

**SITE CHARACTERIZATION
SITE 803**

Roosevelt Roads
U.S. Naval Station
Ceiba, Puerto Rico

Contract Number N62470-93-D-4021
Delivery Order 0002

July 1994



BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

SITE CHARACTERIZATION
SITE 803

U.S. NAVAL STATION
ROOSEVELT ROADS
CEIBA, PUERTO RICO

JULY 1994

PREPARED FOR
UNITED STATES NAVY
CONTRACT NUMBER N62470-93-D-4021
ORDER NUMBER 0002

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Executive Summary

EXECUTIVE SUMMARY

Blasland, Bouck & Lee, Inc. (BB&L) conducted a site characterization (SC) for an underground storage tank (UST), removed in 1993, at the Roosevelt Roads U.S. Naval Station. The Roosevelt Roads U.S. Naval Station is located near the town of Ceiba, on the eastern end of Puerto Rico. The SC evaluated the potential impact of the former UST (UST #803) on the soils and ground water in the area of Building 803, which houses a water pump used to pump ocean water for firefighting water at the fueling pier.

Building 803 is located on the eastern end of the naval station adjacent to a fueling pier in Ensenada Honda. Ensenada Honda is the fueling port for the U.S. Navy Caribbean Fleet. Prior to excavation, UST #803 was used to store fuel for the water pump's backup generator. Currently, fuel for the backup generator is stored in an aboveground storage tank located on the south side of Building 803.

The SC field investigation included collecting soil samples from five soil borings, constructing and sampling ground water from five ground-water monitoring wells, performing field screening of five soil samples and laboratory analysis of six soil samples, performing two slug tests, measuring ground-water elevations and collecting information to prepare a qualitative risk assessment.

Information obtained during this investigation indicates that petroleum hydrocarbons were not detected in the soils or ground-water above the laboratory detection limits. Therefore, no Puerto Rico Environmental Quality Board standards for soil or ground water were exceeded.

Results of the qualitative risk assessment indicate that the human health risks associated with UST #803 are extremely low.

Based on the results of this SC, no further action or assessment is recommended for this site.

SECTION 1.0 - INTRODUCTION

Pursuant to Contract Number N62470-91-D-4021, Blasland, Bouck & Lee, Inc. (BB&L) was authorized by the U.S. Navy to conduct a site characterization (SC) of the underground storage tank (UST) in the area of Building 803 (also referred to as site 803) at the U.S. Naval Station - Roosevelt Roads (NAVSTA Roosevelt Roads), Ceiba, Puerto Rico. The UST (UST #803) was excavated and removed in 1993. The purpose of this SC is to determine the degree and extent of potential soil and ground-water contamination by petroleum products resulting from past site operations. This report presents a summary of the work completed, results of the SC field investigation, and recommendations for no further action or assessments.

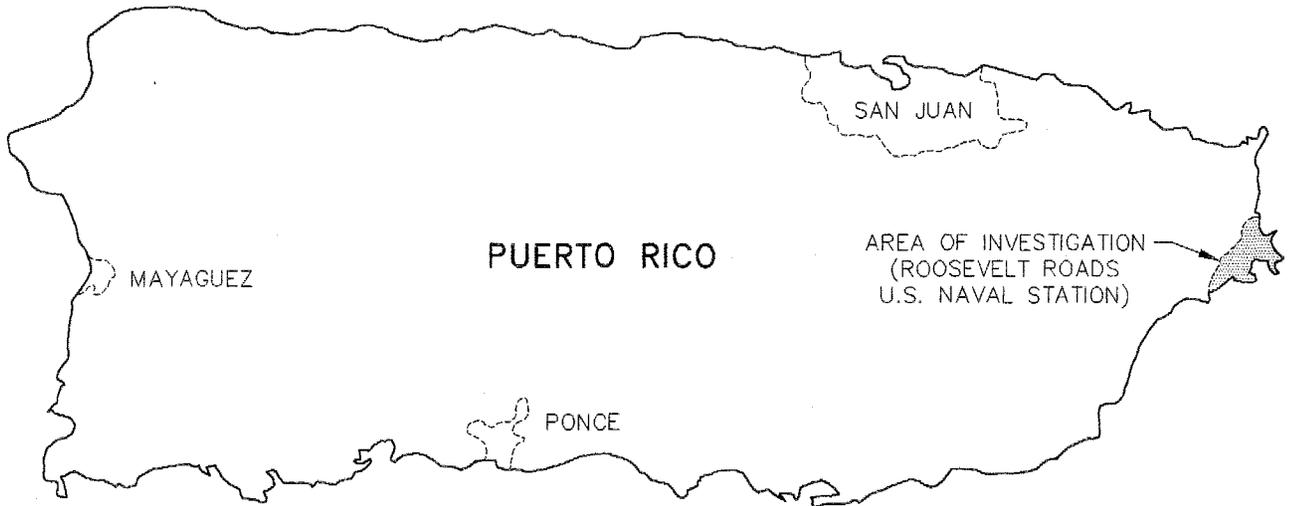
1.1 Site Location

Building 803 is located within NAVSTA Roosevelt Roads, near the town of Ceiba on the eastern end of Puerto Rico (Figure 1-1). The approximate location of the naval station is 18° 15' 00" latitude and 65° 39' 30" longitude. The area of interest for this SC is UST #803, located adjacent to fueling pier #3 in Ensenada Honda (Figure 1-2).

1.2 Site Background

UST #803, a 275 gallon diesel fuel UST, was used to store fuel for a backup generator in Building 803. In case of power supply loss, the generator is available to power a water pump used to maintain water pressure for firefighting activities on the naval station. A concrete conduit (approximately 10 feet below land surface) extends from Building 803 into Ensenada Honda to supply ocean water for the pump (Figure 1-3). An aboveground storage tank

ATLANTIC OCEAN



CARRIBEAN SEA

APPROXIMATE SCALE IN MILES:

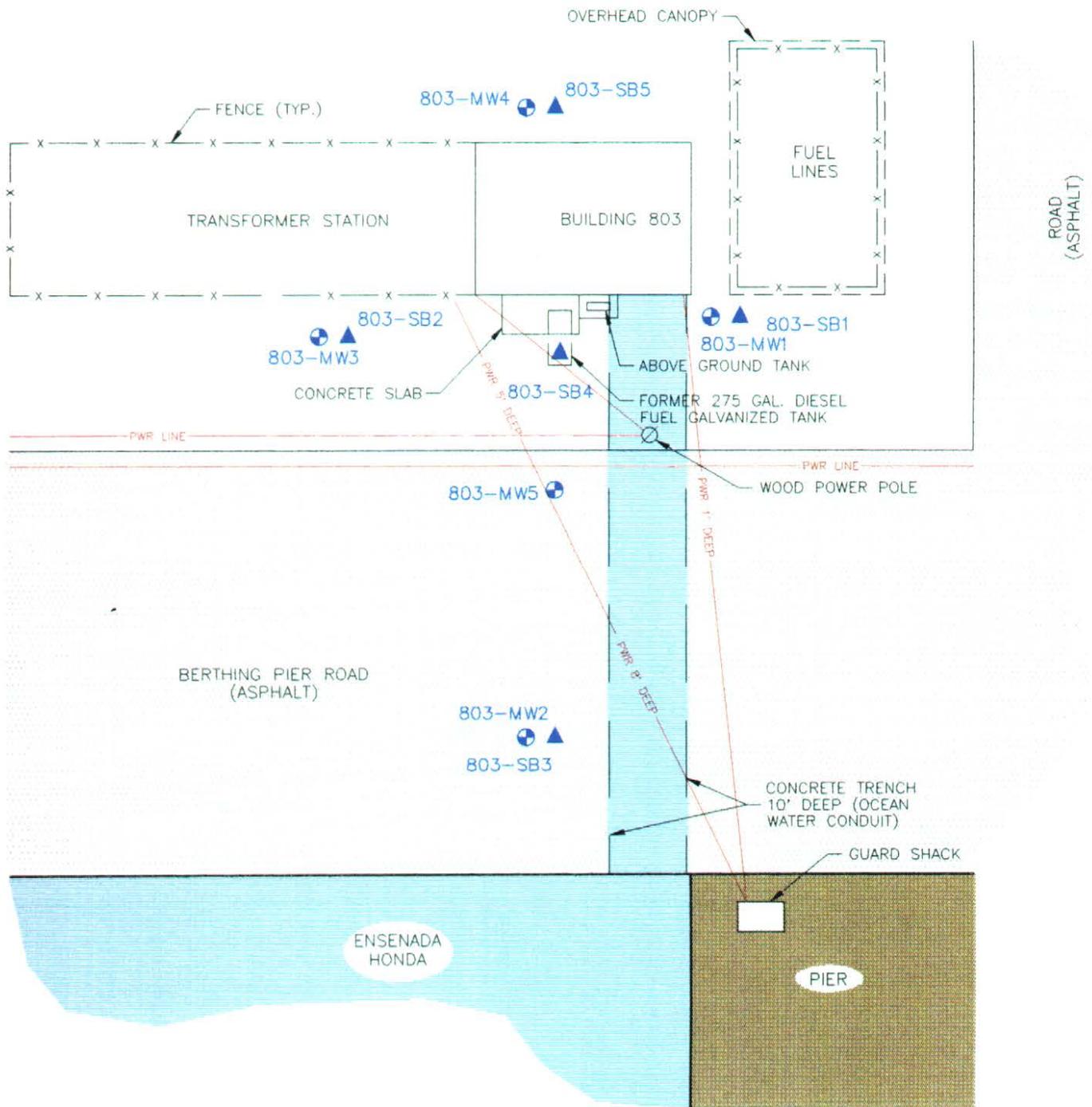


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SITE #803

SITE LOCATION

FIGURE
1-1



SCALE IN FEET

LEGEND

- MONITORING WELL LOCATION
- SOIL BORING LOCATION



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SITE #803

UTILITIES LOCATION

FIGURE
1-3

(AST) located on the south side of Building 803 is currently used to store diesel fuel for the backup generator (see Figure 1-3).

The UST was excavated and removed from the site in 1993. Petroleum contamination was detected in ground-water samples collected during the UST removal by IMECO (IMECO, July 1993). During the tank removal, free product was not encountered.

1.3 Project Objectives

The main project objective was to determine if soil and/or ground-water contamination are still present at the site. This was accomplished by installing soil borings and monitoring wells, and by collecting and analyzing soil and ground-water samples.

The SC field investigation consisted of installing five soil borings, constructing five monitoring wells, measuring ground-water elevations in the monitoring wells, conducting field and laboratory analyses of soil and ground-water samples, and performing two slug tests. Analytical screening of soil and ground-water samples was performed on site prior to making decisions regarding placement of monitoring wells. Screening was conducted by a chemist operating a portable gas chromatograph (GC) and a total petroleum hydrocarbon (TPH) analyzer. This approach enabled the field crew to define the extent of contamination in a single phase. The work completed and field procedures followed at the site are detailed in this report.

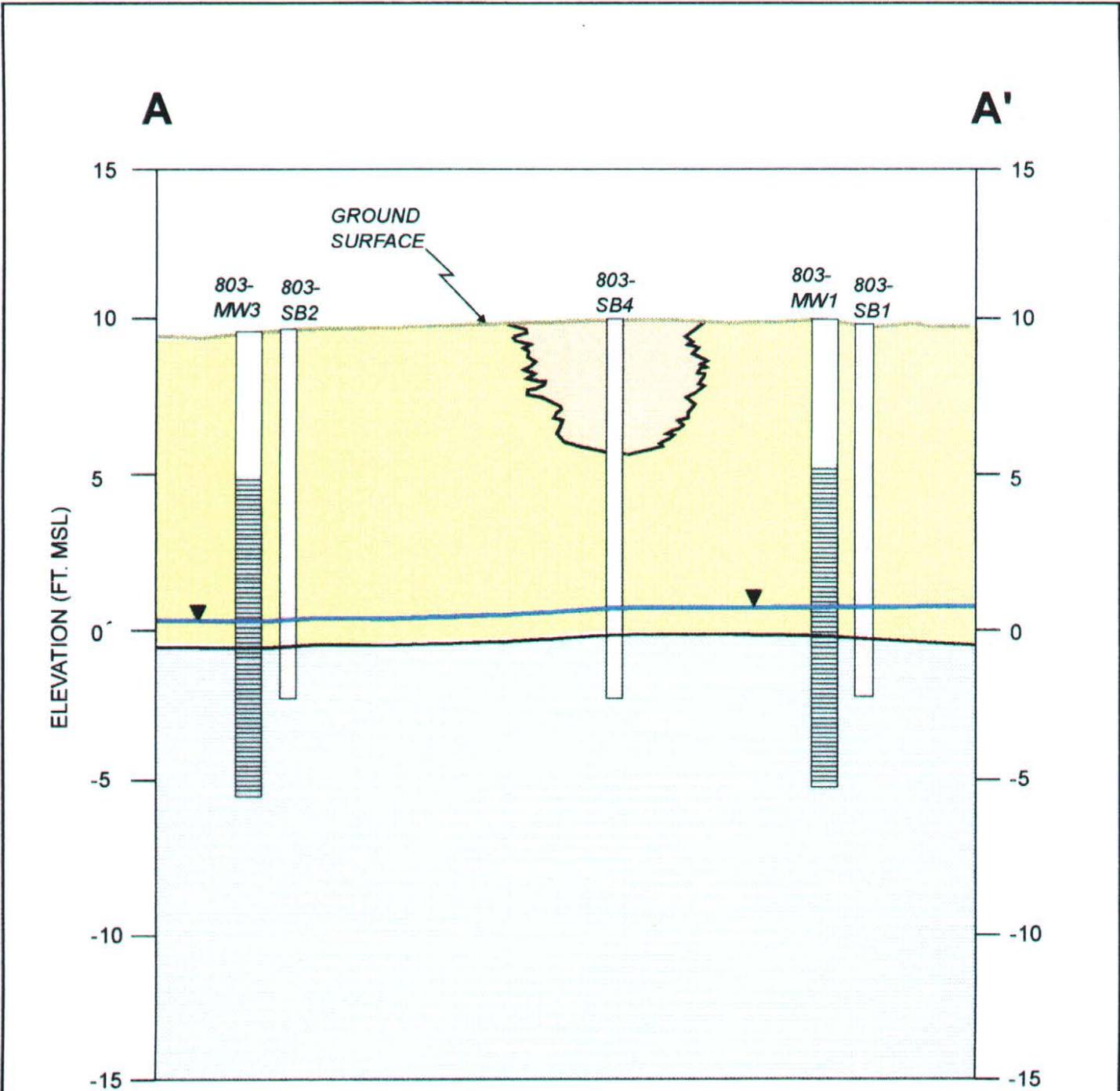


Site Geology

SECTION 2.0 - SITE GEOLOGY

The site geology was described from sample cuttings observed during drilling of the soil borings and monitoring wells. Lithologic descriptions are included with the soil boring lithologic logs and monitoring well construction diagrams and lithologic logs, which are presented in Appendices A and B, respectively.

The surficial lithology (from 0 to 15 feet below land surface) observed at the site consists exclusively of unconsolidated fill material. The fill material consists of fine to medium grained sands (sub-angular) and silts with varying amounts of small (one to two millimeters in diameter) to large (greater than three centimeters in diameter) shell fragments. The color of these materials, as determined by color matching with the Munsell soil color system, consisted primarily of pale yellow and yellow to approximately ten feet below land surface (bls). Between 10 and 15 feet bls, the color changed to grey and olive grey. East-west (Figure 2-1) and north-south (Figure 2-2) trending geologic cross sections were prepared based on the lithology observed in soil borings and monitoring wells. The locations of the cross sections are shown on Figure 3-1.



VERTICAL EXAGGERATION - x3.0

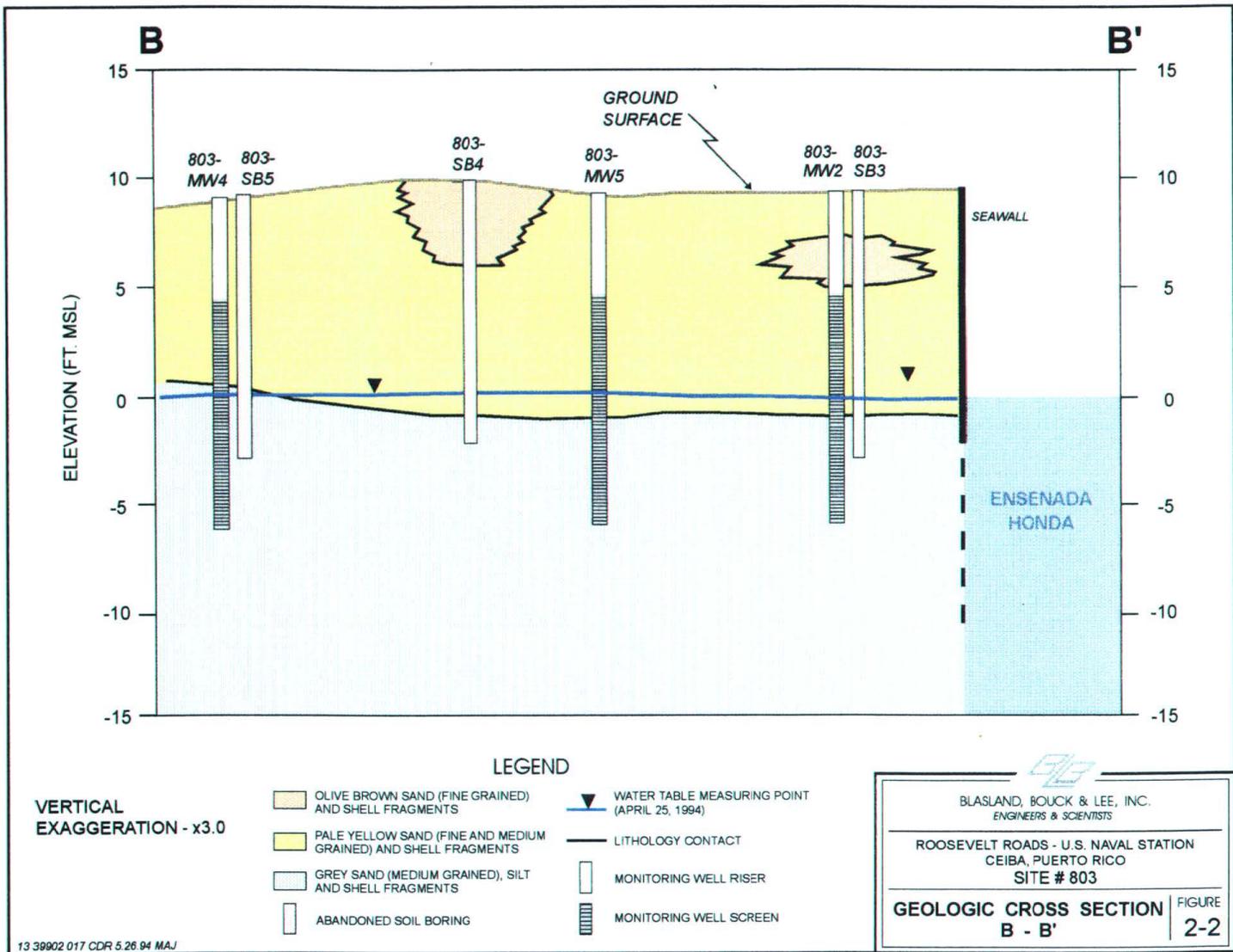
LEGEND

- OLIVE BROWN SAND (FINE GRAINED) AND SHELL FRAGMENTS
- PALE YELLOW SAND (FINE AND MEDIUM GRAINED) AND SHELL FRAGMENTS
- GREY SAND (MEDIUM GRAINED), SILT AND SHELL FRAGMENTS
- ABANDONED SOIL BORING
- WATER TABLE MEASURING POINT (APRIL 25, 1994)
- LITHOLOGY CONTACT
- MONITORING WELL RISER
- MONITORING WELL SCREEN

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SITE # 803

GEOLOGIC CROSS SECTION | FIGURE
A - A' | **2-1**





Field Investigation

SECTION 3.0 - FIELD INVESTIGATION

The SC field investigation was conducted from March 8 through May 14, 1994. The project was delayed approximately one month while awaiting telephone utility clearance prior to installing monitoring well 803-MW5.

Soil assessment activities included field screening with an organic vapor analyzer (OVA), daily analysis with a portable GC and a TPH analyzer, laboratory analysis.

Ground-water assessment activities included collection of ground-water samples for field analysis from soil borings advanced to the water table (used to determine permanent monitoring well locations), construction of monitoring wells to collect ground-water samples for laboratory analysis, and determination of ground-water elevations. In addition, lithologic information was collected during soil boring and monitoring well installation.

3.1 Drilling

The Site 803 soil boring and monitoring well program is summarized in this section. Technical details related to the drilling program have been organized in Appendix C as follows:

<u>Appendix</u>	<u>Contents</u>
C-1	Utility Location/Well Permits
C-2	Equipment Decontamination
C-3	Air Monitoring
C-4	OVA Field Screening Methodology
C-5	Monitoring Well Construction
C-6	Monitoring Well Development

Prior to installing soil borings and monitoring wells at the site, the proper well permits were obtained from the Puerto Rico Department of Natural Resources (Appendix C-1). A utility location check was also performed prior to any drilling activities.

The equipment decontamination procedures used for drilling and the air monitoring conducted during drilling activities are discussed in Appendices C-2 and C-3, respectively.

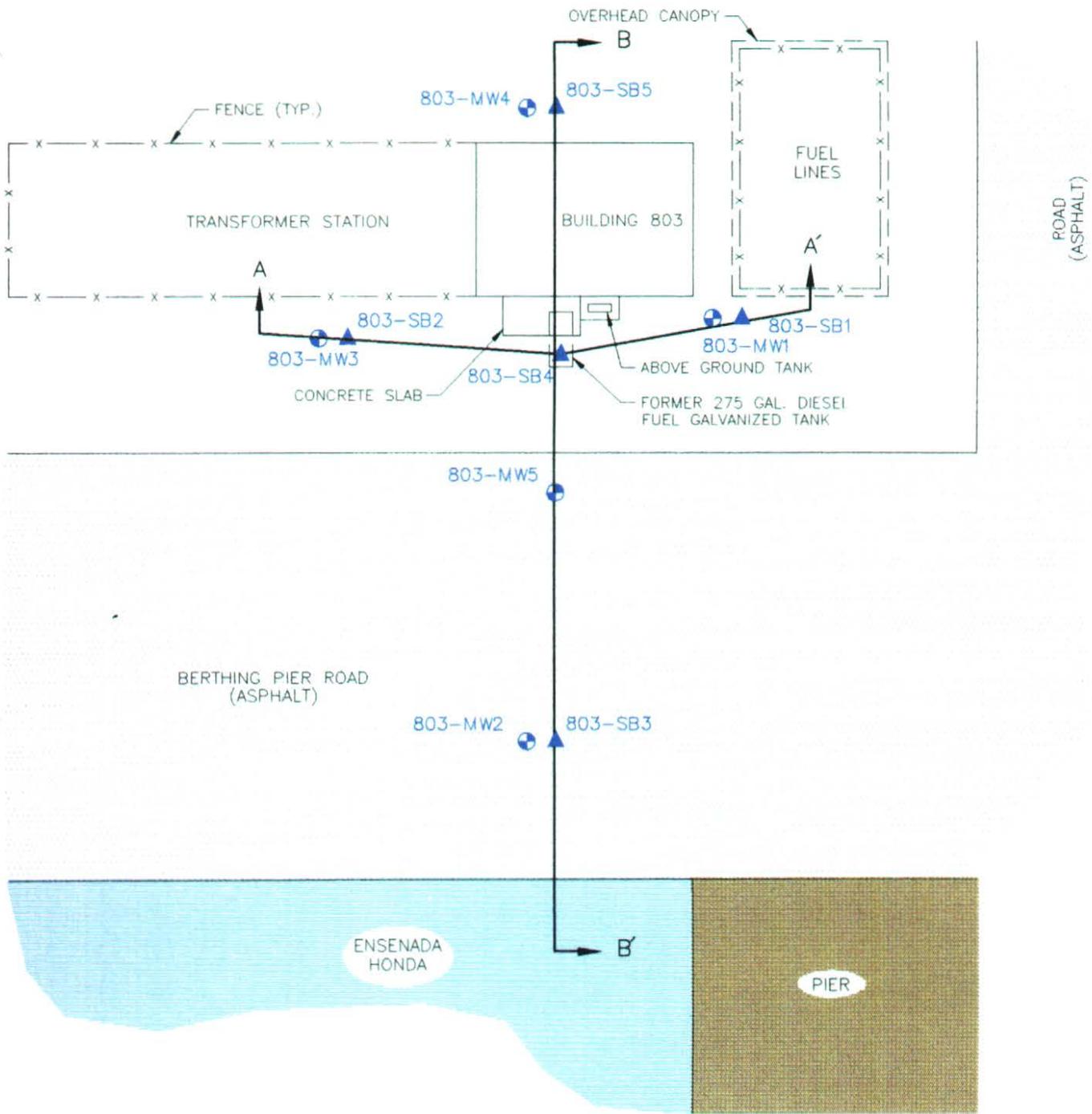
3.1.1 Soil Boring Installation

Five soil borings were installed (803-SB1 through 803-SB5) to determine and delineate the horizontal and vertical extent of soil contamination (Figure 3-1). Although the contract for the SC included ten soil borings, only five were installed because the abundance of underground and aboveground utilities (see Figure 1-3) limited the potential soil boring locations in the immediate vicinity of the former tank location, and the five soil borings installed were sufficient to define the extent of soil and ground-water contamination.

Soil borings were advanced to the water table using a 2-foot long stainless-steel, split-spoon sampler inside a hollow-stem auger. Standard penetration test procedures, in accordance with ASTM D-1586, were followed during collection of soil samples. Soil samples were collected continuously at 2-foot intervals to the water table, approximately 8 to 10 feet bls. Soil types were described in accordance with the Unified Soil Classification System (USCS). Soil boring lithologic logs are presented in Appendix A.

3.1.2 Soil Field Screening and Sampling

Soil samples were collected at 2-foot intervals until the soil/water interface was encountered. Soil samples were collected in 16-ounce glass jars, covered by a sheet of aluminum foil, and securely capped. Once collected, each soil sample was analyzed within five minutes using an OVA. In addition, field analyses utilizing GC and TPH analyzer equipment were performed on selected samples from each soil boring. The methodologies for OVA screening are described in detail in Appendix C-4.



SCALE IN FEET

LEGEND

● MONITORING WELL LOCATION

▲ SOIL BORING LOCATION

B B' GEOLOGIC CROSS-SECTION LOCATION



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SITE #803

SOIL BORING AND MONITORING WELL LOCATIONS | **FIGURE 3-1**

The OVA screening results, summarized in Table 3-1, indicate that none of the 18 soil samples tested with the OVA contained detectable concentrations of hydrocarbon vapors or natural organic vapors (e.g., methane). Due to the shallow water table at the site (approximately 8 feet bls) and the lack of detectable hydrocarbon vapors using the OVA, one soil sample (from four to six feet bls) was selected from each soil boring for additional field screening by modified EPA Method 602 for benzene, toluene, ethylbenzene, and xylenes (BTEX) using a GC; and by modified EPA Method 418.1 for TPH using a TPH analyzer. Field screening analysis reports are presented in Appendix D. Additional sample volume was collected in each soil boring from the same four to six foot bls interval for laboratory confirmation analyses by EPA Methods 602 and 418.1. Field screening and laboratory analytical results are presented and compared in Section 4-1.

3.1.3 Ground-Water Field Screening

After each soil boring was completed to below the water table, a depth of approximately 8 feet bls, the hollow stem auger was advanced an additional 4 feet, to approximately 12 feet bls. Ground-water samples were then collected from the open borehole with a disposable bailer. The samples were analyzed for total BTEX (sum of benzene, toluene, ethylbenzene, and xylenes) with a GC using modified EPA Method 602 and with a TPH analyzer for TPH using modified EPA Method 418.1. Samples were tested within 24 hours of collection to assist in determining the permanent location of the monitoring wells. All five soil boring water samples tested were below the laboratory detection limits for TPH and BTEX constituents. Laboratory reports are presented in Appendix D.

Based on the field screening results, four of the soil borings installed (803-SB1, 803-SB2, 803-SB3 and 803-SB5) were converted to monitoring

TABLE 3-1
SOIL ORGANIC VAPOR ANALYSIS (PPM)

SITE #803
ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO

Boring No./ Well ID	Date Sampled	Sample Depth (ft BLS)	Total Organic Vapors	Total Methane Vapors ¹	Total Petroleum Hydrocarbon Vapors
803-SB1	3/8/94	0-2	<1.0	<1.0	0
		2-4	<1.0	<1.0	0
		4-6	<1.0	<1.0	0
		6-8	<1.0	<1.0	0
803-SB2	3/9/94	0-2	<1.0	<1.0	0
		2-4	<1.0	<1.0	0
		4-6	<1.0	<1.0	0
		6-8	<1.0	<1.0	0
803-SB3	3/9/94	0-2	<1.0	<1.0	0
		2-4	<1.0	<1.0	0
		4-6	<1.0	<1.0	0
803-SB4	3/9/94	0-2	<1.0	<1.0	0
		2-4	<1.0	<1.0	0
		4-6	<1.0	<1.0	0
		6-8	<1.0	<1.0	0
803-SB5	3/9/94	0-2	<1.0	<1.0	0
		2-4	<1.0	<1.0	0
		4-6	<1.0	<1.0	0

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Notes:

ppm - parts per million

bis - below land surface

¹Although methane is the primary organic vapor detected, other naturally occurring vapors may be included in this measurement.

wells (803-MW1 through 803-MW4) to define the horizontal extent of contamination (see Figure 3-1). The fifth soil boring (803-SB4), which was installed near the center of the former UST #803 location, was converted to a monitoring well (803-MW5) to determine the maximum concentrations of petroleum hydrocarbons in the ground water due to activities at the former location of UST #803. Monitoring well 803-MW5 was installed approximately 15 feet south of 803-SB4 because overhead and underground utilities prevented installing the well past nine feet bls in the vicinity of 803-SB4.

3.1.4 Monitoring Well Construction

Five monitoring wells (803-MW1, 803-MW2, 803-MW3, 803-MW4, and 803-MW5) were constructed to determine the presence or absence of dissolved petroleum hydrocarbons at the site (see Figure 3-1). The wells were constructed to allow for representative sampling of the ground water at the site. All well materials and well construction equipment were thoroughly decontaminated prior to construction of each well. Wells were developed by pumping to remove fine-grained sediments (Table 3-2). A detailed description of monitoring well construction and development procedures is presented in Appendices C-5 and C-6, respectively.

A monitoring well completion summary is included in Table 3-3. Monitoring well construction diagrams are presented in Appendix B.

3.2 Slug Tests

Slug tests were performed on March 21 and May 14, 1994, in monitoring wells 803-MW2 and 803-MW5, respectively, to determine the aquifer characteristics beneath the site. Slug tests were performed by quickly removing a slug of water from the well using a centrifugal pump and measuring the recovery rate with a data logger and associated pressure transducer. The slug

TABLE 3-2
MONITORING WELL DEVELOPMENT SUMMARY

SITE #803
ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO

Monitoring Well ID	Development Method	Development Date	Approximate Gallons Developed	Number of Well Volumes Developed
803-MW1	Pumping and Surging ¹	3/10/94	15	16
803-MW2	Pumping and Surging ¹	3/10/94	15	15
803-MW3	Pumping and Surging ¹	3/11/94	15	16
803-MW4	Pumping and Surging ¹	3/11/94	15	15
803-MW5	Pumping and Surging ¹	4/20/94	30	30

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Notes:

¹Development method consisted of pumping with a centrifugal pump and surging by varying the flow rate and quickly raising and lowering pump intake throughout saturated portion of the screen.

TABLE 3-3
MONITORING WELL COMPLETION SUMMARY

SITE #803
ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO

Monitoring Well ID	803 - MW1	803 - MW2	803 - MW3	803 - MW4	803 - MW5
Date Installed	3/10/94	3/10/94	3/10/94	3/11/94	4/19/94
Total Well Depth (ft. bls)	15.0	15.0	15.0	15.0	15.0
Top of Casing Elevation (ft. msl)	9.76	9.05	9.61	9.13	9.14
Casing Diameter (inch)/type	2/Sch 40 PVC				
Casing Length(s) (ft)	5.0	5.0	5.0	5.0	5.0
Screen Type	Sch 40 PVC				
Screen Slot Size (in)	0.010	0.010	0.010	0.010	0.010
Screen Length (ft)	10.0	10.0	10.0	10.0	10.0
Screen Interval (ft. bls)	5-15	5-15	5-15	5-15	5-15
Notes:					
msl = mean sea level					
bls = below land surface					

test results were plotted on semi-logarithmic graphs and analyzed using the Bouwer and Rice method (Bouwer and Rice, 1976). The hydraulic conductivities calculated from the slug tests were identical in both wells tested, 0.23 feet per day (ft/day). The slug test raw data, graphs, and calculations are presented in Appendix E.

The slug test results indicate that the unconsolidated fill material has moderate permeability that is higher than the typical silty clay soils found elsewhere at NAVSTA Roosevelt Roads.

3.3 Water Elevation Measurements

The top-of-casing elevations of the five monitoring wells at Site 803 were surveyed by a licensed surveyor and referenced to mean sea level (msl).

The depth to water was measured from the top of each well casing on four dates (March 12, March 21, April 25 and May 11, 1994). The water elevations were measured with an electronic interface probe, which is accurate to within 0.01 feet. Ground-water and monitoring well elevation information is presented in Table 3-4. The information was used to generate four ground-water elevation contour maps (Figures 3-2 through 3-5).

The ground-water elevation contours on March 12 and 21, 1994, indicate a relatively uniform, average ground-water gradient of 0.002 feet/foot (ft/ft) towards the south-southwest into Ensenada Honda. The ground-water elevation contours on April 25, and May 11, 1994, indicate a slightly more complicated ground-water flow pattern, but the general ground-water flow direction from the former UST location is still to the south-west towards Ensenada Honda. The average gradient is 0.0044 ft/ft.

TABLE 3-4
GROUND-WATER ELEVATION DATA

SITE #803
ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO

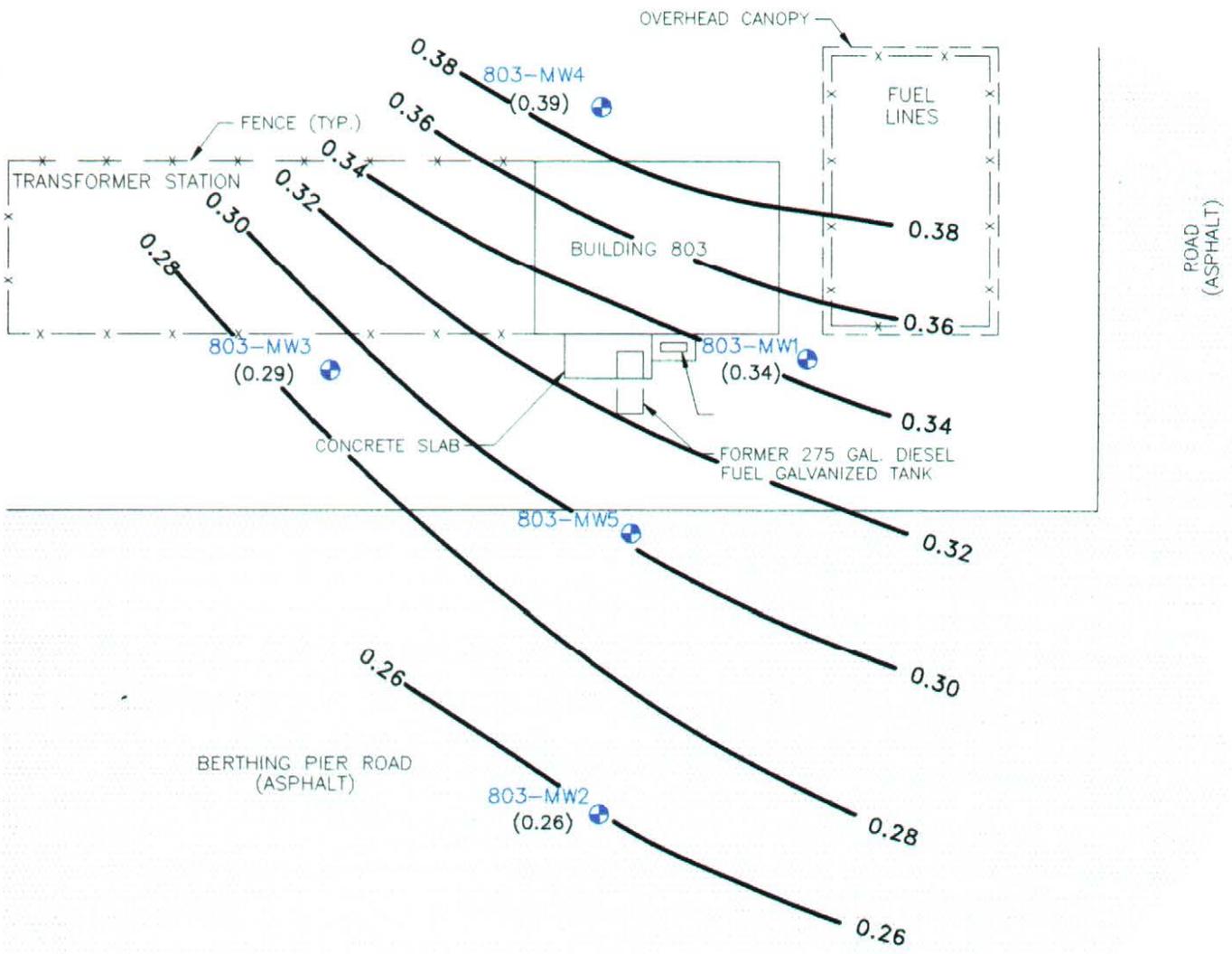
Monitoring Well ID	Casing Elevation (ft. above msl)	WATER ELEVATIONS (ft. above msl)			
		3/12/94	3/21/94	4/25/94	5/11/94
803-MW1	9.76	0.35	0.34	0.23	0.26
803-MW2	9.05	0.27	0.26	0.14	0.14
803-MW3	9.61	0.28	0.29	0.15	0.14
803-MW4	9.13	0.45	0.39	0.13	0.12
803-MW5	9.14	N/A	N/A	0.12	0.12

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Notes:

msl – mean sea level

N/A – data not available; well 803-MW5 was not installed until 4/19/94.



LEGEND

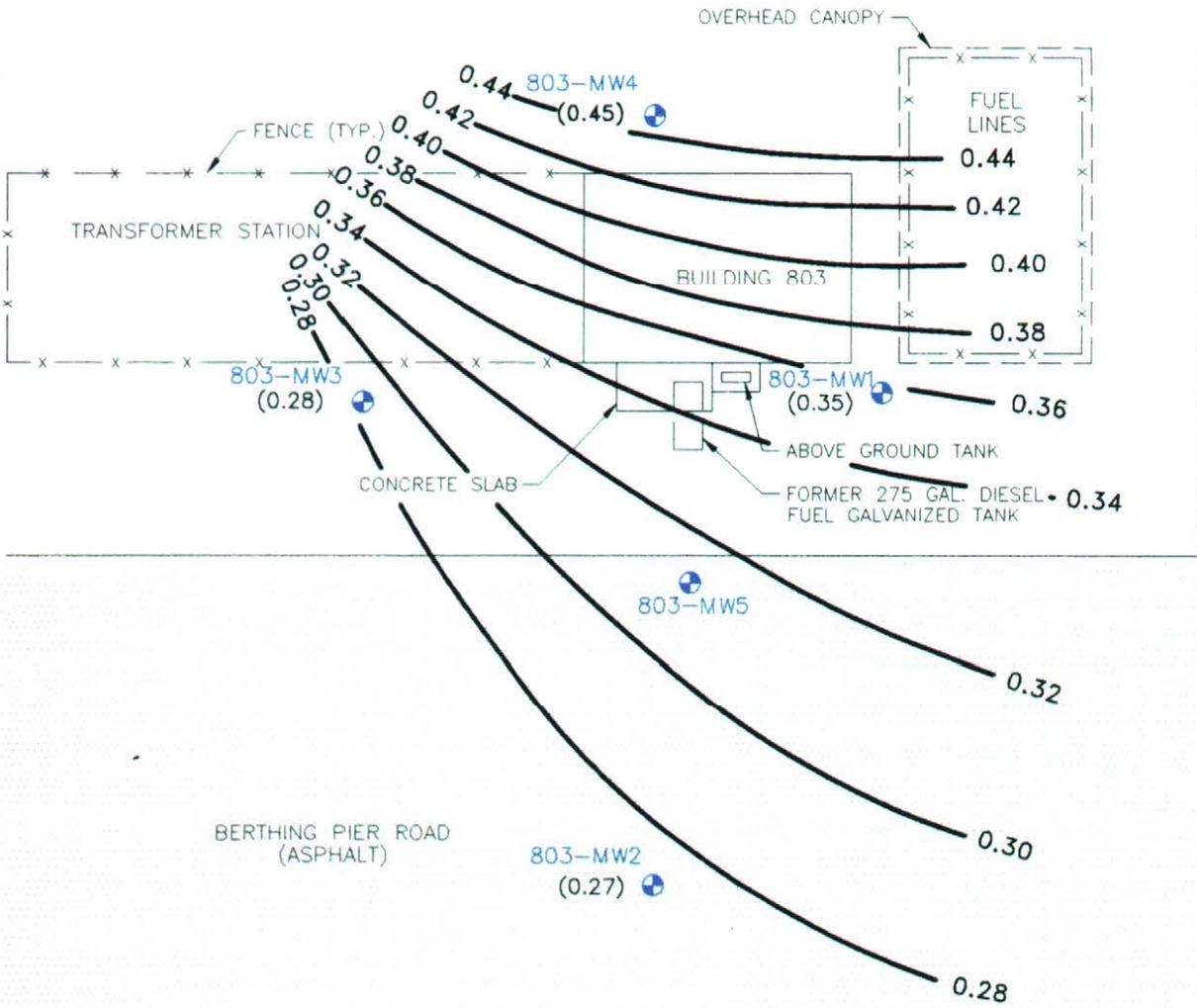
-  MONITORING WELL LOCATION
- (0.29) GROUND-WATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
-  0.30 GROUND-WATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL)



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GROUND WATER ELEVATION CONTOURS (03/12/94) | **FIGURE 3-2**



SCALE IN FEET

LEGEND

- MONITORING WELL LOCATION
- (0.27) GROUND-WATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- 0.30 GROUND-WATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL)

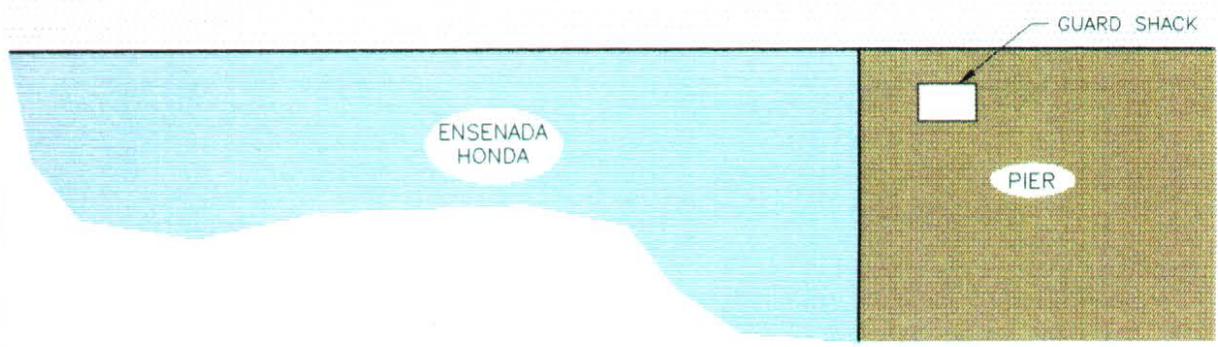
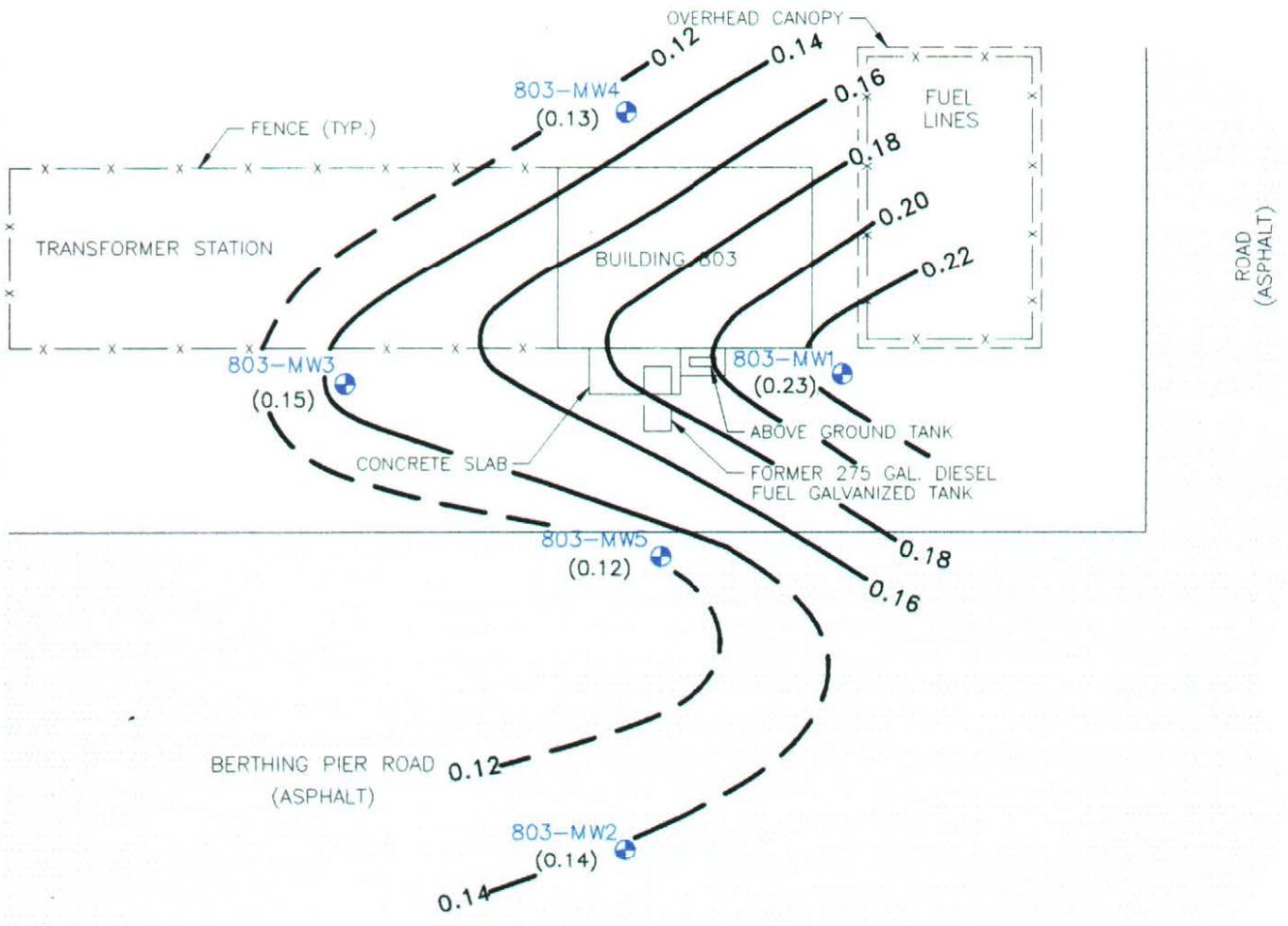


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SITE #803

GROUND WATER ELEVATION CONTOURS (03/21/94) | **FIGURE 3-3**



SCALE IN FEET

LEGEND

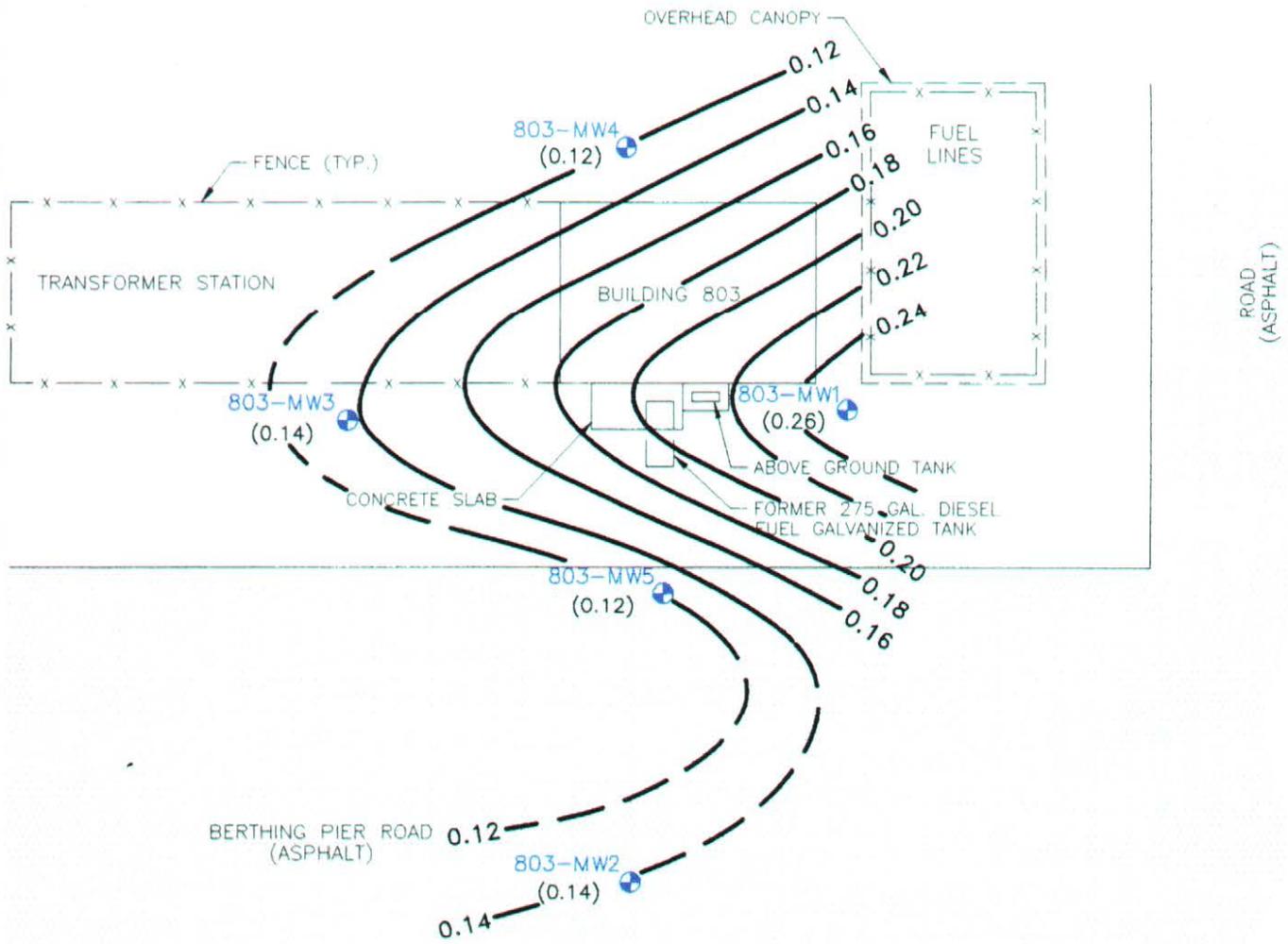
- MONITORING WELL LOCATION
- (0.14) GROUND-WATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- 0.20 GROUND-WATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL) DASHED WHERE INFERRED



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GROUND WATER ELEVATION CONTOURS (04/25/94) | **FIGURE 3-4**



LEGEND

-  **MONITORING WELL LOCATION**
- (0.14)** **GROUND-WATER ELEVATION**
(FEET ABOVE MEAN SEA LEVEL)
- 0.20** **GROUND-WATER ELEVATION**
CONTOUR (FEET ABOVE MEAN SEA LEVEL) DASHED WHERE
INFERRED



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**GROUND WATER ELEVATION
CONTOURS (05/11/94)**

**FIGURE
3-5**

3.4 Ground-Water Sampling

Ground-water samples were collected to assess the presence or absence of dissolved petroleum hydrocarbons in the ground water at the site. Ground-water samples were collected from monitoring wells 803-MW1 through 803-MW4 on March 12, 1994, and from monitoring well 803-MW5 on April 21, 1994 (monitoring well 803-MW5 was sampled at a later date than the other wells because it could not be constructed until April 19, 1994, due to utility location difficulties). Water samples were placed on ice and transported to a certified laboratory for analyses. Ground-water samples from each monitoring well on site were analyzed for BTEX (EPA Method 602) and TPH (EPA Method 418.1). In addition, ground water from monitoring wells 803-MW2, 803-MW4, and 803-MW5 were sampled for analysis by EPA Method 239.1, (total lead), and wells 803-MW2, 803-MW3 and 803-MW5 were sampled for analysis by EPA Method 610 (polynuclear aromatic hydrocarbons).

To ensure that contaminants were not introduced to the ground-water samples before, during, or after sample collection, field blanks, equipment blanks, and trip blanks were also collected. Ground-water sampling procedures and QA/QC guidelines are detailed in Appendix F.



Laboratory Analytical Results

SECTION 4.0 - LABORATORY ANALYTICAL RESULTS

4.1 Soil Analytical Results

A summary of the field screening and laboratory soil analyses results is presented in Table 4-1. Soil field screening results are presented in Appendix D and laboratory analytical reports are presented in Appendix G. Laboratory analytical results for all samples were below the laboratory detection limits for TPH (5.0 milligrams per kilogram (mg/kg)) and BTEX constituents (1.0 microgram per kilogram), and therefore, below the Puerto Rico Environmental Quality Board (PREQB) UST standard for contaminated soils of 100 mg/kg of TPH.

4.2 Ground-Water Analytical Results

Ground-water laboratory analytical results (Table 4-2) indicate ground-water from the five wells on site are below the laboratory detection limits for TPH (5.0 milligrams per liter (mg/L)) and BTEX constituents (1.0 micrograms per liter (ug/L)), and therefore, below the PREQB standards for contaminated water. The PREQB standards for contaminated ground water at UST sites are: above 50 milligrams per liter (mg/L) of TPH, above 5.0 ug/L of benzene and above 50 ug/L of total BTEX.

Results of analytical tests for total lead and polynuclear aromatic hydrocarbons (PAH) indicate these constituents exist in monitoring wells 803-MW2 and 803-MW5, respectively. Monitoring well 803-MW2 contains lead (0.0051 mg/L), and monitoring well 803-MW5 contains the following PAHs; acenaphthene (77 ug/L), fluorene (32 ug/L), phenanthrene+anthracene (16 ug/L) and naphthalene (25 ug/L). The lead concentrations are below the United States Environmental Protection Agency (USEPA) maximum contaminant level (MCL) of 0.05 mg/L, and therefore are not significant. There are no USEPA MCLs for the PAH constituents detected in monitoring well 803-MW5. The PAHs detected

TABLE 4-1
SUMMARY OF SOIL ANALYTICAL RESULTS

SITE #803
ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO

Boring ID	Sample Depth (ft. bls)	ECG Laboratories (field screening)		Savannah Laboratories	
		Modified EPA Method 418.1 Field TPH (mg/kg)	Modified EPA Method 602 Field Total BTEX (ug/kg)	EPA Method 418.1 TPH (mg/kg)	EPA Method 602 Total BTEX (ug/kg)
Puerto Rico EQB ¹ UST Standard		100	NS	100	NS
803-SB1	4-6	<10	<5	<10	<5
803-SB2	4-6	<10	<5	<10	<5
803-SB3	4-6	<10	<5	<10	<5
803-SB4	4-6	<10	<5	<10	<5
803-SB5	4-6	<10	<5	<10	<5
803-Duplicate ²	4-6	---	---	<10	<5

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Notes:

¹EQB – Environmental Quality Board

²803 – Duplicate sample collected from _____.

TPH – Total Petroleum Hydrocarbon

Total BTEX – Sum of benzene, toluene, ethylbenzene and total xylenes

ug/kg – micrograms per kilogram

mg/kg – milligrams per kilogram

UST – underground storage tank

NS – not analyzed

--- – not analyzed

TABLE 4-2
SUMMARY OF GROUND-WATER ANALYTICAL RESULTS

SITE #803
ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO

Monitoring Well ID	Concentrations (ug/L unless otherwise specified)										
	Date Sampled	Benzene	Toluene	Ethyl-Benzene	Total Xylenes ³	Total BTEX ⁴	MTBE	PAH ⁵	Total Naphthalenes	Lead (mg/L)	TPH (mg/L)
U.S. EPA MCL ¹	-	1.0	1,000	700	10,000	NS	NS	NS	NS	0.05	NS
Puerto Rico EQB ² UST Standards	-	5.0	NS	NS	NS	50	NS	NS	NS	NS	50
803 - MW 1	3/12/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	----	----	----	<1.0
803 - MW 2	3/12/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	<10	<10	<0.0050	<1.0
803 - MW 3	3/12/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	<10	<10	----	<1.0
803 - MW4	3/12/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	----	----	<0.0050	<1.0
803 - MW5	4/21/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	125	32	<0.0050	<1.0
803 - Duplicate ⁶	3/12/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	<10	<10	0.0061	<1.0
803 - Bailer Blank ⁷	3/12/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	----	----	----	<1.0
803 - Field Blank	3/12/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	----	----	----	----
803 - Trip Blank	-	<1.0	<1.0	<1.0	<1.0	<4.0	<10	----	----	----	----
803 - Field Blank	4/21/94	<1.0	<1.0	<1.0	<1.0	<4.0	<10	----	----	----	----

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Notes:

¹MCL - Maximum Contaminant Level (drinking water supplies)

²EQB - Environmental Quality Board

³Total Xylenes - Sum of o, m, p-xylenes

⁴Total BTEX - Sum of benzene, toluene, ethylbenzene and total xylenes

⁵PAH - Polynuclear Aromatic Hydrocarbons (excluding naphthalenes)

⁶Duplicate sampled collected from 803 - MW2

⁷Bailer blank = equipment blank collected from a new disposable teflon bailer.

TPH - Total Petroleum Hydrocarbons

ug/L - micrograms per liter

mg/L - milligrams per liter

MTBE - Methyl-tert-butyl ether

---- - constituent not analyzed

NS - no standard

Shaded concentrations indicate constituents detected above the laboratory detection limits.

indicate a small amount of diesel fuel contamination exists at the site. Based on laboratory results from the two other monitoring wells sampled for PAH analysis, 803-MW2 and 803-MW3, the PAH constituents are limited to a small area in the vicinity of the former UST location. Since monitoring wells 803-MW2 and 803-MW3 are both downgradient of the former UST location (see Figures 3-2 through 3-5), the existing PAH contamination has not moved significantly from its source.

A summary of the ground-water laboratory analytical results and the QA/QC laboratory analytical results are presented in Table 4-2. The ground-water laboratory analytical reports are presented in Appendix G.



Qualitative Risk Assessment (QRA)

SECTION 5.0 - QUALITATIVE RISK ASSESSMENT (QRA)

This Qualitative Risk Assessment (QRA) identifies the population potentially at risk of exposure to chemicals present in, or released from, soil and ground water at Site 803. The QRA contains a discussion of exposure pathways and includes a qualitative evaluation of the magnitude of the risk. An exposure pathway describes the path by which a chemical migrates from the source of contamination to a human receptor. The chemicals of concern, possible transport media, exposure "routes" (means by which a chemical comes in contact with a receptor), and an analysis of the potential receptors are taken into account to determine an exposure pathway.

The results of the QRA are utilized to qualitatively determine the health risk to potential receptors of contaminants found at Site 803.

5.1 Nature and Extent of Release

Petroleum hydrocarbon constituents were detected at Site 803 during the tank removal activities in 1993. Based on laboratory information pertaining to the five soil borings and five monitoring wells installed during this SC investigation, petroleum hydrocarbons were detected at low concentrations in ground-water samples (see Table 4-2). No detectable petroleum hydrocarbons were detected in the soil samples collected at the site (see Table 4-1).

The soil and ground-water samples collected and analyzed at site 803 did not contain detectable concentrations of BTEX constituents.

5.2 Chemicals of Concern

Although petroleum products contain a large number of compounds, those compounds present in the ground water that represent a potential risk to human health and the environment are volatile organic aromatics (consisting of benzene,

toluene, ethylbenzene, and xylenes), naphthalenes, and lead. Of those compounds listed, only benzene and lead are known human carcinogens; toluene, ethylbenzene, xylene, and naphthalenes are non-carcinogenic system toxicants.

Of the above listed carcinogens, only lead has been detected at the site. Therefore, the qualitative risk assessment will focus on the qualitative human health impacts of lead in the ground water.

5.3 Exposure Assessment

An exposure assessment describes the potential receptors of the compounds of concern and pathways that the compounds of concern may follow.

5.3.1 Human Receptors

Human receptors on the naval station include personnel working at and around fueling pier #3. The nearest residences on NAVSTA Roosevelt Roads are more than one-quarter mile east of the site. The nearest residences off NAVSTA Roosevelt Roads are three miles west of the site.

The potential for human contact with the compounds of concern is low because the compounds exist at low concentrations (below the USEPA MCLs) in the ground water beneath the ground surface.

5.3.2 Environmental Receptors

The potential for migration of compounds of concern to environmental receptors is primarily due to movement of ground water off the site towards the adjacent bay (Ensenada Honda).

5.3.3 Exposure Pathways

An exposure pathway is the route a compound follows from its source to an exposed potential receptor (human population) and describes a mechanism by which the population can come into contact with the compound. Four elements must be present to complete an exposure pathway:

1. a source and mechanism of release for a compound of concern (e.g., storage tank leak);
2. a feasible environmental transport route (e.g. dissolved ground-water constituents);
3. an exposure point of potential contact with receptors (e.g. a potable well);
4. an exposure route allowing receptors to come into contact with the compound(s) (e.g., inhalation of vapors, ingestion of ground water).

If any one of these four elements is missing, the exposure pathway is considered incomplete and, therefore, does not contribute to the potential exposure from the site. The first element, a source/release mechanism (storage tank leak and/or spills) has been shown to exist at the site.

5.3.4 Ground-Water Consumption Pathway

Potable water in eastern Puerto Rico is primarily recovered from the nearby rain forest, El Yunque. El Yunque is located approximately five miles west of NAVSTA Roosevelt Roads. Based on conversations with U.S. Navy personnel, Puerto Rico Department of Natural Resources personnel, and water supply personnel in the town of Fajardo (located approximately 7 miles northwest of the naval station), the potable water supply for the naval station, the town of Ceiba, (Figure 1-2) and Fajardo is from surface-water sources in El Yunque. The naval station has a gravity feed distribution system from the rain forest to the water treatment plant on the naval station.

Due to the availability of surface water in eastern Puerto Rico, ground water is not exploited as a source of potable water; therefore, a potential ground-water exposure point does not exist.

5.3.5 Ingestion Pathway

The only potential ingestion pathway of the compounds of concern is through consumption of fish from Bahia de Puerca. However, this is not

a feasible pathway for two reasons: (1) no commercial fishing is allowed in Ensenada Honda; and (2) the compounds of concern in the ground water do not exist above PREQB standards.

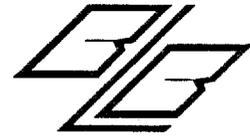
5.3.6 Inhalation Pathway

Inhalation of the compounds of concern may potentially occur by vaporization of compounds from the ground water into the air. The potential for this pathway is low because the ground water is over eight feet bls.

5.4 Risk Evaluation

The results of the risk assessment indicate that due to incomplete exposure pathways, the potential for human contact with the compounds of concern is extremely low. As described in this section, each viable exposure pathway is missing one or two of the four elements to complete an exposure pathway. The missing elements are a viable exposure point and/or a viable exposure route.

The contaminants of concern, therefore, do not present a hazard to personnel who visit, work, or live at the NAVSTA Roosevelt Roads.



Conclusions and Recommendations

SECTION 6.0 - CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This site characterization was conducted to evaluate the presence of petroleum hydrocarbons in the soil and ground water resulting from the former UST #803 located beneath Building 803.

Based on the information obtained during this investigation, the following conclusions have been drawn:

- 1) The ground water does not contain detectable concentrations of either TPH or BTEX constituents. The ground water does contain detectable concentrations of lead and polynuclear aromatic hydrocarbons (PAHs), but at low concentrations below the applicable PREQB UST standards and USEPA MCLs.
- 2) Lead was detected in one (803-MW2) out of three monitoring wells tested at 0.0051 mg/L, which is below the USEPA MCL of 0.05 mg/L.
- 3) PAHs were detected in only one (803-MW5) of three monitoring wells sampled, at a total concentration of 150 ug/L. There are no PREQB standards for PAHs at UST sites in Puerto Rico, and there are no USEPA MCLs for the PAH constituents detected in monitoring well 803-MW5.
- 4) The soil samples collected at the site do not contain detectable concentrations of either TPH or BTEX constituents.
- 5) Slug test results indicate the permeability of the surficial sediments at the site 0.23 feet per day, which indicates moderately transmissive material exists beneath the site.
- 6) Based on results of the qualitative risk assessment, the ground-water that contains low concentrations of lead and PAHs do not pose a threat to human health. Therefore, treatment of the ground water impacted by lead and PAHs is not necessary.

6.2 Recommendations

Based on the information contained in this report, no further actions or assessments are recommended at this site.



References

7.0 REFERENCES

Freeze, R. Allen and John A. Cherry, Groundwater, Prentice-Hall, Inc., 1979.

Bouwer, H. and R.C. Rice, "A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely Penetrating Wells". Water Resources Research, Vol. 12, No. 3, 1976.

IMECO, "Final Closure Plan Report"; Contract No. N62470-91-C-1240, July 1993.



Appendix A

APPENDIX A
SOIL BORING LITHOLOGIC LOGS

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>	Location <p style="text-align: center;">Site #803 Roosevelt Roads, U.S. Naval Station Ceiba, Puerto Rico</p>
Date: <u>03/09/94</u>	Water Table <p style="text-align: center;">~ 8' BLS</p>
Boring No.: <u>803-SB3</u>	
Record By: <u>D. Press</u>	
Drill Type: <u>Hollow Stem Auger</u>	
Weather: <u>Sunny, 90°</u>	

Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SAND; pale yellow (7/4), fine grained, sub-angular, shell fragments and pebbles, dry.
2	PH	2	4	NA	SILT; light olive brown (5/3), some fine sand, shell fragments, moist.
3	SPT	4	6	7-8-6-4	SAND: yellow (7/6), fine to medium grained, sub-angular, shell fragments, some silt, moist.
4	SPT	6	8	4-6-5-5	Same as above, moist.
5	SPT	8	10	4-3-1-1	Same as above, wet.
6	SPT	10	12	3-2-2-4	SAND: gray (6/1), medium grained, sub-angular, shell fragments, wet.

*Remarks PH – Post Hole
 SPT – Standard Penetration Test
 NA – Not Available

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>	Location <p style="text-align: center;">Site #803 Roosevelt Roads, U.S. Naval Station Ceiba, Puerto Rico</p>
Date: <u>03/09/94</u>	Water Table <p style="text-align: center;">~ 8' BLS</p>
Boring No.: <u>803-SB4</u>	
Record By: <u>D. Press</u>	
Drill Type: <u>Hollow Stem Auger</u>	
Weather: <u>Sunny, 90°</u>	

Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SAND; light olive brown (5/6), fine grained, sub-angular, pebbles, dry.
2	PH	2	4	NA	Same as above.
3	SPT	4	6	12-16- 19-20	SAND; pale yellow (8/3), medium grained, shell fragments, dry.
4	SPT	6	8	14-13- 11-7	Same as above, moist.
5	SPT	8	10	4-5-6-6	Same as above, wet.
6	SPT	10	12	3-4-3-2	SAND; light olive gray (6/2), fine to medium grained, sub-angular, shell fragments, wet.

*Remarks PH – Post Hole
 SPT – Standard Penetration Test
 NA – Not Available

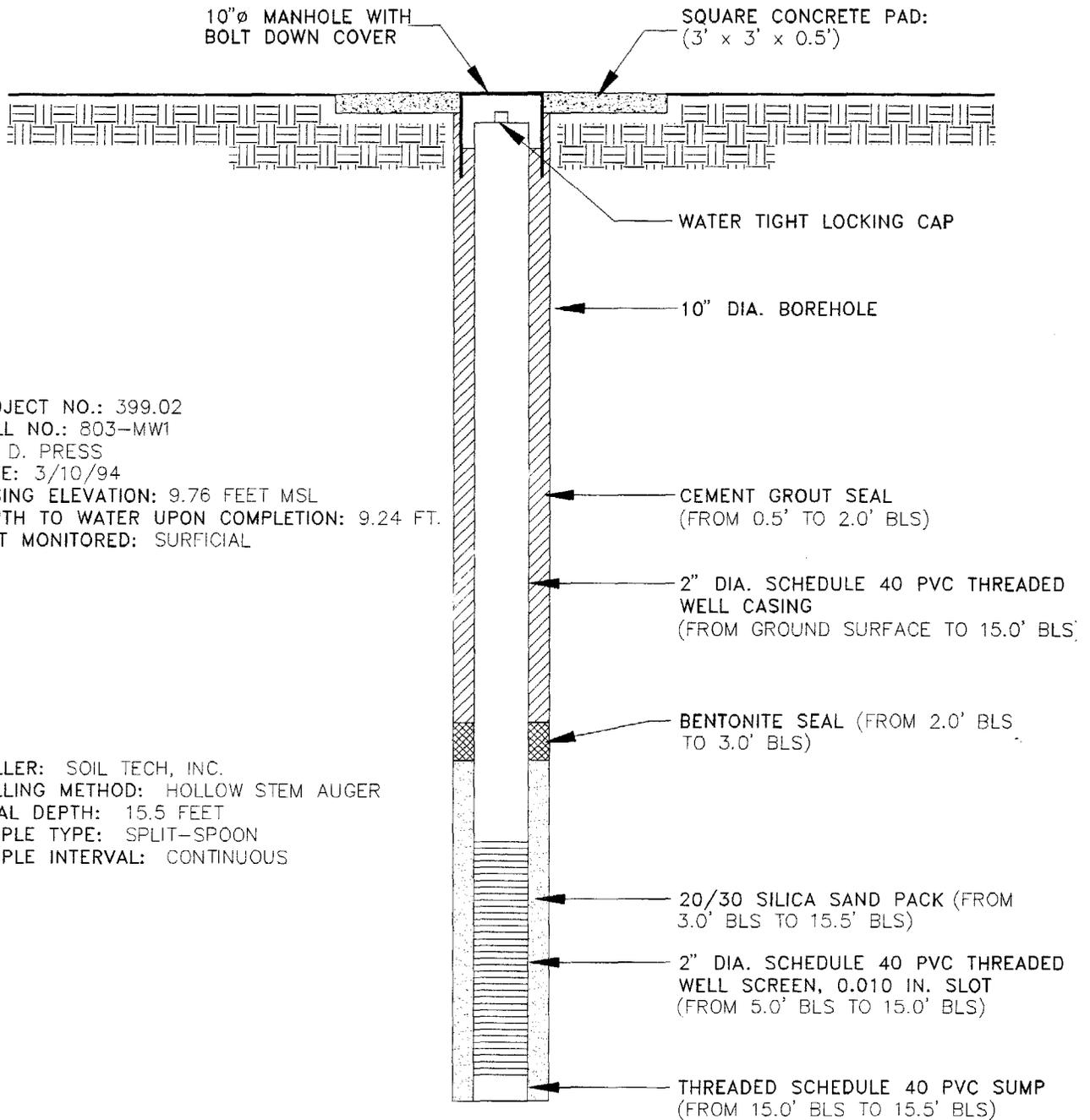


Appendix B



APPENDIX B
MONITORING WELL CONSTRUCTION DIAGRAMS

803-MW1



PROJECT NO.: 399.02
 WELL NO.: 803-MW1
 BY: D. PRESS
 DATE: 3/10/94
 CASING ELEVATION: 9.76 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 9.24 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 15.5 FEET
 SAMPLE TYPE: SPLIT-SPOON
 SAMPLE INTERVAL: CONTINUOUS

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.

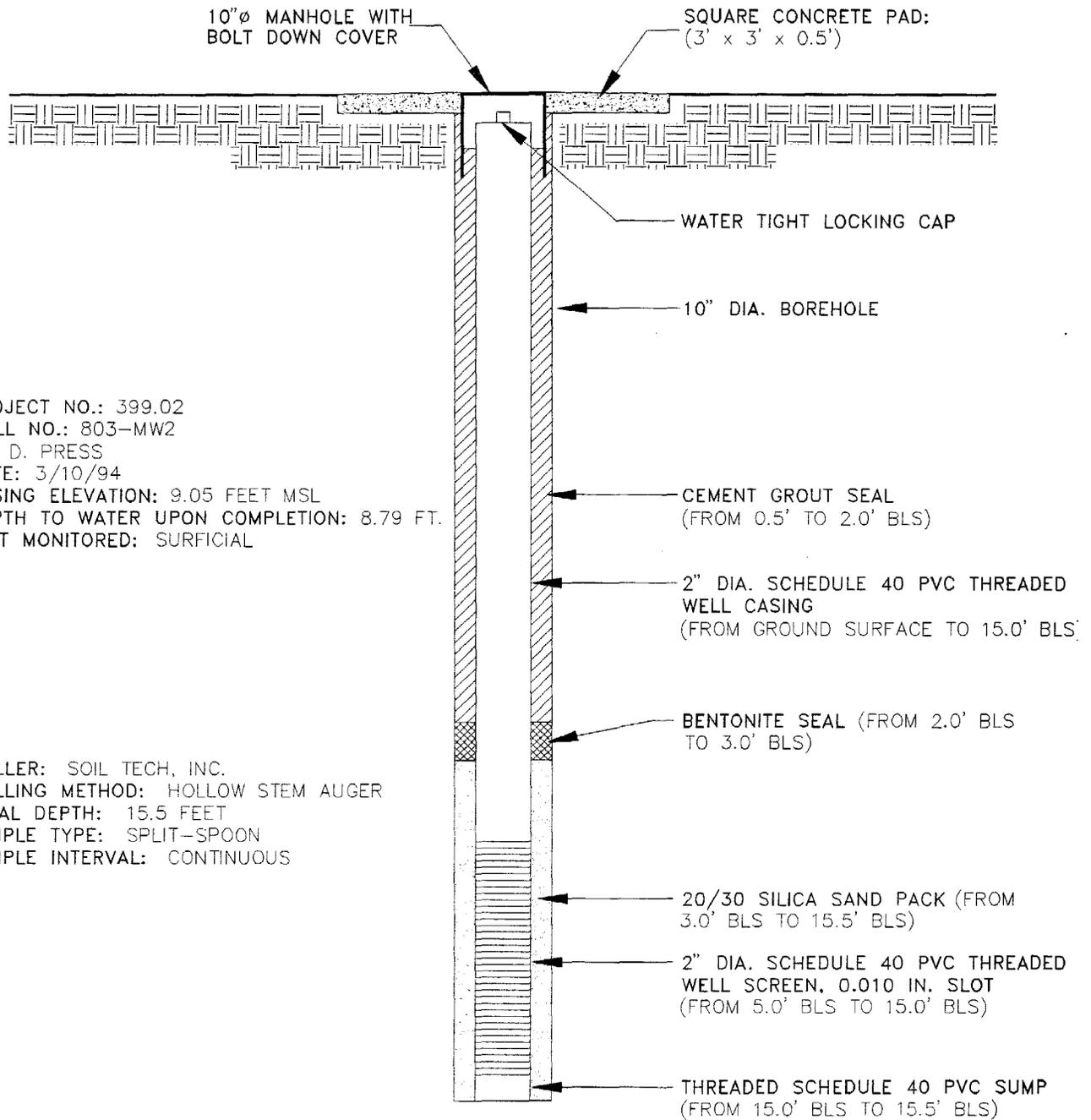
ENGINEERS & SCIENTISTS

NAVAL SECURITY GROUP ACTIVITY - SABANA SECA
 CEIBA, PUERTO RICO

TANK #803

MONITORING WELL 803-MW1 | FIGURE
CONSTRUCTION DETAILS

803-MW2



PROJECT NO.: 399.02
 WELL NO.: 803-MW2
 BY: D. PRESS
 DATE: 3/10/94
 CASING ELEVATION: 9.05 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 8.79 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 15.5 FEET
 SAMPLE TYPE: SPLIT-SPOON
 SAMPLE INTERVAL: CONTINUOUS

(DRAWING NOT TO SCALE)

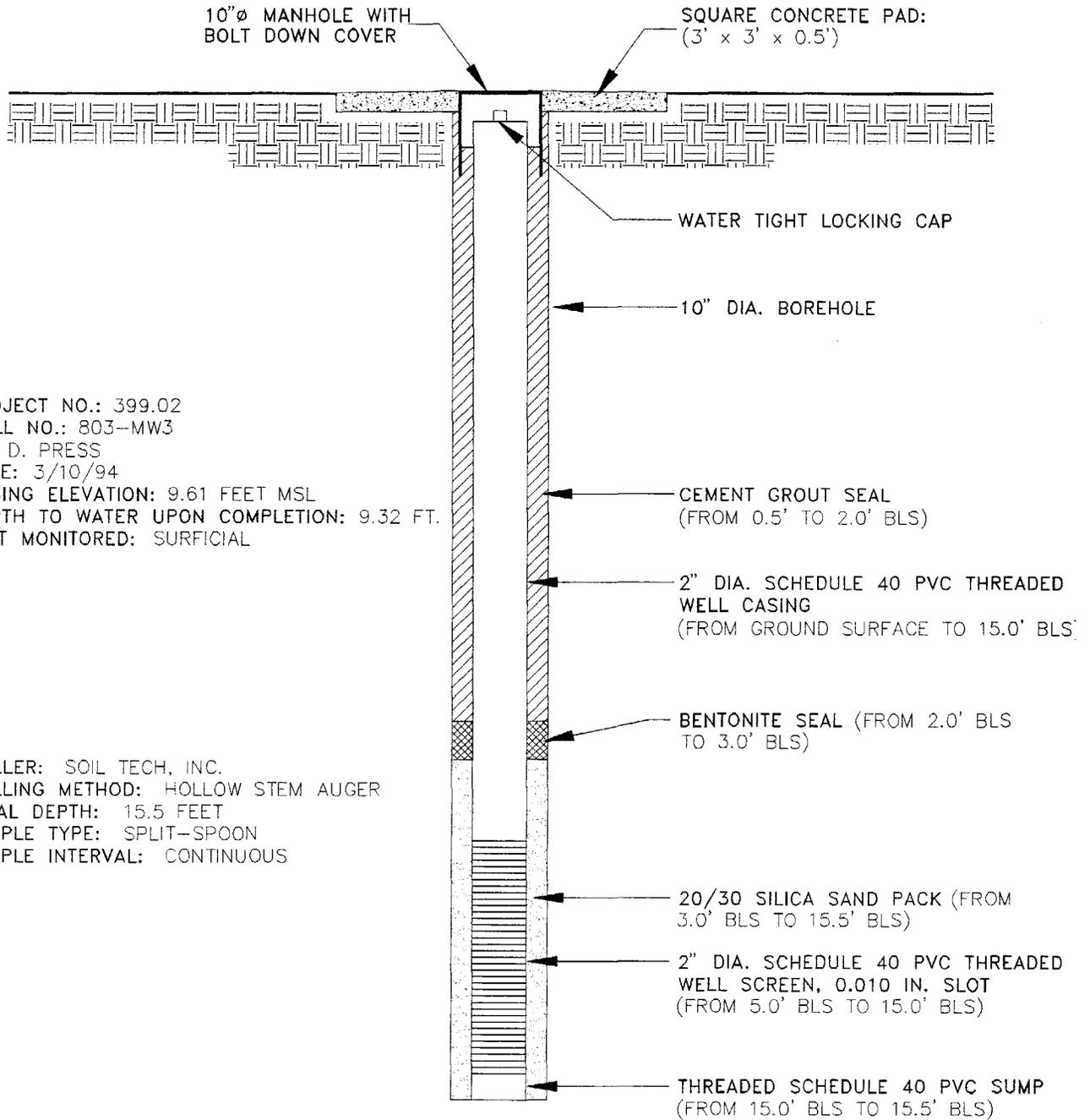


BLASLAND, BOUCK & LEE, INC.
 ENGINEERS & SCIENTISTS

NAVAL SECURITY GROUP ACTIVITY - SABANA SECA
 CEIBA, PUERTO RICO
 TANK #803

MONITORING WELL 803-MW2 | FIGURE
CONSTRUCTION DETAILS

803-MW3



PROJECT NO.: 399.02
WELL NO.: 803-MW3
BY: D. PRESS
DATE: 3/10/94
CASING ELEVATION: 9.61 FEET MSL
DEPTH TO WATER UPON COMPLETION: 9.32 FT.
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 15.5 FEET
SAMPLE TYPE: SPLIT-SPOON
SAMPLE INTERVAL: CONTINUOUS

(DRAWING NOT TO SCALE)

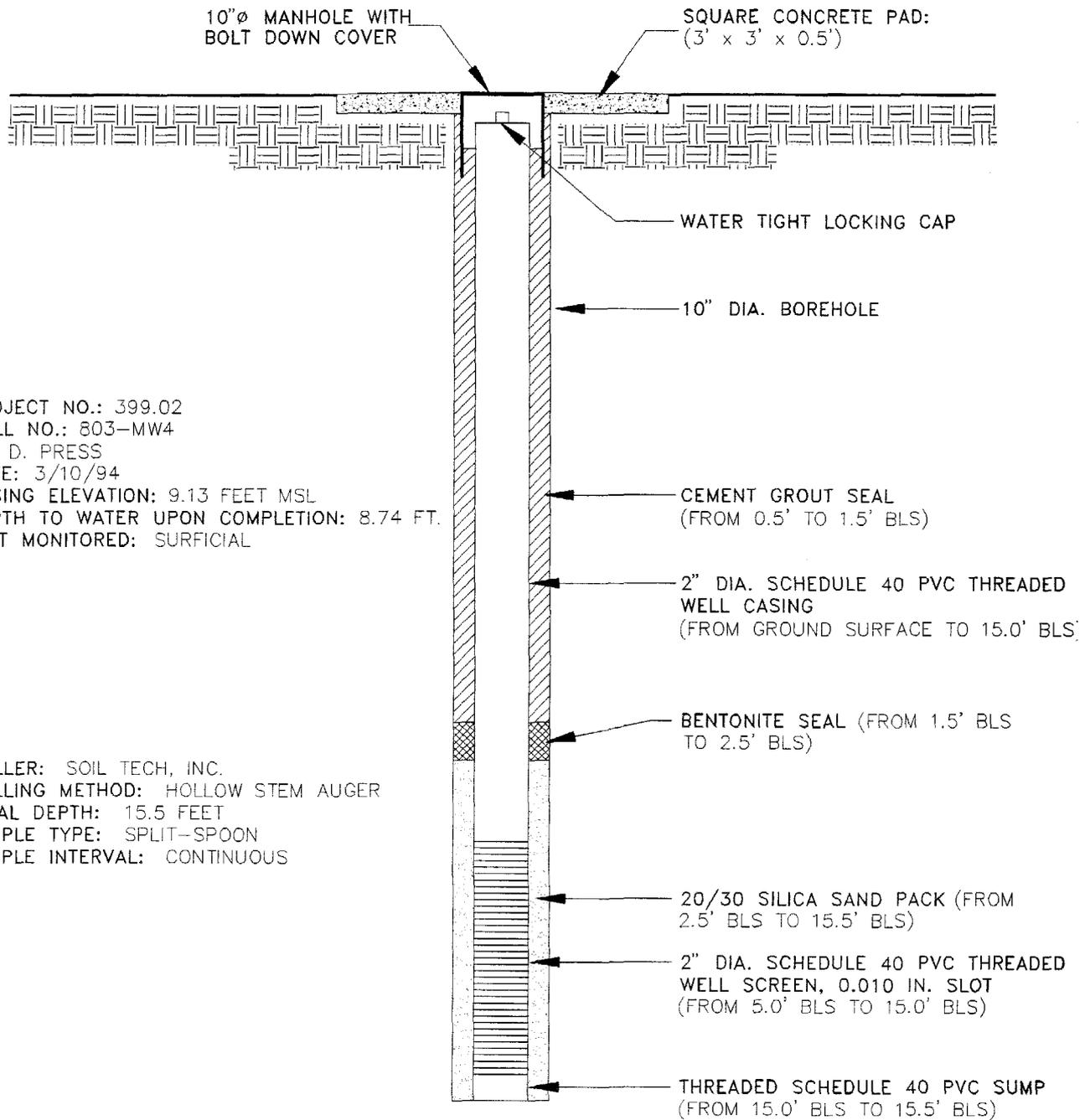


BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

NAVAL SECURITY GROUP ACTIVITY - SABANA SECA
CEIBA, PUERTO RICO
TANK #803

MONITORING WELL 803-MW3 | FIGURE
CONSTRUCTION DETAILS

803-MW4



PROJECT NO.: 399.02
 WELL NO.: 803-MW4
 BY: D. PRESS
 DATE: 3/10/94
 CASING ELEVATION: 9.13 FEET MSL
 DEPTH TO WATER UPON COMPLETION: 8.74 FT.
 UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
 DRILLING METHOD: HOLLOW STEM AUGER
 TOTAL DEPTH: 15.5 FEET
 SAMPLE TYPE: SPLIT-SPOON
 SAMPLE INTERVAL: CONTINUOUS

(DRAWING NOT TO SCALE)

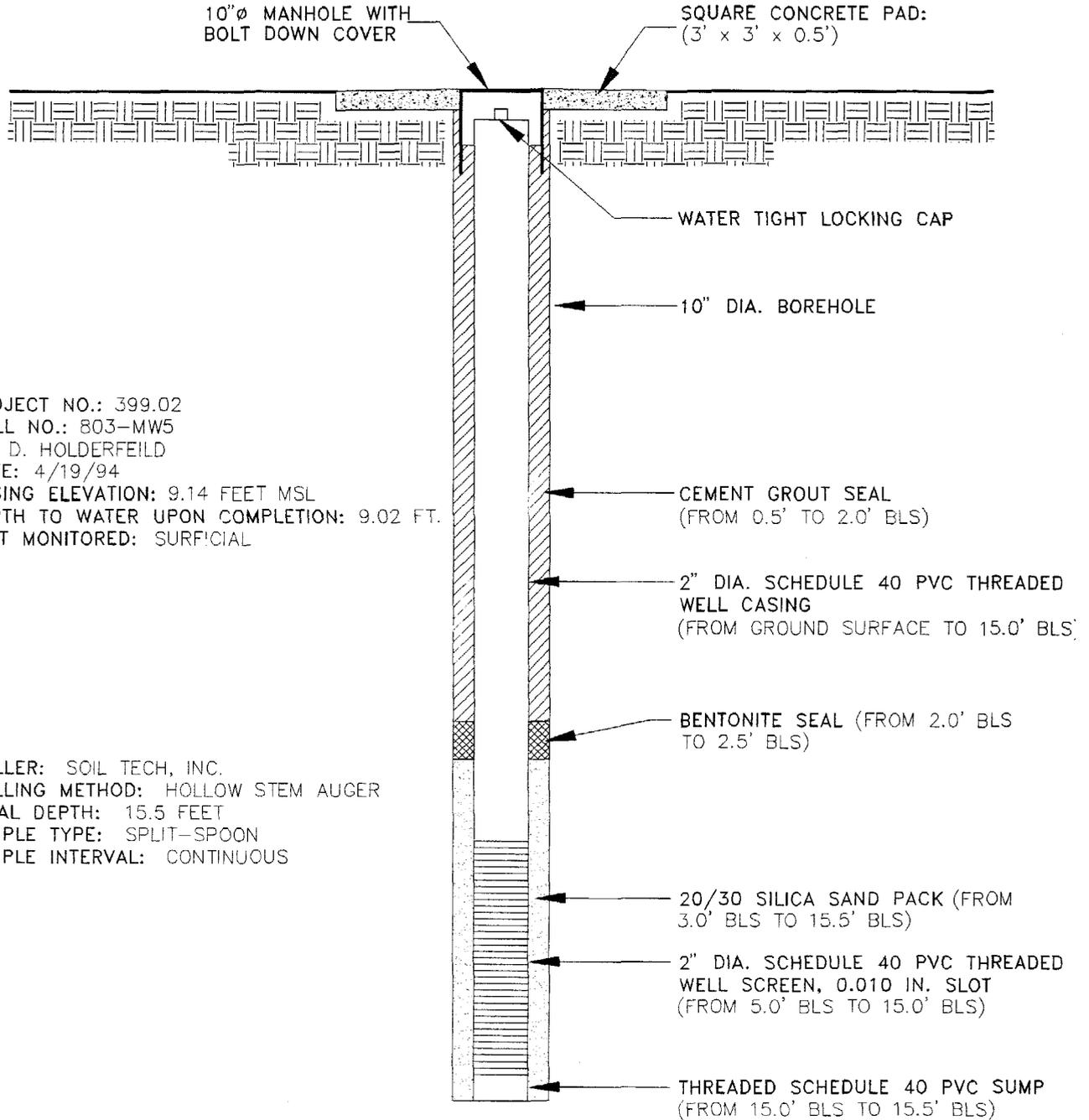


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NAVAL SECURITY GROUP ACTIVITY - SABANA SECA
 CEIBA, PUERTO RICO
 TANK #803

MONITORING WELL 803-MW4 | FIGURE
CONSTRUCTION DETAILS

803-MW5



PROJECT NO.: 399.02
WELL NO.: 803-MW5
BY: D. HOLDERFEILD
DATE: 4/19/94
CASING ELEVATION: 9.14 FEET MSL
DEPTH TO WATER UPON COMPLETION: 9.02 FT.
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 15.5 FEET
SAMPLE TYPE: SPLIT-SPOON
SAMPLE INTERVAL: CONTINUOUS

(DRAWING NOT TO SCALE)



BLASLAND, BOUCK & LEE, INC.

ENGINEERS & SCIENTISTS

NAVAL SECURITY GROUP ACTIVITY - SABANA SECA
CEIBA, PUERTO RICO

TANK #803

MONITORING WELL 803-MW5 | FIGURE
CONSTRUCTION DETAILS



Appendix C

APPENDIX C-1
UTILITY LOCATION/WELL PERMITS

Prior to initiating field work, the proposed soil boring and monitoring well locations were provided to Mr. Pedro Ruiz (NAVSTA Roosevelt Roads - Environmental Engineering Division/Public Works Department). Mr. Ruiz arranged a utility check in the proposed work area prior to initiation of the SC field investigation. As a safety precaution, the first 4 feet of each soil boring and monitoring well were installed with a hand auger to avoid accidentally puncturing underground pipes/conduits.

Well construction permits were obtained from the Puerto Rico Department of Natural Resources, prior to initiating the field investigation.

TRANSLATION OF DEPARTMENT OF NATURAL RESOURCES (DNR) DOCUMENT
DATED 21 APRIL 1994:

Reference: PERMIT NUMBER PPM-45-94, CONSTRUCTION PERMIT FOR MONITORING WELLS, U.S. NAVAL STATION, ROOSEVELT ROADS, CEIBA, P.R.

RESOLUTION

The above applicant submitted to the Department of Natural Resources (DNR) a permit application to construct 21 monitoring wells in Naval Station Roosevelt Roads in Ceiba.

The extracted water will be used for quality test purposes.

In virtue of the authority conferred by Law No. 23 of 20 June 1972 and Law No. 136 of 3 June 1976, the Department of Natural Resources grants this permit to the applicant (from here on called the Grantee) to construct monitoring wells in the site indicated before for the mentioned purposes, in accordance with the following conditions:

GENERAL CONDITIONS

1. The only use of the wells water will be for quality test purposes.
2. The Grantee shall allow the DNR personnel to inspect all authorized wells included in this permit and shall submit all information that would be required.
3. This permit would be available for inspection at the site of the perforation while the construction lasts.
4. Within a 30-day period after the construction be finished, the Grantee must submit a Work Completion Report. This report shall be signed and certified by the contractor or engineer in charge of the construction.
5. The Grantee has the obligation to respond for all nuisance that the construction process authorized by this permit may cause to other people or to public property.
6. This permit could not be transferred without the previous authorization of DNR.

SPECIAL CONDITIONS

1. The Grantee is authorized to drill 21 monitoring wells to the water table level.

2. This permit is granted for one year from the date of its approval.

3. The Work Completion Report mentioned before in item # 4 of the General Conditions Section shall be submitted according to the enclosed form. An original report must be submitted.

4. In addition to the Work Completion Report, the Grantee shall submit the results of all hydrogeologic tests analyzed, including the aquifer water level measurements.

5. The Grantee shall submit the results of all water tests analyzed for organics, cations, anions and other analyzed parameters.

6. The Grantee shall coordinate with DNR the wells sealing or any future use that these wells may have after this investigation be finished.

The Grantee will have the right to request a reconsideration of the Secretary's determination or to request an Administrative Hearing according to Article No. 11 of the Regulation for the Improvement, Use, Conservation and Administration of the Waters of Puerto Rico. The request must be submitted within a period of 30 days from the approval date of this Resolution.

Any intentional violation to Law No. 23 of 20 June 1972, or to Law No. 136 of 3 June 1976, or to Law No. 9 of 8 June 1970, or to any condition listed in this Resolution would cause the revocation of this permit.

Notify:

Julio F. Dumois, Assistant Secretary
Flood Control and Water Resources

Approved today 21 April 1994.

TRANSLATED BY DAMARYS IRIZARRY, 15 MAY 1994



DEPARTAMENTO DE RECURSOS NATURALES

**ESTADO LIBRE ASOCIADO DE PUERTO RICO
DEPARTAMENTO DE RECURSOS NATURALES
AREA DE PLANIFICACION**

**PERMISO DE CONSTRUCCION
POZO DE MONITORIA**

U.S. NAVY
C/O: Sr. Pedro Ruiz
Gilbert St 1510
Norfolk, VA 23511-2699

★
★
★
★
★
★
★

Permiso Ndm. PPM-45-94

R*E*S*O*L*U*C*I*O*N

El solicitante en epigrafe radicó ante este Departamento una solicitud de permiso para construir 21 pozos de monitoria en terrenos de su propiedad sita en la Base Naval Roosevelt Roads en el Municipio de Ceiba.

El agua extraida será utilizada para realizar pruebas de calidad.

El Departamento de Recursos Naturales en virtud de los poderes que nos confiere la Ley Número 23 del 20 de junio de 1972, y la Ley Número 136 del 3 de junio de 1976, CONCEDE este permiso al solicitante (en adelante Concesionario) para construir pozos de monitoria en el lugar arriba indicado para los fines y propósitos antes mencionados, y conforme a las siguientes condiciones:

CONDICIONES GENERALES

P

1. El uso del agua de los pozos se limitará únicamente a las pruebas de monitoria que se realicen .
2. El concesionario permitirá al personal del Departamento la inspección de los pozos aquí autorizados y someterá la información que se le solicite en relación a los mismos.
3. Este permiso estará disponible para ser inspeccionado en el lugar de la perforación o de la construcción durante todo el tiempo en que se realice la obra.
4. Dentro de un periodo no mayor de treinta (30) días de finalizada la construcción de los pozos, el concesionario someterá a este Departamento un Informe de Terminación de Obras. El informe será firmado y certificado correcto por el contratista o ingeniero a cargo de las obras.
5. El concesionario vendrá obligado a responder por los daños que pueda irrogarle a terceras personas o a la propiedad pública o privada en el proceso de construcción y/o utilización de las obras autorizadas mediante este permiso.
6. Este permiso no podrá ser transferido sin la autorización previa del Departamento de Recursos Naturales.

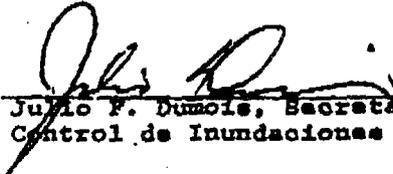
CONDICIONES ESPECIALES

1. Se autoriza al concesionario a hincar 21 pozos de monitoria a nivel freático.
2. Este permiso se concede por el termino de un (1) año, el cual comenzará a partir de la fecha de aprobación.
3. El Informe de Terminación de Obras que se solicita en el inciso Número 4 de las Condiciones Generales de este permiso deberá someterse utilizando el formato que acompaña este permiso. Este informe será sometido en original.
4. Junto al Informe de Terminación de Obras el concesionario someterá los resultados de todas aquellas pruebas hidrogeológicas realizadas, incluyendo los niveles de agua medidos en el acuífero.
5. El concesionario someterá los resultados de todos los análisis realizados a las aguas extraídas de este pozo para compuestos orgánicos, cationes, aniones, y cualquier otro parámetro analizado.
6. El concesionario coordinará con este Departamento el sellado o cualquier utilidad futura que se le de a los pozos una vez culmine el proyecto investigativo.

El Concesionario tendrá derecho a solicitar una reconsideración a la determinación del Secretario o a solicitar una Vista Administrativa de acuerdo a las disposiciones del Artículo 11 del Reglamento para el Aprovechamiento, Uso, Conservación y Administración de las Aguas de Puerto Rico. La solicitud deberá ser radicada por escrito dentro de un término de treinta (30) días a partir de la fecha de aprobación de esta Resolución.

Cualquier violación intencional a la Ley Número 23 del 20 de junio de 1972, a la Ley 136 del 3 de junio de 1976, y a la Ley Número 9 del 8 de junio de 1970, o el incumplimiento de cualesquiera de las condiciones en la presente Resolución podrá conllevar la revocación de este permiso.

Notifíquese:


 Julio F. Dumois, Secretario Auxiliar
 Control de Inundaciones y Recursos de Agua

Aprobado hoy 21 de 12 de 1976

APPENDIX C-2
EQUIPMENT DECONTAMINATION

Prior to beginning work and before installing each soil boring and monitoring well, the drilling rig and associated equipment were decontaminated by removing loose soil from the equipment, followed by steam cleaning. Potable water from a spigot in the fuels pump house andalconox (non-phosphate soap) were used for steam cleaning. The fuels pump house is located approximately 150 feet southeast of the decontamination area, which is located on the north side of Forestall Drive. Prior to beginning field work, water from the pump house spigot was collected and laboratory analyzed by EPA Method 602; all the constituents tested for were below the method detection limit.

Equipment decontamination was conducted in an existing 30-foot x 30-foot concrete bermed area that was covered with plastic sheeting. Decontamination water contained in the decontamination area volatilized to the atmosphere before it could be pumped into 55-gallon drums for disposal.

During installation of each soil boring, the split-spoon sampling equipment was cleaned between each sampling interval by scrubbing the remaining soil off with a brush in soapy water and rinsing in fresh water. The split-spoon equipment was steam cleaned in the decontamination area after each borehole was installed.

APPENDIX C-3
AIR MONITORING

During drilling activities, the breathing zone around the soil borings and monitoring wells was routinely monitored with an OVA. Results of the daily air monitoring are presented in this Appendix. The breathing zone levels did not exceed the maximum levels allowed for Level D work (above 10 ppm) during installation of any boreholes or monitoring wells.

APPENDIX C-4

OVA FIELD SCREENING METHODOLOGY

The following method was employed for OVA screening: (1) two pint-sized mason jars were filled half filled with soil from the same depth; (2) the jar tops were covered with tin foil and sealed; (3) the jars were placed in a cool area for five minutes to allow the headspace to equilibrate; and (4) the headspace was measured with an OVA. Two samples were collected from each interval to measure the headspace with and without a charcoal filter; the filter allows differentiation between natural organic vapors (e.g., methane) and hydrocarbon vapors.

APPENDIX C-5
MONITORING WELL CONSTRUCTION

The five monitoring wells installed for this SC (803-MW1 through 803-MW5) were constructed to intercept the water-table using the hollow-stem auger method. The top of the screened interval was placed several feet above the water table to ensure that the water table will remain below the top of the screen during yearly water-level fluctuations. Maintaining the water table within the screen interval is necessary to accurately assess BTEX ground-water contamination.

Filter pack material consisting of 20/30 grade silica sand was poured in each borehole annulus to two feet above the top of the screen after the well casing and screen were emplaced in the borehole. During sand pack emplacement, the depth to sand was continuously monitored using a weighted tape measure to ensure sand bridging did not occur and to ensure the filter pack was placed at the proper interval. A 1-foot bentonite pellet seal was emplaced on top of the sand pack. Water was poured on top of the bentonite to hydrate the pellets. The bentonite was allowed to hydrate before the well was completed by pouring cement grout to the surface. The monitoring wells were completed using a square shaped concrete pad (measuring 3-ft x 3-ft x 0.5-ft deep) and flush mounted 10-inch diameter manholes with bolt down lids. A monitoring well construction diagram and lithologic summary for each monitoring well constructed is presented in **Appendix C**.

APPENDIX C-6
MONITORING WELL DEVELOPMENT

Development of the five monitoring wells was performed by pumping and surging with a centrifugal pump until the wells were free of silt and sand. Well development dates and volumes developed are summarized in **Table 3-2**.

Based on ground-water field screening results, development water from each monitoring well was determined to be clean and was purged onto the ground surrounding the well.



Appendix D

APPENDIX D

FIELD TPH AND BTEX SCREENING REPORT

ECG LABORATORIES

A DIVISION OF ECG ENTERPRISES

PO BOX 190064 · SAN JUAN, PR 00919-0064 · (809) 384-1534, 385-9521 · FAX: (809) 764-8097

March 22, 1994

Mr. José Garrido
Blasland Blouck and Lee
4730 Northwest
Boca Ratón Blvd.
Boca Ratón, FL 33431-4876

Reference: Report Number 94-002
Order No: Roosevelt Roads

Dear Mr. Garrido:

With respect to your order as shown above we are including the following report with the results obtained in the analysis of Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) and Total Petroleum Hydrocarbons (TPH). For a total of thirty six (36) samples, the analysis included volatile aromatic organics by SW-846-8015 and Total Petroleum Hydrocarbons by EPA Method 418.1.

All samples were obtained on February 23, 1994 to March 10, 1994 and received at the laboratory on February 23, 1994 to March 10, 1994.

All the analysis were performed in accordance to EPA Methods and laboratory SOP's. Further quality assurance and quality control were accomplished according to the methodology requirements.

If you have any questions regarding this report do not hesitate to contact us.

Cordially yours,



Sonia N. Cuevas
Laboratory Manager

ECG SAMPLE SUMMARY REPORT

ECG Case No.	Sample ID for Ground Water	BTEX Analysis Date	TPH Ext. Date	TPH Analysis Date	RL	Parameter Detected	Amount	Units
94-039	28-SB1	2/23/94	2/24/94	2/24/94	10	TPH	23	
94-040	28-SB2	2/23/94	2/24/94	2/24/94	10	TPH	23	
94-044	28-SB3	2/24/94	2/25/94	2/25/94	0.005 10	None	--	
94-045	28-SB4	2/24/94	2/25/94	2/25/94	0.005 10	None	--	
94-048	28-SB5	2/24/94	2/25/94	2/25/94	0.005 10	None	--	
94-051	28-SB6	2/25/94	2/25/94	2/25/94	0.005 10	None	--	
94-052	28-SB7	2/25/94	2/25/94	2/25/94	0.005 10	None	--	
94-053	28-SB9	2/28/94	2/28/94	2/28/94	10	TPH	30	
94-054	28-SB8	2/28/94	2/28/94	2/28/94	10	None	--	
94-055	28-SB10	2/28/94	2/28/94	2/28/94	10	None	--	
ECG Case No.	Sample ID for Soil	BTEX Analysis Date	TPH Ext. Date	TPH Analysis Date	RL	Parameter Detected	Amount	Units
94-041	28-SB1(6'-8')	2/24/94	2/25/94	2/25/94	10	TPH	12	
94-042	28-SB2(6'-8')	2/24/94	2/25/94	2/25/94	10	TPH	34	
94-043	28-SB3(6'-8')	2/24/94	2/25/94	2/25/94	0.005	Benzene	0.005	
94-046	28-SB4(4'-6')	2/24/94	2/25/94	2/25/94	10	None	--	
94-047	28-SB5(4'-6')	2/24/94	2/25/94	2/25/94	10	None	--	
94-049	28-SB6(4'-6')	2/25/94	2/25/94	2/25/94	10	TPH	22	
94-050	28-SB7(4'-6')	2/25/94	2/25/94	2/25/94	10	TPH	122	
94-056	28-SB10(4'-6')	2/28/94	2/28/94	2/28/94	10	None	--	
94-057	28-SB9(4'-6')	2/28/94	2/28/94	2/28/94	10	None	--	
94-058	28-SB8(4'-6')	2/28/94	2/28/94	2/28/94	10	None	--	

BTEX = (Benzene, Toluene, Ethylbenzene and Xylenes)

RL = Reporting Limit

Units = mg/L = mg/Kg = ppm = parts per million except as otherwise specified

Note: This summary is only for positive parameters above the reporting limit

ECG SAMPLE SUMMARY REPORT

ECG Case No.	Sample ID for Ground Water	BTEX Analysis Date	TPH Ext. Date	TPH Analysis Date	RL	Parameter Detected	Amount	Units
94-076	1983-SB2	3/2/94	n/a	n/a	0.005 10	None	--	
94-093	803-SB1	3/9/94	n/a	n/a	0.005 10	None	--	
94-098	803-SB2	3/10/94	n/a	n/a	0.005	None	--	
94-099	803-SB3	3/10/94	n/a	n/a	0.005	None	--	
94-100	803-SB4	3/10/94	n/a	n/a	0.005	None	--	
94-101	803-SB5	3/10/94	n/a	n/a	0.005	None	--	
ECG Case No.	Sample ID for Soil	BTEX Analysis Date	TPH Ext. Date	TPH Analysis Date	RL	Parameter Detected	Amount	Units
94-077	1983-SB2(4'-8')	3/2/94	3/2/94	3/2/94	0.005 10	TPH Xylenes	1,164 0.010	
94-078	1983-SB1(4'-6')	3/2/94	3/2/94	3/2/94	0.005 10	TPH	844	
94-079	1983-SB6(4'-6')	3/3/94	3/3/94	3/3/94	0.005 10	TPH	1,410	
94-080	1983-SB5(6'-8')	3/3/94	3/3/94	3/3/94	0.005 10	TPH	512	
94-081	1983-SB4(4'-6')	3/3/94	3/3/94	3/3/94	0.005 10	TPH	124	
94-092	803SB1(4'-6')	3/9/94	3/9/94	3/9/94	0.005 10	None	--	
94-094	803-SB2(4'-6')	3/10/94	3/10/94	3/10/94	0.005 10	None	--	
94-095	803-SB3(4'-6')	3/10/94	3/10/94	3/10/94	0.005 10	None	--	
94-096	803-SB4(4'-6')	3/10/94	3/10/94	3/10/94	0.005 10	None	--	
94-097	803-SB5(4'-6')	3/10/94	3/10/94	3/10/94	0.005 10	None	--	

BTEX = (Benzene, Toluene, Ethylbenzene and Xylenes)

RL = Reporting Limit

Units = mg/L = mg/Kg = ppm = parts per million except as otherwise specified

n/a = not analyzed

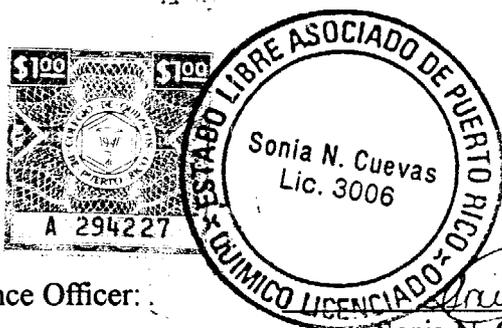
Note: This summary is only for positive parameters above reporting limit

ECG DATA CERTIFICATION

All data was reviewed for any corrective action. Then, the QA Officer verified the corrections and approval of the data was made. All the analysis reported were performed and supervised by qualified personnel.

All data gathered for the preparation of this report will be kept in our custody for a term of three years. All the quality control and quality assurance generated for the validation of the data will be available upon request.

I hereby certify that all raw data and associated documentation was reviewed and approved.



Quality Assurance Officer:

Sonia N. Cuevas
Sonia N. Cuevas, M.S.
Laboratory Manager
Lic. 3006

ECG Case No: 94-092

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
TPH	<10

ECG Case No: 94-093

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/L)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

nd = Not detected, below detectable limit

ECG Case No: 94-094

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
TPH	<10

ECG Case No: 94-095

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

nd = Not detected, below detectable limit

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
TPH	<10

ECG Case No: 94-096

Volatile Aromatic Organics	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

nd = Not detected, below detectable limit

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
TPH	<10

ECG Case No: 94-097

Volatile Aromatic Organics	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
TPH	<10

ECG Case No: 94-098

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/L)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

ECG Case No: 94-099

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/L)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

nd = Not detected, below detectable limit

ECG Case No: 94-100

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/L)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

ECG Case No: 94-101

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/L)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	nd
o-xylene	nd

nd = Not detected, below detectable limit

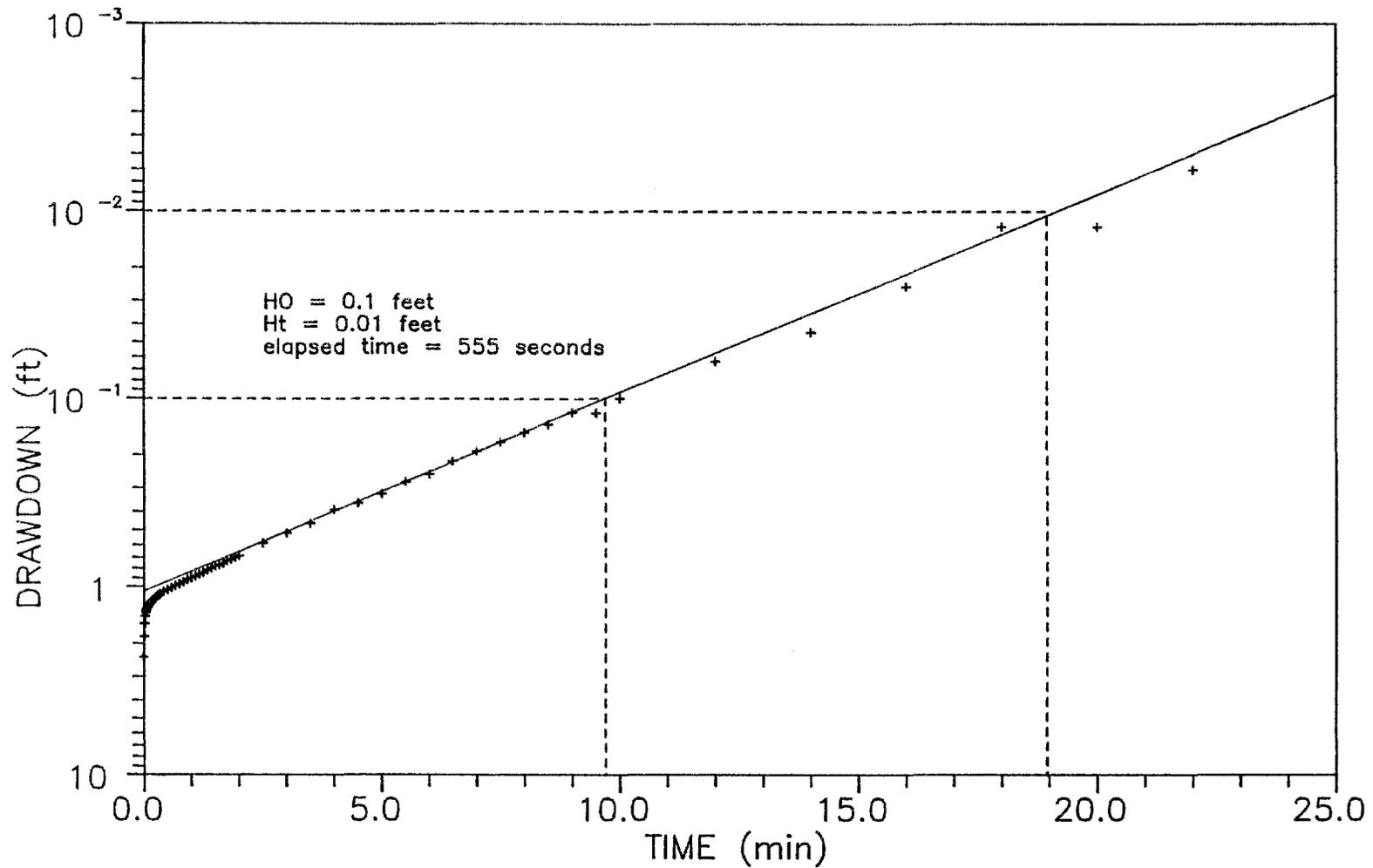


Appendix E

APPENDIX E

SLUG TEST RESULTS AND CALCULATIONS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
803-MW2 (3/21/94)



SLUG TEST RESULTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.02

Well No.: 803-MW2
Test Date: 3/21/94

Formation Tested: Surficial
Rising Head Test

	<u>English Units</u>	<u>Metric Units</u>
Stickup	0.00 (ft)	0.00 (cm)
Static Water Level	8.78 (ft)	267.61 (cm)
Depth to Bottom of Screen (distance from ground level)	15.00 (ft)	457.20 (cm)
Boring Diameter	10.25 (in)	26.04 (cm)
Casing Diameter	2.00 (in)	5.08 (cm)
Screen Diameter	2.00 (in)	5.08 (cm)
Screen Length	10.00 (ft)	304.80 (cm)
Depth to Boundary (b)	30.00 (ft)	914.40 (cm)
Delta H at Time 0	0.10 (ft)	3.05 (cm)
Delta H at Time t	0.010 (ft)	0.30 (cm)
Time t	555 (sec)	555 (sec)
Ratio Kh/Kv	1	1
Porosity of Filter Pack	0.3	0.3

<u>HYDRAULIC CONDUCTIVITY</u>	<u>cm/sec</u>	<u>ft/day</u>	<u>gpd/ft²</u>
Bouwer-Rice Method	8.0E-05	0.23	1.7
 <u>TRANSMISSIVITY</u>	 <u>cm²/sec</u>	 <u>ft²/day</u>	 <u>gpd/ft</u>
	7.3E-02	6.9	51



SLUG TEST WORKSHEET

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.02

Well No.: 803-MW2

Test Date: 3/21/94

EQUATIONS USED

EQUATION 1: Bouwer-Rice Method

$$K = (((Rc^2) * \ln(Re/Rw)) / (2Le)) * (1/T) * \ln(H0/Ht)$$

where:

K = Hydraulic conductivity

Rc = Casing radius

Re = Effective well radius over which the
drawdown is dissipated (this value is
calculated from predetermined curves)

Rw = Borehole radius

Le = Saturated screen length

H0 = Drawdown in well at time zero: time
zero is specified on the slug test curve

Ht = Drawdown in well at time "t": time "t"
is specified on the slug test curve

T = Elapsed time from time zero to time "t"

EQUATION 2: Transmissivity

$$T = K * b$$

where:

K = Hydraulic conductivity

b = Aquifer thickness

*Note: All equations are valid for
any consistent set of units*

VARIABLES USED

<u>Variables</u>	<u>English Units</u>	<u>Metric Units</u>
Rc	1.00 (in)	2.54 (cm)
Rw	5.00 (in)	12.70 (cm)
Le	6.22 (ft)	189.59 (cm)
H0	0.10 (ft)	3.05 (cm)
Ht	0.010 (ft)	0.30 (cm)
T	555 (sec)	555 (sec)
b	30 (ft)	914.40 (cm)



SLUG TEST RESULTS – FIELD DATA

Roosevelt Roads U.S. Naval Station
Ceiba, Puerto Rico
399.02

Well No.: 803-MW2

Test Date: 3/21/94

<u>TIME (min)</u>	<u>DEPTH (ft)</u>	<u>TIME (min)</u>	<u>DEPTH (ft)</u>
0.0010	2.360	0.8333	0.940
0.0083	1.830	0.9166	0.915
0.0166	1.565	1.0000	0.896
0.0250	1.426	1.0833	0.877
0.0333	1.369	1.1666	0.858
0.0416	1.344	1.2500	0.839
0.0500	1.325	1.3333	0.814
0.0583	1.312	1.4166	0.795
0.0666	1.300	1.5000	0.776
0.0750	1.287	1.5833	0.763
0.0833	1.274	1.6666	0.751
0.1000	1.255	1.7500	0.725
0.1166	1.236	1.8333	0.713
0.1333	1.224	1.9166	0.694
0.1500	1.205	2.0000	0.681
0.1666	1.192	2.5000	0.586
0.1833	1.180	3.0000	0.517
0.2000	1.167	3.5000	0.460
0.2166	1.154	4.0000	0.391
0.2333	1.142	4.5000	0.359
0.2500	1.135	5.0000	0.321
0.2666	1.123	5.5000	0.277
0.2833	1.117	6.0000	0.252
0.3000	1.110	6.5000	0.214
0.3166	1.104	7.0000	0.189
0.3333	1.091	7.5000	0.170
0.4166	1.060	8.0000	0.151
0.5000	1.035	8.5000	0.138
0.5833	1.009	9.0000	0.119
0.6666	0.984	9.5000	0.119
0.7500	0.965	10.0000	0.100



SLUG TEST RESULTS – FIELD DATA
ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.02

Well No.: 803-MW2

Test Date: 3/21/94

<u>TIME (min)</u>	<u>DEPTH (ft)</u>	<u>TIME (min)</u>	<u>DEPTH (ft)</u>
12.0000	0.063		
14.0000	0.044		
16.0000	0.025		
18.0000	0.012		
20.0000	0.012		
22.0000	0.006		



SLUG TEST FORM

DATE: 3/21/94

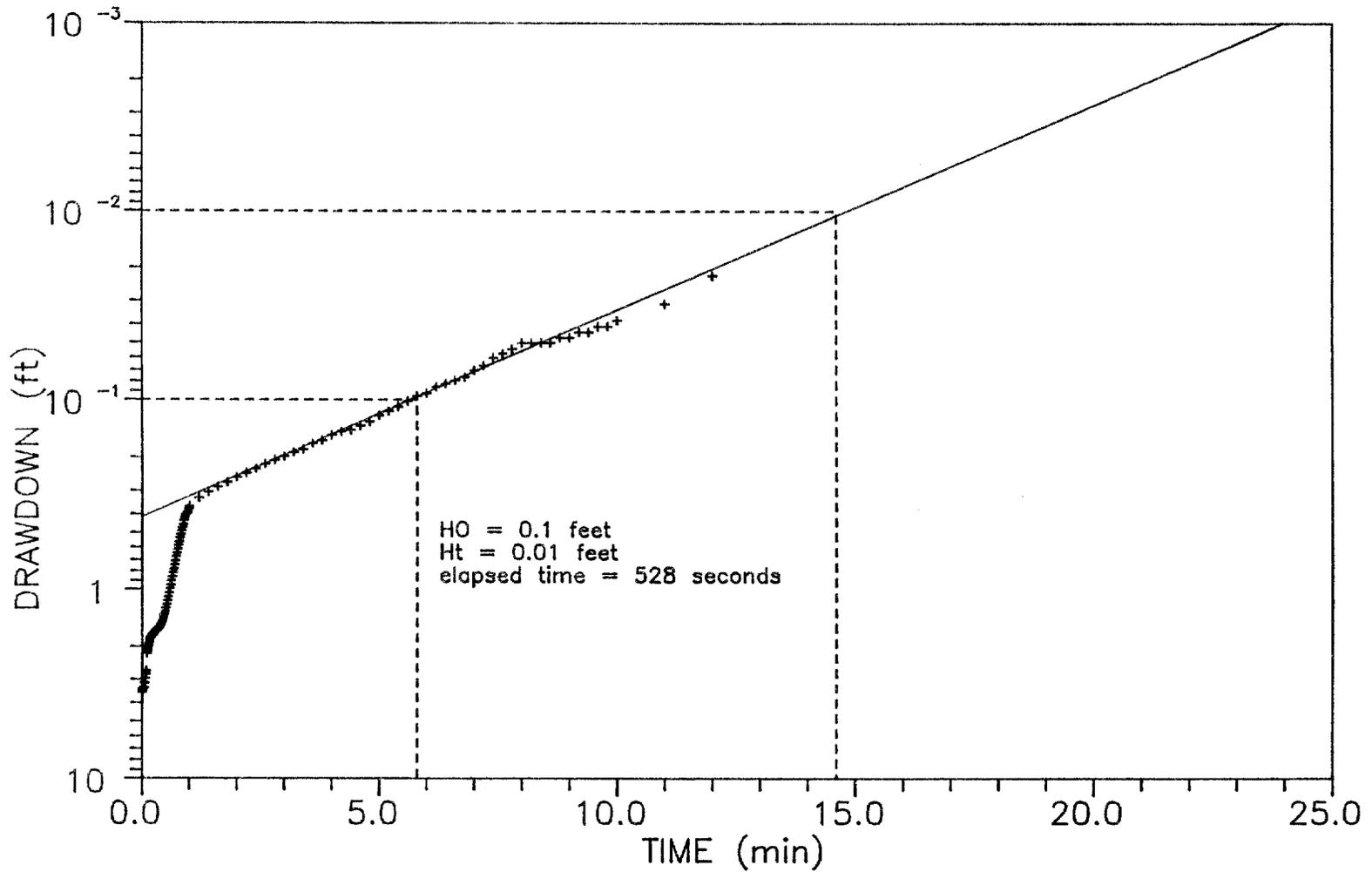
U.S. NAVAL STATION
ROOSEVELT ROADS
PUERTO RICO

Well No. (Site No.) 803 – MW 2 (399.02) Well Diameter 2" Schedule 40 PVC
 Screened Interval 5 – 15' BLS Prot. Casing Flush/manhole
 Total Depth 15' TOC Screen submersed 6.22'
 Depth to Water 8.78' TOC Transducer Serial No. 355155
 Water Column 6.22' Logger No. 2K-332 (Hermit 2000)
 Transducer Calibration
 Lowered to 4.2 Read 1.1
 Lowered to _____ Read _____
 Lowered to _____ Read _____
 Transducer Set 14.09 feet below top of casing
 Transducer Reading 5.313 feet of head above transducer
 Reset reference to zero Yes

Run No. Test 2 Rising/Falling Step 0
 Initial Static 5.313 feet of head above transducer
 Begin Test Static 5.344 feet of head above transducer
 Begin test time 12:15
 End test time 12:39
 End test static water level 5.338 feet of head above transducer
 Slug length* NA Length in water NA Type NA
 Rope Length NA
 Elapsed time until full recovery 22.00 min *Pumped water slug out with a centrifugal pump

Run No. Test 3 Rising/Falling Step 0
 Reset reference to zero Yes
 Initial Static 5.338 feet of head above transducer
 Begin Test Static 5.338 feet of head above transducer
 Begin test time 12:45
 End test time 13:05
 End test static water level 5.350 feet of head above transducer
 Slug length* NA Length in water NA Type NA
 Rope Length NA
 Elapsed time until full recovery 26.00 min *Pumped water slug out with a centrifugal pump

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
803-MW5 (3/21/94)



SLUG TEST RESULTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.02

Well No.: 803-MW5
Test Date: 5/14/94

Formation Tested: Surficial
Rising Head Test

	<u>English Units</u>	<u>Metric Units</u>
Stickup	0.00 (ft)	0.00 (cm)
Static Water Level	9.02 (ft)	274.93 (cm)
Depth to Bottom of Screen (distance from ground level)	15.00 (ft)	457.20 (cm)
Boring Diameter	10.25 (in)	26.04 (cm)
Casing Diameter	2.00 (in)	5.08 (cm)
Screen Diameter	2.00 (in)	5.08 (cm)
Screen Length	10.00 (ft)	304.80 (cm)
Depth to Boundary (b)	30.00 (ft)	914.40 (cm)
Delta H at Time 0	0.10 (ft)	3.05 (cm)
Delta H at Time t	0.010 (ft)	0.30 (cm)
Time t	528 (sec)	528 (sec)
Ratio Kh/Kv	1	1
Porosity of Filter Pack	0.3	0.3

<u>HYDRAULIC CONDUCTIVITY</u>	<u>cm/sec</u>	<u>ft/day</u>	<u>gpd/ft²</u>
Bouwer-Rice Method	8.3E-05	0.23	1.8
 <u>TRANSMISSIVITY</u>	 <u>cm²/sec</u>	 <u>ft²/day</u>	 <u>gpd/ft</u>
	7.6E-02	6.9	54



SLUG TEST WORKSHEET

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.02

Well No.: 803-MW5

Test Date: 5/14/94

EQUATIONS USED

EQUATION 1: Bower-Rice Method

$$K = (((Rc^2) * \ln(Re/Rw)) / (2Le)) * (1/T) * \ln(H0/Ht)$$

where:

K = Hydraulic conductivity

Rc = Casing radius

Re = Effective well radius over which the drawdown is dissipated (this value is calculated from predetermined curves)

Rw = Borehole radius

Le = Saturated screen length

H0 = Drawdown in well at time zero: time zero is specified on the slug test curve

Ht = Drawdown in well at time "t": time "t" is specified on the slug test curve

T = Elapsed time from time zero to time "t"

EQUATION 2: Transmissivity

$$T = K * b$$

where:

K = Hydraulic conductivity

b = Aquifer thickness

Note: All equations are valid for any consistent set of units

VARIABLES USED

<u>Variables</u>	<u>English Units</u>	<u>Metric Units</u>
Rc	1.00 (in)	2.54 (cm)
Rw	5.00 (in)	12.70 (cm)
Le	5.98 (ft)	182.27 (cm)
H0	0.10 (ft)	3.05 (cm)
Ht	0.010 (ft)	0.30 (cm)
T	528 (sec)	528 (sec)
b	30 (ft)	914.40 (cm)



SLUG TEST RESULTS – FIELD DATA

Roosevelt Roads U.S. Naval Station
Ceiba, Puerto Rico
399.02

Well No.: 803-MW5

Test Date: 5/14/94

<u>TIME (min)</u>	<u>DEPTH (ft)</u>	<u>TIME (min)</u>	<u>DEPTH (ft)</u>
0.0010	3.509	0.2666	1.661
0.0083	3.414	0.2750	1.652
0.0166	3.341	0.2833	1.642
0.0250	3.331	0.2916	1.636
0.0333	3.318	0.3000	1.629
0.0416	3.309	0.3083	1.626
0.0500	3.109	0.3166	1.617
0.0583	3.124	0.3250	1.610
0.0666	2.946	0.3333	1.604
0.0750	2.797	0.3500	1.588
0.0833	2.705	0.3666	1.569
0.0916	2.682	0.3833	1.547
0.1000	2.164	0.4000	1.515
0.1083	2.103	0.4166	1.483
0.1166	2.049	0.4333	1.441
0.1250	2.002	0.4500	1.394
0.1333	1.954	0.4666	1.349
0.1416	1.903	0.4833	1.301
0.1500	1.849	0.5000	1.247
0.1583	1.820	0.5166	1.196
0.1666	1.798	0.5333	1.139
0.1750	1.782	0.5500	1.088
0.1833	1.772	0.5666	1.037
0.1916	1.763	0.5833	0.986
0.2000	1.750	0.6000	0.942
0.2083	1.734	0.6166	0.894
0.2166	1.722	0.6333	0.853
0.2250	1.709	0.6500	0.811
0.2333	1.702	0.6666	0.776
0.2416	1.690	0.6833	0.738
0.2500	1.680	0.7000	0.703
0.2583	1.671	0.7166	0.668



SLUG TEST RESULTS – FIELD DATA

Roosevelt Roads U.S. Naval Station
Ceiba, Puerto Rico
399.02

Well No.: 803-MW5

Test Date: 5/14/94

<u>TIME (min)</u>	<u>DEPTH (ft)</u>	<u>TIME (min)</u>	<u>DEPTH (ft)</u>
0.7333	0.639	4.2000	0.146
0.7500	0.608	4.4000	0.143
0.7666	0.582	4.6000	0.136
0.7833	0.557	4.8000	0.130
0.8000	0.531	5.0000	0.120
0.8166	0.509	5.2000	0.114
0.8333	0.487	5.4000	0.108
0.8500	0.468	5.6000	0.101
0.8666	0.452	5.8000	0.095
0.8833	0.429	6.0000	0.092
0.9000	0.413	6.2000	0.085
0.9166	0.404	6.4000	0.082
0.9333	0.397	6.6000	0.079
0.9500	0.394	6.8000	0.076
0.9666	0.385	7.0000	0.070
0.9833	0.372	7.2000	0.066
1.0000	0.362	7.4000	0.060
1.2000	0.327	7.6000	0.057
1.4000	0.305	7.8000	0.054
1.6000	0.286	8.0000	0.050
1.8000	0.270	8.2000	0.050
2.0000	0.254	8.4000	0.050
2.2000	0.241	8.6000	0.050
2.4000	0.229	8.8000	0.047
2.6000	0.216	9.0000	0.047
2.8000	0.206	9.2000	0.044
3.0000	0.197	9.4000	0.044
3.2000	0.187	9.6000	0.041
3.4000	0.181	9.8000	0.041
3.6000	0.168	10.0000	0.038
3.8000	0.162	11.0000	0.031
4.0000	0.152	12.0000	0.022



SLUG TEST FORM

DATE: 5/14/94

U.S. NAVAL STATION
ROOSEVELT ROADS
PUERTO RICO

Well No. 803-MW5 (399.02) Well Diameter 2" schedule 40 pvc
 Screened Interval 5'-15' BLS Prot. Casing Flush/manhole
 Total Depth 15' TOC Screen submersed 6.02'
 Depth to Water 8.98' TOC Transducer Serial No. 201303
 Water Column 6.02' Logger No. 2K-229 (Hermit 2000)

Transducer Calibration
 Lowered to 5.880 Read 5.880
 Lowered to 4.885 Read 4.900
 Lowered to _____ Read _____

Transducer Set 14.86 feet below top of casing
 Transducer Reading 5.880 feet of head above transducer
 Reset reference to zero Yes

Run No. 2 Rising Head Test Step 0
 Initial Static 5.88 feet of head above transducer
 Begin Test Static 5.887 feet of head above transducer

Begin test time 944
 End test time 950
 End test static water level 5.858 feet of head above transducer

Water slug removed with a centrifugal pump
 Elapsed time until full recovery 12 minutes

Run No. 3 Rising head test Step 0
 Reset reference to zero _____
 Initial Static 5.880 feet of head above transducer
 Begin Test Static 5.899 feet of head above transducer

Begin test time 1003
 End test time 1015
 End test static water level 5.858 feet of head above transducer

Water slug removed with a centrifugal pump
 Elapsed time until full recovery 12 minutes



Appendix F

APPENDIX F

GROUND-WATER SAMPLING PROCEDURES AND SAMPLING LOGS

GROUND-WATER SAMPLING PROCEDURES

Sampling Procedures

Each new monitoring well was allowed to stabilize for at least 24 hours after installation prior to being sampled. To avoid cross-contamination between wells, disposable teflon bailers were used to collect ground-water samples. Prior to sampling ground water from the new monitoring wells, depth to water was measured and each well was purged of at least three well volumes. The purge procedure was performed using a peristaltic pump with decontaminated polyethylene tubing. During purging, multiple water-quality measurements of pH, temperature, and conductivity were collected in the field until reaching stabilization. The complete well sampling logs are presented in this **Appendix**.

Ground-water samples were shipped in sealed coolers packed with ice via an overnight delivery service to Savannah Laboratories in Deerfield Beach, Florida.

QA/QC Procedures

Field blanks (803-field blank) were collected on both dates that monitoring wells were sampled: March 12 and April 21, 1994. The field blanks were analyzed for BTEX by EPA Method 602. Field blank samples were collected by filling the appropriate laboratory containers with deionized, organic-free water in an area that ground-water samples were being collected on that date. No constituents were detected above the laboratory detection limits in the field blank samples.

One equipment blank (803-bailer blank) was collected from a new disposable bailer. The sample was collected by pouring deionized, organic-free water into and over the bailer and collecting the runoff in the appropriate laboratory containers. No constituents were detected above the laboratory detection limits in the equipment blank sample.

One set of duplicate samples (803-duplicate) from monitoring well 803-MW2 was collected for analysis by EPA Methods 602, 418.1, 610 and 239.2. To test the laboratory's precision, the origin of the duplicate sample was not known by the laboratory. The duplicate sample results (**Table 4-2**) are essentially identical to the 803-MW2 results.

Project/No. 399.02 Page 1 of 5
 Site Location Roosevelt Roads, U. S. Naval Station
 Site/Well No. 803-MW1 Coded/ Replicate No. N/A Date 03/12/94
 Weather Sunny, breezy, 90's Time Sampling Began 11:51 Time Sampling Completed 12:15

EVACUATION DATA

Description of Measuring Point (MP)	<u>Top of Casing (North Side)</u>			
Height of MP Below Land Surface	<u>0.2</u>	<u>(feet)</u>	MP Elevation	<u>9.76</u> <u>(feet)</u>
Total Sounded Depth (TD) of Well Below MP	<u>15</u>	<u>(feet)</u>	Water-Level Elevation	<u>0.52</u> <u>(feet)</u>
Depth to Water (DTW) Below MP	<u>9.24</u>	<u>(feet)</u>	Diameter of Casing/	<u>2" Schedule 40 PVC</u>
			Construction Type	<u>2" Schedule 40 PVC</u>
Water Column (WC) in Well			Gallons Pumped/Bailed	
(TD - DTW)	<u>5.76</u>	<u>(feet)</u>	Prior to Sampling	
Gallons per Foot (GPF)	<u>0.16</u>		(GAL x 5 VOL x PUMP RATE)	<u>5 gallons</u>
Gallons in Well			Sampling Pump Intake	
(WC x GPF)	<u>0.92</u>		(feet below land surface)	<u>Hand bailed</u>

Evacuation Method Hand bailed using a disposable teflon bailer with monofilament line.

SAMPLING DATA/FIELD PARAMETERS

Color tan Odor none Appearance cloudy Temperature 84.2 °F

Other (specific ion; OVA; HNU; etc.) none

Specific Conductance, umhos/cm >10,000 pH 7.77

Sampling Method and Material Disposable teflon bailer with monofilament line.

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. EPA Method 602	(3)	40 ml glass	HCl/4°C
2. EPA Method 418.1	(1)	1 liter clear glass	HCl/4°C
3.			
4.			
5.			
6.			
7.			

Remarks

Sampling Personnel
D. Press, E. Regensburger

WELL CASING VOLUMES			
GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50
			4" = 0.65
			6" = 1.48

Project/No. 399.02 Page 2 of 5
 Site Location Roosevelt Roads, U. S. Naval Station
 Site/Well No. 803-MW2 Coded/ Replicate No. N/A Date 03/12/94
 Weather Sunny, breezy, 90's Time Sampling Began 12:50 Time Sampling Completed 13:15

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (North Side)
 Height of MP Below Land Surface 0.2 (feet) MP Elevation 9.05 (feet)
 Total Sounded Depth (TD) of Well Below MP 15 (feet) Water-Level Elevation 0.26 (feet)
 Depth to Water (DTW) Below MP 8.79 (feet) Diameter of Casing/ Construction Type 2" Schedule 40 PVC
 Water Column (WC) in Well Prior to Sampling (GAL x 5 VOL x PUMP RATE) 5 gallons
 (TD - DTW) 6.21 (feet)
 Gallons per Foot (GPF) 0.16
 Gallons in Well (WC x GPF) 1.0 Sampling Pump Intake (feet below land surface) Hand bailed

Evacuation Method Hand bailed using a disposable teflon bailer with monofilament line.

SAMPLING DATA/FIELD PARAMETERS

Color tan Odor none Appearance cloudy Temperature 84.4 °F
 Other (specific ion; OVA; HNU; etc.) none
 Specific Conductance, umhos/cm 4,540 pH 7.59

Sampling Method and Material Disposable teflon bailer with monofilament line.

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. EPA Method 602	(3)	40 ml glass	HCl/4°C
2. EPA Method 418.1	(1)	1 liter clear glass	HCl/4°C
3. EPA Method 239.2	(1)	250 ml plastic	HNO3/4°C
4. EPA Method 610	(1)	1 liter amber glass	4°C
5.			
6.			
7.			

Remarks Collected duplicate samples.

Sampling Personnel D. Press, E. Regensburger

GAL./FT.	1-1/4"	2"	3"	4"
	0.077	0.16	0.37	0.65
	0.10	0.24	0.50	1.46

Project/No. 399.02 Page 3 of 5
 Site Location Roosevelt Roads, U. S. Naval Station
 Coded/
 Site/Well No. 803-MW3 Replicate No. N/A Date 03/12/94
 Time Sampling
 Weather Sunny, breezy, 90's Began 11:00 Time Sampling Completed 11:45

EVACUATION DATA

Description of Measuring Point (MP)	<u>Top of Casing (North Side)</u>			
Height of MP Below Land Surface	<u>0.2</u>	<u>(feet)</u>	MP Elevation	<u>9.61</u> <u>(feet)</u>
Total Sounded Depth (TD) of Well Below MP	<u>15</u>	<u>(feet)</u>	Water-Level Elevation	<u>0.29</u> <u>(feet)</u>
Depth to Water (DTW) Below MP	<u>9.32</u>	<u>(feet)</u>	Diameter of Casing/ Construction Type	<u>2" Schedule 40 PVC</u>
Water Column (WC) in Well (TD - DTW)	<u>5.68</u>	<u>(feet)</u>	Gallons Pumped/Bailed Prior to Sampling (GAL x 5 VOL x PUMP RATE)	<u>5 gallons</u>
Gallons per Foot (GPF)	<u>0.16</u>		Sampling Pump Intake (feet below land surface)	<u>Hand bailed</u>
Gallons in Well (WC x GPF)	<u>0.91</u>			

Evacuation Method Hand bailed using a disposable teflon bailer with monofilament line.

SAMPLING DATA/FIELD PARAMETERS

Color tan Odor none Appearance cloudy Temperature 85.2 °F

Other (specific ion; OVA; HNU; etc.) none

Specific Conductance,
umhos/cm 1,960 pH 7.22

Sampling Method and Material Disposable teflon bailer with monofilament line.

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. EPA Method 602	(3)	40 ml glass	HCl/4°C
2. EPA Method 418.1	(1)	1 liter clear glass	HCl/4°C
3. EPA Method 610	(1)	1 liter amber glass	4°C
4.			
5.			
6.			
7.			

Remarks

Sampling Personnel
D. Press, E. Regensburger

WELL CASING VOLUMES				
GAL/FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.02 Page 4 of 5
 Site Location Roosevelt Roads, U. S. Naval Station
 Site/Well No. 803-MW4 Coded/ Replicate No. N/A Date 03/12/94
 Weather Sunny, breezy, 90's Time Sampling Began 10:30 Time Sampling Completed 13:00

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (North Side)
 Height of MP Below Land Surface 0.2 (feet) MP Elevation 9.13 (feet)
 Total Sounded Depth (TD) of Well Below MP 15 (feet) Water-Level Elevation 0.39 (feet)
 Depth to Water (DTW) Below MP 8.74 (feet) Diameter of Casing/
 Construction Type 2" Schedule 40 PVC
 Gallons Pumped/Bailed
 Prior to Sampling
 (GAL x 5 VOL x PUMP RATE) 5 gallons
 Water Column (WC) in Well
 (TD - DTW) 6.26 (feet) Sampling Pump Intake
 (feet below land surface) Hand bailed
 Gallons per Foot (GPF) 0.16
 Gallons in Well
 (WC x GPF) 1.0

Evacuation Method Hand bailed using a disposable teflon bailer with monofilament line.

SAMPLING DATA/FIELD PARAMETERS

Color tan Odor none Appearance cloudy Temperature 84.0 °F

Other (specific ion; OVA; HNU; etc.) none

Specific Conductance,
umhos/cm 2,350 pH 7.56

Sampling Method and Material Disposable teflon bailer with monofilament line.

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. EPA Method 602	(3)	40 ml glass	HCl/4°C
2. EPA Method 418.1	(1)	1 liter clear glass	HCl/4°C
3. EPA Method 239.2	(1)	250 ml plastic	HNO3/4°C
4.			
5.			
6.			
7.			

Remarks

Sampling Personnel
D. Press, E. Regensburger

GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Project/No. 399.02 Page 5 of 5
 Site Location Roosevelt Roads, U. S. Naval Station
 Site/Well No. 803-MW5 Coded/ Replicate No. N/A Date 04/21/94
 Weather Sunny, breezy, 90's Time Sampling Began 16:10 Time Sampling Completed 17:00

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (North Side)
 Height of MP Below Land Surface 0.2 (feet) MP Elevation 9.14 (feet)
 Total Sounded Depth (TD) of Well Below MP 15 (feet) Water - Level Elevation 0.12 (feet)
 Depth to Water (DTW) Below MP 9.02 (feet) Diameter of Casing/
 Construction Type 2" Schedule 40 PVC
 Gallons Pumped/Bailed
 Prior to Sampling
 (GAL x 5 VOL x PUMP RATE) 11.7 gallons
 Water Column (WC) in Well
 (TD - DTW) 5.98 (feet)
 Gallons per Foot (GPF) 0.16
 Gallons in Well
 (WC x GPF) 0.96
 Sampling Pump Intake
 (feet below land surface) 12

Evacuation Method Peristaltic pump with polyethylene tubing.

SAMPLING DATA/FIELD PARAMETERS

Color yellow Odor none Appearance cloudy Temperature 84.6 °F

Other (specific ion; OVA; HNU; etc.) none

Specific Conductance,
 umhos/cm 2,830 pH 7.60

Sampling Method and Material Disposable teflon bailer with monofilament line.

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. EPA Method 602	(3)	40 ml glass	HCl/4°C
2. EPA Method 418.1	(1)	1 liter clear glass	HCl/4°C
3. EPA Method 239.2	(1)	250 ml plastic	HNO3/4°C
4. EPA Method 610	(1)	1 liter amber glass	4°C
5.			
6.			
7.			

Remarks
Collected field blank.

Sampling Personnel
E. Regensburger

WELL CASING VOLUMES				
GAL./FT.	1-1/4" = 0.077	2" = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46



Appendix G



APPENDIX G

LABORATORY ANALYTICAL REPORTS

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

114 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-90831

Received: 12 MAR 94

Ms. Kathy Luke
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Purchase Order: #399.02

Project: #399.04 (U.S. Navy P.R. 1983/803)
Sampled By: Dan Press

REPORT OF RESULTS

Page 9

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES			DATE SAMPLED	
90831-3	803 SB-1			03-08-94	
90831-4	803 SB-2			03-09-94	
90831-5	803 SB-3			03-09-94	
90831-6	803 SB-4			03-09-94	
90831-7	803 SB-5			03-09-94	
PARAMETER	90831-3	90831-4	90831-5	90831-6	90831-7
BTEX (602/8020)					
Benzene, ug/kg dw	<5.0	<5.0	<5.0	<5.0	<5.0
Ethylbenzene, ug/kg dw	<5.0	<5.0	<5.0	<5.0	<5.0
Toluene, ug/kg dw	<5.0	<5.0	<5.0	<5.0	<5.0
Xylenes, ug/kg dw	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	<50	<50	<50	<50
Date Analyzed	03.21.94	03.21.94	03.21.94	03.21.94	03.21.94
Method Number	EPA 8020	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Dilution factor	1	1	1	1	1
Petroleum Hydrocarbons by GC (8015 - Extractable)					
Petroleum Hydrocarbons by GC, mg/kg dw	<10	<10	<10	<10	<10
Date Extracted	03.18.94	03.18.94	03.18.94	03.18.94	03.18.94
Date Analyzed	03.25.94	03.25.94	03.25.94	03.25.94	03.25.94
Method Number	MOD 8015	MOD 8015	MOD 8015	MOD 8015	MOD 8015
Percent Solids, %	82	72	82	86	89

SL SAVANNAH LABORATORIES
 & ENVIRONMENTAL SERVICES, INC.

414 SW 12th Avenue • Deerfield Beach, Florida 33442 • (305) 421-7400 • Fax (305) 421-2584

LOG NO: D4-90831

Received: 12 MAR 94

Ms. Kathy Luke
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Purchase Order: #399.02

Project: #399.04 (U.S. Navy P.R. 1983/803)
 Sampled By: Dan Press

REPORT OF RESULTS

Page 10

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED		
90831-8	803 Duplicate (803)	03-09-94		
90831-9	28 SB-1 (2-4)	02-23-94		
90831-10	28 Duplicate	UNKNOWN		
PARAMETER		90831-8	90831-9	90831-10
BTEX (602/8020)				
Benzene, ug/kg dw		<5.0	<5.0	<5.0
Ethylbenzene, ug/kg dw		<5.0	<5.0	<5.0
Toluene, ug/kg dw		<5.0	<5.0	<5.0
Xylenes, ug/kg dw		<5.0	<5.0	<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw		<50	<50	<50
Date Analyzed		03.21.94	03.21.94	03.21.94
Method Number		EPA 8020	EPA 8020	EPA 8020
Dilution factor		1	1	1
Petroleum Hydrocarbons by GC (8015 - Extractable)				
Petroleum Hydrocarbons by GC, mg/kg dw		<10	400	<10
Date Extracted		03.18.94	03.18.94	03.18.94
Date Analyzed		03.25.94	03.25.94	03.25.94
Method Number		MOD 8015	MOD 8015	MOD 8015
Percent Solids, %		80	89	63

SL SAVANNAH LABORATORIES

& ENVIRONMENTAL SERVICES, INC.

- 5102 LaRoche Avenue, Savannah, GA 31404
- 2846 Industrial Plaza Drive, Tallahassee, FL 32301
- 414 Southwest 12th Avenue, Deerfield Beach, FL 33442
- 900 Lakeside Drive, Mobile, AL 36693
- 6712 Benjamin Road, Suite 100, Tampa, FL 33634

Phone: (912) 354-7858
 Phone: (904) 878-3994
 Phone: (305) 421-7400
 Phone: (205) 666-6633
 Phone: (813) 885-7427

ax (912) 352-0165
 ax (904) 878-9534
 Fax (305) 421-2584
 Fax (205) 666-6696
 Fax (813) 885-7049

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

P.O. NUMBER 399.02		PROJECT NUMBER 399.04		PROJECT NAME U.S. Navy P.R. 1983/003		MATRIX TYPE		REQUIRED ANALYSES				PAGE () OF ()			
CLIENT NAME BBL				TELEPHONE/FAX NO. (407) 856-5502				AQUEOUS MATRIX NONAQUEOUS MATRIX OIL MATRIX AIR MATRIX TECP METALS PCBS 8240/0270 ISTEX TPH (Direct)						<input checked="" type="checkbox"/> STANDARD TAT <input type="checkbox"/> EXPEDITED TAT	
CLIENT ADDRESS 5950 Hazelton Rd, Orlando, FL 32822				CITY, STATE, ZIP CODE Orlando, FL 32822										REPORT DUE DATE _____	
SAMPLER(S) NAME(S) Dan Press				CLIENT PROJECT MANAGER Jose Garrido										* SUBJECT TO RUSH FEES	

SAMPLING		SAMPLE IDENTIFICATION	X	NUMBER OF CONTAINERS SUBMITTED																
DATE	TIME																			
3/2/94	-	1983 SB-6 (4-6)	X																	
3/8/94	-	803 SB-1	X																	
3/9/94	-	803 SB-2	X																	
	-	803 SB-3	X																	
	-	803 SB-4	X																	
	-	803 SB-5	X																	
	-	803 Dupl.'cate (803)	X																	
	-	1983 Dupl.'cate	X																	
2/23/94	1530	28 SB-1 (2-4)	X																	
	-	28 Dupl.'cate	X																	

Hold all samples for verification by project manager

EMPTY BOTTLES		DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
		2/14/94					<i>[Signature]</i>	3/11/94	1100

FOR SAVANNAH LABORATORY USE ONLY				LABORATORY REMARKS	
RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT		
<i>[Signature]</i>	3/13/94	12:10	<input type="checkbox"/> YES <input type="checkbox"/> NO		D4-90831

ORIGINAL

LOG NO: D4-90847

Received: 15 MAR 94

Ms. Kathy Luke
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 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Purchase Order: #399.02

Project: #399.02 (Tank #803)
 Sampled By: ER/DP

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90847-1	803 - MW-1	03-12-94	
90847-2	803 - Bailer Blank	03-12-94	
PARAMETER		90847-1	90847-2
Purgeable Aromatics (602/8020)			
Benzene, ug/l		<1.0	<1.0
Ethylbenzene, ug/l		<1.0	<1.0
Toluene, ug/l		<1.0	<1.0
Xylenes, ug/l		<1.0	<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10	<10
Date Analyzed		03.19.94	03.19.94
Method Number		EPA 602	EPA 602
Dilution factor		1	1
Petroleum Hydrocarbons			
Petroleum Hydrocarbons, mg/l		<1.0	<1.0
Date Extracted		03.18.94	03.18.94
Date Analyzed		03.18.94	03.18.94
Method Number		EPA 418.1	EPA 418.1

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REPORT OF RESULTS

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LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90847-3	803 - MW-2	03-12-94	
90847-4	803 - Duplicate	03-12-94	
PARAMETER		90847-3	90847-4
Purgeable Aromatics (602/8020)			
Benzene, ug/l		<1.0	<1.0
Ethylbenzene, ug/l		<1.0	<1.0
Toluene, ug/l		<1.0	<1.0
Xylenes, ug/l		<1.0	<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10	<10
Date Analyzed		03.19.94	03.19.94
Method Number		EPA 602	EPA 602
Dilution factor		1	1

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REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90847-3	803 - MW-2	03-12-94	
90847-4	803 - Duplicate	03-12-94	
PARAMETER		90847-3	90847-4
Polynuclear Aromatic Hydrocarbons (610)			
Acenaphthene, ug/l		<10	<10
Acenaphthylene, ug/l		<10	<10
Benzo(a)pyrene, ug/l		<10	<10
Benzo(g,h,i)perylene, ug/l		<10	<10
Benzo(b,k)fluoranthene, ug/l		<10	<10
Chrysene + Benzo(a)anthracene, ug/l		<10	<10
Fluoranthene, ug/l		<10	<10
Fluorene, ug/l		<10	<10
Indeno(1,2,3-cd)pyrene+Dibenzo(a,h)anthracene, ug/l		<10	<10
Naphthalene, ug/l		<10	<10
Phenanthrene + Anthracene, ug/l		<10	<10
Pyrene, ug/l		<10	<10
2-Methylnaphthalene, ug/l		<10	<10
1-Methylnaphthalene, ug/l		<10	<10
Date Extracted		03.16.94	03.16.94
Date Analyzed		03.24.94	03.24.94
Method Number		EPA 610	EPA 610
Dilution factor		1	1
Petroleum Hydrocarbons			
Petroleum Hydrocarbons, mg/l		<1.0	<1.0
Date Extracted		03.18.94	03.18.94
Date Analyzed		03.18.94	03.18.94
Method Number		EPA 418.1	EPA 418.1

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Project: #399.02 (Tank #803)
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REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90847-3	803 - MW-2	03-12-94	
90847-4	803 - Duplicate	03-12-94	
PARAMETER		90847-3	90847-4
Lead			
Lead, mg/l		0.0051	0.0061
Date Analyzed		03.16.94	03.16.94
Method Number		EPA 239.2	EPA 239.2

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Project: #399.02 (Tank #803)
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REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
90847-5	803 - MW-3	03-12-94
PARAMETER		90847-5
Purgeable Aromatics (602/8020)		
Benzene, ug/l		<1.0
Ethylbenzene, ug/l		<1.0
Toluene, ug/l		<1.0
Xylenes, ug/l		<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10
Date Analyzed		03.19.94
Method Number		EPA 602
Dilution factor		1
Polynuclear Aromatic Hydrocarbons (610)		
Acenaphthene, ug/l		<10
Acenaphthylene, ug/l		<10
Benzo(a)pyrene, ug/l		<10
Benzo(g,h,i)perylene, ug/l		<10
Benzo(b,k)fluoranthene, ug/l		<10
Chrysene + Benzo(a)anthracene, ug/l		<10
Fluoranthene, ug/l		<10
Fluorene, ug/l		<10
Indeno(1,2,3-cd)pyrene+Dibenzo(a,h)anthracene, ug/l		<10
Naphthalene, ug/l		<10
Phenanthrene + Anthracene, ug/l		<10
Pyrene, ug/l		<10
2-Methylnaphthalene, ug/l		<10
1-Methylnaphthalene, ug/l		<10
Date Extracted		03.16.94
Date Analyzed		03.24.94
Method Number		EPA 610
Dilution factor		1

LOG NO: D4-90847

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REPORT OF RESULTS

Page 6

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
90847-5	803 - MW-3	03-12-94
PARAMETER	90847-5	
Petroleum Hydrocarbons		
Petroleum Hydrocarbons, mg/l	<1.0	
Date Extracted	03.18.94	
Date Analyzed	03.18.94	
Method Number	EPA 418.1	

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Project: #399.02 (Tank #803)
Sampled By: ER/DP

REPORT OF RESULTS

Page 7

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
90847-6	803 - MW-4	03-12-94
PARAMETER	90847-6	
Purgeable Aromatics (602/8020)		
Benzene, ug/l		<1.0
Ethylbenzene, ug/l		<1.0
Toluene, ug/l		<1.0
Xylenes, ug/l		<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10
Date Analyzed		03.19.94
Method Number		EPA 602
Dilution factor		1
Petroleum Hydrocarbons		
Petroleum Hydrocarbons, mg/l		<1.0
Date Extracted		03.18.94
Date Analyzed		03.18.94
Method Number		EPA 418.1
Lead		
Lead, mg/l		<0.0050
Date Analyzed		03.16.94
Method Number		EPA 239.2

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REPORT OF RESULTS

Page 8

LOG NO SAMPLE DESCRIPTION , LIQUID SAMPLES

90847-7 803 - - Field
 90847-8 Trip Blank

PARAMETER	90847-7	90847-8
Purgeable Aromatics (602/8020)		
Benzene, ug/l	<1.0	<1.0
Ethylbenzene, ug/l	<1.0	<1.0
Toluene, ug/l	<1.0	<1.0
Xylenes, ug/l	<1.0	1.5
Methyl-Tert-Butyl-Ether (MTBE), ug/l	<10	<10
Date Analyzed	03.19.94	03.21.94
Method Number	EPA 602	EPA 602
Dilution factor	1	1

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REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

90847-9 Lab Blank
 90847-10 Accuracy - % Recovery (Mean)
 90847-11 Precision - Relative % Difference
 90847-12 Detection Limit

PARAMETER	90847-9	90847-10	90847-11	90847-12
Purgeable Aromatics (602/8020)				
Benzene, ug/l	<1.0	100 %	8.0 %	1.0
Ethylbenzene, ug/l	<1.0	---	---	1.0
Toluene, ug/l	<1.0	101 %	5.9 %	1.0
Xylenes, ug/l	<1.0	---	---	1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l	<10	---	---	10
Date Analyzed	03.19.94	---	---	---
Method Number	EPA 602	---	---	---

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Project: #399.02 (Tank #803)
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REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

90847-9 Lab Blank
 90847-10 Accuracy - % Recovery (Mean)
 90847-11 Precision - Relative % Difference
 90847-12 Detection Limit

PARAMETER	90847-9	90847-10	90847-11	90847-12
Polynuclear Aromatic Hydrocarbons (610)				
Acenaphthene, ug/l	<10	---	---	10
Acenaphthylene, ug/l	<10	72 %	13 %	10
Benzo(a)pyrene, ug/l	<10	---	---	10
Benzo(g,h,i)perylene, ug/l	<10	---	---	10
Benzo(b,k)fluoranthene, ug/l	<10	---	---	10
Chrysene + Benzo(a)anthracene, ug/l	<10	---	---	10
Fluoranthene, ug/l	<10	85 %	2.4 %	10
Fluorene, ug/l	<10	76 %	11 %	10
Indeno(1,2,3-cd)pyrene+Dibenzo(a,h)anthracene, ug/l	<10	---	---	10
Naphthalene, ug/l	<10	65 %	13 %	10
Phenanthrene + Anthracene, ug/l	<10	---	---	10
Pyrene, ug/l	<10	85 %	2.4 %	10
2-Methylnaphthalene, ug/l	<10	---	---	10
1-Methylnaphthalene, ug/l	<10	---	---	10
Date Extracted	03.16.94	---	---	---
Date Analyzed	03.24.94	---	---	---
Method Number	EPA 610	---	---	---
Dilution factor	1	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/l	<1.0	76 %	1.3 %	1.0
Date Extracted	03.18.94	---	---	---
Date Analyzed	03.18.94	---	---	---
Method Number	EPA 418.1	---	---	---

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Purchase Order: #399.02

Project: #399.02 (Tank #803)
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REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

 90847-9 Lab Blank
 90847-10 Accuracy - % Recovery (Mean)
 90847-11 Precision - Relative % Difference
 90847-12 Detection Limit

PARAMETER	90847-9	90847-10	90847-11	90847-12
Lead				
Lead, mg/l	<0.0050	104 %	0 %	0.0050
Date Analyzed	03.16.94	---	---	---
Method Number	EPA 239.2	---	---	---

Method References: EPA 40 CFR Part 136 and EPA 600/4-79-020.


 Paul Canevaro



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

P.O. NUMBER 399.02		PROJECT NUMBER 399.02		PROJECT NAME Tank # 803		MATRIX TYPE		REQUIRED ANALYSES										PAGE 1		OF 1			
CLIENT NAME BB+L				TELEPHONE/FAX NO. 407-994-2711				AQUEOUS MATRIX NONAQUEOUS MATRIX OIL MATRIX AIR MATRIX BTEX GIU+MUMMA TRPH Lead										<input checked="" type="checkbox"/> STANDARD TAT <input type="checkbox"/> EXPEDITED TAT *		REPORT DUE DATE _____		* SUBJECT TO RUSH FEES	
CLIENT ADDRESS 4730 NW 2nd Ave Boca Raton FL 33431				CITY, STATE, ZIP CODE																			
SAMPLER(S) NAME(S) E. Regensburger/D. Press				CLIENT PROJECT MANAGER E. Regensburger																			
SAMPLING		SAMPLE IDENTIFICATION																					
DATE	TIME																						
3-12-94	1230	803 - MW1						X 3 1															
3-12-94	1100	803 - MW2						X 3 1 1 1															
3-12-94	1200	803 - MW3						X 3 1 1															
3-12-94	1300	803 - MW4						X 3 1 1															
3-12-94	1245	803 - Bailor Blank						X 3 1															
3-12-94	1230	803 - Field Blank						X 3															
3-12-94		803 - Duplicate						X 3 1 1 1															
		Trip Blank						X 3															
RELINQUISHED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME	RELINQUISHED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME								
<i>[Signature]</i> (BB+L)		3/14/94	0600	<i>[Signature]</i>				<i>[Signature]</i>				<i>[Signature]</i>											
RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME	RECEIVED BY: (SIGNATURE)		DATE	TIME								
<i>[Signature]</i>		3/15/94	10:00	<i>[Signature]</i>				<i>[Signature]</i>				<i>[Signature]</i>											
FOR SAVANNAH LABORATORY USE ONLY										LABORATORY REMARKS													
RECEIVED FOR LABORATORY BY: (SIGNATURE)		DATE	TIME	CUSTODY INTACT		CUSTODY SEAL NO.		S.L. LOG NO.															
<i>[Signature]</i>		3/15/94	10:00	<input type="checkbox"/> YES <input type="checkbox"/> NO				D4-90847 D4-90847															

LOG NO: D4-91252

Received: 23 APR 94

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Project: #399.02 (Site #803)
 Sampled By: E Regensburger

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
91252-1	803 - MW-5	04-21-94
PARAMETER	91252-1	
BTEX (602/8020)		
Benzene, ug/l		<1.0
Ethylbenzene, ug/l		<1.0
Toluene, ug/l		<1.0
Xylenes, ug/l		<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10
Date Analyzed		04.27.94
Method Number		EPA 602
Dilution factor		1
Polynuclear Aromatic Hydrocarbons (610)		
Acenaphthene, ug/l		77
Acenaphthylene, ug/l		<10
Benzo(a)pyrene, ug/l		<10
Benzo(g,h,i)perylene, ug/l		<10
Benzo(b,k)fluoranthene, ug/l		<10
Chrysene + Benzo(a)anthracene, ug/l		<10
Fluoranthene, ug/l		<10
Fluorene, ug/l		32
Indeno(1,2,3-cd)pyrene+Dibenzo(a,h)anthracene, ug/l		<10
Naphthalene, ug/l		25
Phenanthrene + Anthracene, ug/l		16
Pyrene, ug/l		<10
2-Methylnaphthalene, ug/l		<10
1-Methylnaphthalene, ug/l		<10
Date Extracted		04.25.94
Date Analyzed		04.28.94
Method Number		EPA 610
Dilution factor		1

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Project: #399.02 (Site #803)
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REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
91252-1	803 - MW-5	04-21-94
PARAMETER	91252-1	
Petroleum Hydrocarbons		
Petroleum Hydrocarbons, mg/l	<1.0	
Date Extracted	04.26.94	
Date Analyzed	04.26.94	
Method Number	EPA 418.1	
Lead		
Lead, mg/l	<0.0050	
Date Analyzed	04.27.94	
Method Number	EPA 239.2	

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REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
91252-2	803 - Field Blank	04-21-94
PARAMETER	91252-2	
BTEX (602/8020)		
Benzene, ug/l		<1.0
Ethylbenzene, ug/l		<1.0
Toluene, ug/l		<1.0
Xylenes, ug/l		<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10
Date Analyzed		04.27.94
Method Number		EPA 602
Dilution factor		1

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REPORT OF RESULTS

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

91252-3 Lab Blank
 91252-4 Accuracy - % Recovery (Mean)
 91252-5 Precision - Relative % Difference
 91252-6 Detection Limit

PARAMETER	91252-3	91252-4	91252-5	91252-6
BTEX (602/8020)				
Benzene, ug/l	<1.0	102 %	2.9 %	1.0
Ethylbenzene, ug/l	<1.0	---	---	1.0
Toluene, ug/l	<1.0	99 %	0 %	1.0
Xylenes, ug/l	<1.0	---	---	1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l	<10	---	---	10
Date Analyzed	04.27.94	---	---	---
Method Number	EPA 602	---	---	---

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REPORT OF RESULTS

Page 5

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

91252-3 Lab Blank
 91252-4 Accuracy - % Recovery (Mean)
 91252-5 Precision - Relative % Difference
 91252-6 Detection Limit

PARAMETER	91252-3	91252-4	91252-5	91252-6
Polynuclear Aromatic Hydrocarbons (610)				
Acenaphthene, ug/l	<10	---	---	10
Acenaphthylene, ug/l	<10	68 %	1.5 %	10
Benzo(a)pyrene, ug/l	<10	---	---	10
Benzo(g,h,i)perylene, ug/l	<10	---	---	10
Benzo(b,k)fluoranthene, ug/l	<10	---	---	10
Chrysene + Benzo(a)anthracene, ug/l	<10	---	---	10
Fluoranthene, ug/l	<10	88 %	10 %	10
Fluorene, ug/l	<10	74 %	1.4 %	10
Indeno(1,2,3-cd)pyrene+Dibenzo(a,h)anthracene, ug/l	<10	---	---	10
Naphthalene, ug/l	<10	56 %	3.6 %	10
Phenanthrene + Anthracene, ug/l	<10	---	---	10
Pyrene, ug/l	<10	86 %	4.7 %	10
2-Methylnaphthalene, ug/l	<10	---	---	10
1-Methylnaphthalene, ug/l	<10	---	---	10
Date Extracted	04.25.94	---	---	---
Date Analyzed	04.28.94	---	---	---
Method Number	EPA 610	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/l	<1.0	93 %	8.6 %	1.0
Date Extracted	04.26.94	---	---	---
Date Analyzed	04.26.94	---	---	---
Method Number	EPA 418.1	---	---	---

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Project: #399.02 (Site #803)
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REPORT OF RESULTS

Page 6

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

91252-3 Lab Blank
91252-4 Accuracy - % Recovery (Mean)
91252-5 Precision - Relative % Difference
91252-6 Detection Limit

PARAMETER	91252-3	91252-4	91252-5	91252-6
Lead				
Lead, mg/l	<0.0050	99 %	2.0 %	0.0050
Date Analyzed	04.27.94	---	---	---
Method Number	EPA 239.2	---	---	---

Method References: EPA 40 CFR Part 136 and EPA 600/4-79-020.


Paul Canevaro



Final Page Of Report

Laboratory locations in Savannah, GA • Tallahassee, FL • Mobile, AL • Deerfield Beach, FL • Tampa, FL

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

P.O. NUMBER 399.02	PROJECT NUMBER 399.02	PROJECT NAME Site # 803	MATRIX TYPE	REQUIRED ANALYSES	PAGE 1	OF 1
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CLIENT NAME BB+L	TELEPHONE/FAX NO. 407-994-2711				
CLIENT ADDRESS 4730 NW 2 nd Ave. Boca Raton FL	CITY, STATE, ZIP CODE 33431				
SAMPLER(S) NAME(S) E. Regensburger	CLIENT PROJECT MANAGER E. Regensburger				

AQUEOUS MATRIX
 NONAQUEOUS MATRIX
 OIL MATRIX
 AIR MATRIX

BTEX
 TPH
 Total Lead
 610

STANDARD TAT

EXPEDITED TAT *

REPORT DUE DATE _____

* SUBJECT TO RUSH FEES

SAMPLING		SAMPLE IDENTIFICATION			NUMBER OF CONTAINERS SUBMITTED									
DATE	TIME													
4/21/94	1600	803-MWS	X		3	1	1	1						
4/21/94	1615	803-Field Blank	X		3									

RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE 4/16/94	TIME 15:00	RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE 4/21/94	TIME 1600	RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE 4/22/94	TIME 1900
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY					LABORATORY REMARKS
RECEIVED FOR LABORATORY BY: (SIGNATURE) <i>[Signature]</i>	DATE 4/22/94	TIME 13:28	CUSTODY INTACT <input type="checkbox"/> YES <input type="checkbox"/> NO	CUSTODY SEAL NO.	
					S.L. LOG NO. D4-91252

ORIGINAL