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# DRAFT SAMPLING AND ANALYSIS PLAN FOR SOLID WASTE MANAGEMENT UNITS 53/54 NAVAL ACTIVITY PUERTO RICO (DRAFT ACTING AS FINAL)

8/4/2000

CH2M HILL

Draft

# Sampling and Analysis Plan
# SWMUs 53/54

Naval Station Roosevelt Roads

RCRA/HSWA Permit No. PR2170027203

Ceiba, Puerto Rico

**Prepared For**

## Department of the Navy
### Atlantic Division
### Naval Facilities Engineering Command

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| | |
|---|---|
| Baker | Baker Environmental, Inc. |
| bgs | below ground surface |
| CCC | Criteria Continuous Concentration |
| CMC | Criteria Maximum Concentration |
| CFR | Code of Federal Regulations |
| CMS | Corrective Measures Study |
| IDW | Investigation Derived Waste |
| MCLs | Maximum Contaminant Levels |
| MS/MSD | Matrix Spike/Matrix Spike Duplicate |
| NAWQC | National Ambient Water Quality Criteria |
| NEX | Navy Exchange |
| NSRR | Naval Station Roosevelt Roads |
| OU | Operable Unit |
| PCBs | polychlorinated biphenyls |
| PID | Photoionization Detector |
| pvc | poly-vinyl chloride |
| QA/QC | Quality Assurance/Quality Control |
| RBCs | risk-based concentrations |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA Facility Investigation |
| SOPs | Standard Operating Procedures |
| SWMU | Solid Waste Management Unit |
| TPH | Total Petroleum Hydrocarbons gasoline and diesel range organics |
| USEPA | United States Environmental Protection Agency |
| UST | Underground Storage Tank |

## 1.0 INTRODUCTION

This Sampling and Analysis Plan has been prepared by Baker Environmental, Inc. (Baker), to perform field investigation work at Naval Station Roosevelt Roads (NSRR) under the Corrective Action provisions of the Station's Resource Conservation and Recovery Act (RCRA) Part B permit.

The Solid Waste Management Units (SWMUs) discussed in the following sections include SWMU 53, located approximately 300 feet northeast of SWMU 13. The other SWMU discussed in this sampling and analysis plan is SWMU 54, located north-northeast of SWMU 26, as presented on Figure 1-1.

The specific element of the SWMU 53 investigation to be performed includes:

- A soil collection program focused in areas around Building 64, to ascertain the extent of contamination, if any is present.

- A wipe sample collection program focused inside Building 64, to ascertain the extent of contamination, if any is present.

The specific element of the SWMU 54 investigation to be performed includes:

- A soil collection program focused in certain areas (e.g. open excavation, oil/water separator, above ground storage tank, open storage shed, and perimeter of Building 1914) to ascertain the extent of contamination, if any is present.

- A groundwater collection program focused in certain areas (e.g. seven existing monitoring wells located adjacent to SWMU 54 and two temporary monitoring wells located down gradient from Building 1914 and the oil/water separator) to ascertain the extent of contamination, if any is present.

When this work is completed, the results will be provided in a draft report.

## 2.0 GOALS AND OBJECTIVES

The goal of this Sampling and Analysis Plan is to determine whether a release of hazardous waste including hazardous constituents from SWMUs 53 and 54 has occurred, is likely to have occurred, or is likely to occur. It is the objective of the work described in this plan to demonstrate that the Sampling and Analysis Plan develops a sampling and analysis program capable of yielding representative samples including the necessary parameters sufficient to identify migration of hazardous waste, including hazardous constituents, from SWMUs 53 and 54.

This plan proposes an investigation to address the concerns of the Navy and officials at Naval Station Roosevelt Roads. The goals of the program, and how they are reached, are briefly discussed for each SWMU in the paragraphs which follow.

## 3.0 SITE HISTORY

The sections that follow present a brief history of each of the two new SWMUs, as well as the site-specific tasks which will be implemented to meet the goals and objectives of this plan.

### 3.1 SWMU 53 – Building 64 (Malaria Control Building)

The Malaria Control Building (Building 64) was built in 1942 and condemned in 1980. Currently, the building is unoccupied and lies on approximately 1/8 acre. The building structure itself is 21 feet by 18 feet in dimension, and occupies about ten percent of the total SWMU 53 acreage. This SWMU is located on a gentle slope (approximately 5-7% grade) from northeast (upgradient) to the southwest (down gradient) approximately 200 feet away from Forrestall Road. The building was utilized to store pesticides. Malathion, aldrin, and DDT were known to have been stored in the building. It is not known if stocks of pesticides were maintained in the building for the entire duration. Although no direct evidence exists, it is assumed that mixing and other preparation for pesticide use was also performed at the building. No wastes are known to have been disposed at the unit. There are no known releases related to this unit. No other use of the site was identified. SWMU 53 is located across Forrestall Road from SWMU 13.

To meet the goals and objectives of this report, the following task will be implemented:

- Establish the extent, if any, of contamination around the perimeter of Building 64. This will be accomplished through a soil collection program during which surface soil and subsurface soil samples will be obtained and analyzed at a fixed base laboratory.

- Establish the extent, if any, of contamination inside Building 64. This will be accomplished through a collection program during which wipe samples will be obtained and analyzed at a fixed base laboratory.

Details of the investigations to be performed are provided in Section 4.0 of this work plan.

### 3.2 SWMU 54 – Building 1914 (Former NEX Repair/Maintenance Shop)

Building 1914 is a former NEX facility which was built in 1979 and lies on approximately 1 acre of land in the Bundy Area of NSRR. Currently, this site is occupied by SOCs south command for limited vehicle maintenance. The building structure and pavement covers approximately 40 percent of the total SWMU 54 acreage. This SWMU contains a slight slope to the west, and a small hill to the east approximate 100 feet in elevation. A small hill lies in the southern part of this SWMU, which is approximately 50 feet in elevation. The building structure itself consists of a small concrete block building with a center office area and open bays on either side. The building was used to perform maintenance on vehicles including oil changes, lubrications, etc. No wastes are known to have been disposed at the unit. Although there are no known releases related to the unit, oil/grease stains were observed at this site during a recent site visit by CH2MHill and the environmental staff at NSRR (CH2MHill, February 2000). SWMU 54 is located across Bairoko Street from SWMU 26 and Building 1686 (Base Laundromat).

To meet the goals and objectives of the investigations at SWMU 54, the following tasks will be implemented:

- Establish the extent, if any, of contamination around the oil/water separator. This will be accomplished through the combination of surface soil and subsurface soil samples obtained from a point off of each side of the oil/water separator.

- Establish the extent, if any, of contamination around the wheel mounted 500 gallon tank. This will be accomplished through the collection of surface soil samples on the east and west sides of the tank.

- Establish the extent, if any, of contamination around the open storage shed located in the southeastern portion of the site. This will be accomplished through the collection of surface soil samples on the north and the west sides of the shed.

- Establish the extent, if any, of contamination in the area around Building 1914. This will be accomplished through the collection of surface soil samples on each side of the service bays at either end of Building 1914.

- Establish the extent, if any, of contamination located in two open excavation locations south of Building 1914. This will be accomplished through the collection of two surface water samples from the algae stained water located in each excavation location.

- Establish the extent, if any, of groundwater contamination located in the SWMU 54 area. This will be accomplished through the collection of groundwater samples from seven existing monitoring wells located adjacent to SWMU 54, and two temporary wells located down gradient from Building 1914 and the oil/water separator.

Details of the investigations to be performed are provided in Section 4.0 of this work plan.

## 4.0 TECHNICAL APPROACH

This section of the work plan describes the technical elements of the investigation necessary to accomplish the goals described in Section 2.0.

### 4.1 Basis of the Sampling and Analysis Plan

The United States Environmental Protection Agency (USEPA) has approved a RCRA Facility Investigation (RFI) work plan for the initial work at Roosevelt Roads under the Corrective Action Program (Baker, 1995). This work plan addressed necessary technical elements such as standard operating procedures and resumes of key personnel, as well as provisions of the following separate plans:

- Project Management Plan
- Data Collection Quality Assurance Plan
- Data Management Plan, and
- Health and Safety Plan.

Together, these plans provided all the details regarding field investigatory techniques, laboratory analyses, data validation and data evaluation needed to fulfill the requirements of the RFI program. Since the abovementioned document is in place and approved, it will form the basis of this plan. All the investigatory tasks described in subsequent sections of this plan will be performed in accordance with the techniques and methodologies provided in the original EPA approved work plan. Therefore, only the work elements themselves are discussed in the sections which follow.

## 4.2 Site Characterization

The sections that follow present site-specific information obtained form visual site inspections performed by CH2MHill, Baker, as well as the environmental staff at NSRR. The following sections also provide a description of the environmental field investigations that will be conducted at SWMUs 53 and 54.

### 4.2.1 SWMU 53 – Building 64 (Malaria Control Building)

Site Context

The information gathered from the visual site inspection by Baker and environmental staff at NSRR, revealed that there are no known wastes dumped at this facility, nor is there any evidence of source contamination (Baker, 2000). Investigations have been performed at nearby SWMU 13 as presented on Figure 4-1. Baker observed signs of possible past leakage of chemicals on the storage shelves inside the building, as well as identified migration pathways along the floor leading to the outside. With this in mind, along with the activities known to have taken place at this SWMU, a site characterization is to be performed to determine whether a release of hazardous waste including hazardous constituents has occurred, is likely to have occurred, or is likely to occur.

Investigations Proposed

A total of twelve surface soil samples will be collected around the perimeter of Building 64, as presented on Figure 4-2. These samples will be submitted to a mainland laboratory for analysis of pesticides/polychlorinated biphenyls (PCBs) and Appendix IX Inorganics, as presented in Table 4-1. The laboratory results will be validated by an independent, third party, data validation firm.

Four soil boring sampling locations will be installed around the perimeter of Building 64. One soil boring will be installed along each side of the building. These soil borings will assist if operations at this site impacted the surrounding soil. Due to a cut in the floor curbing underneath the door on the western side of the building, one of the four soil boring locations will be installed immediately outside the cut in the curb beneath the door. Two additional soil borings will be installed, with one boring located approximately 10 feet from the western side of the building, and the other boring located approximately 10 feet from the northeast corner of the building. These soil boring locations are placed down gradient of Building 64 and are represented on Figure 4-2. This task will aid in addressing our goals and objectives. At each soil boring location, continuous split-spoon sampling will be implemented in two foot intervals, with environmental soil samples collected from any suspected areas of contamination and/or from the interval immediately above the water table. All the soil samples will be submitted to a mainland laboratory for analysis of pesticides/PCBs and inorganics, as presented in Table 4-1. The laboratory results will be validated by an independent, third party, data validation firm. As presented in the Additional Investigations Report for Operable Unit (OU) 1,6, and 7 (May 1998)(Baker, 1998), the suspected water table level for adjacent area SWMU 13, ranges from 4 to 13 feet below ground surface (bgs). Therefore, it is anticipated that groundwater will be encountered in the 10 to 20 foot bgs range at SWMU 53 because of its increased elevation over SWMU 13.

A total of four wipe samples will be collected inside Building 64. These samples will be collected from areas of staining along the floors and shelving in the building. These samples will be submitted to a mainland laboratory for analysis of pesticides/PCBs as presented in Table 4-1. The laboratory results will be validated by an independent, third party, data validation firm.

Base background sample results obtained during the OU 2 (SWMU 7/8) field activities performed in March 1996, will be utilized to compare to the SWMU specific samples to ascertain what constituents of the soil are naturally occurring.

In summary, the following order will be followed in performing the investigation at this SWMU:

- Six surface soil samples will be collected around the perimeter of Building 64.
- Four soil borings will be installed around the perimeter of Building 64.
- An additional two soil borings will be installed approximately 10 feet downgradient from the building.
- Four wipe sample will be collected inside Building 64.

Investigations Rationale

Surface soil and subsurface soil sample locations are proposed around the perimeter of Building 64. Three sample locations are proposed on the eastern side of Building 64, because a strong pesticide odor was observed on this side of the building during the recent site visit performed by Baker. Two sample locations are proposed for the northern and southern side of this building. These locations will help characterize the extent of contamination, if any were to be present adjacent to the structure. The western side of the building contains four sampling locations. These locations will address the cut in the curbing beneath the door. This cut in the curbing may be a release point to the exterior of the building from any liquids on the floor of the interior of Building 64. One sampling location exists off of the northeast corner of the building, to characterize the lateral migration of contamination, if any were present, down gradient from this building. These sample locations will help characterize the extent of contamination coming from the building, both horizontally and vertically, if any were to be present. Wipe samples are proposed inside Building 64, because of signs of possible past leavage on the storage shelves and on the floor. These samples will help characterize the extent of contamination, if any were to be present inside the structure. These tasks will aid in addressing our goals and objectives.

The abovementioned samples will be acquired following the appropriate Baker Standard Operating Procedures (SOPs) mentioned in the EPA approved 1995 Work Plan (Baker, 1995). The soil borings will be advanced using a drill rig, instead of direct push technology. The reason for this rationale is that the soils in this area, specifically obtained from adjacent SWMU 13, contain a considerable amount of weathered rock. Direct push technology would not be an efficient method in the soil of this

nature. The reason for continuous split-spoon sampling is that boring logs will give us an accurate representation of the geologic stratigraphy located at SWMU 53. These boring logs can then be used as a tool for future work conducted at this site if necessary.

Data Usage

The data obtained from this investigation will be utilized to determine whether a release of hazardous constituents from SWMU 53 has occurred, is likely to have occurred, or is likely to occur. The data will be thoroughly evaluated as described in Section 5.0 of this work plan.

### 4.2.2 SWMU 54 – Building 1914 (Former NEX Repair/Maintenance Shop)

Site Context

The information gathered from the visual site inspection performed by CH2MHILL and environmental staff at NSRR, revealed that there were several areas of oil stained soil around the Former NEX Building 1914 (CH2MHILL, February 2000). Due to this, it was recommended that a sampling program is necessary to characterize the areas around several structures in the SWMU 54 area. Investigations have been performed at nearby SWMU 26 and Building 510, as presented on Figure 4-3. The results from the Site Characterization for Site 510 developed by Blasland, Bouck, and Lee were taken into consideration in development of this plan, due to the close proximity of its existing monitoring wells to SWMU 54. The monitoring well construction diagram and lithologic logs for soil borings installed closest to these existing monitoring wells at former Site 510, are included for reference in Appendix A of this report. These lithologic logs will aid the geologist in the field during the SWMU 54 investigation. According to the environmental staff at NSRR, the above ground storage tank that once was located at this SWMU has been removed and replaced with a wheel mounted 500 gallon tank located on the containment pad. CH2MHILL also observed two open excavation locations south of the building, which contained algae stained water. With this in mind, along with the activities (oil changes, lubrications, etc.) known to have taken place at this SWMU, a site characterization is to be performed to determine whether a release of hazardous waste including hazardous constituents has occurred, is likely to have occurred, or is likely to occur.

Investigations Proposed

A total of seven existing monitoring wells, located adjacent to SWMU 54, will be utilized for this investigation as shown on Figure 4-4. Two of the seven monitoring wells are considered deep, while the remaining monitoring wells are shallow, as presented in Table 4-2. These monitoring wells were installed in February 1995 by Blasland, Bouck & Lee. Two additional groundwater samples (54TW01 and 54TW02) will be collected through the installation of two temporary shallow monitoring wells. Groundwater samples will be collected from each of the seven monitoring wells, and analyzed for the Appendix IX list and Total Petroleum Hydrocarbons gasoline and diesel range organics (TPH).

A total of 16 surface soil samples will be collected in the SWMU 54 area. One surface soil sample (54SB01-00 taken from sample location 54TW01) will be collected west of the oil/water separator in conjunction with soil boring activities, four surface soil samples (54SS02-54SS05) will be collected around the perimeter of Building 1914, two surface soil samples (54SS01 and 54SS06) will be collected in the gravel area off the western side of Building 1914, and a total of five surface soil samples (54SS07, 54SS08, 54SS11, 54SS14, and 54SS15) are proposed to be collected from a distance of 45 feet from each corner of Building 1914, as well as 45 feet off the eastern side of the building, as shown on Figure 4-4. Two additional surface soil samples (54SS12 and 54SS13) will be collected from the east and west sides of the wheel mounted 500 gallon storage tank, and two surface soil samples (54SS10 and 54SS09) will be collected from the north and west sides of the open storage shed, as shown on Figure 4-4. This task will aid in meeting our goals and objectives. All the surface soil samples will be submitted to a mainland laboratory for analysis of the full Appendix IX list and TPH, as presented in Table 4-3. The laboratory results will be validated by an independent, third party, data validation firm.

A total of two soil borings at sample locations (54TW01 and 54TW02) will be installed in the SWMU 54 area. One boring (54TW01) will be advanced west of the oil/water separator, while the other boring (54TW02) will be installed west of the southern bay of Building 1914. The proposed locations for these soil borings are presented on Figure 4-4. At each soil boring location, continuous split-spoon sampling will be implemented in two foot intervals, with environmental soil samples (54SB01-XX, 54SB01-XX, 54SB02-XX, and 54SB02-XX) collected from any areas of suspected contamination and/or from the interval immediately above the water table. As presented in the Blasland, Bouck, and Lee Site Characterization Report for Site 510 (July 1995), the suspected water

table level for adjacent area former Site 510, ranges from 11 to 18.5 feet below ground surface. All the soil samples will be submitted to a mainland laboratory for analysis of the full Appendix IX list and TPH, as presented in Table 4-3. The laboratory results will be validated by an independent, third party, data validation firm.

Two surface water samples will be collected from the algae stained water in the two open excavation areas located south of Building 1914, as represented on Figure 4-4. Surface water samples will be submitted to a mainland laboratory for analysis of the full Appendix IX list and TPH, as presented in Table 4-3. The laboratory results will be validated by an independent, third party, data validation firm. This task will aid in meeting our goals and objectives.

Both base background, as well as SWMU 26 site specific background sample results will be utilized to compare to the SWMU 54 samples to ascertain what constituents of the water and soil are naturally occurring.

In summary, the following order will be followed in performing the investigation at this SWMU:

- Seven existing monitoring wells will be sampled.
- A total of 16 surface soil samples will be collected in the SWMU 54 area.
- A total of two soil borings will be advanced in the SWMU 54 area, along with the installation of two temporary shallow monitoring wells.
- Two surface water samples will be collected from the algae stained water located in the two open excavation areas south of Building 1914

Investigations Rationale

All seven existing monitoring wells from adjacent Site 510 will be sampled during this investigation. According to the Site Characterization Report (July 1995) prepared by Blasland, Bouck, and Lee (BB&L, 1995), two of the seven monitoring wells (510-MW1 and 510-DW1) contained positive detections of Benzene, which exceeded the Federal Maximum Contaminant Levels (MCLs). The collection of additional samples from these two wells will help to characterize whether high levels of benzene continues to be present at this site. Sample collection from the other five monitoring wells will help to determine whether the constituents detected in 1995 have laterally migrated throughout the site, or if they have naturally attenuated out of the groundwater. Two temporary monitoring wells

will be installed in the SWMU 54 area to determine if past site operations have impacted groundwater in the area. These wells will determine if any contamination present has migrated down gradient from possible source areas. These tasks will aid in meeting our goals and objectives.

Surface soil and subsurface soil sample locations are proposed in the area of SWMU 54. The surface soil sample locations proposed around the perimeter of Building 1914 and the oil/water separator will aid in addressing our goals and objectives. The surface soil locations proposed approximately 45 feet from each corner of Building 1914, as well as 45 feet off of the eastern side of the building will help to determine the lateral migration of contaminants, if any were to be present. Surface soil locations around the wheel mounted 500 gallon tank, as well as around the open storage shed will help to characterize the extent of contamination, if any were to be present adjacent to the structures. The collection of the subsurface soil on either side of the oil/water separator will help to determine whether past underground releases from this separator have occurred.

The surface soil samples will be acquired according to the appropriate Baker SOP mentioned in the EPA-approved 1995 work plan. The soil borings will be advanced using a drill rig, instead of direct push technology. The reason for this rationale is that the soils in this area contain some granite fill material as indicated in the lithologic logs referenced in the Appendix A portion of this document. Direct push technology would not be an efficient method in an area of this nature. The reason for continuous split-spoon sampling is that boring logs will give us an accurate representation of the geologic stratigraphy located at SWMU 54. These boring logs can then be used in conjunction with boring logs from the Site Characterization Report for Site 510, as a tool for future work conducted at this SWMU.

One surface water sample will be collected from each of the two open excavation areas south of Building 1914 for a total of two surface water samples. Although the water looks to be algae stained, two surface water samples will be collected to verify if the water contains any contaminants. No soil samples will be collected at these pits during this time.

Data Usage

The data obtained from this investigation will be utilized to determine whether a release of hazardous constituents from SWMU 54 has occurred, is likely to have occurred, or is likely to occur. The data will be thoroughly evaluated as described in Section 5.0 of this plan.

Groundwater Quality

Each of the existing monitoring wells that has been indicated for resampling at SWMU 54, will be analyzed for the constituents indicated in the appropriate sections. In addition, two of the seven wells (510-MW1 and 510-MW4) will also be sampled for:

- Aluminum 7000 Series*
- Odor ----------
- Salinity ----------
- Color 110.1**
- TDS 160.1*
- Fluoride 340.2**
- Hardness 130.2**
- Chloride 9250*
- Iron 7000 Series*
- pH (field) ----------
- Manganese 7000 Series*
- Corrosivity Langlier Saturation Index
- Sulfate 9035-38*
- Copper 7000 Series*
- Silver, and 7000 Series*
- Zinc 7000 Series*

* "Methods for Chemical Analysis of Water and Wastes, "USEPA, EPA 600/4-79-020. Revised March 1983.

** "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," USEPA. SW-846

These parameters comprise the National Secondary Drinking Water quality criteria as established in 40 Code of Federal Regulations (CFR), Part 143. These analyses will be performed in the mainland laboratory. The data will be used to assess overall suitability of the uppermost aquifer to be used as a potable water source. While this is the case, the base is presently served by a high quality and high capacity water source which is piped in from the El Yunque rainforest. There is no intent to utilize the uppermost aquifer as a source of water.

## 4.3 Miscellaneous Investigation Considerations

This section contains some miscellaneous investigations that are required for the work proposed in the previous sections for both SWMUs 53 and 54.

### 4.3.1 Surveying

All sampling locations will be flagged in the field and will be surveyed for vertical and horizontal location using established control. Additional survey points (the structure for each building, existing sample locations, oil/water separator, above ground storage tank, open storage shed, two excavation areas, etc.) will be collected at each SWMU to provide more accurate locations on figures for future work. The survey will be performed by the same firm which has performed previous work for Baker at other SWMUs at NSRR. This will then ensure that the same level of survey quality and detail is attained.

### 4.3.2 Laboratory Analyses

All analyses done in the mainland laboratory will be performed using current full Appendix IX Methodologies, as presented in Table 4-4. Tables 4-1 and 4-3 summarize the samples to be obtained and the analyses to be performed.

### 4.3.3 Data Validation

All mainland laboratory data generated by these investigations will be subjected to independent, third party, validation. The EPA Region II Data Validation Standard Operating Procedures will be followed. The same firm which has performed data validation for previous RCRA Facility Investigation (RFI) reports prepared by Baker will continue. This will ensure that the same techniques are followed and that an equivalent review of the data is performed.

### 4.3.4 Field QA/QC

The collection of Quality Assurance/Quality Control (QA/QC) samples will be obtained during these investigations. These will include the collection of equipment rinsates, field blanks, field duplicates, and matrix spike/matrix spike duplicate (MS/MSD).

#### 4.3.4.1 Equipment Rinsates

Equipment rinsates are the final analyte-free water rinse from equipment decontamination procedures. Equipment rinsate blanks will be collected daily during each sampling event. Initially, samples from every other day should be analyzed. If analytes pertinent to the project are detected in the rinsate, the remaining samples (equipment rinsates) must be analyzed. The results from the blanks will be used to evaluate the decontamination methods. This comparison is made during data validation and the rinsates are analyzed for the same parameters as the related samples. One equipment rinsate will be collected per day of field sampling.

#### 4.3.4.2 Field Blanks

Field blanks consist of the source water used in equipment decontamination procedures. At a minimum, one field blank for each event and each source of water must be collected and analyzed for the same parameters as the related samples. One field blank per source per event will be collected.

#### 4.3.4.3 Field Duplicates/Split Samples

Field duplicates (or split samples) for surface soil, subsurface soil, and sediment samples are collected, homogenized, and split. The duplicate (or split samples) collected for analysis of volatile organic compounds will be collected first without being homogenized. The duplicates for water samples should be collected simultaneously. The water samples will not be composited. Field duplicates will be collected at a frequency of ten percent.

#### 4.3.4.4 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSDs are not field sampling activities, they are laboratory derived, and are collected to evaluate the matrix effect of the sample upon the analytical methodology. An MS and MSD must be performed for each group of samples of a similar matrix. MS/MSD samples will be collected at a frequency of five percent.

### 4.3.5 Investigation Derived Waste (IDW)

Only three sources of minimal IDW are expected during these investigations:

- Purged water from the sampling of existing wells
- Cuttings from the advancement of soil boring locations
- Soil boring tool decontamination water

All waters will be containerized in 55 gallon drums located onsite. The removal of these drums will be handled according to the specific SOP for this procedure as listed in the 1995 EPA approved work plan.

Cuttings from the advancement of the soil borings will be placed back in the hole from which they came, unless contamination is present. As much as possible, soils last out of the hole will be returned first, thereby, approximating original stratigraphy.

### 4.3.6 Standard Operating Procedures

All the SOPs applicable to the work discussed in the earlier sections are listed in this sampling and analysis plan. These SOPs can be viewed in their entirety in the EPA approved 1995 RFI Work Plan. The following SOPs are incorporated into this work plan by reference:

- SOP F101 – Borehole and Sample Logging
- SOP F102 – Soil and Rock Sample Acquisition
- SOP F104 – Groundwater Sample Acquisition
- SOP F105 – Surface Water and Sediment Sample Acquisition
- SOP F202 – Water Level, Water-Product Level Measurements, and Well Depth Measurements
- SOP F203 – Photoionization Detector (PID), Hnu Models PI 101 and DL 101
- SOP F208 – Bacharach Combustible Gas/Oxygen Meter and Personal Gas Monitor
- SOP F301 – Sample Preservation and Handling
- SOP F302 – Chain-of-Custody
- SOP F303 – Field Logbook
- SOP F304 – QA/QC Samples

- SOP F501 – Decontaminating of Drilling Rigs and Monitoring Well Materials
- SOP F502 – Decontaminating of Sampling and Monitoring Equipment
- SOP F504 – Handling of Site Investigation Wastes
- SOP A008 – Filing

## 5.0 DATA EVALUATION

The data obtained from these investigations will be evaluated as follows:

SWMU 53

The sample results obtained during this investigation will be compared to several criteria. The sample results will be compared to their respective risk-based concentrations (RBCs) for both industrial and residential conditions as determined by USEPA Region III (April 13, 2000). The inorganic compounds will be compared against the RBCs, as well as the base background analytical data to determine if the constituents detected are naturally occurring. The background screening criteria will be developed by taking twice the average of each constituent detected in the background samples. One-half the detection limit will be used for non-detects. This background value will be determined in accordance with recent EPA guidance (EPA, 1999b). Based on the results from this investigation, the EPA will then determine whether additional work is required at this SWMU. If additional work is required, then a RFI Work Plan will be developed in accordance with the EPA guidelines.

SWMU 54

The sample results obtained during this investigation will be compared to several criteria. The soil sample results will be compared to their respective RBCs for both industrial and residential conditions as determined by the EPA Region III (April 13, 2000). The inorganic compounds will be compared against the RBCs, as well as the base background and SWMU 26 site specific background analytical data to determine if the constituents detected are naturally occurring. The background screening criteria will be developed by taking twice the average of each constituent detected in the background samples. One-half the detection limit will be used for non-detects. This background value will be determined in accordance with recent EPA guidance (EPA, 1999b). The surface water sample results will be compared to the National Ambient Water Quality Criteria (NAWQC) Criteria Continuous Concentration (CCC) and Criteria Maximum Concentration (CMC) (EPA, 1999c). Based on the

results from this investigation, the EPA will then determine whether additional work is required at this SWMU. If additional work is required, then a RFI Work Plan will be developed in accordance with the EPA guidelines.

The data from the SWMU 54 investigation will also be evaluated for establishment of groundwater flow directions to assist in understanding potential contamination migration pathways at SWMU 54 Groundwater flow directions are important in assessing potential contamination migration pathways at SWMU 54. The data from the measurements of groundwater elevations in the seven existing monitoring wells, as well as the two temporary shallow monitoring wells at SWMU 54, will be used to understand groundwater flow. In addition, the location of the screen intervals of each well will be compared to groundwater elevations to insure they straddle the water table. Each existing monitoring well is located in the surficial aquifer.

## 6.0 REPORTING

The reports generated for these investigations will be submitted 30 days upon receipt of validated data following completion of the field investigation. The reports will be labeled Draft Sampling and Analysis Reports for SWMUs 53 and 54. The reports shall present all the data collected during the field investigation. The data shall be analyzed to determine if a release of hazardous constituents has occurred from past operations at these sites. This shall be determined by comparing the analytical results to various screening criteria. This report shall determine if an additional investigation is warranted for these sites through the performance of a RFI as outlined in Condition E.1 of Module III of the stations RCRA part B Permit.

## 7.0 SCHEDULE

The work elements described in this plan will commence once the EPA gives its approval of this Sampling and Analysis Plan, and funding is made available. Once funding is made available for the field work to commence, the schedule of events will be as presented in Table 7-1.

## 8.0 REFERENCES

Baker Environmental, Inc., (Baker) 1995. Final RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico. September 14, 1995.

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# TABLES

**TABLE 4-1**

**SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM**
**SWMU 53 - BUILDING 64 (MALARIA CONTROL BUILDING)**
**NAVAL STATION ROOSEVELT ROADS, PUERTO RICO**

| | | | Analytical Parameters | | |
|---|---|---|---|---|---|
| Sample Media | Sample Designation | Sample Depth (ft bgs) | Pesticides/ PCBs | Appendix IX Metals | Comments |
| Surface Soil | 53SS01 | 0.0-1.0 | X | X | |
| | 53SS02 | 0.0-1.0 | X | X | |
| | 53SS03 | 0.0-1.0 | X | X | |
| | 53SS04 | 0.0-1.0 | X | X | |
| | 53SS04D | 0.0-1.0 | X | X | Duplicate Sample |
| | 53SS04MS/MSD | 0.0-1.0 | X | X | Matrix Spike/Matrix Spike Duplicate |
| | 53SS05 | 0.0-1.0 | X | X | |
| | 53SS06 | 0.0-1.0 | X | X | |
| | 53SS06D | 0.0-1.0 | X | X | Duplicate Sample |
| | 53SS06MS/MSD | 0.0-1.0 | X | X | Matrix Spike/Matrix Spike Duplicate |
| | 53SB01-00 | 0.0-1.0 | X | X | |
| | 53SB02-00 | 0.0-1.0 | X | X | |
| | 53SB03-00 | 0.0-1.0 | X | X | |
| | 53SB04-00 | 0.0-1.0 | X | X | |
| | 53SB04-00D | 0.0-1.0 | X | X | Duplicate Sample |
| | 53SB05-00 | 0.0-1.0 | X | X | |
| | 53SB06-00 | 0.0-1.0 | X | X | |
| Subsurface Soil | 53SB01-XX | (1) | X | X | Suspected Area of Contamination |
| | 53SB01-XX | (1) | X | X | Interval immediately above water table |
| | 53SB02-XX | (1) | X | X | Suspected Area of Contamination |
| | 53SB02-XX | (1) | X | X | Interval immediately above water table |
| | 53SB03-XX | (1) | X | X | Suspected Area of Contamination |
| | 53SB03-XX | (1) | X | X | Interval immediately above water table |
| | 53SB04-XX | (1) | X | X | Suspected Area of Contamination |
| | 53SB04-XX | (1) | X | X | Interval immediately above water table |
| | 53SB05-XX | (1) | X | X | Suspected Area of Contamination |
| | 53SB05-XX | (1) | X | X | Interval immediately above water table |
| | 53SB06-XX | (1) | X | X | Suspected Area of Contamination |
| | 53SB06-XX | (1) | X | X | Interval immediately above water table |
| Wipe Sample | 53WP01 | NA | X | | Suspected Area of Contamination |
| | 53WP02 | NA | X | | Suspected Area of Contamination |
| | 53WP03 | NA | X | | Suspected Area of Contamination |
| | 53WP04 | NA | X | | Suspected Area of Contamination |

Notes:

(1) = Sample will be collected from areas of suspected contamination and/or a depth immediately above the water table.
XX = The sample depth designator in which the sample was collected (i.e. 01 = 1-3 ft bgs, 02 = 3-5 ft bgs, etc.).
D = Duplicate
MS/MSD = Matrix Spike/Matrix Spike Duplicate
ft bgs = feet below ground surface
Refer to Table 4-4 for a listing of Appendix IX Parameters
NA = Not Applicable.

**TABLE 4-2**

**SUMMARY OF WELL CONSTRUCTION DETAILS**
**SWMU 54 - BUILDING 1914 (FORMER NEX REPAIR/MAINTENANCE SHOP)**
**NAVAL STATION ROOSEVELT ROADS, PUERTO RICO**

| Well No. | Date Installed | Top of Casing Elevation (feet, msl) | Ground Surface Elevation (feet above msl) | Boring Depth (feet, bgs) | Well Depth (feet, bgs) | Screen Interval Depth (feet, bgs) | Sand Pack Interval (feet, bgs) | Bentonite Interval (feet, bgs) | Stick-Up (feet, ags) |
|---|---|---|---|---|---|---|---|---|---|
| 510-MW1 | 2/21/95 | 22.59 | NA | 13.5 | 13 | 3-13 | 2-13 | 1.5-2.0 | NA |
| 510-MW2 | 2/21/95 | 22.94 | NA | 20.5 | 20 | 5-20 | 4-20 | 3.0-4.0 | *3 |
| 510-MW3 | 2/21/95 | 22.92 | NA | 15.5 | 15 | 5-15 | 4-15 | 3.0-4.0 | *3 |
| 510-MW4 | 2/22/95 | 21.56 | NA | 15.5 | 15 | 5-15 | 4-15 | 3.5-4.0 | NA |
| 510-MW5 | 3/21/95 | 25.30 | NA | 20.0 | 19.5 | 9.5-19.5 | 7.5-20 | 6.3-7.5 | NA |
| 510-DW1 | 3/23/95 | 22.80 | NA | 25.5 | 25 | 20-25 | 18-25 | 16.5-18.0 | NA |
| 510-DW2 | 4/17/95 | 22.76 | NA | 45.5 | 45 | 40-45 | 36-45 | 35.5-36.0 | NA |

Notes:

ags = above ground surface
bgs = below ground surface
msl = mean sea level
NA = Not Available
* = Approximately

**TABLE 4-3**

**SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM**
**SWMU 54 - BUILDING 1914 (FORMER NEX REPAIR/MAINTENANCE SHOP)**
**NAVAL STATION ROOSEVELT ROADS, PUERTO RICO**

| | | | Analytical Parameters | | | | |
|---|---|---|---|---|---|---|---|
| Sample Media | Sample Designation | Sample Depth (ft bgs) | Appendix IX List | TPH (Diesel Range Organics) | TPH (Gasoline Range Organics) | Groundwater Quality | Comments |
| Surface Soil | 54SS01 | 0.0-1.0 | X | X | X | | |
| | 54SS02 | 0.0-1.0 | X | X | X | | |
| | 54SS03 | 0.0-1.0 | X | X | X | | |
| | 54SS04 | 0.0-1.0 | X | X | X | | |
| | 54SS04D | 0.0-1.0 | X | X | X | | Duplicate Sample |
| | 54SS05 | 0.0-1.0 | X | X | X | | |
| | 54SS06 | 0.0-1.0 | X | X | X | | |
| | 54SS07 | 0.0-1.0 | X | X | X | | |
| | 54SS08 | 0.0-1.0 | X | X | X | | |
| | 54SS09 | 0.0-1.0 | X | X | X | | |
| | 54SS10 | 0.0-1.0 | X | X | X | | |
| | 54SS11 | 0.0-1.0 | X | X | X | | |
| | 54SS12 | 0.0-1.0 | X | X | X | | |
| | 54SS13 | 0.0-1.0 | X | X | X | | |
| | 54SS13D | 0.0-1.0 | X | X | X | | Duplicate Sample |
| | 54SS13MS/MSD | 0.0-1.0 | X | X | X | | Matrix Spike/Matrix Spike Duplicate |
| | 54SS14 | 0.0-1.0 | X | X | X | | |
| | 54SS15 | 0.0-1.0 | X | X | X | | |
| | 54SB01-00 | 0.0-1.0 | X | X | X | | |
| Subsurface Soil | 54SB01-00 | (1) | X | X | X | | Suspected Area of Contamination |
| | 54SB01-XX | (1) | X | X | X | | Interval immediately above water table |
| | 54SB02-XX | (1) | X | X | X | | Suspected Area of Contamination |
| | 54SB02-XX | (1) | X | X | X | | Interval immediately above water table |
| Groundwater | 510-MW1 | NA | X | X | X | X | |
| | 510-MW2 | NA | X | X | X | | |
| | 510-MW2D | NA | X | X | X | | Duplicate Sample |
| | 510-MW02MS | NA | X | X | X | | Matrix Spike |
| | 510-MW02MSD | NA | X | X | X | | Matrix Spike Duplicate |
| | 510-MW3 | NA | X | X | X | | |
| | 510-MW4 | NA | X | X | X | X | |
| | 510-MW5 | NA | X | X | X | | |
| | 510-DW1 | NA | X | X | X | | |
| | 510-DW2 | NA | X | X | X | | |
| | 54TW01 | NA | X | X | X | | |
| | 54TW02 | NA | X | X | X | | |
| Surface Water | 54SW01 | NA | X | X | X | | |
| | 54SW01D | NA | X | X | X | | Duplicate Sample |
| | 54SW02 | NA | X | X | X | | |

Notes:
(1) = Sample will be collected from areas of suspected contamination and/or a depth immediately above the water table.
XX = The sample depth designator in which the sample was collected (i.e. 01 = 1-3 ft bgs, 02 = 3-5 ft bgs, etc.).
D = Duplicate
MS/MSD = Matrix Spike/Matrix Spike Duplicate
ft bgs = feet below ground surface
NA = Not Applicable Refer to Table 4-4 for a listing of Appendix IX Parameters

## TABLE 4-4

## METHOD PERFORMANCE LIMITS
## APPENDIX IX COMPOUND LIST AND CONTRACT
## REQUIRED QUANTITATION LIMITS (CRQL)

| Volatiles | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| Acetone | 50 | 50 | 8260 |
| Acetonitrile | 200 | 200 | 8260 |
| Acrolein | 100 | 100 | 8260 |
| Acrylonitrile | 100 | 100 | 8260 |
| Benzene | 5.0 | 5.0 | 8260 |
| Bromodichloromethane | 5.0 | 5.0 | 8260 |
| Bromoform | 5.0 | 5.0 | 8260 |
| Bromomethane | 10 | 10 | 8260 |
| Carbon Disulfide | 5.0 | 5.0 | 8260 |
| Carbon Tetrachloride | 5.0 | 5.0 | 8260 |
| Chlorobenzene | 5.0 | 5.0 | 8260 |
| Chloroethane | 10 | 10 | 8260 |
| Chloroform | 5.0 | 5.0 | 8260 |
| Chloromethane | 10 | 10 | 8260 |
| Chloroprene | 5.0 | 3.0 | 8260 |
| 3-Chloropropene | 5.0 | 5.0 | 8260 |
| 1,2-Dibromo-3-chloropropane | 5.0 | 10 | 8260 |
| Dibromochloromethane | 5.0 | 5.0 | 8260 |
| 1,2-Dibromoethane | 5.0 | 5.0 | 8260 |
| Dibromomethane | 5.0 | 5.0 | 8260 |
| trans-1,4-Dichloro-2-butene | 10 | 10 | 8260 |
| Dichlorodifluoromethane | 10 | 5.0 | 8260 |
| Dibromomethane | 5.0 | 5.0 | 8260 |
| 1,1-Dichloroethane | 5.0 | 5.0 | 8260 |
| 1,2-Dichloroethane | 5.0 | 5.0 | 8260 |
| trans-1,2-Dichloroethylene | 5.0 | 5.0 | 8260 |
| 1,1-Dichloroethylene | 5.0 | 5.0 | 8260 |
| Dichloromethane | 5.0 | 5.0 | 8260 |
| 1,2-Dichloropropane | 5.0 | 5.0 | 8260 |
| cis-1,3-Dichloropropene | 5.0 | 5.0 | 8260 |
| trans-1,3-Dichloropropene | 5.0 | 5.0 | 8260 |

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Volatiles | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| Ethyl benzene | 5.0 | 5.0 | 8260 |
| Ethyl methacrylate | 5.0 | 5.0 | 8260 |
| 2-Hexanone | 25 | 25 | 8260 |
| Iodomethane | 5.0 | 5.0 | 8260 |
| Isobutyl alcohol | 200 | 200 | 8260 |
| Methacrylonitrile | 100 | 100 | 8260 |
| Methyl ethyl ketone | 25 | 25 | 8260 |
| Methyl methacrylate | 5.0 | 5.0 | 8260 |
| 4-Methyl-2-pentanone | 25 | 25 | 8260 |
| Pentachloroethane | 25 | 25 | 8260 |
| Propionibrile | 100 | 100 | 8260 |
| Stryene | 5.0 | 5.0 | 8260 |
| 1,1,1,2-Tetrachloroethane | 5.0 | 5.0 | 8260 |
| 1,1,2,2-Tetrachloroethane | 5.0 | 5.0 | 8260 |
| Tetrachloroethene | 5.0 | 5.0 | 8260 |
| Toluene | 5.0 | 5.0 | 8260 |
| 1,1,1-Trichloroethane | 5.0 | 5.0 | 8260 |
| 1,1,2-Trichloroethane | 5.0 | 5.0 | 8260 |
| Trichloroethene | 5.0 | 5.0 | 8260 |
| Trichlorofluoromethane | 5.0 | 5.0 | 8260 |
| 1,2,3-Trichloropropane | 5.0 | 5.0 | 8260 |
| Vinyl Acetate | 10 | 10 | 8260 |
| Vinyl Chloride | 10 | 10 | 8260 |
| Xylene | 10 | 10 | 8260 |

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Semivolatiles | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| Acenaphthene | 10 | 330 | 8270 |
| Acenaphthylene | 10 | 330 | 8270 |
| Acetophenone | 10 | 330 | 8270 |
| 2-Acetylaminofluorene | 10 | 330 | 8270 |
| 4-Aminobiphenyl | 20 | 330 | 8270 |
| Aniline | 20 | 330 | 8270 |
| Anthracene | 10 | 330 | 8270 |
| Aramite | 10 | 330 | 8270 |
| Benzo(a)anthracene | 10 | 330 | 8270 |
| Benzo(b)fluoranthene | 10 | 330 | 8270 |
| Benzo(k)fluoranthene | 10 | 330 | 8270 |
| Benzo(g,h,i)perylene | 10 | 330 | 8270 |
| Benzo(a)pyrene | 10 | 330 | 8270 |
| Benzyl alcohol | 10 | 330 | 8270 |
| Bis(2-chloroethoxyl)methane | 10 | 330 | 8270 |
| Bis(2-chloroethyl)ether | 10 | 330 | 8270 |
| Bis(2-ethylhexyl)phthalate | 10 | 330 | 8270 |
| 4-Bromophenyl phenyl ether | 10 | 330 | 8270 |
| Butyl benzyl phthalate | 10 | 330 | 8270 |
| p-Chloroaniline | 20 | 660 | 8270 |
| p-Chloro-m-cresol | 10 | 330 | 8270 |
| 2-Chloronaphthalene | 10 | 330 | 8270 |
| 2-Chlorophenol | 10 | 330 | 8270 |
| 4-Chlorophenyl phenyl ether | 10 | 330 | 8270 |
| Chrysene | 10 | 330 | 8270 |
| m,p-Cresol | 10 | 330 | 8270 |
| ortho-Cresol | 10 | 330 | 8270 |
| Diallate | 10 | 330 | 8270 |
| Dibenzofuran | 10 | 330 | 8270 |
| Di-n-butyl phthalate | 10 | 330 | 8270 |
| Dibenzo(a,h)anthracene | 10 | 330 | 8270 |

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Semivolatiles | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| o-Dichlorobenzene | 10 | 330 | 8270 |
| m-Dichlorobenzene | 10 | 330 | 8270 |
| p-Dichlorobenzene | 10 | 330 | 8270 |
| 3,3'-Dichlorobenzidine | 20 | 660 | 8270 |
| 2,4-Dichlorophenol | 10 | 330 | 8270 |
| 2,6-Dichlorophenol | 10 | 330 | 8270 |
| Diethylphthalate | 10 | 330 | 8270 |
| p-(Dimethylamino)azobenzene | 10 | 330 | 8270 |
| 7,12-Dimethyl benz(a)anthracene | 10 | 330 | 8270 |
| 3,3-Dimethyl benzidine | 20 | 1,700 | 8270 |
| 2,4-Dimethylphenol | 10 | 330 | 8270 |
| alpha, alpha-Dimethylphenethylamine | 2,000 | 67,000 | 8270 |
| Dimethyl phthalate | 10 | 330 | 8270 |
| m-Dinitrobenzene | 10 | 330 | 8270 |
| 4,6-Dinitro-o-cresol | 50 | 1,700 | 8270 |
| 2,4-Dinitrophenol | 50 | 1,700 | 8270 |
| 2,4-Dinitrotoluene | 10 | 330 | 8270 |
| 2,6-Dinitrotoluene | 10 | 330 | 8270 |
| Di-n-octylphthalate | 10 | 330 | 8270 |
| 1,4-Dioxane | 10 | 330 | 8270 |
| Dinoseb | 10 | 330 | 8270 |
| Ethylmethanesulfonate | 10 | 330 | 8270 |
| Fluoranthene | 10 | 330 | 8270 |
| Fluorene | 10 | 330 | 8270 |
| Hexachlorobenzene | 10 | 330 | 8270 |
| Hexachlorobutadiene | 10 | 330 | 8270 |
| Hexachlorocyclopentadiene | 10 | 330 | 8270 |
| Hexachloroethane | 10 | 330 | 8270 |
| Hexachlorophene | 5,000 | 170,000 | 8270 |
| Hexachloropropene | 10 | 330 | 8270 |
| Indeno(1,2,3-cd)pyrene | 10 | 330 | 8270 |

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Semivolatiles | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| Isophorone | 10 | 330 | 8270 |
| Isosafrole | 10 | 330 | 8270 |
| Methapyrilene | 2,000 | 67,000 | 8270 |
| 3-Methylcholanthrene | 10 | 330 | 8270 |
| Methyl methanesulfonate | 10 | 330 | 8270 |
| 2-Methylnaphthalene | 10 | 330 | 8270 |
| Naphthalene | 10 | 330 | 8270 |
| 1,4-Naphthoquinone | 10 | 330 | 8270 |
| 1-Naphthylamine | 10 | 330 | 8270 |
| 2-Naphthylamine | 10 | 330 | 8270 |
| o-Nitroaniline | 50 | 1,700 | 8270 |
| m-Nitroaniline | 50 | 1,700 | 8270 |
| p-Nitroaniline | 50 | 1,700 | 8270 |
| Nitrobenzene | 10 | 330 | 8270 |
| o-Nitrophenol | 10 | 330 | 8270 |
| p-Nitrophenol | 50 | 1,700 | 8270 |
| 4-Nitroquinoline-1-oxide | 20 | 3,300 | 8270 |
| n-Nitrosodi-n-butylamine | 10 | 330 | 8270 |
| n-Nitrosodiethylamine | 10 | 330 | 8270 |
| n-Nitrosodimethylamine | 10 | 330 | 8270 |
| n-Nitrosodiphenylamine | NA | 330 | 8270 |
| n-Nitrosodi-n-propylamine | 10 | 330 | 8270 |
| n-Nitrosomethylethylamine | 10 | 330 | 8270 |
| n-Nitrosomorpholine | 10 | 330 | 8270 |
| n-Nitrosopiperidine | 10 | 330 | 8270 |
| n-Nitrosopyrrolidine | 10 | 330 | 8270 |
| 5-Nitro-o-toluidine | 10 | 330 | 8270 |
| 2,2'-Oxybis(1-chloropropane) | 10 | 330 | 8270 |
| Pentachlorobenzene | 10 | 330 | 8270 |
| Pentachloronitrobenzene | 10 | 330 | 8270 |
| Pentachlorophenol | 50 | 1,700 | 8270 |
| Phenacetin | 10 | 330 | 8270 |
| Phenanthrene | 10 | 330 | 8270 |

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Semivolatiles | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| Phenol | 10 | 330 | 8270 |
| p-Phenylenediamine | 2,000 | 1,700 | 8270 |
| 2-Picolin | 10 | 330 | 8270 |
| Pronamide | 10 | 330 | 8270 |
| Pyrene | 10 | 330 | 8270 |
| Pyridine | 50 | 330 | 8270 |
| Safrole | 10 | 330 | 8270 |
| 1,2,4,5-Tetrachlorobenzene | 10 | 330 | 8270 |
| 2,3,4,6-Tetrachlorophenol | 10 | 330 | 8270 |
| o-Toluidine | 10 | 330 | 8270 |
| 1,2,4-Trichlorobenzene | 10 | 330 | 8270 |
| 2,4,5-Trichlorophenol | 10 | 330 | 8270 |
| 2,4,6-Trichlorophenol | 10 | 330 | 8270 |
| sym-Trinitrobenzene | 10 | 330 | 8270 |

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

NA = Not Available

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Pesticides/PCBs | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| Aldrin | 0.05 | 1.7 | 8081 |
| Alpha-BHC | 0.05 | 1.7 | 8081 |
| beta-BHC | 0.05 | 1.7 | 8081 |
| delta-BHC | 0.05 | 1.7 | 8081 |
| Lindane | 0.05 | 1.7 | 8081 |
| Chlordane | 0.5 | 17 | 8081 |
| Chlorobenzilate | 0.5 | 17 | 8081 |
| 4,4'-DDT | 0.1 | 3.3 | 8081 |
| 4,4'-DDE | 0.1 | 3.3 | 8081 |
| 4,4'-DDD | 0.1 | 3.3 | 8081 |
| Dieldrin | 0.1 | 3.3 | 8081 |
| Endosulfan I | 0.05 | 1.7 | 8081 |
| Endosulfan II | 0.1 | 3.3 | 8081 |
| Endosulfan sulfate | 0.1 | 3.3 | 8081 |
| Endrin | 0.1 | 3.3 | 8081 |
| Isodrin | 0.05 | 3.3 | 8081 |
| Kepone | 1.0 | 170 | 8081 |
| Toxaphene | 5.0 | 170 | 8081 |
| Endrin Aldehyde | 0.1 | 3.3 | 8081 |
| Heptachlor | 0.05 | 1.7 | 8081 |
| Heptachlor epoxide | 0.05 | 1.7 | 8081 |
| Methyoxychlor | 0.5 | 17 | 8081 |
| Aroclor-1016 | 1.0 | 33 | 8082 |
| Aroclor-1221 | 2.0 | 67 | 8082 |
| Aroclor-1232 | 1.0 | 33 | 8082 |
| Aroclor-1242 | 1.0 | 33 | 8082 |
| Aroclor-1248 | 1.0 | 33 | 8082 |
| Aroclor-1254 | 1.0 | 33 | 8082 |
| Aroclor-1260 | 1.0 | 33 | 8082 |

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| OP-Pesticides | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| Dimethoate | 10 | 330 | 8270 |
| Disulfoton | NA | 330 | 8270 |
| Famphur | 10 | 330 | 8270 |
| Methyl parathion | 10 | 330 | 8270 |
| o,o,o-Triethylphosphorothioate | 10 | 330 | 8270 |
| Parathion | 10 | 330 | 8270 |
| Phorate | 10 | 330 | 8270 |
| Sulfotepp | 10 | 330 | 8270 |
| Thionazin | 10 | 330 | 8270 |

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

NA = Not Available

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Dioxins (SW-846 Method 8280) | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| 2,3,7,8-TCDD | 0.005 | 0.50 | 8280 |

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

TABLE 4-4 (continued)

METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Chlorinated Herbicides | Quantitation Limits* | | Method Number |
|---|---|---|---|
| | Water (µg/L) | Low Soil (µg/kg) | |
| 2,4-Dichlorophenoxyacetic acid | 0.50 | 8.3 | 8151 |
| 2,4,5-T | 0.50 | 8.3 | 8151 |
| Silvex | 0.50 | 8.3 | 8151 |

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

TABLE 4-4 (continued)

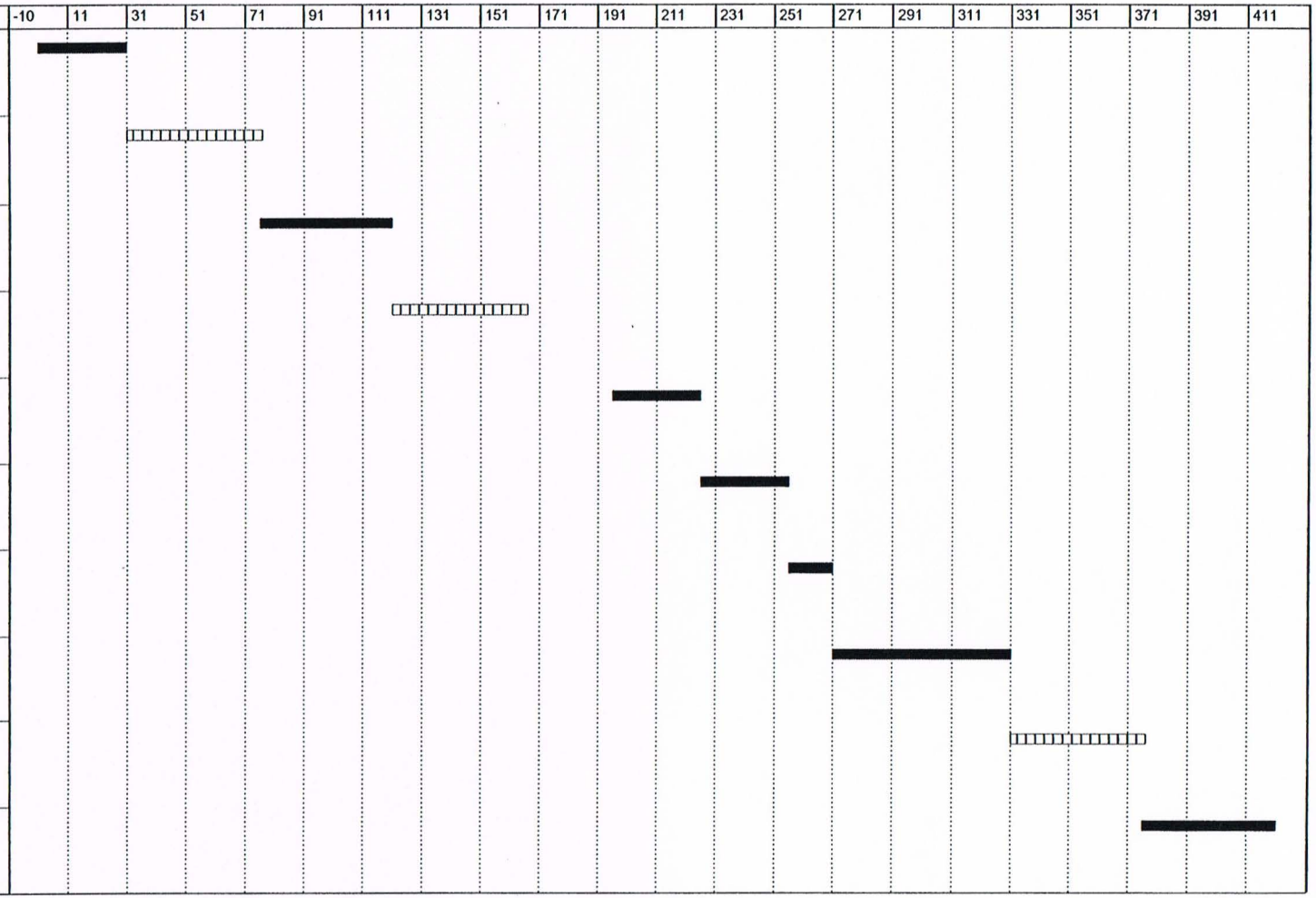
METHOD PERFORMANCE LIMITS
APPENDIX IX COMPOUND LIST AND CONTRACT
REQUIRED QUANTITATION LIMITS (CRQL)

| Inorganics | Method Number | Quantitation Limits* | | Method Description |
|---|---|---|---|---|
| | | Water (µg/L) | Low Soil (µg/kg) | |
| Antimony | 6010 | 20 | 2.0 | Inductively Coupled Plasma |
| Arsenic | 6010 | 10 | 1.0 | Inductively Coupled Plasma |
| Barium | 6010 | 10 | 1.0 | Inductively Coupled Plasma |
| Beryllium | 6010 | 4.0 | 0.4 | Inductively Coupled Plasma |
| Cadmium | 6010 | 5.0 | 0.5 | Inductively Coupled Plasma |
| Chromium | 6010 | 10 | 1.0 | Inductively Coupled Plasma |
| Cobalt | 6010 | 10 | 1.0 | Inductively Coupled Plasma |
| Copper | 6010 | 20 | 2.0 | Inductively Coupled Plasma |
| Lead | 6010 | 5.0 | 0.5 | Inductively Coupled Plasma |
| Mercury | 7470/7471 | 0.2 | 0.02 | Cold Vapor AA |
| Nickel | 6010 | 40 | 4.0 | Inductively Coupled Plasma |
| Selenium | 6010 | 10 | 1.0 | Inductively Coupled Plasma |
| Silver | 6010 | 10 | 1.0 | Inductively Coupled Plasma |
| Thallium | 6010 | 10 | 1.0 | Inductively Coupled Plasma |
| Tin | 6010 | 10 | 5.0 | Inductively Coupled Plasma |
| Vanadium | 6010 | 10 | 1.0 | Inductively Coupled Plasma |
| Cyanide | 9012 | 0.010 | 1.0 | Colorimetric |
| Sulfide | 9030 | 1.0 | 25 | Titrimetric, Iodine |
| Zinc | 6010 | 20 | 2.0 | Inductively Coupled Plasma |

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

**Table 7-1**
**Task Schedule**
**SWMU 53 - Building 64 (Malaria Control Building)**
**SWMU 54 - Building 1914 (Former NEX Repair/Maintenance Shop)**
**Naval Station Roosevelt Roads, Puerto Rico**

| Task Name | Elapsed Days |
|---|---|
| Draft Sampling and Analysis Plan | 30 edays |
| EPA Review | 45 edays |
| Final Sampling and Analysis Plan | 45 edays |
| EPA Review | 45 edays |
| Field Work | 30 edays |
| Laboratory Analysis | 30 edays |
| Data Validation | 15 edays |
| Draft Sampling and Analysis Report | 60 edays |
| EPA Review | 45 edays |
| Final Sampling and Analysis Report | 45 edays |




Project: SWMUs 53 and 54
Date: 7/17/00

Task ▬▬▬ Review ▭▭▭

*Footnote: Submittal dates are dependent upon Government review calendar days.*

# FIGURES

K:\CAD\277-TEMP\2099564S

51

GATE NO.2

37

12/14

9 AREA B

9 AREA A

9 AREA C

25

53

13

7/8

AOC D

46/AOC C

10

23/24

6/AOC B

31/32

39

45/11

30

AOC D

3

2

AOC D

1

AOC D

FORRESTAL DRIVE

ENSENADA

HONDA

BASE BOUNDARY

AGRICULTURAL

OBSTRUCTION LIGHTS

AGRICULTURAL

54

28

MANGROVE

MANGROVE

MANGROVE

MANGROVE

MANGROVE

MEDIO MUNDO PASSAGE

PINERITA ISLAND

PUERCA POINT

VIEQUES PASSAGE

Baker

Baker Environmental, Inc.

LEGEND

1 – SWMUs

53 – AREA OF WHICH THIS INVESTIGATION PERTAINS TO

AOC D – AOCs

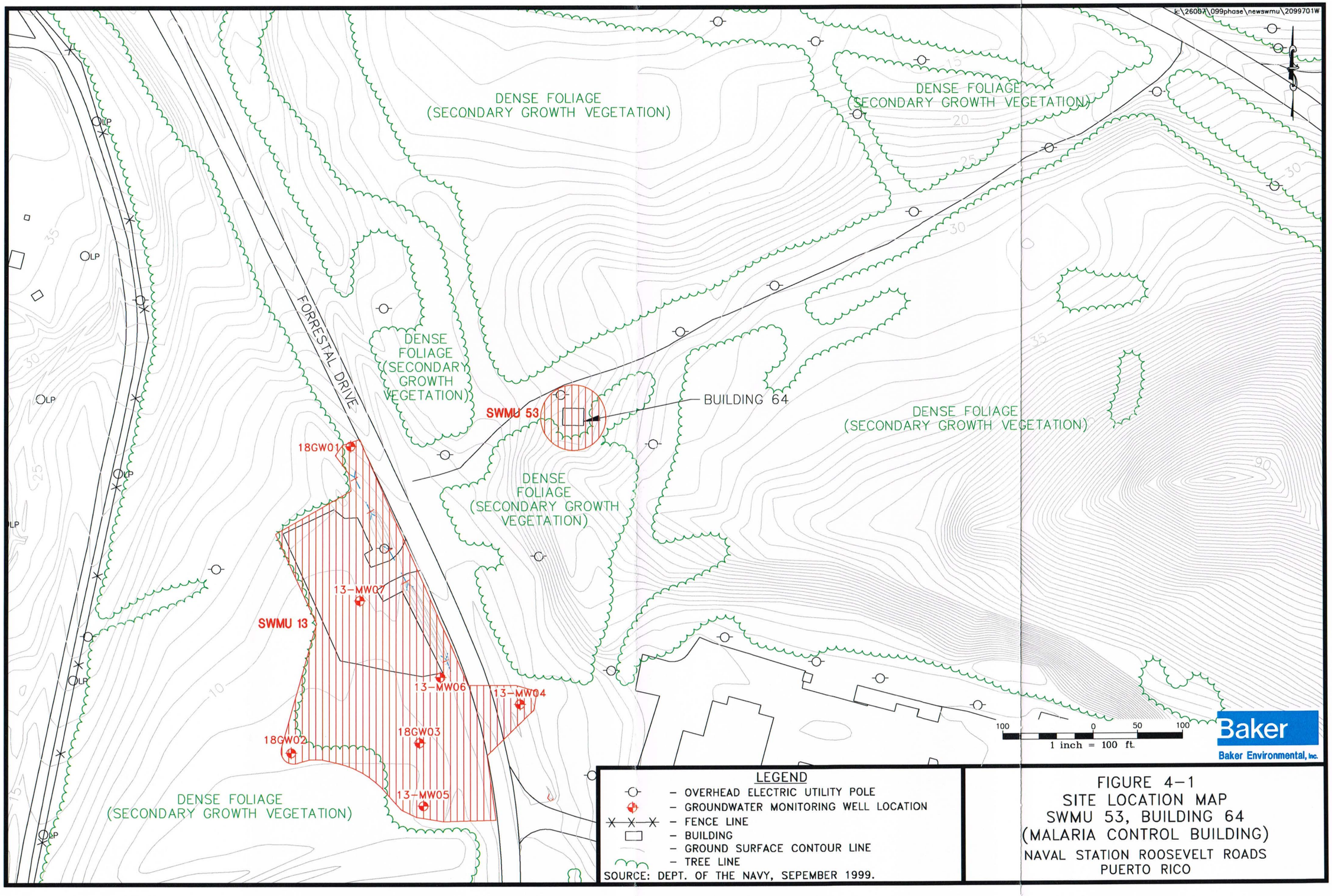
SOURCE: LANTDIV, FEB. 1992/1997

2500 0 1250 2500

1 inch = 2500 ft.

FIGURE 1-1
SWMU/AOC LOCATION MAP

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO




LEGEND

- OVERHEAD ELECTRIC UTILITY POLE
- GROUNDWATER MONITORING WELL LOCATION
- FENCE LINE
- BUILDING
- GROUND SURFACE CONTOUR LINE
- TREE LINE

SOURCE: DEPT. OF THE NAVY, SEPEMBER 1999.

FIGURE 4-1
SITE LOCATION MAP
SWMU 53, BUILDING 64
(MALARIA CONTROL BUILDING)
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

k:\26007\099phase\newswmu\2099703W

DENSE FOLIAGE
(SECONDARY
GROWTH
VEGETATION)

53SB01

53SS02

53SB02

53SS01

53SS03

53SB06

53SB05

BUILDING 64

53SB03

53SS06

53SS04

53SB04

53SS05

DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)

DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)

10 0 5 10
1 inch = 10 ft.

Baker
Baker Environmental, Inc.

LEGEND

- – PROPOSED SURFACE SOIL SAMPLE LOCATION
- – PROPOSED SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- – OVERHEAD ELECTRIC UTILITY POLE
- – BUILDING
- – GROUND SURFACE CONTOUR LINE
- – TREE LINE

SOURCE: DEPT. OF THE NAVY, SEPEMBER 1999.

FIGURE 4–2
PROPOSED SAMPLING LOCATIONS
SWMU 53, BUILDING 64
(MALARIA CONTROL BUILDING)
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

k:\26007\099phase\newswmu\2099700W

DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)

SWMU 54

BLDG.
1686

BLDG.
1914

510-MW4

510-MW5

510-MW1

510-DW1

510-DW2

510-MW3

BAIROKO STREET

FORMER LOCATION
OF BUILDING 510

BLDG.
1687

DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)

510-MW2

SWMU 26

DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)

100 0 50 100
1 inch = 100 ft.

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LEGEND

- EXISTING GROUNDWATER MONITORING WELL LOCATION
- OVERHEAD ELECTRIC UTILITY POLE
- OVERHEAD ELECTRIC UTILITY POLE WITH LIGHT
- FENCE LINE
- BUILDING
- GROUND SURFACE CONTOUR LINE
- TREE LINE

SOURCE: DEPT. OF THE NAVY, SEPTEMBER 1999.

FIGURE 4-3
SITE LOCATION MAP
SWMU 54, BUILDING 1914
(NEX REPAIR/MAINTENANCE SHOP)
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

k:\26007\099phase\newswmu\2099704W

GRAVEL
54SS14
AST
54SS13
54SS12
DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)
54SS15
GRAVEL
54SS02
54SS03
54SS11
510-MW4
OIL/WATER
SEPARATOR
54TW04
54SS01
(OFFICE)
BLDG. 1914
CONCRETE
BLDG. 1686
54SS04
54SS10
GRASS
54TW02
54SS09
OPEN STORAGE
SHED
54SS05
54SS06
510-MW5
54SW02
54SW01
HAZARDOUS MATERIALS
STORAGE SHED
54SS08
APPROXIMATE
OPEN EXCAVATION
LOCATION
GRAVEL
BAIROKO STREET
54SS07
510-MW1
510-DW1
510-DW2
GRAVEL
DENSE FOLIAGE
(SECONDARY GROWTH VEGETATION)
510-MW3
510-MW2

50 0 25 50
1 inch = 50 ft.

Baker
Baker Environmental, Inc.

LEGEND

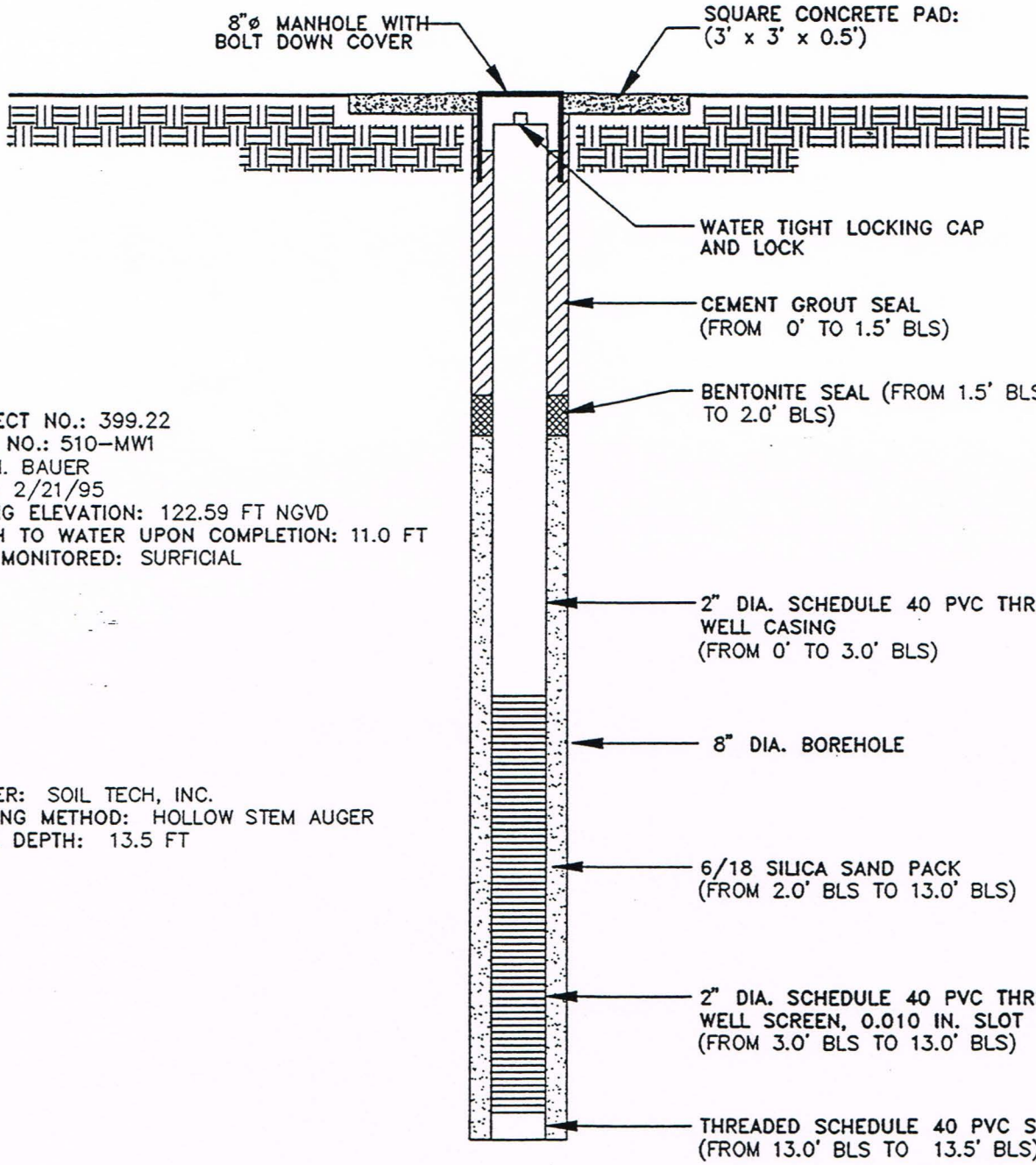
- PROPOSED TEMPORARY SHALLOW WELL LOCATION
- SHALLOW MONITORING WELL APPROXIMATE LOCATION
- DEEP MONITORING WELL APPROXIMATE LOCATION
- SURFACE WATER SAMPLE LOCATION
- PROPOSED SURFACE SOIL SAMPLE SAMPLE LOCATION
- OVERHEAD ELECTRIC UTILITY POLE
- FENCE LINE
- BUILDING
- GROUND SURFACE CONTOUR LINE
- TREE LINE
- EDGE OF GRAVEL

SOURCE: DEPT. OF THE NAVY, SEPTEMBER 1999.

# FIGURE 4-4
# PROPOSED SAMPLING LOCATIONS
# SWMU 54, BUILDING 1914
# (NEX REPAIR/MAINTENANCE SHOP)
## NAVAL STATION ROOSEVELT ROADS
## PUERTO RICO

# APPENDIX A
# MONITORING WELL CONSTRUCTION DIAGRAM AND LITHOLOGIC LOGS

# 510-MW1




PROJECT NO.: 399.22
WELL NO.: 510-MW1
BY: M. BAUER
DATE: 2/21/95
CASING ELEVATION: 122.59 FT NGVD
DEPTH TO WATER UPON COMPLETION: 11.0 FT
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 13.5 FT

(DRAWING NOT TO SCALE)

BLS = BELOW LAND SURFACE

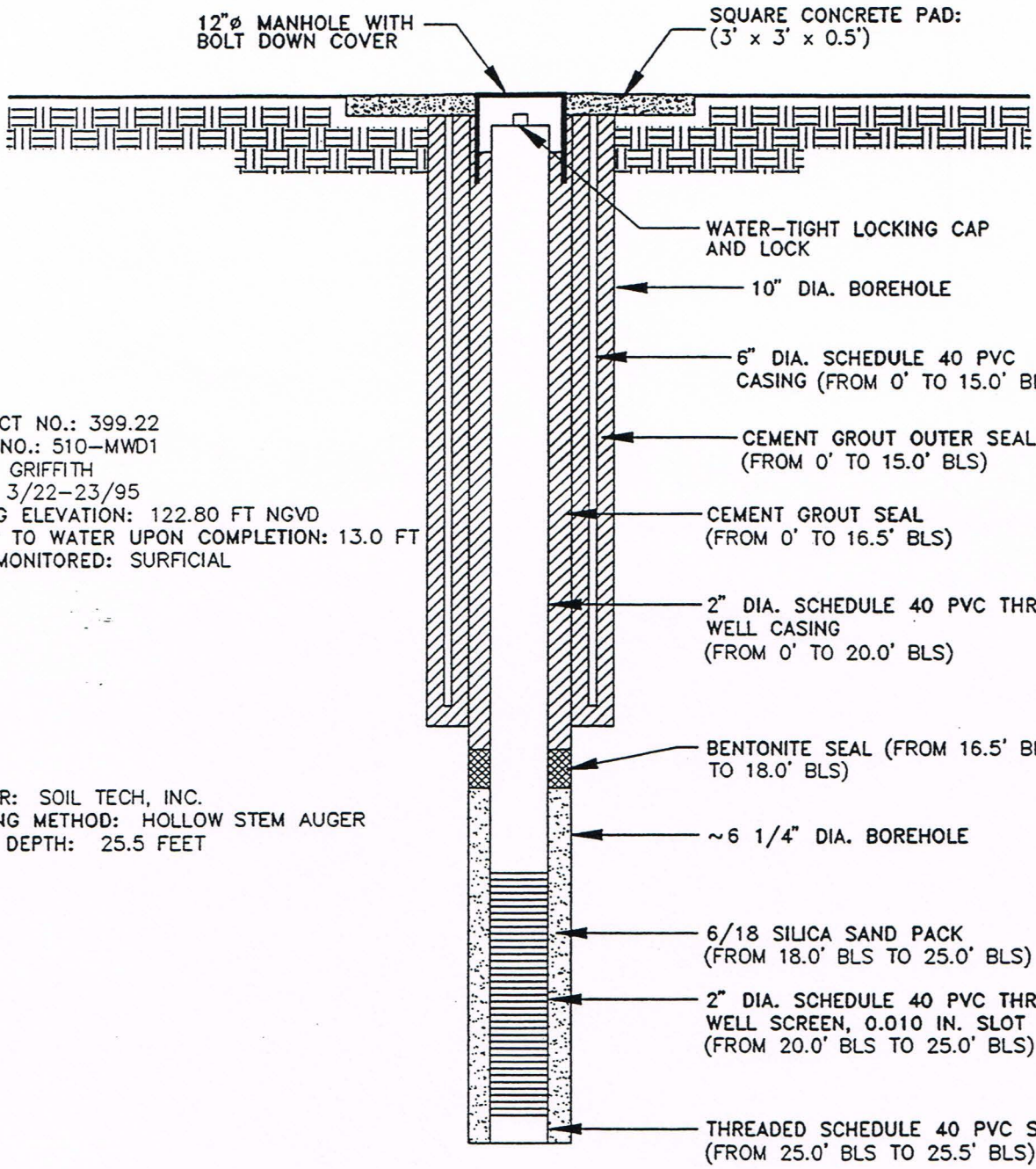
**BLASLAND, BOUCK & LEE, INC.**
*ENGINEERS & SCIENTISTS*

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
SITE #510

**MONITORING WELL 510-MW1 CONSTRUCTION DETAILS** | FIGURE --

19JUN95 26 JR
D:\39922\39922WL3.DWG

# 510-DW1




PROJECT NO.: 399.22
WELL NO.: 510-MWD1
BY: L. GRIFFITH
DATE: 3/22-23/95
CASING ELEVATION: 122.80 FT NGVD
DEPTH TO WATER UPON COMPLETION: 13.0 FT
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 25.5 FEET

(DRAWING NOT TO SCALE)

BLS = BELOW LAND SURFACE

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CEIBA, PUERTO RICO
SITE #510

**MONITORING WELL 510-DW1 CONSTRUCTION DETAILS**

FIGURE --

EDIT: 21JUN95 27 JO
19JUN95 26 JR
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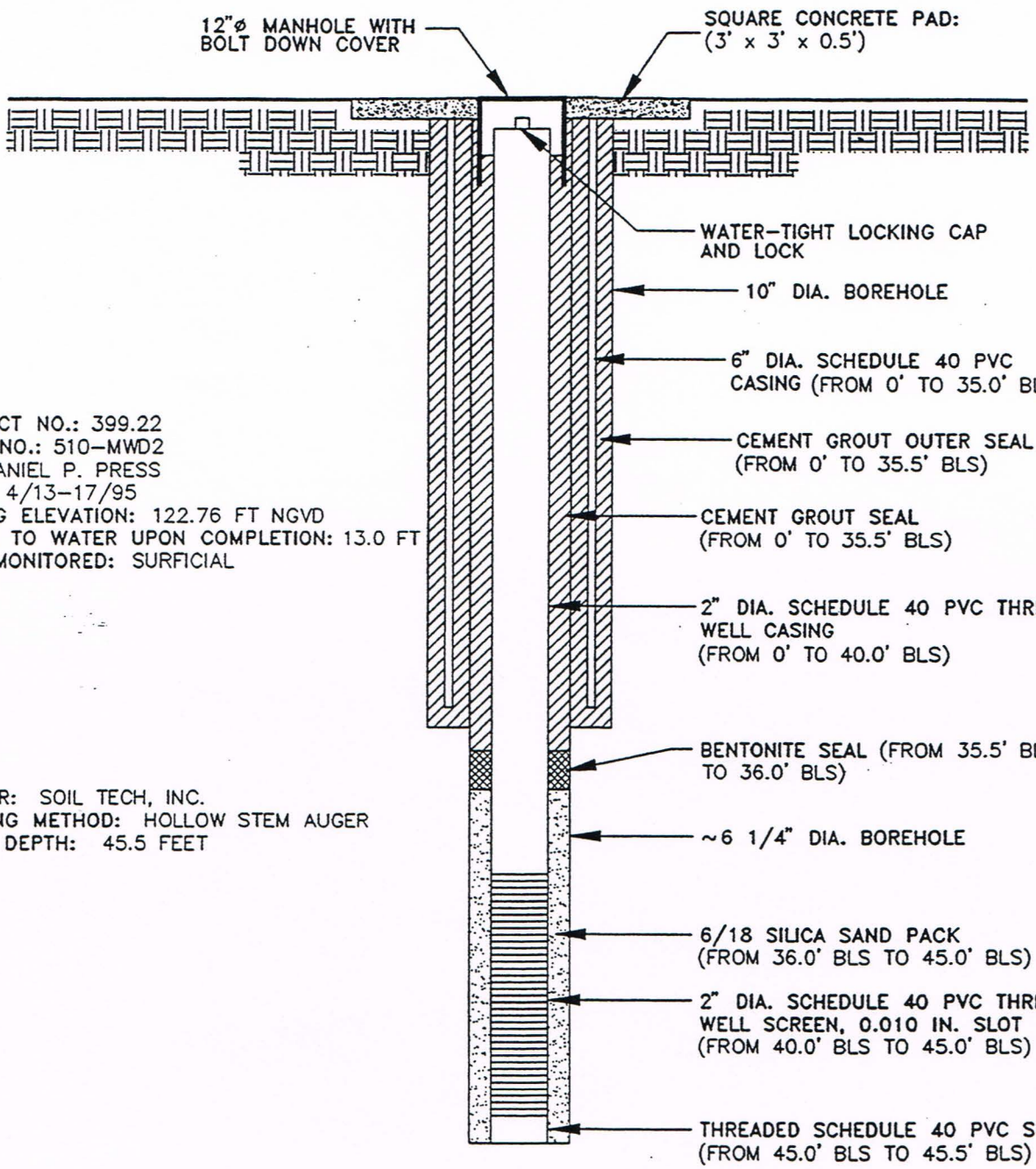
# 510-DW2




PROJECT NO.: 399.22
WELL NO.: 510-MWD2
BY: DANIEL P. PRESS
DATE: 4/13-17/95
CASING ELEVATION: 122.76 FT NGVD
DEPTH TO WATER UPON COMPLETION: 13.0 FT
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 45.5 FEET

(DRAWING NOT TO SCALE)

BLS = BELOW LAND SURFACE

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CEIBA, PUERTO RICO
SITE #510

**MONITORING WELL 510-DW2 CONSTRUCTION DETAILS**

FIGURE --

EDIT: 21JUN95 27 JO
19JUN95 26 JR
D:\39922\39922WL7.DWG

## SOIL BORING LOG

| | |
|---|---|
| Exploration for: Site Characterization | Location |
| Date: Feb. 14, 1995 | 510 |
| Boring No.: SB-2 | Water Table |
| Recorded By: M. Bauer/J. Garrido | approx. 6.10 ft BLS |
| Drill Type: Hollow Stem Auger | 1/100' Free product in bailer |
| Weather: Sunny, Breezy 85° | |

| Sample No. | Type | Depth | | No. of Blows | Soil Description and Boring Log |
|---|---|---|---|---|---|
| | | From | To | | |
| SB-2 | PH | 0 | 2 | N/A | 7.5 YR 4/4 brown rocks & fine sand |
| SB-2 | PH | 2 | 4 | N/A | 7.5 YR 4/4 brown rocks & fine sand |
| SB-2 | SPT | 4 | 6 | 11, 9, 9, 9 | Gravel size granite fill |
| SB-2 | SPT | 6 | 8 | 11, 11, 11, 7 | Gravel sized granite fill (moist) |
| SB-2 | SPT | 8 | 10 | 7, 4, 2, 8 | Coarse black sand, clay found at bottom of spoon (wet) |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

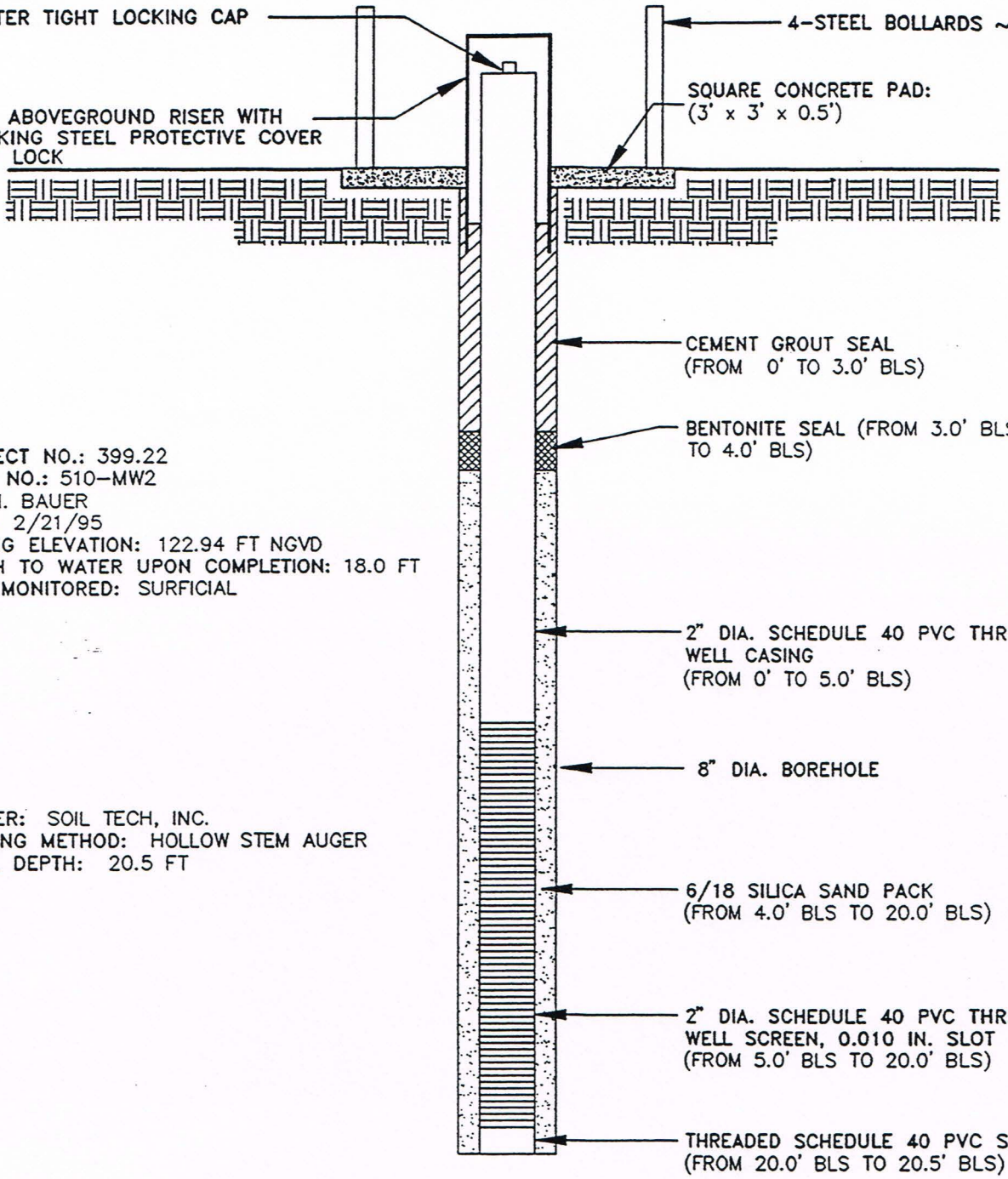
Remarks

PH - post hole

SPT - standard penetration test

NA - not applicable

# 510-MW2




PROJECT NO.: 399.22
WELL NO.: 510-MW2
BY: M. BAUER
DATE: 2/21/95
CASING ELEVATION: 122.94 FT NGVD
DEPTH TO WATER UPON COMPLETION: 18.0 FT
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 20.5 FT

(DRAWING NOT TO SCALE)

BLS = BELOW LAND SURFACE

**BLASLAND, BOUCK & LEE, INC.**
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CEIBA, PUERTO RICO
SITE #510

**MONITORING WELL 510-MW2 CONSTRUCTION DETAILS** | FIGURE --

EDIT: 21JUN95 27 JD
19JUN95 26 JR
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## SOIL BORING LOG

| | |
|---|---|
| Exploration for: Site Characterization | Location |
| Date: Feb. 16, 1995 | 510 |
| Boring No.: SB-6 | Water Table |
| Recorded By: M. Bauer | approx. 13.64 ft BLS |
| Drill Type: Hollow Stem Auger | |
| Weather: Sunny 80° light breeze | |

| Sample No. | Type | Depth | | No. of Blows | Soil Description and Boring Log |
|---|---|---|---|---|---|
| | | From | To | | |
| SB-6 | PH | 0 | 2 | N/A | 7.5 YR 3/2 dk brown clay with pebble sized carbon |
| SB-6 | PH | 2 | 4 | N/A | 7.5 YR 4/6 strong brown clay |
| SB-6 | SPT | 4 | 6 | 5, 8, 9, 12 | 7.5 YR 4/4 brown clay |
| SB-6 | SPT | 6 | 8 | 5, 9, 12, 16 | 7.5 YR 5/6 strong brown clay |
| SB-6 | SPT | 8 | 10 | 5, 8, 12, 17 | 7.5 YR 6/4 light brown clay with pebble sized limerock |
| SB-6 | SPT | 10 | 12 | 5, 8, 13, 16 | 7.5 YR 5/4 and 7.5 YR 7/4 mottled clay (moist) |
| SB-6 | SPT | 12 | 14 | 6, 10, 13, 17 | 7.5 YR 7/4 and 5 YR 5/6 mottled clay (moist) |
| SB-6 | SPT | 14 | 16 | 4, 5, 9, 14 | 5 YR 5/6 and 10 YR 6/4 mottled clay (moist) |
| | | | | | |
| | | | | | |

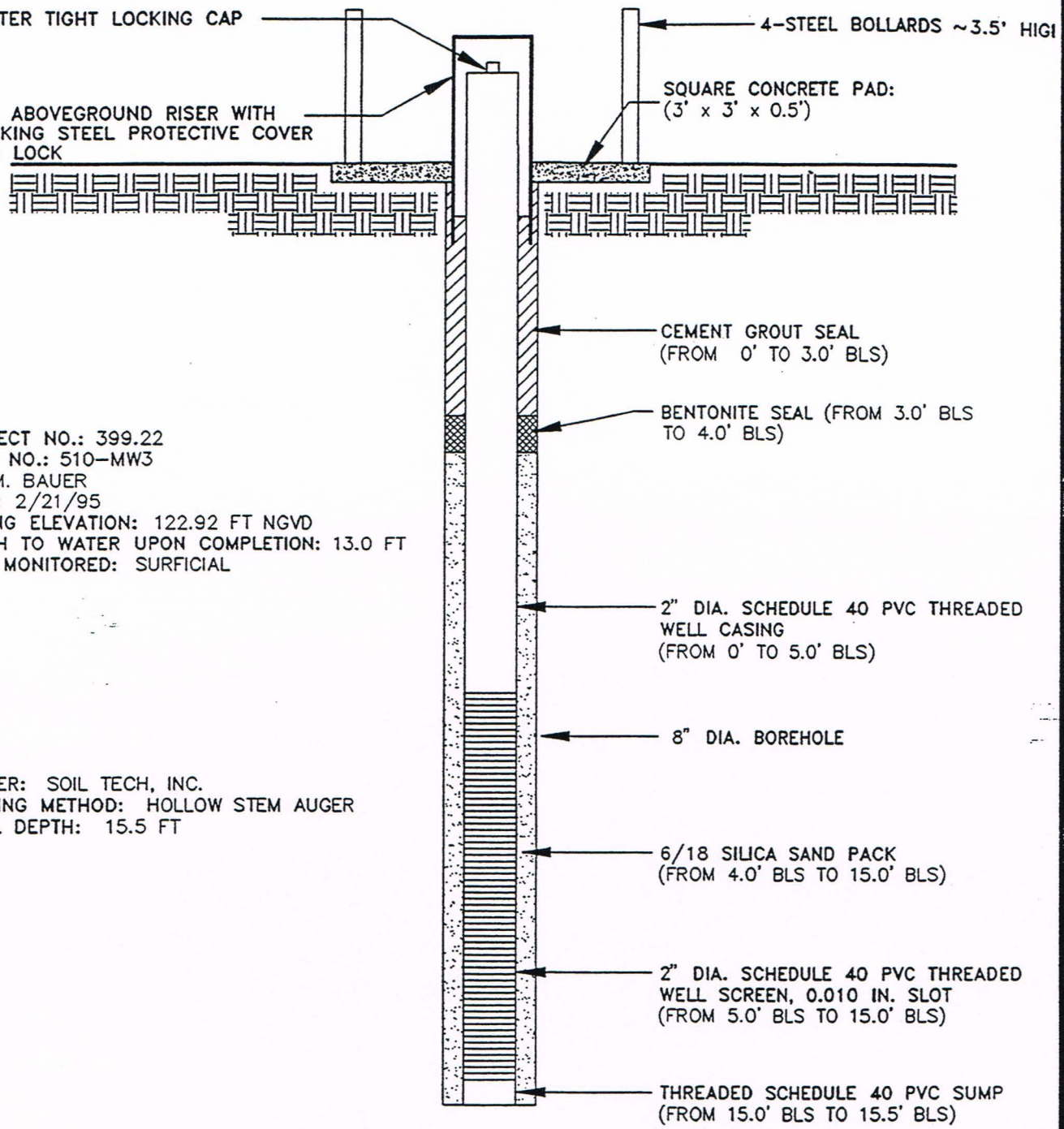
Remarks

PH - post hole

SPT - standard penetration test

NA - not applicable

# 510-MW3




PROJECT NO.: 399.22
WELL NO.: 510-MW3
BY: M. BAUER
DATE: 2/21/95
CASING ELEVATION: 122.92 FT NGVD
DEPTH TO WATER UPON COMPLETION: 13.0 FT
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 15.5 FT

(DRAWING NOT TO SCALE)

BLS = BELOW LAND SURFACE

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CEIBA, PUERTO RICO
SITE #510

**MONITORING WELL 510-MW3 CONSTRUCTION DETAILS**

FIGURE
--

EDIT: 21JUN95 27 JD
19JUN95 26 JR
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# SOIL BORING LOG

| | |
|---|---|
| Exploration for: Site Characterization | Location |
| Date: Feb. 20, 1995 | 510 |
| Boring No.: SB-12 | Water Table |
| Recorded By: M. Bauer | approx. 9.30 ft BLS |
| Drill Type: Hollow Stem Auger | |
| Weather: Sunny, breezy, 85° | |

| Sample No. | Type | Depth | | No. of Blows | Soil Description and Boring Log |
|---|---|---|---|---|---|
| | | From | To | | |
| SB-12 | PH | 0 | 2 | N/A | 10 YR 3/2 very dark grayish brown clay with pebble sized fill |
| SB-12 | PH | 2 | 4 | N/A | 2.5 YR 4/4 olive brown clay |
| SB-12 | SPT | 4 | 6 | 2, 2, 3, 5 | 2.5 YR 5/3 light olive brown clay with gravel sized rocks |
| SB-12 | SPT | 6 | 8 | 2, 3, 5, 7 | 2.5 YR 4/3 olive brown clay with pebble sized limerock |
| SB-12 | SPT | 8 | 10 | 3, 6, 9, 9 | 5 YR 7/3 pale yellow clay (moist) |
| SB-12 | SPT | 10 | 12 | 6, 7, 13, 20 | 7.5 YR 4/3 brown and 2.5 YR 4/6 dark red clay with limerock pebbles (moist) |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

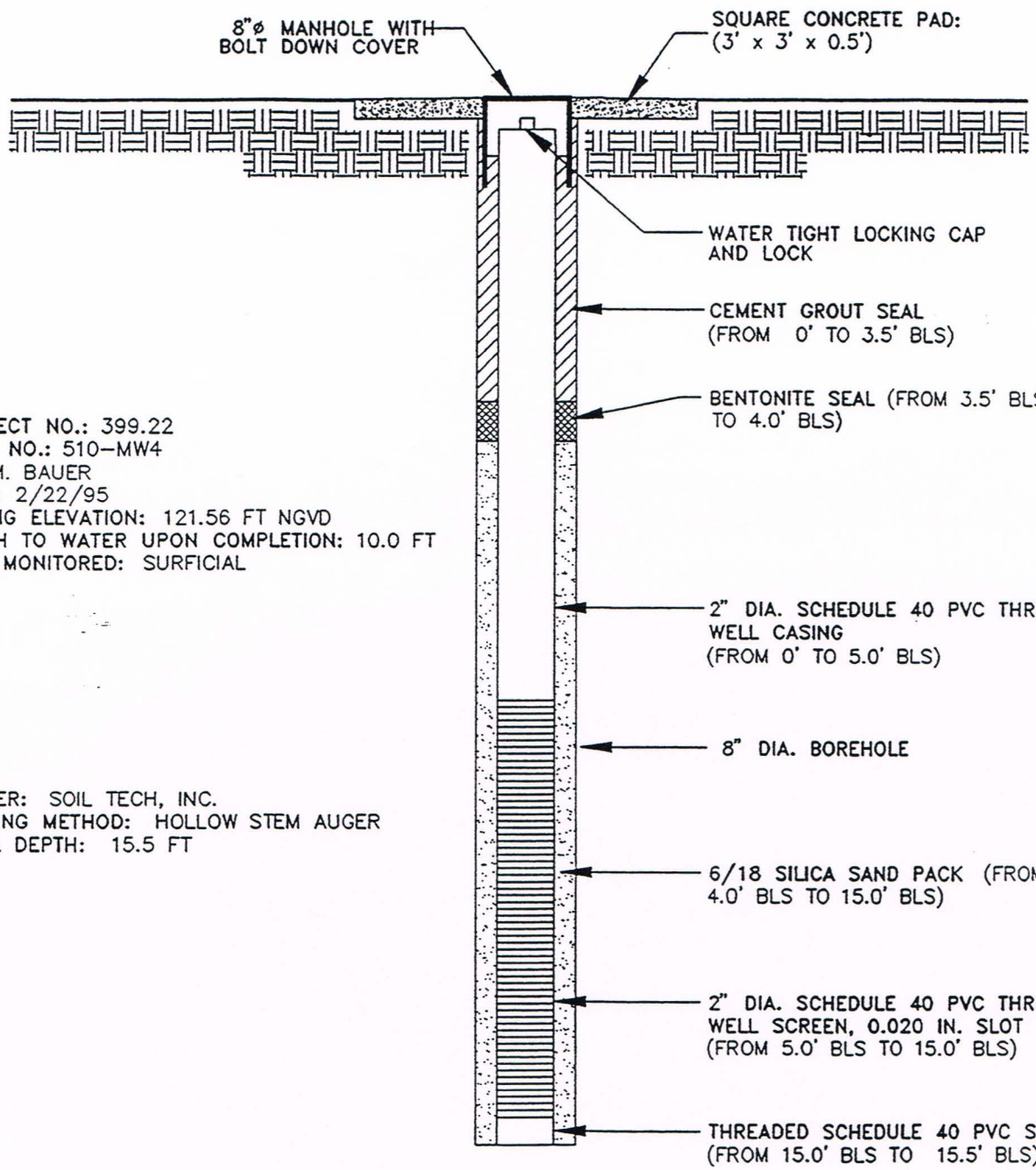
Remarks

PH - post hole

SPT - standard penetration test

NA - not applicable

# 510–MW4




PROJECT NO.: 399.22
WELL NO.: 510–MW4
BY: M. BAUER
DATE: 2/22/95
CASING ELEVATION: 121.56 FT NGVD
DEPTH TO WATER UPON COMPLETION: 10.0 FT
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 15.5 FT

(DRAWING NOT TO SCALE)

BLS = BELOW LAND SURFACE

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ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
SITE #510

**MONITORING WELL 510-MW4 CONSTRUCTION DETAILS**

FIGURE --

EDIT: 21JUN95 27 JD
19JUN95 26 JR
D:\39922\39922WL2.DWG

## SOIL BORING LOG

| | |
|---|---|
| Exploration for: Site Characterization | Location |
| Date: Feb. 15, 1995 | 510 |
| Boring No.: SB-4 | Water Table |
| Recorded By: M. Bauer | approx. 9.92 ft BLS |
| Drill Type: Hollow Stem Auger | |
| Weather: Ptly Cloudy, 80° Breezy | |

| Sample No. | Type | Depth | | No. of Blows | Soil Description and Boring Log |
|---|---|---|---|---|---|
| | | From | To | | |
| SB-4 | PH | 0 | 2 | N/A | 2.5/10 Y Greenish black clay |
| SB-4 | PH | 2 | 4 | N/A | 10 YR 3/1 dark gray clay with pebble sized fill |
| SB-4 | SPT | 4 | 6 | 3, 2, 4, 5 | 10 YR 3/6 dark yellowish brown clay with pebble sized fill |
| SB-4 | SPT | 6 | 8 | 2, 4, 9, 11 | 10 YR 4/4 dark yellowish brown clay with pebble sized pieces of carbon |
| SB-4 | SPT | 8 | 10 | 5, 10, 13, 22 | 10 YR 4/4 dark yellowish brown and 6/10 greenish gray clay |
| SB-4 | SPT | 10 | 12 | 4, 12, 19, 11 | 7.5 YR 4/4 brown clay (moist) |
| SB-4 | SPT | 12 | 14 | 5, 7, 9, 11 | 7.5 YR 7/1 light gray clay (moist) |
| SB-4 | SPT | 14 | 16 | 5, 7, 10, 13 | 2.5 YR 5/6 red clay (moist) |
| SB-4 | SPT | 16 | 18 | 5, 7, 11, 12 | 7.5 YR 7/1 light gray and 2.5 YR 5/6 red clay (moist) |
| SB-4 | SPT | 18 | 20 | NA | Drillers misunderstood instructions. Did not collect sample from 18-20 |
| SB-4 | SPT | 20 | 22 | 4, 7, 10, 12 | Same as above with 5 YR 5/8 mottled clay (moist) |
| SB-4 | SPT | 23 | 25 | 4, 5, 6, 8 | Same as above (moist) |

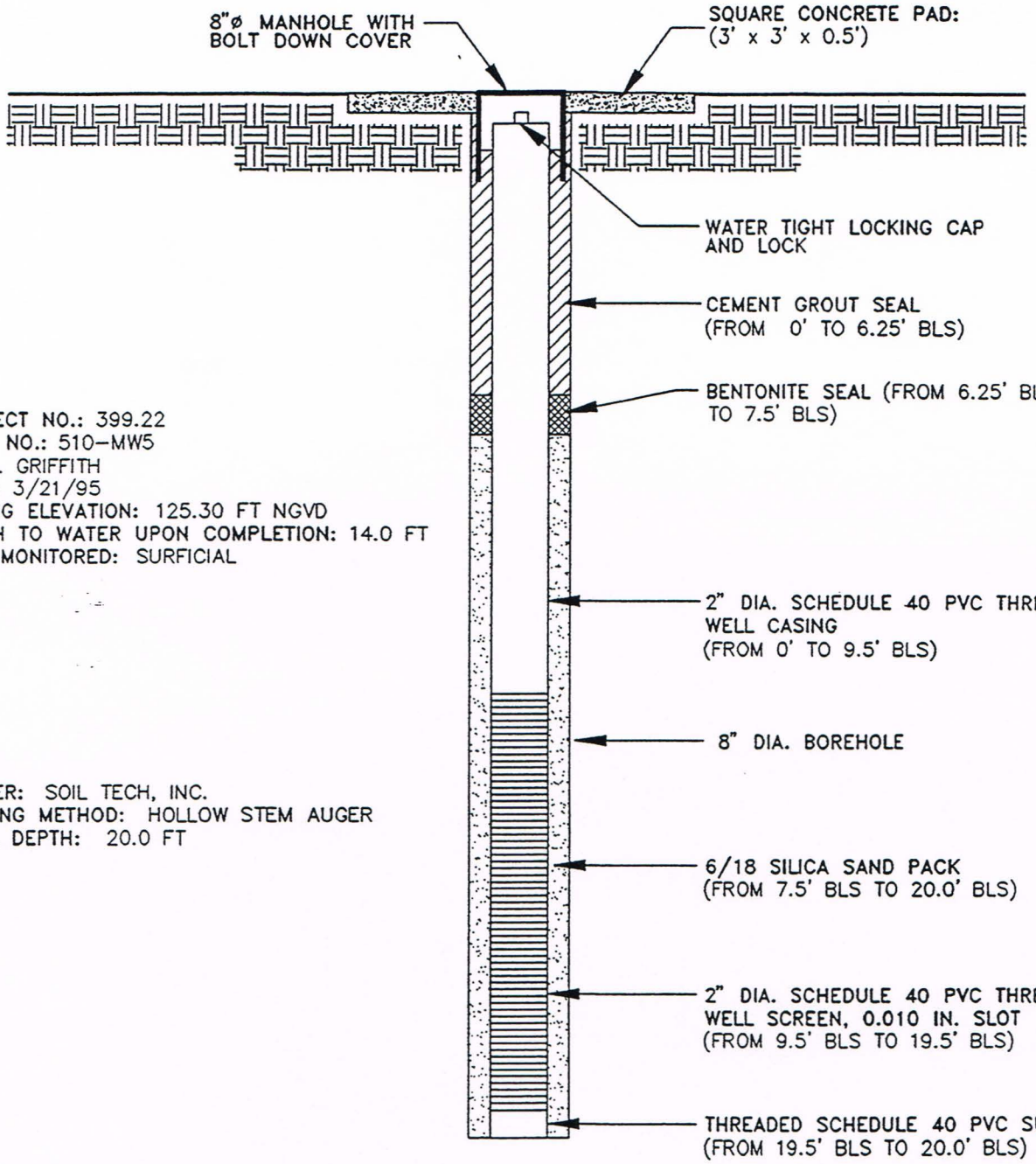
Remarks

PH - post hole

SPT - standard penetration test

NA - not applicable

# 510-MW5




PROJECT NO.: 399.22
WELL NO.: 510-MW5
BY: L. GRIFFITH
DATE: 3/21/95
CASING ELEVATION: 125.30 FT NGVD
DEPTH TO WATER UPON COMPLETION: 14.0 FT
UNIT MONITORED: SURFICIAL

DRILLER: SOIL TECH, INC.
DRILLING METHOD: HOLLOW STEM AUGER
TOTAL DEPTH: 20.0 FT

(DRAWING NOT TO SCALE)

BLS = BELOW LAND SURFACE

**BLASLAND, BOUCK & LEE, INC.**
*ENGINEERS & SCIENTISTS*

ROOSEVELT ROADS U.S. NAVAL STATION
CEIBA, PUERTO RICO
SITE #510

**MONITORING WELL 510-MW5 CONSTRUCTION DETAILS** | FIGURE --

EDIT: 21JUN95 27 JO
19JUN95 26 JR
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## SOIL BORING LOG

| | |
|---|---|
| Exploration for: Site Characterization | Location |
| Date: March 17, 1995 | 510 |
| Boring No.: SB-14 | |
| Recorded By: L. Griffith | Water Table |
| Drill Type: Hollow Stem Auger | approx. 14.0 BLS |
| Weather: Sunny, 80° | |

| Sample No. | Type | Depth | | No. of Blows | Soil Description and Boring Log |
|---|---|---|---|---|---|
| | | From | To | | |
| SB-14 | SPT | 0 | 2 | 24, 16, 17, 19 | 2.5 YR 5/4 light olive brown clay, top 6" of spoon, 2.5 YR 4/6 dark red clay, (see note A below) |
| SB-14 | SPT | 2 | 4 | 24, 24, 26, 27 | 7.5 YR 5/8 strong brown clay, trace fine gravel, moist, very stiff |
| SB-14 | SPT | 4 | 6 | 50 @ 4" | Same as above |
| SB-14 | SPT | 6 | 8 | 50 @ 4" | Same as above, trace coarse gravel |
| SB-14 | SPT | 8 | 10 | 21, 30, 50 @ 4" | 2.5 YR 5/4 light olive brown clay, slightly moist, stiff |
| SB-14 | SPT | 10 | 12 | 25, 33, 44, 45 | Same as above |
| SB-14 | SPT | 12 | 14 | 29, 38, 50 @ 6" | 5 YR 5/3 olive clay, trace fine gravel, slightly moist, very stiff |
| SB-14 | SPT | 14 | 16 | 41, 50 @ 3" | 5 YR 6/3 olive clay, trace fine to medium gravel, slightly moist |
| SB-14 | SPT | 16 | 18 | 50 @ 4" | 5 YR 5/3 olive clay, trace fine to medium gravel, slightly moist, stiff |
| SB-14 | SPT | 18 | 20 | 50 @ 4" | 2.5 YR 5/4 light olive brown clay, slightly moist |

Remarks

PH - post hole

SPT - standard penetration test

Note: A = trace fine to coarse gravel, slightly moist, very stiff, bottom 18" of spoon