
135									
140									
145									
150									
155									

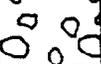
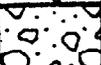
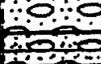
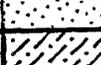
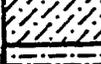
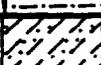
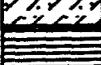
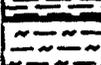
TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-18-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: ES&E INC.		DATE STARTED: NA	COMPLTD: 11-7-90
METHOD: GEOPHYSICAL LOGGING	CASE SIZE:	BORING DIA.:	PROTECTION LEVEL: D
TOC ELEV.: 183.49 FT.	MONITOR INST.: NA	TOT DPTH: 122.5 FT.	DPTH TO $\nabla$ 90.88 FT.
LOGGED BY: NA	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAYEY MATERIAL		CL		
10								
15								
20								
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90				SANDY MATERIAL		SP		
95								
100								
105								
110								
115								
120								
125								
130								

**APPENDIX C**

**PIEZOCONE PENETROMETER LOGS**

# UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS	GTGS CODE	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS  MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS  (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURE, LITTLE OR NO FINES	25
		GRAVELS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	26
		GRAVELS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	28
		GRAVELS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	26-43
	SAND AND SANDY SOILS  MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND  (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	1
		CLEAN SAND  (LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	22
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES	37
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND-CLAY MIXTURES	36
FINE GRAINED SOILS	SILTS AND CLAYS  LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	39	
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	33	
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	22-14	
	SILTS AND CLAYS  LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	19	
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	34	
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	40	
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT	20	

## SOIL CLASSIFICATION CHART

**NOTE:**  
WHEN SHOWN ON THE BORING LOGS, THE FOLLOWING TERMS ARE USED TO DESCRIBE THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE COMPACTNESS OF COHESIONLESS SOILS.

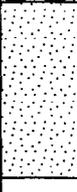
### COHESIVE SOILS (APPROXIMATE SHEARING STRENGTH IN KSF)

VERY SOFT	LESS THAN .25
SOFT	0.25 TO 0.5
MEDIUM STIFF	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

### COHESIONLESS SOILS

VERY LOOSE	THESE ARE USUALLY BASED ON AN EXAMINATION OF SOIL SAMPLES, PENETRATION RESISTANCE AND SOIL DENSITY DATA
LOOSE	
MEDIUM DENSE	
DENSE	
VERY DENSE	

TITLE: NAS WHITING FIELD RI		LOG of WELL: WHF-1-CPT-1	BORING NO.
CLIENT: SOIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED: 1-11-91	COMPLTD: 1-11-91
METHOD: PCPT	CASE SIZE: NA	SCREEN INT: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 138FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-dense sand		SP		
10								
15								
20								
25				CLAY-stiff clay		CH		
30				SAND-dense sand		SP		
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90				SILT-silt w/ some clay		ML		
95								
100				SAND-dense sand w/ stiff clay seams		SC		
105								
110								
115								
120								
125				SAND-dense sand		SP		
130								
135								
140								

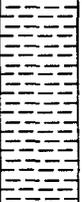
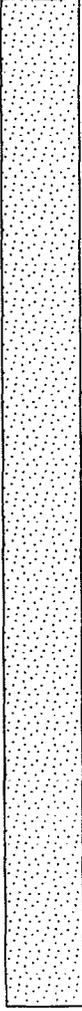
TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-2-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 1-13-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 152FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-dense sand		SP		
10								
15								
20								
25								
30								
35				CLAY-stiff clay		CH		
40				SAND-dense sand		SP		
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95				SAND-dense sand w/ few clay seams		SP		
100								
105								
110				SAND-dense sand		SP		
115								
120								
125								
130								
135								
140								
145								
150				SAND-dense gravelly coarse sand		SP		
155								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-3-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-15-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 103FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH F.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-dense sand	[Symbol]	SP		
10				CLAY-stiff clay	[Symbol]	CH		
15								
20				SAND-dense sand	[Symbol]	SP		
25				CLAY-stiff clay	[Symbol]	CH		
28				SAND-dense sand	[Symbol]	SP		
30				CLAY-stiff clay	[Symbol]	CH		
35				SAND-dense sand	[Symbol]	SP		
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-3-CPT-2	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-15-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 100FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-loose sand		SP		
10				CLAY-stiff clay		CH		
20				SAND-very dense sand		SP		
30				SAND-moderately dense to dense sand		SP		

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-9-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-15-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 100FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-dense sand	[Symbol]	SP		
				CLAY-firm clay	[Symbol]	CH		
10				SAND-moderately dense sand w/ stiff sandy clay seams	[Symbol]	SC		
15					[Symbol]			
20					[Symbol]			
25					[Symbol]			
30					[Symbol]			
35				SAND-moderately dense to dense sand	[Symbol]	SP		
40					[Symbol]			
45					[Symbol]			
50					[Symbol]			
55					[Symbol]			
60					[Symbol]			
65					[Symbol]			
70					[Symbol]			
75					[Symbol]			
80					[Symbol]			
85					[Symbol]			
90					[Symbol]			
95					[Symbol]			
100					[Symbol]			

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-10-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED: 12-15-90	COMPLTD: 1-14-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 123FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-moderately dense sand	[Symbol]	SP		
10				CLAY-stiff clay interbedded w/ sand seams	[Symbol]	CL		
15					[Symbol]			
20					[Symbol]			
25				SAND-moderately dense sand	[Symbol]	SP		
30				CLAY-stiff clay w/ some sand	[Symbol]	CH		
35				SAND-moderately dense sand	[Symbol]	SP		
40				SAND-very dense sand	[Symbol]	SP		
45					[Symbol]			
50				CLAY-stiff clay w/ some sand	[Symbol]	CH		
55				SAND-dense to very dense sand	[Symbol]	SP		
60					[Symbol]			
65					[Symbol]			
70					[Symbol]			
75				CLAY-soft clay	[Symbol]	CH		
80					[Symbol]			
85					[Symbol]			
90				SAND-dense to very dense sand	[Symbol]	SP		
95					[Symbol]			
100					[Symbol]			
105					[Symbol]			
110					[Symbol]			
115				CLAY-stiff clay	[Symbol]	CH		
120				SAND-dense sand	[Symbol]	SP		
125					[Symbol]			

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-10-CPT-2	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-17-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 110FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH F.T.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-moderately dense sand		SP		
5				CLAY-stiff clay		CH		
10								
15				SAND-moderately dense sand		SP		
20								
25								
30								
35								
40				CLAY-stiff clay w/ some sand and sand lenses		CL		
45								
50				SAND-very dense some		SP		
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-II-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 6500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-14-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 135FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-loose to medium dense sand		SP		
				CLAY-firm clay		CH		
10				SAND-loose sand		SP		
				CLAY-stiff clay		CH		
15				SAND-medium dense sand		SP		
				CLAY-stiff clay		CH		
20				SAND-moderately dense sand		SP		
				CLAY-stiff clay		CH		
25				SAND-moderately dense sand		SP		
				CLAY-stiff clay		CH		
30				SAND-moderately dense sand		SP		
				CLAY-stiff clay		CH		
35				SAND-moderately dense sand		SP		
				CLAY-stiff clay		CH		
40				SAND-dense sand		CH		
				CLAY-firm clay		ML		
45				SILT-silt w/ some clay				
50				SAND-dense sand w/ interbedded clay lenses		CH		
55								
60								
65				SAND-dense sand		SP		
70								
75								
80								
85				SAND-dense sand w/ some silt		SM		
90						SP		
95								
100				CLAY-stiff clay		CH		
				SAND-dense sand		SP		
105				CLAY-stiff clay		CH		
				SAND-dense sand		SP		
110								
115								
120								
125								
130								
135								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-12-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-17-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 130FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5					SAND-loose sand		SP		
					CLAY-firm clay		CL		
10					CLAY-stiff clay		CH		
15					SAND-moderately dense sand		SP		
20									
25					SAND-dense to very dense sand		SP		
30									
35									
40									
45									
50									
55									
60					CLAY-firm to stiff clay		CH		
65									
70									
75									
80					SAND-dense to very dense sand		SP		
85									
90									
95									
100									
105									
110									
115									
120									
125									
130									

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-13-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-18-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 130FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-medium dense sand	[Symbol]	SP		
5				CLAY-stiff clay	[Symbol]	CH		
10				SAND-dense sand	[Symbol]	SP		
15								
20								
25								
30								
35				SILT-loose silt w/ some clay	[Symbol]	ML		
40								
45				SAND-dense sand w/ silty clay lenses	[Symbol]	SC		
50								
55								
60								
65								
70				SAND-dense sand	[Symbol]	SP		
75								
80								
85								
90				CLAY-firm clay w/ some silt	[Symbol]	CL		
95								
100				SAND-dense sand	[Symbol]	SP		
105								
110				CLAY-stiff clay	[Symbol]	CH		
115				SAND-dense sand	[Symbol]	SP		
120				CLAY-firm clay	[Symbol]	CH		
125				SAND-dense sand	[Symbol]	SP		
130				SAND-dense sand w/ some silt	[Symbol]	SM		

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-13-CPT-2	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 6500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-17-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 130FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-dense sand w/ some clay		SC		
10				SAND-dense sand		SP		
15								
20								
25								
30				CLAY-firm clay		CH		
35								
40								
45								
50								
55				SAND-dense sand w/ silty clay lenses		SP		
60								
65								
70				SAND-dense sand		SP		
75								
80								
85								
90								
95								
100								
105				CLAY-stiff clay		CH		
110				SAND-dense sand		SP		
115				SAND-dense sand		SP		
120								
125								
130								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-14-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-17-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: 138.58 FT.	MONITOR INST.: NA	TOT DPTH: 153FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-loose sand w/ clay lenses		SP		
10				CLAY-stiff clay		CH		
15				SAND-dense sand		SP		
20								
25								
30								
35								
40								
45								
50								
55								
60				CLAY-stiff clay		CH		
65				SAND-dense sand		SP		
70								
75								
80				SILT-dense silt w/ some clay		ML		
85								
90				SAND-dense sand w/ clay lenses		SC		
95								
100				SAND-dense to very dense sand		SP		
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155								

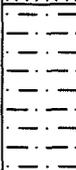
TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-15-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPL TO: 12-11-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 98FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-moderately dense sand		SP		
10				CLAY-clay w/ some sand		CL		
20				SAND-dense sand		SP		
100								

<b>TITLE:</b> NAS WHITING FIELD RI		<b>PCPT SOUNDING:</b> WHF-15-CPT-2	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b>	<b>COMPLTD:</b> 12-11-90
<b>METHOD:</b> PCPT	<b>CASE SIZE:</b> NA	<b>BORING DIA:</b> NA	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 80.18 FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 100FT.	<b>DPTH TO <math>\nabla</math>:</b> NA FT.
<b>LOGGED BY:</b> COMPUTER	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-moderately dense sand		SP		
15				CLAY-stiff clay		CH		
20				SAND-dense sand		SP		
22				CLAY-stiff clay		CH		
25				SAND-dense sand w/ clay lenses		SC		
40				SAND-moderately dense sand		SP		
85				CLAY-stiff clay		CH		
90				SAND-dense sand		SP		

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-16-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-11-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 80FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-dense sand		SP		
10				SAND-dense sand w/ some clay and clay lenses		SC		
15								
20				SAND-moderately dense sand		SP		
25								
30								
35								
40								
45								
50								
55								
60								
65								
70								
75								
80								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-18-CPT-2	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 6500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 12-11-90
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 80FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5					SAND-loose to moderately dense sand	[Stippled pattern]	SP		
15					CLAY-stiff clay	[Horizontal dashed pattern]	CH		
20					SAND-dense sand	[Stippled pattern]	SP		
25					CLAY-stiff clay	[Horizontal dashed pattern]	CH		
30					SAND-very dense sand	[Stippled pattern]	SP		
70					SAND-dense sand	[Stippled pattern]	SP		

<b>TITLE:</b> NAS WHITING FIELD RI		<b>PCPT SOUNDING:</b> WHF-17-CPT-1	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b>	<b>COMPLTD:</b> 1-9-91
<b>METHOD:</b> PCPT	<b>CASE SIZE:</b> NA	<b>BORING DIA:</b> NA	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> NA FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 185FT.	<b>DPTH TO ∇:</b> NA FT.
<b>LOGGED BY:</b> COMPUTER	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-firm to stiff clay		CH		
10								
15				SAND-moderately dense sand		SP		
20								
25				CLAY-firm to stiff clay and sandy clay		CH		
30								
35								
40								
45								
50								
55				SAND-dense to very dense sand		SP		
60								
65								
70								
75								
80				CLAY-stiff clay		CH		
85				SAND-dense sand		SP		
90								
95								
100								
105				SAND-dense coarse sand w/ some gravel		SP		
110								
115								
120								
125				SAND-dense to very dense sand		SP		
130								
135								
140								
145								
150								
155				CLAY-soft clay		CH		
160				SAND-very dense sand		SP		
165								
170								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-18-CPT-1	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 1-8-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 178FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-loose to dense sand		SP		
10								
15								
20								
25				CLAY-stiff clay w/ some sand		CL		
30				SAND-moderately dense to dense sandlay		SP		
35								
40								
45				CLAY-stiff clay		CH		
50				SAND-dense sand		SP		
55								
60								
65								
70								
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155				SAND-dense sand w/ clay lenses		SC		
160								
165				SILT-loose silt w/ some sand		ML		
170								
175				SAND-very dense sand		SP		
180								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-S2-WP-01	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-28-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 144FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-moderately dense sand	[stippled]	SP		
10								
15				SAND-dense sand	[stippled]	SP		
20								
25								
30								
35				SAND-dense sand	[stippled]	SP		
40								
45								
50								
55								
60								
65								
70								
75				CLAY-stiff clay	[horizontal dashes]	CH		
80				SAND-very dense sand	[stippled]	SP		
85				CLAY-stiff clay	[horizontal dashes]	CH		
90				SAND-very dense sand	[stippled]	SP		
95								
100								
105								
110				SAND-dense sand w/ clay lenses	[stippled with horizontal dashes]	SC		
115								
120								
125								
130				SAND-dense sand	[stippled]	SP		
135								
140								
145								
150								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-S2-WP-02	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: B500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-5-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 132FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-loose to moderately dense sand		SP		
10								
15								
20								
25								
30				SAND-dense sand		SP		
35								
40								
45								
50								
55								
60								
65								
70								
75								
80				SILT-firm silt w/ some clay		ML		
85								
90								
95				SAND-dense to very dense sand		SP		
100								
105								
110								
115								
120								
125								
130								
135								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-S2-WP-03	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-20-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 138FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-moderately dense sand		SP		
				CLAY-firm clay w/ some sand		CL		
10				SAND-loose sand		SP		
				CLAY-firm clay w/ some sand		CL		
15				SAND-loose to moderately dense sand		SP		
20								
25				SAND-dense sand		SP		
30								
35								
40								
45								
50								
55								
60								
65								
70								
75				CLAY-stiff clay		CH		
80				SAND-dense to very dense sand		SP		
85								
90								
95								
100								
105								
110								
115				SAND-moderately dense sand w/ clay lenses		SC		
120								
125								
130								
135				SAND-dense sand		SP		
140								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-S2-WP-04	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-20-81
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 157 FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-moderately dense sand	[Symbol]	SP		
10				CLAY-stiff clay	[Symbol]	CH		
15				SAND-loose to moderately dense sand	[Symbol]	SP		
20								
25								
30				SAND-dense sand	[Symbol]	SP		
35								
40								
45								
50								
55								
60								
65				SAND-moderately dense sand	[Symbol]	SP		
70				SAND-dense sand	[Symbol]	SP		
75								
80								
85								
90								
95								
100								
105								
110								
115								
120								
125								
130								
135								
140								
145								
150								
155								
160								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-S2-WP-05	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-27-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 133FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				CLAY-firm to stiff sandy clay		CL		
15				SAND-moderately dense to dense sand		SP		
25				CLAY-stiff clay		CH		
30				SAND-dense sand		SP		
35				CLAY-stiff clay		CH		
40				SAND-dense to very dense sand		SP		
50				SAND-moderately dense sand		SP		
70				CLAY-clay lense		CH		
75				SAND-dense sand		SP		
110				SILT-moderately dense silt w/ some clay		ML		
125				SAND-dense sand		SP		

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-S2-WP-08	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 1-7-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 188FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH F.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5					SAND-moderately dense sand		SP		
10					CLAY-very stiff clay		CH		
15					SAND-dense sand		SP		
20									
25									
30									
35									
40									
45									
50									
55									
60							SP		
65									
70									
75					SAND-dense sand w/ clay lenses		SC		
80					SAND-dense to very dense sand		SP		
85									
90									
95									
100									
105									
110									
115									
120									
125									
130					SILT-moderately dense silt w/ some clay and sand lenses		ML		
135									
140									
145									
150									
155					SILT-moderately dense silt w/ some clay		ML		
160									
165									
170					SAND-dense sand w/ silt and clay lenses		SP		

<b>TITLE:</b> NAS WHITING FIELD RI		<b>PCPT SOUNDING:</b> WHF-S2-WP-07	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b>	<b>COMPLTD:</b> 1-12-91
<b>METHOD:</b> PCPT	<b>CASE SIZE:</b> NA	<b>BORING DIA.:</b> NA	<b>PROTECTION LEVEL:</b> 0
<b>TOC ELEV.:</b> NA FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 157FT.	<b>DPTH TO <math>\nabla</math>:</b> NA FT.
<b>LOGGED BY:</b> COMPUTER	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
6				CLAY-very soft clay		CH		
10				CLAY-firm clay		CH		
15				SAND-moderately dense sand w/ some silt		SM		
25				CLAY-stiff clay		CH		
30				SAND-dense sand		SP		
35				CLAY-stiff clay		CH		
40				SAND-dense to very dense sand		SP		
90				SAND-dense sand		SP		
105				SILT-moderately dense silt w/ some clay		ML		
115				SAND-dense sand		SP		
120				SILT-moderately dense silt w/ some clay		ML		
125				SAND-dense to very dense sand		SP		

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-S2-WP-08	BORING NO.
CLIENT: SDIV NAVY			PROJECT NO: 8500-01
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 1-12-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 133FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-very loose sand		SP		
10				CLAY-firm clay		CH		
15				SAND-moderately dense sand		SP		
20								
25				CLAY-stiff clay		CH		
30				SAND-dense sand		SP		
35								
40								
45				SAND-moderately dense sand				
50								
55								
60				SAND-dense sand				
65								
70								
75				CLAY-stiff clay		CH		
80				SAND-dense sand		SP		
85								
90				CLAY-stiff clay		CH		
95				SAND-very dense sand w/ some gravel		SP		
100								
105								
110								
115								
120								
125								
130								
135								
140								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-W3-WP-01	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 3-1-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 118 FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-loose to moderately dense sand		SP		
10				CLAY-stiff clay w/ sand lenses		CH		
15				CLAY-stiff clay		CH		
20				CLAY-stiff clay w/ some silt and sand		CL		
25				SAND-dense sand		SP		
30				CLAY-stiff clay		CH		
35				SAND-moderately dense sand		SP		
40								
45								
50								
55				CLAY-firm clay		CH		
60				SAND-dense sand		SP		
65								
70								
75				CLAY-firm clay w/ some silt and sand		CL		
80				SAND-dense sand		SP		
85								
90				SAND-dense coarse sand w/ some gravel		SP		
95				SAND-dense sand		SP		
100				CLAY-stiff clay w/ some silt and sand		CL		
105				SAND-moderately dense sand w/ some silt		SM		
110				SAND-dense sand		SP		
115								
120								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-W3-WP-02	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-2-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 130FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-loose to moderately dense sand		SP		
15				CLAY-stiff clay		CH		
25				SAND-moderately dense to dense sand w/ some silt		SM		
35				CLAY-very stiff clay		CH		
45				SAND-dense sand		SP		
50				SAND-dense coarse sand w/ some gravel		SP		
55				SAND-dense sand		SP		
75				CLAY-firm clay		CH		
80				SAND-dense sand		SP		

<b>TITLE:</b> NAS WHITING FIELD RI		<b>PCPT SOUNDING:</b> WHF-W3-WP-03	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b> 1-31-91	<b>COMPLTD:</b> 2-28-91
<b>METHOD:</b> PCPT	<b>CASE SIZE:</b> NA	<b>BORING DIA.:</b> NA	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> NA FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 140FT.	<b>DPTH TO ∇:</b> NA FT.
<b>LOGGED BY:</b> COMPUTER	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-loose to moderately dense sand		SP		
10				CLAY-stiff clay w/ few sand lenses		CH		
15								
20								
25				SAND-moderately dense sand		SP		
30				CLAY-stiff clay		CH		
35				SAND-moderately dense sand		SP		
40								
45								
50								
55								
60								
65								
70								
75				CLAY-stiff clay		CH		
80				SAND-dense sand		SP		
85				SAND-dense coarse sand w/ some gravel		SP		
90								
95								
100								
105								
110								
115								
120				SAND-dense sand		SP		
125								
130				SAND-dense coarse sand w/ some gravel		SP		
135								
140								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-W3-WP-04	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-28-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 153FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-loose to moderately dense sand	[Symbol]	SP		
10				CLAY-stiff clay	[Symbol]	CH		
15				SAND-loose to moderately dense sand	[Symbol]	SP		
20				SAND-dense sand	[Symbol]	SP		
25				CLAY-stiff clay	[Symbol]	CH		
30				SAND-dense sand	[Symbol]	SP		
35				CLAY-stiff clay	[Symbol]	CH		
40				SAND-moderately dense sand	[Symbol]	SP		
45								
50								
55								
60								
65				SAND-dense sand	[Symbol]	SP		
70								
75				SAND-dense sand w/ clay lenses	[Symbol]	SC		
80				SAND-dense sand	[Symbol]	SP		
85								
90								
95				SAND-very dense sand coarse sand w/ some gravel	[Symbol]	SP		
100								
105								
110								
115								
120				SAND-moderately dense to dense sand	[Symbol]	SP		
125								
130				SAND-dense coarse sand w/ some gravel	[Symbol]	SP		
135								
140								
145								
150								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-W3-WP-05	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 1-13-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 132FT.	DPH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-loose sand		SP		
15				SAND-moderately dense sand		SP		
30				CLAY-firm clay		CH		
35				SAND-dense to very dense sand		SP		
50				CLAY-soft clay		CH		
55				SAND-dense sand		SP		
80				CLAY-soft clay		CH		
85				SAND-moderately dense sand		SP		
90				SAND-dense to very dense sand		SP		
105				CLAY-very soft clay		CH		
120				SAND-moderately dense sand w/ clay lenses		SP		
130				SAND-dense sand		SP		

<b>TITLE:</b> NAS WHITING FIELD RI		<b>PCPT SOUNDING:</b> WHF-W3-WP-08	<b>BORING NO.</b>
<b>CLIENT:</b> SDIV NAVY		<b>PROJECT NO:</b> 8500-01	
<b>CONTRACTOR:</b> WILLIAMS & ASSOC.		<b>DATE STARTED:</b>	<b>COMPLTD:</b> 3-17-81
<b>METHOD:</b> PCPT	<b>CASE SIZE:</b> NA	<b>BORING DIA.:</b> NA	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> NA FT.	<b>MONITOR INST.:</b> NA	<b>TOT DPTH:</b> 158FT.	<b>DPTH TO <math>\nabla</math>:</b> NA FT.
<b>LOGGED BY:</b> COMPUTER	<b>WELL DEVELOPMENT DATE:</b> NA		<b>SITE:</b> WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-loose sand		SP		
10				SAND-moderately dense sand		SP		
15				SAND-dense sand		SP		
20				CLAY-firm clay		CH		
25				SAND-dense to very dense sand		SP		
30						CH		
35						SP		
40						SP		
45						SP		
50						SP		
55				SAND-very dense coarse sand w/ some gravel		SP		
60				SAND-dense sand		SP		
65						SP		
70				CLAY-firm clay		CH		
75				SAND-dense sand		SP		
80						SP		
85						SP		
90						SP		
95						SP		
100						SP		
105						SP		
110						SP		
115				SILT-moderately dense silt		ML		
120						ML		
125						ML		
130						ML		
135						ML		
140						ML		
145				SILT-moderately dense silt w/ some clay		ML		
150				SAND-dense sand		SP		
155						SP		
160						SP		

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-W3-WP-07	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 3-4-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 132FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5					SAND-loose sand	[stippled pattern]	SP		
10									
15					SAND-moderately dense to dense sand	[stippled pattern]	SP		
20									
25									
30									
35									
40					CLAY-stiff clay	[horizontal lines]	CH		
45					SAND-moderately dense to dense sand	[stippled pattern]	SP		
50									
55									
60									
65									
70									
75									
80									
85									
90									
95									
100									
105									
110									
115					CLAY-firm clay w/ some silt	[horizontal lines]	CL		
120									
125					SAND-dense to very dense sand	[stippled pattern]	SP		
130									
135									

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-W3-WP-08	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 2-4-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA.: NA	PROTECTION LEVEL: 0
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 124FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA	SITE: WHITING FIELD	

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				SAND-loose sand	[Symbol]	SP		
10				CLAY-stiff clay w/ some sand	[Symbol]	CH		
15								
20				SAND-moderately dense sand	[Symbol]	SP		
25				CLAY-very stiff clay	[Symbol]	CH		
30				SAND-dense sand	[Symbol]	SP		
35				CLAY-very stiff clay	[Symbol]	CH		
40				SAND-moderately dense sand	[Symbol]	SP		
45								
50								
55								
60								
65								
70				CLAY-firm clay	[Symbol]	CH		
75				SAND-dense sand	[Symbol]	SP		
80								
85				SAND-dense coarse sand w/ some gravel	[Symbol]	SP		
90								
95								
100								
105								
110				CLAY-firm clay	[Symbol]	CH		
115				SAND-dense to very dense coarse sand w/ some gravel	[Symbol]	SP		
120								
125								

TITLE: NAS WHITING FIELD RI		PCPT SOUNDING: WHF-W3-WP-09	BORING NO.
CLIENT: SDIV NAVY		PROJECT NO: 8500-01	
CONTRACTOR: WILLIAMS & ASSOC.		DATE STARTED:	COMPLTD: 3-2-91
METHOD: PCPT	CASE SIZE: NA	BORING DIA: NA	PROTECTION LEVEL: D
TOC ELEV.: NA FT.	MONITOR INST.: NA	TOT DPTH: 113FT.	DPTH TO $\nabla$ NA FT.
LOGGED BY: COMPUTER	WELL DEVELOPMENT DATE: NA		SITE: WHITING FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				SAND-loose sand		SP		
				CLAY-soft clay w/ some sand		CL		
10				CLAY-very stiff clay		CH		
15				SAND-moderately dense sand		SP		
20				CLAY-stiff clay		CH		
25				SAND-very dense sand		SP		
30				CLAY-stiff clay		CH		
35				SAND-moderately dense sand		SP		
40								
45								
50								
55								
60								
65								
70								
75								
80								
85								
90				SAND-very dense coarse sand w/ some gravel		SP		
95								
100								
105								
110								
115								