

**SITE CHARACTERIZATION
SITE 28**

**Roosevelt Roads Naval Station
Ceiba, Puerto Rico**

Contract Number N62470-93-4021

May 1994



BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

SITE CHARACTERIZATION
SITE 28

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

MAY 1994

PREPARED FOR

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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 (NAVSTA Roosevelt Roads) located near the town of Ceiba, Puerto Rico. The SC evaluated the potential impact of the former UST on the soils and groundwater in the area of Compound 28 (also referred to as Site 28), which is an impounded vehicle lot.

Site 28 is located on the eastern end of the naval station adjacent to a dry dock which has access to Bahia de Puerca, a bay adjacent to the naval fueling port Ensenada Honda. Ensenada Honda is the fueling port for the U.S. Navy Caribbean Fleet. Site 28 is currently used to store impounded vehicles. One building (Building 28), which contained a boiler that supplied steam to the dry dock area, and a 5,000-gallon UST, were formerly located on the site. Both the building and the UST have been removed.

The SC field investigation included collecting soil samples from 10 soil borings, installing and sampling five groundwater monitoring wells, performing field screening of 10 soil samples and laboratory analysis of seven soil samples, performing two slug tests, measuring groundwater elevations and collecting information to prepare a qualitative risk assessment.

Information obtained during this investigation indicates that petroleum hydrocarbons were not detected above PREQB target levels (benzene above 5 ug/Kg, total BTEX above 50 ug/Kg or TPH greater than 100 mg/Kg) in the soils at the site, except in sample 28-SB1 (2 to 4 feet bls) where laboratory analysis identified TPH at 400 mg/Kg. The laboratory analytical results indicate that soil contamination above PREQB target concentrations is not present in any other samples from the site.

Dissolved petroleum hydrocarbons were not detected in the groundwater samples obtained from the monitoring wells installed at the site at levels above the PREQB target levels of 5 ug/L for benzene, 50 ug/L for total BTEX or 50 mg/L for TPH. Results of the qualitative risk assessment indicate that the human health risks associated with Site 28 are extremely low.

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



SECTION 1

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), removed in 1993, in the area of the former Building 28 at the U.S. Naval Station - Roosevelt Roads, Ceiba, Puerto Rico. The purpose of the SC was to determine the degree and extent of potential soil and groundwater 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.

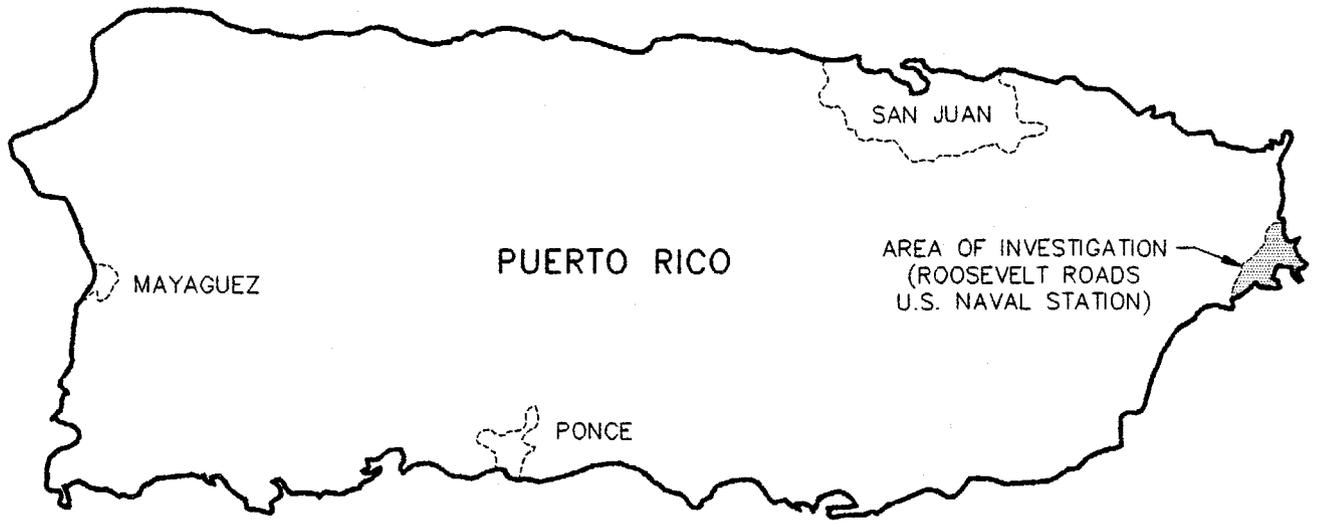
1.1 Site Location

Site 28 is located in the U.S. Naval Station - Roosevelt Roads (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 underground storage tank Site 28, located near a dry dock at the northwest corner of Bahia de Puerca (Figure 1-2).

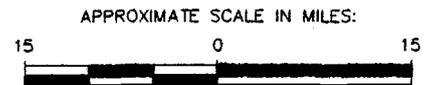
1.2 Site Background

Site 28 formerly provided steam for the dry dock area located approximately 100 feet south of the site. The site included one 5,000-gallon steel UST containing diesel fuel used to operate a boiler housed in Building 28. The boiler in Building 28 supplied steam to the dry dock area. The boiler and Building 28 were removed in the 1970s.

ATLANTIC OCEAN



CARRIBEAN SEA



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TANK 28
CEIBA, PUERTO RICO

SITE LOCATION

FIGURE
1-1

The UST was excavated and removed from the site in July 1993. Petroleum contamination was detected in soil and groundwater samples collected during the UST removal by IMECO (IMECO, July 1993). During the tank removal no free product was encountered.

Site 28 is currently used to store impounded vehicles.

1.3 Project Objectives

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

The SC field investigation consisted of installing 10 soil borings, constructing five monitoring wells, measuring groundwater elevations from the monitoring wells, conducting field and laboratory analyses of soil and groundwater samples, and performing slug tests. Analytical screening of soil and groundwater samples was performed on site prior to making decisions regarding placement of monitoring wells. Screening was conducted by a field chemist operating a portable gas chromatograph (GC) and a total petroleum hydrocarbon (TPH) analyzer and a certified technician analyzing samples with immunoassay petroleum hydrocarbon test kits. 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.



SECTION 2

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 lithology observed at the site consists primarily of unconsolidated fill material, composed of shell, limestone, and coral fragments with fine sands, silts, and rock fragments. Clay was present only in soil boring 28-SB10 from 4 to 8 feet below land surface (bls). Minor amounts of clay were also present in soil borings 28-SB5, 28-SB8, and 28-SB9 from 4 to 6 feet bls. Soils observed across the site were shell, limestone, and coral fragments, white to tan, coarse to fine grained, and subrounded. The clays are marbled textured, tan to red to dark brown in color in boring 28-SB10, and dark gray in borings 28-SB5, 28-SB8, and 28-SB9. An impenetrable surface was encountered at 12 feet below land surface (bls) in monitoring well 28-MW2. The surficial geologic material is fairly uniform across the site (**Figure 2-1**).

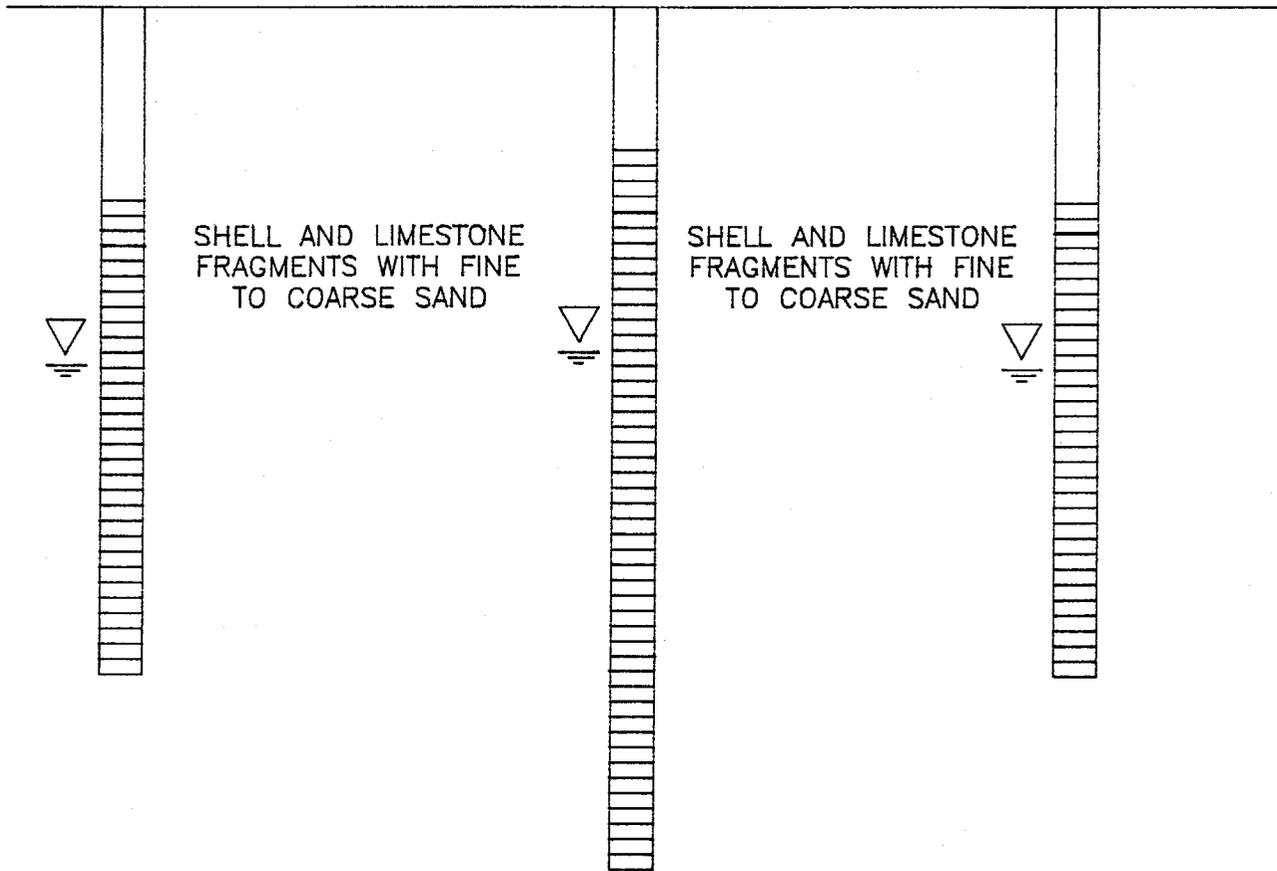
EAST
A

WEST
A'

28MW-3

28MW-1

28MW-5



LEGEND



GROUNDWATER ELEVATION IN WELL (3/21/94)



MONITORING WELL RISER



MONITORING WELL SCREEN

NOTE: CROSS SECTION LOCATION SHOWN
ON FIGURE 3-1

VERTICAL EXAGGERATION X10

5/94 27 JHD
3990313R/39903002.DWG

SOURCE: BBL, 1994



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GEOLOGIC CROSS SECTION A-A'

FIGURE
2-1



SECTION 3

SECTION 3.0 - FIELD INVESTIGATION

The SC field investigation was conducted from February 22 through March 21, 1994.

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

Groundwater assessment activities included collection of groundwater samples for field analysis from soil borings advanced to the water table, installation of monitoring wells to collect groundwater samples for laboratory analysis, and determination of groundwater elevations. In addition, lithologic data were collected during soil boring and monitoring well installation.

3.1 Drilling

The Site 28 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 and Immunoassay Field Screening Methodologies
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 all drilling activities are discussed in **Appendices C-2 and C-3**, respectively.

3.1.1 Soil Boring Installation

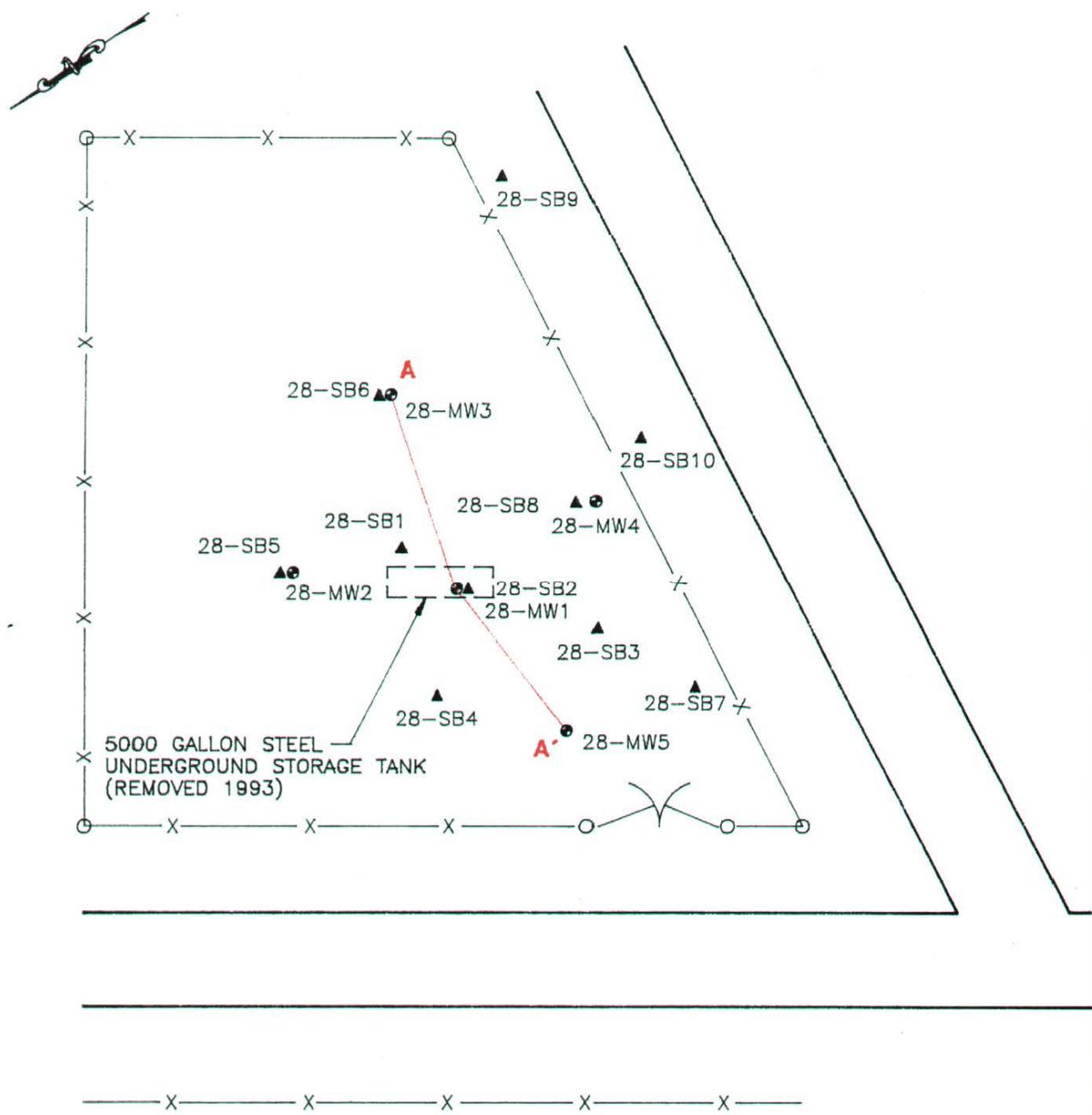
Ten soil borings were installed 28-SB1 through 28-SB10, (see **Figure 3-1**) to determine and delineate the extent of soil contamination.

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, to the water table approximately 8 feet below land surface (bls). Rock and 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

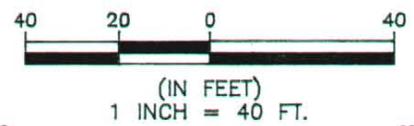
Soil samples were collected at 2-foot intervals until the soil/water interface was encountered. Soil samples were collected in 16-ounce glass jars, covered by a sheet of aluminum foil, and securely capped. Once collected, each soil sample was analyzed within five minutes using an organic vapor analyzer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

The OVA screening results, summarized in **Table 3-1**, indicate that of the 30 soil samples tested with the OVA, only five produced detectable concentrations of total organic vapors, all of which were measured at 2.2 parts



LEGEND

- 28-MW2
● MONITOR WELL
- 28-SB4
▲ SOIL BORING
- A - A' GEOLOGIC CROSS SECTION LOCATION



4/94 27 JHD
3990313R/39903201.DWG

SOURCE: BBL, 1994



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TANK 28
CEIBA, PUERTO RICO

**SOIL BORING AND
MONITORING WELL LOCATIONS**

FIGURE
3-1

TABLE 3-1
Organic Vapor Analysis of Soil
(ppm)

Site 28
Roosevelt Roads, U.S. Naval Station
Ceiba, Puerto Rico

Sample Designation	Date Sampled	Sample Depth (ft bls)	Total Organic Vapors	Total Methane Vapors*	Total Petroleum Hydrocarbon Vapors
28-SB1	2/23/94	0-2	0	0	0
	2/23/94	2-4	0.6	0	0.6
	2/23/94	4-6	0	0	0
28-SB2	2/23/94	0-2	0	0	0
	2/23/94	2-4	0	0	0
	2/23/94	4-6	0	0	0
28-SB3	2/23/94	0-2	1.8	0	1.8
	2/24/94	2-4	2.2	0	2.2
	2/24/94	4-6	1.2	0	1.2
28-SB4	2/24/94	0-2	0	0	0
	2/24/94	2-4	0	0	0
	2/24/94	4-6	0	0	0
28-SB5	2/24/94	0-2	0	0	0
	2/24/94	2-4	0	0	0
	2/24/94	4-6	0	0	0
28-SB6	2/24/94	0-2	0	0	0
	2/24/94	2-4	0	0	0
	2/24/94	4-6	0	0	0
28-SB7	2/24/94	0-2	0	0	0
	2/24/94	2-4	0	0	0
	2/24/94	4-6	0	0	0
28-SB8	2/24/94	0-2	0	0	0
	2/24/94	2-4	1.0	0	1.0
	2/24/94	4-6	0.8	0	0.8
28-SB9	2/25/94	0-2	0	0	0
	2/25/94	2-4	0	0	0
	2/25/94	4-6	0	0	0
28-SB10	2/25/94	0-2	0	0	0
	2/25/94	2-4	0	0	0
	2/25/94	4-6	0	0	0

NOTE: See Figure 3-1 for sample locations.

ppm = parts per million
bls = below land surface
* = Although methane is the primary organic vapor detected, other naturally occurring vapors may be included in this measurement

Source: Blasland, Bouck & Lee, Inc., 1994.

per million (ppm) or less. Activated carbon filtering confirmed that the concentrations did not result from the presence of organic vapors (e.g. methane) in the soil. Immunoassay confirmation testing indicated similar results (Table 3-2).

Selected soil samples that were tested using the OVA and/or immunoassay methods were subjected to additional field screening by modified EPA Method 602 for benzene, ethylbenzene, toluene, and xylenes (BTEX) using a GC; and by modified EPA Method 418.1 for TPH using a TPH analyzer. Based on the field screening analysis results (Appendix D), selected soil samples were collected 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 Groundwater Field Screening

After each soil boring was completed to the water table, a depth of approximately 7 to 8 feet below land surface (bls), the hollow stem auger was advanced an additional 2 feet, to approximately 10 feet bls. Groundwater 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. Three samples (28-SB1, 28-SB2, and 28-SB9) screened for TPH contained concentrations ranging from 23 milligrams per liter (mg/L) to 30

TABLE 3-2
Immunoassay Results

Site 28
ROOSEVELT ROADS, U.S. NAVAL STATION
Ceiba, Puerto Rico

Sample No.	Photometer Reading
28-SB1 (6-8)	0.09
28-SB2 (6-8)	0.14
28-SB3 (6-8)	0.33
28-SB4 (4-6)	0.37
28-SB5 (4-6)	0.41
28-SB6 (4-6)	0.32
28-SB7 (4-6)	0.30
28-SB8 (4-6)	0.34
28-SB9 (4-6)	0.27
28-SB10 (4-6)	0.69

NOTES:

Detection Limit = 15 ppm
 Constituent of Concern = diesel
 Positive Value = No diesel present
 Negative Value = Diesel present above 15 ppm detection limit

Source: Blasland, Bouck & Lee, Inc., 1994.

mg/L, all of which are below the PREQB target level of 50 mg/L. All groundwater samples screened in the field for benzene and total BTEX produced results below detection limits. The groundwater field screening report is included in **Appendix D**. Based on the field screening results, several borings (28-SB2, 28-SB5, 28-SB6, and 28-SB8) were converted to monitoring wells.

3.1.4 Monitoring Well Construction

Five monitoring wells (28-MW1, 28-MW2, 28-MW3, 28-MW4, and 28-MW5) were constructed to determine the presence or absence of dissolved petroleum hydrocarbons at the site (see **Figure 3-1**). The wells were installed under the observation of BB&L personnel and were constructed to allow for representative sampling of the groundwater at the site. All well materials and well installation equipment were thoroughly decontaminated prior to installation of each well. Wells were developed by pumping to remove fine-grained sediments (**Table 3-3**). 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 3-4**. Monitoring well construction diagrams are presented in **Appendix B**.

3.2 Slug Tests

Slug tests were performed on March 21, 1994, in monitoring wells 28-MW1 and 28-MW3 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 Hermit data logger and associated pressure transducer. The slug 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 ranged

**TABLE 3-3
Monitoring Well Development Summary**

Site 28
ROOSEVELT ROADS, U.S. NAVAL STATION
Ceiba, Puerto Rico

Well	Development Method	Development Date(s)	Approximate Gallons Developed	Number of Well Volumes Developed
28-MW1	Pumping	3/3/94	135	67
28-MW2	Pumping	3/4/94	9	8
28-MW3	Pumping	3/4/94	225	300
28-MW4	Pumping	3/4/94	90	82
28-MW5	Pumping	3/10/94	90	82

Source: Blasland, Bouck & Lee, Inc.; 1994.

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28-MW4	Pumping	3/4/94	90	82
28-MW5	Pumping	3/10/94	90	82

Source: Blasland, Bouck & Lee, Inc.; 1994.

**TABLE 3-4
Monitoring Well Completion Summary**

Site 28
ROOSEVELT ROADS, U.S. NAVAL STATION
Ceiba, Puerto Rico

Well Designation	28-MW1	28-MW2	28-MW3	28-MW4	28-MW5
Date Installed	3-2-94	3-3-94	3-4-94	3-3-94	3-4-94
Total Well Depth (ft, bls)	18.0	12.0	14	14	14
Top of Casing Elevation (ft, msl)	6.89	7.34	7.51	7.38	7.38
Casing Type	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC
Casing Length(s) (ft)	3	2	4	4	4
Screen Type	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC	Sch 40 PVC
Slot Size (in)	0.010	0.010	0.010	0.010	0.010
Screen Length (ft)	15	10	10	10	10
Screen Interval (ft, bls)	3-18	2-12	4-14	4-14	4-14
NOTE:					
All monitoring wells are 2 inches in diameter.					
msl	=	mean sea level			
bls	=	below land surface			

Source: Blasland, Bouck & Lee, Inc., 1994.

from 1.7 feet per day (ft/day) to 2.2 ft/day (Appendix E). The slug test raw data, graphs, and calculations are presented in Appendix E.

3.3 Water Elevation Measurements

The top-of-casing elevations of the five monitoring wells at Site 28 were surveyed by a licensed surveyor and referenced to the mean sea level.

On March 21, 1994, the depth to water was measured from the top of each well casing with an electronic water level indicator. The water elevations were measured with an electronic interface probe, which is accurate to within 0.01 feet. Depth to water and monitoring well elevation information is presented in Table 3-5 and was used to generate a groundwater elevation map (Figure 3-2).

Based on the March 21, 1994 groundwater elevations map (Figure 3-2), there is no discernable groundwater gradient at the site.

3.4 Groundwater Sampling

Groundwater samples were collected to assess the presence or absence of dissolved petroleum hydrocarbons in the groundwater at the site. Groundwater samples were collected from each monitoring well, 28-MW1 through 28-MW5, on March 10, 1994, and March 21, 1994, and transported on ice to a certified laboratory for BTEX (EPA Method 602) and TPH (EPA Method 418.1) analyses, respectively. In addition, monitoring wells 28-MW1, 28-MW2, and 28-MW4 were sampled for analysis by EPA Method 239.1, (total lead) and wells 28-MW1 and 28-MW4 were sampled for analysis by EPA Method 610 (polynuclear aromatic hydrocarbons).

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

TABLE 3-5
Water Level Data

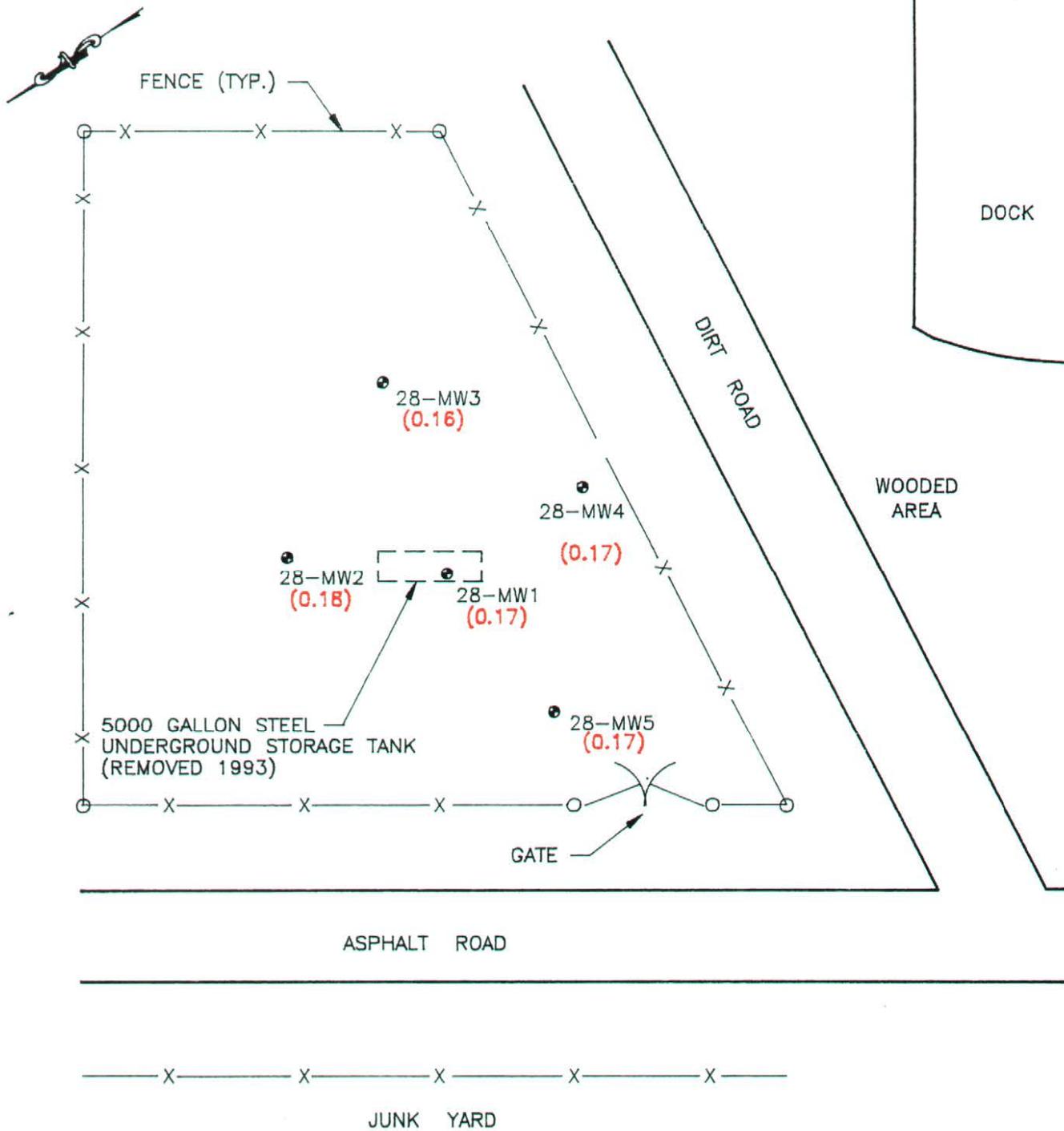
March 21, 1994

Site 28
ROOSEVELT ROADS, U.S. NAVAL STATION
Ceiba, Puerto Rico

Well Designation	Elevation of Top of Casing (ft, msl)	Depth to Water (ft)	Water Level Elevation (ft, msl)
28-MW1	6.89	6.72	0.17
28-MW2	7.34	7.16	0.18
28-MW3	7.51	7.35	0.16
28-MW4	7.38	7.21	0.17
28-MW5	7.38	7.21	0.17

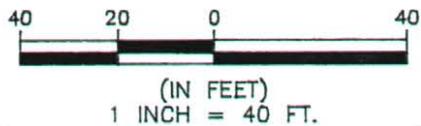
NOTE: Top-of-casing elevations referenced to the MSL.
msl = mean sea level

Source: Blasland, Bouck & Lee, Inc., 1994.



LEGEND

- 28-MW2
- MONITOR WELL
- (0.17) GROUNDWATER ELEVATION IN FEET (3/21/94)



4/84 27 JHD
3990313R/39903G01.DWG

SOURCE: B&L, 1994



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Roosevelt Roads U.S. Naval Station
TANK 28
CEIBA, PUERTO RICO

GROUNDWATER ELEVATIONS (3/21/94) FIGURE 3-2



SECTION 4

SECTION 4.0 - LABORATORY ANALYTICAL RESULTS

4.1 Soil Analytical Results

A summary of the field screening and laboratory soil analysis 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**. Soil field screening and laboratory analytical results for all samples were below the Puerto Rico Environmental Quality Board (PREQB) TPH target level of 100 milligrams per kilogram (mg/Kg), except for one instance soil boring 28-SB1 (2 to 4 feet bls) contained 400 mg/Kg of TPH. Based on surrounding soil boring laboratory analysis, TPH concentrations in 28-SB1 represent an isolated condition. **Figure 4-1** illustrates the laboratory TPH concentrations from the 4 to 6-foot sampling interval at soil borings 28-SB4 through 28-SB8.

Table 4-1 also lists the field and laboratory analytical results for benzene and total BTEX. As shown in **Table 4-1**, results of all soil samples analyzed for total BTEX were below detection limits, except sample 28-SB3 (6 to 8 feet bls) where field screening indicated a benzene concentration of 5 mg/Kg.

4.2 Groundwater Analytical Results

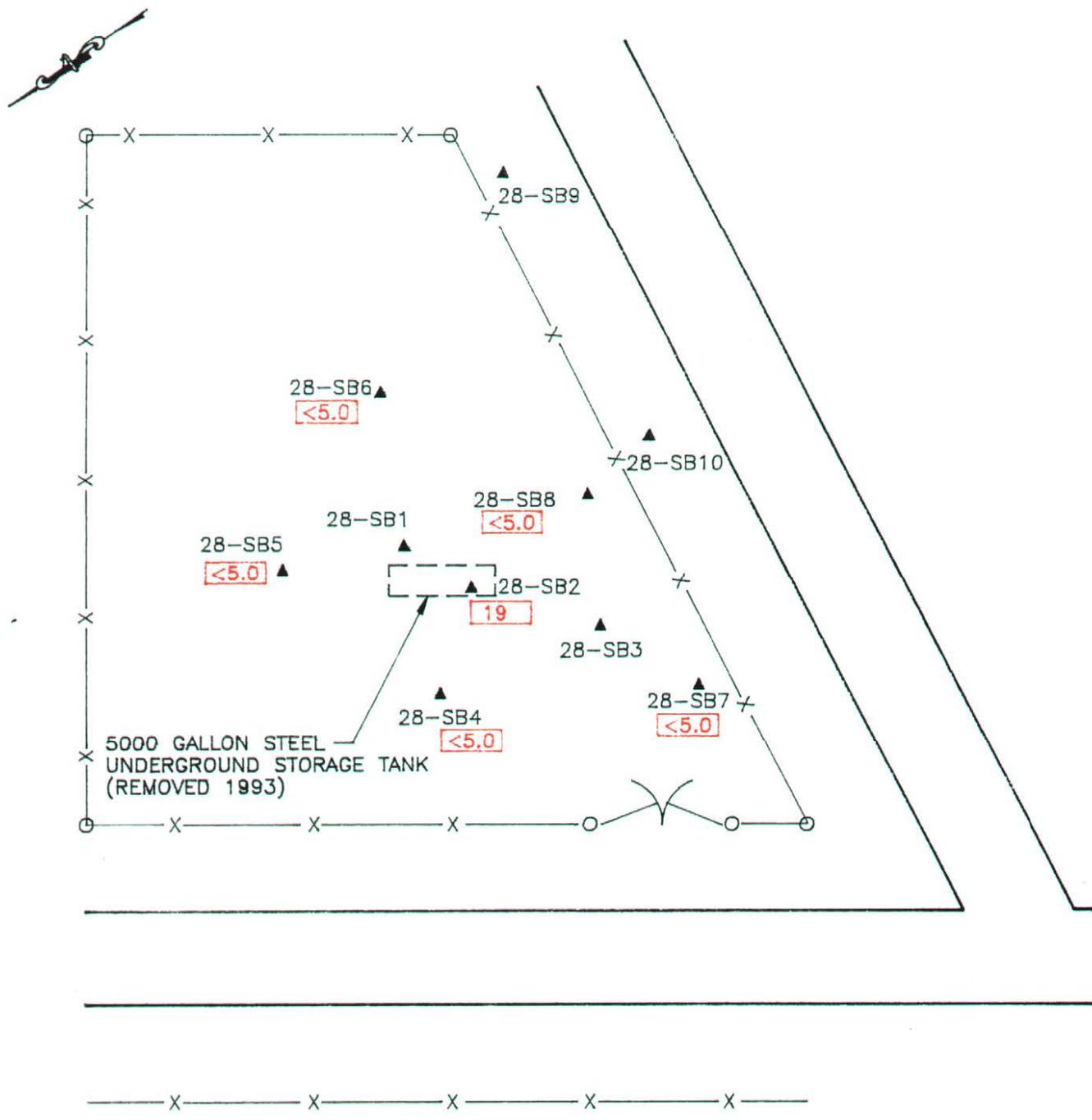
Groundwater laboratory analytical results (**Table 4-2**) indicate that none of the five wells sampled by BB&L personnel in 1994 contained benzene, total BTEX, or TPH concentrations above the PREQB target levels for UST sites. PREQB defines groundwater contamination on a site-by-site basis, but groundwater typically is considered contaminated if it contains benzene concentrations above 5 micrograms per liter (ug/L), total BTEX concentrations above 50 ug/L, or TPH concentrations above 50 milligrams per liter (mg/L).

TABLE 4-1
Summary of Soil Analytical Results

Site 28
ROOSEVELT ROADS, U.S. NAVAL STATION
Ceiba, Puerto Rico

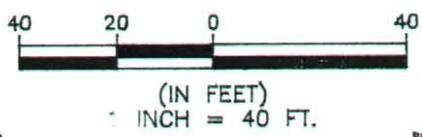
Soil Boring	ECG Laboratories (field screening)		Savannah Laboratories	
	Modified EPA Method 418.1 Field TPH (mg/Kg)	Modified EPA Method 602 Total BTEX (ug/Kg)	EPA Method 418.1 Laboratory TPH (mg/Kg)	EPA Method 8010 Laboratory Total BTEX (ug/Kg)
28-SB1 (2-4)	NA	NA	400	<5.0
28-SB1 (6'-8')	12	<5.0	NA	NA
28-SB2 (6'-8')	34	<5.0	19	<5.0
28-SB3 (6'-8')	<10	5.0	NA	NA
28-SB4 (4'-6')	<10	<5.0	<5.0	<5.0
28-SB5 (4'-6')	<10	<5.0	<5.0	<5.0
28-SB6 (4'-6')	22	<5.0	<5.0	<5.0
28-SB7 (4'-6')	122	<5.0	<5.0	<5.0
28-SB8 (4'-6')	<10	<5.0	<5.0	<5.0
28-SB9 (4'-6')	<10	<5.0	NA	NA
28-SB10 (4'-6')	<10	<5.0	NA	NA
Puerto Rico EQB ¹ UST Target Levels	100	50	100	50
NOTES: EQB ¹ = Environmental Quality Board TPH = total petroleum hydrocarbons Total BTEX = Sum of benzene, toluene, ethylbenzene, and xylenes ug/Kg = micrograms per kilogram mg/Kg = milligrams per kilogram NA = not analyzed UST = underground storage tank				

Source: Blasland, Bouck & Lee, Inc.; Savannah Laboratories; and ECG Laboratories, 1994.



LEGEND

- 28-SB4 ▲ SOIL BORING
- 12 LABORATORY TPH CONCENTRATION IN SOIL (mg/Kg)
(COLLECTED AT 4 TO 6 FEET BLS)



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TANK 28
CEIBA, PUERTO RICO

**SOIL LABORATORY TPH CONCENTRATIONS
(4 TO 6 FEET BLS)**

FIGURE
4-1

TABLE 4-2
Summary of Groundwater Analytical Results
EPA Methods 602 and 418.1

Site 28
ROOSEVELT ROADS, U.S. NAVAL STATION
Ceiba, Puerto Rico

Parameter (units)	Puerto Rico EQB Target Levels	U.S. EPA MCL	28-MW1	28-MW2	28-MW3	28-MW4	28-MW5	Dup (28) (28-MW1)	Equipment Blank	Laboratory Blank	Trip Blank
Date Sampled			3-10-94	3-10-94	3-10-94	3-10-94	3-10-94	3-21-94	3-21-94	3-25-94	
Benzene (ug/L)	5	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene (ug/L)	NS	1,000	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene(ug/L)	NS	700	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Xylenes (ug/L)	NS	10,000	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total BTEX (ug/L)	50	NS	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
MTBE (ug/L)	NS	NS	<10	<10	<10	<10	<10	<10	<10	<10	<10
PAH (ug/L)	NS	NS	<10	NA	NA	<10	NA	<10	<10	<10	NA
Total Napthalenes (ug/L)	NS	NS	14	NA	NA	<10	NA	<10	<10	<10	NA
Lead (ug/L)	NS	.015	0.10	NA	0.041	0.017	NA	0.020	NA	<0.005	NA
TPH* (mg/L)	50	NS	6.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NA

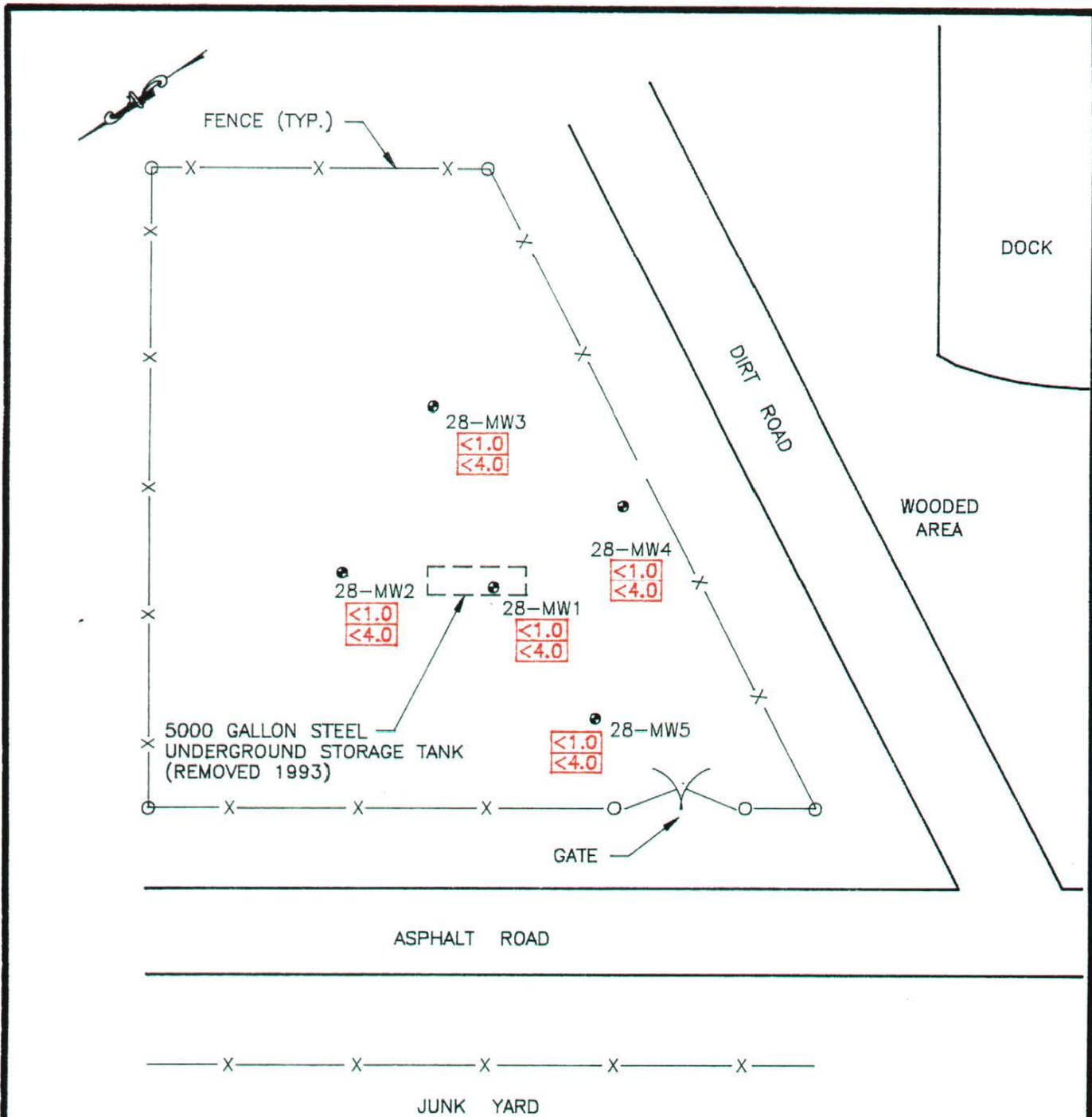
NOTE:

- TPH* = All TPH samples collected on 3/21/94.
- ug/L = micrograms per liter
- mg/L = milligrams per liter
- MTBE = methyl-tert-butyl ether
- Total BTEX = sum of benzene, toluene, ethylbenzene, and xylenes
- PAH = Polynuclear Aromatic Hydrocarbons (excluding naphthalenes)
- NA = Not analyzed
- NS = No Standard
- MCL = Maximum Contaminant Level (drinking water supplies)

Source: Blasland, Bouck & Lee, Inc.; Savannah Laboratories, Inc., 1994.

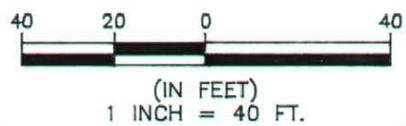
Benzene and total BTEX were not detected above the laboratory method detection limits in any groundwater samples collected from the site. The highest TPH concentration (6.8 mg/L) detected at the site was from monitoring well 28-MW1. **Figure 4-2** illustrates the benzene and total BTEX concentrations, and **Figure 4-3** depicts the TPH concentrations in the groundwater determined from the laboratory analytical results.

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



LEGEND

- 28-MW2
- MONITOR WELL
- <1.0 BENZENE Concentration in Groundwater (ug/L)
- <4.0 BTEX Concentration in Groundwater (ug/L)



4/94 27 JHD
3990313R/39903001.DWG

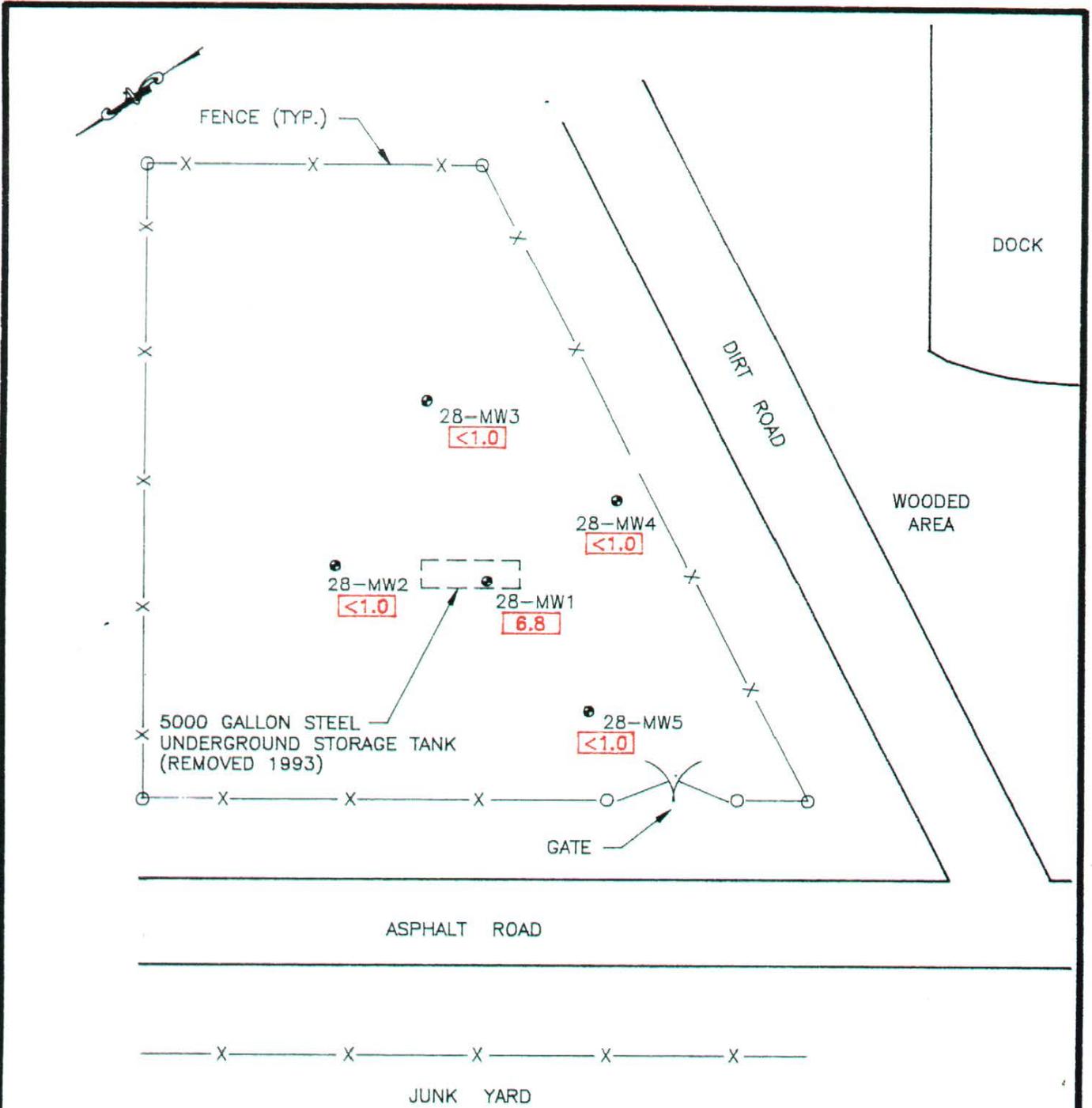
SOURCE: B&L, 1994

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TANK 28
CEIBA, PUERTO RICO

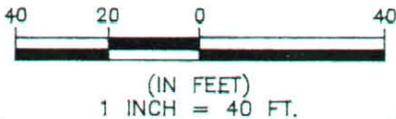
**GROUNDWATER BENZENE AND BTEX
CONCENTRATIONS**

FIGURE
4-2



LEGEND

- 28-MW2
- MONITOR WELL
- <1.0** TPH CONCENTRATION IN GROUNDWATER (mg/L)



4/84 27 JHD
3990313R/39903001.DWG

SOURCE: BBL, 1994

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Roosevelt Roads U.S. Naval Station
TANK 28
CEIBA, PUERTO RICO

GROUNDWATER TPH CONCENTRATIONS

FIGURE
4-3



SECTION 5

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 groundwater at Site 28. 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 28.

5.1 Nature and Extent of Release

Petroleum hydrocarbon constituents were detected at Site 28 during the tank removal activities in 1993. Based on laboratory information pertaining to the 10 soil borings and five monitoring wells installed during this SC investigation, petroleum hydrocarbons were detected at low concentrations in soil and groundwater samples, but were measured at a concentration above PREQB target levels for UST sites (see **Tables 4-1 and 4-2**) in only one soil sample (28-SB1).

5.2 Chemicals of Concern

Although petroleum products contain a large number of compounds, those compounds present in the groundwater that represent a potential risk to human health and the environment are volatile organic aromatics [consisting of benzene, toluene, ethylbenzene, and xylenes (BTEX)], 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.

The qualitative risk assessment will therefore focus on the qualitative human health impacts of benzene and lead in the groundwater.

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 in the site itself (Compound 28 impound lot). The nearest residences on NAVSTA Roosevelt Roads are more than one-quarter mile south-southwest 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 beneath the ground surface and access to the site is limited to security personnel.

5.3.2 Environmental Receptors

The potential for migration of compounds of concern to environmental receptors is primarily due to movement of groundwater off the site towards the nearby bay.

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 groundwater 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. However, the latest laboratory analytical results did not detect any compounds of concern above Puerto Rico EQB standards for UST sites. The other three conditions are discussed below.

5.3.4 Groundwater 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 (Fajardo is 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 groundwater 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 Bahía de Puerca. However, this is not a feasible pathway for two reasons: (1) no commercial fishing is allowed in Bahía de Puerca; and (2) the compounds of concern in the groundwater do not exist above EQB standards.

5.3.6 Inhalation Pathway

Inhalation of the compounds of concern may potentially occur by vaporization of compounds from the soil and groundwater into the air, and by wind action picking up contaminated soil at the surface. The potential for either of these pathways is low because the contaminated soil and groundwater are typically several feet or more below ground surface.

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.



SECTION 6

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 groundwater resulting from the former underground storage tank located at Site 28.

Information obtained during this investigation indicates that petroleum hydrocarbons were not detected above PREQB target levels in the soils at the site, except in sample 28-SB1 (2 to 4 feet bls) where laboratory analysis identified TPH at 400 mg/Kg. The laboratory analytical results indicate that soil contamination (benzene above 5 ug/Kg, total BTEX above 50 ug/Kg or TPH greater than 100 mg/Kg) does not exist in any other samples from the site. Dissolved petroleum hydrocarbons were not detected in the groundwater samples obtained from the monitoring wells installed at the site at levels above the PREQB target levels of 5 ug/L for benzene, 50 ug/L for total BTEX or 50 mg/L for TPH. No free product was identified in any of the test wells or monitoring wells installed at the site.

The groundwater and soil contamination at the site does not present a threat to human health based on the lack of a complete exposure pathway as discussed in the Qualitative Risk Assessment.

6.2 Recommendations

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



SECTION 7

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> <hr/> Date: <u>2/23/94</u> Boring No.: <u>28-SB1</u> Recorded By: <u>Jose Garrido</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">-7 ft BLS</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------

Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SHELL AND LIMESTONE FRAGMENTS, reddish brown to gray to dark yellowish brown, silt size to 20mm. SAND, reddish brown to gray, fine, and ROCK FRAGMENTS gray and olive green, 5mm to 20mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	5-5-4-3	SAME AS ABOVE.
4	SPT	6	8	4-4-6-4	SHELL AND LIMESTONE FRAGMENTS, reddish brown to gray to dark yellowish brown, silt size to 20mm. SAND, black, medium, with ROCK FRAGMENTS, gray and olive green, 5mm to 20mm.
5	SPT	8	10	19-11-18-13	SAME AS ABOVE.

*Remarks
PH - post hole
SPT - standard penetration test
mm - millimeter

SOIL BORING LOG

Exploration for: <u>Site Characterization</u> <hr/> Date: <u>2/23/94</u> Boring No.: <u>28-SB2</u> Recorded By: <u>Jose Garrido</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">~7 ft BLS</p>
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Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SHELL AND LIMESTONE FRAGMENTS, reddish brown to gray to dark yellowish brown, silt size to 20mm. SAND, reddish brown to gray, fine, and ROCK FRAGMENTS gray and olive green, 5mm to 20mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	4-6-48-11	SAME AS ABOVE.
4	SPT	6	8	8-9-16-11	SHELL AND LIMESTONE FRAGMENTS, Gray to dark yellowish brown, SAND, brown, fine, ROCK FRAGMENTS, olive green 5mm to 20mm, slight odor.

*Remarks
PH - post hole
SPT - standard penetration test
mm - millimeter

SOIL BORING LOG

Exploration for: <u>Site Characterization</u> <hr/> Date: <u>2/24/94</u> Boring No.: <u>28-SB3</u> Recorded By: <u>Jose Garrido</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">~7 ft BLS</p>
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Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SHELL AND LIMESTONE FRAGMENTS, gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty, ROCK FRAGMENTS, gray-green, 1mm to 5mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	10-11-10-12	SAME AS ABOVE.
4	SPT	6	7	12-10-7-17	SHELL AND LIMESTONE FRAGMENTS, reddish brown to gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty and ROCK FRAGMENTS, gray-green
		7	8		SHELL AND LIMESTONE FRAGMENTS, reddish brown to gray to yellowish brown, silt size to 20mm. SAND, black, coarse.

*Remarks
PH - post hole
SPT - standard penetration test
mm - millimeter

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>	Location Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico
Date: <u>2/24/94</u>	Water Table ~7 ft BLS
Boring No.: <u>28-SB4</u>	
Recorded By: <u>Jose Garrido</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	SHELL AND LIMESTONE FRAGMENTS, gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty, ROCK FRAGMENTS, gray-green, 1mm to 5mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	17-25-19-14	SAME AS ABOVE.
4	SPT	6	7	30-19-20-15	SANDY CLAY, reddish yellow, wet.
		7	8		

*Remarks

PH - post hole

SPT - standard penetration test

mm - millimeter

SOIL BORING LOG

Exploration for: <u>Site Characterization</u> <hr/> Date: <u>2/24/94</u> Boring No.: <u>28-SB5</u> Recorded By: <u>Jose Garrido</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">~7 ft BLS</p>
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Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SHELL AND LIMESTONE FRAGMENTS, to gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty, ROCK FRAGMENTS, gray-green, 1mm to 5mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	5	10-8-13-17	SAME AS ABOVE.
		5	6		CLAY, dark gray - gray-green, with SHELL AND LIMESTONE FRAGMENTS.
4	SPT	6	8	24-11-11-15	CLAY, brown and olive green, some ROCK FRAGMENTS, olive green.

*Remarks
PH - post hole
SPT - standard penetration test
mm- millimeter

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>			Location Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico		
Date: <u>2/24/94</u>			Water Table ~7 ft BLS		
Boring No.: <u>28-SB6</u>					
Recorded By: <u>Jose Garrido</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	SHELL AND LIMESTONE FRAGMENTS, gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty, ROCK FRAGMENTS, gray-green, 1mm to 5mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	17-13-11-7	SAME AS ABOVE.
4	SPT	6	8	7-11-12-29	SAME AS ABOVE.
PH - post hole					
SPT - standard penetration test					

SOIL BORING LOG

Exploration for: <u>Site Characterization</u> <hr/> Date: <u>2/24/94</u> Boring No.: <u>28-SB7</u> Recorded By: <u>Jose Garrido</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">~7 ft BLS</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------

Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SHELL AND LIMESTONE FRAGMENTS, gray, silt size to 20mm. SAND, gray, very fine, silty, ROCK FRAGMENTS, gray, 1mm to 5mm.
2	PH	2	4	NA	SHELL AND LIMESTONE FRAGMENTS, gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine to silty.
3	SPT	4	6	11-14-12-8	SAME AS ABOVE.
4	SPT	6	7		SAME AS ABOVE.
		7	8		Encountered ROCKS or hard surface from (7-8 feet BLS)

*Remarks
PH - post hole
SPT - standard penetration test
mm - millimeter

SOIL BORING LOG

Exploration for: <u>Site Characterization</u> <hr/> Date: <u>2/25/94</u> Boring No.: <u>28-SB10</u> Recorded By: <u>Jose Garrido</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">~7 ft BLS</p>
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Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SHELL AND LIMESTONE AND CORAL FRAGMENTS, reddish brown to gray to dark yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	7-4-5-5	CLAY, light brown-red dark yellowish orange, with ROCK FRAGMENTS, light olive brown, 5mm to 20 mm.
4	SPT	6	8	2-3-4-5	CLAY, yellow-light brown-red-dark yellowish orange (MOTTLED).

*Remarks
PH - post hole
SPT - standard penetration test
mm - millimeter

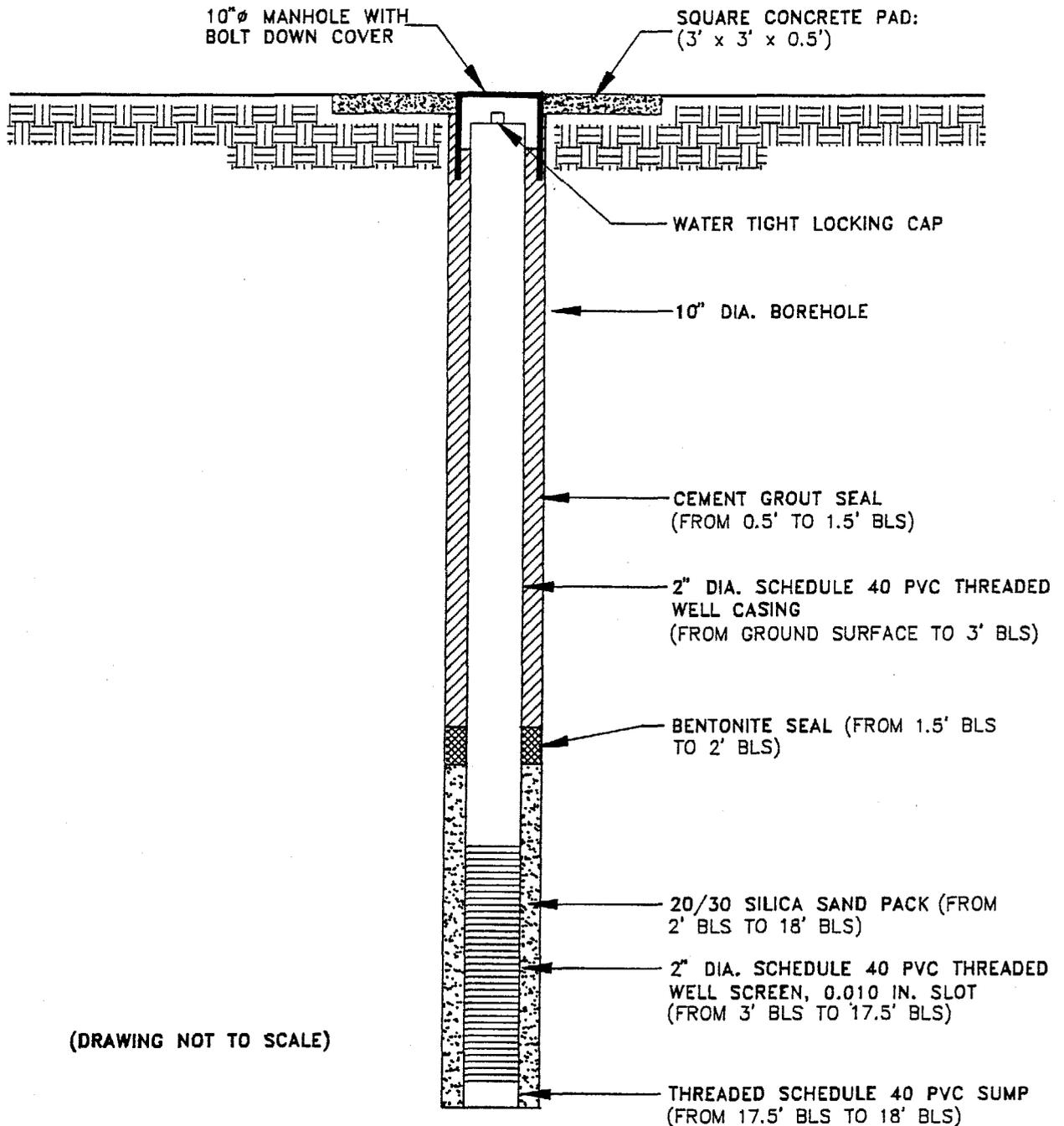


APPENDIX B

APPENDIX B

MONITORING WELL CONSTRUCTION DIAGRAM AND LITHOLOGIC LOGS

28-MW1



(DRAWING NOT TO SCALE)

PROJECT NO.: 399.03
WELL NO.: 28-MW1
BY: JRG
DATE: 3/2/94
CASING ELEVATION: 6.89
DEPTH TO WATER UPON COMPLETION: 7 FT.
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 18 FEET
SAMPLE TYPE: SPLIT-SPOON
SAMPLE INTERVAL: CONTINUOUS



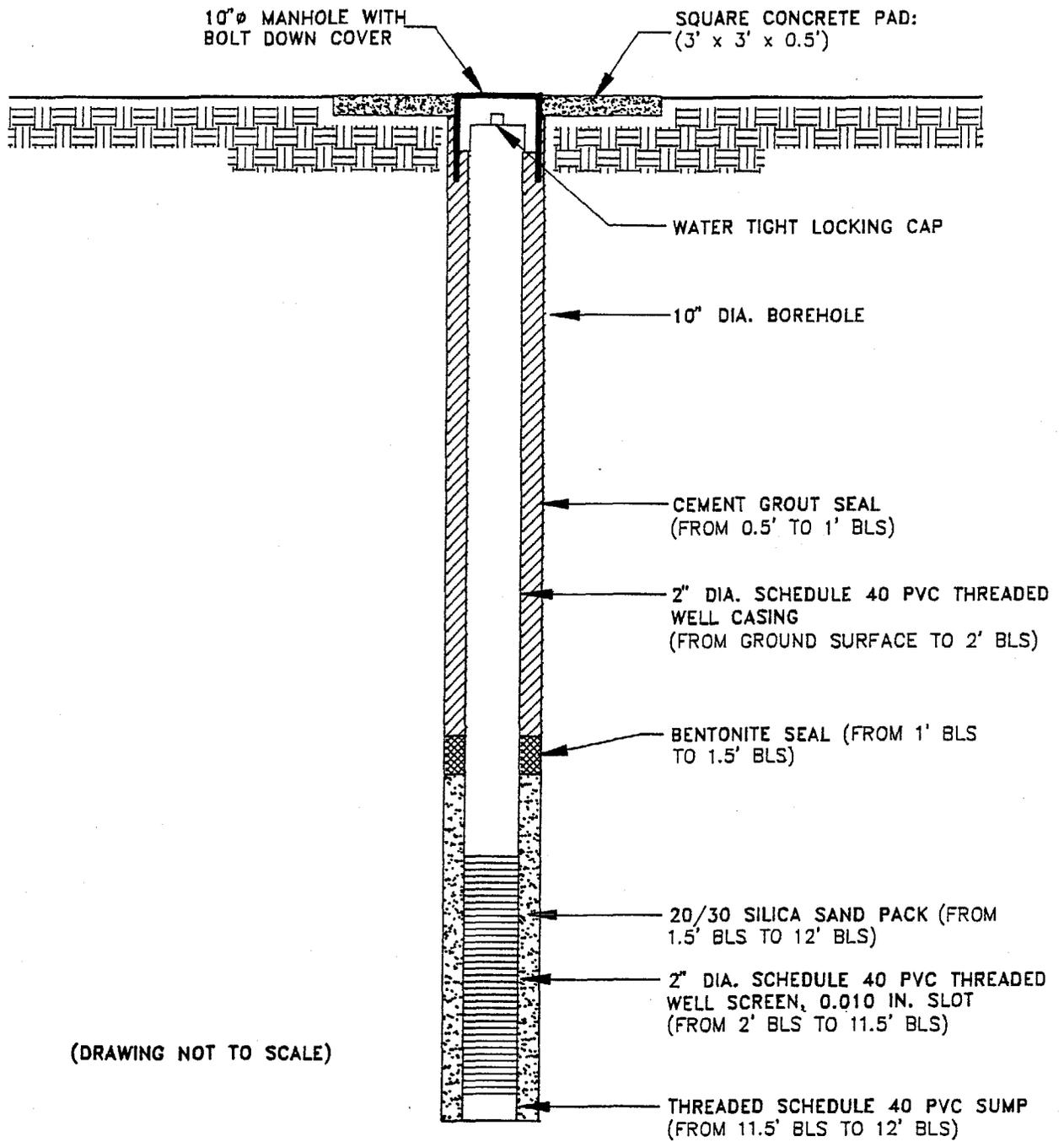
BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
TANK 28

CEIBA, PUERTO RICO

MONITORING WELL 28-MW1
CONSTRUCTION DETAILS

28-MW2



(DRAWING NOT TO SCALE)

PROJECT NO.: 399.03
WELL NO.: 28-MW2
BY: JRG
DATE: 3/3/94
CASING ELEVATION: 7.34
DEPTH TO WATER UPON COMPLETION: 7 FT.
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 12 FEET
SAMPLE TYPE: SPLIT-SPOON
SAMPLE INTERVAL: CONTINUOUS

4/94 27 JHD
399031.R/39903002.DWG

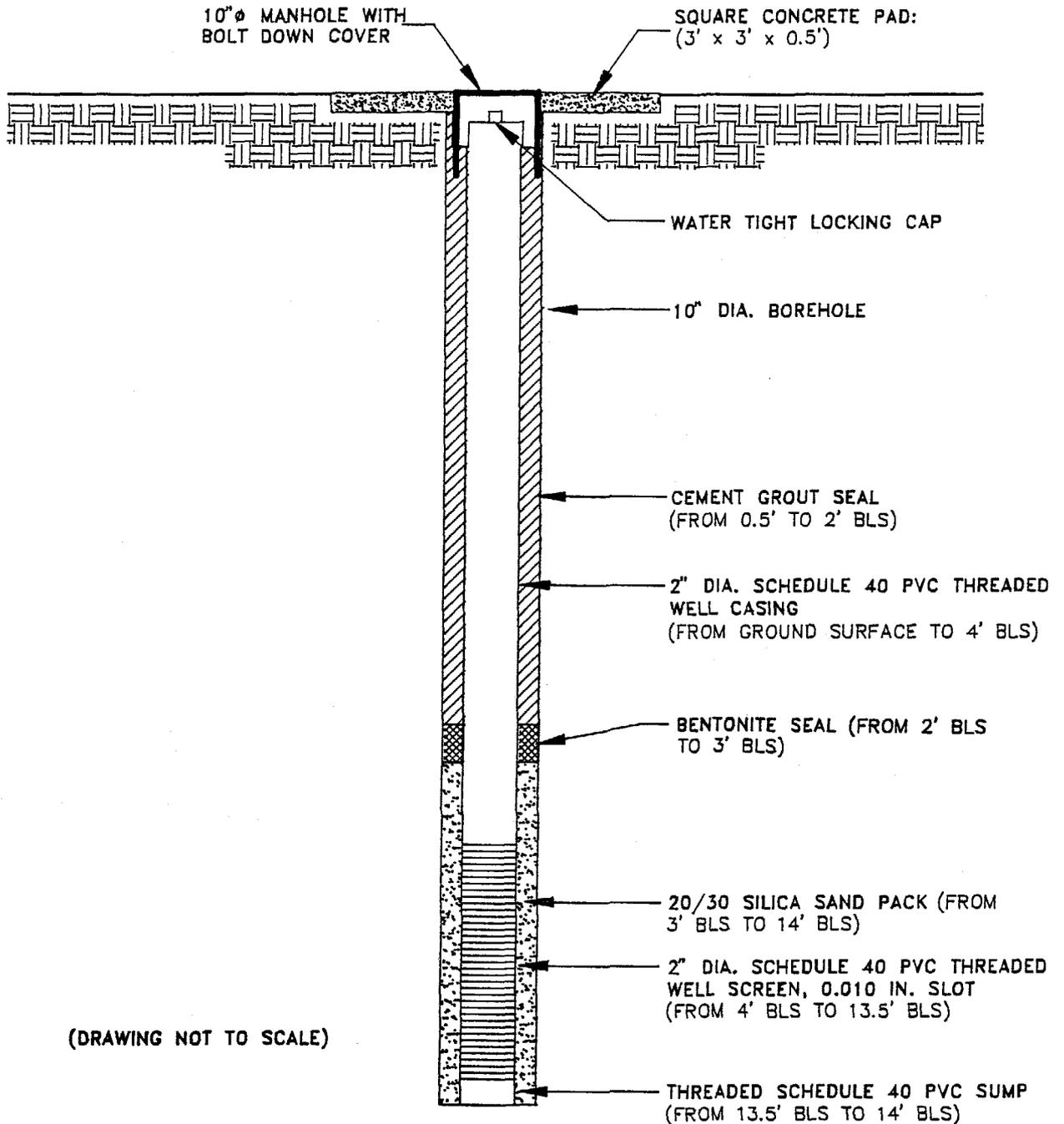


BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
TANK 28
CEIBA, PUERTO RICO

MONITORING WELL 28-MW2
CONSTRUCTION DETAILS

28-MW3



(DRAWING NOT TO SCALE)

PROJECT NO.: 399.03
WELL NO.: 28-MW3
BY: JRG
DATE: 3/3/94
CASING ELEVATION: 12.27
DEPTH TO WATER UPON COMPLETION: 10 FT.
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 19 FEET
SAMPLE TYPE: SPLIT-SPOON
SAMPLE INTERVAL: CONTINUOUS

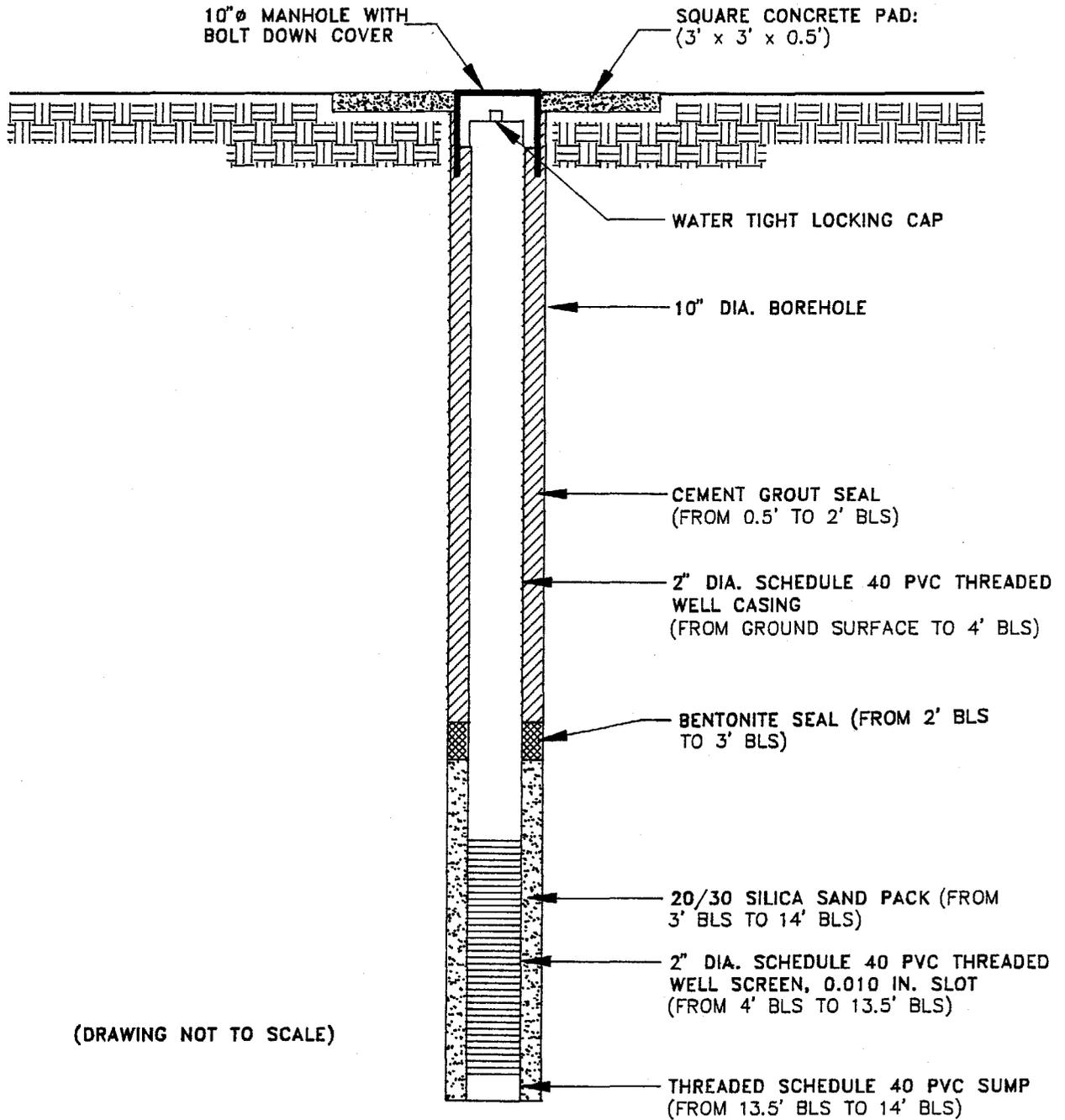


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TANK 28
CEIBA, PUERTO RICO

MONITORING WELL 28-MW3
CONSTRUCTION DETAILS

28-MW4



(DRAWING NOT TO SCALE)

PROJECT NO.: 399.03
WELL NO.: 28-MW3
BY: JRG
DATE: 3/3/94
CASING ELEVATION: 12.27
DEPTH TO WATER UPON COMPLETION: 10 FT.
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 19 FEET
SAMPLE TYPE: SPLIT-SPOON
SAMPLE INTERVAL: CONTINUOUS

4/84 27 JHD
399031.3R/39903.02.DWG

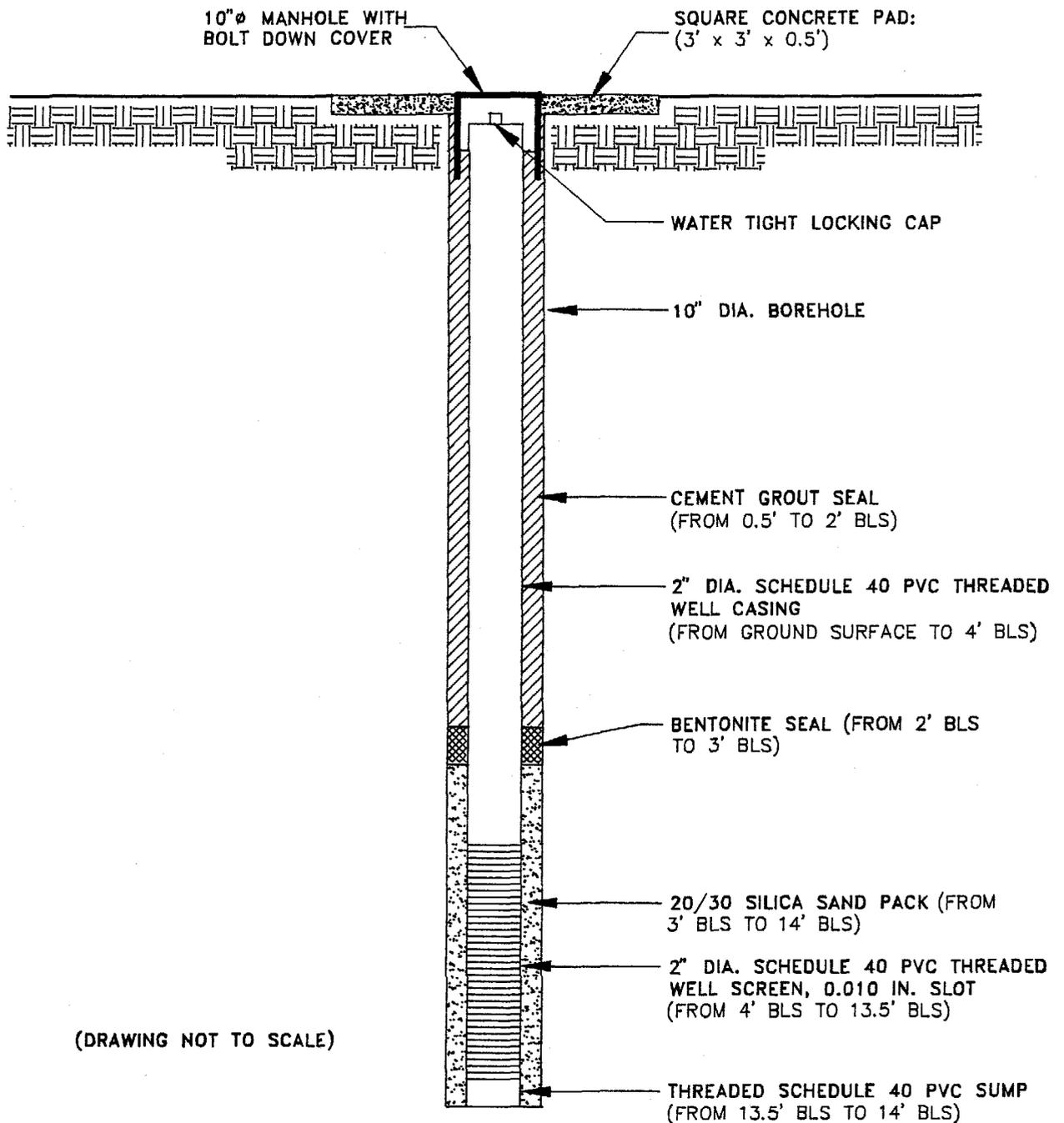


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ENGINEERS & SCIENTISTS

ROOSEVELT ROADS U.S. NAVAL STATION
TANK 28
CEIBA, PUERTO RICO

MONITORING WELL 28-MW4
CONSTRUCTION DETAILS

28-MW5



(DRAWING NOT TO SCALE)

PROJECT NO.: 399.03
WELL NO.: 28-MW3
BY: JRG
DATE: 3/3/94
CASING ELEVATION: 12.27
DEPTH TO WATER UPON COMPLETION: 10 FT.
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 19 FEET
SAMPLE TYPE: SPLIT-SPOON
SAMPLE INTERVAL: CONTINUOUS

4/84 27 JHO
3990313R/39903L02.DWG



BLASLAND, BOUCK & LEE, INC.
ENGINEERS & SCIENTISTS

Roosevelt Roads U.S. Naval Station
TANK 28
CEIBA, PUERTO RICO

**MONITORING WELL 28-MW5
CONSTRUCTION DETAILS**

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>	Location Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico
Date: <u>3/2/94</u>	Water Table ~7 ft BLS
Boring No.: <u>28-MW1</u>	
Recorded By: <u>Dan 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	SHELL AND LIMESTONE FRAGMENTS, reddish brown to gray to dark yellowish brown, silt size to 20mm. SAND, reddish brown to gray, fine, and ROCK FRAGMENTS gray and olive green, 5mm to 20mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	4-6-48-11	SAME AS ABOVE.
4	SPT	6	8	8-9-16-11	SAME AS ABOVE.
5	SPT	8	10	10-17-20-13	SHELL AND LIMESTONE FRAGMENTS, reddish brown to gray to dark yellowish brown, silt size to 20mm.
6	SPT	10	12	5-5-5-4	SAME AS ABOVE.
7	SPT	12	14	9-13-17-28	SAME AS ABOVE.
8	SPT	14	16	12-22-50-Refusal	SAME AS ABOVE.

***Remarks**

PH - post hole

mm - millimeter

SPT - standard penetration test

SOIL BORING LOG

Exploration for: <u>Site Characterization</u> <hr/> Date: <u>3/3/94</u> Boring No.: <u>28-MW2</u> Recorded By: <u>Dan Press</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">~7 ft BLS</p>
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Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SHELL AND LIMESTONE FRAGMENTS, gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty, ROCK FRAGMENTS, gray-green, 1mm to 5mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	10-8-13-17	SAME AS ABOVE.
4	SPT	6	8	24-11-11-15	CLAY, brown and olive green
5	SPT	10	12	27-50 (only 3" recovery)	CLAY, brown, with ROCK FRAGMENTS, olive green, 1mm to 20 mm.

*Remarks
PH - post hole
SPT - standard penetration test
mm - millimeter

SOIL BORING LOG

Exploration for: <u>Site Characterization</u> <hr/> Date: <u>3/3/94</u> Boring No.: <u>28-MW3</u> Recorded By: <u>Dan Press</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">~7 ft BLS</p>
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Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	NA	SHELL AND LIMESTONE FRAGMENTS, gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty, ROCK FRAGMENTS, gray-green, 1mm to 5mm.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	17-13-11-7	SAME AS ABOVE.
4	SPT	6	8	7-11-12-29	SHELL AND LIMESTONE FRAGMENTS, fine-coarse, gray to yellowish brown, SAND AND SILT, gray, some very fine, with SLIGHT ROCKS AND CORAL, yellowish orange-lt. gray.
5	SPT	10	12	16-17-14-12	ROCK FRAGMENTS, tan, CORAL FRAGMENTS, tan, CLAY, brown.
6	SPT	12	14	3-4-5-7	CLAY, light brown, ROCK AND SHELL FRAGMENTS.

*Remarks
PH - post hole
SPT - standard penetration test
mm - millimeter

SOIL BORING LOG

Exploration for: <u>Site Characterization</u>			Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p>		
Date: <u>3/3/94</u>			Water Table <p align="center">~7 ft BLS</p>		
Boring No.: <u>28-MW4</u>					
Recorded By: <u>Jose Garrido</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	SHELL AND LIMESTONE FRAGMENTS, gray to yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, to silty.
2	PH	2	4	NA	SAME AS ABOVE.
3	SPT	4	6	5-8-8-18	SAME AS ABOVE.
4	SPT	6	8	9-7-4-4	SAME AS ABOVE.
5	SPT	10	12	11-5-6-12	SHELL FRAGMENTS, creamy tan-brown, fine, ROCK FRAGMENTS, brown.
6	SPT	12	14	6-6-6-21	SHELL FRAGMENTS, brown, fine, ROCK FRAGMENTS AND CLAY, brown
*Remarks					
PH - post hole					
SPT - standard penetration test					
mm - millimeter					

SOIL BORING LOG

Exploration for: <u>Site Characterization</u> <hr/> Date: <u>3/4/94</u> Boring No.: <u>28-MW5</u> Recorded By: <u>Dan Press</u> Drill Type: <u>Hollow stem auger</u> Weather: <u>Sunny, 90°</u>	Location <p align="center">Site 28 Roosevelt Roads - U.S. Naval Station Ceiba, Puerto Rico</p> Water Table <p align="center">~7 ft BLS</p>
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Sample No.	Type	Depth		No. of Blows	Soil Description and Boring Log
		From	To		
1	PH	0	2	N/A	SHELL, CORAL, AND LIMESTONE FRAGMENTS, reddish brown to gray to dark yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty.
2	PH	2	4	N/A	SAME AS ABOVE.
3	SPT	4	6	6-12-12-13	SAME AS ABOVE.
4	SPT	6	8	13-13-13-15	SAME AS ABOVE.
5	SPT	8	10	6-7-12-11	CORAL, white, 20mm, SHELL AND LIMESTONE FRAGMENTS, light yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty,
6	SPT	10	12	5-6-7-5	SHELL, CORAL, AND LIMESTONE FRAGMENTS, reddish brown to gray to dark yellowish brown, silt size to 20mm. SAND, light yellowish gray, very fine, silty.
7	SPT	12	14	4-7-4-6	SAME AS ABOVE.

*Remarks
PH - post hole
SPT - standard penetration test



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.

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 (mdl).

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 AND IMMUNOASSAY FIELD SCREENING METHODOLOGIES

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.

The following method (EPA Method 846/4030) was employed for immunoassay petroleum hydrocarbon screening: (1) standards for 15 mg/kg petroleum hydrocarbons were prepared; (2) the sample was weighed (10 grams of soil) and extracted; (3) the sample was filtered and diluted; (4) the sample was allowed to incubate for 10 minutes; (5) the coated antibody tube was vigorously washed; (6) substrates were added and allowed to sit for 2-1/2 minutes; and, (7) photometer color readings were recorded, and the sample tubes were then compared against the standard tube to determine the presence of diesel constituents above or below the 15 mg/Kg detection limit.

APPENDIX C-5

MONITORING WELL CONSTRUCTION

The five monitoring wells installed for this SC (28-MW1 through 28-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 groundwater contamination).

Filter pack material consisting of 20/30 grade silica sand was poured in each borehole annulus to 1 to 2 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). A monitoring well construction diagram and lithologic summary for each monitoring well constructed under the supervision of BB&L 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 3-3**.

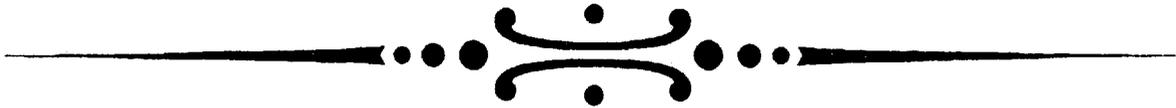
Based on groundwater field screening results, development water from each monitoring well was determined to be clean and was purged onto the ground surrounding the well.



APPENDIX D

APPENDIX D

FIELD TPH AND BTEX SCREENING REPORT



ANALYSIS 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

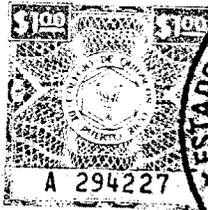
Note: This summary is only for positive parameters above reporting limit

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, M.S.
Laboratory Manager
Lic. 3006

Results Table

ECG Case No: 94-039

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

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/l)</i>
TPH	23

ECG Case No: 94-040

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

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/l)</i>
TPH	23

ECG Case No: 94-041

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	12

ECG Case No: 94-042

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	34

ECG Case No: 94-043

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
Benzene	0.005
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: 94-044

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

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

ECG Case No: 94-045

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

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

ECG Case No: 94-046

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: 94-047

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: 94-048

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

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

ECG Case No: 94-049

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	22

ECG Case No: 94-050

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	122

ECG Case No: 94-051

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

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

ECG Case No: 94-052

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

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

ECG Case No: 94-053

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

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/l)</i>
TPH	30

ECG Case No: 94-054

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

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

ECG Case No: 94-055

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

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

ECG Case No: 94-056

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: 94-057

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: 94-058

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: 94-076

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: 94-077

Volatile Aromatics Organics	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
Benzene	nd
Toluene	nd
Ethylbenzene	nd
m & p -xylene	0.010
o-xylene	nd

nd = Not detected, below detectable limit

Total Petroleum Hydrocarbons	
<i>Constituent</i>	<i>Amount (mg/Kg)</i>
TPH	1,164

ECG Case No: 94-078

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	844

ECG Case No: 94-079

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	1,410

ECG Case No: 94-080

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	512

ECG Case No: 94-081

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	124

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 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: 94-097

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: 94-098

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

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

PROJECT NUMBER 399.03		PROJECT NAME Tank # 28		MATRIX TYPE		REQUIRED ANALYSES				PAGE 1	OF 1						
CLIENT NAME BBIL			TELEPHONE/FAX NO. 407-994-7711			AQUEOUS MATRIX NONAQUEOUS MATRIX OIL MATRIX AIR MATRIX TPH/BTEX						<input type="checkbox"/> STANDARD TAT <input type="checkbox"/> EXPEDITED TAT *					
CLIENT ADDRESS 150 RW 2nd Ave Boca Raton, FL			CITY, STATE, ZIP CODE 33421									REPORT DUE DATE 2/14 - 2/25 * SUBJECT TO RUSH FEES					
SAMPLER(S) NAME(S) Guerrido / E. Rejnarsburg			CLIENT PROJECT MANAGER E. Rejnarsburg														
SAMPLING		SAMPLE IDENTIFICATION				NUMBER OF CONTAINERS SUBMITTED											
DATE	TIME																
2/14	1530	28-SB1 (6'-8')		X		1											
2/14	1745	28-SB2 (2'-4')		X		1											
2/14	1750	28-SB2 (6'-8')		X		1											
4/19	0845	28-SB3 (6'-8')		X		1											
2/14	0900	28-SB3		X		2											
2/14	1045	28-SB4		X		2											
2/14	1030	28-SB4 (4'-6')		X		1											
2/14	1300	28-SB5 (4'-6')		X		1											
2/14	1315	28-SB5		X		2											

RELINQUISHED BY: (SIGNATURE) <i>[Signature]</i>	DATE 2-24-14	TIME 1330	RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE 2-24-14	TIME 1320	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY						LABORATORY REMARKS	
RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT <input type="checkbox"/> YES <input type="checkbox"/> NO	CUSTODY SEAL NO.	S/L LOG NO.		

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

I.D. NUMBER 349.D3	PROJECT NUMBER	PROJECT NAME DB 927 219. # 28	MATRIX TYPE	REQUIRED ANALYSES	PAGE	OF
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CLIENT NAME DB 927	TELEPHONE/FAX NO.	
CLIENT ADDRESS		CITY, STATE, ZIP CODE

AMPLER(S) NAME(S) DB 927	CLIENT PROJECT MANAGER ...	
------------------------------------	--------------------------------------	--

SAMPLING		SAMPLE IDENTIFICATION	MATRIX TYPE				NUMBER OF CONTAINERS SUBMITTED										REPORT DUE DATE _____	* SUBJECT TO RUSH FEES									
DATE	TIME		AQUEOUS MATRIX	NONAQUEOUS MATRIX	OIL MATRIX	AIR MATRIX	1	2	3	4	5	6	7	8	9	10			11	12							
1/15	11:00	28-5B9	X				2																				
1/15	11:00	28-5B8	X				2																				
1/15	11:00	28-5B10	X				2																				
1/15	11:30	28-5B10 (11.6)	X									✓	✓														
1/15	11:00	28-5B7 (14.6)	X									✓	✓														
1/15	11:00	28-5B8 (11.6)	X									✓	✓														

RELINQUISHED BY: (SIGNATURE) <i>Carolyn Hudson</i>	DATE 2/15/94	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE) <i>[Signature]</i>	DATE 2/15/94	TIME
RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

FOR SAVANNAH LABORATORY USE ONLY					LABORATORY REMARKS
RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT <input type="checkbox"/> YES <input type="checkbox"/> NO	CUSTODY SEAL NO.	

CLIENT'S CHAIN OF CUSTODY



APPENDIX E

APPENDIX E

SLUG TEST RESULTS AND CALCULATIONS

U.S. NAVAL STATION
ROOSEVELT ROADS
PUERTO RICO

Well No. (Site No.) 28 - MW 1 (399.03) Well Diameter 2" Schedule 40 PVC
 Screened Interval 5 - 18' BLS Prot. Casing Flush/manhole
 Total Depth 20' TOC Screen submersed 13.28
 Depth to Water 6.72 TOC Transducer Serial No. 355155
 Water Column 13.28 Logger No. 2K-332 (Hermit 2000)
 Transducer Calibration
 Lowered to 8.82 Read 1.05
 Lowered to _____ Read _____
 Lowered to _____ Read _____
 Transducer Set 16.59 feet below top of casing
 Transducer Reading 9.870 feet of head above transducer
 Reset reference to zero X

Run No. Step 4 Select No. NA Rising/Falling Step NA
 Initial Static 9.870 feet of head above transducer
 Begin Test Static 9.870 feet of head above transducer

Begin test time 16:25
 End test time 16:29
 End test static water level 9.870 feet of head above transducer

Slug length* NA Length in water NA Type NA
 Rope Length NA
 Elapsed time until full recovery 1.66 min *Pumped water slug out with a centrifugal pump

Run No. Step 5 Select No. NA Rising/Falling Step NA
 Reset reference to zero X
 Initial Static 9.889 feet of head above transducer
 Begin Test Static 9.889 feet of head above transducer

Begin test time 16.31
 End test time 16.34
 End test static water level 9.895 feet of head above transducer

Slug length* NA Length in water NA Type NA
 Rope Length NA
 Elapsed time until full recovery 1.42 min *Pumped water slug out with a centrifugal pump

Methods of analysis _____

Calculated hydraulic conductivity _____ ft/min _____ cm/sec
 Thickness of aquifer _____ Saturated thickness _____
 Calculated transmissivity _____
 Water rising through screen _____ Static column of water _____
 radius of well casing _____
 Actual well radius _____
 Porosity of gravel pack _____
 Horizontal distance from well center to undisturbed aquifer _____
 Starting drawdown _____

SLUG TEST RESULTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.01

Well No.: 28-MW1
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	6.89 (ft)	210.01 (cm)
Depth to Bottom of Screen (distance from ground level)	15.00 (ft)	457.20 (cm)
Boring Diameter	8.25 (in)	20.96 (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	51 (sec)	51 (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	7.7E-04	2.2	16.4
 <u>TRANSMISSIVITY</u>	 <u>cm²/sec</u>	 <u>ft²/day</u>	 <u>gpd/ft</u>
	0.70	66	492



SLUG TEST WORKSHEET

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.01

Well No.: 28-MW1

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	4.00 (in)	10.16 (cm)
Le	11.11 (ft)	338.63 (cm)
H0	0.10 (ft)	3.05 (cm)
Ht	0.010 (ft)	0.30 (cm)
T	51 (sec)	51 (sec)
b	30 (ft)	914.40 (cm)



SLUG TEST RESULTS – FIELD DATA

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.01

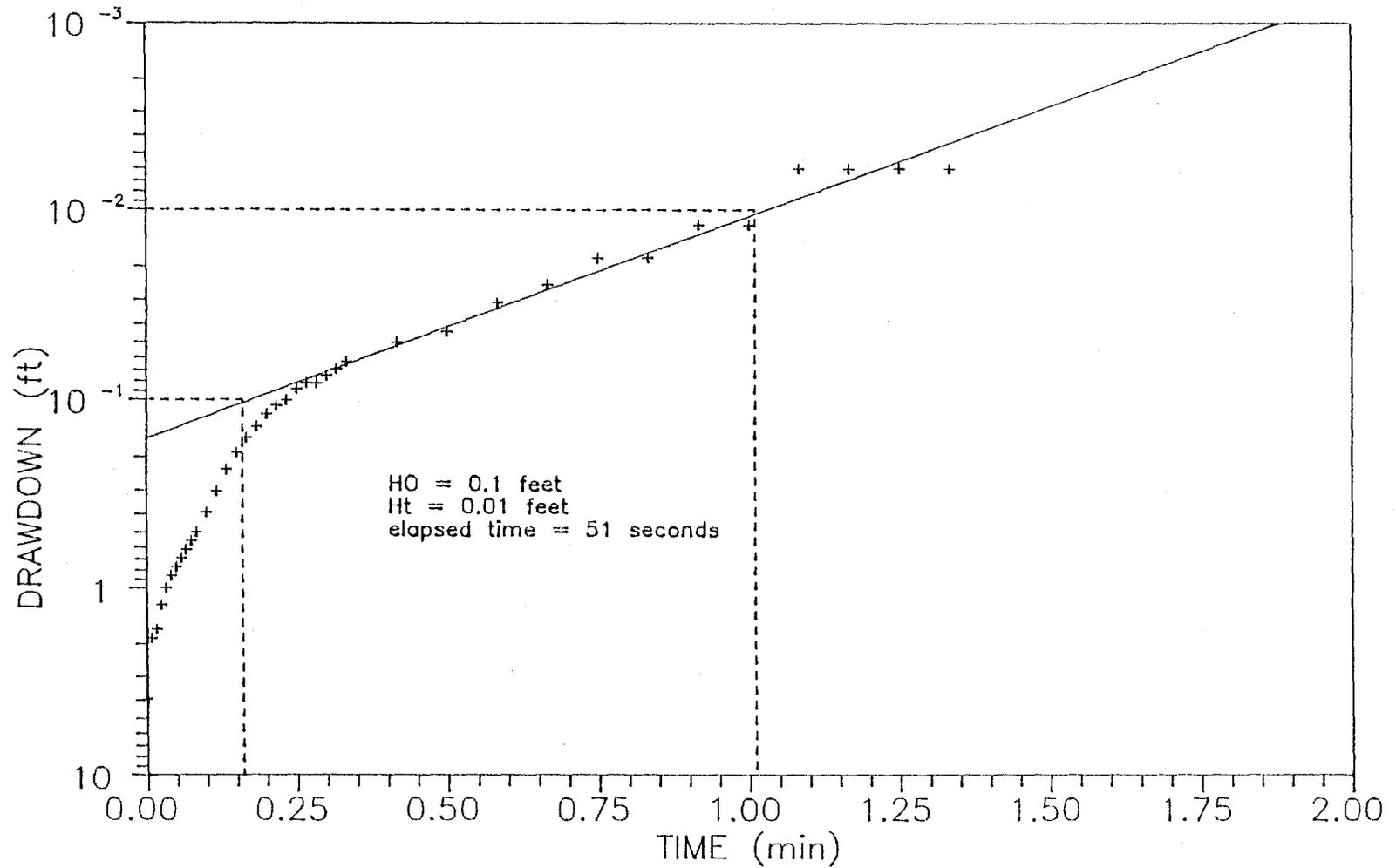
Well No.: 28-MW1

Test Date: 3/21/94

<u>TIME (min)</u>	<u>DEPTH (ft)</u>	<u>TIME (min)</u>	<u>DEPTH (ft)</u>
0.0000	3.938	0.8333	0.018
0.0083	1.862	0.9166	0.012
0.0166	1.666	1.0000	0.012
0.0250	1.230	1.0833	0.006
0.0333	0.990	1.1666	0.006
0.0416	0.852	1.2500	0.006
0.0500	0.763	1.3333	0.006
0.0583	0.688		
0.0666	0.618		
0.0750	0.555		
0.0833	0.498		
0.1000	0.391		
0.1166	0.302		
0.1333	0.233		
0.1500	0.189		
0.1666	0.157		
0.1833	0.138		
0.2000	0.119		
0.2166	0.107		
0.2333	0.100		
0.2500	0.088		
0.2666	0.082		
0.2833	0.082		
0.3000	0.075		
0.3166	0.069		
0.3333	0.063		
0.4166	0.050		
0.5000	0.044		
0.5833	0.031		
0.6666	0.025		
0.7500	0.018		



ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
28-MW1 (03/21/94)



U.S. NAVAL STATION
ROOSEVELT ROADS
PUERTO RICO

Well No. (Site No.) 28 - MW 3 (399.03) Well Diameter 2" Schedule 40 PVC
 Screened Interval 5 - 12' BLS Prot. Casing Flush/manhole
 Total Depth 20' TOC Screen submersed 12.65
 Depth to Water 7.35 TOC Transducer Serial No. 355155
 Water Column 12.65 Logger No. 2K-332 (Hermit 2000)
 Transducer Calibration
 Lowered to 4.73 Read 4.732
 Lowered to _____ Read _____
 Lowered to _____ Read _____
 Transducer Set 13.09 feet below top of casing
 Transducer Reading 5.742 feet of head above transducer
 Reset reference to zero _____

Run No. Step 6 Select No. NA Rising/Falling Step NA
 Initial Static 5.742 feet of head above transducer
 Begin Test Static 5.742 feet of head above transducer
 Begin test time 16:48
 End test time 16:58
 End test static water level 5.760 feet of head above transducer
 Slug length* NA Length in water NA Type NA
 Rope Length NA
 Elapsed time until full recovery 3.0 min *Pumped water slug out with a centrifugal pump

Run No. Step 7 Select No. NA Rising/Falling Step NA
 Reset reference to zero X
 Initial Static 5.751 feet of head above transducer
 Begin Test Static 5.751 feet of head above transducer
 Begin test time 17:01
 End test time 17:09
 End test static water level 5.776 feet of head above transducer
 Slug length* NA Length in water NA Type NA
 Rope Length NA
 Elapsed time until full recovery 3.0 min *Pumped water slug out with a centrifugal pump

Methods of analysis _____
 Calculated hydraulic conductivity _____ ft/min _____ cm/sec
 Thickness of aquifer _____ Saturated thickness _____
 Calculated transmissivity _____
 Water rising through screen _____ Static column of water _____
 Radius of well casing _____
 Actual well radius _____
 Porosity of gravel pack _____
 Horizontal distance from well center to undisturbed aquifer _____
 Starting drawdown _____

SLUG TEST RESULTS

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.01

Well No.: 28-MW3
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	7.45 (ft)	227.08 (cm)
Depth to Bottom of Screen (distance from ground level)	15.00 (ft)	457.20 (cm)
Boring Diameter	8.25 (in)	20.96 (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	80.4 (sec)	80.4 (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	6.1E-04	1.7	12.9
 <u>TRANSMISSIVITY</u>	 <u>cm²/sec</u>	 <u>ft²/day</u>	 <u>gpd/ft</u>
	0.56	51	387



SLUG TEST WORKSHEET

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.01

Well No.: 28-MW3

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	4.00 (in)	10.16 (cm)
Le	6.49 (ft)	197.82 (cm)
H0	0.10 (ft)	3.05 (cm)
Ht	0.010 (ft)	0.30 (cm)
T	80.4 (sec)	80.4 (sec)
b	30 (ft)	914.40 (cm)



SLUG TEST RESULTS – FIELD DATA

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
399.01

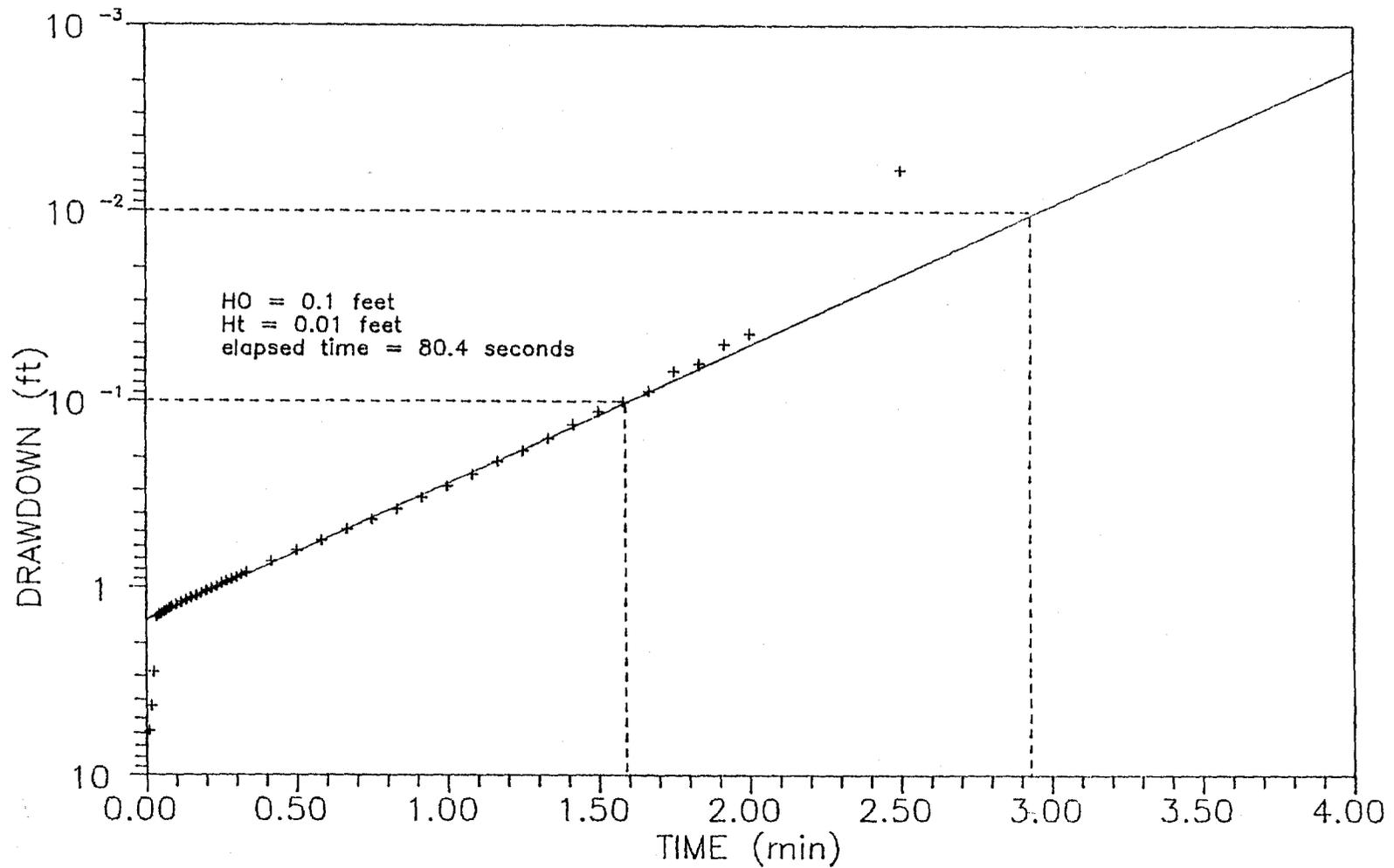
Well No.: 28-MW3

Test Date: 3/21/94

<u>TIME (min)</u>	<u>DEPTH (ft)</u>	<u>TIME (min)</u>	<u>DEPTH (ft)</u>
0.0083	5.818	0.9166	0.328
0.0166	4.303	1.0000	0.284
0.0250	2.846	1.0833	0.246
0.0333	1.432	1.1666	0.208
0.0416	1.394	1.2500	0.183
0.0500	1.375	1.3333	0.157
0.0583	1.344	1.4166	0.132
0.0666	1.325	1.5000	0.113
0.0750	1.300	1.5833	0.100
0.0833	1.274	1.6666	0.088
0.1000	1.236	1.7500	0.069
0.1166	1.199	1.8333	0.063
0.1333	1.167	1.9166	0.050
0.1500	1.136	2.0000	0.044
0.1666	1.104	2.5000	0.006
0.1833	1.072		
0.2000	1.041		
0.2166	1.009		
0.2333	0.984		
0.2500	0.952		
0.2666	0.927		
0.2833	0.902		
0.3000	0.877		
0.3166	0.852		
0.3333	0.826		
0.4166	0.719		
0.5000	0.631		
0.5833	0.555		
0.6666	0.485		
0.7500	0.429		
0.8333	0.378		



ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
28-MW3 (03/21/94)





APPENDIX F

APPENDIX F

GROUNDWATER SAMPLING PROCEDURES AND SAMPLING LOGS

GROUNDWATER 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 bailers were used to collect groundwater samples. Prior to sampling groundwater 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 by hand bailing using a disposable bailer. 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**.

Groundwater 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 were collected on every date that two or more wells were sampled: March 10 and March 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 groundwater samples were being collected on that date. No constituents were detected above the laboratory detection limits in any of the field blank samples.

Two equipment blanks were collected during the SC, one from a new disposable bailer and one from decontaminated hollow-stem augers used to install borings. The samples were collected by pouring deionized, organic-free

water into and over the bailer and augers and collecting the runoff in the appropriate laboratory containers. No constituents were detected above the laboratory detection limits in either of the equipment blank samples.

One set of duplicate samples from monitoring well 28-MW1 was collected for analysis by EPA Methods 602, 610, and 418.1. To test the laboratory's precision, the origin of the duplicate sample was not known by the laboratory. The duplicate sample analysis (**Table 4-2**) was essentially identical.

Project/No. 399.03 Page 1 of 5
 Site Location: Roosevelt Road, U.S. Naval Station
 Site/Well No. 28-MW1 Coded/ Replicate No. _____ Date 3/21/94
 Weather Sunny 90's Time Sampling Began 14:30 Time Sampling Completed 14:46

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Below Land Surface Approximately 0.3 (feet) MP Elevation 6.89 (feet)
 Total Sounded Depth (TD) of Well Below MP 18 (feet) Water-Level Elevation 0.17 (feet)
 Depth to Water (DTW) Below MP 6.72 (feet) Diameter of Casing/
 Construction Type 2-inch/Schedule 40 PVC
 Gallons Pumped/Bailed
 Prior to Sampling
 (GAL x 3 VOL x PUMP RATE) 6.5
 Water Column (WC) in Well
 (TD - DTW) 11.28 (feet)
 Gallons per Foot (GPF) 0.16
 Gallons in Well
 (WC x GPF) 1.8
 Sampling Pump Intake
 (feet below land surface) NA
 Evacuation Method Teflon bailer

SAMPLING DATA/FIELD PARAMETERS

Color light brown Odor none Appearance cloudy/silty Temperature 85.3°F
 Other (specific ion; OVA; HNU; etc.) None
 Specific Conductance,
 umhos/cm 1,800 pH 7.72
 Sampling Method and Material Dedicated teflon bailer with monofilament line

	Constituents Sampled	Container Description		Preservative
		From Lab	X or BB&L	
1.	<u>418.1</u>	<u>1 liter clear glass</u>	<u>X</u>	<u>HCL/4°C</u>
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____
6.	_____	_____	_____	_____
7.	_____	_____	_____	_____

Remarks _____

Sampling Personnel
Eric 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. 399.03 Page 2 of 5

Site Location Roosevelt Road, U.S. Naval Station

Site/Well No. 28-MW2 Coded/ Replicate No. _____ Date 3/21/94

Weather Sunny 90's Time Sampling Began 14:56 Time Sampling Completed 15:12

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Below Land Surface Approximately 0.3 (feet) MP Elevation 7.34 (feet)
 Total Sounded Depth (TD) of Well Below MP 14 (feet) Water-Level Elevation 0.18 (feet)
 Depth to Water (DTW) Below MP 7.16 (feet) Diameter of Casing/
 Construction Type 2-inch/Schedule 40 PVC
 Gallons Pumped/Bailed
 Prior to Sampling
 (GAL x 3 VOL x PUMP RATE) 6.5
 Water Column (WC) in Well
 (TD - DTW) 6.84 (feet) Sampling Pump Intake
 (feet below land surface) NA
 Gallons per Foot (GPF) 0.16
 Gallons in Well
 (WC x GPF) 1.1

Evacuation Method Teflon bailer

SAMPLING DATA/FIELD PARAMETERS

Color light brown Odor none Appearance cloudy/silty Temperature 82.4°F

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

Specific Conductance, umhos/cm 804 pH 8.06

Sampling Method and Material Dedicated teflon bailer with monofilament line

	Constituents Sampled	Container Description		Preservative
		From Lab	X or BB&L	
1.	<u>418.1</u>	<u>1 liter clear glass</u>	<u>X</u>	<u>HCL/4°C</u>
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____
6.	_____	_____	_____	_____
7.	_____	_____	_____	_____

Remarks _____

Sampling Personnel
Eric 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. 399.03 Page 3 of 5
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. 28-MW3 Coded/ Replicate No. _____ Date 3/21/94
 Weather Sunny 90's Time Sampling Began 15:25 Time Sampling Completed 15:35

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Below Land Surface Approximately 0.3 (feet) MP Elevation 7.51 (feet)
 Total Sounded Depth (TD) of Well Below MP 12 (feet) Water-Level Elevation 0.16 (feet)
 Depth to Water (DTW) Below MP 7.35 (feet) Diameter of Casing/ Construction Type 2-inch/Schedule 40 PVC
 Gallons Pumped/Bailed Prior to Sampling _____
 Water Column (WC) in Well (TD - DTW) 4.65 (feet) (GAL x 3 VOL x PUMP RATE) 5.0
 Gallons per Foot (GPF) 0.16
 Gallons in Well (WC x GPF) 0.75 Sampling Pump Intake (feet below land surface) NA

Evacuation Method Teflon bailer

SAMPLING DATA/FIELD PARAMETERS

Color light brown Odor none Appearance cloudy/silty Temperature 82.9°F
 Other (specific ion; OVA; HNU; etc.) None

Specific Conductance, umhos/cm 2,190 pH 7.88

Sampling Method and Material Dedicated teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. <u>418.1</u>	<u>X</u>	<u>1 liter clear glass</u>	<u>HCL/4°C</u>
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____

Remarks Collected duplicate sample

Sampling Personnel Eric 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. 399.03 Page 4 of 5
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. 28-MW4 Coded/ Replicate No. _____ Date 3/21/94
 Weather Sunny 90's Time Sampling Began 15:42 Time Sampling Completed 15:52

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Below Land Surface Approximately 0.3 (feet) MP Elevation 7.38 (feet)
 Total Sounded Depth (TD) of Well Below MP 14 (feet) Water-Level Elevation 0.17 (feet)
 Depth to Water (DTW) Below MP 7.21 (feet) Diameter of Casing/ Construction Type 2-inch/Schedule 40 PVC
 Gallons Pumped/Bailed Prior to Sampling _____
 (GAL x 3 VOL x PUMP RATE) 6.5
 Water Column (WC) in Well (TD - DTW) 6.79 (feet) Sampling Pump Intake (feet below land surface) NA
 Gallons per Foot (GPF) 0.16
 Gallons in Well (WC x GPF) 1.1

Evacuation Method Teflon bailer

SAMPLING DATA/FIELD PARAMETERS

Color light brown Odor none Appearance cloudy/silty Temperature 83.9°F
 Other (specific ion; OVA; HNU; etc.) None

Specific Conductance, umhos/cm 1,250 pH 8.69

Sampling Method and Material Dedicated teflon bailer with monofilament line

Constituents Sampled	Container Description		Preservative
	From Lab	X or BB&L	
1. <u>418.1</u>	<u>1 liter clear glass</u>	<u>X</u>	<u>HCL/4°C</u>
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____

Remarks _____

Sampling Personnel
Eric 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. 399.03 Page 5 of 5
 Site Location Roosevelt Road, U.S. Naval Station
 Site/Well No. 28-MW5 Coded/Replicate No. _____ Date 3/21/94
 Weather Sunny 90's Time Sampling Began 15:59 Time Sampling Completed 16:08

EVACUATION DATA

Description of Measuring Point (MP) Top of Casing (north side)
 Height of MP Below Land Surface Approximately 0.3 (feet) MP Elevation 7.38 (feet)
 Total Sounded Depth (TD) of Well Below MP 14 (feet) Water-Level Elevation 0.17 (feet)
 Depth to Water (DTW) Below MP 7.21 (feet) Diameter of Casing/Construction Type 2-inch/Schedule 40 PVC
 Wet _____ Water Column (WC) in Well (TD - DTW) 6.79 (feet) Gallons Pumped/Bailed Prior to Sampling (GAL x 3 VOL x PUMP RATE) 6.5
 Gallons per Foot (GPF) 0.16 Sampling Pump Intake (feet below land surface) NA
 Gallons in Well (WC x GPF) 1.1
 Evacuation Method Teflon bailer

SAMPLING DATA/FIELD PARAMETERS

Color white Odor none Appearance cloudy/silty Temperature 82.9°F
 Other (specific ion; OVA; HNU; etc.) None

Specific Conductance, umhos/cm 1,020 pH 8.23

Sampling Method and Material Dedicated teflon bailer with monofilament line

	Constituents Sampled	Container Description		Preservative
		From Lab	X or BB&L	
1.	<u>418.1</u>	<u>1 liter clear glass</u>	<u>X</u>	<u>HCL/4°C</u>
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____
6.	_____	_____	_____	_____
7.	_____	_____	_____	_____

Remarks _____

Sampling Personnel
Eric 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 REPORT

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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

LOG NO: D4-90831A

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 1

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

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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

LOG NO: D4-90831A

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 2

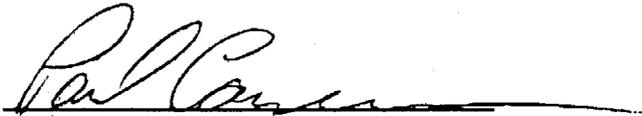
LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

90831A-3 Lab Blank
90831A-4 Accuracy - % Recovery (Mean)
90831A-5 Precision - Relative % Difference
90831A-6 Detection Limit

PARAMETER	90831A-3	90831A-4	90831A-5	90831A-6

BTEX (602/8020)				
Benzene, ug/kg dw	<5.0	88 %	18 %	5.0
Ethylbenzene, ug/kg dw	<5.0	---	---	5.0
Toluene, ug/kg dw	<5.0	104 %	0 %	5.0
Xylenes, ug/kg dw	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg dw	<50	---	---	50
Date Analyzed	03.21.94	---	---	---
Method Number	EPA 8020	---	---	---
Petroleum Hydrocarbons by GC (8015 - Extractable)				
Petroleum Hydrocarbons by GC, mg/kg dw	<10	73 %	5.5 %	10
Date Extracted	03.18.94	---	---	---
Date Analyzed	03.25.94	---	---	---
Method Number	MOD 8015	---	---	---

Method Reference: EPA SW-846.


Paul Canevaro

Final Page Of Report

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

LOG NO: D4-90697

Received: 28 FEB 94

Mr. Eric Regensburger
 Blasland, Bouck & Lee
 4730 NW Boca Raton Boulevard
 Boca Raton, FL 33431

Project: #399.03 (Tank #28)
 Sampled By: ER/JG

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED				
90697-1	28-SB2 (6' -8')	02-23-94				
90697-2	28-SB4 (4' -6')	02-24-94				
90697-3	28-SB5 (4' -6')	02-24-94				
90697-4	28-SB6 (4' -6')	02-24-94				
90697-5	28-SB7 (4' -6')	02-24-94				
PARAMETER	90697-1	90697-2	90697-3	90697-4	90697-5	
Purgeable Aromatics (602/8020)						
Benzene, ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	
Ethylbenzene, ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	
Toluene, ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	
Xylenes, ug/kg	<5.0	<5.0	<5.0	<5.0	<5.0	
Methyl-Tert-Butyl-Ether (MTBE), ug/kg	<50	<50	<50	<50	<50	
Date Analyzed	02.28.94	02.28.94	02.28.94	02.28.94	02.28.94	
Method Number	EPA 8020	EPA 8020	EPA 8020	EPA 8020	EPA 8020	
Dilution factor	1	1	1	1	1	
Petroleum Hydrocarbons						
Petroleum Hydrocarbons, mg/kg	19	<5.0	<5.0	<5.0	<5.0	
Date Extracted	02.28.94	02.28.94	02.28.94	02.28.94	02.28.94	
Date Analyzed	03.01.94	03.01.94	03.01.94	03.01.94	03.01.94	
Method Number	EPA 9073	EPA 9073	EPA 9073	EPA 9073	EPA 9073	

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.03 (Tank #28)
Sampled By: ER/JG

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	DATE SAMPLED
90697-6	28-SB8 (4' -6')	02-25-94
PARAMETER		90697-6
Purgeable Aromatics (602/8020)		
Benzene, ug/kg		<5.0
Ethylbenzene, ug/kg		<5.0
Toluene, ug/kg		<5.0
Xylenes, ug/kg		<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg		<50
Date Analyzed		02.28.94
Method Number		EPA 8020
Dilution factor		1
Petroleum Hydrocarbons		
Petroleum Hydrocarbons, mg/kg		<5.0
Date Extracted		02.28.94
Date Analyzed		03.01.94
Method Number		EPA 9073

Received: 28 FEB 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.03 (Tank #28)
Sampled By: ER/JG

REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
90697-7	Equip Blank - Augers	02-24-94
PARAMETER		90697-7
Purgeable Aromatics (602/8020)		
Benzene, ug/l		<5.0
Ethylbenzene, ug/l		<5.0
Toluene, ug/l		<5.0
Xylenes, ug/l		<5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<50
Date Analyzed		02.28.94
Method Number		EPA 8020
Dilution factor		1

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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

LOG NO: D4-90697

Received: 28 FEB 94

Mr. Eric Regensburger
Blasland, Bouck & Lee
4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.03 (Tank #28)
Sampled By: ER/JG

REPORT OF RESULTS

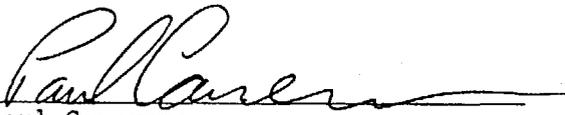
Page 4

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID

90697-8 Lab Blank
90697-9 Accuracy - % Recovery (Mean)
90697-10 Precision - Relative % Difference
90697-11 Detection Limit

PARAMETER	90697-8	90697-9	90697-10	90697-11
Purgeable Aromatics (602/8020)				
Benzene, ug/kg	<5.0	100 %	10 %	5.0
Ethylbenzene, ug/kg	<5.0	---	---	5.0
Toluene, ug/kg	<5.0	99 %	2.0 %	5.0
Xylenes, ug/kg	<5.0	---	---	5.0
Methyl-Tert-Butyl-Ether (MTBE), ug/kg	<50	---	---	50
Date Analyzed	02.28.94	---	---	---
Method Number	EPA 8020	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/kg	<5.0	88 %	6.8 %	5.0
Date Extracted	02.28.94	---	---	---
Date Analyzed	03.01.94	---	---	---
Method Number	EPA 9073	---	---	---

Method Reference: EPA SW-846.


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

NUMBER	PROJECT NUMBER 399.03	PROJECT NAME Tank # 28	MATRIX TYPE	REQUIRED ANALYSES	PAGE 2	OF 1
NT NAME BB+L		TELEPHONE/FAX NO. 407-994-2711		<input checked="" type="checkbox"/> STANDARD TAT <input checked="" type="checkbox"/> EXPEDITED TAT REPORT DUE DATE 3/1 * SUBJECT TO RUSH FEES		
NT ADDRESS 30 NW 2nd Ave Baco Raton, FL 33431		CITY, STATE, ZIP CODE				
PLER(S) NAME(S) Rogensburger / J. Carado		CLIENT PROJECT MANAGER E. Rogensburger				
SAMPLING		SAMPLE IDENTIFICATION				
DATE	TIME			NUMBER OF CONTAINERS SUBMITTED		

DATE	TIME	SAMPLE IDENTIFICATION	AQUEOUS MATRIX	NONAQUEOUS MATRIX	OIL MATRIX	AIR MATRIX	NUMBER OF CONTAINERS SUBMITTED							
23	1750	28-SB02 (6'-8')	X		1	1								
24	1030	28-SB4 (4'-6')	X		1	1								
24	1300	28-SB5 (4'-6')	X		1	1								
24	1445	28-SB6 (4'-6')	X		1	1								
23	1530	28-SB1 (6'-8')	X		1	1								Hold for analysis per P.M. request
24	0845	28-SB3 (4'-6')	X		1	1								Hold for Analysis per P.M. request
24	1530	28-SB7 (4'-6')	X		1	1								Hold for Analysis per P.M. request
25	0900	28-SB8 (4'-6')	X		1	1								
25	1015	28-SB4 (4'-6')	X		1	1								Hold for Analysis per P.M. request
25	1130	28-SB10 (4'-6')	X		1	1								Hold for Analysis per P.M. request
24	1515	Equip Blank - Augers	X		1									

RELINQUISHED BY: (SIGNATURE) <i>[Signature]</i>	DATE 2-25	TIME 1800	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
CEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE	TIME	RELINQUISHED 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 2-28-71	TIME 09:30	CUSTODY INTACT <input type="checkbox"/> YES <input type="checkbox"/> NO	CUSTODY SEAL NO.					

ORIGINAL

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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

LOG NO: D4-90832

Received: 12 MAR 94

Mr. Jose Garrido
Blasland Bouck & Lee, Inc.
5950 Hazeltine National Dr., Suite 140
Orlando, FL 32822

Purchase Order: #399.03

Project: #399.04 (US Navy P.R. #28)

Sampled By: Dan Press

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90832-1	28 MW-1	03-10-94	
90832-2	28 MW-4	03-10-94	
PARAMETER		90832-1	90832-2
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		03.17.94	03.17.94
Method Number		EPA 602	EPA 602
Dilution factor		1	1

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REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90832-1	28 MW-1	03-10-94	
90832-2	28 MW-4	03-10-94	
PARAMETER		90832-1	90832-2
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		14	<10
Date Extracted		03.14.94	03.14.94
Date Analyzed		03.18.94	03.18.94
Method Number		EPA 610	EPA 610
Dilution factor		1	1
Petroleum Hydrocarbons			
Petroleum Hydrocarbons, mg/l		14	<1.0
Date Extracted		03.14.94	03.14.94
Date Analyzed		03.15.94	03.15.94
Method Number		EPA 418.1	EPA 418.1

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REPORT OF RESULTS

Page 3

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90832-1	28 MW-1	03-10-94	
90832-2	28 MW-4	03-10-94	
PARAMETER		90832-1	90832-2
Lead			
Lead, mg/l		0.10	0.017
Date Analyzed		03.17.94	03.16.94
Method Number		EPA 239.2	EPA 239.2

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REPORT OF RESULTS

Page 4

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
90832-3	28 MW-2	03-10-94
PARAMETER	90832-3	
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		03.17.94
Method Number		EPA 602
Dilution factor		1
Lead		
Lead, mg/l		0.041
Date Analyzed		03.16.94
Method Number		EPA 239.2

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REPORT OF RESULTS

Page 5

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES			
90832-4	28 MW-3			
90832-5	28 MW-5			
90832-6	Trip Blank			
PARAMETER		90832-4	90832-5	90832-6
Purgeable Aromatics (602/8020)				
Benzene, ug/l		<1.0	<1.0	<1.0
Ethylbenzene, ug/l		<1.0	<1.0	<1.0
Toluene, ug/l		<1.0	<1.0	<1.0
Xylenes, ug/l		<1.0	<1.0	<1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l		<10	<10	<10
Date Analyzed		03.17.94	03.17.94	03.17.94
Method Number		EPA 602	EPA 602	EPA 602
Dilution factor		1	1	1

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Project: #399.04 (US Navy P.R. #28)
Sampled By: Dan Press

REPORT OF RESULTS

Page 6

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
90832-7	Duplicate (28)	03-10-94
PARAMETER	90832-7	
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		03.17.94
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		03.14.94
Date Analyzed		03.18.94
Method Number		EPA 610
Dilution factor		1

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LOG NO: D4-90832

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Purchase Order: #399.03

Project: #399.04 (US Navy P.R. #28)
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REPORT OF RESULTS

Page 7

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED
90832-7	Duplicate (28)	03-10-94
PARAMETER	90832-7	
Lead		
Lead, mg/l	0.020	
Date Analyzed	03.16.94	
Method Number	EPA 239.2	

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LOG NO: D4-90832

Received: 12 MAR 94

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Purchase Order: #399.03

Project: #399.04 (US Navy P.R. #28)
 Sampled By: Dan Press

REPORT OF RESULTS

Page 8

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90832-8	Eq. Blank 28	03-10-94	
90832-9	803 Eq. Blank (Aug)	03-10-94	
PARAMETER		90832-8	90832-9
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		03.17.94	03.17.94
Method Number		EPA 602	EPA 602
Dilution factor		1	1

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Purchase Order: #399.03

Project: #399.04 (US Navy P.R. #28)
Sampled By: Dan Press

REPORT OF RESULTS

Page 9

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90832-8	Eq. Blank 28	03-10-94	
90832-9	803 Eq. Blank (Aug)	03-10-94	
PARAMETER		90832-8	90832-9
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		03.14.94	03.14.94
Date Analyzed		03.18.94	03.18.94
Method Number		EPA 610	EPA 610
Dilution factor		1	1

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REPORT OF RESULTS

Page 10

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

90832-10 Lab Blank
90832-11 Accuracy - % Recovery (Mean)
90832-12 Precision - Relative % Difference
90832-13 Detection Limit

PARAMETER	90832-10	90832-11	90832-12	90832-13
Purgeable Aromatics (602/8020)				
Benzene, ug/l	<1.0	96 %	3.1 %	1.0
Ethylbenzene, ug/l	<1.0	---	---	1.0
Toluene, ug/l	<1.0	97 %	2.1 %	1.0
Xylenes, ug/l	<1.0	---	---	1.0
Methyl-Tert-Butyl-Ether (MTBE), ug/l	<10	---	---	10
Date Analyzed	03.17.94	---	---	---
Method Number	EPA 602	---	---	---

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REPORT OF RESULTS

Page 11

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

90832-10 Lab Blank
90832-11 Accuracy - % Recovery (Mean)
90832-12 Precision - Relative % Difference
90832-13 Detection Limit

PARAMETER	90832-10	90832-11	90832-12	90832-13
Polynuclear Aromatic Hydrocarbons (610)				
Acenaphthene, ug/l	<10	---	---	10
Acenaphthylene, ug/l	<10	84 %	1.2 %	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	80 %	1.2 %	10
Fluorene, ug/l	<10	95 %	4.2 %	10
Indeno(1,2,3-cd)pyrene+Dibenzo(a,h)anthracene, ug/l	<10	---	---	10
Naphthalene, ug/l	<10	87 %	2.3 %	10
Phenanthrene + Anthracene, ug/l	<10	---	---	10
Pyrene, ug/l	<10	96 %	1.0 %	10
2-Methylnaphthalene, ug/l	<10	---	---	10
1-Methylnaphthalene, ug/l	<10	---	---	10
Date Extracted	03.14.94	---	---	---
Date Analyzed	03.18.94	---	---	---
Method Number	EPA 610	---	---	---
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/l	<1.0	95 %	2.1 %	1.0
Date Extracted	03.14.94	---	---	---
Date Analyzed	03.15.94	---	---	---
Method Number	EPA 418.1	---	---	---

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REPORT OF RESULTS

Page 12

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

90832-10 Lab Blank
90832-11 Accuracy - % Recovery (Mean)
90832-12 Precision - Relative % Difference
90832-13 Detection Limit

PARAMETER	90832-10	90832-11	90832-12	90832-13
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

Final Page Of Report

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

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

LOG NO: D4-90936

Received: 23 MAR 94

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

Project: #399.03 (Roosevelt Roads)
Sampled By: E Regensburger

REPORT OF RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED				
90936-1	28 - MW-1	03-21-94				
90936-2	28 - MW-2	03-21-94				
90936-3	28 - MW-3	03-21-94				
90936-4	28 - MW-4	03-21-94				
90936-5	28 - MW-5	03-21-94				
PARAMETER		90936-1	90936-2	90936-3	90936-4	90936-5
Petroleum Hydrocarbons						
Petroleum Hydrocarbons, mg/l		6.8	<1.0	<1.0	<1.0	<1.0
Date Extracted		03.24.94	03.24.94	03.24.94	03.24.94	03.24.94
Date Analyzed		03.25.94	03.25.94	03.25.94	03.25.94	03.25.94
Method Number		EPA 418.1	EPA 418.1	EPA 418.1	EPA 418.1	EPA 418.1

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

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LOG NO: D4-90936

Received: 23 MAR 94

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4730 NW Boca Raton Boulevard
Boca Raton, FL 33431

Project: #399.03 (Roosevelt Roads)
Sampled By: E Regensburger

REPORT OF RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION , LIQUID SAMPLES	DATE SAMPLED	
90936-6	Equipment Blank	03-21-94	
90936-7	Duplicate	03-21-94	
PARAMETER		90936-6	90936-7
Petroleum Hydrocarbons			
Petroleum Hydrocarbons, mg/l		<1.0	<1.0
Date Extracted		03.24.94	03.24.94
Date Analyzed		03.25.94	03.25.94
Method Number		EPA 418.1	EPA 418.1

SL SAVANNAH LABORATORIES
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LOG NO: D4-90936

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 Boca Raton, FL 33431

Project: #399.03 (Roosevelt Roads)
 Sampled By: E Regensburger

REPORT OF RESULTS

Page 3

LOG NO SAMPLE DESCRIPTION , QC REPORT FOR LIQUID SAMPLES

90936-8 Lab Blank
 90936-9 Accuracy - % Recovery (Mean)
 90936-10 Precision - Relative % Difference
 90936-11 Detection Limit

PARAMETER	90936-8	90936-9	90936-10	90936-11
Petroleum Hydrocarbons				
Petroleum Hydrocarbons, mg/l	<1.0	100 %	9.0 %	1.0
Date Extracted	03.24.94	---	---	---
Date Analyzed	03.25.94	---	---	---
Method Number	EPA 418.1	---	---	---

Method Reference: EPA 600/4-79-020.

Paul Canevaro
 Paul Canevaro





**SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.**

- 5102 LaRoche Avenue, Savannah, GA 31404
- 2646 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) 8 8 Fax (912) 352
 Phone: (904) 6 44 Fax (904) 876
 Phone: (305) 421-7400 Fax (305) 421
 Phone: (205) 666-6633 Fax (205) 666
 Phone: (813) 885-7427 Fax (813) 885

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

P.O. NUMBER 399-03	PROJECT NUMBER 399.03	PROJECT NAME Roosevelt Roads	MATRIX TYPE	REQUIRED ANALYSES	PAGE 1	OF 1
CLIENT NAME BB+L		TELEPHONE/FAX NO. 407-994-2711		TRPH	<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		CITY, STATE, ZIP CODE 33431				
SAMPLER(S) NAME(S) E. Ragensburger		CLIENT PROJECT MANAGER E. Ragensburger				
SAMPLING		SAMPLE IDENTIFICATION		NUMBER OF CONTAINERS SUBMITTED		
DATE	TIME					

DATE	TIME	SAMPLE IDENTIFICATION	AQUEOUS MATRIX	NONAQUEOUS MATRIX	OIL MATRIX	AIR MATRIX	NUMBER OF CONTAINERS SUBMITTED								
3/21	1446	28-MW1	X				1								
3/21	1512	28-MW2	X				1								
3/21	1535	28-MW3	X				1								
3/21	1552	28-MW4	X				1								
3/21	1608	28-MW5	X				1								
3/21	1730	Equipment Blank	X				1								
3/21	1730	Field Blank	X				1								
3/21	1730	Duplicate	X				1								

* Do not analyze unless P.M. requests

NOTE: VOC Trip Blank vials are for the second cooler (proj. # 399.05).

RELINQUISHED BY: (SIGNATURE) <i>Carolyn Shenden</i>	DATE 2/18/94	TIME 1500	RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE 2/22/94	TIME 1800	RELINQUISHED BY: (SIGNATURE) <i>[Signature]</i>	DATE 3-22-94	TIME 1800
RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE 3/23	TIME 9:00	RELINQUISHED BY: (SIGNATURE) <i>[Signature]</i>	DATE 3/23	TIME 9:00	RECEIVED BY: (SIGNATURE) <i>[Signature]</i>	DATE 3/23	TIME 9:00

FOR SAVANNAH LABORATORY USE ONLY						LABORATORY REMARKS	
RECEIVED FOR LABORATORY BY: (SIGNATURE) <i>[Signature]</i>	DATE 3/23	TIME 9:00	CUSTODY INTACT <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	CUSTODY SEALING <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	LABORATORY USE ONLY <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		