N00204.AR.005016
NAS PENSACOLA
5090.3a

CONTAMINATION ASSESSMENT REPORT AND APPENDICES A THROUGH E VOLUME I OF II SITE 2662W NAVAL AVIATION DEPOT NAS PENSACOLA FL
04/20/1994
ABB ENVIRONMENTAL SERVICES INC

CONTAMINATION ASSESSMENT REPORT AND APPENDICES A THROUGH E

SITE 2662W
NAVAL AVIATION DEPOT
NAVAL AIR STATION
PENSACOLA, FLORIDA

VOLUME I OF II

CONTRACT TASK ORDER NO. 008
CLEAN - DISTRICT I
CONTRACT NO. N62467-89-D-0317

APRIL 1994

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
29419-9010

PRINTED ON RECYCLED PAPER

20 April, 1994

Southern Division
Naval Facilities Engineering Command
ATTN: Luis Vazquez
2155 Eagle Drive
North Charleston, SC 29418

Subject: Transmittal Letter for the Contamination Assessment Report
Site 2662W, Naval Aviation Depot, Naval Air Station, Pensacola, Florida
Contract N62467-89-D-0317, CTO No. 8

Dear Luis:

Please find attached five copies of the Contamination Assessment Report (CAR) for site 2662W at the Naval Fuel Depot (NADEP) on Naval Air Station Pensacola. The document is presented in two volumes. The first volume is the CAR and Appendices A through E. The second volume is Appendix F, Laboratory Data, that accompanies the CAR. One copy of the document has been sent to Frank Stuart at the NADEP facility and two copies have been forwarded to David Clowes at the Florida Department of Environmental Protection (FDEP) for his review.

As directed by the FDEP, ABB Environmental Services, Inc. (ABB-ES) has prepared a comprehensive CAR to include all data collected since the contamination assessment investigation began in early 1992. These data include all references to petroleum and chlorinated compounds contamination in the vicinity of Buildings 2662 and 3380. ABB-ES has recommended that a Remedial Action Plan (RAP) be prepared (pending CAR approval) for the petroleum plume in the vicinity of Building 2662 under the requirements of Chapter 17-770, Florida Administrative Code. ABB-ES also recommends that the mixed plume of petroleum and chlorinated compound contamination in the vicinity of Building 3380 be addressed under the Installation Restoration Program under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act.

Please review the document at your leisure and provide us with comments as soon as possible. Pending receipt of comments from the FDEP, we will insure that your comments as well as FDEP's are incorporated into the document.

ABB Environmental Services Inc.

2590 Executive Center Circle East
Berkeley Building
Tallahassee, Florida 32301

Telephone (904) 656-1293
Fax (904) 877-0742

ABB

Subject: Transmittal Letter for the CAR for Site 2662W, NADEP Pensacola

If you have any questions or concerns please give me a call at your earliest convenience at (904)-656-1293.

Sincerely,

ABB ENVIRONMENTAL SERVICES, INC.

Mark C. Diblin

Mark C. Diblin, P.G.
Task Order Manager

cc: Frank Stuart, NADEP, Pensacola

File:users\mdiblin\2662car.let

DISTRIBUTION

SOUTHNAVFACENGCOM	5
NADEP Pensacola	1

CONTAMINATION ASSESSMENT REPORT

SITE 2662W
NAVAL AVIATION DEPOT
NAVAL AIR STATION
PENSACOLA, FLORIDA

Contract Task Order No. 008

Contract No. N62467-89-D-0317

Prepared by:

ABB Environmental Services, Inc.
2590 Executive Center Circle, East
Tallahassee, Florida 32301

Authors:

Mark Diblin
Roger Durham
Jay Koch

Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29418

Luis Vazquez, Code 1843, Engineer-in-Charge

April 1994

FOREWORD

Subtitle I of the Hazardous and Solid Waste Amendments (HSWA) of 1984 to the Solid Waste Disposal Act (SWDA) of 1965 established a national regulatory program for managing underground storage tanks (USTs) containing hazardous materials, especially petroleum products. Hazardous wastes stored in USTs were already regulated under the Resource Conservation and Recovery Act (RCRA) of 1976, which was also an amendment to SWDA. Subtitle I requires that the U.S. Environmental Protection Agency (USEPA) promulgate UST regulations. The program was designed to be administered by the individual States, who were allowed to develop more stringent standards, but not less stringent standards. Local governments were permitted to establish regulatory programs and standards that are more stringent, but not less stringent than either State or Federal regulations. The USEPA UST regulations are found in the Code of Federal Regulations, Title 40, Part 280 (40 CFR 280) (*Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks*) and Title 40 CFR 281 (*Approval of State Underground Storage Tank Programs*). Title 40 CFR 280 was revised and published on September 23, 1988, and became effective December 22, 1988.

The Navy's UST program policy is to comply with all Federal, State, and local regulations pertaining to USTs. This report was prepared to satisfy the requirements of the Florida Department of Environmental Protection (formerly the Florida Department of Environmental Regulation) Chapter 17-770, Florida Administrative Code (FAC) (*State Underground Petroleum Environmental Response*) regulations on petroleum contamination in Florida's environment as a result of spills or leaking tanks or piping.

Questions regarding this report should be addressed to the Environmental Coordinator, Naval Aviation Depot (NADEP), Naval Air Station, Pensacola, Florida, at 904-452-2320, or to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), Code 1843, at AUTOVON 563-0613 or 803-743-0613.

EXECUTIVE SUMMARY

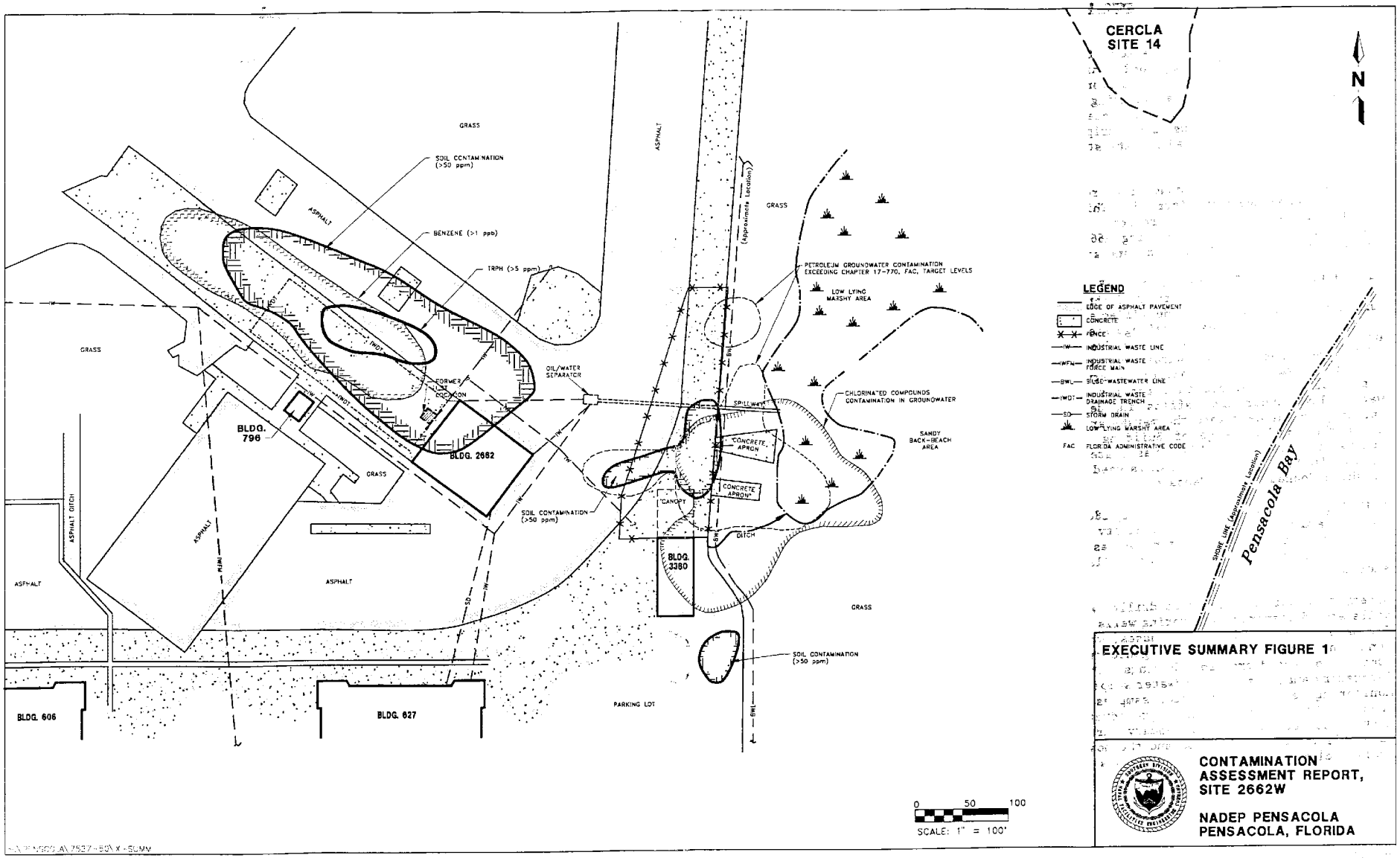
Site 2662W is the former location of a 1,000-gallon underground storage tank (UST) located near Building 2662, which is in the southeast part of Chevalier Field. Chevalier Field is predominantly used as a helicopter maintenance and testing facility. The UST at Building 2662 was installed in 1983 and was removed during a tank removal program conducted in 1989 and 1990. Building 2662 is used as a helicopter cleaning and stripping facility. According to facility personnel, the UST was used for the storage of water-contaminated JP-5 jet fuel and used oil.

The UST was located in a concreted area on the northwest side of Building 2662 (see Executive Summary Figure 1). This area is currently used for helicopter maintenance and defueling operations. The asphalt-covered area along the north, east, and south side of Building 2662 is used as a thoroughfare for routine vehicular traffic, helicopters, and associated machinery.

ABB Environmental Services, Inc. (ABB-ES), conducted a contamination assessment (CA) at the site from January 1992 through March 1994. During the CA, several underground pipelines were identified as possible sources of contamination at the site. An industrial waste drainage trench (IWDT) is located along the perimeter of the helicopter maintenance and defueling area northwest of Building 2662. The IWDT feeds into an oil-water separator northeast of Building 2662. Two industrial waste (IW) pipelines carry the oil and floating liquid from the separator via pipelines that run out of the separator to the southwest. The water flows under the baffles inside of the separator and out through the spillway to the east into the marshy area. An additional IW pipeline is located along the northern edge of Building 2662 and is oriented in a northwest to southeast direction. A bilge wastewater line (BWL) is located along the eastern side of Building 3380. The BWL is used to transport oily wastewater from bilges of ships docked at NAS Pensacola.

Building 3380, located approximately 180 feet southeast of Building 2662, is used as a hazardous waste storage facility and was identified as another potential source of contamination. Hazardous wastes are stored inside a fenced area along the northern side of the building. Oils, paint, and other flammable liquids are stored inside Building 3380.

Ninety-five soil borings were drilled and sampled, and 52 permanent monitoring wells and 15 temporary monitoring wells were installed at the site during the CA. The CA was performed in four phases, which are summarized in Table ES-1. Soil contamination was assessed by organic vapor analyzer (OVA) headspace analysis of samples collected from soil borings. Groundwater contamination was assessed by laboratory analyses of groundwater samples collected from permanent and temporary monitoring wells. Groundwater samples were collected during each of the four phases. The most comprehensive groundwater sample collection occurred during the last phase, conducted from January through March 1994 (Table ES-1). Based on data collected during the CA and the most current groundwater sample laboratory analytical results, the following is a summary of conditions at the site.



EXECUTIVE SUMMARY FIGURE 1

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

Table ES-1
Chronology of Soil Boring Installations, Monitoring Well Installations, and Groundwater Sampling

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Assessment Phase	Dates	Borings Installed	Monitoring Wells Installed	Monitoring Wells Sampled	Groundwater Analysis (USEPA Methods)
Phase I	January 25 and 26, 1992	SB-1 through SB-9	MW-1 through MW-9		
	March 6, 1992			MW-1 through MW-9	624; 625; 418.1; 206.2; 200.7; 239.2
	April 8 through 13, 1992	SB-10 through SB-28	MW-10 through MW-15, MW-17 through MW-23		
	April 21 and 22, 1992			MW-10 through MW-15, MW-17 through MW-23	624; 625; 418.1; 206.2; 200.7; 239.2
Phase II	August 26 and 27, 1992	SB-29 through SB-39	MW-24 through MW-31		
	August 29 and 30, 1992			MW-1 through MW-15, MW-17 through MW-31	624; 625; 418.1; 206.2; 200.7; 239.2
Phase III	January 12 through 15, 1993	SB-40 through SB-68	MW-32 through MW-51		
	January 15 through 17, 1993			MW-10, MW-13, MW-19, MW-21, MW-22, MW-23, MW-26, MW-27, MW-28, MW-34, MW-37, MW-39, MW-40, MW-47 through MW-51	601/602; 504; 610; 418.1; 239.2
Phase IV	January 1 through February 3, 1994	SB-69 through SB-72	TW-1 through TW-11	MW-2 through MW-15, MW-18, MW-19, MW-20, MW-22 through MW-51, TW-1 through TW-11	601/602; 610; 418.1
	March 7 through 11, 1994	SB-73 through SB-95	TW-12 through TW-15 and MW-52D	TW-12 through TW-15	601/602 and 418.1
				MW-4 and MW-29	RAP Parameters
				MW-52D	Kerosene Group
				TW-1	601/602
				TW-10	418.1
	March 29, 1994			MW-29, MW-35, MW-52D, and TW-2	601/602

Notes: USEPA = U.S. Environmental Protection Agency.
RAP = Remedial Action Plan.

FINDINGS

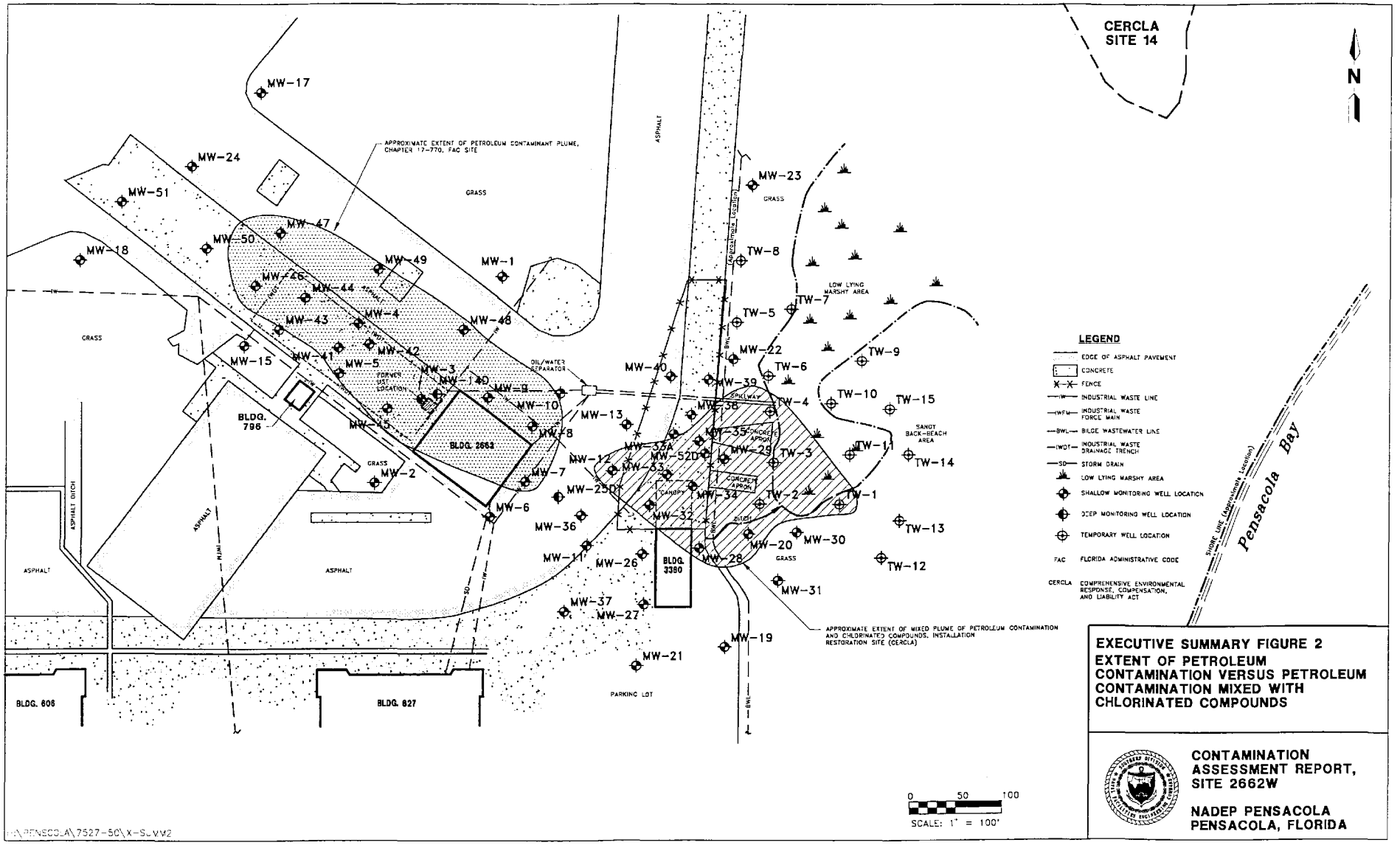
- Sediment encountered during drilling operations is typically very fine-grained to medium-grained quartz sand, which is part of the surficial zone of the sand-and-gravel aquifer (Roaza and others, 1991). The water table was encountered approximately 2 to 4 feet below land surface (bls). The direction of groundwater flow in the surficial zone is to the southeast toward Pensacola Bay.

- Three areas of excessively contaminated soil were identified by OVA headspace analyses (see Executive Summary Figure 1). The largest area of soil contamination is located north and northwest of Building 2662 and the former UST area. Two smaller areas of excessively contaminated soil were identified: one in the vicinity of the hazardous waste storage area north of Building 3380 along the BWL and the other in the immediate area surrounding soil boring SB-19, located approximately 30 feet west of the BWL, southeast of Building 3380.

- Free-floating petroleum product was observed in four wells in the vicinity of Building 2662 during the CA. The maximum measured thickness was 0.1 foot. Free product was not observed in any monitoring well at the site during the most recent phase, conducted from January through March 1994.

- Benzene, ethylbenzene, toluene, xylenes, acenaphthene, fluorene, naphthalenes, and total recoverable petroleum hydrocarbons (TRPH) were detected in groundwater samples. Several chlorinated compounds were detected in samples collected from monitoring wells in the vicinity of Building 3380 including chlorobenzene, 1,2-dichlorobenzene (1,2-DCB), 1,3-dichlorobenzene (1,3-DCB), 1,4-dichlorobenzene (1,4-DCB), vinyl chloride, and tetrachloroethene (PCE).

- Two general areas of groundwater contamination exceeding State target levels were identified (Executive Summary Figure 2). One area is in the vicinity of the former UST and upgradient of this area to the northwest, where benzene and TRPH concentrations exceeded Chapter 17-770, Florida Administrative Code (FAC), target levels. This area is associated with the largest area of excessively contaminated soil. The second area is located north and northeast of Building 3380 where petroleum contaminants and chlorinated compounds are intermingled. Petroleum contaminants that exceed Chapter 17-770, FAC, target levels are benzene, total volatile organic aromatics (VOA; the sum of benzene, ethylbenzene, toluene, and xylenes), total naphthalenes, and TRPH. The chlorinated compounds do not have established target levels in Chapter 17-770, FAC: therefore, State guidance concentrations (FDEP, February 1989) or Chapter 17-550, FAC, maximum contaminant levels (MCLs) were used for evaluating the data. Chlorobenzene, 1,2-DCB, 1,3-DCB, 1,4-DCB, PCE, and vinyl chloride exceeded their respective MCLs. The areal extent of chlorinated compounds in groundwater appears to be largely contained within the petroleum plume north and east of Building 3380.



EXECUTIVE SUMMARY FIGURE 2
EXTENT OF PETROLEUM CONTAMINATION VERSUS PETROLEUM CONTAMINATION MIXED WITH CHLORINATED COMPOUNDS

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA PENSACOLA, FLORIDA

- Laboratory analyses of groundwater samples collected from three vertical extent wells indicate that groundwater contamination does not exceed 25 feet bls in well MW-14D and 30 feet bls in well MW-25D. Low levels of benzene and chlorobenzene contamination were present in samples from vertical extent well MW-52D which is 35 feet deep.

- No potable water sources were identified within a 0.25-mile radius of the site.

CONCLUSIONS

Based on the findings of the CA and site conditions, the following can be concluded.

- Excessive soil contamination in the area near the former UST and northwest of Building 2662 appears to be related to the former UST and the defueling and maintenance activities that take place in this area. The excessive soil contamination in the area north and east of Building 3380 may be related to leaks in the bilge wastewater line, outfall from the line leading from the oil-water separator, activities at the hazardous materials storage area, and unknown prior releases. Soil contamination is shallow (less than 4 feet bls).

- Presently, free product does not appear to be a major concern at the site because free product was not detected in any monitoring well at the site from January through March 1994.

- The areal extent of petroleum related groundwater contamination exceeding Chapter 17-770, FAC, target levels appears to coincide with areas of excessively contaminated soil and the surrounding vicinity of the soil contamination.

- Petroleum-contaminated groundwater does not appear to extend below 35 feet in the surficial zone of the sand-and-gravel aquifer.

- The chlorinated compounds detected in groundwater in the vicinity of Building 3380 may be the result of previous disposal activities, the storage and handling of hazardous waste and hazardous materials in the general area, or a release from one of the IW pipelines that run through the area, particularly the bilge wastewater line east of Building 3380. The source of the chlorinated compounds is believed to be unrelated to the UST at Building 2662.

- There is no evidence indicating groundwater contaminants have migrated off the facility. The contamination appears to be moving toward Pensacola Bay, but presently does not appear to be a threat to surface water.

- No potable wells were identified near the site; therefore, there appears to be little chance for contamination of the public water supply system from activities at the site.

RECOMMENDATIONS

The soil and groundwater contamination at the site can be divided into two distinct areas (Executive Summary Figure 2). The area surrounding Building 2662 is petroleum contamination whose source appears to be the associated UST and the defueling, maintenance, and testing activities. The area surrounding Building 3380 is contaminated with a mixture of petroleum and chlorinated compounds whose sources appear to be the hazardous waste storage facility adjacent to Building 3380 and the industrial pipelines in the vicinity of the building.

Because of the composition and areal distinction of the two contaminated areas, the following is recommended.

- The petroleum contamination in the area of Building 2662 should be addressed in a remedial action plan following Chapter 17-770, FAC, requirements.

- Because of the high concentrations of chlorinated compounds and the areal distinction of the plume, the petroleum and chlorinated compound contamination in the area surrounding Building 3380 should be addressed by the Base Installation Restoration Program in accordance with the U.S. Environmental Protection Agency Comprehensive Environmental Response, Compensation, and Liability Act.

ACKNOWLEDGMENTS

In preparing this report, the Underground Storage Tank Section of the Comprehensive Long-Term Environmental Action, Navy (CLEAN) Group at ABB Environmental Services, Inc. (ABB-ES), commends the support, assistance, and cooperation provided by the personnel at Naval Aviation Depot, Naval Air Station, Pensacola, Florida, and Southern Division, Naval Facilities Engineering Command.

TABLE OF CONTENTS

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Section	Title	Page No.
1.0	INTRODUCTION	1-1
1.1	PURPOSE	1-1
1.2	SCOPE	1-1
2.0	SITE BACKGROUND	2-1
2.1	SITE DESCRIPTION	2-1
2.2	SITE HISTORY	2-4
3.0	SITE CONDITIONS	3-1
3.1	PHYSIOGRAPHY	3-1
3.2	HYDROGEOLOGY	3-1
	3.2.1 Regional and Local	3-1
	3.2.2 Site Specific	3-1
4.0	METHODOLOGIES AND EQUIPMENT	4-1
4.1	SOIL BORING PROGRAM	4-1
4.2	MONITORING WELL INSTALLATION AND CONSTRUCTION	4-1
4.3	WATER TABLE ELEVATION MEASUREMENTS	4-1
4.4	SAMPLING PROGRAM	4-4
	4.4.1 Soil Sampling	4-4
	4.4.2 Groundwater Sampling	4-4
4.5	AQUIFER SLUG TESTS	4-4
5.0	CONTAMINATION ASSESSMENT RESULTS	5-1
5.1	SITE-SPECIFIC AQUIFER CHARACTERISTICS AND HYDROGEOLOGIC PARAMETERS	5-1
5.2	CONTAMINANT ASSESSMENT AND CHARACTERIZATION	5-1
	5.2.1 Soil Contamination Assessment	5-1
	5.2.1.1 Organic Vapor Analyzer (OVA) Headspace Data	5-1
	5.2.1.2 Laboratory Analytical Results for Soil	5-13
	5.2.2 Groundwater Contamination Assessment	5-17
	5.2.2.1 Volatile Organic Compounds (VOCs) in Groundwater	5-21
	5.2.2.2 Total Recoverable Petroleum Hydrocarbons (TRPH) in Groundwater	5-34
	5.2.2.3 Polynuclear Aromatic Hydrocarbons (PAH) in Groundwater	5-37
	5.2.2.4 Tentatively Identified Compounds (TICs) in Groundwater	5-39
	5.2.2.5 Metals in Groundwater	5-39
5.3	FREE PRODUCT ASSESSMENT	5-40
5.4	TIDAL INFLUENCE STUDY	5-40
5.5	POTABLE WELL SURVEY	5-40

TABLE OF CONTENTS (Continued)

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Section	Title	Page No.
6.0	SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	6-1
6.1	SUMMARY	6-1
6.2	CONCLUSIONS	6-4
6.3	RECOMMENDATIONS	6-6
7.0	PROFESSIONAL REVIEW CERTIFICATION	7-1

REFERENCES

APPENDICES

Appendix A: Groundwater Laboratory Analytical Data Summary Tables
Appendix B: Site Conditions
Appendix C: Lithologic Logs
Appendix D: Investigative Methodologies and Procedures
Appendix E: Aquifer Parameter Calculations
Appendix F: Laboratory Analytical Data

LIST OF FIGURES

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Figure	Title	Page No.
1-1	Facility Location Map	1-2
2-1	Site Location Map	2-2
2-2	Site Plan with Underground Pipelines	2-3
4-1	Soil Boring Location Map	4-2
4-2	Monitoring Well and Temporary Well Location Map	4-3
5-1	Water Table Elevation Contour Map, Surficial Zone, Sand-and-Gravel Aquifer, April 21, 1992	5-5
5-2	Water Table Elevation Contour Map, Surficial Zone, Sand-and-Gravel Aquifer, August 31, 1992	5-6
5-3	Water Table Elevation Contour Map, Surficial Zone, Sand-and Gravel Aquifer, January 16, 1993	5-7
5-4	Water Table Elevation Contour Map, Surficial Zone, Sand-and-Gravel Aquifer, February 3, 1994	5-8
5-5	Areal Extent of Excessively Contaminated Soil Determined by Organic Vapor Analyzer (OVA)	5-14
5-6	Lead in Soil (2 feet to 4 feet below land surface)	5-18
5-7	Total Volatile Organic Aromatics in Groundwater, February and March 1994	5-22
5-8	Benzene in Groundwater, February and March 1994	5-25
5-9	Chlorobenzene in Groundwater, February and March 1994	5-28
5-10	1,4-Dichlorobenzene in Groundwater, February and March 1994	5-29
5-11	1,3-Dichlorobenzene in Groundwater, February and March 1994	5-30
5-12	1,2-Dichlorobenzene in Groundwater, February and March 1994	5-31
5-13	PCE, TCE, and Vinyl Chloride in Groundwater, February and March 1994	5-33
5-14	Total Recoverable Petroleum Hydrocarbons (TRPH) in Groundwater, February 1994	5-35
5-15	Total Naphthalenes in Groundwater, February 1994	5-38
5-16	Potable Well Locations	5-41
6-1	Extent of Petroleum Contamination Versus Petroleum Contamination Mixed With Chlorinated Compounds	6-5

LIST OF TABLES

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Table	Title	Page No.
1-1	Chronology of Soil Boring Installations, Monitoring Well Installations, and Groundwater Sampling	1-3
5-1	Top of Casing and Groundwater Elevations, August 31, 1992, January 16, 1993, and February 3, 1994	5-2
5-2	Average Hydraulic Conductivities Calculated From Slug Test Data, NADEP Pensacola	5-9
5-3	Summary of Soil Sample Organic Vapor Analyzer (OVA) Headspace Analyses, January 25, 1992, through March 8, 1994	5-10
5-4	Summary of Soil Sample Laboratory Analyses, January 1992	5-15
5-5	Summary of Soil Sample Metals Analyses, January through August 1992	5-16
5-6	Summary of Soil Sample Laboratory Analyses, Tentatively Identified Compounds, January 1992	5-19
5-7	Summary of Groundwater Analytical Results, Detected Concentrations of Benzene and Total Volatile Organic Aromatics (VOA), January through March 1994 (Phase IV)	5-23
5-8	Summary of Groundwater Analytical Results, Detected Concentrations of Chlorinated Compounds, January through March 1994 (Phase IV)	5-27
5-9	Summary of Groundwater Analytical Results, Detected Concentrations of Naphthalenes and Total Recoverable Petroleum Hydrocarbons (TRPH), January through March 1994 (Phase IV)	5-36
5-10	Potable Well Inventory Data, Naval Air Station, Pensacola, Florida	5-42

GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
Ag	silver
As	arsenic
Ba	barium
bdl	below detection limits
bls	below land surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
BWL	bilge wastewater line
CA	contamination assessment
CAP	Contamination Assessment Plan
CAR	Contamination Assessment Report
Cd	cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action, Navy
Cr	chromium
CompQAP	Comprehensive Quality Assurance Plan
CTO	Contract Task Order
1,1-DCA	1,1-dichloroethane
1,2-DCB	1,2-dichlorobenzene
1,3-DCB	1,3-dichlorobenzene
1,4-DCB	1-4-dichlorobenzene
1,1-DCE	1,1-dichloroethene
1,2-DCE	1,2-dichloroethene
EDB	ethylene dibromide
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FID	flame ionization detector
ft/day	feet per day
ft/ft	feet per foot
ft/min	feet per minute
GC	gas chromatograph
Hg	mercury
HSWA	Hazardous and Solid Waste Amendments of 1984
i_{avg}	average hydraulic gradient
ID	inside diameter
IRP	Installation Restoration Program
IW	industrial waste
IWD	industrial waste drainage trench
IWFM	industrial waste force main

K	hydraulic conductivity
K_{avg}	average hydraulic conductivity
MCL	maximum contaminant level
MTBE	methyl tert-butyl ether
msl	mean sea level
NADEP	Naval Aviation Depot
NARF	Naval Air Rework Facility
NAS	Naval Air Station
NGVD	National Geodetic Vertical Datum
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbons
Pb	lead
POA	Plan of Action
PCE	tetrachloroethene
ppb	parts per billion
ppm	parts per million
PVC	polyvinyl chloride
QA/QC	quality assurance and quality control
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
Se	selenium
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SWDA	Solid Waste Disposal Act of 1965
TICs	tentatively identified compounds
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TOC	top of casing
TRPH	total recoverable petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
V	average pore water velocity
VOA	volatile organic aromatics
VOCs	volatile organic compounds

1.0 INTRODUCTION

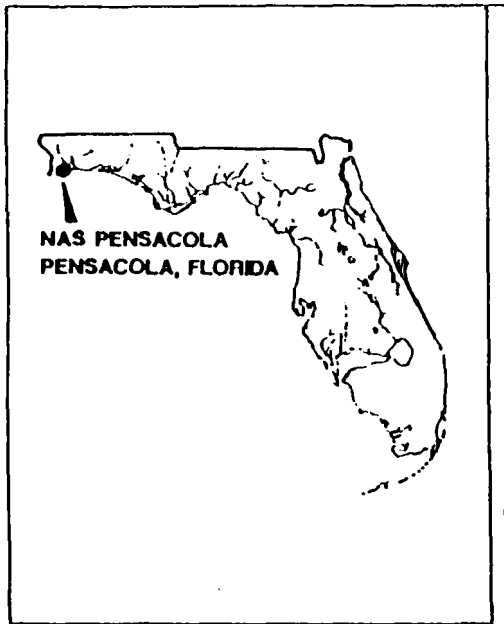
In 1987, the Naval Air Rework Facility (NARF) in Pensacola, Florida, was renamed the Naval Aviation Depot (NADEP). NADEP Pensacola, Florida, formerly the operations and repair department of the Naval Air Station (NAS) Pensacola, is now a tenant command located on NAS facilities within the Pensacola Naval Base Complex. The Pensacola Naval Base Complex is located on the western edge of Pensacola Bay on State Route 295 (Navy Boulevard; Figure 1-1). NADEP Pensacola occupies approximately 130 acres at NAS Pensacola. The mission of NADEP Pensacola is to: maintain and operate facilities for, and perform a complete range of, depot-level rework operations on designated weapons systems, accessories, and equipment; manufacture parts and assemblies, as required; provide engineering services in hardware design; furnish technical services on aircraft maintenance and logistic problems; and perform other levels of aircraft maintenance.

During a tank removal program implemented by the U.S. Navy in 1989 and 1990, petroleum underground storage tanks (USTs) at various NADEP locations were removed. In many cases, these tanks were replaced with new USTs. Tank contents were reportedly restricted to petroleum products ranging from waste oil, diesel fuel, unleaded gasoline, and PD-680 (a petroleum distillate solvent similar to mineral spirits). The reported capacity of the tanks varied from 500 to 3,000 gallons. Soil samples were collected from each tank excavation and analyzed for total recoverable petroleum hydrocarbons (TRPH). Based on TRPH concentrations, 18 sites were found to be non-compliant with Florida Department of Environmental Protection (FDEP; formerly Florida Department of Environmental Regulation [FDER]) standards, as defined in Chapter 17-770, Florida Administrative Code (FAC).

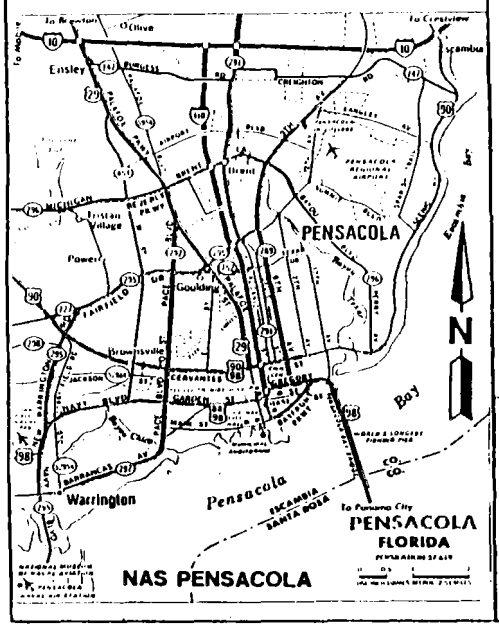
ABB Environmental Services, Inc. (ABB-ES), was contracted by Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to perform a contamination assessment (CA) and submit a Contamination Assessment Report (CAR) for each of the 18 petroleum contaminated sites at NADEP. This CAR has been prepared and is being submitted for one of the sites, Site 2662W.

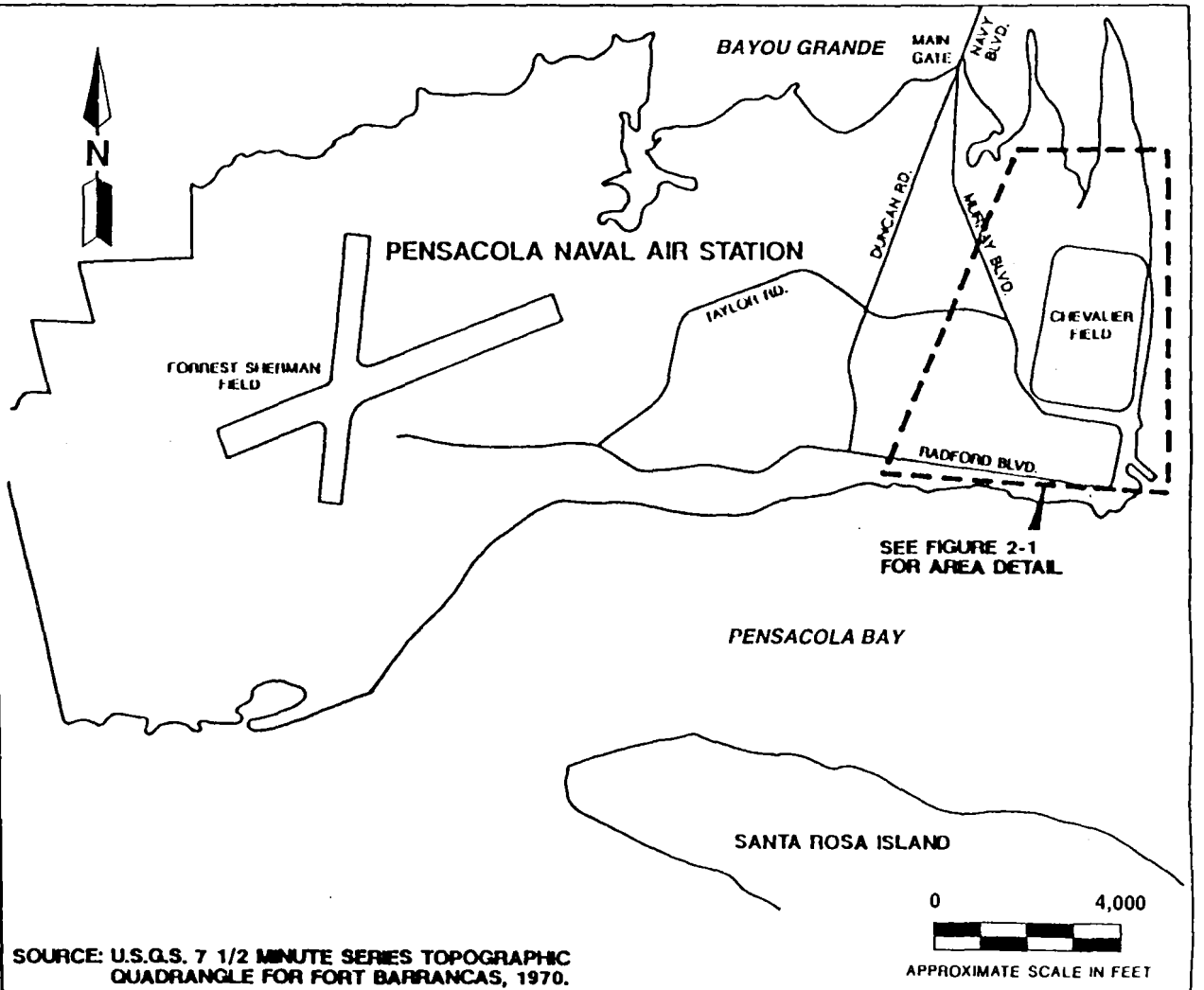
1.1 PURPOSE. The purpose of the CA was to assess the vertical and horizontal extent of the petroleum contamination in the soil and groundwater beneath the site. The purpose of the CAR is to present the findings and conclusions of the CA and recommend appropriate further action for this site. Information developed from the CA will be used to assess the need for site remediation and develop a remedial action plan (RAP), if deemed necessary.

1.2 SCOPE. The scope of services for the CA investigations at Site 2662W is described in Contract Task Order (CTO) No. 008, the Plan of Action (POA), and the Contamination Assessment Plan (CAP). ABB-ES initiated the site investigation in January 1992 and completed the investigation in March 1994. The investigation occurred in four phases, Phase I through Phase IV. The scope of work executed in each phase of the CA is summarized in Table 1-1. The following tasks were executed in performing the CA:



SOURCE: D.O.T. STATE OF FLORIDA, 1982





SOURCE: U.S.G.S. 7 1/2 MINUTE SERIES TOPOGRAPHIC QUADRANGLE FOR FORT BARRANCAS, 1970.

FIGURE 1-1

FACILITY LOCATION MAP

CONTAMINATION ASSESSMENT REPORT
SITE 2662W
NADEP PENSACOLA
PENSACOLA, FLORIDA

Table 1-1
Chronology of Soil Boring Installations, Monitoring Well Installations, and Groundwater Sampling

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Assessment Phase	Dates	Borings Installed	Monitoring Wells Installed	Monitoring Wells Sampled	Groundwater Analysis (USEPA Methods)
Phase I	January 25 & 26, 1992	SB-1 through SB-9	MW-1 through MW-9		
	March 6, 1992			MW-1 through MW-9	624; 625; 418.1; 206.2; 200.7; 239.2
	April 8 through 13, 1992	SB-10 through SB-28	MW-10 through MW-15, MW-17 through MW-23		
	April 21 & 22, 1992			MW-10 through MW-15, MW-17 through MW-23	624; 625; 418.1; 206.2; 200.7; 239.2
Phase II	August 26 & 27, 1992	SB-29 through SB-39	MW-24 through MW-31		
	August 29 & 30, 1992			MW-1 through MW-15, MW-17 through MW-31	624; 625; 418.1; 206.2; 200.7; 239.2
Phase III	January 12 through 15, 1993	SB-40 through SB-68	MW-32 through MW-51		
	January 15 through 17, 1993			MW-10, MW-13, MW-19, MW-21, MW-22, MW-23, MW-26, MW-27, MW-28, MW-34, MW-37, MW-39, MW-40, MW-47 through MW-51	601/602; 504; 610; 418.1; 239.2
Phase IV	January 1 through February 3, 1994	SB-69 through SB-72	TW-1 through TW-11	MW-2 through MW-15, MW-18, MW-19, MW-20, MW-22 through MW-51, TW-1 through TW-11	601/602; 610; 418.1
	March 7 through 11, 1994	SB-73 through SB-95	TW-12 through TW-15 and MW-52D	TW-12 through TW-15	601/602, 418.1
				MW 4 and MW-29	RAP Parameters
				MW-52D	Kerosene Group
				TW-1	601/602
				TW-10	418.1
	March 29, 1994			MW-29, MW-35, MW-52D, and TW-2	601/602

Note: USEPA = U.S. Environmental Protection Agency.

- advancing soil borings and collecting soil samples to aid in the assessment of the presence and extent of soil contamination and free product, if present;

- installing shallow monitoring wells and deep wells to assess the horizontal and vertical extent of groundwater contamination at the site;

- collecting groundwater samples for laboratory analyses of related contamination as outlined in *Petroleum Contamination Site Cleanup Criteria*, Chapter 17-770, FAC, to assess the horizontal and vertical extent of groundwater contamination;

- conducting a site features survey and topographic survey of monitoring well top-of-casing elevations and measuring liquid levels in each well to assess the direction of groundwater flow and the hydraulic gradient;

- conducting an inventory of potable wells within a 1/4-mile radius of the site;

- conducting aquifer slug tests in representative monitoring wells to develop estimates of aquifer parameters for remedial design; and

- reducing and analyzing all data gathered during the CA to complete a CAR.

The first phase of the CA was conducted from January to March 1992. The objective of Phase I was to assess the petroleum contamination in the vicinity of the tank that was removed from the northwest side of Building 2662 and to assess the presence and nature of the contamination in the area where the tank was removed. The Phase I CA included:

- conducting 28 soil borings (PEN-2662W-SB-1 through PEN-2662W-SB-28) to assess the presence of petroleum contamination in the soils above the water table;

- installing 22 monitoring wells (PEN-2662W-MW-1 through PEN-2662W-MW-23: note there is no monitoring well PEN-2662W-MW-16) to assist in the delineation of the horizontal and vertical extent of contamination (for simplicity, the prefix "PEN-2662W-" is not included on tables, figures, and the remaining text of this report);

- surveying top-of-casing elevations of the monitoring wells and measuring water levels;

- collecting groundwater samples from monitoring wells MW-1 through MW-15 and MW-17 through MW-23 for analysis of the used oil group of parameters outlined in Chapter 17-770, FAC; and

- conducting slug tests on selected wells to estimate aquifer characteristics.

Excessive petroleum-contaminated soil was identified by organic vapor analyzer (OVA) headspace analysis. Groundwater analytical data from Phase I indicated the presence of elevated levels of petroleum contamination and non-petroleum

chlorinated compound contamination in groundwater. The chlorinated compounds were detected downgradient of Building 2662 and upgradient of Building 3380. Groundwater laboratory analytical results are summarized in Tables A-1 through A-5 and presented in Appendix A, Groundwater Laboratory Analytical Data Summary Tables. Groundwater flow direction was found to be southeast toward Pensacola Bay. The downgradient boundary of the contaminant plume east of Building 2662 had not been defined. Better lateral definition of the plume was also required. Therefore, Phase II activities were conducted in August 1992 and included:

- conducting 11 soil borings (SB-29 through SB-39) to assess the presence of petroleum contamination in the soils above the water table,

- installing 8 monitoring wells (MW-24 through MW-31) to assist in the delineation of the horizontal and vertical extent of contamination,

  surveying top-of-casing elevations of the monitoring wells and measuring water levels, and

- collecting groundwater samples from monitoring wells MW-1 through MW-15 and MW-17 through MW-31 for analysis of the used oil group of parameters outlined in Chapter 17-770, FAC.

The significant finding of the Phase II CA was a mixed contaminant plume of petroleum compounds and chlorinated compounds in the vicinity north and northeast of Building 3380. Because the chlorinated compounds detected in groundwater in the vicinity of Building 3380 are not regulated under petroleum guidelines established under Chapter 17-770, FAC, a meeting was held with ABB-ES, SOUTHNAVFACENGCOM, and FDER representatives on November 20, 1992, to discuss findings at the site and the manner of future investigation. It was agreed that additional investigation was needed to define the downgradient extent of groundwater contamination. Because chlorinated compounds in groundwater appeared to be associated with petroleum contamination in the vicinity of Building 3380, ABB-ES was granted permission by FDER to continue the investigation under Chapter 17-770, FAC, guidelines. Additional monitoring wells were to be installed to delineate the extent of groundwater contamination in the vicinity of Building 3380 and to further characterize the degree of contamination in areas already delineated. Because much of the groundwater contamination at the site appeared to be the result of JP-5 jet fuel and other petroleum discharges from sources other than the former UST, it was agreed that future groundwater samples would be analyzed for constituents of the kerosene analytical group as defined in Chapter 17-770, FAC.

Also, free floating petroleum product was observed in three monitoring wells (MW-3, MW-4, and MW-9) during the Phase II CA. Groundwater flow direction remained consistent in a southeasterly direction towards Pensacola Bay. The Phase III CA was conducted in January 1993 and included:

- conducting 29 soil borings (SB-40 through SB-68) to better define the presence of petroleum contamination in the soils above the water table both downgradient and in the interior of the plume;

- installing 20 monitoring wells (MW-32 through MW-51) to assist in the delineation of the horizontal and vertical extent of contamination;

- surveying top-of-casing elevations of the monitoring wells and measuring water levels; and

- collecting groundwater samples from selected monitoring wells for analysis of the kerosene analytical group parameters outlined in Chapter 17-770, FAC.

The analytical results from the Phase III CA confirmed the persistence of chlorinated compounds in the groundwater in the vicinity of Building 3380. At the conclusion of the Phase III CA, the contaminant plume was continuous across the entire site, particularly the area between Buildings 2662 and 3380. Monitoring well MW-7, located between the two buildings, was observed to contain 0.02 foot of free product. The groundwater flow direction was again confirmed to be in a southeasterly direction. A meeting was held with ABB-ES and FDEP representatives on February 12, 1993, to discuss the findings of the Phase III investigation. It was agreed that additional field investigation would be required to assess the extent of petroleum and chlorinated compound groundwater contamination. Because the chlorinated compound plume appeared to be contained within the petroleum plume, and chlorinated compound concentrations suggested that remediation could be performed in conjunction with petroleum remediation, FDER recommended that additional site investigation proceed under Chapter 17-770, FAC, guidelines.

The area in which the remaining wells were to be installed posed access problems because of a sandy beach environment, a marshy low lying area, and extensive piles of large concrete boulders and assorted construction debris. Because it was not possible to get a drill rig to most of the locations where the additional monitoring wells were needed, it was decided that temporary wells would be installed in these areas. The Phase IV CA was conducted between January and March 1994 and included:

- conducting 27 soil borings (SB-69 through SB-95) to better define the presence of petroleum contamination in the soils above the water table both downgradient, lateral, and in the interior of the both plumes (northwest of Building 2662 and in the vicinity of Building 3380);

- installing 1 vertical extent monitoring well (MW-52D) in the area north of Building 3380 to assess the vertical extent of contamination in the mixed plume area of contamination;

- installing 15 temporary monitoring wells (TW-1 through TW-15) to assist in the delineation of the downgradient extent of mixed plume contamination;

- surveying top-of-casing elevations of the new monitoring well and the temporary wells and measuring water levels;

- collecting groundwater samples from all site monitoring wells (except MW-1, MW-17, and MW-21) for analysis by U.S. Environmental Protection Agency (USEPA) Methods 601, 602, 610 and 418.1 (wells TW-12 through TW-15 were not analyzed by USEPA Method 610);

- resampling monitoring wells MW-29, MW-35, MW-52D, TW-1, and TW-2 for analysis by USEPA Method 601 and 602;

- resampling of temporary well TW-10 for analysis by USEPA Method 418.1; and

- collecting groundwater samples from monitoring wells MW-4 and MW-29 and soil samples from the subsurface in the vicinity of wells MW-4 and MW-29 for analyses of RAP parameters for use in developing the RAP.

A complete discussion of the Phase IV CA results and investigation is presented in detail in Chapter 5.0 of this document. The following chapters of the report present the background information, the site conditions, the methodologies and equipment used during the CA, data compilation, and the results, conclusions, and recommendations of the CA.

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION. Site 2662W is the former location of a 1,000-gallon UST located near Building 2662, which is in the southeast part of Chevalier Field (Figure 2-1). Chevalier Field is predominantly used as a helicopter maintenance and testing facility. The site is located several hundred feet southwest of Site 14, which is currently being investigated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Building 2662 is used as a helicopter cleaning and stripping facility. According to facility personnel, the UST was used to store water-contaminated JP-5 jet fuel and used oil. The former location of the UST, pertinent surface features, and subsurface pipelines in the site vicinity are shown in Figure 2-2.

The concreted area northwest of the former UST location is used for helicopter maintenance and defueling operations. The asphalt-covered area along the north, east, and south side of Building 2662W is used as a thoroughfare for routine vehicular traffic, helicopters, and associated machinery. The grassy areas along the northern and western edges of the site do not appear to have any current use.

There are four other buildings in the immediate site vicinity. Building 796, located approximately 125 feet west of Building 2662, is used as an office for personnel conducting the helicopter maintenance and defueling operations northwest of Building 2662. Building 3380, located approximately 180 feet southeast of Building 2662, is used as a temporary hazardous waste storage facility. The facility is listed in its Resource Conservation and Recovery Act (RCRA) Part B Permit as a "less than 90-day hazardous waste storage facility." This allows the facility to store hazardous waste for no more than 90 days and then the waste must be removed from the site, or they are in violation of the permit. Building 3380 is surrounded by an 8-foot high chain-link fence. Hazardous wastes are stored along the northern side of the building inside the fenced area. The building is used to store hazardous materials such as oil, paint, and related chemicals. The concreted area south of Building 3380 is used as a parking lot. The area east of Building 3380 is a vacant, sandy back-beach, and there is a low-lying marshy area to the northeast. Pensacola Bay is located approximately 500 to 600 feet east of Building 3380. Buildings 606 and 627 located to the south (Figure 2-2) are used by NADEP personnel. Activities at these buildings did not appear to be a concern for this investigation.

Several underground utility lines are potential sources of contamination at the site. An industrial waste drainage trench (IWDT) is located along the perimeter of the helicopter maintenance and defueling area northwest of Building 2662. The trench was installed in early 1992 and is used to collect surface-water runoff from helicopter maintenance and defueling operations. The IWDT connects to an industrial waste (IW) pipeline located along the northern side of Building 2662, which discharges into an oil-water separator located approximately 90 feet northeast of the east corner of Building 2662. The outfall from the oil-water separator is transported by an underground pipeline that extends east from the oil-water separator to a spillway located approximately 140 feet north-northeast of Building 3380. The spillway discharges into the marshy area east of the site.

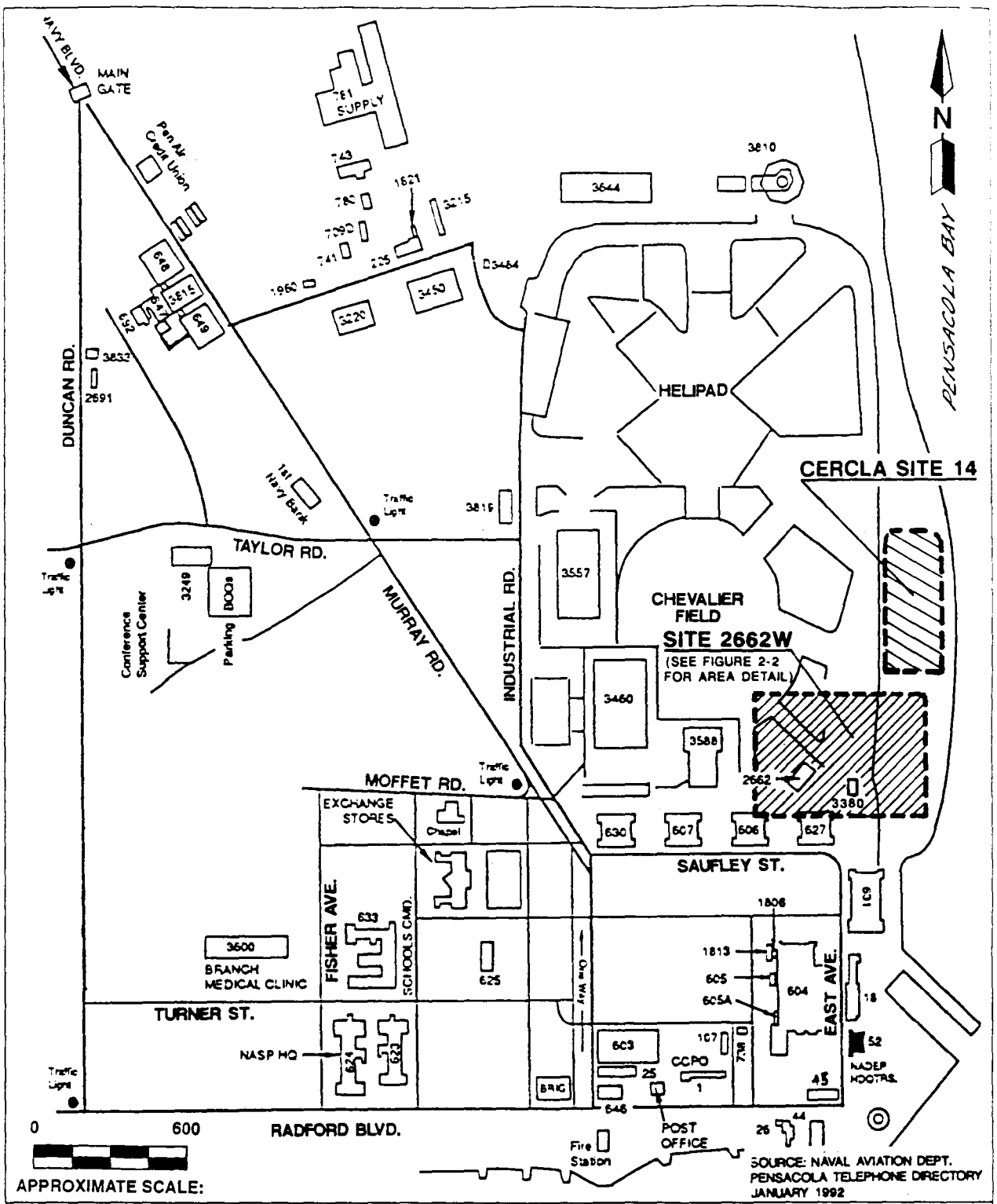


FIGURE 2-1
SITE LOCATION MAP

CONTAMINATION ASSESSMENT REPORT
SITE 2662W
NADEP PENSACOLA
PENSACOLA, FLORIDA

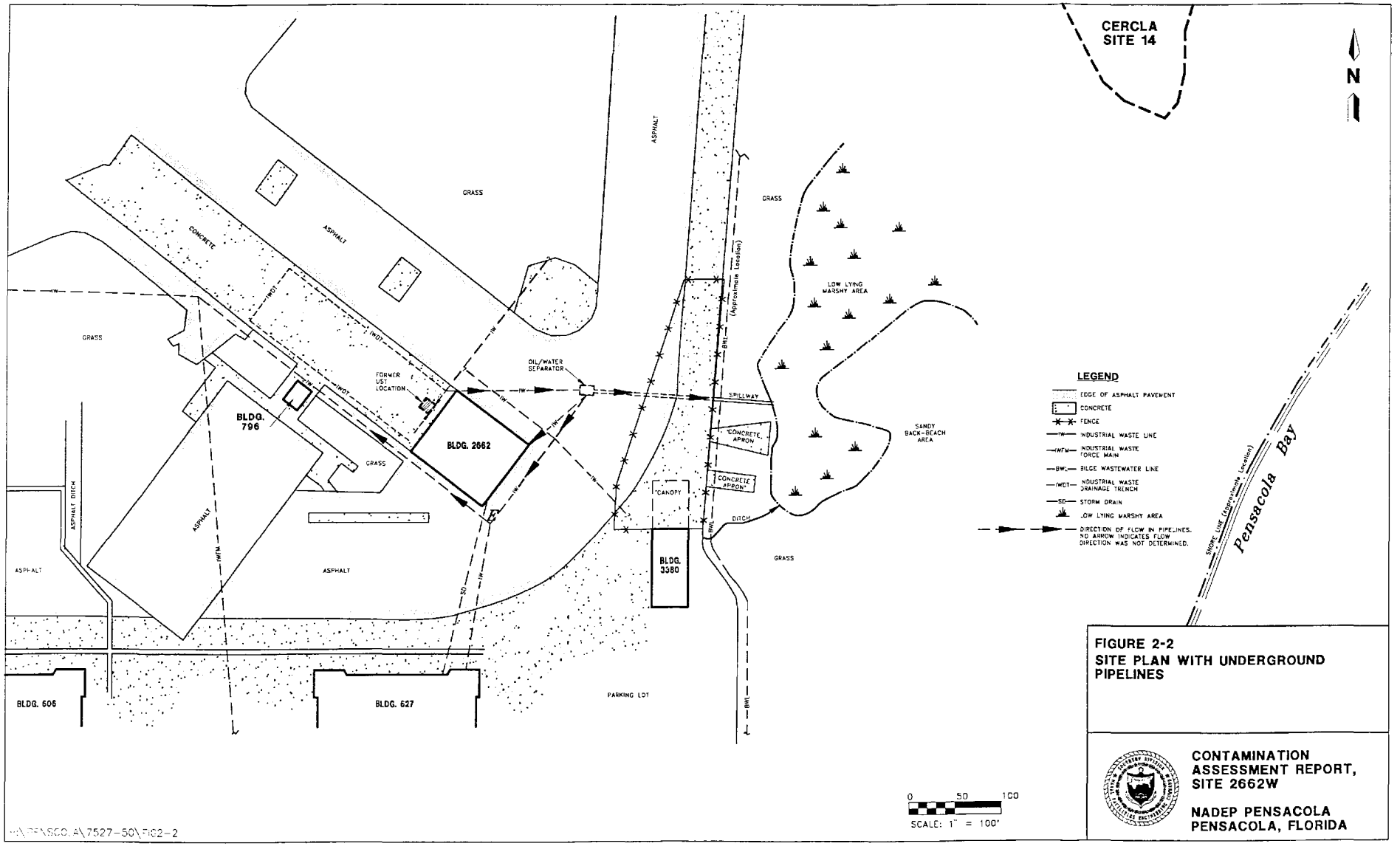


FIGURE 2-2
SITE PLAN WITH UNDERGROUND PIPELINES

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA PENSACOLA, FLORIDA

H:\PENSCOLA\7527-50\FIG2-2

Two IW pipelines carry oil and floating liquid from the oil-water separator. One IW pipeline runs to the eastern corner of Building 2662, and the second pipeline runs along the southeast side of Building 2662. This IW pipeline turns to the northwest at the southern corner of Building 2662. This IW pipeline, oriented northwest to southeast along the southwest side of Building 2662, connects with the IW pipeline extending from Building 627. This IW pipeline connects with an industrial waste force main (IWFM) approximately 150 feet northwest of Building 796, and continues westerly from that junction (see Figure 2-2). A third IW pipeline is located along the northern edge of Building 2662 and is oriented in a northwest to southeast direction. The origination and termination points of this pipeline are not known.

A stormwater drain extends from the northeastern corner of Building 627 to the southern corner of Building 2662. A bilge wastewater line (BWL) is located along the eastern side of Building 3380. The BWL is used to transport oily wastewater from bilges of ships docked at NAS Pensacola. The line continues northerly and discharges into a holding basin located northeast of the site (CERCLA Site 14).

2.2 SITE HISTORY. The UST at Building 2662 was installed in 1983 and was removed during the tank removal program, conducted in 1989 and 1990. A composite soil sample was collected from the UST excavation and analyzed for TRPH. The reported TRPH concentration of 2,100 parts per million (ppm) exceeded the State target level of 50 ppm for soil contaminated by either JP-5 jet fuel (a member of the kerosene analytical group) or used oil constituents (FDER, May 1992). Further site investigation pursuant to Chapter 17-770, FAC, was therefore warranted. Excavated soil was reportedly returned to the excavation after UST removal. No reports or tank closure forms were completed following the tank removal.

3.0 SITE CONDITIONS

3.1 PHYSIOGRAPHY. Regional physiography is discussed in Appendix B, Site Conditions. The topography at the site is relatively flat and elevations range from approximately 5 to 9 feet above mean sea level (msl).

3.2 HYDROGEOLOGY.

3.2.1 Regional and Local The Pensacola area is underlain by three water bearing zones. These zones, in order of increasing depth, are: the sand-and-gravel aquifer, the Upper Floridan aquifer, and the Lower Floridan aquifer. A detailed discussion of these three aquifers is presented in Appendix B, Site Conditions.

3.2.2 Site Specific The principal water-bearing zone of concern at the site is the surficial zone of the sand-and-gravel aquifer. The surficial zone was penetrated to a maximum depth of 35 feet below land surface (bls) during this investigation at monitoring well MW-52D. The surficial zone is unconfined, and the water table was encountered at depths ranging from 1 to 3 feet bls during this investigation. Groundwater flow direction at the site is to the southeast, towards Pensacola Bay.

In some areas near NAS Pensacola, the surficial zone of the sand-and-gravel aquifer has been demonstrated to be hydraulically connected with the main producing zone of the sand-and-gravel aquifer, making potable water supplies susceptible to contamination in these areas (Roaza and others, 1991). For this reason, the surficial zone at NAS Pensacola will be treated as a Class G-II water source, and Class G-II State regulatory standards will be applied throughout this report.

Surficial and subsurface soil is generally composed of very fine-grained to medium-grained quartz sand. The sand generally varies in color from light gray to gray. Complete lithologic logs for all monitoring wells (MW-1 through MW-52D), temporary wells (TW-1 through TW-15), and soil borings (SB-1 through SB-67) are presented in Appendix C, Lithologic Logs. Lithologic logs for soil borings SB-68 through SB-95 are not included in this report because the lithology of the site has been adequately assessed by previous borings, temporary well borings, and monitoring well borings.

4.0 METHODOLOGIES AND EQUIPMENT

4.1 SOIL BORING PROGRAM. Ninety-five soil borings (designated SB-1 through SB-95) were advanced into the water table to assess the horizontal and vertical extent of petroleum contamination in the vadose zone, characterize the type of subsurface material, and aid in placing groundwater monitoring wells. A soil boring location map is provided on Figure 4-1.

Soil borings were advanced using a truck-mounted drill rig and hollow-stemmed augers, or a post-hole digger in shallow borings (less than 4 feet bls). Soil samples were collected directly above the water table with a post-hole digger, and below the water table with a split-spoon sampling device. The samples were placed in 16-ounce glass jars and sealed with a double layer of aluminum foil. The samples were analyzed with an OVA equipped with a flame ionization detector (FID). Soil petroleum contamination was assessed by OVA headspace analysis following procedures outlined by the FDEP (FDER, 1992). Total depth of soil borings ranged from 2 to 35 feet bls. The CA soil boring results are discussed in Subsection 5.2.1.

4.2 MONITORING WELL INSTALLATION AND CONSTRUCTION. From January 25, 1992, to March 10, 1994, 51 permanent monitoring wells (MW-1 through MW-15 and MW-17 through MW-52D) were installed at the site. Each monitoring well is constructed of polyvinyl chloride (PVC) material. Monitoring wells are designated MW-1 through MW-15 and MW-17 through MW-52D on figures and tables in this report. The wells are screened in the upper part of the surficial zone of the sand-and-gravel aquifer. Well screen depths are approximately 2 to 12 feet bls, except for deep monitoring wells MW-14D, MW-25D, and MW-52D. The deep monitoring wells are screened from 20 to 25 feet bls, 25 to 30 feet bls, and 30 to 35 feet bls, respectively.

In addition to the permanent monitoring wells, 15 temporary wells (TW-1 through TW-15) were installed at the site in February and March 1994. Each temporary well is constructed of stainless-steel material with 5-foot screened intervals and were installed to depths of 4 to 6 feet bls. Monitoring well and temporary well locations are shown on Figure 4-2. When installed and during each sampling episode, the temporary wells were identified with the designation "P" and subsequently given the designation "TW." Construction methodologies, materials, and rationale for the installation of the temporary wells are discussed in Appendix D, Investigative Methodologies and Procedures.

4.3 WATER TABLE ELEVATION MEASUREMENTS. Water table elevations were calculated for existing monitoring wells in which liquid levels were measured on April 21, 1992; August 31, 1992; January 16, 1993; and February 3, 1994. On March 11, 1994, water levels were recorded in most of the wells in the vicinity of Building 3380. Depth to groundwater was measured to the nearest 0.01 foot using an electronic water-level indicator. Water table elevations were calculated for each well by subtracting the depth to groundwater from the top of casing elevation. Top of casing elevations were referenced to a benchmark located on the northeast corner of Building 631. This benchmark is part of the U.S. Coastal and Geodetic Survey benchmarking system and has an elevation of 11.15 feet above

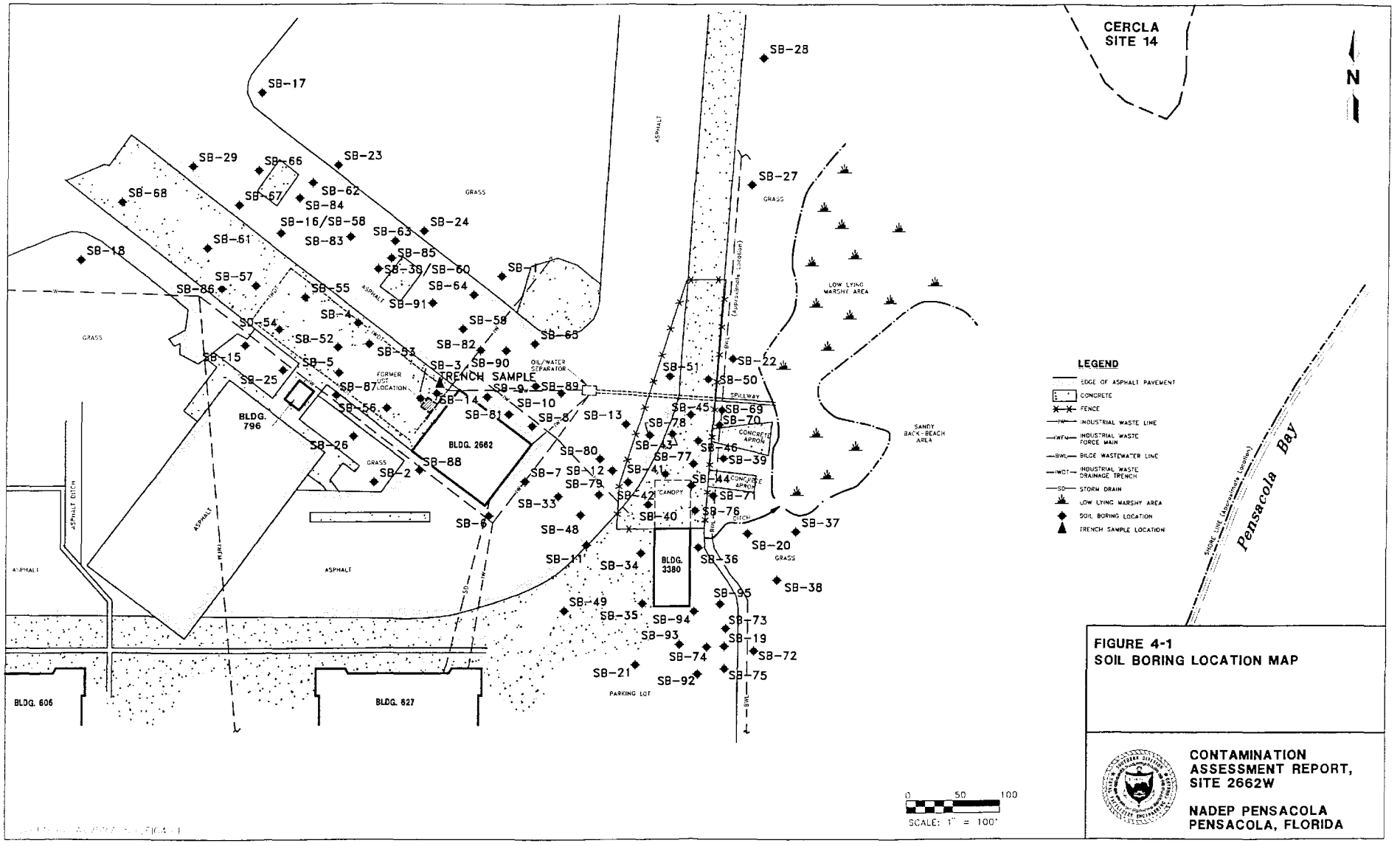


FIGURE 4-1
SOIL BORING LOCATION MAP

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

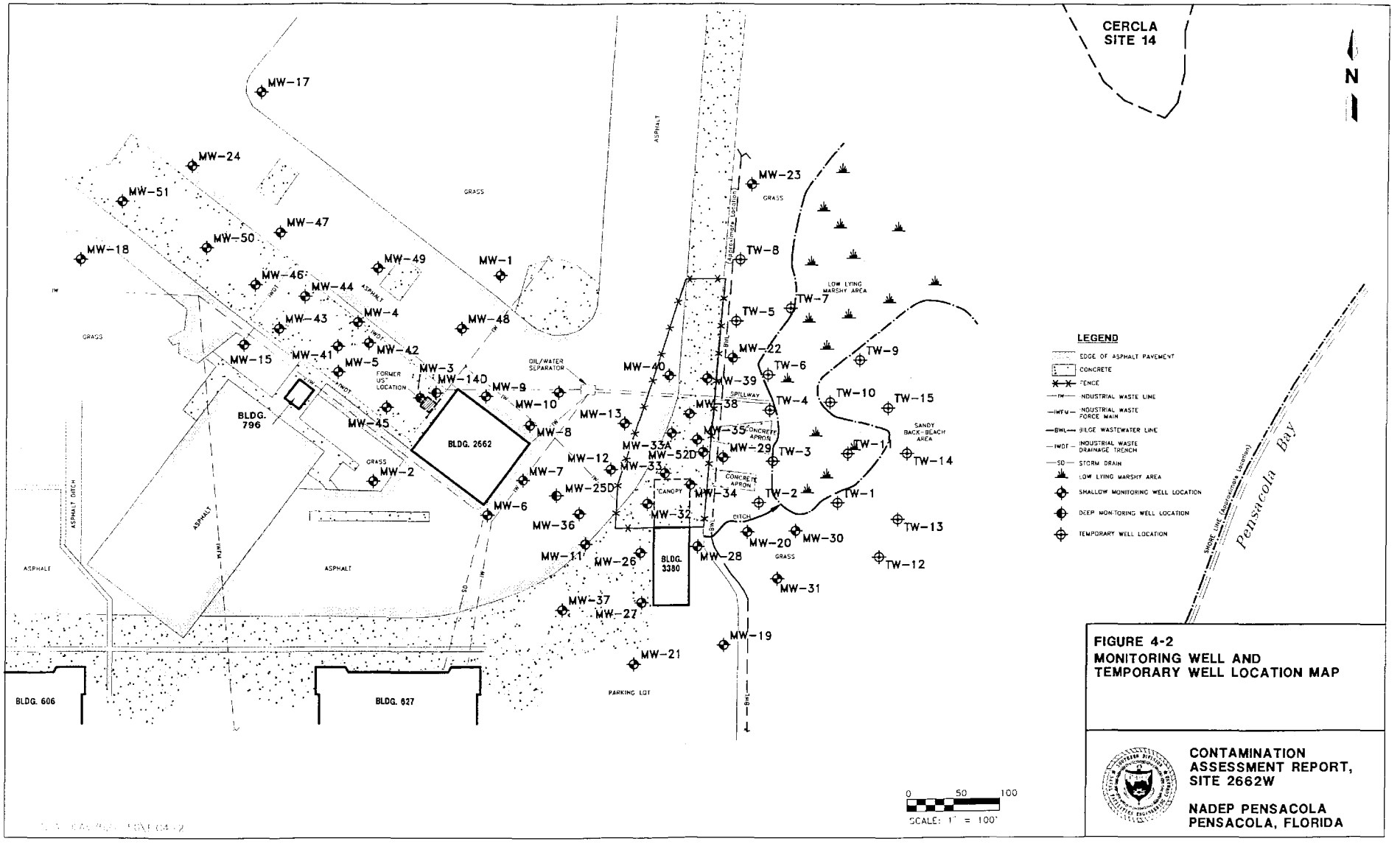


FIGURE 4-2
MONITORING WELL AND TEMPORARY WELL LOCATION MAP

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

the National Geodetic Vertical Datum (NGVD) of 1929. Water table elevation contour maps for each date (except March 11, 1994) were prepared using this information and are discussed in Section 5.1 of this report.

4.4 SAMPLING PROGRAM.

4.4.1 Soil Sampling. In Phase I, soil samples for laboratory analysis were collected directly above the water table from soil borings SB-1 through SB-39. Samples collected from soil borings SB-4, SB-5, SB-9, and the trench (the trench is synonymous with the IWDT surrounding the defueling and maintenance area northwest of Building 2662) were sent to Wadsworth/Alert Laboratories (Wadsworth) in Tampa, Florida, to be analyzed for volatile organics by USEPA Method 8240, extractable organics by USEPA Method 8270, TRPH by USEPA Method 418.1, and total metals by USEPA Methods 206.2, 200.7, and 239.2. Samples collected from the remaining soil borings (SB-1 through SB-39) were sent to Wadsworth to be analyzed for total metals only. Laboratory analytical results of the soil sampling program are discussed in Subsection 5.2.1.2.

4.4.2 Groundwater Sampling Groundwater samples were collected from selected monitoring wells and analyzed for appropriate parameters during Phases I through IV (from March 6, 1992, to March 29, 1994; see Table 1-1). Before sample collection, monitoring wells were purged with a Teflon™ bailer until five well volumes had been removed from the well. Groundwater samples were then collected using the bailer, poured into appropriate containers, properly preserved, and placed on ice. Groundwater samples were shipped by overnight carrier to Wadsworth in Tampa, Florida, for analysis. Appropriate quality assurance and quality control (QA/QC) samples were also collected and analyzed. Procedures for collection of groundwater samples are presented in Appendix D, Investigative Methodologies and Procedures.

The UST was reportedly used to store water-contaminated JP-5 jet fuel and used oil. Groundwater samples, therefore, were initially analyzed for used oil analytical group parameters and subsequently for kerosene analytical group parameters. Used oil group parameters included volatile organics by USEPA Method 624; base-neutral and acid extractable organics by USEPA Method 625; non-priority pollutant organics (tentatively identified compounds [TICs]) by USEPA Methods 624 and 625; the metals arsenic (As), cadmium (Cd), chromium (Cr), and lead (Pb) by USEPA Methods 206.2, 200.7, 200.7, and 239.2, respectively; and TRPH by USEPA Method 418.1. The kerosene analytical group excludes USEPA Methods 624, 625, 206.6, and 200.7, but includes volatile organic halocarbons by USEPA Method 601, volatile organic aromatics (VOA) and methyl tert-butyl ether (MTBE) by USEPA Method 602, polynuclear aromatic hydrocarbon (PAH) by USEPA Method 610, and ethylene dibromide (EDB) by USEPA Method 504.1. Phase IV sample analytical parameters were limited to those methods for which historical analytical data supported the need for the analytes selected. Phase IV analyses included USEPA Methods 601, 602, 610, and 418.1. In addition, samples from monitoring well MW-52D were analyzed for the kerosene analytical group and samples from monitoring wells MW-4 and MW-29 were analyzed for the RAP parameters.

4.5 AQUIFER SLUG TESTS. Rising head slug tests were conducted October 20, 1993, in monitoring wells MW-1 and MW-2 to estimate the hydraulic conductivity (K) of the surficial aquifer. The slug test developed by Bouwer and Rice (1976)

measures the saturated K value using a single well. The test method used is termed a "rising head" test and is performed by quickly withdrawing a volume of water (slug) from the well and measuring the subsequent rate of the rising water level in the well. Bouwer (1989) recommends the rising head slug test for wells with screened intervals that are only partially submerged or partially penetrate unconfined aquifers.

The slug was constructed of 1-inch, outside diameter, PVC pipe, 5 feet in length, filled with sand, and capped watertight at both ends. The water level changes in the monitoring wells were recorded using a data logger and pressure transducer. The pressure transducer was suspended near the bottom of the well, and the water level was recorded before beginning the test. The slug was then lowered into the well to a depth below the water table. The water level was then recorded until it returned to the level before the slug was placed in the well. The slug was quickly removed from the well, and the rate of the rising water level in the well was recorded until the water level recovered to the initial value at the time of slug removal. Three slug tests were conducted in each well to obtain an average K value. Slug test graphs and calculations are attached in Appendix E, Aquifer Parameter Calculations.

5.0 CONTAMINATION ASSESSMENT RESULTS

5.1 SITE-SPECIFIC AQUIFER CHARACTERISTICS AND HYDROGEOLOGIC PARAMETERS. Depth to water beneath the site is typically between 1 and 4 feet bls. Depth to water measurements were recorded on several occasions during the CA field investigation. Presented in Table 5-1 are top of casing elevations, depth to water measurements, and water table elevations recorded on March 21, 1992; August 31, 1992; January 16, 1993; and February 3, 1994. Water table elevation contour maps for each date are provided in Figures 5-1 through 5-4, respectively. Also presented in Table 5-1 is the total depth and screened interval of each well.

The data indicate that the groundwater flow direction has been consistently flowing in a southeasterly direction toward Pensacola Bay. The data have been collected during a 2-year time frame and in several different seasons. Water level measurements were also recorded in wells in the vicinity of Building 3380 on March 11, 1994. These data are not provided in this CAR, but were consistent with the previous four data sets that indicate a southeasterly flow direction.

Hydrologic characteristics of the surficial aquifer were developed from aquifer slug test data, groundwater elevation data, lithologic descriptions, and assumptions based on documented porosity ranges of sediments at the site. Aquifer slug tests were performed in Phase I (March 1992) on two of the site monitoring wells (MW-1 and MW-2). The analytical solution presented by Bouwer and Rice (1976), developed for unconfined aquifers and partially penetrating wells, was used to estimate the average hydraulic conductivity (K_{avg}) for the two wells (Table 5-2). Presented in Table 5-2 are the K_{avg} values for the two wells at Site 2662W in addition to the K_{avg} values for all wells at other UST sites where slug testing was conducted at NADEP Pensacola.

The K_{avg} for the aquifer material intersected by the well screens is 49.5 feet per day (ft/day). The calculated average hydraulic gradient (i_{avg})across the site is 0.002 feet per foot (ft/ft). The calculated pore water velocity (V) is 4.2×10^{-1} ft/day. Equations and calculations used to estimate these values are presented in Appendix E, Aquifer Parameter Calculations.

5.2 CONTAMINANT ASSESSMENT AND CHARACTERIZATION.

5.2.1 Soil Contamination Assessment The following sections provide soil contamination data obtained using the OVA field screening techniques described in Chapter 17-770, FAC, and laboratory analytical methods. The laboratory analytical data for soil includes volatile organics, base-neutral extractables, TRPH, and metals.

5.2.1.1 Organic Vapor Analyzer (OVA) Headspace Data A summary of the soil sample OVA headspace analyses is presented in Table 5-3. Soil assessment criteria follow Chapter 17-770, FAC, guidelines for the kerosene or mixed products analytical group because JP-5 is a kerosene product. Soil with OVA headspace readings greater than 10 ppm, therefore, is considered to be petroleum contaminated. Soil with OVA headspace readings greater than 50 ppm is defined as "excessively contaminated." "Excessively contaminated" soil must be remediated in accordance with *Guidelines for Assessment and Remediation of Petroleum Contaminated Soils* (FDER, May 1992).

Table 5-1
Top of Casing and Groundwater Elevations,
August 31, 1992, January 16, 1993, and February 3, 1994

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

				April 21, 1992		August 31, 1992		January 16, 1993		February 3, 1994	
Well Number	Total Depth	Screened Interval	Top of Casing Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation
MW-1	12	2 to 12	5.03	2.66	2.37	2.28	2.75	2.13	2.90	2.58	2.45
MW-2	13	3 to 13	6.53	4.12	2.41	3.67	2.86	3.70	2.83	4.05	2.48
MW-3	13	3 to 13	4.55	2.15	2.40	1.70	2.85	1.69	2.86	2.08	2.47
MW-4	11.5	1.5 to 11.5	4.55	NM	NM	FP	--	1.45	3.10	1.84	2.71
MW-5	11.5	1.5 to 11.5	4.83	2.27	2.56	1.75	3.08	1.74	3.09	2.13	2.70
MW-6	11.5	1.5 to 11.5	4.89	2.61	2.28	2.26	2.63	2.28	2.61	2.64	2.25
MW-7	11.5	1.5 to 11.5	4.30	2.05	2.25	1.76	2.54	FP	--	2.13	2.17
MW-8	11.5	1.5 to 11.5	4.42	2.12	2.30	1.85	2.57	1.79	2.63	2.18	2.24
MW-9	11.5	1.5 to 11.5	4.45	2.11	2.34	1.75	2.70	1.70	2.75	2.10	2.35
MW-10	12	2 to 12	4.77	2.50	2.27	2.22	2.55	2.16	2.61	2.54	2.23
MW-11	12	2 to 12	4.42	2.24	2.18	2.00	2.42	2.01	2.41	2.37	2.05
MW-12	12	2 to 12	4.28	NM	NM	1.89	2.39	NM	NM	2.25	2.03
MW-13	12	2 to 12	4.40	2.20	2.20	2.00	2.40	1.97	2.43	2.35	2.05
MW-14D	25	20 to 25	4.29	1.90	2.39	1.46	2.83	1.42	2.87	1.82	2.47
MW-15	12	2 to 12	6.01	3.28	2.73	2.74	3.27	2.75	3.26	3.14	2.87
MW-17	12	2 to 12	6.53	3.62	2.91	3.00	3.53	2.90	3.63	3.40	3.13
MW-18	12	2 to 12	6.62	3.56	3.06	2.82	3.80	2.91	3.71	3.30	3.32
MW-19	12	2 to 12	6.34	4.31	2.03	4.27	2.07	4.35	1.99	4.77	1.57
MW-20	12	2 to 12	5.23	3.16	2.07	3.11	2.12	3.15	2.08	3.54	1.69
MW-21	12	2 to 12	5.65	3.58	2.07	3.41	2.24	3.48	1.99	3.86	1.79
MW-22	12	2 to 12	3.82	1.58	2.24	1.55	2.27	1.52	2.30	1.90	1.92

See notes at end of table.

DRAFT

Table 5-1 (Continued)
Top of Casing and Groundwater Elevations, August 31, 1992, January 16, 1993, and February 3, 1994

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

				April 21, 1992		August 31, 1992		January 16, 1993		February 3, 1994	
Well Number	Total Depth	Screened Interval	Top of Casing Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation
MW-23	12	2 to 12	3.95	1.77	2.18	1.52	2.43	1.47	2.48	1.86	2.09
MW-24	11.5	1.5 to 11.5	5.43	NI		1.80	3.63	1.76	3.67	2.24	3.19
MW-25D	30	25 to 30	4.27	NI		1.76	2.51	1.78	2.49	2.15	2.12
MW-26	12	2 to 12	4.85	NI		2.54	2.31	2.55	2.30	2.93	1.92
MW-27	12	2 to 12	5.41	NI		3.12	2.29	3.18	2.23	3.55	1.86
MW-28	12	2 to 12	4.87	NI		2.65	2.22	2.67	2.20	3.05	1.82
MW-29	5.5	0.5 to 5.5	7.22	NI		5.00	2.22	5.01	2.21	5.38	1.84
MW-30	4	0 to 4	[1]5.93	NI		6.19	1.99	3.97	1.96	4.39	1.54
MW-31	5	0 to 5	7.06	NI		5.04	2.02	5.10	1.96	5.53	1.53
MW-32	12	2 to 12	4.35	NI		NI		2.00	2.35	2.40	1.95
MW-33	12	1.5 to 11.5	3.97	NI		NI		1.62	2.35	2.02	1.95
MW-33A	12	2 to 12	3.92	NI		NI		1.55	2.37	1.94	1.98
MW-34	12	1.5 to 11.5	4.07	NI		NI		1.81	2.26	2.19	1.88
MW-35	12	1.5 to 11.5	3.66	NI		NI		1.36	2.30	1.75	1.91
MW-36	12	2 to 12	4.42	NI		NI		1.97	2.45	2.33	2.09
MW-37	12	2 to 12	4.81	NI		NI		2.44	2.37	2.81	2.00
MW-38	12	1.5 to 11.5	3.60	NI		NI		1.25	2.35	1.64	1.96
MW-39	12	1 to 11	3.36	NI		NI		1.03	2.33	1.40	1.96
MW-40	12	2 to 12	4.00	NI		NI		1.60	2.40	1.98	2.02
MW-41	12	2 to 12	4.57	NI		NI		1.45	3.12	1.88	2.69
MW-42	12	2 to 12	4.37	NI		NI		1.28	3.09	1.69	2.68
MW-43	12	2 to 12	4.98	NI		NI		1.78	3.20	2.17	2.81

See notes at end of table.

DRAFT

Table 5-1 (Continued)
Top of Casing and Groundwater Elevations, August 31, 1992, January 16, 1993, and February 3, 1994

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

				April 21, 1992		August 31, 1992		January 16, 1993		February 3, 1994	
Well Number	Total Depth	Screened Interval	Top of Casing Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation	Depth to Water	Water Table Elevation
MW-44	12	2 to 12	4.75	NI		NI		1.61	3.14	1.95	2.80
MW-45	12	2 to 12	4.64	NI		NI		1.74	2.90	2.10	2.54
MW-46	12	2 to 12	5.01	NI		NI		1.65	3.36	2.06	2.95
MW-47	12	2 to 12	4.95	NI		NI		1.52	3.43	1.97	2.98
MW-48	12	1.5 to 11.5	4.57	NI		NI		1.66	2.91	2.09	2.48
MW-49	12	2 to 12	4.68	NI		NI		1.53	3.15	1.96	2.72
MW-50	12	2 to 12	5.12	NI		NI		1.62	3.50	2.06	3.06
MW-51	12	2 to 12	5.74	NI		NI		2.02	3.72	2.46	3.28
MW-52D	35	30 to 35	3.96	NI		NI		NI		NI	
P-1	5	0 to 5	6.12	NI		NI		NI		4.72	1.40
P-2	5	0 to 5	7.40	NI		NI		NI		5.73	1.67
P-3	5	0 to 5	6.77	NI		NI		NI		5.07	1.70
P-4	5	0 to 5	6.35	NI		NI		NI		4.60	1.75
P-5	6	1 to 6	6.39	NI		NI		NI		4.44	1.95
P-6	5.5	0.5 to 5.5	7.12	NI		NI		NI		5.33	1.79
P-7	3.5	0 to 3.5	6.57	NI		NI		NI		4.74	1.83
P-8	5.5	0.5 to 5.5	6.79	NI		NI		NI		4.78	2.01
P-9	6	1 to 6	5.34	NI		NI		NI		4.00	1.34
P-10	5.5	0.5 to 5.5	6.70	NI		NI		NI		5.21	1.49
P-11	4	0 to 4	3.05	NI		NI		NI		1.6	1.4
P-12	6	1 to 6	5.90	NI		NI		NI		NI	
P-13	6	1 to 6	5.24	NI		NI		NI		NI	
P-14	6	1 to 6	5.93	NI		NI		NI		NI	
P-15	6	1 to 6	6.11	NI		NI		NI		NI	

[1]Current top of casing (TOC) for MW-30. During the August 31, 1992, water level survey, the TOC of this well was 8.18 feet.

Notes: All elevations referenced to a U.S. Coastal and Geodetic Survey benchmark of 11.15 feet above the National Geodetic Vertical Datum of 1929 located on the north wall of Building 631.
FP = free product. NI = not installed. NM = not measured.

DRAFT

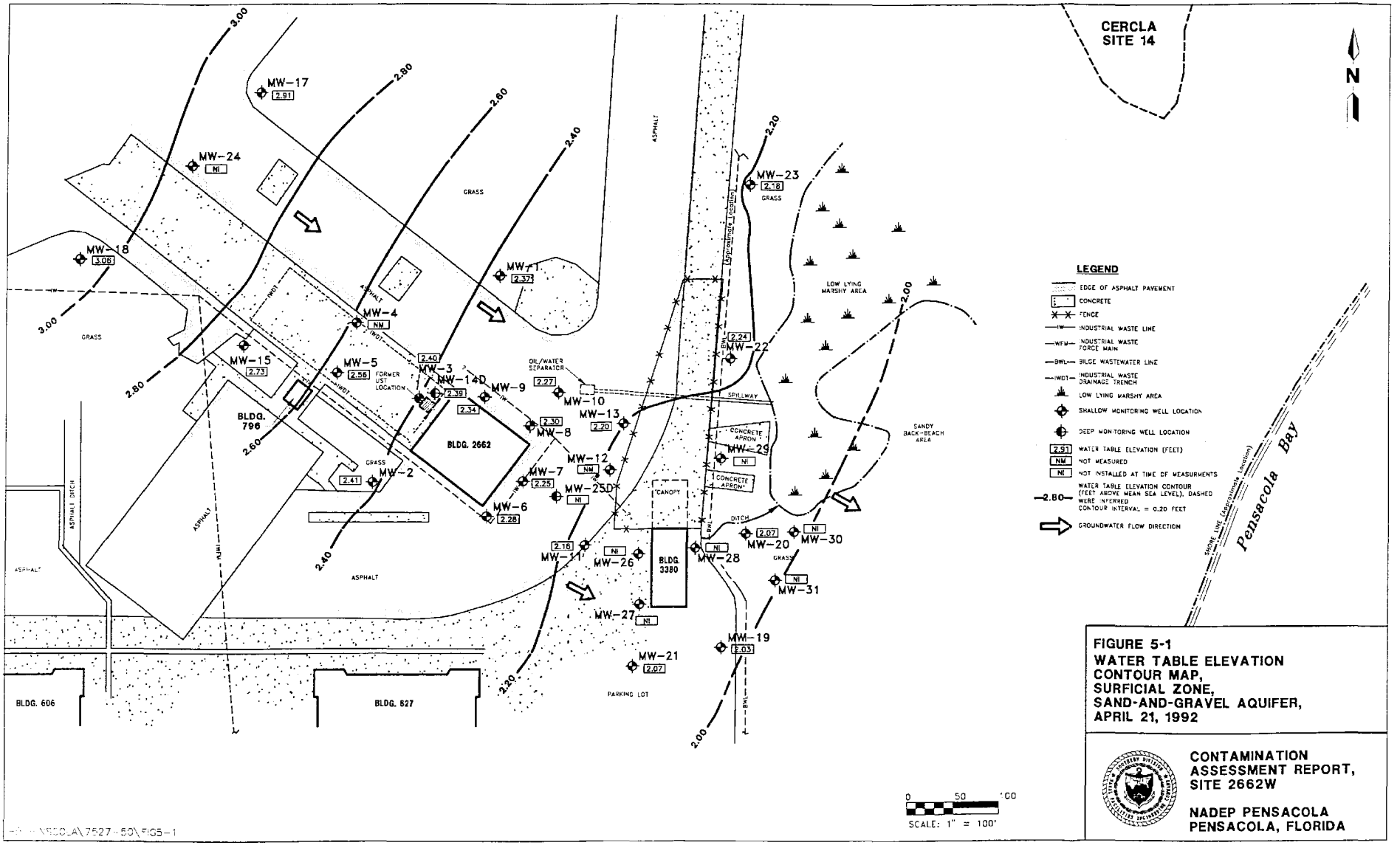


FIGURE 5-1
WATER TABLE ELEVATION CONTOUR MAP, SURFICIAL ZONE, SAND-AND-GRAVEL AQUIFER, APRIL 21, 1992

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

\PENSCOLA\7527-50\FIG5-1

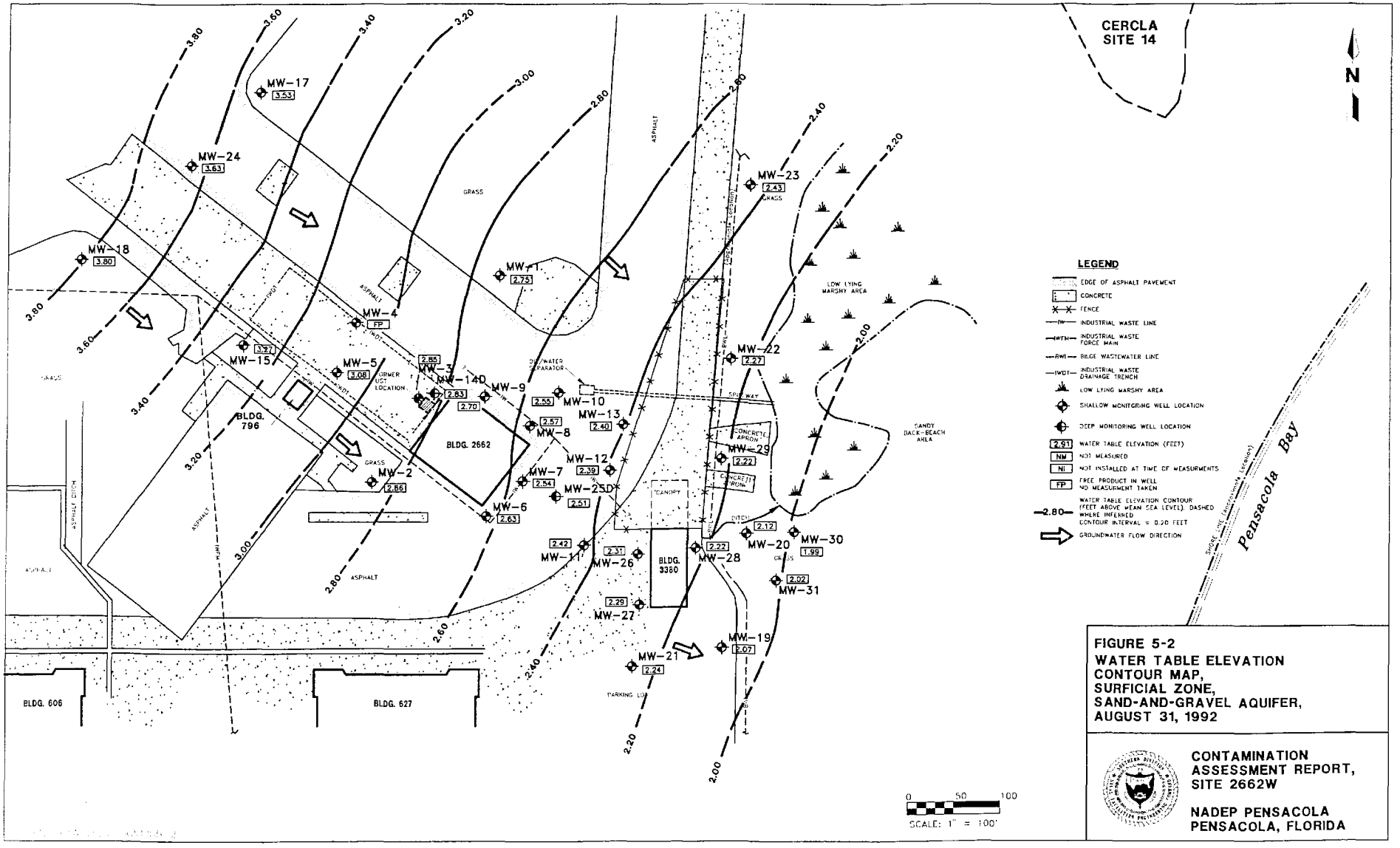


FIGURE 5-2
WATER TABLE ELEVATION CONTOUR MAP, SURFICIAL ZONE, SAND-AND-GRAVEL AQUIFER, AUGUST 31, 1992

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA PENSACOLA, FLORIDA

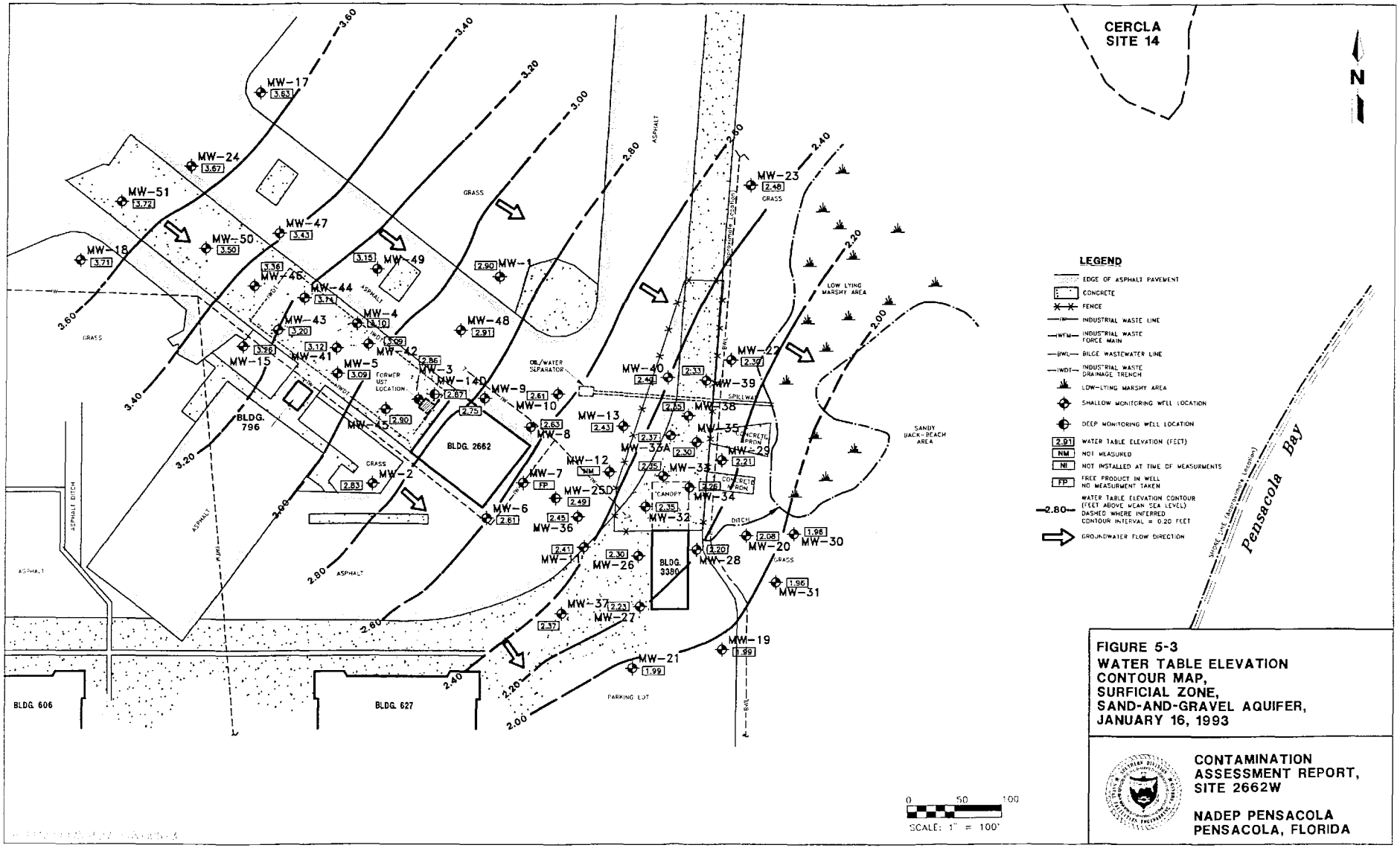


FIGURE 5-3
WATER TABLE ELEVATION CONTOUR MAP, SURFICIAL ZONE, SAND-AND-GRAVEL AQUIFER, JANUARY 16, 1993

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

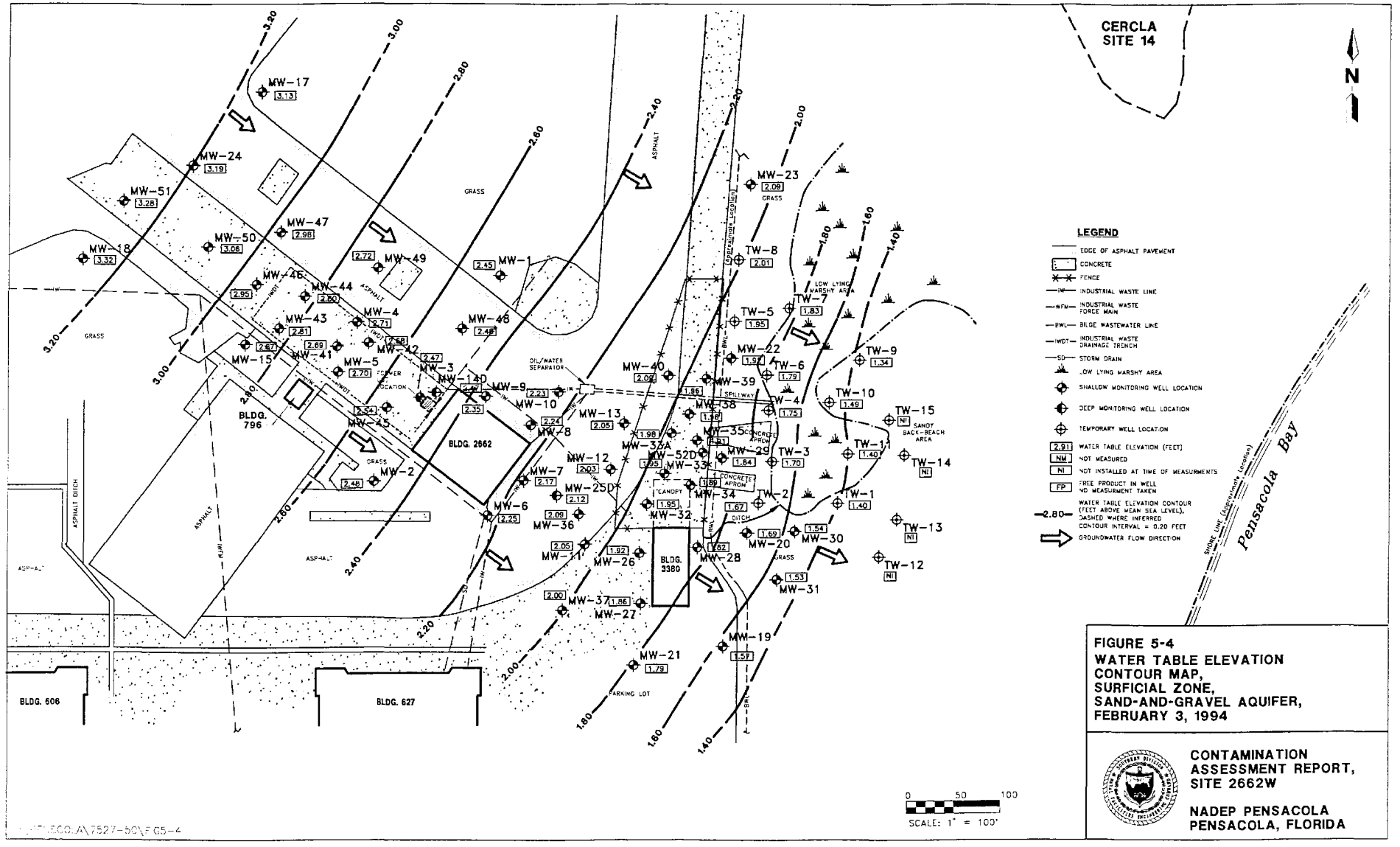


FIGURE 5-4
WATER TABLE ELEVATION CONTOUR MAP, SURFICIAL ZONE, SAND-AND-GRAVEL AQUIFER, FEBRUARY 3, 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

Table 5-2
Average Hydraulic Conductivities Calculated From Slug Test Data, NADEP Pensacola

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Site/Well Number	Total Depth	Screened Interval (feet)	K (ft/day)
PEN-604S-MW-6	13.00	3.00 to 13.00	2.1×10^{1}
PEN-604S-MW-11	13.45	3.45 to 13.45	2.9×10^{1}
PEN-604S-MW-12D	31.71	26.71 to 31.71	3.2×10^{1}
PEN-607NE-MW-5	12.87	2.87 to 12.87	7.2
PEN-647N-MW-2	26.63	16.63 to 26.63	2.5×10^{1}
PEN-647N-MW-8D	40.05	35.05 to 40.05	5.7×10^{1}
PEN-648N-MW-3	26.95	16.95 to 26.95	2.8×10^{1}
PEN-648N-MW-5D	50.48	45.48 to 50.48	9.0×10^{1}
PEN-648N-MW-6	27.01	17.01 to 27.01	3.0×10^{1}
PEN-648N-MW-9	27.67	17.67 to 27.67	1.8×10^{1}
PEN-649N-MW-4D	36.78	31.78 to 36.78	4.0×10^{1}
PEN-649N-MW-8	26.78	16.78 to 26.78	0.7×10^{1}
PEN-649W-MW-1	25.75	15.75 to 25.75	2.9×10^{1}
PEN-649W-MW-6D	40.63	35.63 to 40.63	7.6×10^{1}
PEN-709DN-MW-3	25.15	15.15 to 25.15	3.7×10^{1}
PEN-709DN-MW-6D	34.50	29.50 to 34.50	6.8×10^{1}
PEN-709DN-MW-10	25.08	15.08 to 25.08	2.6×10^{1}
PEN-2662W-MW-1	**[1]12.00**	**2.00 to 12.00**	**5.7×10^{1}**
PEN-2662W-MW-2	**[1]12.00**	**2.00 to 12.00**	**4.2×10^{1}**
PEN-3220S-MW-6	27.55	17.55 to 27.55	3.5×10^{1}
PEN-3220S-MW-9D	45.27	40.27 to 45.27	4.6×10^{1}
PEN-3221NE-MW-6	14.86	4.86 to 14.86	4.3×10^{1}
PEN-3221NE-MW-9	14.98	4.98 to 14.98	3.0×10^{1}
PEN-3221NE-MW-10	15.02	5.02 to 15.02	2.6×10^{1}
PEN-3221NE-MW-12D	34.69	29.69 to 34.69	1.0×10^{1}
PEN-3221NW-MW-1	14.85	4.85 to 14.85	4.1×10^{1}
PEN-3221SW-MW-1	14.91	4.91 to 14.91	4.0×10^{1}
PEN-3450S-MW-2	24.90	14.90 to 24.90	5.5×10^{1}
PEN-3450W-MW-1	25.55	15.55 to 25.55	2.2×10^{1}
PEN-3557S-MW-1	13.00	3.00 to 13.00	1.7×10^{1}
PEN-3810N-MW-4	13.00	3.00 to 13.00	5.5×10^{1}
PEN-3810N-MW-6	13.00	3.00 to 13.00	4.9×10^{1}
PEN-3810N-MW-10D	19.65	14.65 to 19.65	8.3×10^{1}

[1] Estimated depth.

Note: K = hydraulic conductivity, feet per day (ft/day).

Table 5-3
Summary of Soil Sample Organic Vapor Analyzer (OVA) Headspace Analyses, January 25, 1992, through March 8, 1994

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Boring Designation	Depth (feet)	Concentration[1] (ppm)	Comments
SB-1/MW-1	2 to 3	<1	
SB-2/MW-2	4	<1	
SB-3/MW-3	3	900	Strong fuel odor
SB-4/MW-4	0 to 3	2,300/10	Strong fuel odor
SB-5/MW-5	0.3 to 3	50/<1	
SB-6/MW-6	2	<1	
SB-7/MW-7	0.3 to 2	<1	
SB-8/MW-8	0.3 to 2	<1	
SB-9/MW-9	0.3 to 2.5	100	Strong fuel odor
SB-10/MW-10	0.5 to 2	<1	
SB-11/MW-11	0.5 to 3	<1	
	5 to 7	600	Saturated sample
SB-12/MW-12	0.5 to 3	80	Strong diesel odor
	5 to 7	20	Saturated sample
SB-13/MW-13	3 to 5	<1	
	5 to 7	900	Saturated sample
SB-14/MW-14	3	>5,000	Strong odor
SB-15/MW-15	2	<1	
SB-16	1.5 to 2.5	130	
SB-17/MW-17	0 to 3	<1	
	3 to 3.5	5	
SB-18/MW-18	2	<1	
SB-19/MW-19	2	150	Strong odor
SB-20/MW-20	2.5	<1	
SB-21/MW-21	3	<1	
SB-22/MW-22	2.5	<1	
SB-23	2.5	<1	
SB-24	2.5	<1	
SB-25	2.5	<1	
SB-26	2.5	<1	
SB-27/MW-23	2	9	Faint organic odor
SB-28	3	<1	
SB-29/MW-24	0 to 2	<1	
SB-30	0 to 2	440	Strong odor
SB-31	NM	NM	--
SB-32	0 to 2	150	Strong odor
SB-33/MW-25D	2	<1	
SB-34/MW-26	2	<1	
SB-35/MW-27	2	<1	

See notes at end of table.

Table 5-3 (continued)
Summary of Soil Sample Organic Vapor Analyzer (OVA) Headspace Analyses, January 25, 1992, through March 8, 1994

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Boring Designation	Depth (feet)	Concentration[1] (ppm)	Comments
SB-36/MW-28	2	<1	
SB-37/MW-30	0 to 3	<1	
SB-38/MW-31	0 to 3	<1	
SB-39/MW-29	0 to 3	<1	
SB-40/MW-32	2	<1	
SB-41/MW-33	2	<1	
SB-42	2	<1	
SB-43/MW-33A	2	47	
SB-44/MW-34	1.5	55	Some odor, non-petroleum
SB-45	NM	NM	–
SB-46/MW-38	1.5	<1	Strong fuel odor at 5' bls
SB-47/MW-35	1.5	3,000	Strong petroleum odor
SB-48/MW-36	2	<1	Possible odor
SB-49/MW-37	2	1	
SB-50/MW-39	1.5	<1	
SB-51/MW-40	1.5	<1	
SB-52/MW-41	1.5	>5,000	Strong petroleum odor
SB-53/MW-42	2	>5,000	Very strong petroleum odor
SB-54/MW-43	2	<1	Petroleum odor at >3' bls
SB-55/MW-44	2	3,400	Petroleum odor
SB-56/MW-45	2	250	Petroleum odor, black discoloration
SB-57/MW-46	2	4,800	Strong petroleum odor, discoloration
SB-58/MW-47	2	<1	
SB-59/MW-48	2	1,200	Strong petroleum odor, discoloration
SB-60/MW-49	2	90	Petroleum odor
SB-61/MW-50	2	2	
SB-62	2	1	
SB-63	2	<1	
SB-64	2	4	
SB-65	2	1	
SB-66	2	2	Strong petroleum odor, discoloration
SB-67	2	33/<1	Slight metallic odor
SB-68/MW-51	2	<1	Possible petroleum odor
SB-69	1.5	<1	
SB-70	2	<1	

See notes at end of table.

Table 5-3 (continued)
Summary of Soil Sample Organic Vapor Analyzer (OVA) Headspace Analyses, January 25, 1992, through March 8, 1994

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Boring Designation	Depth (feet)	Concentration[1] (ppm)	Comments
SB-71	2.5	<1	
SB-72	2	<1	Diesel odor
SB-73	0.3 to 2	4,700	Diesel odor
SB-74	0.3 to 2	130	Diesel odor
SB-75	0.5 to 2	<1	
SB-76	0.4 to 2	2	
SB-77	0.5 to 2	>5,000	Strong diesel odor
SB-78	0.5 to 2	29	
SB-79	0.5 to 2	4	Slight odor
SB-80	0.5 to 2	<1	
SB-81	0.5 to 2	1,400	Diesel odor
SB-82	0.5 to 2	95	Diesel odor
SB-83	0.5 to 2	650	Strong diesel odor
SB-84	0.5 to 2	9	Diesel odor
SB-85	0.5 to 2	<1	Faint odor
SB-86	0.5 to 2	<1	
SB-87	0.5 to 2	<1	
SB-88	0.5 to 2	<1	
SB-89	0.5 to 2	700	Diesel odor
SB-90	0.5 to 2	<1	
SB-91	0.5 to 2	200	Diesel odor
SB-92	0.5 to 2	<1	
SB-93	0.5 to 2	<1	
SB-94	0.5 to 2	<1	
SB-95	0.5 to 2	<1	

[1] Corrected for methane.

Notes: ppm = parts per million.
NM = not measured.

Three areas of excessively contaminated soil were identified by OVA headspace analysis (Figure 5-5). The OVA headspace reading at each boring shown on Figure 5-5 is the highest recorded at that location. All soil samples were collected above the water table, between 0 and 5 feet bls (typically 2 feet bls). In many soil borings only one soil sample was collected due to shallow water table conditions (2 feet bls or less). The areal extent of excessively contaminated soil is shown within the 50 ppm isoconcentration lines. With few exceptions, the highest reading was recorded in the sample collected directly above the water table. Excessively contaminated soil appears to be restricted to within 1 to 2 feet above the top of the water table.

The largest zone of contaminated soil is located north and northwest of Building 2662. This area includes the former UST location at Building 2662, a large area upgradient of the UST covering approximately 300 by 150 feet, and the area north of the UST covering approximately 100 by 150 feet (Figure 5-5).

Two smaller areas of excessively contaminated soil were also identified. One is in the vicinity of the hazardous waste storage area north of Building 3380; the other in the immediate vicinity of SB-19, southeast of Building 3380.

5.2.1.2 **Laboratory Analytical Results for Soil** Forty soil samples were collected for laboratory analysis. Four of the 40 samples (SB-4, SB-5, SB-9, and the trench sample) were analyzed for volatile organics, base-neutral acid extractables, TRPH, and metals (silver [Ag], barium [Ba), mercury [Hg], and selenium [Se]). The laboratory analytical results are presented in Table 5-4. All of the soil samples were analyzed for metals including As, Cd, Cr, and Pb for soil borings SB-1 through SB-39 and the trench sample. These data are presented in Table 5-5. Appendix F, Laboratory Analytical Data, provides all of the laboratory analytical data sheets for all soil analyses.

Volatile organics detected above the method detection limits include ethylbenzene in samples SB-4 and the trench sample (220 parts per billion [ppb] and 1,200 ppb, respectively). The trench sample also contained 4,800 ppb of xylenes. Methylene chloride was detected in two of the soil samples (SB-5 with 13 ppb and SB-9 with 22 ppb) and their respective laboratory blank samples (equipment and trip with 7 ppb); therefore, this compound is believed to be a laboratory contaminant.

Base-neutral acid extractable compounds were detected in soil samples SB-4 and the trench sample. The SB-4 sample contained 12 ppm naphthalene, 16 ppm 1-methylnaphthalene, and 20 ppm 2-methylnaphthalene. For SB-4, the total naphthalene concentration equaled 48 ppm. The trench sample contained 15 ppm naphthalene, 32 ppm 1-methylnaphthalene, and 35 ppm 2-methylnaphthalene. For the trench sample, the total naphthalene concentration equaled 82 ppm.

SB-4, the trench sample, and sample SB-9 contained elevated TRPH levels. Sample SB-4 contained 17,000 ppm TRPH, the trench sample contained 19,000 ppm TRPH, and sample SB-9 contained 770 ppm TRPH.

Soil contamination at the site appears to be associated with the old UST, and to previous and current maintenance and defueling activities. The trench where the soil sample was collected is part of the IWDT system and receives surface runoff from the maintenance and defueling area. This runoff is believed to be a major contributing factor to the soil contamination in the trench.

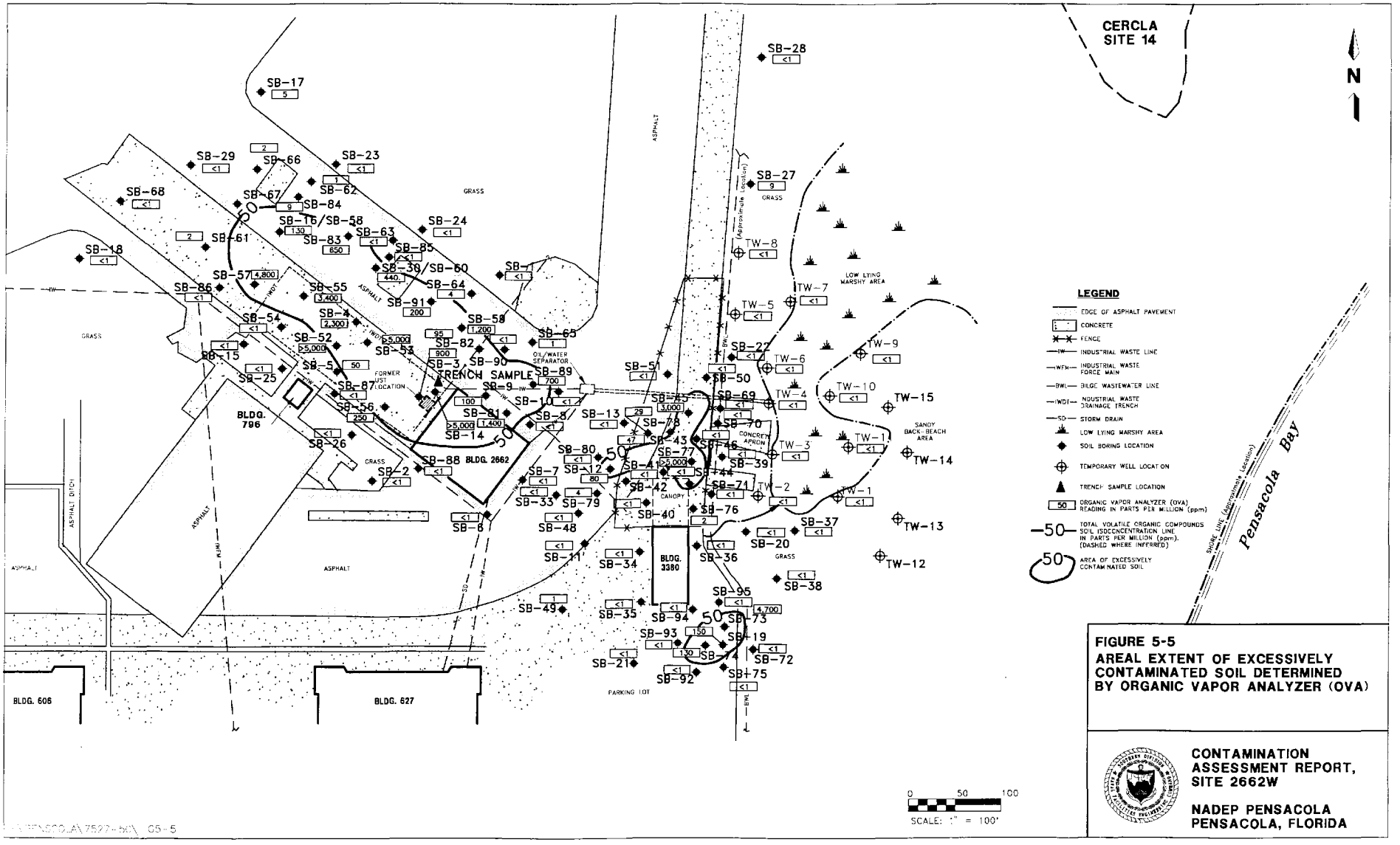


FIGURE 5-5
AREAL EXTENT OF EXCESSIVELY CONTAMINATED SOIL DETERMINED BY ORGANIC VAPOR ANALYZER (OVA)

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA PENSACOLA, FLORIDA

Table 5-4
Summary of Soil Sample Laboratory Analyses, January 1992

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Compound	Regulatory[1] Standard	SB-4	SB-5	SB-9	Trench
Volatile Organics (USEPA Method 8240, ppm)					
Benzene		<54	<11	<8	<700
Ethylbenzene		220	<11	<8	1,200
Toluene		<54	<11	<8	<700
Xylene (total)		<54	<11	<8	4,800
Total VOA	0.1	220N	<44	<32	6,000N
Methylene chloride		<54	[2]13	[2]22	<700
Base-Neutral Acid Extractables (USEPA Method 8270, ppm)					
Naphthalene		12	<0.33	<1.1	15
1-Methylnaphthalene		16	<0.33	<1.1	32
2-Methylnaphthalene		20	<0.33	<1.1	35
Total Naphthalenes		48	<0.99	<3.3	82
Total Recoverable Petroleum Hydrocarbons (TRPH) (USEPA Method 418.1, ppm)					
TRPH	10	17,000	<5	770	19,000
TCLP Metals (USEPA Methods 200.7, 245.1, and 270.2, ppm)					
Silver	5	<0.05	<0.05	<0.05	<0.05
Barium	100	0.61	0.59	0.20	1.2
Mercury	0.2	<0.002	<0.002	<0.002	<0.002
Selenium	1	<0.5	<0.5	<0.5	<0.5

[1] Chapter 17-775.400, Florida Administrative Code, cleanup level.
[2] Methylene chloride was detected in the method blank associated with this sample.

Notes: All samples were collected between 2 and 3 feet below land surface (bls).
USEPA = U.S. Environmental Protection Agency.
ppm = parts per million.
Total VOA = total volatile organic aromatics; sum of benzene, ethylbenzene, toluene, and xylenes.
Total naphthalenes = sum of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.
TCLP = Toxicity Characteristic Leaching Procedure.
N = actual value may be greater than summed value.

Table 5-5
Summary of Soil Sample Metals Analyses, January through August 1992

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Compound	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	SB-7	SB-8	SB-9	SB-11
Arsenic	ND	0.5	1.5	ND	1.5	ND	ND	ND	ND	ND
Cadmium	ND	ND	2.4	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	9.4	ND	ND	ND	ND	ND	ND	ND
Lead	91	62	59	37	280	<2.5	3.5	<2.5	25	16

Compound	SB-12	SB-13	SB-14	SB-15	SB-16	SB-17	SB-18	SB-19	SB-20	SB-21
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.5
Chromium	ND	ND	ND	ND	ND	ND	ND	5.7	ND	0.5
Lead	3.8	61	140	13	90	24	35	16	27	46

Compound	SB-22	SB-23	SB-24	SB-25	SB-26	SB-27	SB-29	SB-30	SB-31	SB-32
Arsenic	0.8	ND	ND	1.2	1.2	ND	ND	ND	ND	ND
Cadmium	2.5	ND	ND	0.6	ND	ND	ND	ND	ND	ND
Chromium	7.3	ND	ND	ND	5.9	3.6	ND	ND	ND	ND
Lead	130	46	32	48	80	6.8	32	92	12	190

Compound	SB-33	SB-34	SB-35	SB-36	SB-37	SB-38	SB-39	Trench
Arsenic	ND	0.9	0.7	ND	ND	ND	0.8	2.7
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	3.2	3.5
Lead	10	16	24	18	<2.5	6.1	15	1,200

Notes: Concentrations reported in parts per million (ppm).
All samples were collected between 2 and 3 feet below land surface (bls).
ND = not detected.

The Toxicity Characteristic Leaching Procedure (TCLP) for the metals Ag, Ba, Hg, and Se were all reported below detectable limits in Site 2662W soil samples. The remaining metal analytes include As, Cd, Cr, and Pb. The metal As was not detected in any of the samples in concentrations greater than the regulatory limit of 5 ppm. The metal Cd was detected in concentrations exceeding the regulatory limit of 1 ppm in SB-3 (2.4 ppm) and SB-22 (2.5 ppm). The metal Cr was not detected in any of the soil samples in concentrations exceeding the regulatory limit of 5 ppm.

Thirty-three of the 40 soil samples contained lead concentrations that exceeded the detection limit of 5 ppm. The Pb concentration of each soil sample collected at Site 2662W and the 108 ppm isoconcentration line is provided on Figure 5-6. The 108 ppm isoconcentration line represents the remediation cleanup level provided in Chapter 17-775, FAC, for Pb in soil. Pb concentrations ranged from 6.1 ppm in sample SB-38 to 280 ppm in sample SB-5. The trench sample contained an anomalously high concentration (1,200 ppm) of Pb.

Elevated levels of Pb in soil from the trench may be associated with site operations involving materials or wastes with high Pb concentrations. The high Pb levels are not believed to be associated with the petroleum releases. To support this hypothesis, an examination of the laboratory results from soil sample SB-1 and groundwater sample MW-1 is presented below. Well MW-1 was installed in the soil boring where sample SB-1 was collected.

Soil sample SB-1 contained no detectable concentrations of volatile compounds from the field screening analysis using the FID nor any metals concentrations above detectable limits, except Pb. In addition, all groundwater analyses from well MW-1 indicate that all compounds are below detectable limits for petroleum compounds and metals, including Pb. The Pb concentration in soil is 91 ppm and the groundwater concentration is less than 5 ppb. Because no other petroleum or metal contaminants are present in the sample, it is likely that the levels of Pb detected are indicative of the soils in that area, and not a result of a petroleum release. Because other non-petroleum-related contaminants were identified at elevated levels in the trench sample, the elevated Pb concentration in the trench sample is likely related to maintenance activities or other operations in this area.

Table 5-6 lists TICs detected in samples from SB-4, SB-5, SB-9, and the trench sample. As many as 19 TICs were identified in sample SB-5. The remaining samples each contained fewer than 19 TICs. The TICs include petroleum related and petroleum breakdown compounds that typically do not have regulatory guidelines or standards, and little is known concerning their toxicity characteristics.

5.2.2 Groundwater Contamination Assessment Groundwater analytical laboratory results for each sampling episode at Site 2662W are presented in Appendix F, Laboratory Analytical Data Sheets. Presented in Appendix A are Tables A-1 through A-5, which summarize all data for each sample that contained detectable concentrations of contaminants.

For petroleum compounds regulated under Chapter 17-770, FAC, Class G-II groundwater target levels will be used, where applicable. The following target level concentrations have been established in Chapter 17-770, FAC: benzene 1 ppb, total VOA (the sum of benzene, ethylbenzene, toluene, and xylenes) 50 ppb,

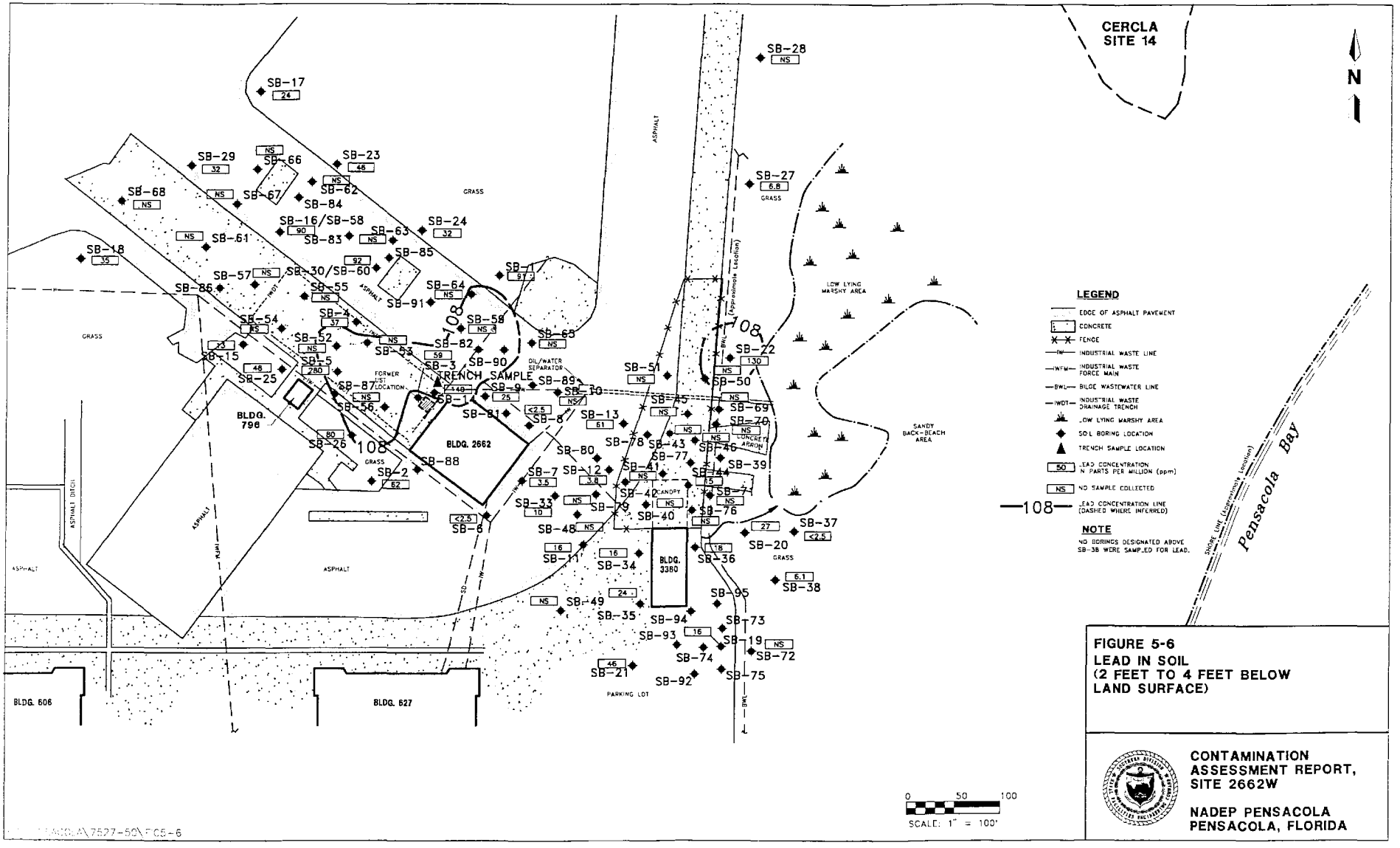


FIGURE 5-6
LEAD IN SOIL
(2 FEET TO 4 FEET BELOW LAND SURFACE)

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

Table 5-6
Summary of Soil Sample Laboratory Analyses, Tentatively Identified Compounds, January 1992

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Compound	SB-4	SB-5	SB-9	SB-9 DUP	Trench
1-Ethyl-3-methyl benzene	ND	ND	ND	ND	28
1-Ethyl-4-methyl benzene	ND	33.15	ND	ND	ND
Methyl(1-methylethyl) benzene	ND	ND	ND	ND	43
1-Methyl-3-(1-methylethyl)-benzene	ND	0.078	ND	ND	ND
1,3-Dimethyl-5-(1-methylethyl) benzene	26	ND	ND	ND	ND
4-Ethyl-1,2-dimethyl benzene	ND	79	ND	ND	ND
2-Ethyl-1,3-dimethyl benzene	ND	92	ND	ND	ND
1-Ethyl-2,4-dimethyl benzene	0.99	0.022	ND	ND	ND
1,2,3,4-Tetramethyl benzene	ND	ND	ND	ND	25
Decahydro naphthalene	ND	0.13	ND	ND	39
Decahydro-2-methyl naphthalene	1.60	ND	ND	ND	ND
2,7-Dimethyl naphthalene	ND	29	ND	ND	ND
2,4-Dimethyl hexane	1.30	ND	ND	ND	ND
2,3-Dimethyl octane	ND	0.14	ND	ND	ND
3,3-Dimethyl octane	3.30	ND	ND	ND	ND
3-6-Dimethyl octane	0.98	0.12	ND	ND	ND
2,3,7-Trimethyl octane	ND	0.33	ND	ND	ND
5-Ethyl-2-methyl octane	ND	26	ND	ND	ND
Undecane	50	ND	ND	ND	ND
4-Methyl decane	ND	0.24	ND	ND	ND
2,5,6-Trimethyl decane	ND	0.21	ND	ND	ND
3-Cyclohexyl decane-3-cyclohexyl	1.80	ND	ND	ND	ND
4-Cyclohexyl decane-4-cyclohexyl	4.20	0.26	ND	ND	ND
6-Propyl tridecane	ND	ND	ND	0.33	ND
2,6,10,14-Tetramethyl hexadecane	ND	24	ND	ND	ND
Heptadecane	ND	ND	ND	0.33	ND
Tetradecane	ND	ND	ND	0.60	ND
4,6-Dimethyl dodecane	ND	ND	ND	0.28	ND

See notes at end of table.

Table 5-6 (Continued)
Summary of Soil Sample Laboratory Analyses, Tentatively Identified Compounds, January 1992

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Compound	SB-4	SB-5	SB-9	SB-9 DUP	Trench
2,6,11-Trimethyl dodecane	ND	ND	ND	0.50	ND
1-Methyl-3-(2-methylpropyl)-cyclopentane	ND	0.31	ND	ND	ND
1,2-Dimethyl-3-(1-methylethyl)-cyclopentane	ND	ND	ND	ND	45
1-Hexyl-3-methyl cyclopentane	ND	ND	ND	ND	39
Methyl cycloheptane	3.60	ND	ND	ND	ND
Methyl cyclohexane	ND	ND	ND	ND	69
1-Ethyl-methyl cyclohexane	0.94	ND	ND	ND	29
Cis-1,3-dimethyl cyclohexane	ND	ND	0.027	ND	62
Trans-1,3-dimethyl cyclohexane	ND	ND	ND	ND	23
Trans-1-(cyclohexylmethyl)-2-ethyl cyclohexane	ND	ND	0.02	ND	ND
2-Propenyl-cyclohexane	ND	0.12	ND	ND	ND
Methoxy cyclohexane	ND	ND	ND	0.25	ND
Cis-2-methyl-1,1-Bicyclohexyl	5.60	ND	ND	ND	ND
4-(1-methyl-1-phenylethyl) phenol	ND	ND	ND	0.58	ND
Chloro-2,5-dimethyl-4-tert-butylphenol	ND	ND	ND	0.38	ND
Octacosane	94	ND	ND	ND	ND
Hextriacontane	180	ND	ND	ND	ND
Sulfur, mol. (S8)	ND	1.2	ND	ND	ND
Isoctanol	ND	ND	0.008	ND	ND
2-Butenyl hydrazone acetaldehyde	ND	ND	0.019	ND	ND
1-Undecen-6-one	ND	ND	0.01	ND	ND
Unknowns (total)	200	200.36	ND	1.6	ND

Notes: Concentrations are reported in parts per million (ppm).
All samples were collected between 2 and 3 feet below land surface (bls).
ND = not detected.

TRPH 5 ppm, lead 50 ppb, total naphthalenes (the sum of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene) 100 ppb, individual PAH 10 ppb or best achievable detection limit (excluding naphthalenes), MTBE 50 ppb, and 1,2-dichloroethane 3 ppb. Other chlorinated hydrocarbon compounds detected in samples from the site will be compared to State recommended guidance concentrations established by FDER (February 1989).

Groundwater samples have been collected at the site on four separate occasions since March 1992. Before the February 1994 sampling episode, the most recent data was from January 1993 and was more than a year old. Chapter 17-770, FAC, requires submittal of current data (within the last 6 months) with the CAR; therefore, the following discussion of groundwater contamination relates to the February 1994 and March 1994 groundwater analytical data. Previous groundwater data that are germane to the contamination assessment are discussed in this section; otherwise, the groundwater analytical data from earlier phases of the CA are provided in summary tables in Appendix A.

At the conclusion of the Phase III CA, the cumulative data for interpreting the extent of the groundwater contamination indicted that one large continuous plume existed beneath Buildings 2662 and 3380. The western end of the plume in the vicinity of Building 2662 consisted of petroleum contamination, whereas the eastern end of the plume in the vicinity of Building 3380 consisted of a mixed plume of petroleum contamination and chlorinated compounds. The laboratory results for the samples from the monitoring wells that comprised the central area of the contaminant plume between Buildings 2662 and 3380 (wells MW-6, MW-7, MW-8, MW-10, MW-13, and MW-36) indicated low levels of petroleum contamination existed in this area of the plume. Subsequent resampling and analysis of most of the wells at the site during the Phase IV CA indicated that the contaminant levels that existed at the conclusion of the Phase III CA had dissipated. Laboratory results for the samples from monitoring wells in the central area of the plume (MW-6, MW-7, MW-8, MW-10, MW-13, and MW-36) were reported as below detection limits for most of the contaminants of concern. The emergence of a zone of groundwater between Buildings 2662 and 3380 that was below Chapter 17-770, FAC, target levels was observed as a result of these data. Hence, two distinct groundwater contaminant plumes are discussed in the following sections.

5.2.2.1 Volatile Organic Compounds (VOCs) in Groundwater

Petroleum Compounds. Two areas of petroleum-contaminated groundwater were identified during the contamination assessment. One area is in the vicinity of the former UST at Building 2662 and upgradient of this area to the northwest. The second area is east of Building 2662 and north of Building 3380. Presented on Figure 5-7 are total VOA concentrations in groundwater samples from wells in these two areas, the areal extent of total VOA contamination, and the location of contaminant plumes in relationship to the surrounding Buildings. Presented in Table 5-7 is a summary of all of the Phase IV (1994) groundwater analytical data from well samples with detectable levels of benzene, toluene, ethylbenzene, and xylenes, and their sum, total VOA.

The highest total VOA concentration in the area northwest of Building 2662 was 42 ppb in sample MW-41. Other groundwater samples in the area contained detectable levels of total VOA; however, none exceeded 12 ppb. The total VOA concentrations in this area do not exceed the Chapter 17-770, FAC, target level for total VOA of 50 ppb. Contamination in this area appears to be related to

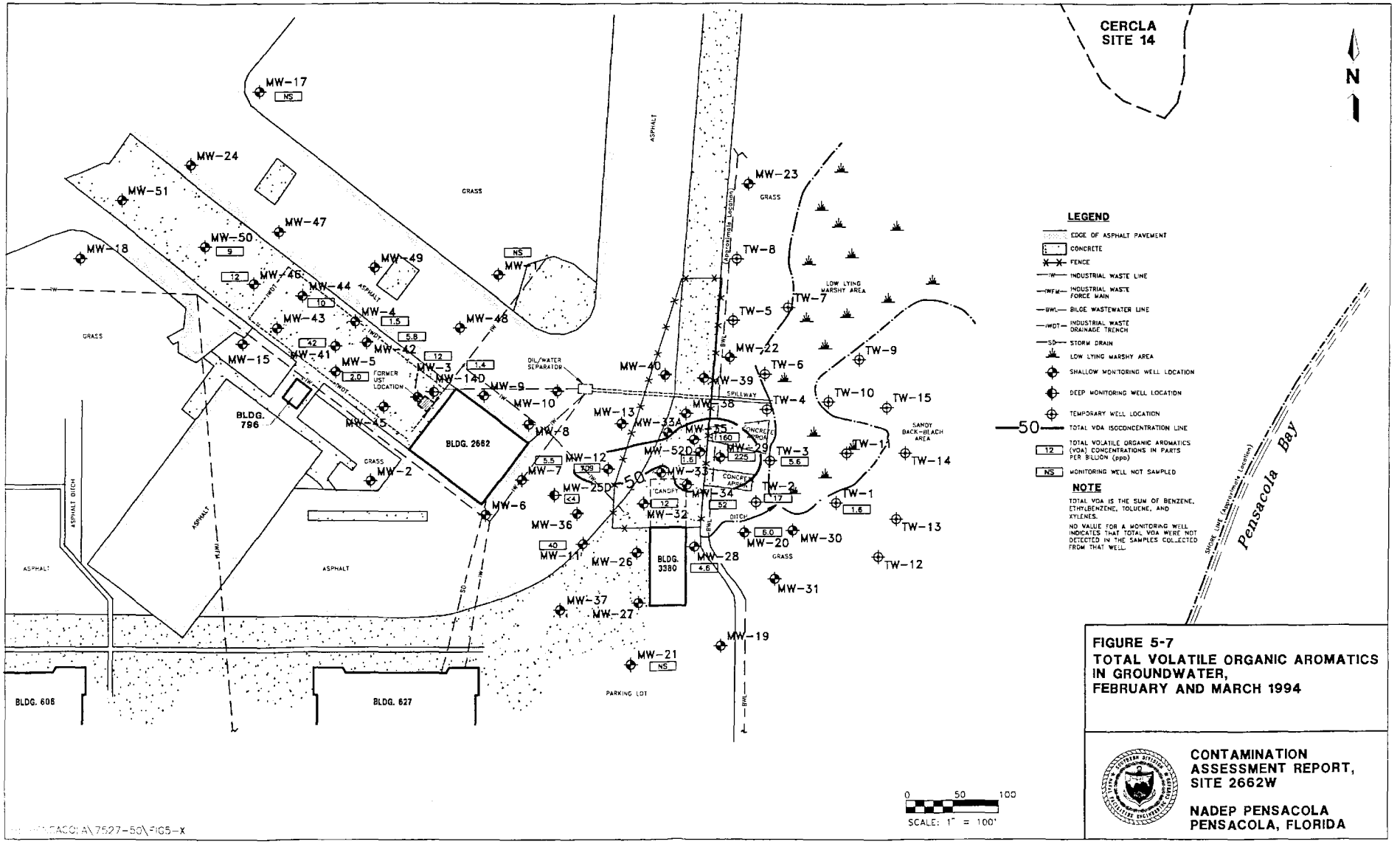


FIGURE 5-7
TOTAL VOLATILE ORGANIC AROMATICS IN GROUNDWATER, FEBRUARY AND MARCH 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA PENSACOLA, FLORIDA

Table 5-7
Summary of Groundwater Analytical Results,
Detected Concentrations of Benzene and Total Volatile Organic Aromatics (VOA),
January through March 1994 (Phase IV)

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Compounds	State Target Level[1]	MW-3	MW-4	MW-5	MW-7	MW-7 DUP	MW-11	MW-12	MW-14D
Benzene	1	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene		10	<1.0	2.0	<1.0	<1.0	<1.0	9.1	1.4
Ethylbenzene		1.5	<1.0	<1.0	1.0	<1.0	13	110	<1.0
Xylenes		<1.0	<1.0	<1.0	4.5	4.0	27	590	<1.0
Total VOA[2]	50	12N	1.5N	2.0N	5.5N	4.0N	40N	709N	1.4N

Compounds	State Target Level[1]	MW-20	MW-28	[3]MW-29	MW-32	MW-34	[3]MW-35	MW-41	MW-42
Benzene	1	<1.0	<1.0	28 (24)	<1.0	43	64 (17)	22	1.7
Toluene		<1.0	<1.0	<1.0 (16)	<1.0	<1.0	<1.0 (11)	17	4.1
Ethylbenzene		4.6	2.1	190 (130)	4.4	1.6	51 (41)	3.0	<1.0
Xylenes		1.4	2.5	7.2 (18)	7.7	7.3	45 (35)	<1.0	<1.0
Total VOA[2]	50	6.0N	4.6N	225N (188)	12N	52N	160N (104)	42N	5.8N

Compounds	State Target Level[1]	MW-44	MW-46	MW-50	[3]MW- 52D	[3]TW-1	[3]TW-2	TW-3
Benzene	1	1.6	1.7	1.3	1.6 (1.5)	<1.0 (<1.0)	13 (49)	1.8
Toluene		7.2	7.8	5.0	<1.0 <1.0)	<1.0 (<1.0)	<1 (3.9)	<1.0
Ethylbenzene		1.6	2.2	2.7	<1.0 (<1.0)	<1.0 (<1.0)	1.6 (<1.0)	2.0
Xylenes		<1.0	<1.0	<1.0	<1.0 (<1.0)	1.6 (<1.0)	2.1 (2.4)	1.8
Total VOA[2]	50	10N	12N	9.0N	1.6N (1.5N)	1.6N (<4.0)	17N (55.3)	5.6N

[1] State target level: Florida Department of Environmental Protection (FDEP), Chapter 17-770, Florida Administrative Code (FAC).
[2] Total VOA: the sum of benzene, ethylbenzene, toluene, and xylenes concentrations.
[3] Numbers in parentheses are results of resampling in March 1994.

Notes: All concentrations are in parts per billion (ppb).
VOA = volatile organic aromatic.
N = actual value may be greater than the reported value.

defueling and maintenance activities that take place in the area. The majority of the contaminated area is surrounded by the IWDT, which collects surface spills and surface runoff from the defueling and maintenance area.

The second area of total VOA contamination includes four wells in which detectable levels of total VOA exceeded the 50 ppb target level (see Figure 5-7). Samples from wells MW-12, MW-29, MW-34, and MW-35 contained total VOA concentrations of 709 ppb, 225 ppb, 52 ppb, and 160 ppb, respectively. Other samples in the area containing detectable levels of total VOA below the 50 ppb target level were from wells MW-7, MW-11, MW-20, MW-28, MW-32, MW-34, TW-1, TW-2, and TW-3.

The source for this area of petroleum contamination is not clearly identifiable. One suspected source is a bilge wastewater line that runs beneath the surface parallel to the orientation of the contaminated groundwater plume. Another suspected source area is where general helicopter maintenance, fueling, and defueling activities take place. Also, an IW line runs beneath this area in a northwest to southwest orientation. Recently, the area north of Building 3380 has been used to store hazardous waste and materials that may be potential sources of petroleum contamination.

Total VOA concentrations greater than the State target level of 50 ppb were not detected in groundwater below the screened intervals of the deep wells at the site. The total VOA concentration in the sample from MW-14D was 1.4 ppb (screened interval 20 to 25 feet bls), the concentration in the sample from MW-25D was <4 ppb (below detection limits [bdl]), (screened interval 25 to 30 feet bls)], and the concentration in the sample from MW-52D was 1.6 ppb (screened interval 30 to 35 feet bls).

Other petroleum contaminants of concern such as MTBE, 1,2-dichloroethane (1,2-DCA), and EDB were all reported below detection limits for samples collected in February 1994 and, for all practical purposes, all other sampling episodes as well. In March 1994, MTBE was detected in the sample from monitoring well MW-29 at a concentration of 5.2 ppb. This is below the Chapter 17-770, FAC, target level of 50 ppb and is the only observed occurrence of MTBE at this site.

Benzene. The benzene contaminant plume overlaps the total VOA contaminant plume and is generally located in the same area. Presented in Figure 5-8 are the benzene concentrations in groundwater and the 1 ppb isoconcentration contour for benzene in groundwater beneath the site. Laboratory analytical results for samples with detectable levels of benzene are presented in Table 5-7.

The area of benzene contamination northwest of Building 2662 encircles wells MW-4, MW-41, MW-42, MW-46, and MW-50, with the highest benzene concentration of 22 ppb in the sample from MW-41. All other benzene concentrations in the area were between 1 and 2 ppb. The contamination northwest of Building 2662 appears to be related to the defueling and maintenance activities that take place on the apron in this area.

The second area of benzene contamination is north and northeast of Building 3380 and encompasses wells MW-29, MW-34, MW-35, MW-52D, TW-2 and TW-3, with the highest concentration of 64 ppb in the sample from MW-35. This area of benzene contamination exceeds the Chapter 17-770, FAC, target level of 1 ppb and is suspected to be related to discharges from the bilge wastewater line that runs through this area. The sample from vertical extent well MW-52D contained 1.6 ppb

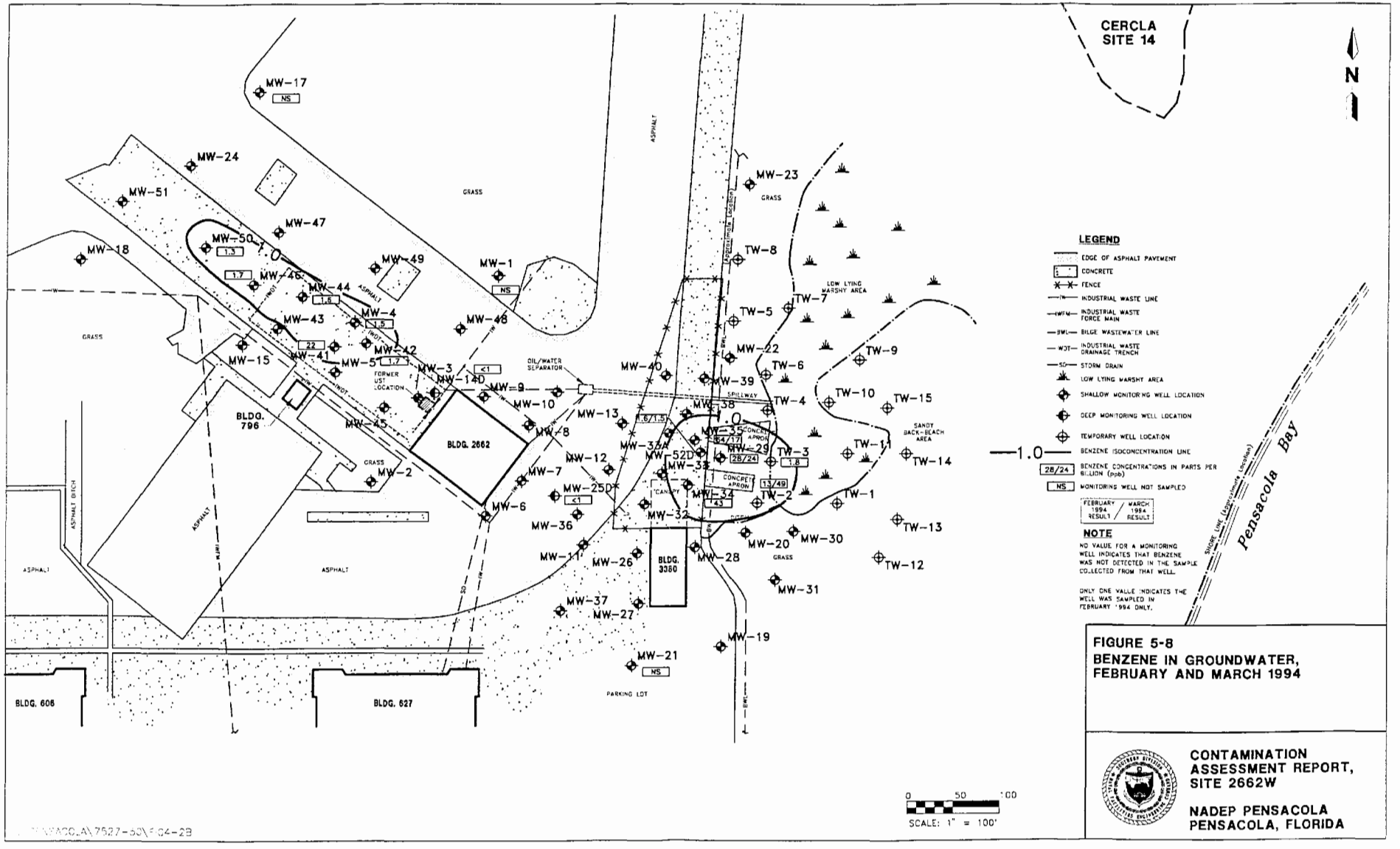


FIGURE 5-8
BENZENE IN GROUNDWATER, FEBRUARY AND MARCH 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

benzene. The well was subsequently resampled and analyzed and the benzene concentration was 1.5 ppb. In addition, temporary monitoring well TW-2 was resampled and the benzene concentration increased from 13 ppb in February 1994 to 49 ppb in March 1994.

Chlorinated Compounds. Fourteen chlorinated compounds were detected in site groundwater samples. These include chlorobenzene, 1,4-dichlorobenzene (1,4-DCB), 1,3-dichlorobenzene (1,3-DCB), 1,2-dichlorobenzene (1,2-DCB), tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride, 1,1-dichloroethane (1,1,-DCA), trichlorofluoromethane, cis-1,2-dichloroethene, 1,1-dichloroethene (1,1,-DCE), 1,2-DCE, methylene chloride, and chloroform. Presented in Table 5-8 is a summary of the chlorinated compounds detected in groundwater samples from the February 1994 (Phase IV) sampling episode.

Chlorobenzene, 1,4-DCB, 1,3-DCB, and 1,2-DCB were detected in samples collected from an area north and northeast of Building 3380, which encompasses the majority of this contamination, including samples from MW-29, MW-34, MW-35, TW-1, TW-2, TW-3, TW-4, and TW-11. The chlorinated compounds and petroleum contaminants are intermixed in the groundwater in this area. Presented on Figures 5-9, 5-10, 5-11, and 5-12 are the groundwater sample concentrations and isoconcentration lines for chlorobenzene, 1,4-DCB, 1,3-DCB, and 1,2-DCB, respectively. No target levels for these four compounds have been established in Chapter 17-770, FAC; therefore, other State standards or guidance concentrations will be used for comparison.

Chlorobenzene concentrations exceeded the State groundwater guidance concentration of 10 ppb (FDER, February 1989) in eight of the nine wells. Chlorobenzene concentrations were 1,500 ppb in the sample from TW-2, 990 ppb in the sample from TW-1, 360 ppb in the sample from TW-3, 340 ppb in the sample from MW-35, 320 ppb in the sample from MW-34, 290 ppb in the sample from MW-29, 43 ppb in the sample from MW-52D, and 28 ppb in the sample from TW-4 (Figure 5-9). Monitoring wells TW-2, TW-1, MW-35, MW-29, and MW-52D were resampled and analyzed for confirmation and the resulting concentrations were 1,200 ppb, 380 ppb, 360 ppb, 200 ppb, and 38 ppb, respectively.

The compound 1,4-DCB was detected in nine samples collected from monitoring wells MW-29, MW-34, MW-35, MW-36, MW-52D, TW-1, TW-2, TW-3, and TW-11 (Figure 5-10). Of these nine samples only three samples contained 1,4-DCB exceeding the State Primary Drinking Water Standard of 75 ppb established in Chapter 17-550, FAC. The sample from MW-35 contained 920 ppb, the sample from TW-2 contained 210 ppb, and the sample from MW-29 contained 100 ppb of 1,4-DCB. Monitoring wells TW-2, TW-1, MW-35, MW-29, and MW-52D were resampled and analyzed for confirmation and the resulting concentrations were 37 ppb, 22 ppb, 1,100 ppb, 60 ppb, and 6.4 ppb, respectively.

The compound 1,3-DCB was detected in nine samples collected from monitoring wells MW-29, MW-34, MW-35, MW-36, MW-52D, TW-1, TW-2, TW-3, and TW-11 (Figure 5-11). Of these nine samples, only four exceeded the State groundwater guidance concentration of 10 ppb (FDER, February 1989). These include the sample from MW-35 with 510 ppb, the sample from MW-29 with 40 ppb, the sample from TW-2 with 21 ppb, and the sample from TW-1 with 20 ppb. Monitoring wells TW-2, TW-1, MW-35, MW-29, and MW-52D were resampled and analyzed for confirmation and the resulting concentrations were 290 ppb, 10 ppb, 600 ppb, 21 ppb, and 1.2 ppb, respectively.

Table 5-8
Summary of Groundwater Analytical Results, Detected Concentrations of Chlorinated Compounds, January through March 1994 (Phase IV)

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Compound	Applied Standard	MW-12	MW-20	MW-28	[1]MW-29	MW-32	MW-34	[1]MW-35
Trichloroethene	[2]3	<1.0	1.9	1.9	<1.0 (<1.0)	<1.0	<1.0	1.6 (<10)
Tetrachloroethene	[2]3	<1.0	5.2	19	<1.0 (<1.0)	<1.0	<1.0	<1.0 (<10)
Chlorobenzene	[3]10	<1.0	<1.0	<1.0	290 (200)	<1.0	320	340 (360)
1,2-dichlorobenzene	[3]10	4.4	<1.0	<1.0	7.9 (4.3)	1.7	<1.0	510 (580)
1,3-dichlorobenzene	[3]10	<1.0	<1.0	<1.0	40 (21)	<1.0	2.7	510 (600)
1,4-dichlorobenzene	[2]75	<1.0	<1.0	<1.0	100 (60)	<1.0	25	920 (1,100)
Vinyl chloride	[2]1	<1.0	9.8	<1.0	<1.0 (<1.0)	<1.0	1.6	<1.0 (<10)

Compound	Applied Standard	MW-36	[1]MW-52D	[1]TW-1	[1]TW-2	TW-3	TW-4	TW-11
Trichloroethene	[2]3	<1.0	<1.0 (<1.0)	<1.0 (<1.0)	<1.0 (<1.0)	<1.0	<1.0	<1.0
Tetrachloroethene	[2]3	<1.0	<1.0 (<1.0)	<1.0 (<1.0)	<1.0)<1.0)	<1.0	<1.0	<1.0
Chlorobenzene	[3]10	<1.0	43 (38)	990 (380)	1,500 (1,200)	360	28	2.6
1,2-dichlorobenzene	[3]10	2.5	<1.0 (<1.0)	4.0 (1.5)	11 (<39)	2.8	<1.0	1.0
1,3-dichlorobenzene	[3]10	1.0	1.3 (1.2)	20 (10)	20 (<290E)	8.8	<1.0	1.1
1,4-dichlorobenzene	[2]75	3.3	4.8 (6.4)	30 (22)	190 (37)	21	<1.0	4.1
Vinyl chloride	[2]1	<1.0	<1.0 (<1.0)	<1.0 (<1.0)	<1.0 (<10)	<1.0	<1.0	<1.0

[1] Numbers in parentheses are results of resampling in March 1994.
[2] Primary Drinking Water Standard: Florida Department of Environmental Protection (FDEP), Chapter 17-550, Florida Administrative Code (FAC).
[3] Guidance concentration recommended by FDEP (February, 1989).

Notes: All concentrations are in parts per billion (ppb).
E = estimated value.

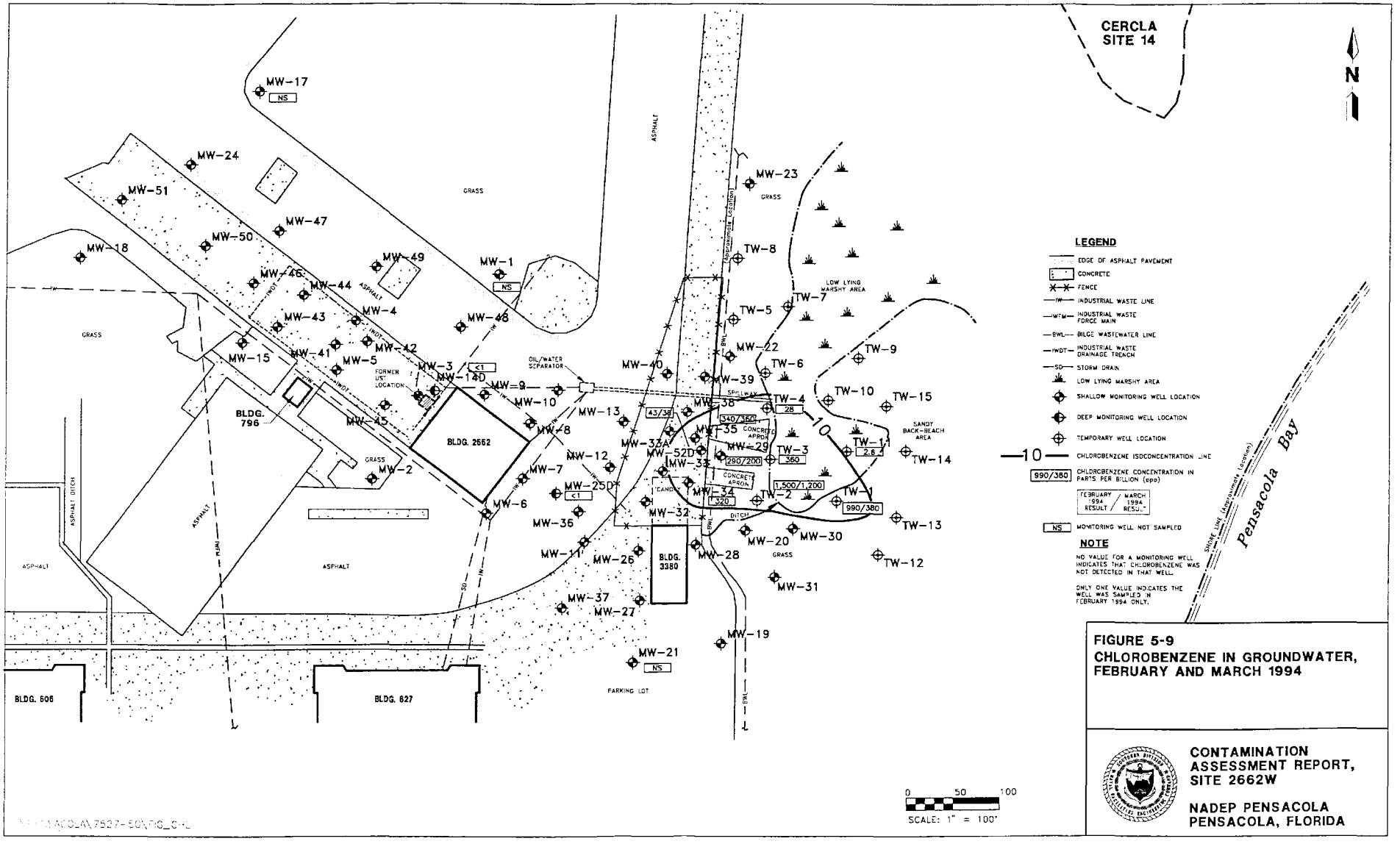


FIGURE 5-9
CHLOROBENZENE IN GROUNDWATER, FEBRUARY AND MARCH 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA PENSACOLA, FLORIDA

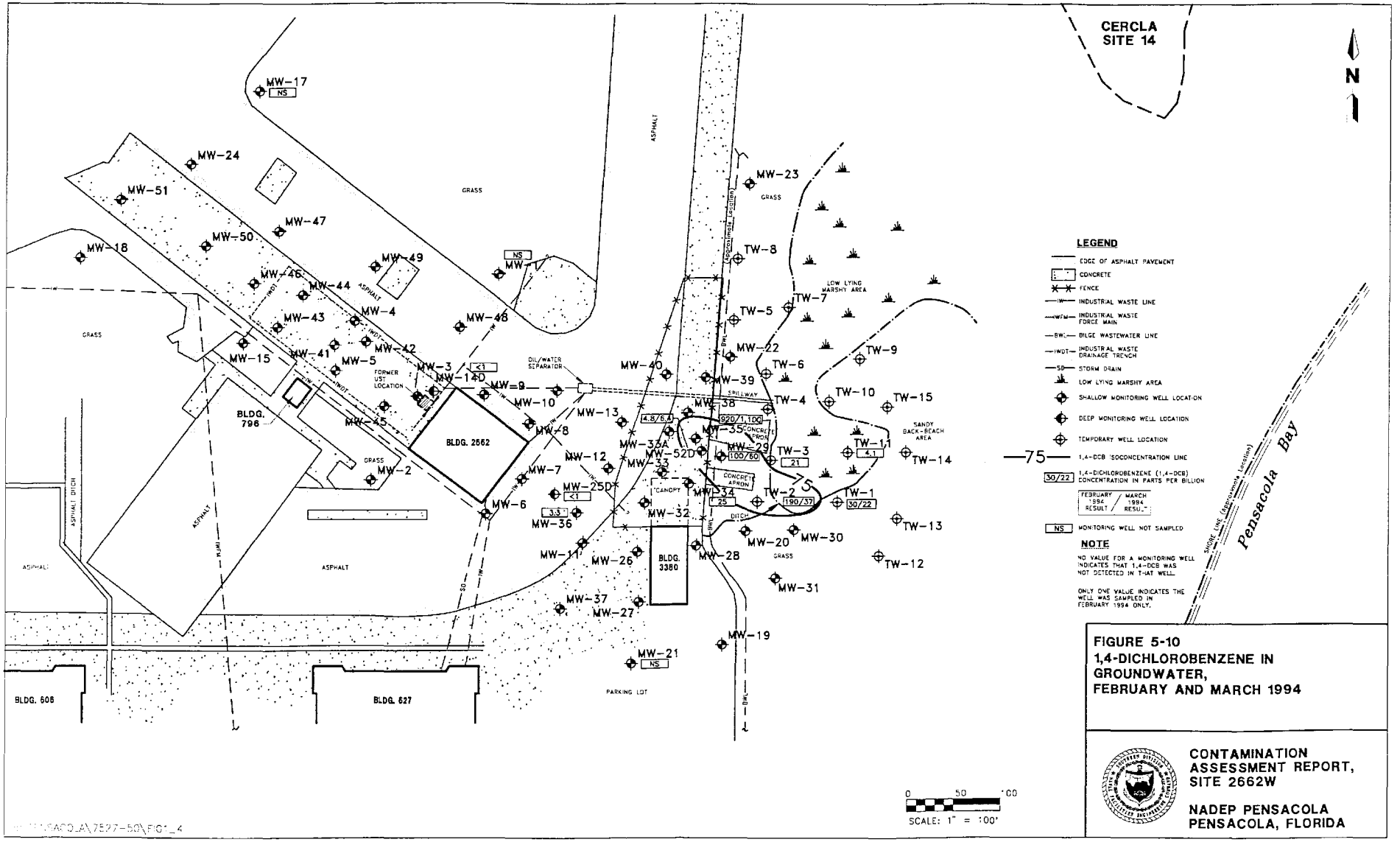


FIGURE 5-10
1,4-DICHLOROBENZENE IN GROUNDWATER, FEBRUARY AND MARCH 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

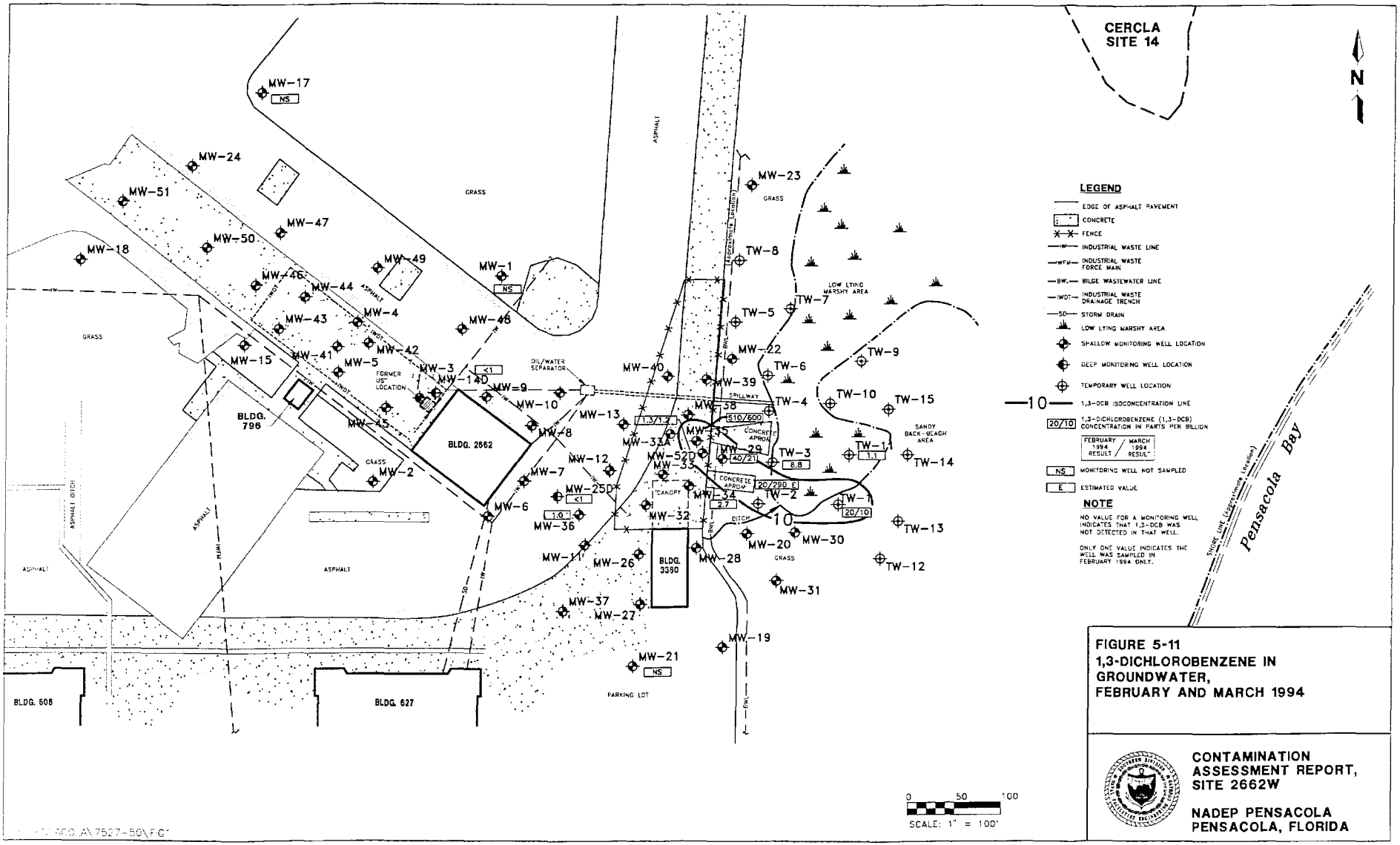


FIGURE 5-11
1,3-DICHLOROBENZENE IN GROUNDWATER, FEBRUARY AND MARCH 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

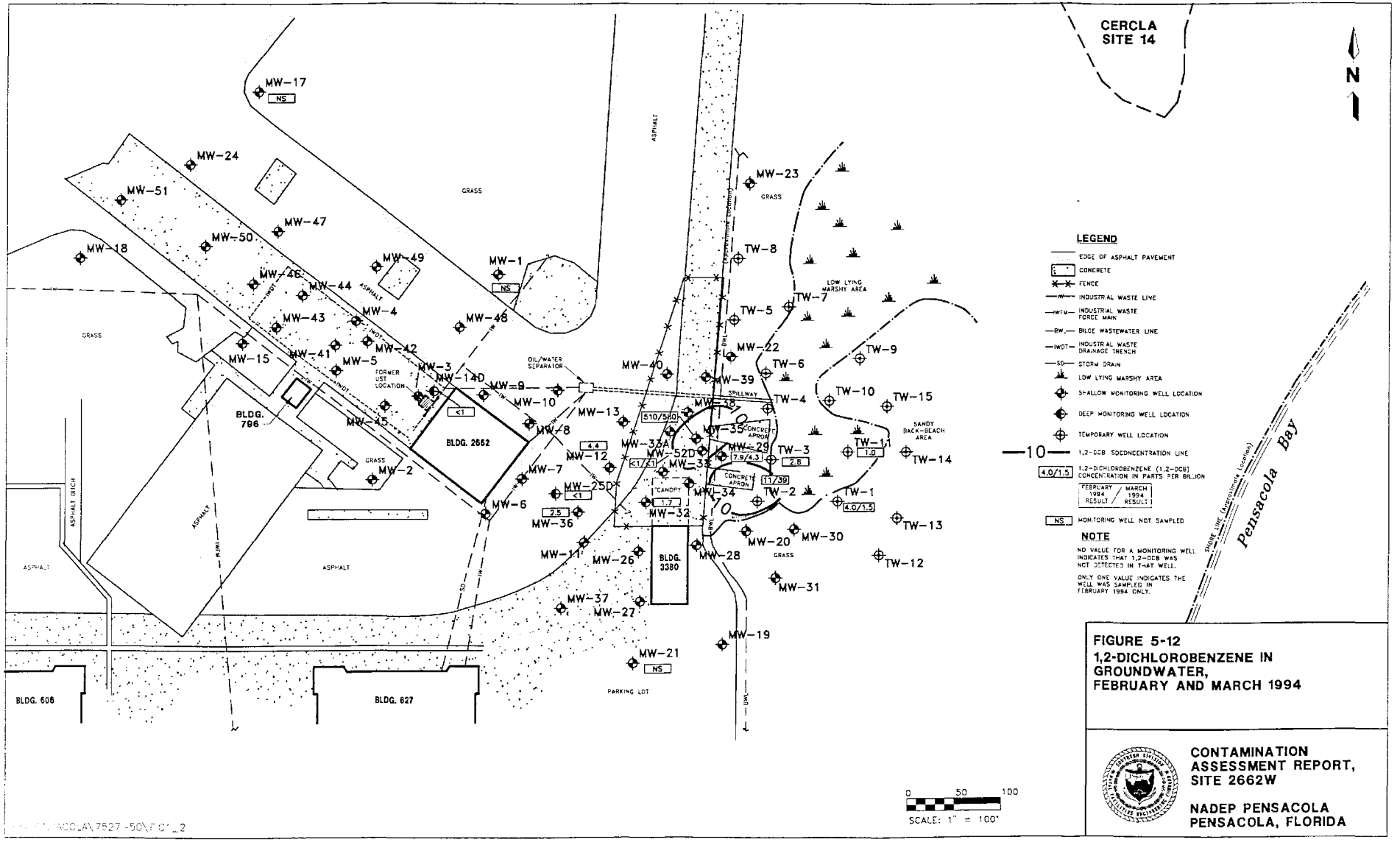


FIGURE 5-12
1,2-DICHLOROBENZENE IN GROUNDWATER, FEBRUARY AND MARCH 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

The compound 1,2-DCB was detected in nine samples collected from monitoring wells MW-12, MW-29, MW-32, MW-35, MW-36, TW-1, TW-2, TW-3, and TW-11 (Figure 5-12). Of these nine samples, only two contained 1,2-DCB exceeding the State groundwater guidance concentration of 10 ppb (FDER, February 1989). These include the sample from MW-35 with 510 ppb and the sample from TW-2 with 11 ppb. Monitoring wells TW-2, TW-1, MW-35, and MW-29 were resampled and analyzed for confirmation and the resulting concentrations were 39 ppb, 1.5 ppb, 580 ppb, and 4.3 ppb, respectively.

Chlorobenzene, 1,4-DCB, 1,3-DCB, and 1,2-DCB can be constituents in petroleum contaminant plumes; therefore, a petroleum release is a possible source of these chlorinated compounds (Watts, 1989). Another possible source may be either the previous or current activities associated with Building 3380 and/or one of the many underground pipelines that carry industrial waste, bilge wastewater, or surface runoff. A definite source for this contamination has not been identified.

The compound PCE was detected in two samples collected from monitoring wells MW-28 and MW-20. The concentration in the sample from MW-28 was 19 ppb and the concentration in the sample from MW-20 was 5.2 ppb. Both the State groundwater guidance concentration (FDER, February 1989) and the State Primary Drinking Water Standard (Chapter 17-550, FAC) is 3 ppb. Samples from MW-20 and MW-28 were the only two samples with detectable levels of PCE and both exceeded the 3 ppb standard. The areal extent of this contamination is small and isolated.

The compound TCE was detected in three samples collected from monitoring wells MW-20, MW-28, and MW-35. The TCE concentration in each sample was 1.9 ppb, 1.9 ppb, and 1.6 ppb, respectively. Monitoring well MW-35 was resampled and the TCE concentration was less than the detection limit of 10 ppb. Neither the State groundwater guidance concentration (FDER, February 1989) nor the State Primary Drinking Water Standard (Chapter 17-550, FAC) of 3 ppb for TCE was exceeded in these samples. Also, the areal extent of this contamination is small, isolated, and coexists with the PCE contamination.

Vinyl chloride was detected in two samples collected from monitoring wells MW-20 and MW-34. The concentration in each sample was 9.8 ppb and 1.6 ppb, respectively. In March 1994, temporary monitoring well TW-2 was resampled and the resulting vinyl chloride concentration increased from a less than the detection limit value of 1.0 ppb to 10 ppb. Vinyl chloride concentrations in these wells exceed both the State groundwater guidance concentration (FDER, February 1989) and the State Primary Drinking Water Standard (Chapter 17-550, FAC) of 1 ppb. The areal extent of this contamination, however, is small, isolated, and coexists with both the PCE and TCE contamination.

Presented on Figure 5-13 is a summary of the of PCE, TCE, and vinyl chloride concentrations in groundwater samples. The 3 ppb isoconcentration line for PCE and the 1 ppb isoconcentration line for vinyl chloride are also shown. PCE can degrade to TCE, which in turn can degrade to vinyl chloride; therefore, it is understandable why these compounds were detected in the same area (Watts, 1989). However, PCE, TCE, and vinyl chloride are not believed to be related to the petroleum contamination near Building 2662. The PCE, TCE, and vinyl chloride plume is relatively isolated and limited in areal extent and is more likely related to operations at Building 3380.

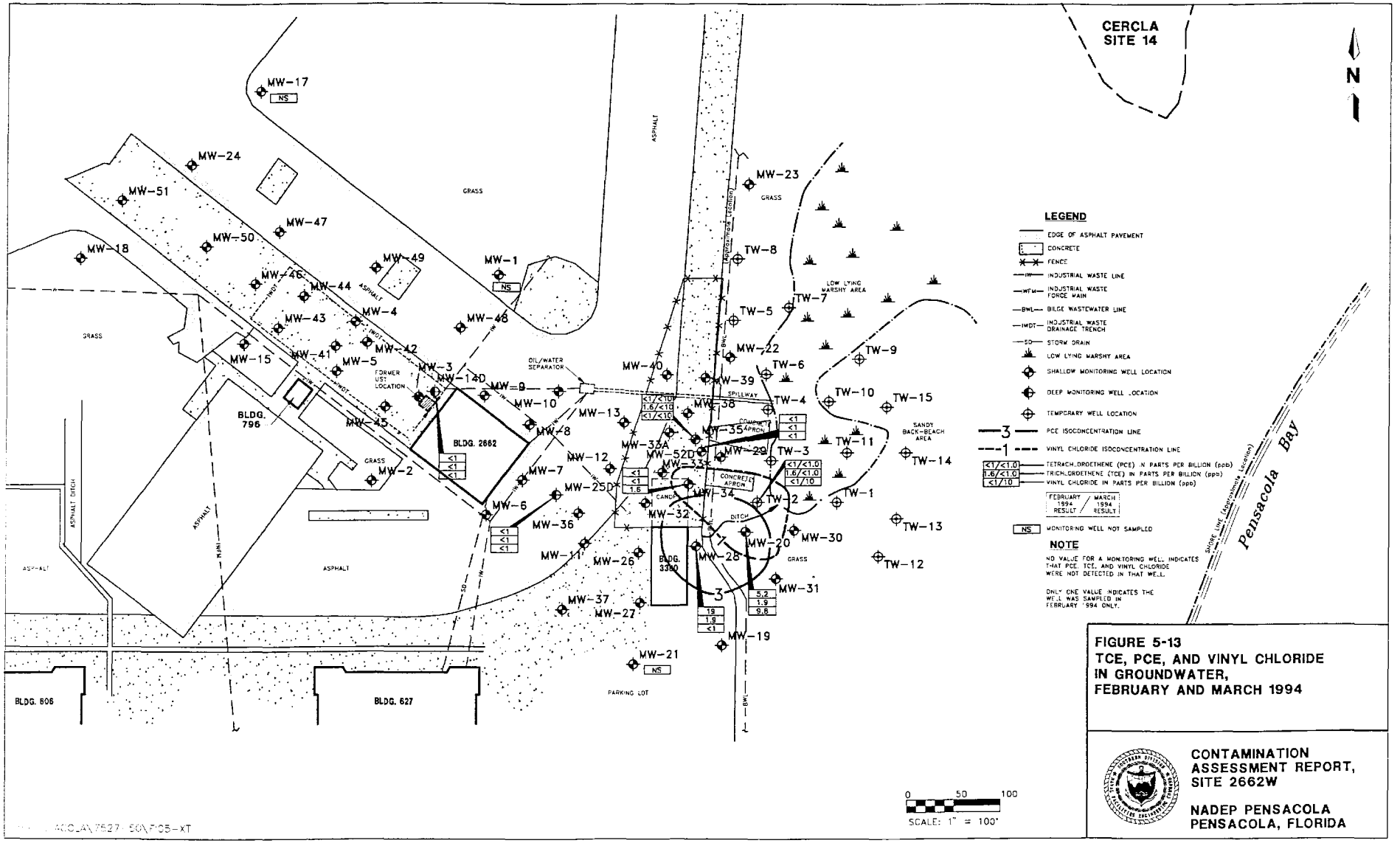


FIGURE 5-13
TCE, PCE, AND VINYL CHLORIDE IN GROUNDWATER, FEBRUARY AND MARCH 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

The compound 1,1-DCA was detected in five samples collected from monitoring wells MW-12, MW-13, MW-20, MW-33, and MW-33A. The highest 1,1-DCA concentration (2.3 ppb) was in the sample from MW-12 and is well below the State groundwater guidance concentration of 2,400 ppb (FDER, February 1989).

Trichlorofluoromethane was detected in 10 samples collected from monitoring wells MW-3, MW-4, MW-5, MW-41, MW-43, MW-44, MW-45, MW-46, MW-48, and MW-49. The highest trichlorofluoromethane concentration of 2.3 ppb was detected in the sample from MW-45. No standard for trichlorofluoromethane is currently available for comparison.

The compound *cis* 1,2-DCE was detected in two samples, from MW-20 with a concentration of 1 ppb and from MW-28 with a concentration of 2 ppb. These concentrations are below the State groundwater guidance concentration (FDER, February 1989) of 4.2 ppb.

Concentrations of 1,1-DCE, 1,2-DCE, chloroform, and methylene chloride were reported as <1 ppb in all samples except the one from MW-35. The detection limit for the sample from MW-35 was elevated to 10 ppb. Concentrations of 1,1-DCE, 1,2-DCE, chloroform, and methylene chloride were <10 ppb. These results are from the February and March 1994 sampling episode. Previous analytical data also indicated low levels of compounds such as 2 ppb of 1,1-DCE in sample MW-20 from August 1992, 20 ppb of 1,2-DCE in the sample from MW-20 in August 1992, and 3 ppb of chloroform in the sample from MW-9 in August 1992. Methylene chloride was detected in both samples and blanks during the August 1992 sampling episode. Methylene chloride in the August 1992 samples is believed to be a result of laboratory contamination. The March 1994 laboratory analytical results support the hypothesis that these contaminants are not indicative of groundwater contamination beneath the site and, therefore, are not considered a concern from the standpoint of this investigation. All laboratory results are summarized in tables as part of Appendix A and laboratory data sheets are provided in Appendix F.

Analytical results of the samples from the three vertical extent wells (MW-14D, MW-25D, and MW-52D) were reported as less than the detection limit for all chlorinated compounds with the exception of the sample from MW-52D. The specific compounds detected in the sample from MW-52D (chlorobenzene, 1,4-DCB, and 1-3-DCB) have been previously discussed in this section.

The 43 ppb concentration of chlorobenzene in the sample from MW-52D is the only concentration to exceed the State guidance concentration of 10 ppb. No drinking water standard or Chapter 17-770, FAC, target levels have been established for chlorobenzene. Because the facility is targeted for closure and rapid implementation of remedial activities, well MW-52D should suffice for vertical extent purposes.

5.2.2.2 **Total Recoverable Petroleum Hydrocarbons (TRPH) in Groundwater** TRPH were detected in groundwater samples collected from monitoring wells MW-3, MW-4, MW-8, MW-9, MW-29, MW-33A, MW-34, MW-35, TW-1, TW-5, TW-8, TW-10, and TW-11 (Figure 5-14). Presented in Table 5-9 is a summary of all detected TRPH concentrations in samples from the February 1994 sampling episode. Three areas of TRPH contamination in groundwater exceeding the Chapter 17-770, FAC, target level of 5 ppm were identified. Concentrations of TRPH in samples collected from monitoring wells MW-4 (41 ppm), TW-5 (13 ppm), and TW-10 (8.8 ppm) exceed the

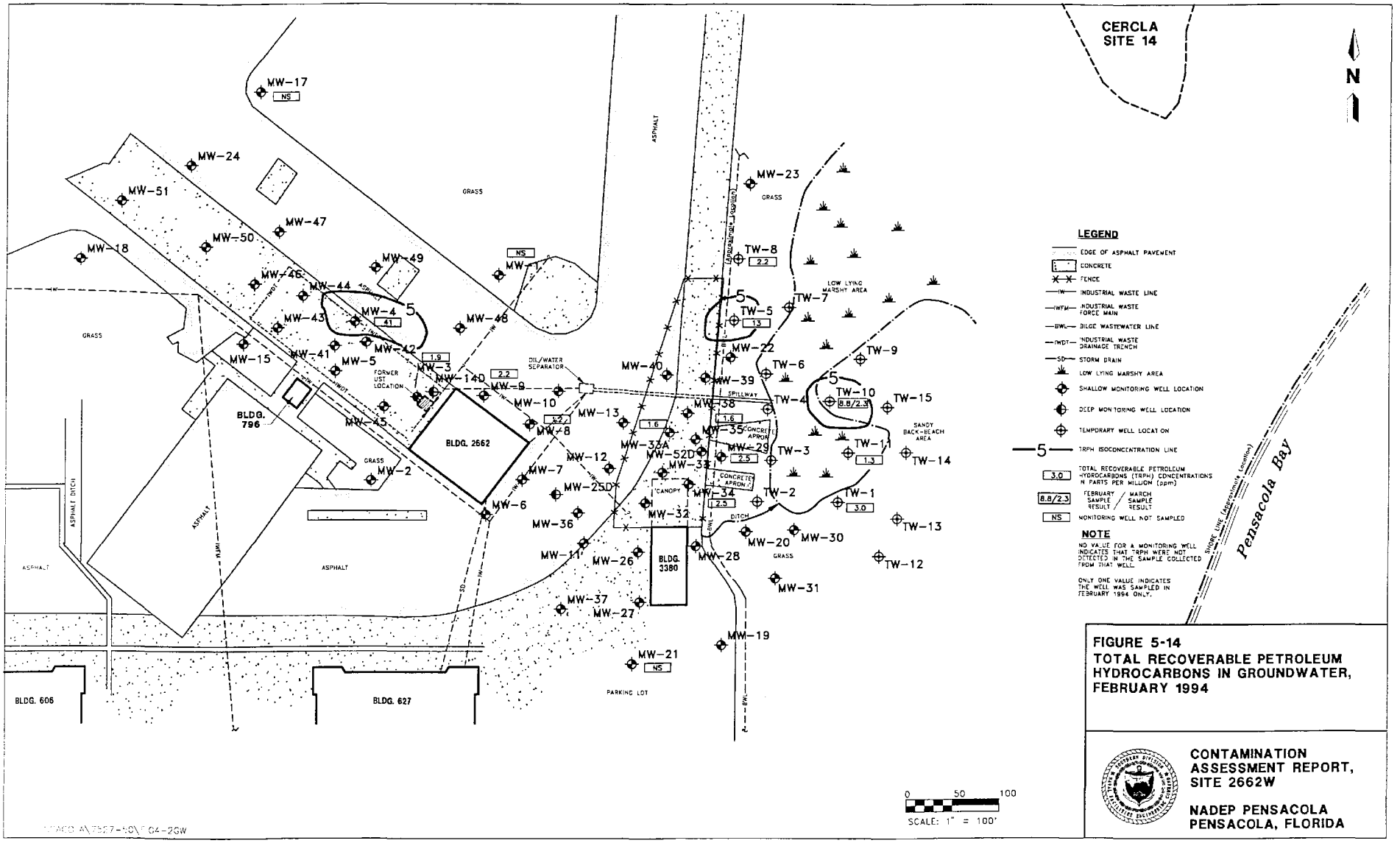


FIGURE 5-14
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS IN GROUNDWATER, FEBRUARY 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

Table 5-9
Summary of Groundwater Analytical Results, Detected Concentrations of Naphthalenes and Total Recoverable Petroleum Hydrocarbons (TRPH), January through March 1994 (Phase IV)

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Compound	State Target Level[1]	MW-2	MW-3	MW-4	MW-7	MW-7 DUP	MW-8	MW-9
Naphthalene		<5.0	<5.0	19	5.9	<5.0	<5.0	7.6
1-Methylnaphthalene		<5.0	5.5	30	<5.0	<5.0	15	23
2-Methylnaphthalene		<5.0	5.3	36	<5.0	<5.0	16	24
Total naphthalenes	100	<15	11N	85	5.9N	<15	31N	55
TRPH	5	1.2	1.9	41	<1.0	<1.0	1.2	1.5

Compound	State Target Level[1]	MW-9 DUP	MW-19	MW-20	MW-22	MW-22 DUP	MW-29	MW-31
Naphthalene		6.5	21	6.0	21	26	110	12
1-Methylnaphthalene		17	<6.0	<5.0	5.5	7.2	5.4	<5.0
2-Methylnaphthalene		17	<6.0	<5.0	5.9	7.4	6.6	<5.0
Total naphthalenes	100	41	21N	6.0N	32	41	122	12N
TRPH	5	2.2	<1.0	<1.0	<1.0	<1.0	2.5	<1.0

Compound	State Target Level[1]	MW-33A	MW-34	MW-35	MW-41	MW-44	MW-52D	TW-1
Naphthalene		<5.0	19	130	19	9.3	9.8	<5.0
1-Methylnaphthalene		<5.0	<5.0	22	8.1	8.5	<5.0	<5.0
2-Methylnaphthalene		<5.0	<5.0	33	7.6	6.7	<5.0	<5.0
Total naphthalenes	100	<15	19N	185	35	25	9.8N	<15
TRPH	5	1.6	2.5	1.6	<1.0	<1.0	<1.0	3.0

Compound	State Target Level[1]	TW-2	TW-5	TW-6	TW-8	TW-10	TW-10 resample	TW-11
Naphthalene		24	8.5	83	<5.0	<5.0	NA	<5.0
1-Methylnaphthalene		<5.0	<5.0	5.1	<5.0	<5.0	NA	<5.0
2-Methylnaphthalene		<5.0	<5.0	5.0	<5.0	<5.0	NA	<5.0
Total naphthalenes	100	24N	8.5N	93	<15	<15	NA	<15
TRPH	5	<1.0	13	<1.0	2.2	8.8	2.3	1.3

[1] State target level: Florida Department of Environmental Protection, Chapter 17-770, Florida Administrative Code.

Notes: All naphthalene concentrations are in parts per billion (ppb).
All TRPH concentrations are in parts per million (ppm).
N = actual value may be greater that the reported value.
NA = not analyzed.
Total naphthalenes = the sum of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene concentrations.
TRPH = total recoverable petroleum hydrocarbons.

Chapter 17-770, FAC, target level of 5 ppm for TRPH. The levels of TRPH in the sample from well TW-10 were unexpectedly high; therefore, the well was resampled in March 1994 and the concentration was 2.3 ppm. All other detectable TRPH concentrations were below the Chapter 17-770, FAC, target level of 5 ppm.

Monitoring well MW-4 had previously contained free-floating petroleum product and may account for the elevated TRPH levels. The existence of free product at the site is discussed in Section 5.3, Free Product Assessment. In February and March 1994, free product was not observed in well MW-4.

The other two areas with elevated TRPH concentrations only slightly exceed the target level. Well TW-5, which had a sample containing 13 ppm TRPH, is located adjacent to the bilge wastewater line. Because of its proximity to well TW-5, the line is the suspected cause of groundwater contamination in this area. The 8.8 ppm TRPH concentration detected in the sample from TW-10 is anomalous and does not correspond to any known or suspected source of contamination. This well was resampled to confirm this finding and the resulting concentrations decreased to 2.3 ppm TRPH.

Groundwater analytical data indicate the vertical extent of TRPH in groundwater does not extend below 20 to 30 feet bls. TRPH were reported as bdl (<1 ppm) in samples collected from the vertical extent monitoring wells (MW-14D, MW-25D, and MW-52D).

5.2.2.3 Polynuclear Aromatic Hydrocarbons (PAH) in Groundwater PAH were detected in samples collected from monitoring wells MW-3, MW-4, MW-7, MW-8, MW-9, MW-19, MW-20, MW-22, MW-29, MW-31, MW-34, MW-35, MW-41, MW-44, TW-2, TW-5, and TW-6 (Figure 5-15). PAH detected in groundwater samples include naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, and fluorene. Phenanthrene, bis(2-ethylhexyl)phthalate, and diethylphthalate were detected in previous sampling phases, but were not present in samples collected in February and March 1994. Table 5-9 summarizes the laboratory data for samples with detectable levels of PAH.

Naphthalenes. Total naphthalene concentrations exceeded the Chapter 17-770, FAC, Class G-II groundwater target level of 100 ppb in the samples collected from monitoring wells MW-29 and MW-35 located approximately 100 feet north-northeast of Building 3380 (Figure 5-15). The areal extent of total naphthalenes in groundwater exceeding 100 ppb is approximated by the 100 ppb isoconcentration line on Figure 5-15. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene concentrations detected in the samples collected from monitoring well MW-29 were 110 ppb, 5.4 ppb, and 6.6 ppb, and from MW-35 were 130 ppb, 22 ppb, and 33 ppb, respectively. All other well samples with detectable levels of total naphthalenes were below the 100 ppb target level. It is possible that the PAH concentrations in these two wells and the other well samples in the area below the total naphthalene concentration of 100 ppb are related to the bilge wastewater line. Another possible source is the outfall from the spillway near the north end of the total naphthalene plume.

Non-naphthalenes. Non-naphthalene PAHs were detected in the groundwater sample collected from monitoring well MW-20. Acenaphthene and fluorene concentrations detected in the sample from MW-20 were 5.8 and 5.6 ppb, respectively. All PAH concentrations from well samples with detectable levels are presented in the summary tables in Appendix A. The Chapter 17-770, FAC, target level for non-

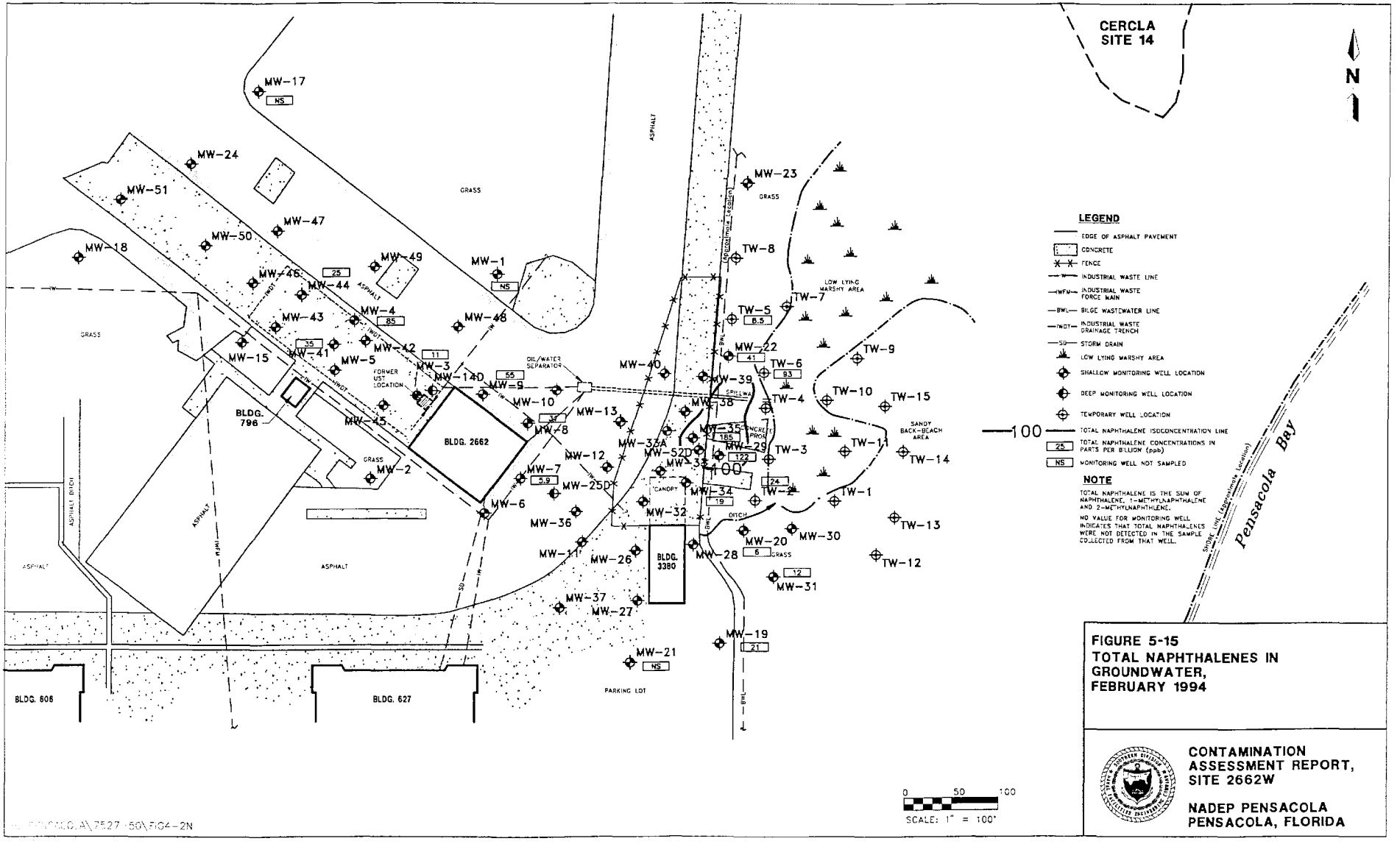


FIGURE 5-15
TOTAL NAPHTHALENES IN GROUNDWATER, FEBRUARY 1994

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA
PENSACOLA, FLORIDA

naphthalene PAHs is 10 ppb or the lowest obtainable detection limit for each compound. No non-naphthalene PAHs detected in the February and March 1994 sampling episode exceeded the 10 ppb level. However, acenaphthene and fluorene were reported as 5.8 ppb and 5.6 ppb in the sample from MW-20. The detection limit for most non-naphthalene compounds was 5 ppb.

The laboratory results from the samples collected in April 1992 reported the bis(2-ethylhexyl)phthalate concentration in the sample from monitoring well MW-2 was 19 ppb. Bis(2-ethylhexyl)phthalate was not detected in the samples from well MW-2 in August 1992 and February 1994. The laboratory data for the samples collected in August 1992 reported bis(2-ethylhexyl)phthalate concentrations in samples from monitoring wells MW-4, MW-20, and MW-29 were 82 ppb, 11 ppb, and 23 ppb, respectively. Subsequent groundwater sampling in February 1994 reported concentrations of bis(2-ethylhexyl)phthalate as bdl (<5 ppb) in all wells sampled.

Laboratory results of deep well samples MW-14D, MW-25D, and MW-52D indicate the vertical extent of PAH (including naphthalenes) in groundwater does not extend below 20 to 30 feet bls. Deep well MW-52D is adjacent to monitoring well MW-29 (within the total naphthalene plume) and is screened between 30 and 35 feet bls. Naphthalene, at a concentration of 9.8 ppb, was the only PAH detected in the sample from MW-52D. This is below the 100 ppb target level for total naphthalenes established in Chapter 17-700, FAC.

5.2.2.4 Tentatively Identified Compounds (TICs) in Groundwater Presented in Appendix A are summary tables of all TICs identified in groundwater samples from Site 2662W. All samples analyzed for TICs were collected between March and August 1992. The March 1992 data identified 54 detectable TICs from 8 groundwater samples. The highest total concentration of all TICs was reported in the sample from MW-9 with a concentration of 1,808 ppb from 14 TICs. The April 1992 data identified 62 detectable TICs from 8 groundwater samples. The highest total concentration of all TICs was reported in the sample from MW-11 with a concentration of 6,788 ppb from 12 TICs. The August 1992 data identified 117 detectable TICs from 20 groundwater samples. The highest total concentration of all TICs was reported in the sample from MW-9 with a concentration of 3,051 ppb from 13 TICs.

Most of the TICs appear to be fuel-related and fuel-breakdown products. The TICs include compounds that typically do not have regulatory guidelines or standards and little is known concerning their toxicity characteristics. Not all well samples were analyzed for TICs. The source of the TICs may be related to petroleum use at the site, or the various maintenance, storage, or disposal activities.

5.2.2.5 Metals in Groundwater Pb concentrations detected in the samples collected from monitoring wells MW-29, MW-31, and MW-50 were 9 ppb, 8 ppb, and 5 ppb, respectively (see summary tables in Appendix A). Pb concentrations do not exceed the Chapter 17-770, FAC, target level of 50 ppb for Class G-II groundwater. All other well samples were reported as bdl (<5 ppb) for Pb. Subsequent to the sampling of monitoring wells MW-1 through MW-31, Pb in groundwater was not considered to be a contaminant of concern at Site 2662W. Therefore, all of the temporary wells and some of the wells installed after MW-31 were not sampled for Pb. Pb was not detected in the samples collected from the three vertical extent monitoring wells (MW-14D, MW-25D, and MW-52D).

In addition to sampling for Pb, monitoring wells MW-1 through MW-31 were also sampled for the metals As, Cd, and Cr. All groundwater samples from these monitoring wells were reported as bdl for these metals. The detection limit for As and Cd was 10 ppb, whereas the detection limit for Cr was 50 ppb. The primary drinking water standards as defined in Chapter 17-550, FAC, for As, Cd, and Cr are 50 ppb, 10 ppb, and 50 ppb, respectively.

5.3 FREE PRODUCT ASSESSMENT. Free floating petroleum product was observed in four onsite wells during the CA. During the Phase II CA in August 1992, free product was observed in monitoring wells MW-3, MW-4, and MW-9; however, product thicknesses were not recorded. Personnel involved with the Phase II field investigation estimated that the product was approximately 0.1 foot thick in monitoring well MW-4, and only a thin sheen in monitoring wells MW-3 and MW-9. The product was amber in color. Free product in monitoring wells MW-3 and MW-4 was observed while bailing the wells before sample collection. During the Phase III CA in January 1993, free product observed in monitoring well MW-7 measured 0.02 foot in thickness. Free product was not observed in monitoring wells MW-3, MW-4, or MW-9 during the Phase III CA. Subsequent field checks for free product in these wells have reported no measurable thickness of free product since August 1992 in monitoring wells MW-3, MW-4, and MW-9 and since January 1993 in monitoring well MW-7. In March 1994, small globules of a clear floating liquid believed to be a petroleum product were observed in monitoring well MW-4 during bailing. No measurable thickness was observed; therefore, this liquid is not considered free product. The groundwater from this well did emit a strong petroleum odor.

5.4 TIDAL INFLUENCE STUDY. A site-specific tidal influence study was not conducted at Site 2662W. However, water table elevations were recorded from existing monitoring wells at the site on five separate occasions (April and August 1992, January 1993, February 1994, and March 1994). The March 1994 water levels were collected from most of the wells closest to Pensacola Bay in the vicinity of Building 3380. Temporary wells TW-12, TW-13, and TW-14 are the closest wells to Pensacola Bay and are located approximately 350 feet west of the waters edge. The data have consistently indicated a southeasterly groundwater flow towards Pensacola Bay. The data do not indicate any areas of stagnated groundwater or areas in which the flow has reversed direction. Groundwater flow direction maps are presented in Section 5.1 along with a table of all the water level measurements collected through time.

Water level measurements, taken on numerous occasions at other low-elevation sites on NAS Pensacola located near Pensacola Bay, indicate that tidal fluctuations do not appear to alter the groundwater flow direction and do not appear to have a great effect on hydraulic gradients at NAS Pensacola.

5.5 POTABLE WELL SURVEY. A potable well survey was conducted to assess the risk of contamination to potable water sources from activities at Site 2662W. Two potable supply wells (designated as Well No. 1 and Well No 2 on Figure 5-16) exist at NAS Pensacola (Wilkins and others, 1985). The NAS Pensacola water supply system is used in conjunction with the Corry Field water supply system, which is located approximately 2 miles north of NAS Pensacola. According to NADEP personnel, these wells are not currently used for potable water supplies

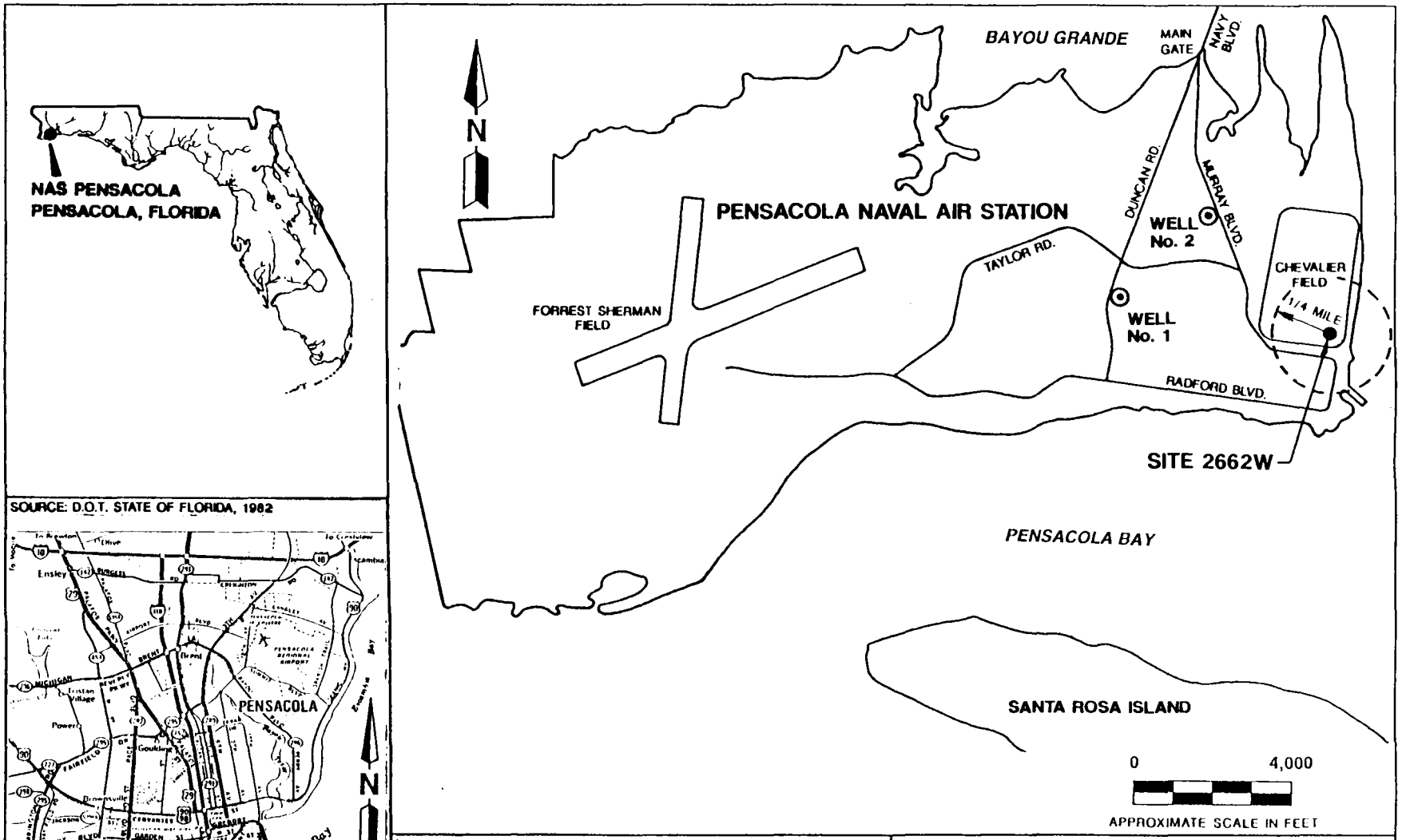


FIGURE 5-16

POTABLE WELL LOCATIONS

CONTAMINATION ASSESSMENT REPORT
SITE 2662W
NADEP PENSACOLA
PENSACOLA, FLORIDA

at NAS Pensacola, but are available as reserve potable water supplies should the need arise.

Potable well inventory data are presented in Table 5-10. Both wells at NAS Pensacola are screened in the main producing zone of the sand-and-gravel aquifer at depths ranging from 105 to 160 feet bls. Neither of the potable wells is located within a 0.25-mile radius of the site. This fact, in addition to the southeasterly direction of groundwater flow, suggests that the possibility of contamination of potable water sources from activities at Site 2662W is not likely.

Table 5-10
Potable Well Inventory Data,
Naval Air Station, Pensacola, Florida

Contamination Assessment Report
Site 2662W, Naval Aviation Depot
Pensacola, Florida

Well Identification Number/Local Name	Location	Total Depth (feet bls)	Screened Interval (feet bls)	Diameter Casing/Screen (inches)
302116087170201/No. 1	Sec. 1,T3S,R30W Duncan and Taylor Roads	174	105-160	24/12
302124087163601/No. 2	Sec. 1,T3S,R30W Murray and Farrar Roads	178	110-160	24/12

Note: bls = below land surface.

6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.1 SUMMARY. Based on the findings of the CA field investigations and laboratory analytical results, the following is a summary of existing conditions at the site.

Aquifer Characteristics and Hydrogeologic Parameters Summary.

- The sediments encountered during drilling operations are generally comprised of very fine-grained to medium-grained quartz sand. These sediments are part of the surficial zone of the sand-and-gravel aquifer (Roaza and others, 1991).

- Groundwater beneath the site was encountered at depths of approximately 2 to 4 feet bls and is classified as G-II.

- The direction of groundwater flow in the surficial zone has consistently been southeasterly.

- The average hydraulic gradient across the site is 2.0×10^{-3} ft/ft.

- The average hydraulic conductivity at the site is 4.95×10^{1} ft/day.

- The average pore water velocity is 4.2×10^{-1} ft/day.

Soil Contamination Assessment Summary.

- Three areas of excessively contaminated soils were identified by OVA headspace analyses. The largest areal extent of soil contamination is located north and northwest of Building 2662 and the old UST area. Two smaller areas of excessively contaminated soil were identified: one in the vicinity of the hazardous waste storage area north of Building 3380 along the bilge wastewater line and the other in the immediate area surrounding soil boring SB19 southeast of Building 3380.

- Volatile organic aromatics detected included ethylbenzene concentrations in the sample from SB-4 and the trench sample of 220 ppm and 1,200 ppm, respectively. The trench sample also contained 4,800 ppm of xylenes (Table 5-4).

- Base-neutral acid extractable compounds were detected in two of the soil samples, from SB-4 and the trench sample. The sample from SB-4 contained 12 ppm naphthalene, 16 ppm 1-methylnaphthalene, and 20 ppm 2-methylnaphthalene, or a total naphthalene concentration of 48 ppm. The trench sample contained 15 ppm naphthalene, 32 ppm 1-methylnaphthalene, and 35 ppm 2-methylnaphthalene, or a total naphthalene concentration of 82 ppm.

- TRPH concentrations were elevated in samples from SB-4, SB-9, and the trench. The sample from SB-4 contained 17,000 ppm TRPH, the sample from SB-9 contained 770 ppm TRPH, and the trench sample contained 19,000 ppm TRPH.

- The TCLP metals Ag, As, Ba, Hg, and Se were all reported below detectable limits in soil samples from Site 2662W. Cd concentrations detected in soil samples from SB-3 and SB-22 were 2.4 and 2.5 ppm, both of which exceed the regulatory limit of 1 ppm. Cr was not detected in any of the soil samples exceeding the regulatory limit of 5 ppm.

- Pb contamination in soil greater than the Chapter 17-775, FAC, remedial cleanup target level of 108 ppm was detected in 5 of the 40 soil samples. Pb concentrations ranged from 6.1 ppm in the sample from SB-38 to 280 ppm in the sample from SB-5 (Figure 5-6). The trench sample contained an anomalously high Pb concentration of 1,200 ppm. Many of the soil samples with elevated Pb concentrations are located upgradient or lateral to the most contaminated areas. Therefore, elevated Pb concentrations in soils are believed to be associated with past site maintenance operations.

Groundwater Contamination Assessment Summary.

- Two areas of total VOA contamination in groundwater were identified during the contamination assessment. One area includes the former UST location near Building 2662 and upgradient of the UST to the northwest. The second area is east of Building 2662 and north of Building 3380. The highest total VOA concentration in the area northwest of Building 2662 was 42 ppb in the sample from MW-41. The next highest was 12 ppb. Total VOA concentrations in groundwater do not exceed the Chapter 17-770, FAC, target level of 50 ppb. The second area of total VOA contamination encircles three wells where detectable levels of total VOA in samples exceeded the 50 ppb State target level (see Figure 5-7). Samples from MW-12, MW-29, and MW-35 contained total VOA concentrations of 709 ppb, 225 ppb, and 160 ppb, respectively.

- The benzene contaminant plume overlaps the total VOA contamination and is generally in the same location. The area of benzene contamination northwest of Building 2662 encircles wells MW-4, MW-41, MW-42, MW-46, and MW-50. The highest benzene concentration (22 ppb) was in the sample from MW-41. All other reported benzene concentrations in the area were between 1 and 2 ppb. The second area of benzene contamination is north and northeast of Building 3380 and encompasses wells MW-29, MW-34, MW-35, TW-2, and TW-3. The highest benzene concentration (64 ppb) was in the sample from MW-35. Both areas of benzene contamination exceed the Chapter 17-770, FAC, target level of 1 ppb (Figure 5-8).

- Chlorobenzene, 1,4-DCB, 1,3-DCB, and 1,2-DCB were detected in samples from wells MW-29 and MW-35, in addition to other wells in this general vicinity. Each compound exceeds the State groundwater guidance concentration or State Primary Drinking Water Standard in at least two groundwater samples.

- Both PCE and vinyl chloride were detected in two samples exceeding the State groundwater guidance concentration (FDER, February 1989) and the State Primary Drinking Water Standard (Chapter 17-550, FAC) of 3 ppb for PCE and 1 ppb for vinyl chloride. The compound TCE was detected below both the State groundwater guidance concentration (FDER, February 1989) and the State Primary Drinking Water Standard (Chapter 17-550, FAC) of 3 ppb. Presented in Figure 5-13 is a summary of the concentrations of PCE, TCE, and vinyl chloride in well samples from site 2662W.

- 1,1-DCA, *cis* 1,2-DCE, and trichlorofluoromethane were predominantly reported as bdl. In the few samples where detectable levels of these compounds were reported, all concentrations were below State guidance concentration (FDER, February 1989) or State drinking water standards. The highest concentration of any of these three compounds was 2.3 ppb of both 1,1-DCA and trichlorofluoromethane.

- 1,1-DCE, 1,2-DCE, chloroform, and methylene chloride were reported as <1 ppb in all samples except the sample from MW-35. The detection limit for the sample from MW-35 was elevated to 10 ppb and the concentrations were <10 ppb.

- Three separate areas of TRPH contamination in groundwater exceeding the Chapter 17-770, FAC, target level of 5 ppm were identified. These three areas are each associated with samples collected from monitoring wells MW-4 (41 ppm), TW-5 (13 ppm), and TW-10 (8.8 ppm).

- Total naphthalene concentrations exceeded the Chapter 17-770, FAC, Class G-II groundwater target level of 100 ppb in the samples collected from monitoring wells MW-29 (122 ppb) and MW-35 (185 ppb) located approximately 100 feet north northeast of Building 3380 (Figure 5-15).

- There were no reported non-naphthalene PAHs from the February and March 1994 sampling phase that exceeded the detection limit of 5 ppb except acenaphthene and fluorene, and both concentrations were less than 6 ppb.

- Between March and August 1992 the majority of the wells (MW-1 through MW-31) were sampled and analyzed for TICs. As many as 117 TICs were reported. The highest single well sample concentration of all TICs was 6,788 ppb.

- Lead concentrations in monitoring well samples did not exceed the Chapter 17-770, FAC, target level of 50 ppb for Class G-II groundwater. The highest lead concentration was 9 ppb.

- Free floating petroleum product was observed in four wells during all four phases of the CA. During the Phase II CA in August 1992, free product was observed in monitoring wells MW-3, MW-4, and MW-9. The greatest thickness was in MW-4 (approximately 0.1 foot). During the Phase III CA in January 1993, free product was observed in monitoring well MW-7. The measured free product thickness in MW-7 was 0.02 foot. Subsequent field checks for free product in these wells have reported no measurable thickness of free product. In March 1994, small globules of a clear floating liquid were observed in monitoring well MW-4 during bailing. No measurable thickness was observed, but the groundwater from this well had a strong petroleum odor.

- No potable water sources were identified within a 0.25-mile radius of the site and the groundwater flow direction is to the southeast; therefore, there appears to be little chance for contamination of the public water supply system from activities at the site.

6.2 CONCLUSIONS. Based on the findings of the CA and site conditions, the following can be concluded.

- Excessive soil contamination in the area near the old UST and to the northwest of Building 2662 appears to be related to the old UST and the defueling and maintenance activities in this area. Excessive soil contamination in the area north and east of Building 3380 may be related to leaks or releases from the bilge wastewater line, activities at the hazardous materials storage area, and unknown prior activities. Overall soil contamination is shallow (less than 4 feet bls).

- The areal extent of groundwater contamination exceeding Chapter 17-770, FAC, target levels is consistently located beneath the areas of excessively contaminated soil and the surrounding vicinity of the soil contamination.

- Benzene concentrations exceed the Chapter 17-770, FAC, target level of 1 ppb for Class G-II groundwater in the areas beneath the excessively contaminated soils (except in the vicinity of MW-19).

- The vertical extent of groundwater petroleum contamination appears to be restricted to the upper 25 feet of the surficial sand-and-gravel aquifer. Laboratory results reported contaminant concentrations in samples from vertical extent wells MW-14D (25 feet bls), MW-25D (30 feet bls), and MW-52D (35 feet bls) as bdl except for 1.6 ppb benzene and 43 ppb dichlorobenzene in the sample from MW-52D.

- Chlorinated compound contamination in groundwater is located north, northeast, and east of Building 3380. This contamination may be the result of previous disposal activities, releases from one or more of the underground pipelines, or storage and handling of hazardous waste and hazardous materials in the general area. The bilge wastewater line, which runs north to south approximately 25 to 50 feet east of Building 3380, is also a possible source.

- The soil and groundwater contamination can be divided into two distinct areas (Figure 6-1). The area surrounding Building 2662 is petroleum contamination whose source is the previous UST, and the defueling and maintenance activities associated with the building. The second area surrounding Building 3380 is contaminated with a mixture of petroleum and chlorinated compounds whose sources appear to be the hazardous waste storage area and any previous disposal activities and the industrial waste pipelines in the vicinity of the building.

- There are no potable water wells within a 0.25-mile radius of the site and the wells that are on the facility are upgradient and screened significantly deeper than the contamination at Site 2662W. The risk to human health caused by groundwater contamination of these wells is extremely low.

- There is no evidence to indicate that groundwater contaminants are migrating off the facility. Contamination is moving toward Pensacola Bay, but does not appear to be a threat to surface water. For this reason, groundwater contamination at the site appears to be a low risk to area fish and wildlife.

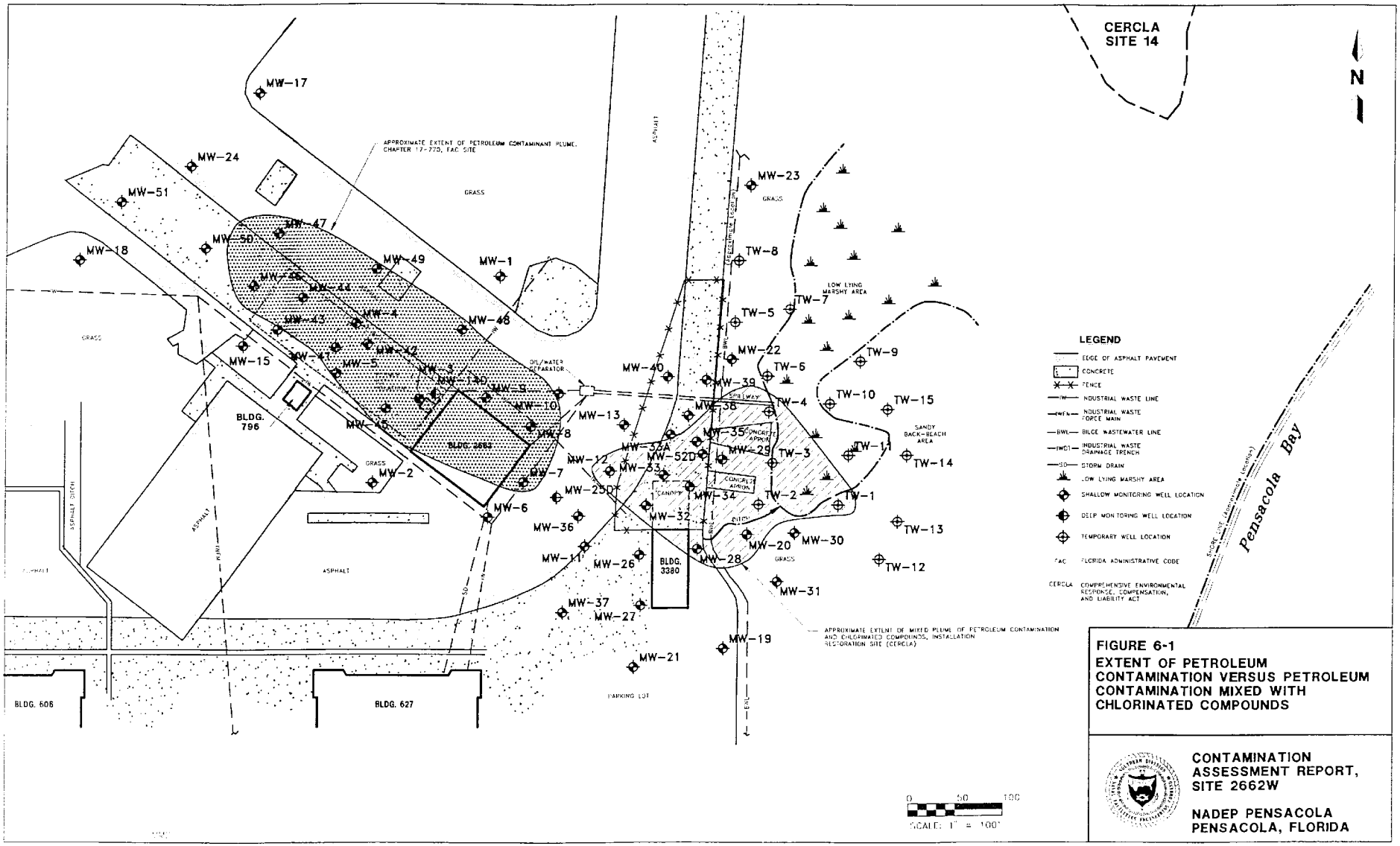


FIGURE 6-1
EXTENT OF PETROLEUM CONTAMINATION VERSUS PETROLEUM CONTAMINATION MIXED WITH CHLORINATED COMPOUNDS

CONTAMINATION ASSESSMENT REPORT, SITE 2662W

NADEP PENSACOLA PENSACOLA, FLORIDA

6.3 RECOMMENDATIONS. Based on the findings, conclusions, and interpretations of the CA, ABB-ES recommends that the petroleum plume associated with Building 2662 be retained by ABB-ES for development of a RAP. The primary contamination in the vicinity of Building 2662 includes excessively contaminated soil, and benzene and TRPH in groundwater. The RAP will be developed to address the requirements of Chapter 17-770, FAC. Because the contaminants in the vicinity of Building 3380 are of a mixture of petroleum and chlorinated contamination, ABB-ES recommends that this area be addressed under the Installation Restoration Program (IRP). This area is a mixed plume of benzene, total VOA, TRPH, PAH, and chlorinated compounds in groundwater and excessively contaminated soils. The IRP will require an evaluation of the area surrounding Building 3380 based on the requirements of the CERCLA under USEPA supervision.

7.0 PROFESSIONAL REVIEW CERTIFICATION

This contamination assessment report was prepared using sound hydrogeologic principles and judgment. This assessment is based on the geologic investigation and associated information detailed in the text and appended to this report. If conditions are determined to exist that differ from those described, the undersigned geologist should be notified to evaluate the effects of any additional information on the assessment described in this report. This CAR was developed for Site 2662W and the contamination plume in the vicinity of Building 3380 at NADEP, NAS Pensacola, Florida, and should not be construed to apply to any other site.

Michael J. Williams
Professional Geologist
P.G. No. 344

Date

REFERENCES

Barr, G.L., 1987, Potentiometric surface of the upper Floridan aquifer in Florida, May 1985: Florida Geological Survey Map Series No. 119.

Bouwer, H., and Rice, R.C., 1976, A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells: Water Resources Research, vol. 12, p. 423-428.

Bouwer, H., 1989, The Bouwer and Rice slug test, an update: Groundwater, vol. 127, p. 304-309.

Florida Department of Environmental Regulation, February 1989, Groundwater guidance concentrations: compiled by R. Merchant, Division of Water Facilities, 14 p.

Florida Department of Environmental Regulation, February 1991, Guidelines for assessment and remediation of petroleum contaminated soils: Division of Waste Management, 33 p.

Florida Department of Environmental Regulation, May 1992, Guidelines for assessment and remediation of petroleum contaminated soils, revised: Division of Waste Management, 39 p.

Florida Department of Transportation, 1982, Florida official transportation map: 1 sheet.

Geraghty and Miller, Inc., 1989, AQTESOLV, aquifer test design and analysis: computer version 1.00.

Healy, H.G., 1980, Potentiometric surface of the upper Floridan aquifer in Florida: Florida Bureau of Geology Map Series 104.

Marsh, O.T., 1966, Geology of Escambia and Santa Rosa Counties, western Florida panhandle: Florida Geological Survey Report of Investigations No. 46, 140 p.

Musgrove, R.H., Barraclough, J.T., and Grantham, R.G., 1965, Water resources of Escambia and Santa Rosa Counties, Florida: Florida Geological Survey Report of Investigations No. 40, 102 p.

Naval Aviation Depot, Pensacola, 1992, Telephone Directory: 32 p.

Puri, H.S., and Vernon, R.O., 1964, Summary of the geology of Florida and a guidebook to the classic exposures: Florida Geological Survey Special Publication 5, revised, 312 p.

Roaza, H.P., Pratt, T.R., Richards, C.J., Johnson, J.L., and Wagner, J.R., 1991, Conceptual model of the sand-and-gravel aquifer, Escambia County, Florida: Northwest Florida Water Management District, Water Resources Special Report 91-6, 125 p.

REFERENCES (Continued)

Roaza, H.P., Pratt, T.R., and Richards, C.J., 1993, Numerical Modeling of ground water flow and contaminant transport in the sand-and-gravel aquifer, Escambia County, Florida: Northwest Florida Water Management District, Water Resources Special Report 93-4, 92 p.

U.S. Geological Survey, 1970, Fort Barrancas Quadrangle: 7.5-minute topographic series.

Watts, G.B., 1989, Groundwater Monitoring Parameters and Pollution Sources, Third Edition: Bureau of Waste Cleanup, Florida Department of Environmental Regulation, 116 p.

Wilkins, K.T., Wagner, J.R., and Allen, T.W., 1985, Hydrogeologic data from the sand-and-gravel aquifer in southern Escambia County, Florida: Northwest Florida Water Management District Technical File Report 85-2, 153 p.

TITLE: NADEP Pensacola		LOG of WELL:	BORING NO. SB31
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-30
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 8/26/92	COMPLTD: 8/26/92
METHOD: 4.25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2FT.	DPTH TO ▽ FT.
LOGGED BY: B. Anderson	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT: Underlain by black compacted fill material.				
							SP		
					SAND: overlain by a hardpan layer at 1.5' bls.				
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW32	BORING NO. SB40
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/12/93	COMPLTD: 1/12/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.35 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 2.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/12/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
				0	SAND: gray, fine- to medium-grained.				
5					SAND: gray, very fine- to medium-grained, diesel odor.				
10									
15									
20									

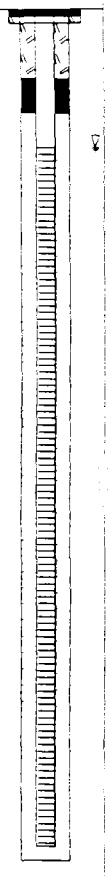


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL:	BORING NO. SB32
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-30
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 8/26/92	COMPLTD: 8/26/92
METHOD: 4.25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2FT.	DPTH TO ▽ FT.
LOGGED BY: B. Anderson	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT: Underlain by black compacted fill material.				
							SP		
				150					
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW33	BORING NO. SB41
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/12/93	COMPLTD: 1/12/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 1.5-11.5'	PROTECTION LEVEL: D
TOC ELEV.: 3.97 FT.	MONITOR INST.: OVA	TOT DPTH: 11.5FT.	DPTH TO ▽ 1.62 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/12/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
				0	SAND: gray, fine- to medium-grained, overlain by a hardpan layer.				
5					SAND: gray, very fine- to medium-grained, diesel odor, oily sheen.				
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW33A	BORING NO. SB43
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/12/93	COMPLTD: 1/12/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 3.92 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.55 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/12/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
					SAND: brown, very fine-grained, some pieces of brick.		SP		
				47	SAND: gray, fine- to medium-grained, diesel odor.		SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW34	BORING NO. SB44
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/13/93	COMPLTD: 1/13/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 1.5-11.5'	PROTECTION LEVEL: D
TOC ELEV.: 4.07 FT.	MONITOR INST.: OVA	TOT DPTH: 11.5FT.	DPTH TO ▽ 1.81 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/13/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
							SP		
				55	SAND: white to light gray, fine-grained, some non-petroleum odors.				
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola	LOG of WELL: PEN-2662W-MW35	BORING NO. SB47
CLIENT: SOUTHNAVFACENGCOM		PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 1/13/93	COMPLTD: 1/13/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 1.5-11.5'
PROTECTION LEVEL: D		
TOC ELEV.: 3.66 FT.	MONITOR INST.: OVA	TOT DPTH: 11.5FT.
DPTH TO ▽ 1.36 FT		
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/13/93	SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
		■		3000	SAND: mixed with debris, gray to brown, very fine- to fine-grained, strong petroleum odor.		SP		
5									
					SAND: gray to light brown, fine-grained, strong petroleum odor.				
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW36	BORING NO. SB48
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/13/93	COMPLTD: 1/13/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.42 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.97 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/13/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT		SM		
				0	SAND: brown to gray, very fine- to fine-grained.				
					SAND: light gray, very fine- to fine-grained, petroleum odor.				
5									
					SAND: tan and gray, very fine- to fine-grained, strong petroleum odor				
10									
15									
20									

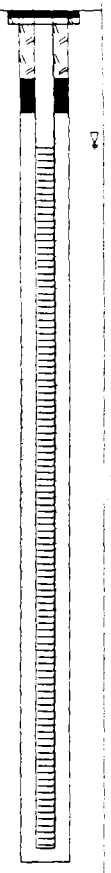


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW37	BORING NO. SB49
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/13/93	COMPLTD: 1/13/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.81 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 2.44 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/13/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE		SM		
				1	SAND: yellow-brown to gray, very fine- to fine-grained.				▽
5									
					SAND: gray, very fine- to fine-grained.				
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW38	BORING NO. SB46
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 1.5-11.5'	PROTECTION LEVEL: D
TOC ELEV.: 3.60 FT.	MONITOR INST.: OVA	TOT DPTH: 11.5FT.	DPTH TO ▽ 1.25 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
				0	CLAYEY SAND: orange-brown to tan-gray, fine-grained, overlain by a hardpan layer.		SC		
							SP		
5					SAND: brownish-gray, fine-grained, strong fuel odor.				
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola	LOG of WELL: PEN-2662W-MW39	BORING NO. SB50
CLIENT: SOUTHNAVFACENGCOM		PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 1-11'
PROTECTION LEVEL: D		
TOC ELEV.: 3.36 FT.	MONITOR INST.: OVA	TOT DPTH: 11FT.
DPTH TO ▽ 1.03 FT.		
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93	SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE		SP		
		■		0	SAND: brownish-gray, fine-grained.				
					SAND: brownish-gray, fine-grained, strong petroleum odor.				
5									
10									
15									
20									

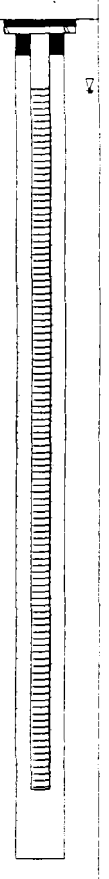


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW40	BORING NO. SB51
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.00 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.60 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
					HARDPAN		SP		
		■		0	SAND: tan to brown-gray, very fine- to fine-grained.				
5									
					SAND: brownish-gray, fine-grained.				
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW41	BORING NO. SB52
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.57 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.45 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
					HARDPAN: mixed with concrete.				
				>5000	SAND: gray, discolored, fine-grained, strong petroleum odor.		SP		
5									
					SAND: brownish-gray, fine-grained, strong petroleum odor.				
10									
15									
20									

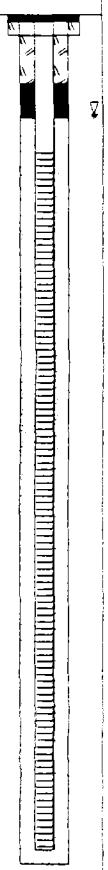


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW42	BORING NO. SB53
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.37 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.28 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
					HARDPAN		SP		
				>5000	SAND: gray with black discoloration, fine-grained, very strong petrol eum odor.				
5									
					SAND: brownish-gray, fine-grained, very strong petroleum odor.				
10									
15									
20									

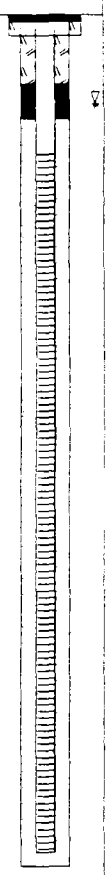


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola	LOG of WELL:		BORING NO. SB42
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/12/93	COMPLTD: 1/12/93
METHOD: 4.25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2.5FT.	DPTH TO ▽ FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
							SM		
				0	SAND: gray, very fine- to fine-grained.				
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW43	BORING NO. SB54
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.98 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.78 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
					HARDPAN		SP		
				0	SAND: brown-gray, very fine- to fine-grained.				
5									
					SAND: brownish-gray, fine-grained, petroleum odor.				
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW44	BORING NO. SB55
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.75 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.61 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
					SAND: gray with some black discoloration, very fine- to fine-grained, petroleum odor.		SM		
				3400	SAND: gray, very fine- to fine-grained, petroleum odor.				
5									
					SAND: brownish-gray, very fine- to fine-grained, petroleum odor.				
10									
15									
20									

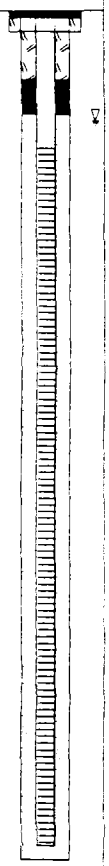


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW45	BORING NO. SB56
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.64 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.74 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE		SM		
				250	SAND: gray with some black discoloration, very fine- to fine-grained, petroleum odor.				
5									
					SAND: gray, very fine- to fine-grained, strong petroleum odor.				
10									
15									
20									

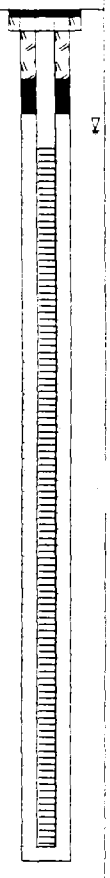


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW46	BORING NO. SB57
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 5.01 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.65 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE		SM		
				4800	SAND: gray, discolored, very fine- to fine-grained mixed with hardpan , strong petroleum odor.				
5									
					SAND: gray, very fine- to fine-grained, strong petroleum odor.				
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW47	BORING NO. SB58
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/14/93	COMPLTD: 1/14/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.95 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.52 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/14/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
							SP		
				0	SAND: gray to brown, fine-grained.				
5									
					SAND: gray to brown, fine-grained, trace of petroleum odor.				
10									
15									
20									

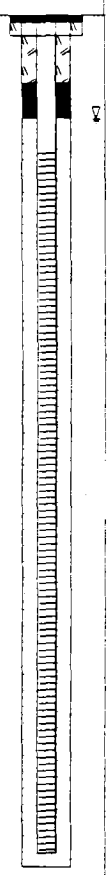


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW48	BORING NO. SB59
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 1-11'	PROTECTION LEVEL: D
TOC ELEV.: 4.57 FT.	MONITOR INST.: OVA	TOT DPTH: 11FT.	DPTH TO ▽ 1.66 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/15/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT		SM		
				1200	SAND: gray, discolored, very fine- to fine-grained, hardpan layer at 1' bls, strong petroleum odor.				
5									
					SAND: brownish-gray, very fine- to fine-grained, odors abate at 8' bls.				
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW49	BORING NO. SB60
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 4.68 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.53 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/15/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT				
					HARDPAN				
				90	SAND: gray, very fine- to fine-grained, petroleum odor.		SM		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW50	BORING NO. SB61
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 5.12 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 1.62 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/15/93		SITE: 2662W

DEPTH FT	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE		SM		
				2	SAND: brown, very fine- to fine-grained.				
5									
					SAND: brown-gray, very fine- to fine-grained, strong petroleum odor.				
10									
15									
20									

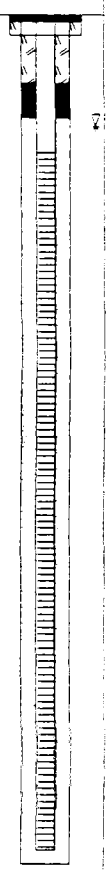


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW51	BORING NO. SB68
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE: 2 inches	SCREEN INT.: 2-12'	PROTECTION LEVEL: D
TOC ELEV.: 5.74 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 2.02 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 1/15/93		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					CONCRETE				
					HARDPAN: mixed with brown, fine- to medium-grained sand.				
				0	SAND: brown, very fine- to fine-grained, possible petroleum odor.		SM		
5									
					SAND: brown to gray, very fine- to fine-grained, slight petroleum odor.				
10									
15									
20									

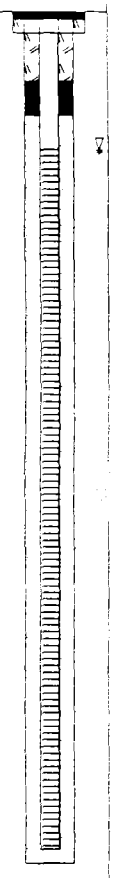


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL:	BORING NO. SB62
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2.5FT.	DPTH TO ▽ FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT				
							SM		
				1	SAND: gray-brown, very fine- to fine-grained.				
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL:	BORING NO. SB63
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4 25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2.5FT.	DPTH TO ▽ FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT				
							SM		
				0	SAND: gray-brown, very fine- to fine-grained.				
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL:	BORING NO. SB64
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2.5FT.	DPTH TO ▽ FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT				
							SM		
				4	SAND. brown, very fine- to fine-grained.				
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL:	BORING NO. SB65
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2.5FT.	DPTH TO ▽ FT.
LOGGED BY: P. Wagner	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT				
							SW		
				1	SAND: gray, fine- to medium-grained, moderately well sorted.				
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL:	BORING NO. SB66
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2.5FT.	DPTH TO ▽ FT.
LOGGED BY: P. Wagner	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT				
					CLAYEY SAND: red, fill material.		SC		
				2	SAND: dark gray, discolored, fine- to medium-grained, strong petroleum odor.		SW		
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola	LOG of WELL:		BORING NO. SB67
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-40
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 1/15/93	COMPLTD: 1/15/93
METHOD: 4.25" ID HSA	CASE SIZE:	SCREEN INT.:	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 2.5FT.	DPTH TO ▽ FT.
LOGGED BY: P. Wagner	WELL DEVELOPMENT DATE:		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					ASPHALT				
					HARDPAN				
				33	SAND: gray, very fine- to fine-grained, silty, poorly sorted, slight metallic odor.		SM		
5									
10									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-MW52D	BORING NO. N⊽
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-45
CONTRACTOR: Ivey Drilling		DATE STARTED: 3/9/94	COMPLTD: 3/10/94
METHOD: Mud rotary	CASE SIZE: 6 & 2 in.	SCREEN INT.: 30-35'	PROTECTION LEVEL: D
TOC ELEV.: 3.96 FT.	MONITOR INST.: OVA	TOT DPTH: 35FT.	DPTH TO ⊽ 1.93 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: 3/10/94		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
					CONCRETE			
					SAND: brown to light brown, fine- to coarse-grained, *diesel odor.*		SW	
							SP	
5			24/24		SAND: brown to white, very fine- to medium-grained, *diesel odor.*			5,6,11,17
10			21/24		SAND: light brown, very fine- to medium-grained, *diesel odor.*			7,8,17,20
15			24/24		As above.			12,12,21,23
20			16/24		SAND: light brown, very fine- to medium-grained, *strong petroleum odor.*			11,12,18,21
							SW	
25			24/24		SAND: light brown, fine- to coarse-grained, *petroleum odor.*			4,8,12,12
30			12/24		SAND: white to light gray, fine- to coarse-grained, *petroleum odor.*			7,8,10,12
35			12/24		SAND: white to light gray, fine- to coarse-grianed, *slight unidentified odor.*			6,7,8,7
40								
45								
50								

WELL DATA

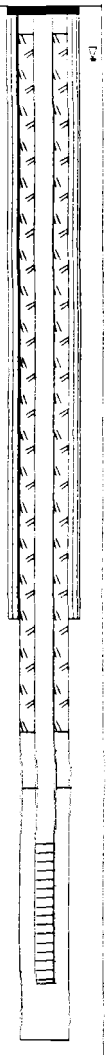


 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW1	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/1/94	COMPLTD: 2/1/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0-5'	PROTECTION LEVEL: D
TOC ELEV.: 6.12 FT.	MONITOR INST.: OVA	TOT DPTH: 5FT.	DPTH TO ▽ 1.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1			SW		
5									
10									
15									
20									

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW2	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/1/94	COMPLTD: 2/1/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0-5'	PROTECTION LEVEL: D
TOC ELEV.: 7.40 FT.	MONITOR INST.: OVA	TOT DPTH: 5FT.	DPTH TO ▽ 2.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: light orange-brown, medium-grained.		SP		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW3	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/1/94	COMPLTD: 2/1/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0-5'	PROTECTION LEVEL: D
TOC ELEV.: 6.77 FT.	MONITOR INST.: OVA	TOT DPTH: 5FT.	DPTH TO ▽ 2.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				2.5	SAND: light orange-brown, medium-grained.		SP		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW4	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/1/94	COMPLTD: 2/1/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0-5'	PROTECTION LEVEL: D
TOC ELEV.: 6.35 FT.	MONITOR INST.: OVA	TOT DPTH: 5FT.	DPTH TO ▽ 2.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: red brown, medium- to coarse-grained.		SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW5	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/1/94	COMPLTD: 2/1/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 1-6'	PROTECTION LEVEL: D
TOC ELEV.: 6.39 FT.	MONITOR INST.: OVA	TOT DPTH: 6FT.	DPTH TO ▽ 2.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: red brown, medium- to coarse-grained.		SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW6	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/1/94	COMPLTD: 2/1/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0.5-5.5'	PROTECTION LEVEL: D
TOC ELEV.: 7.12 FT.	MONITOR INST.: OVA	TOT DPTH: 5.50FT.	DPTH TO ▽ 2.50 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662w

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: orange to light brown, medium- to coarse-grained.		SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW7	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/2/94	COMPLTD. 2/2/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0-3.5'	PROTECTION LEVEL: D
TOC ELEV.: 6.57 FT.	MONITOR INST.: OVA	TOT DPTH: 3.50FT.	DPTH TO ▽ .75 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: dark gray, with roots and organic material.		PT		
							SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW8	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/2/94	COMPLTD: 2/2/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0.5-5.50'	PROTECTION LEVEL: D
TOC ELEV.: 6.79 FT.	MONITOR INST.: OVA	TOT DPTH: 5.50FT.	DPTH TO ▽ 2.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: red brown, medium- to coarse-grained.		SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW9	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/2/94	COMPLTD: 2/2/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 1-6'	PROTECTION LEVEL: D
TOC ELEV.: 5.34 FT.	MONITOR INST.: OVA	TOT DPTH: 6.00FT.	DPTH TO ▽ 2.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: white to orange to light brown, medium- to coarse-grained.		SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW10	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/2/94	COMPLTD: 2/2/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0.5-5.50'	PROTECTION LEVEL: D
TOC ELEV.: 6.70 FT.	MONITOR INST.: OVA	TOT DPTH: 5.50FT.	DPTH TO ▽ 3.00 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: orange brown, medium- to coarse-grained.		SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW11	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 2/2/94	COMPLTD: 2/2/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 0-4'	PROTECTION LEVEL: D
TOC ELEV.: 3.05 FT.	MONITOR INST.: OVA	TOT DPTH: 4.00FT.	DPTH TO ▽ 0.7 FT.
LOGGED BY: R. Durham	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: gray to dark gray, medium- to coarse-grained, organics.		SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW12	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 3/7/94	COMPLTD: 3/7/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 1-6'	PROTECTION LEVEL: D
TOC ELEV.: 5.90 FT.	MONITOR INST.: OVA	TOT DPTH: 6.00FT.	DPTH TO ▽ 2.50 FT.
LOGGED BY: M. Diblin	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
							SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW13	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 3/7/94	COMPLTD: 3/7/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 1-6'	PROTECTION LEVEL: D
TOC ELEV.: 5.24 FT.	MONITOR INST.: OVA	TOT DPTH: 6.00FT.	DPTH TO ▽ 2.50 FT.
LOGGED BY: M. Diblin	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
							SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW14	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 3/7/94	COMPLTD: 3/7/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 1-6'	PROTECTION LEVEL: D
TOC ELEV.: 5.93 FT.	MONITOR INST.: OVA	TOT DPTH: 6.00FT.	DPTH TO ▽ 2.50 FT.
LOGGED BY: M. Diblin	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
							SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NADEP Pensacola		LOG of WELL: PEN-2662W-TW15	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 7527-50
CONTRACTOR: N/A		DATE STARTED: 3/7/94	COMPLTD: 3/7/94
METHOD: Post hole	CASE SIZE: 2 inches	SCREEN INT.: 1-6'	PROTECTION LEVEL: D
TOC ELEV.: 6.11 FT.	MONITOR INST.: OVA	TOT DPTH: 6.00FT.	DPTH TO ▽ 2.50 FT.
LOGGED BY: M. Diblin	WELL DEVELOPMENT DATE: N/A		SITE: 2662W

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
							SW		
5									
10									
15									
20									

 ABB ENVIRONMENTAL SERVICES, INC.

APPENDIX D

INVESTIGATIVE METHODOLOGIES AND PROCEDURES

Soil Boring Methods

Boreholes were advanced using 4.25-inch inside diameter (ID), hollow-stem augers by a rotary drill rig. Soil samples were collected directly above the water table with a post-hole digger, and below the water table with a split-spoon sampling device. The soil samples collected above the water table were placed in 16-ounce glass jars and head space analyses were performed using an organic vapor analyzer (OVA) with a flame ionization detector (FID) following Florida Department of Environmental Protection (FDEP) Chapter 17-770.200(2), Florida Administrative Code (FAC), guidelines. Select soil samples from below the water table were analyzed using a portable gas chromatograph (GC) calibrated to detect benzene, toluene, ethylbenzene, and xylene (BTEX) to the part per billion (ppb) level. The purpose of the screening procedure was to optimize monitoring well placement during the investigation.

Monitoring Well Construction

Monitoring wells PEN-2662W-MW-1 through PEN-2662W-MW-51 (excluding PEN-2662W-14D, PEN-2662W-25D) were constructed of 2-inch ID, schedule 40, polyvinyl chloride (PVC) casing with flush-threaded joints and 10 feet of 0.010-inch machine-slotted screen. PVC well casings extend from the top of the screen to land surface. A 20/30 grade silica sand filter pack was placed in the annular space to approximately 1 foot above the top of the screen. A 6-inch thick bentonite seal was placed on top of the filter pack. The remaining annular space was grouted to the surface with a neat cement grout.

Deep wells PEN-2662W-14D, PEN-2662W-25D, and PEN-2662W-52D were constructed of 2-inch ID, schedule 40, PVC with flush-threaded joints and 5 feet of 0.010-inch machine-slotted screen. PVC well casings extend from the top of the screen to land surface. A 20/30 grade silica sand filter pack was placed in the annular space to approximately 2 feet above the top of the screen. A 1- to 2-foot thick bentonite seal was placed on top of the filter pack. The remaining annular space was grouted to the surface with a neat cement grout. Monitoring well PEN-2662W-52D was double-cased. The outer casing consists of 6-inch diameter, schedule 80, PVC well casing and extends from land surface to a depth of 22 feet below land surface.

A protective traffic-bearing vault was installed to complete each well. In concreted areas, the well pad consisted of 6-inch thick reinforced concrete around the traffic-bearing vault to the depth of the surrounding concrete. Each monitoring well was equipped with a locking well cap and a padlock. Figure D-1 depicts a typical shallow monitoring well installation for the site. Figure D-2 illustrates the construction details for the double-cased monitoring well, PEN-2662W-52D.

In addition to the permanent monitoring wells, 15 temporary wells (designated PEN-2662W-TW-1 through PEN-2662W-TW-15) were manually installed at the site. All temporary wells were constructed of 2-inch ID, schedule 40, stainless steel casing with flush-threaded joints and 5 feet of 0.010-inch machine-slotted screen. Each temporary well was installed by post-holing to 1 foot below the water table (1 to 3 feet below land surface). The temporary well was then dropped into the hole and pounded further into the ground with a 3-inch diameter fence post driver. Each temporary well was driven to a depth of 3 to 4 feet below the water table, leaving a minimum of 1 foot of screen above the water table. The annular space surrounding the temporary well above the water table was back-filled with the native soil that had been removed with the post-hole digger. The annular space surrounding the screen consists of the native fine- to medium-grained sands that comprise this part of the surficial sand-and-gravel aquifer. Each temporary well is equipped with a locking well cap and a padlock.

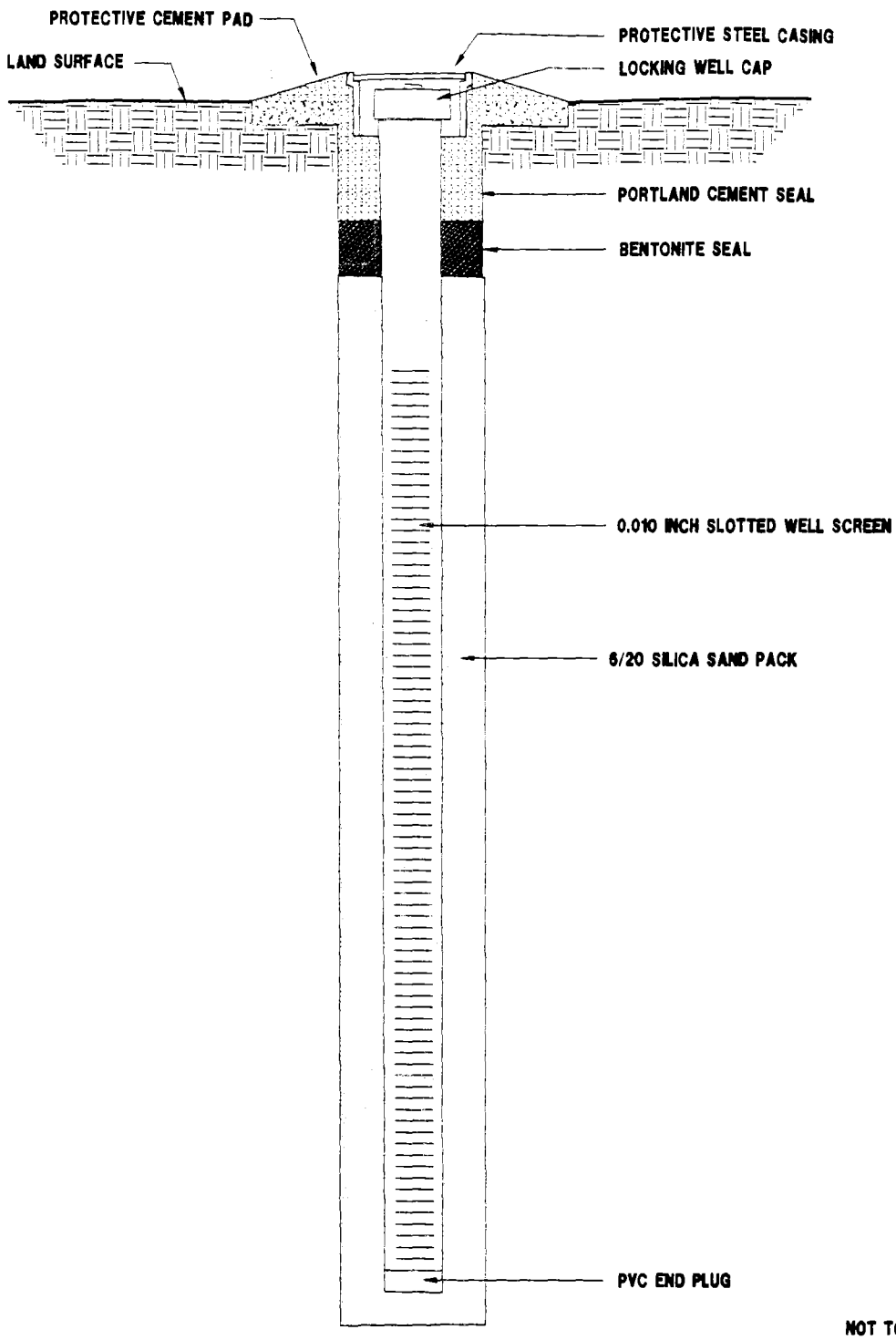
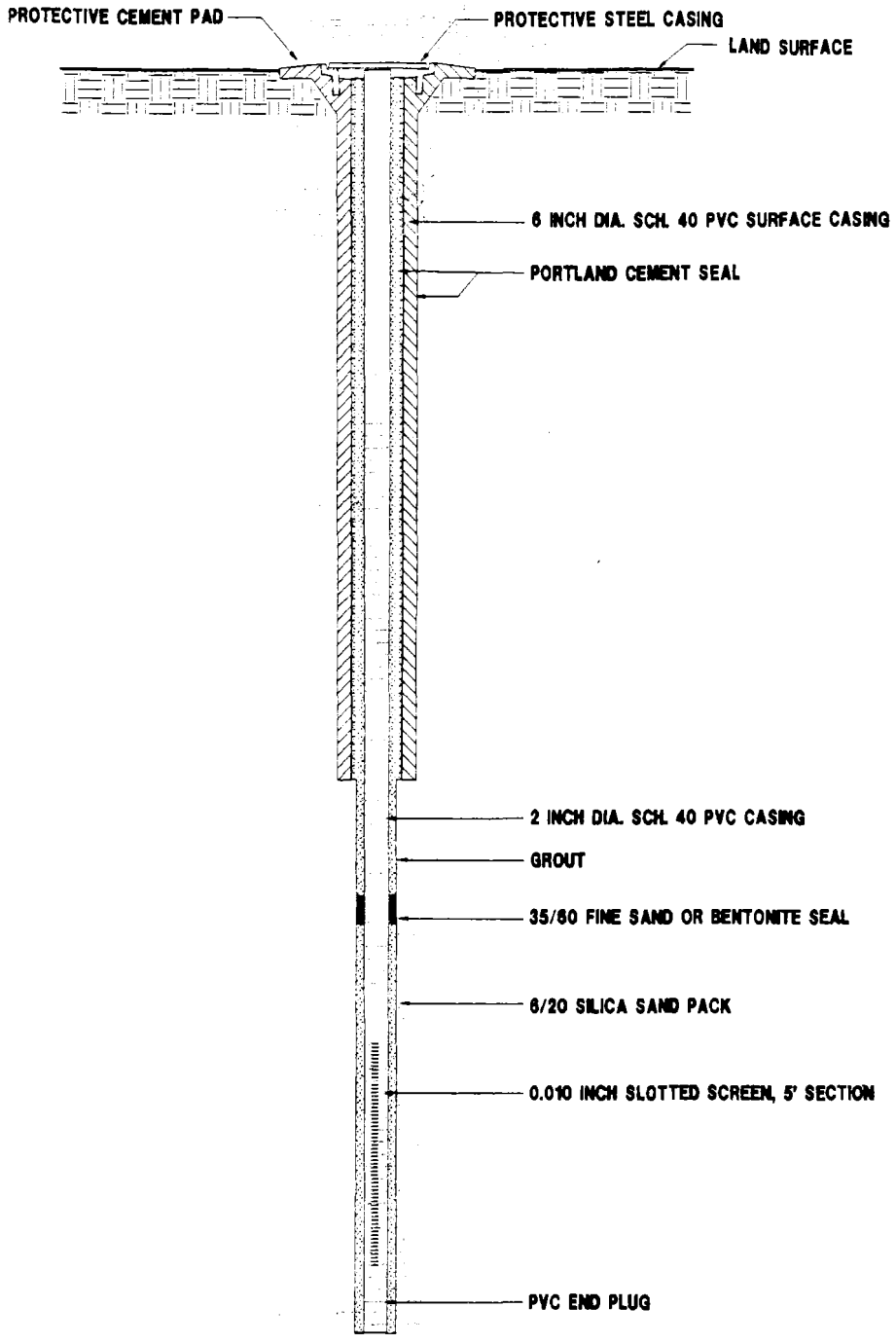


FIGURE D-1
TYPICAL SINGLE CASED MONITORING WELL INSTALLATION DETAIL

PENSACOL/WELLS.dwg/NP/3-29-94

CONTAMINATION ASSESSMENT REPORT,
BUILDING 2662 WEST

NADEP PENSACOLA
PENSACOLA, FLORIDA



NOT TO SCALE

FIGURE D-2
TYPICAL DOUBLE CASED
MONITORING WELL INSTALLATION DETAIL

PENSACOL/WELL.3mg/KDP/08/28/93

CONTAMINATION ASSESSMENT REPORT,
BUILDING 2662 WEST

NADEP PENSACOLA
PENSACOLA, FLORIDA

The temporary wells were installed by hand because of the inability of a drill rig to reach the well locations. Obstructions that prohibited the use of a drill rig included bermed rubble piles of concrete and construction debris, a sandy beach environment, and a low-lying marshy area where the water table was within 0.3 foot of the ground surface.

Water Level Measurements

Groundwater levels were measured using an electric water level indicator and an engineering tape divided into increments of 0.01 foot. Water level elevations were calculated by subtracting the measured depth to groundwater from the elevation at the top of the well casing. The wells were checked for the presence of free product by visual observation of a groundwater sample taken from each well using an extruded Teflon™ bailer. Some monitoring wells suspected to contain free product were also checked with an oil-water interface probe.

Groundwater Sampling

Groundwater samples were collected in accordance with ABB Environmental Services, Inc. (ABB-ES), Florida Department of Environmental Protection (FDEP)-approved Comprehensive Quality Assurance Plan (CompQAP). The monitoring wells were purged with an Teflon™ bailer. Purging continued until five well volumes had been removed from the well. Groundwater samples were collected using an extruded Teflon™ bailer.

The samples were placed into appropriate containers, properly preserved, and placed on ice. Samples were then shipped to Wadsworth/ALERT Laboratories, Inc., in Tampa, Florida. For a description of sampling parameters see Table 1-1 or Subsection 4.4.2, Groundwater Sampling.

Slug Test Procedures

The slug test developed by Bouwer and Rice (1976) measures the saturated hydraulic conductivity (K) using a single well. The test method used is termed a "rising head" test and is performed by quickly withdrawing a volume of water (slug) from the well and measuring the subsequent rate of the rising water level in the well. Bouwer (1989) recommends the rising head slug test for wells with screened intervals that are only partially submerged or partially penetrate unconfined aquifers.

The slug was constructed of 1-inch outside diameter PVC pipe, 5 feet in length, filled with sand, and capped watertight at both ends. The water level changes in the monitoring wells were recorded using a data logger and pressure transducer. The pressure transducer was suspended less than 1 foot above the bottom of the well and an initial water level was recorded prior to beginning the test. The slug was then lowered into the well to a depth below the original water table. Water levels were then observed until they stabilized at the original level. Following stabilization, the slug was quickly removed and water level measurements were recorded over time until the water level returned to the original level. Three rising head tests were conducted for each well in order to obtain an average recovery response.

APPENDIX E

AQUIFER PARAMETER CALCULATIONS

Hydraulic gradient

Water table elevations were plotted on a map of the site. A water table contour map was drawn with flow lines (depicting groundwater flow direction) perpendicular to the groundwater elevation contours. The average groundwater hydraulic gradient was calculated by subtracting the differences in groundwater elevation (in feet) between two points on the map and dividing the elevation difference by the distance between the two points to obtain a resulting gradient in feet per foot. Water elevation data collected on August 31, 1992, and January 16, 1993, were used to calculate hydraulic gradients at the site. For each date, three traverses were made perpendicular to equipotential contour lines to calculate an average site hydraulic gradient. For each traverse, the hydraulic gradient was calculated as follows:

$$i = \frac{(h_1 - h_2)}{d} \qquad (1)$$

where

- i = hydraulic gradient (feet per foot [ft/ft]),
- h_1 = water table elevation, upgradient (feet),
- h_2 = water table elevation, downgradient (feet), and
- d = horizontal distance (feet) between h_1 and h_2 along a flow line.

Hydraulic gradients calculated in this manner varied from 2.07×10^{-3} ft/ft to 2.18×10^{-3} ft/ft. The average hydraulic gradient at the site was calculated to be 2.13×10^{-3} ft/ft.

Hydraulic conductivity

Hydraulic conductivity from slug test data was calculated following the methods of Bouwer and Rice (1976) and Bouwer (1989) for partially penetrating wells screened in unconfined aquifers. The following well information is needed to assess the hydraulic conductivity:

- radius of well casing (r_c),
- r_w = radius of borehole (r_c plus radius of the sand pack surrounding the well screen),
- length of screened interval below the water table (L_e),
- effective well radius (r_e),
- depth of well below the water table (L_w),
- depth to confining unit or bottom of aquifer below the static water table (H), and
- plot of time versus the logarithm of y, where y is the difference between the static water level outside the well and the water level inside the well.

Figure E-1 is a well diagram depicting most of the aquifer and well parameters. Calculations were made assuming that $L_w < H$. Hydraulic conductivity, K, was calculated as follows:

$$K = [R_c^2 \ln(\frac{r_e}{r_w}) - 2L_e] \; [\frac{1}{t} \ln(\frac{y_o}{y_t})] \qquad (2)$$

where

y_0 = y at time zero, and
y_t = y at time t.

The effective well radius, r_e, and the term $[(1/t)\ln(y_0/y_t)]$ were derived by using the computer program AQTESOLV™ (Geraghty & Miller, Inc., 1989). This computer program follows procedures and assumptions outlined by Bouwer (1989).

Slug test graphs are attached at the end of this appendix. Values of y were calculated for a particular time, t, and plotted on the graph. The computer program selects a "best-fit" line through the data points by linear regression along a "straight-line" portion of the graph. The slope of the "best-fit" line is used to calculate the hydraulic conductivity, K.

Three slug tests each were performed inside monitoring wells PEN-2662W-1 and PEN-2662W-2. Hydraulic conductivity, K, is reported in feet per minute (ft/min) on the slug test graphs, and was recalculated to feet per day (ft/day). K was found to vary from 21.83 ft/day to 75.02 ft/day with an average K of 49.54 ft/day.

<u>Average pore water velocity</u>

Estimates of average pore water velocity were obtained using the following formula:

$$V = \frac{(K*i)}{n} \qquad (3)$$

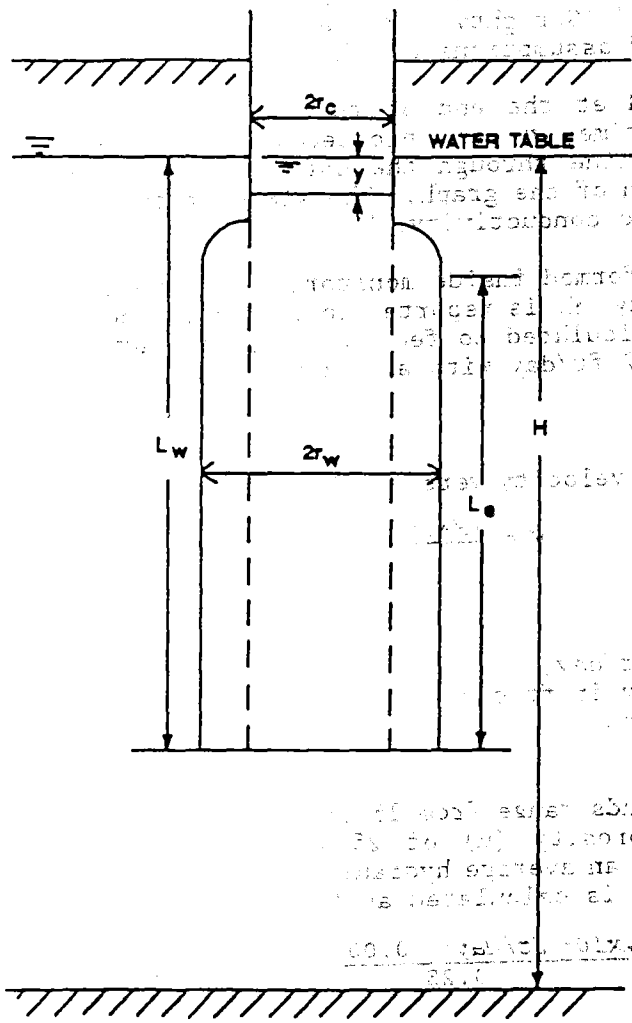
where

V = seepage velocity in ft/day,
K = hydraulic conductivity in ft/day,
i = hydraulic gradient, and
n = estimated porosity.

Porosities of unconsolidated sands range from 25 to 50 percent (Freeze and Cherry, 1979). Using an estimated porosity (n) of 25 percent, an average hydraulic gradient of 2.13×10^{-3} ft/ft, and an average hydraulic conductivity of 49.54 ft/day, the average pore water velocity is calculated as follows:

$$V = \frac{(4.954 x 10^1 \; ft/day) \; (0.00213 \; ft/ft)}{0.25} \qquad (4)$$

$$V = 0.42 \; ft/day$$



r_c – radius of well.

r_w – radius of well + total thickness of the sand/gravel pack.

L_e – length of screened interval below the water table.

L_w – depth of well below water table.

H – depth to confining unit below the water table.

y – difference between static water level outside well and water level inside well.

FIGURE E-1

DEFINITIONS OF SLUG TEST PARAMETERS (from Bouwer, 1989)

CONTAMINATION ASSESSMENT REPORT
SITE 2662W
NADEP PENSACOLA
PENSACOLA, FLORIDA

AQUIFER PARAMETER CALCULATIONS

Site Name: 2662W
Location: NADEP – PENSACOLA, FL

Monitoring Wells Tested:
PEN–2662W–1
PEN–2662W–2

Data Input Section

Hydraulic Gradient (i) =	0.0021	(foot per foot)
Porosity (n) =	25%	
Saturated Thickness (b) =	9.490	PEN–2662W–1
(test interval thickness)	9.020	PEN–2662W–2

Hydaulic Conductivity Input (K)

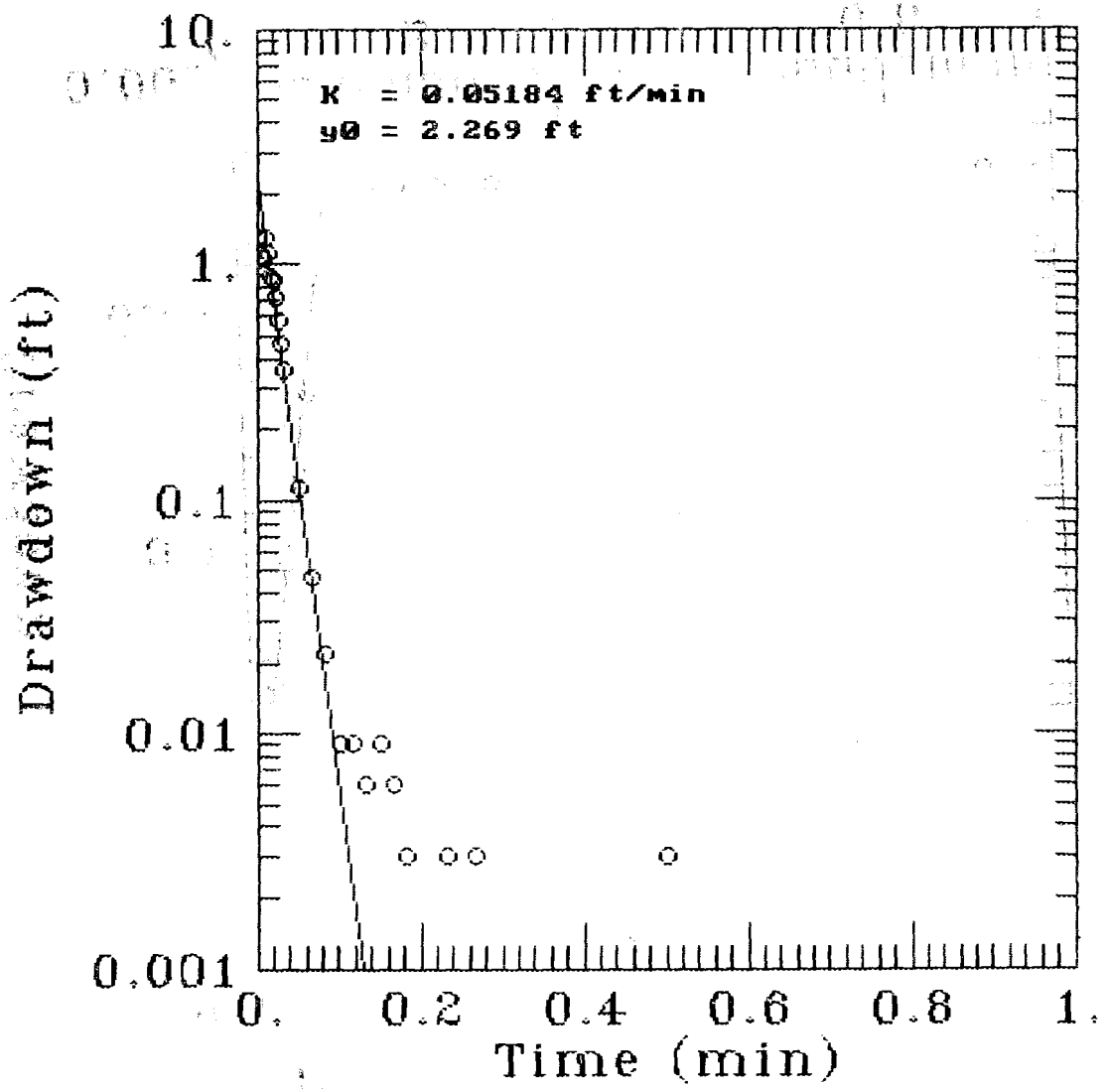
Monitoring Well	Average K Value (ft/day)
PEN–2662W–1	57.170
PEN–2662W–2	41.900
AVERAGE	49.535

Average Pore Water Velocity Calculation (V= K*I/n)

Monitoring Well	Result (ft/day)
PEN–2662W–1	0.480
PEN–2662W–2	0.352
AVERAGE	0.416

SLUG TEST PLOTS

PEN-2662W-MW1 RUN#1

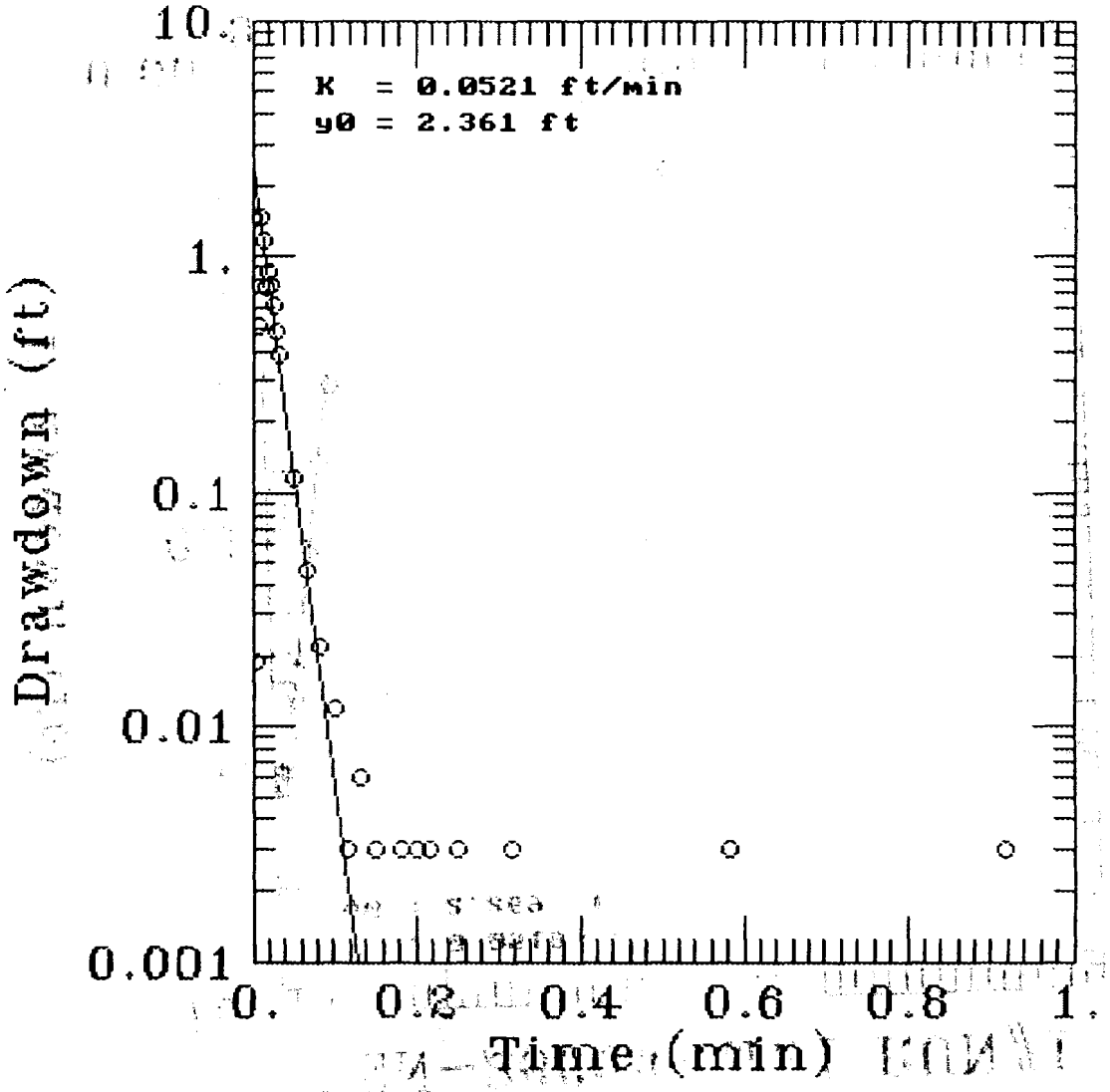


AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

PEN-2662W-MW1 RUN#2

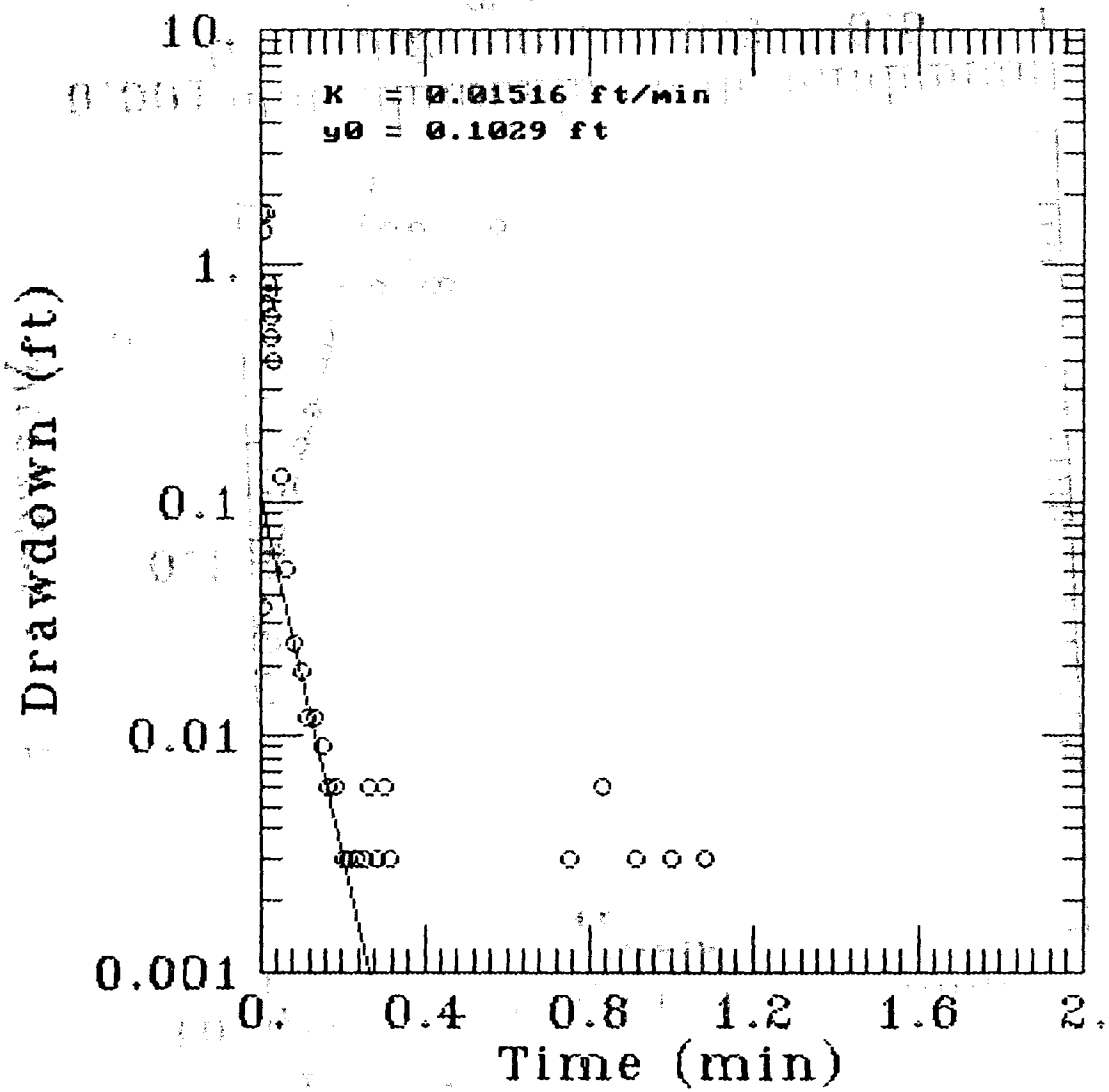


AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

PEN-2662W-MW1 RUN#3

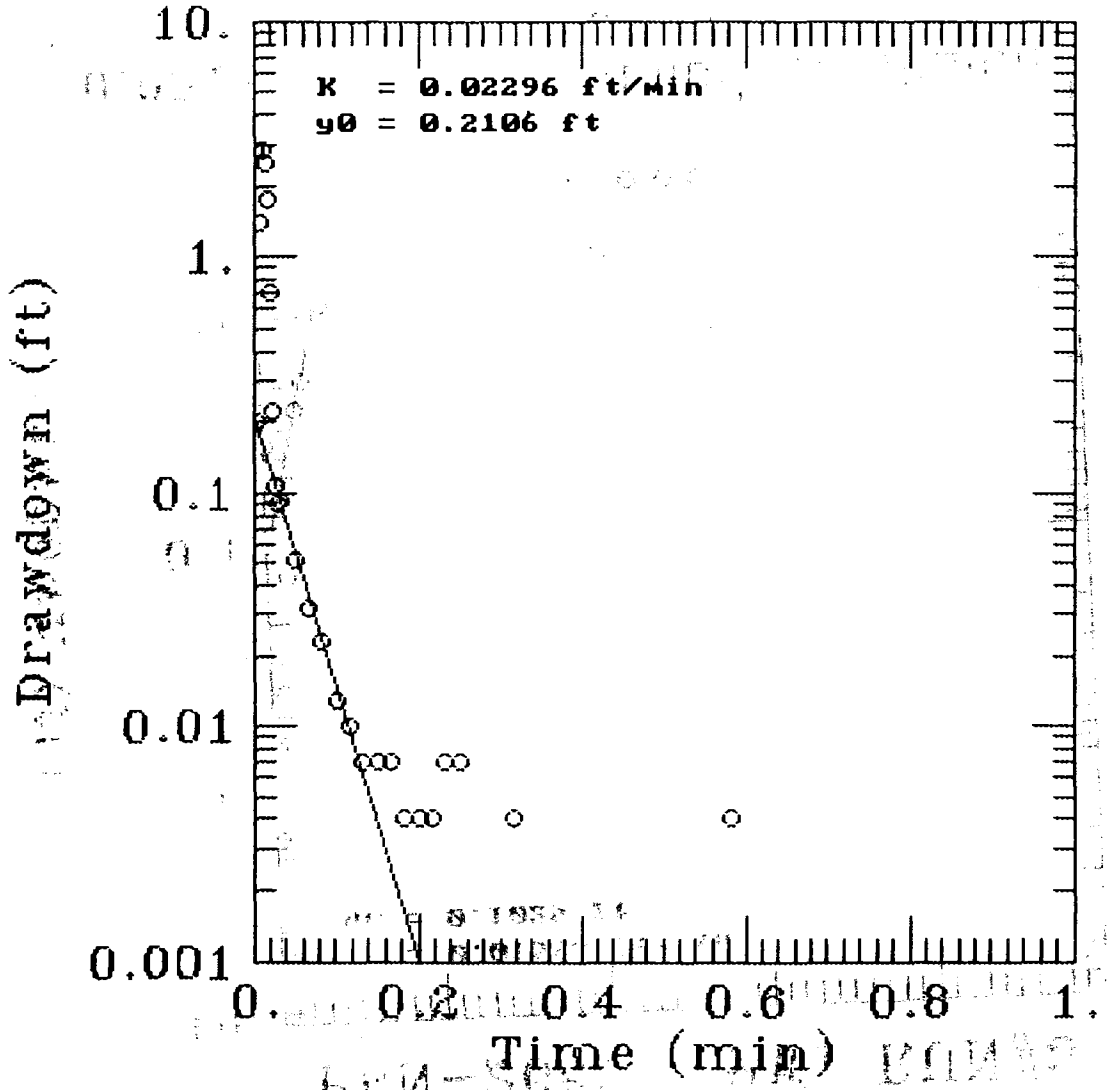


AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

PEN-2662W-MW2 RUN#1

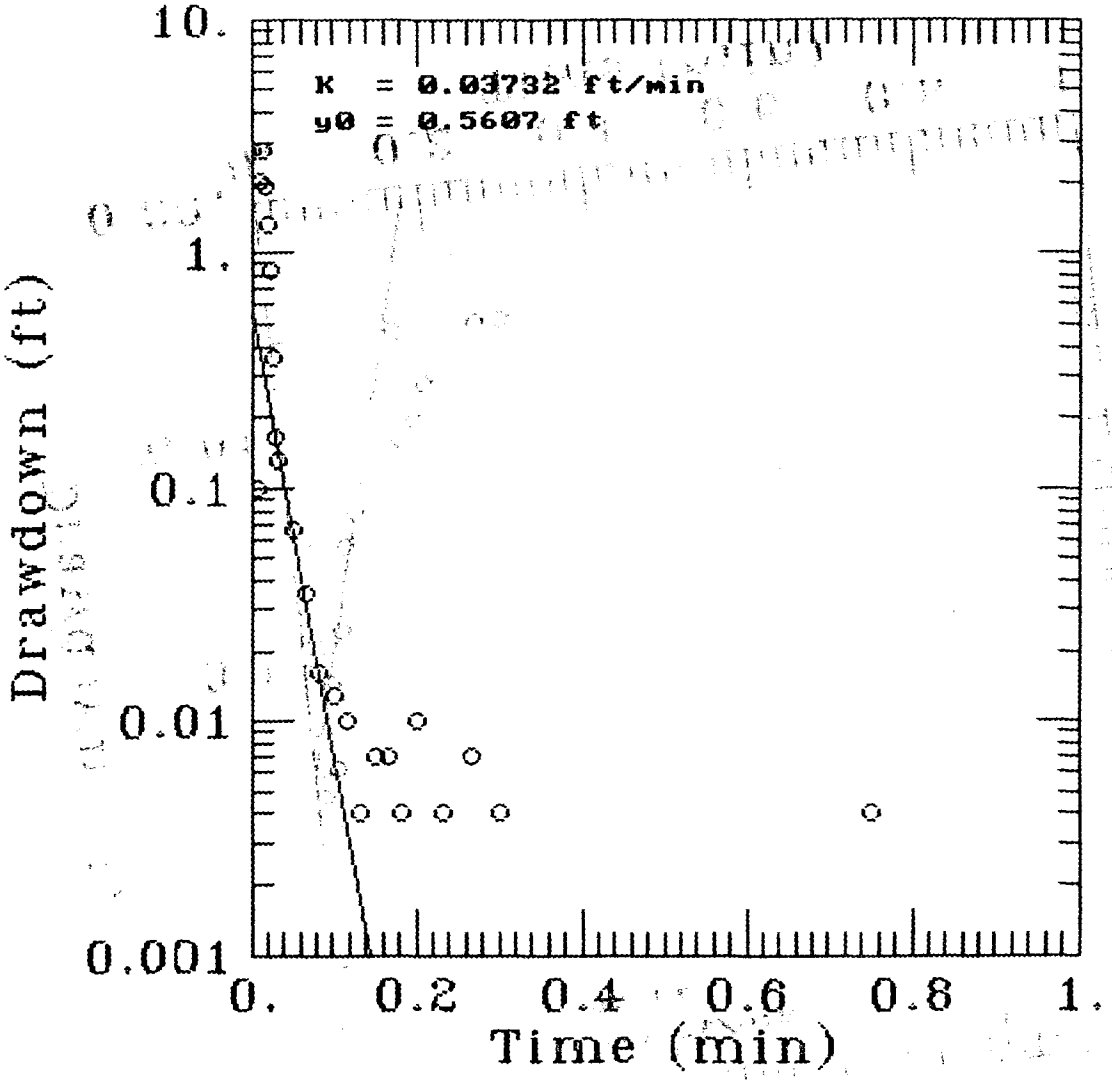


AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

PEN-2662W-MW2 RUN#2

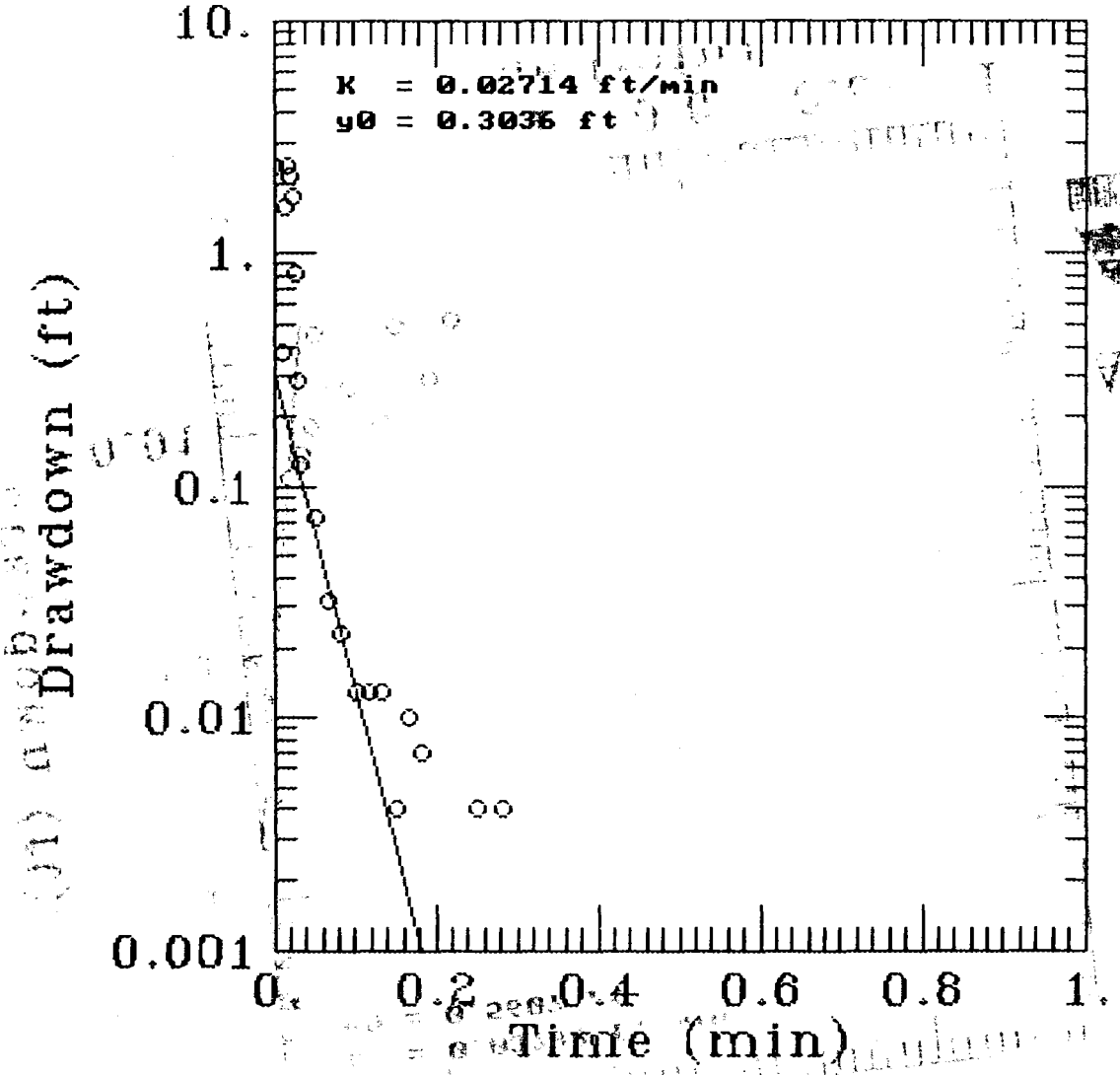


AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

PEN-2662W-MW2 RUN#3



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group