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RCRA Facility Investigation Report for Phase I Investigations at Operable Units 1, 6, and 7 Naval Station Roosevelt Roads Ceiba, Puerto Rico

Text - Volume I of II

Prepared For:

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia

Under the

LANTDIV CLEAN Program

Comprehensive Long-Term
Environmental Action Navy

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1.0 INTRODUCTION

This RCRA Facility Investigation (RFI) Data Summary Report, for operable units (OU) 1, 6 and 7 at Naval Station Roosevelt Roads (NSRR), Puerto Rico, has been prepared by Baker Environmental, Inc. (Baker) for the Atlantic Division (LANTDIV), Naval Facilities Engineering Command. The project was performed under Contract Task Order (CTO) 0277 under the LANTDIV Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract Number N62470-89-D-4814.

The RFI was mandated for these units (and others) in the Corrective Action portion of the Facility's RCRA Permit effective November 28, 1994. Pursuant to these requirement, RFI project plans were submitted to the EPA and, in due course, approval of the plans was received. The investigations described in this report were conducted in accordance with these plans.

The RCRA Permit divided the entire list of SWMUs at the Activity into three groups:

! Those SWMUs where no release of hazardous waste or hazardous constituents was likely to have occurred;

! Those SWMUs where the wastes managed could have been released to the environment (based on pathways present, duration of storage, wastes managed, management techniques or a combination of factors); and

! Those SWMUs where releases were likely based on the factors discussed above.

No further work was required in the permit for the SWMUs with little release potential. Phase I RFIs were required for the second class of SWMUs where releases could have occurred. Full RFIs are required for the SWMUs where releases are likely.

The Navy grouped the various SWMUs into OUs based on the nature of the wastes managed, the waste management techniques, geographical location, and similarity of investigatory approach. This resulted in the creation of seven OUs. The OUs were then grouped to provide a staged approach to the RFI process. Criteria for grouping included: level of investigation required, expected severity of problem, and areal location.

This report addresses the SWMUs comprising OUs 1, 6 and 7. These are grouped together because they all fell into the second class of SWMUs, where releases could have occurred and a Phase I RFI is required. Phase I RFIs are generally limited in scope and are designed to identify whether release of hazardous waste or hazardous constituents has occurred. If no indication of a release is found, no further action at the SWMU is required. If evidence of a release is detected, additional investigations may be warranted up to and including a full RFI.

Following in the list of Solid Waste Management Units (SWMUs) and Areas of Concern (AOC) included in the Phase I RFI conducted by Baker in March 1996 in accordance with the Scope of Work and as outlined in the Final Project Plans (Baker, September 1995).

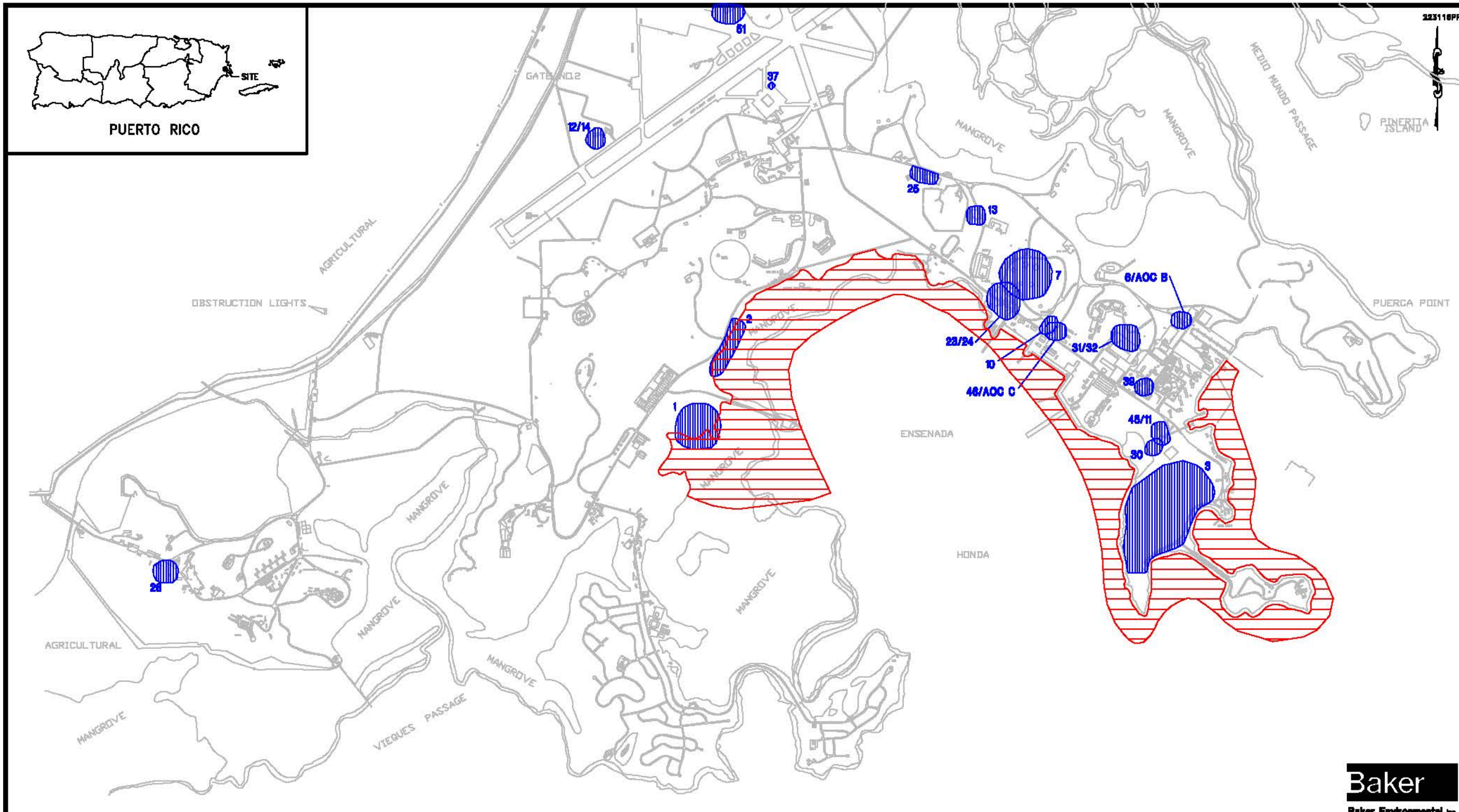
Operable Unit 1:	SWMU 6	-	Building 145 Storage Area
	SWMU 10	-	Substation 2/Building 90
	SWMU 12	-	Fire Training Pit Oil/Water Separator
	SWMU 13	-	Old Pest Control Shop/Building 258
	SWMU 14	-	Fire Training Pit Area
	SWMU 23	-	Old Spill Separator Tanks
	SWMU 24	-	Oil Spill Oil/Water Separator
	SWMU 25	-	DRMO Storage Yard
	SWMU 26	-	Building 544 Area
	SWMU 30	-	Former Incinerator
	SWMU 31	-	Waste Oil Collection Area/Buildings 31 and 2022
	SWMU 32	-	PWD Storage Yard/Battery Collection Area/Building 31
	SWMU 37	-	Waste Storage Area/Building 200
	SWMU 39	-	Former Battery Drain Area/Building 3158
	SWMU 46	-	Pole Storage Yard Covered Pad
	SWMU 51	-	New AIMD Storage Pad/Building 379
	AOC C (SWMU55)	-	Transformer Storage Pad
Operable Unit 6:	AOC B	-	Former site of Building 25

Operable Unit 7:	AOC D	-	Ensenada Honda Sediments located adjacent to SWMUs 1, 2, 3, 7, and 11/45

Figure 1-1 shows the location of each study area.

This report is organized into seven additional sections, including: Section 2.0 Environmental Setting; Section 3.0 Facility Background; and, Section 4.0 RCRA Facility Investigation Field Activities which presents the physical features of the various SWMUs and AOCs included during this study, as well as a brief discussion of the sampling effort. Section 5.0, Results of the RFI, provides analytical data as well as an evaluation of the results. The Environmental and Health Risk Assessment is included in Section 6.0. Sections 7.0 and 8.0 present Conclusions and Recommendations and References, respectively.

SECTION 1.0 FIGURES



LEGEND

1 SWMU AND/OR AOC WITHIN OU#1, OU#6 OR OU#7

AOC D – ENSENADA HONDA SEDIMENTS (OU#7)

SOURCE: LANTDIV, FEB. 1992

2500 0 1250 2500 5000

1 inch = 2500 ft.

FIGURE 1–1
SWMU/AOC LOCATION MAP
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

2.0 ENVIRONMENTAL SETTING

The environmental setting of NSRR was documented in the 1984 IAS (NEESA Document 13-051). This information is summarized below.

2.1 Climatology

The climate of the Roosevelt Roads area is characterized as warm and humid, with frequent showers occurring throughout the year. A major factor affecting the weather is the pattern of trade winds associated with the Bermuda High, the center of which is in the vicinity of 30E North, 30E West. The prevailing wind direction reflects the easterly trade winds. The area receives a surface flow varying between the northeast and southeast about 75 percent of the year, and as much as 95 percent of the time in July when the easterly winds are strongest. The differential heating of the land and sea during the day tends to give a more northerly component to the flow on the northern side of the island and a more southerly component on the southern side. During the night, a land breeze causes a prevailing southeasterly flow in the north and a prevailing northeasterly flow over the southern coast. The mean annual wind velocity is 5.5 knots, with a minimum in November and a maximum in August. Gales associated with westward moving disturbances in the trade winds or hurricanes passing either north or south of the area have the highest probability of occurrence from June through October.

Uniform temperatures prevail, with small diurnal ranges as a result of insular exposure and the relatively small land areas. The warmest months are August and September, while the coolest are January and February. Mean annual maximum temperatures range from 82.0E in January to 88.2EF in August. The mean annual minimum temperatures vary from 64.0E in January to 73.2E in June. The highest maximum temperature recorded was 95EF, while the lowest minimum was 59EF. Rain usually occurs at least nine days in every month, with an average of 60 inches per year. A dry winter season occurs from December through April. About 22 thunderstorm-days occur per year, with maximum frequencies of three days per month from May through October.

In late summer, the mean sky cover begins a steady decrease from a monthly maximum average of 6.5-tenths coverage in September to a minimum monthly average of 4.4-tenths coverage in February. From March through August, the monthly average clouds over increases steadily from 4.5- to

6.0-tenths coverage during the period. Over the open sea, a maximum of clouds (usually broken stratocumulus) occurs during early morning, with the skies clearing or becoming scattered with cumulus by afternoon. Completely clear or overcast skies are rare during daylight hours, while clear skies frequently occur at night.

The hurricane season is from mid-June through mid-September; maximum winds exceed 95 knots during severe hurricanes. An average of two tropical storms per year occur in the study area, one of which usually reaches hurricane intensity.

2.2 Topography

The regional area of Roosevelt Roads consists of an interrupted, narrow coastal plain with small valleys extending from the Sierra de Luquillo range, which has been severely eroded by streams into valleys several hundreds of feet deep. Slopes of up to 60E are common.

In the immediate area of the station, elevations range from sea level to approximately 295 feet. Immediately to the north of the NSRR boundary, the hills rise abruptly to heights of 800 to 1,050 feet above sea level, with the tallest peak located within two kilometers of the station boundary. There is a series of three hilly areas on the station, two of which separate the southern airfield area from the Port/Industrial, Housing and Personnel Support areas. The third set of hills is in the Bundy area. These ridge lines not only separate sections of the station, but dictate the degree of allowable development. The ridge line south of the airfield provides an excellent barrier which effectively decreases the aircraft-generated noise which reaches the Unaccompanied Enlisted Personnel Housing areas to an acceptable level. Relief is low along the shoreline. Lagoons and mangrove swamps are common.

2.3 Geology

The underlying geology of the station area is predominantly volcanic (composed of lava and tuff), as well as sedimentary (rocks derived from discontinuous beds of limestone). These rocks all range in age from early Cretaceous to middle Eocene. The volcanic rocks and interbedded limestones have been complexly faulted, folded, metamorphosed and variously intruded by dioritic rocks. This complex geological structuring occurred sometime after the deposition of the limestone during the middle Tertiary, when Puerto Rico was separated from the other major Antillean Islands by block faulting, and was arched, uplifted and tilted to the northeast. Culebra, Vieques, and the Virgin Islands are part of the Puerto Rican block; they are separated from the main island simply because of the drowning that resulted from the tilting.

In addition to the predominant volcanic and sedimentary rock, the northwestern and western sectors of the base are underlain by unconsolidated alluvial and older deposits from the Quaternary period.

The primary geologic formations on and near NSRR are various beach deposits, alluvium, quartz diorite and granodiorite, quartz keratophyre, the Daguao Formation, and the Figuera Lava. The station is traversed by the Peña Pobre fault zone.

2.4 Soils

Soil associations found at the station are predominantly of two types typical of humid areas; the Swamps-Marshes Association and the Mabi-Rio-Arriba-Cayagua Association, as well as the Descalabrado-Guayama Association, which is typical of dry areas. In addition, isolated areas of the Caguabo-Mucara-Naranjito Association, the Coloso-Toa-Bajura Association, and the Jacana-Amelia-Fraternidad Association are found at the station.

The Swamps-Marshes and Mabi-Rio-Arriba-Cayagua associations cover over one half of the station's surface area and are equally distributed. The remaining area is covered primarily by the Descalabrado-Guayama and Caguabo-Mucara-Naranjito associations.

The Swamps-Marshes Association consists of deep, very poorly drained soils. This association is found in level or nearly level areas that are slightly above sea level but are wet, and when the tide is high, are covered or affected by saltwater or brackish water. The soils are sandy or clayey, and contain organic materials from decaying mangrove trees and are underlain by coral, shells and marl at varying depths. The high concentration of salt inhibits the growth of all vegetation except mangrove trees, and in small scattered patches, other salt-tolerant plants.

The Mabi-Rio-Arriba-Cayagua Association are typically deep, somewhat poorly drained and moderately well-drained, nearly level to moderately steep soils found on foot and side slopes, terraces and alluvial fans. Soils of this association are basically clayey at the station.

The Descalabrado-Guayama Association are shallow, well-drained, strongly sloping to very steep soils on volcanic uplands. Soils of this association are found primarily in the hilly areas located directly inland and adjacent to the soils of the Swamps-Marshes Association.

The Caguabo-Mucara-Naranjito Association consists of shallow and moderately deep, well-drained, sloping to very steep soils on volcanic uplands. This association consists of soils which formed in residual material that are weathered from volcanic rocks. This association is represented at the station by soils of the Sabana series, which are found on the side slopes and the hilly terrain west of Langley Drive in the Fort Bundy area. These soils are suited for pasture and woodland. Steep slopes, susceptibility to erosion and depth to bedrock are the main limitations for farming, recreation, and urban areas.

The Coloso-Toa-Bajura Association is deep, moderately well drained to poorly drained, nearly level soils found on floodplains. This soil association extends along the western boundary of the station and around the airfield. The soils of this association formed in fine-textured and moderately fine-textured sediment of mixed origin on floodplains. The Coloso soils are deep and somewhat poorly drained; the Toa soils are deep and moderately well drained; and the Bajura soils and Maunabo soils are deep and poorly drained. The Reilly soils, also part of this association, are shallow sand and gravel, are excessively drained, and are found adjacent to streams. The minor soils are Talante, Vivi, Fortuna, Vega Alta and Vega Baja. The Talante, Vivi, Fortuna and Vega Baja soils are found on floodplains, while the Vega Alta soils occupy slightly higher positions on terraces.

The Jacana-Amelia-Fraternidad Association consists generally of moderately deep and deep, well-drained and moderately well-drained, nearly level to strongly sloping soils on terraces, alluvial fans and foot slopes. This association is represented at the station by soils of the Jacana series, which are moderately deep, well-drained soils found on the foot slopes and low rolling hills along Langley Drive and just east of the airfield. These soils were formed in fine-textured sediment and residuum derived from basic volcanic rocks.

2.5 Hydrology

The surface waters that flow across the northeastern plain of Puerto Rico, where the Station is located, originate on the eastern slopes of the Sierra de Luquillo mountains. Surface runoff is channeled into various rivers and streams which eventually flow into the Caribbean Sea. The Daguao River and Quebrada Seca Stream (a tributary to Rio Daguao) collect surface waters from the hills immediately north of the station, and in periods of heavy rain, on-station flooding occurs. The Daguao-Quebrada Seca watershed comprises an area of approximately 7.6 square miles (4,900 acres), and the river falls some 700 feet from its source to sea level. Increased development in the Town of Ceiba, especially in areas adjacent to the station’s northern boundary, has significantly increased the surface runoff reaching the station, which caused ponding and erosion in the Boxer Drive area. Boxer Drive, for a major portion of its length, was subject to surface water flooding, as are Hangar 200 and AIMD Hangar 379 and adjacent apron areas. Recently, the Station's boundary fence was moved closer to Boxer Road to allow for highway construction outside the fence. Included in this project was extensive drainage control works in the area which are expected to significantly reduce the potential for flooding on the Base.

The quality of surface waters is variable, reflecting the drainage area through which the water flows. Generally, surface waters have high turbidities and bio-organics (naturally occurring organics, such as decay products of vegetable and animal matter) due to the periodic heavy rains which can easily erode soils from steep slopes, exposed areas and disturbed stream beds.

In the low-lying shore areas, seawater flooding results from storms, wind and abnormally high tides. The tidal ranges in the Roosevelt Roads area are rather small, with a maximum spring range of less than three feet. The tides are semidiurnal and have a usual range of about one foot in the main harbor of the station.

Little information exists concerning the geohydrology of NSRR. The only known potential sources of groundwater lie in lenticular beds of clay, sand and gravel, and rock fragments which occur at a depth of less than 30 meters. No wells have been developed on-base from these layers since all water for Base use is piped in from the mountains. Some wells had been developed upgradient of the station in Ceiba, some three kilometers from base headquarters, but were abandoned due to high levels of salinity.

Water from alluvial aquifers along the coast of the station is of a calcium bicarbonate type, and has high concentrations of iron and manganese. The source of these minerals is unknown, but they may be derived from buried swamp or lagoon deposits. A seawater-freshwater interface is present in the aquifers throughout the coastal areas of Puerto Rico, usually within a short distance inland of the coastline.

The station water treatment plant receives raw water from the Rio Blanco through a 27 inch reinforced concrete pipe that replaced the old, open channel. This buried raw water line traverses a distance of 14 miles from the intake to the station boundary. The intake is located at the foot of the El Yunque rain forest. A raw water reservoir is located at the water treatment plant and has a 45-million gallon capacity. Additionally, there are two fire protection storage reservoirs with a total capacity of 520,000 gallons.

The base has been served for over 30 years by the present treatment facility (Building 88) which has a capacity of 4.0 million gallons per day (mgd). Water flows by gravity into a 45 million gallon raw water storage basin from which the plant draws its supply at a rate of 1.3 mgd on average. Treatment consists of pre-chlorination, coagulation sedimentation, filtration and post-chlorination. The single potable water supply system provides water to all industrial operations at the facility. The water supply is low in hardness, and, therefore, is an excellent source for industrial uses, particularly in boiler operation and maintenance.

Three hundred acres are used for pasture near Gate 1, and are irrigated as needed. Extensive sprinkling of lawns and green areas is evident throughout the base.

3.0 FACILITY BACKGROUND

This section contains a description of the facility location, historical background information, and a summary of previous investigations conducted at NSRR.

3.1 Facility Description

NSRR occupies over 33,500 acres on the northern side of the east coast of Puerto Rico, along Vieques Passage. Vieques Island, where NSRR also has administrative and command responsibilities, is located to the east about 10 miles from the harbor entrance. The north entrance to the mainland facility is about 35 miles east along the coast road (Route 3) from San Juan. The nearest large town, Fajardo (population: about 37,000), is situated about 10 miles north of NSRR. Ceiba (population: approximately 17,000), is located just west of NSRR.

NSRR was commissioned in 1943 as a Naval Operations Base, and finally redesignated a naval station in 1957. The primary mission of NSRR today is provision of full support for Atlantic Fleet weapons training and development activities.

Prior to 1993, environmental activities at NSRR, exclusive of underground storage tanks (USTs), were conducted in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations under the Department of the Navy's (DoN's) Installation Restoration (IR) Program.

On October 20, 1994, a Final RCRA Part B Permit was issued by USEPA Region II to the Defense Reutilization and Marketing Office (DRMO), Naval Station Roosevelt Roads. This permit contains requirements for RFI activities at 24 SWMUs and three AOCs (see Figure 1-1).

3.2 Summary of Previous Investigations

A number of environmental investigations have been conducted at NSRR, including:

- Initial Assessment Study - 1983/84
- Confirmation Study - 1986

- RCRA Facility Assessment (RFA) - 1988
- RI/FS at Site 15 (SWMU 10) - 1992
- Supplemental Investigation - 1993
- Summary and Technical Evaluation Review (RFA Reinspection) - 1993

Results of these investigations have identified areas where releases to the environment were possible, provided information regarding the nature and extent of contamination at selected SWMUs/AOCs and provided information used to establish the need for the RFI. The previous investigations are discussed in the sections which follow.

3.2.1 Initial Assessment Study

As part of a Navy-wide program to manage past disposal sites through the Navy Assessment and Control of Installation Pollutants (NACIP) initiated in September 1980, NSRR was designated for an Initial Assessment Study (IAS) in March 1982. The IAS was conducted in 1983 and 1984 by Greenleaf/Telesca Planners, Architects and by Ecology and Environment, respectively, and consisted of: a records search at various government agencies, national and regional archives, and the United States Geological Survey; on-site reconnaissance; and, interviews with facility personnel. The study identified 16 sites that warranted further investigation under the NACIP Program.

3.2.2 Confirmation Study

In May 1986, the Confirmation Study (CS) was performed by Environmental Science and Engineering, Inc. (ESE). Fifteen (15) of the 16 potentially contaminated sites identified in the IAS were investigated; one site had been cleaned up prior to this study. Two rounds of samples were collected during the CS. The report, completed in April 1988, indicated that 14 of 15 sites required additional investigation under the NACIP Program.

3.2.3 RCRA Facility Assessment

In 1988, a RCRA Facility Assessment (RFA) was conducted by A.T. Kearney, Inc. for the USEPA to identify SWMUs and AOCs and assess the potential for release of hazardous wastes and/or hazardous constituents to the environment from these units. Information obtained during the RFA was based upon a preliminary review of available existing information, as well as a Visual Site Inspection (VSI) of the facility.

SWMUs and AOCs identified in this study were assessed in terms of the waste managed, duration of use, potential pathways and waste management practices. Further actions were recommended for 25 of the 47 SWMUs and 4 AOCs identified during the RFA. These actions included investigations to: 1) determine soil, groundwater, surface water and sediment conditions; and, 2) determine/verify individual unit integrity. Suggestions for better facility management were also provided to NSRR.

3.2.4 Remedial Investigation/Feasibility Study at Site 15 (SWMU 10)

A Remedial Investigation/Feasibility Study (RI/FS) was conducted at Installation Restoration Program (IRP) Site 15 (SWMU 10) by Versar, Inc. (Versar) in 1992 to develop remedial alternatives for soil known to be PCB-contaminated. The RI/FS was performed according to criteria outlined in the National Contingency Plan (NCP) and guidelines stipulated by USEPA in RI/FS guidance documents. Based on the results of this RI/FS, a removal action was undertaken (in accordance with approved work plans) and was completed in 1995.

3.2.5 Supplemental Investigation

Baker completed a Supplemental Investigation (SI) of selected IRP sites in 1993, including:

- IR Site 5 - Army Cremator Disposal Site (SWMU 1)
- IR Site 6 - Langley Drive Disposal Area (SWMU 2)
- IR Site 7 - Station Landfill (SWMU 3)
- IR Site 10 - Building 25 Storage Area (SWMUs 31 and 32, AOC B)
- IR Site 13 - Tanks 210-217 (SWMU 9)
- IR Site 14 - Ensenada Honda Shoreline and Mangroves (now included in AOC D)
- IR Site 16 - Old Power Plant/Building 38 (SWMUs 11 and 45)
- IR Site 18 - Old Pest Control Shop/Building 258 (SWMU 13)

[Note: IRP sites do not necessarily correspond to individual SWMUs. IRP sites were often general areas in which later work would identify specific waste management units]

Activities associated with the Supplemental Investigation included: photo-interpretation and map analysis; geophysical investigation; wellhead tests; soil sampling and analysis; groundwater sampling and analysis; surface water/sediment sampling and analysis; and a quantitative risk assessment.

Environmental samples were obtained and analyzed for Target Compound List (TCL) of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), Target Analyte List (TAL) inorganic compounds, and cyanide.

3.2.6 RFA Reinspection

In 1993, TRC Environmental Corporation (TRC) prepared a report for the USEPA which summarized work performed at SWMUs/AOCs and assessed the investigations and/or remedial work completed at 51 SWMUs and AOCs. This effort, referred to as the "RFA Reinspection", included: 1) a review of all available technical documents generated since the original RFA; 2) a review of the corrective measures conducted at the facility; and, 3) a site visit. It was the intent of this document to provide the final "snapshot" of waste management activities (both past and present) prior to issuance of the Final RCRA Permit.

3.2.7 Site Characterization and Evaluation

In the fall of 1995, Baker conducted an expedited site characterization and evaluation of IR Sites 11 and 17 at the Station. Site 11 incorporates SWMU 6 and AOC B where soil and groundwater were investigated. Site 17 consists of SWMUs 12 and 14 where surface soil samples were obtained. A Final Site Characterization and Evaluation Report was submitted in October 1995.

3.3 <u>Operable Units 1 and 6 Site Descriptions</u>

A total of 17 SWMUs, presented on Table 2-1, comprise Operable Unit 1 (OU 1). OU No. 6 includes AOC B, the former location of Building 25. Unless otherwise noted in the following sections, a first-phase RFI was recommended for the majority of these SWMUs to characterize soil, groundwater, surface water, and/or sediment quality as appropriate and as dictated in the Final RCRA Permit. It should be noted that the intent of the investigations was to provide a reasonable indication of whether there were past or present releases associated with the various sites. Additional characterization and definition of the nature and extent of contamination will follow for those sites indicating a release that poses a significant risk to human health or the environment. Figures 3-1 to 3-13 present current site conditions as found at each area of study.

3.3.1 SWMU 6 - Building 145 Storage Area/AOC B - Building 25

This SWMU, also investigated as part of the Site Characterization and Evaluation (Baker, October 1995), is located adjacent to AOC B (OU 6) on the northeast section of Ensenada Honda (see Figure 3-1). Building 145 is a bunker, approximately 60 yards long, 7 feet high, and 8 feet wide with three openings to the surface through the roof. Drums and other containers had been stored in this building since about 1957 as reported in the IAS. The 1993 reinspection found the building to be empty with only some standing water in the lowest point.

The 1984 IAS reported that the majority of the material (approximately 2,000 gallons of paint, boot polish and adhesives) stored at the site could be classified as "hazardous". Both the RFA and RFA Reinspection reports indicated that the building was empty and that there was no evidence of a release to the environment. This SWMU was recommended for a first-phase RFI to determine soil quality. In addition, a full RFI was recommended to address soil and groundwater quality at Building 25 (AOC B) located adjacent to SWMU 6. Figure 3-1 presents current site conditions at SWMU 6/AOC B.

3.3.2 SWMU 10 - Substation 2/Building 90

SWMU 10 is located near the intersection of Forrestal Drive and Valley Forge Road. The site is relatively flat and surrounded by shallow drainage ditches associated with the roadways. This area formerly was used to repair electrical transformers and reportedly, past activities at this site included PCB-containing transformer oils being poured on the ground.

This SWMU was remediated by removing approximately one foot of PCB-contaminated soil/sediment (about 235 cubic yards) from across the site with much deeper excavations near the building where the actual maintenance transformer draining work was done. The results of the corrective action were provided to the EPA by OHM Remediation Services in May, 1995. The corrective measure only addressed soils. Since the possibility of downward migration of PCBs to groundwater exists, a Phase I RFI for groundwater was mandated in the Final RCRA Permit. Figure 3-2 shows current site conditions at this location.

3.3.3 SWMU 12 - Fire Training Pit Oil/Water Separator

SWMUs 12 and 14 are located north of the base airfield. The fire training pit oil/water separator (SWMU 12) is an inground concrete tank measuring approximately 7 feet wide x 30 feet long x 10 feet deep covered by a heavy grating. Waste oils are burned at the fire training pit (SWMU 14) during training exercises; the excess oil and fire fighting water is collected in the oil/water separator. Water from the oil/water separator is pumped to the sewer and oils are pumped back into the pit to be reused.

An area of dead grass adjacent to the separator and oil stains on the curbing and guardrail uprights were noted during the Visual Site Inspection conducted as part of the RFA in 1988. No evidence of releases was observed during the RFA Reinspection conducted in 1993. Figure 3-3 presents current site conditions at SWMU 12.

3.3.4 SWMU 13 - Old Pest Control Shop/Building 258

SWMU 13 is located adjacent to Forrestal Drive and includes an area in the vicinity of former Building 258, a small concrete pad directly adjacent to the building and a large concrete parking apron located just north of the building. Tall grass covers the southern half of the site while the northern half is covered with asphalt. Two large areas within the southern portion of the site were devoid of vegetation during the 1998 VSI and appeared as shallow depressions. These areas were found to be fully vegetated during the 1993 reinspection. A drainage swale located east of SWMU 13 was grass covered along its entire length.

The Pest Control Shop operated at Building 258 from the late 1950s through 1983. Pesticides were stored in Building 258 and also on the parking apron. In 1976, a 55-gallon drum of malathion, stored outside the building, ruptured. The spilled contents eventually washed into the drainage ditch located near the building. This ditch also regularly received rinse waters from the cleaning of pesticide application equipment over a storm drain which discharged to the ditch. Reportedly, excess pesticides also were poured into this ditch.

Past environmental studies of the ditch cited numerous aquatic kills due to pesticide releases. Pesticides typically used in the past include DDT, Paris Green, maldane, malathion, and chlordane. There is no available information regarding the volume or concentrations of pesticides used at this location.

During the CS conducted in 1988, two rounds of verification samples were obtained in which a total of 15 soil samples, eight surface water and sediment samples, and three shallow groundwater samples were collected and analyzed for pesticides. The quality of some data obtained during this investigation is questionable as a result of laboratory error and; therefore, no conclusions regarding conditions at the site can be drawn on the basis of this information. However, the presence of pesticides in sediment and surface soil was confirmed.

The building was used by the Diving Club as a pump room in 1988 and reportedly was decontaminated by washing the interior walls and floor with bleach before being sealed with a vinyl coating and tiled. Since the 1988 RFA, the building has been demolished. No visible signs of releases were identified in the RFA Reinspection conducted in 1993. Figure 3-4 presents current site conditions at SWMU 13.

3.3.5 SWMU 14 - Fire Training Pit Area

This SWMU is located near the Fire Training Pit Oil/Water Separator (SWMU 12) described in Section 2.3.3. This area (approximately 40 feet in diameter) was operated by the Air Operations Department from the early 1960s through 1983. An estimated 120,000 gallons of waste solvents, fuels, oils were burned during fire training exercises. Additional items burned in this area included wood, trash, plastic, fuel filter elements, oily rags and other debris.

The fires were extinguished using aqueous film-forming foam (AFFF) and potassium bicarbonate (Purple K). Aerial photographs indicate drainage from the pit to the ditch located along the adjacent runway shoulder. A new fire training pit was built at the same location as the old pit in 1983; operations continue in this pit.

The new pit is a concrete structure, constructed below grade, with a concrete apron. A drainage system encircling the apron intercepts any overtopping which is directed to an oil/water separator.

3.3.6 SWMU 23 - Oil Spill Separator Tanks

Three oil spill separator tanks, located approximately 100 feet inshore from the fuel pier, process waste pumped from the Ships Waste Off-Load Barges (SWOBs). The oil/water separator tanks are large steel boxes underlain by a concrete pad with an 8-inch curb. Each box is fitted with a pipe that extends out laterally from the bottom. After water separates to the bottom of the tank, a valve on the pipe is opened, and the contents are allowed to spill out until all the water has been removed. The separated oil subsequently is transferred to the Oil Spill Oil/Water Separator (SWMU 24). The VSI team observed black staining on the concrete pad, curbing, and areas of asphalt around SWMU 23 in 1988 and during the 1993 RFA reinspection. Figure 3-5 presents current site conditions at SWMU 23.

3.3.7 SWMU 24 - Oil Spill Oil/Water Separator

Located almost due west of SWMU 23, SWMU 24 is a concrete structure built below ground and has steel grating covering the top at ground level (Figure 2-3). The oil/water separator has approximately a 1,500 gallon capacity and receives discharge from SWMU 23. After separation, the waste oil is removed by the Defense Reutilization and Marketing Office (DRMO). Minor staining around the edge of the separator was observed during the 1993 RFA reinspection. Figure 3-5 also presents current site conditions at SWMU 24.

3.3.8 SWMU 25 - DRMO Storage Yard

The DRMO facility consists of an administrative/hazardous waste storage building, a large metal building used for waste storage, a flammable material storage building, some storage racks and a large fenced area where surplus material is stored. It is the DRMO facility for which the original Part B RCRA Permit application was filed. The SWMU associated with the DRMO is an area within the large fence, adjacent to the flammable materials storage building (Building 2009), containing storage racks. During the 1993 reinspection (TRC), the racks were found to contain some drums of non-hazardous solid waste. Based on this finding, the possibility of storage of other materials in the racks before permit issuance and evidence of staining seen in the original VSI, a Phase I RFI was mandated in the RCRA Final permit. Figure 3-6 shows current site conditions at SWMU 25.

3.3.9 SWMU 26 - Building 544 Area

This SWMU, located in the Bundy area was comprised of approximately twenty-five 30-gallon drums, some of which had polyethylene liners. A 1988 RFA inspection indicated that these drums were located behind Building 544 and surrounded by thick brush. Some of these drums were observed to contain what appeared to be engine lubricating oil. In 1990, Building 544 was demolished and the drums were removed. Soil from the drum storage area was bulldozed approximately 20 feet and stockpiled. Figure 3-7 presents current site conditions at SWMU 26.

3.3.10 SWMU 30 - Former Incinerator

This SWMU is located south of SWMU 11 (Old Power Plant) and includes an incinerator formerly used to burn flammable wastes and an associated UST. The UST was removed under the UST regulations; some residual groundwater contamination is present which is also being addressed in accordance with UST regulations. A disturbed area was noted along the perimeter fence southwest of the incinerator. Figure 3-8 presents current site conditions at SWMU 30.

3.3.11 SWMU 31 - Waste Oil Collection Area/Building 31 and 2022

Building 31 and the yard located north of the building are used by the Transportation Shop to service Public Works Department (PWD) vehicles. A concrete pad, used for the temporary storage of 55-gallon waste oil drums, is located approximately 30 yards from the Transportation shop warehouse. The pad also contains a 5,000-gallon tank into which waste oils are placed for later recycling. A six-inch concrete curb surrounds the pad which measures approximately 13 feet by 20 feet. A steel drainage pipe with a valve is set into the curbing.

During the Supplemental Investigation, a total of eight soil samples were collected. A risk assessment conducted on the data indicated that there was no threat to human health or the environment from this site. Figure 3-9 presents current site conditions at SWMU 31.

3.3.12 SWMU 32 - PWD Storage Yard/Battery Collection Area/Building 31

This SWMU is located northeast of the Transportation Shop warehouse (Building 31) within the Public Works operation yard. The SWMU consisted of a number of batteries stored on the bed of a truck and on a pallet. The 1988 VSI team noted that several dozen batteries were in various stages of decay, but that none were corroded to the point of leakage. Currently, the area is used for the storage of heavy equipment including rescue vehicles, front end loaders, and bulldozers. No batteries are now stored in the area.

3.3.13 SWMU 37 - Waste Oil Storage Area/Building 200

Located north of Building 200, this unit consists of drums stored on pallets situated on a covered concrete pad with secondary containment curbs. The VSI Team reported that these drums contain waste fuel and lubricating oil from Aircraft Intermediate Maintenance Department (AIMD) operations. The storage area is located on the edge of the concrete tarmac surrounding Building 200.

During the 1993 RFA reinspection, the area was found to be well managed. A minor area of stressed vegetation was observed at the rear of the unit. Freshly exposed soil from the area yielded measurable organic vapors (TRC). Figure 3-10 presents current site conditions at SWMU 37.

3.3.14 SWMU 39 - Former Battery Drain Area/Building 3158

This unit consisted of a covered battery drainage area. An adjacent building (3158) stored waste batteries and battery acid that were generated by Naval Mobile Construction Battalion (NMCB or “SEABEEs”) operations. A metal battery drain tank was underlain by a curbed concrete pad. Battery contents were poured into the drain tank and the battery acid was caught below in a container. SWMU 39, no longer used for battery storage, is paved with asphalt on the north side and is grass covered on the remaining three sides.

During a site visit in March 1992, the Navy observed no visible signs of release to the soils. The area is no longer used for battery storage according to the 1993 RFA reinspection. The original pad could not be located (TRC). Figure 3-11 presents current site conditions at SWMU 39.

3.3.15 SWMU 46 - Pole Storage Yard Covered Pad

Based on a 1988 RFA report, this unit was cited in the Naval Assessment and Control of Installation Pollutants (NACIP) report as a Public Works Department hazardous waste storage area that had been used to store transformers and 55-gallon drums of PCB-contaminated material. The unit is a fenced area containing a covered concrete pad. The 1988 VSI team observed that this unit was used for the storage of various products including insulators, telephone poles, small cardboard boxes of electrical equipment, and several full 5-gallon pails. No evidence of release was observed by the VSI team. The 1993 RFA reinspection noted the pad was clean with only some wire present.

During the RFI 55-gallon drums were observed to be stored on the covered pad and is apparently being used by the Base operations contractor as the under 90 day waste accumulation area. The pad is surrounded by a grassy area. Figure 3-12 presents current site conditions at SWMU 46.

3.3.16 SWMU 51 - New AIMD Storage Pad/Building 379

SWMU 51 consists of a curbed concrete storage pad located adjacent to Building 379 (Figure 3-12). The storage pad is covered, enclosed with a cyclone fence, and surrounded by asphalt. This SWMU is utilized by the AIMD facilities. Also present at this SWMU is a 200-gallon tank which touches the storage pad, but is outside the curbed area. Oil stains were observed emanating from two drain valves in the curb surrounding this pad, and from the 200-gallon tank located outside the pad curb (TRC). Surface drainage at the site is to the north and west toward the earthen drainage swale. Figure 3-13 presents current site conditions at SWMU 51.

3.3.17 SWMU 55 - Area of Concern (AOC) C - Transformer Storage Pad

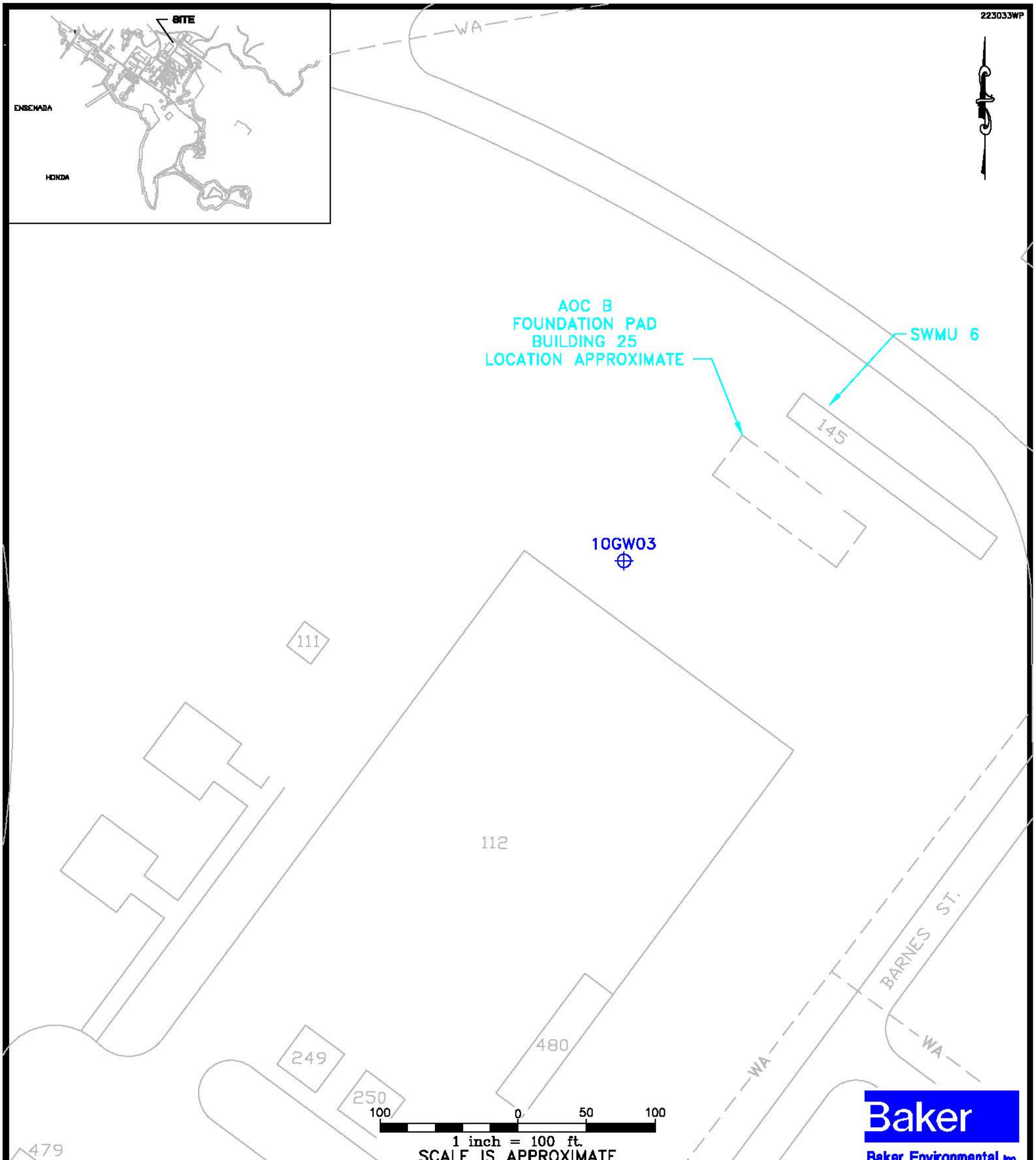
AOC C is located adjacent to and south of SWMU 46 (Figure 3-12) and consists of three raised concrete pads with curbing. The two northern pads are divided into two sections by a concrete curb; the southern pad is one continuous slab. Each pad measures approximately 20 feet by 50 feet. These pads were used to store transformers and other miscellaneous electrical equipment. Areas of staining were observed on each of the three pads. The eastern one-third of the middle pad was covered with tar. The ground surrounding the pads was overgrown with tall grass and shrubbery.

The 1988 RFA report noted that this site was uncovered and contained at least 25 transformers and 20 to 40 batteries. Products stored in this area were observed to be in good condition. Standing oil, noted inside the north pad, apparently released to the soil through a crack in the concrete. The 1993 RFA reinspection indicated that the site remains as found in 1988 except more transformers were present (TRC).

3.4 Operable Unit 7 Site Description

Operable Unit 7 contains a single Area of Concern; AOC D, comprised of Ensenada Honda sediments (see Figures 1-1). Episodic spills of fuels and possible releases from SWMUs abutting the Honda (e.g., SWMUs 1, 2, 3, 7, 11/45) may have affected the sediments of this AOC. Figures 3-14 through 3-18 present the current conditions associated with these SWMUs, respectively.

SECTION 3.0 FIGURES



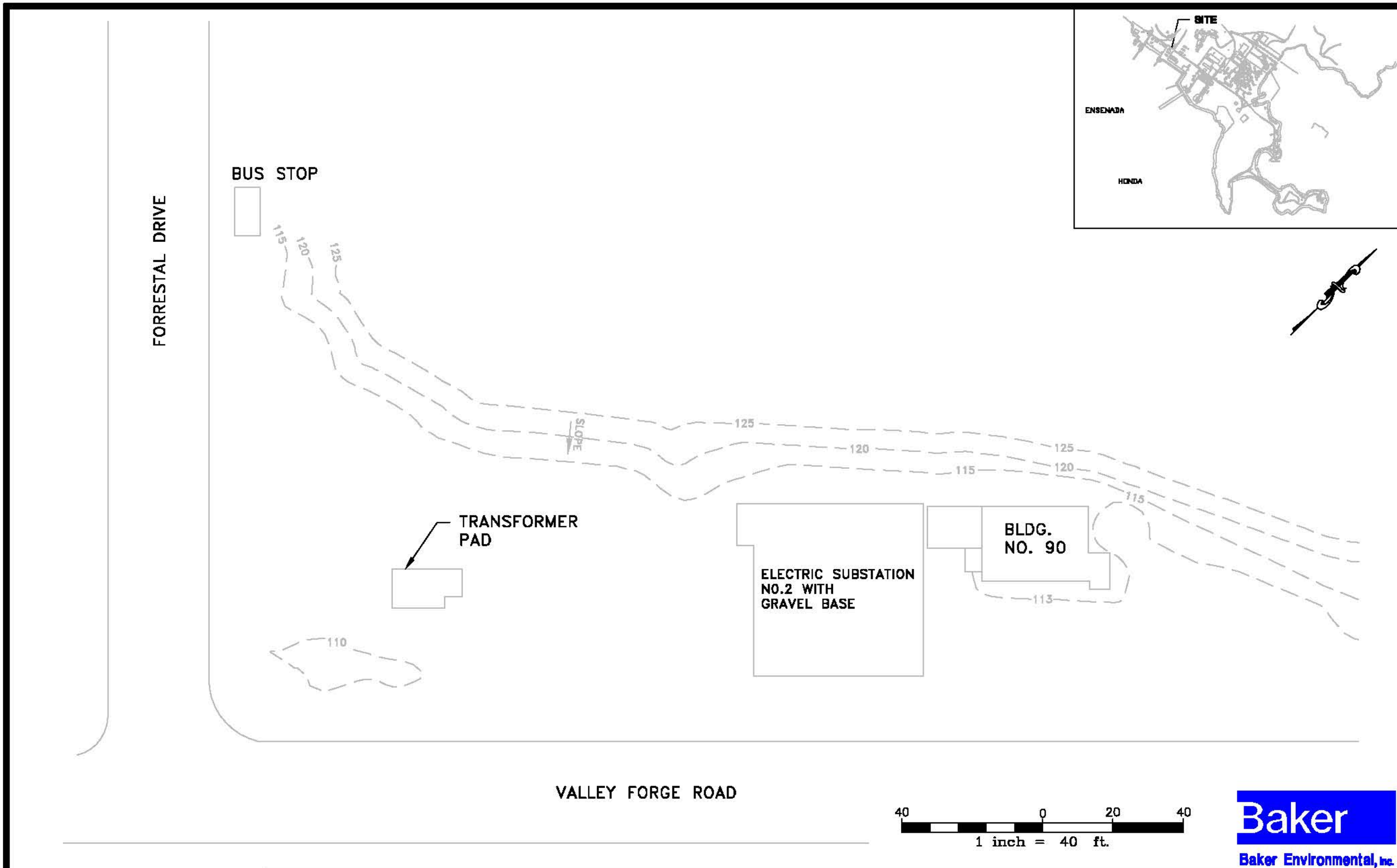
LEGEND

249	STATION STRUCTURE
— WA —	WATERLINE
10GW03 ⊕	EXISTING MONITORING WELL LOCATION (IR SITE 10 INVESTIGATION)

SOURCE: STATION PUBLIC WORKS BASE MAP, FEB. 1992
SOURCE: BAKER ENVIRONMENTAL GPS SURVEY, NOV. 1992

FIGURE 3-1
EXISTING SITE CONDITIONS
OU#1 – SWMU 6 AND AOC B
BUILDING 25 STORAGE AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

120 – ESTIMATED CONTOUR LINE WITH ELEVATION

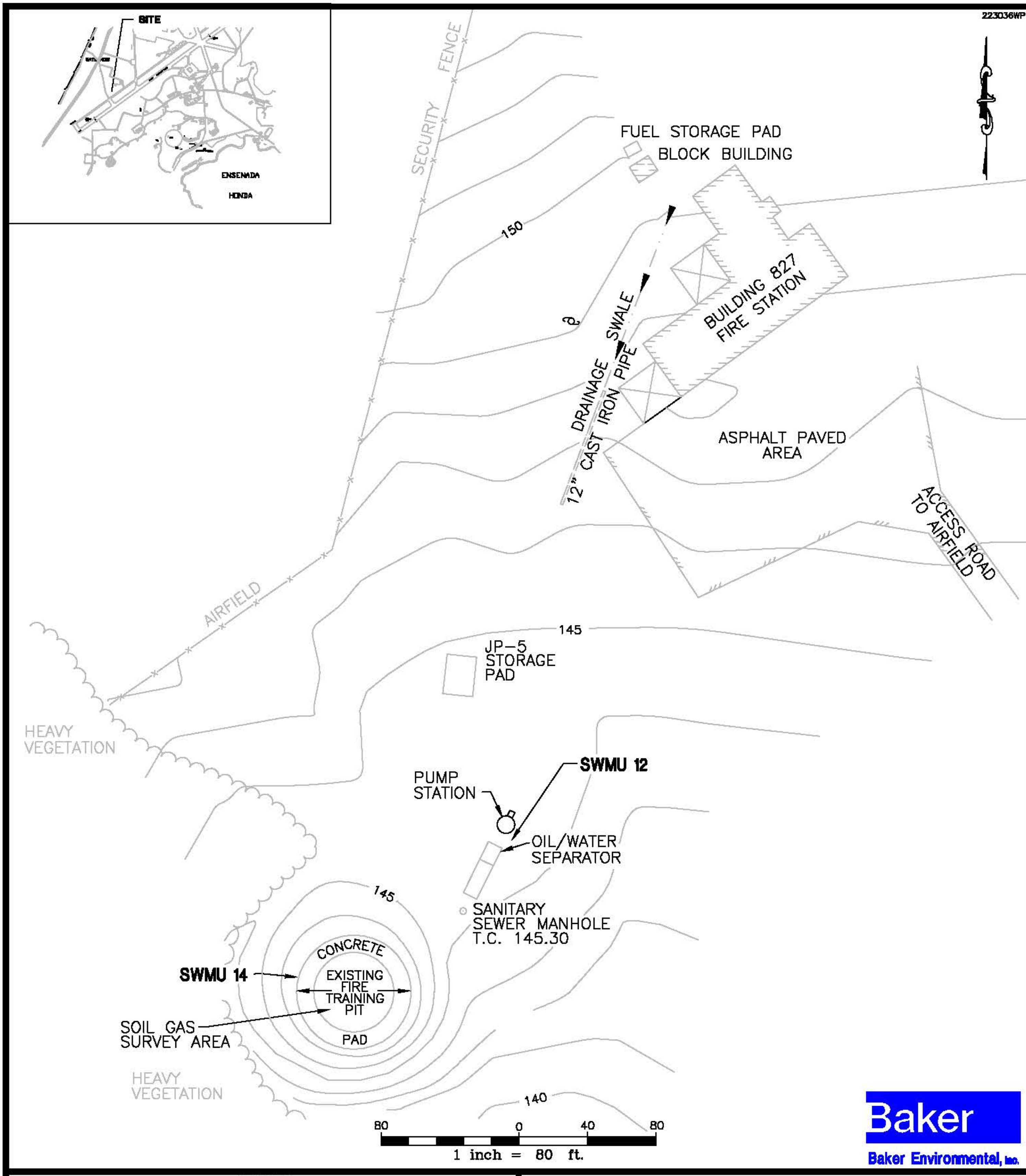
– BUILDING OR STRUCTURE

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-2
EXISTING SITE CONDITIONS
OU#1-SWMU 10 SUBSTATION 2/BUILDING 90

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

277025WP



LEGEND

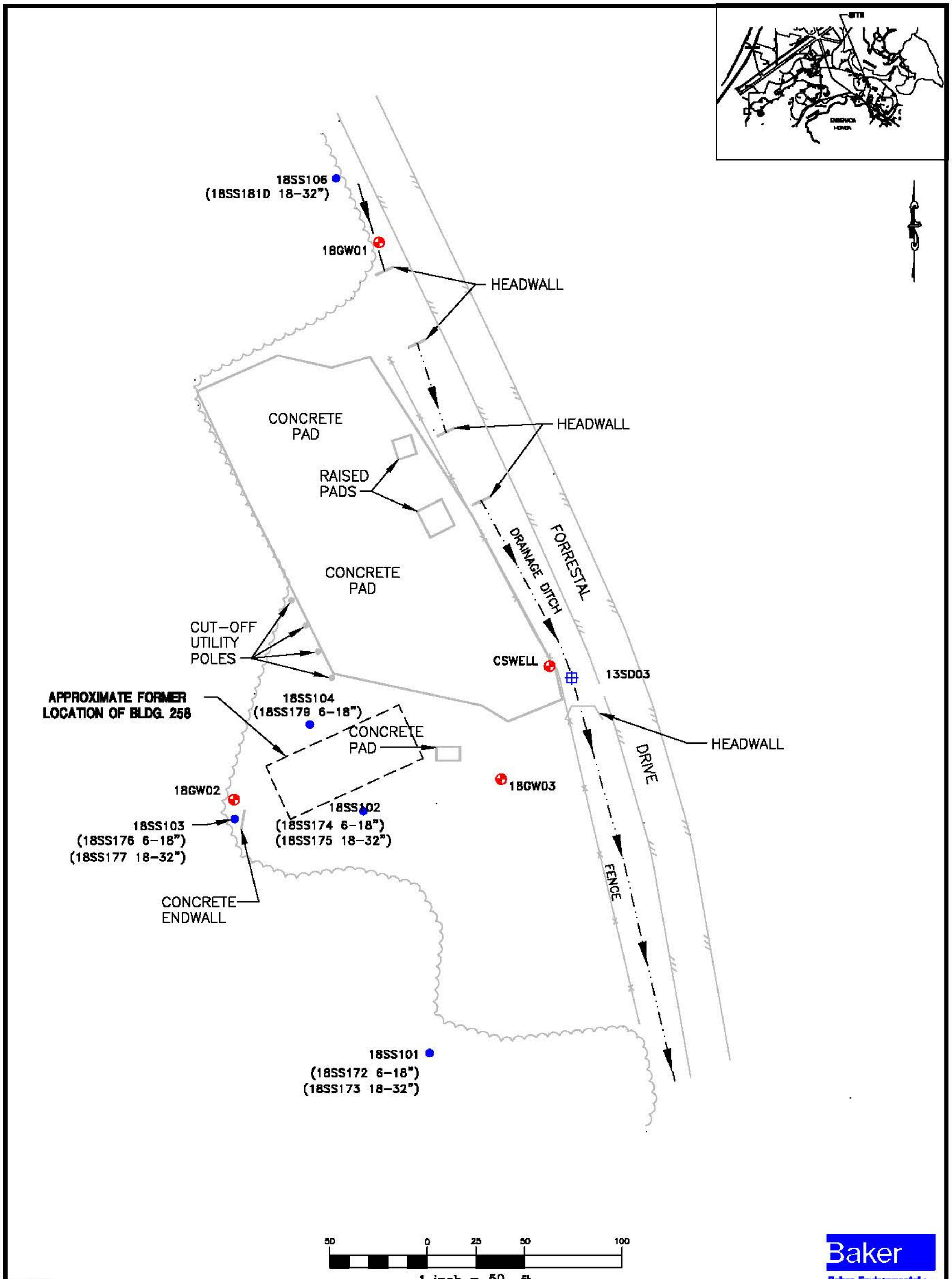
145 SURFACE ELEVATION CONTOUR

SURFACE WATER DRAINAGE DIRECTION

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-3
EXISTING SITE CONDITIONS
OU#1 – SWMU 12–FIRE TRAINING PIT OIL/WATER
SEPARATOR AND SWMU 14 –
FIRE TRAINING PIT AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

18GW03 — EXISTING MONITORING WELL LOCATION (CONFIRMATION STUDY)

18SS102 — 1992 SOIL SAMPLE LOCATIONS (APPROXIMATE)

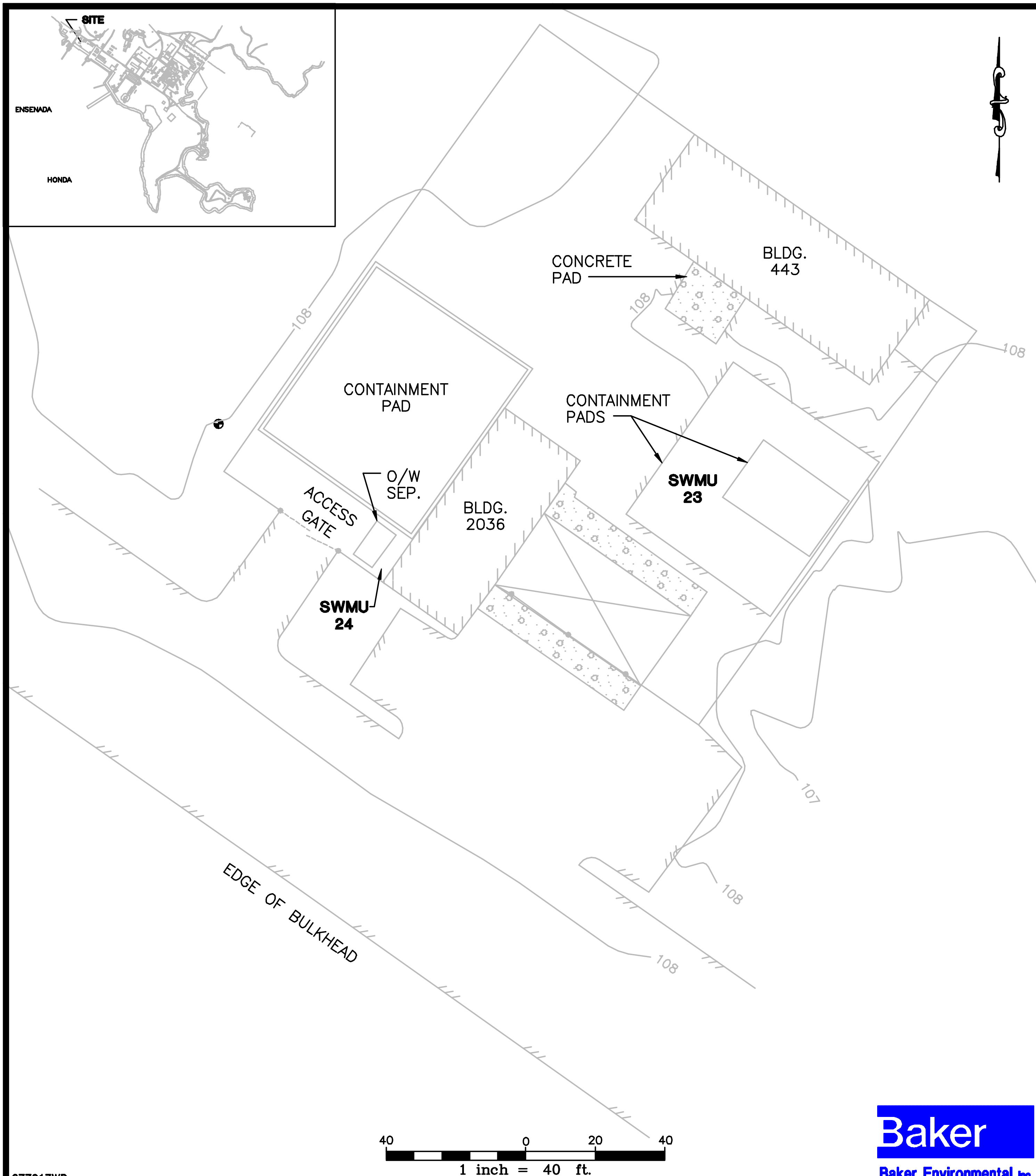
18SED108 — 1992 SEDIMENT SAMPLE LOCATION

DRAINAGE DITCH/SURFACE DRAINAGE FLOW DIRECTION

SOURCE: BAKER ENVIRONMENTAL, INC., MAY 1994

FIGURE 3-4
EXISTING SITE CONDITIONS
OU#1 – SWMU 13
PEST CONTROL SHOP AND SURROUNDING AREAS

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Baker Environmental, Inc.

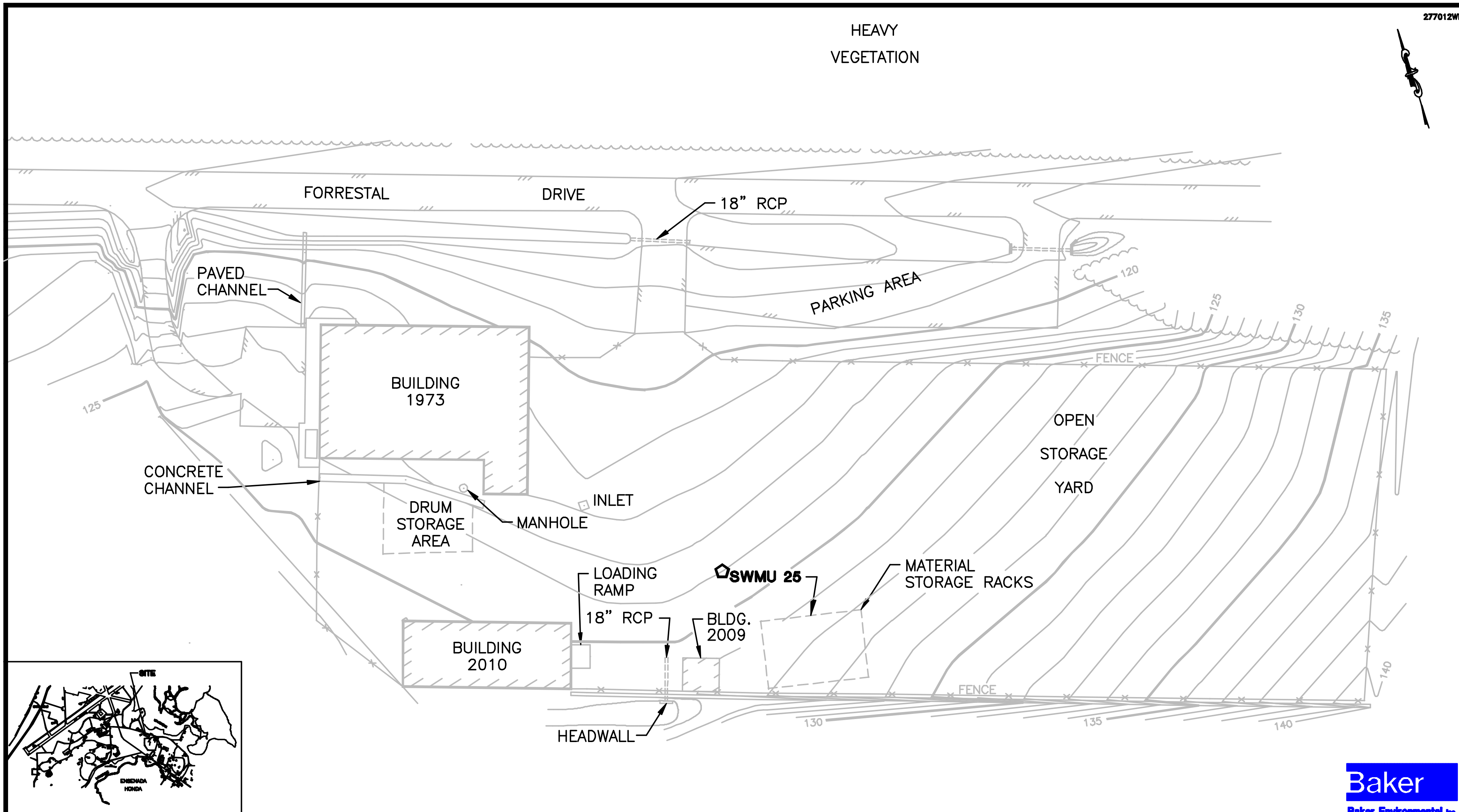
LEGEND

EXISTING MONITORING WELL LOCATION

108 SURFACE ELEVATION CONTOUR

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-5
EXISTING SITE CONDITIONS
OU#1 – SWMUs 23 AND 24
OIL SPILL SEPARATOR TANKS AND
OIL/WATER SEPARATOR
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

130 SURFACE ELEVATION CONTOUR

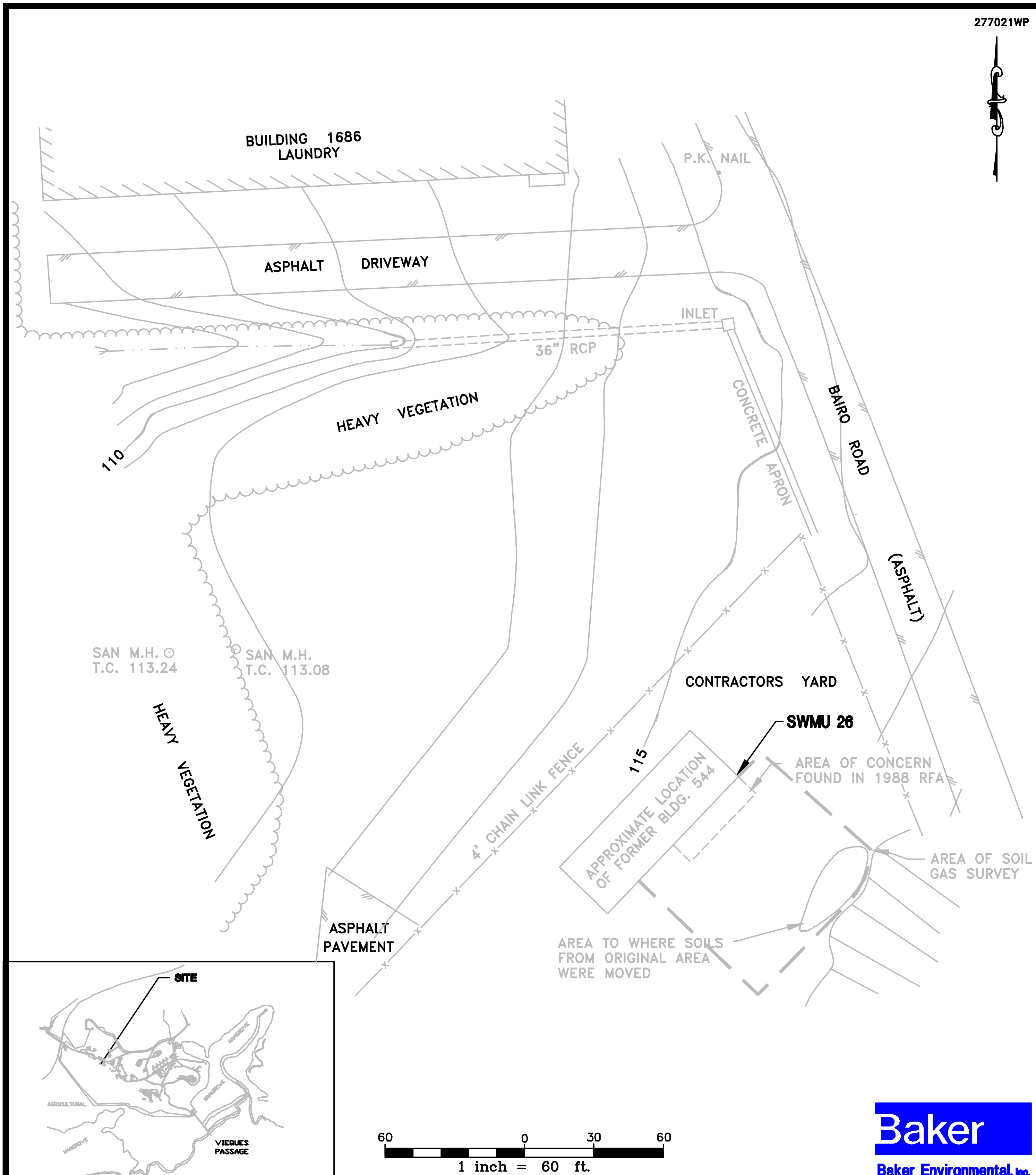
AREA OF STAINING APPROXIMATED FROM 1988 RFA PHOTO

60 0 30 60 120

1 inch = 60 ft.

FIGURE 3-6
EXISTING SITE CONDITIONS
OU#1 – SWMU 25
DRMO STORAGE YARD

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



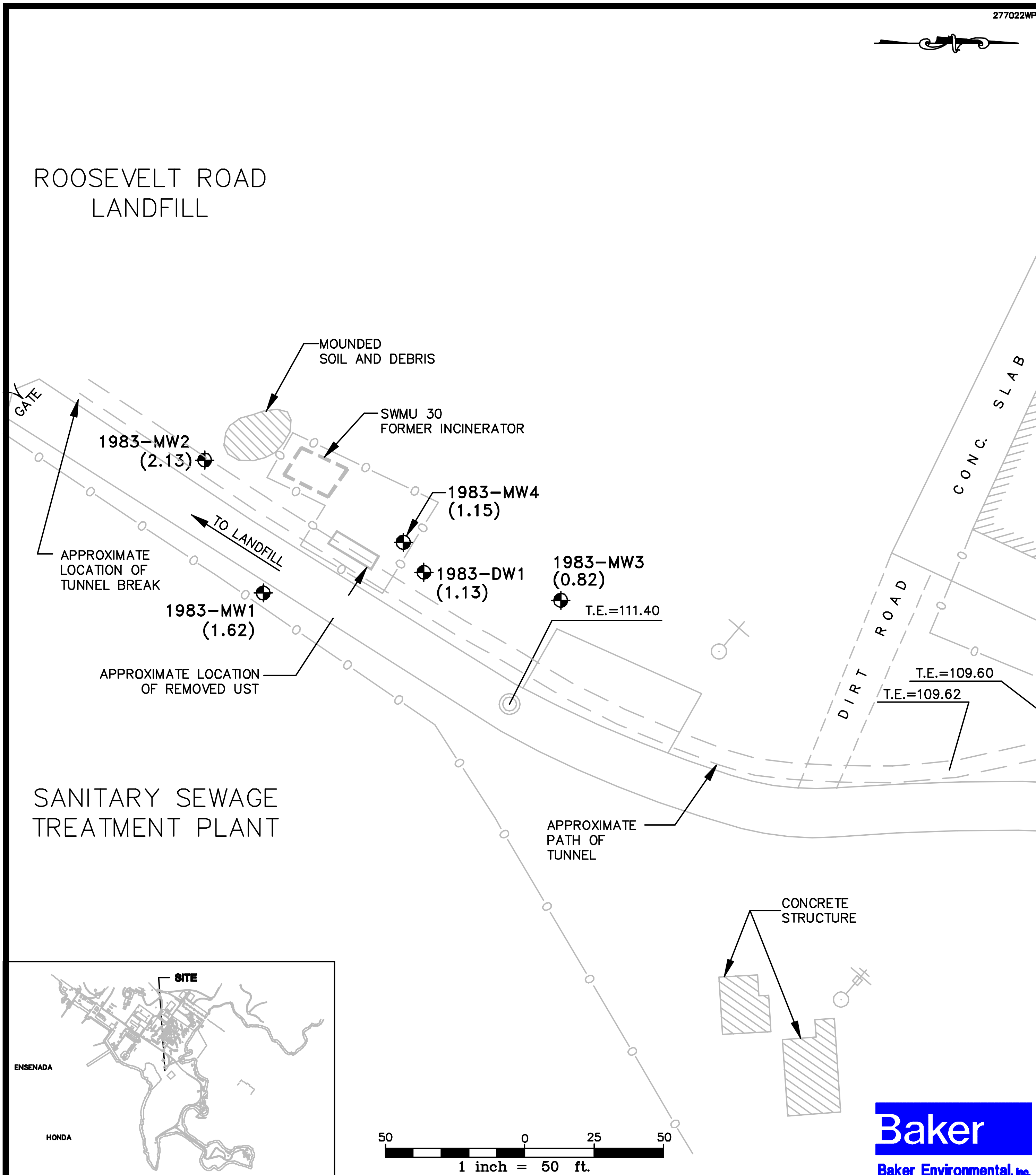
LEGEND

110 SURFACE ELEVATION CONTOURS

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-7
EXISTING SITE CONDITIONS
OU#1 – SWMU 26
BUILDING 544 AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



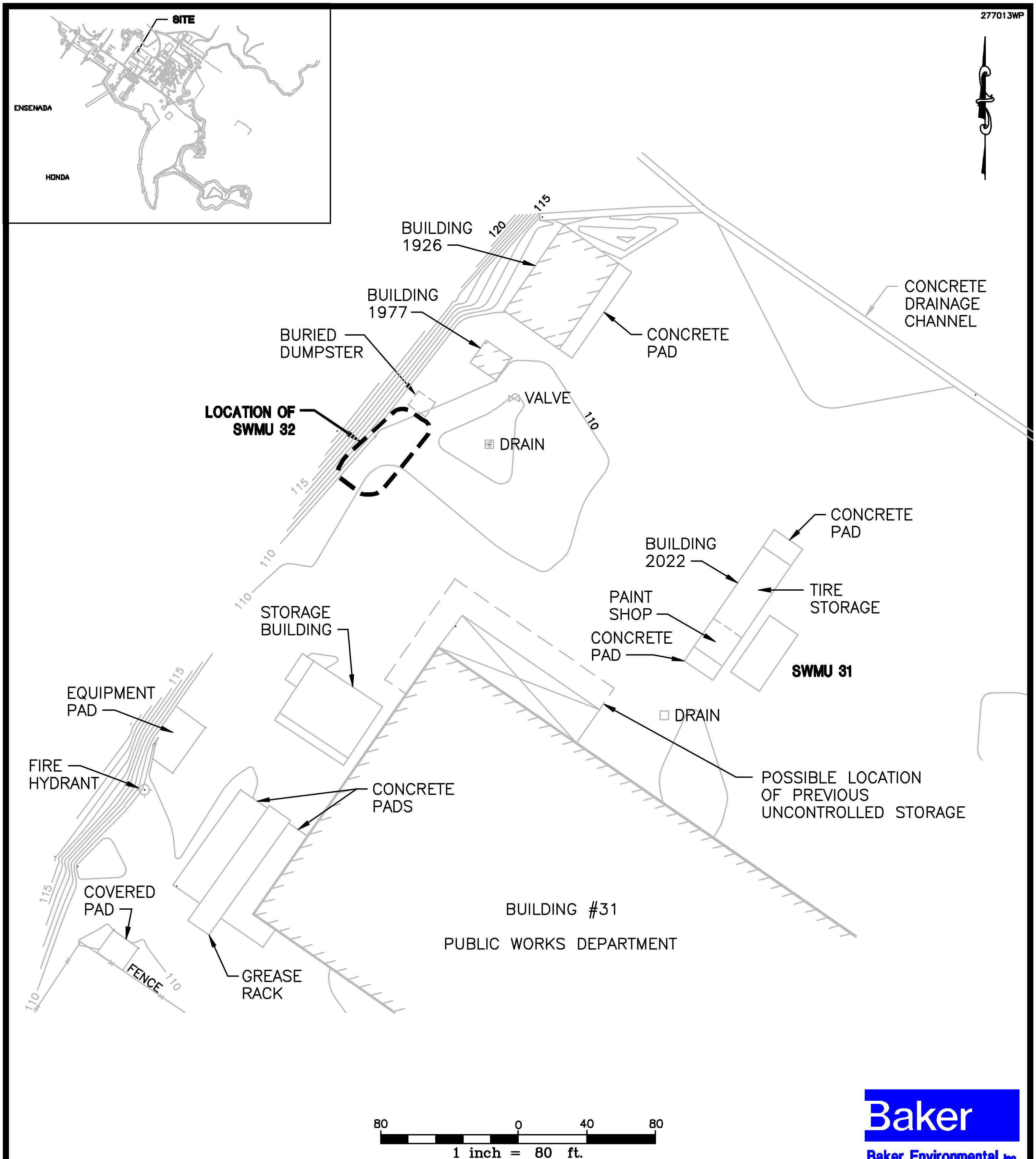
LEGEND

EXISTING MONITORING WELL LOCATION (BLASLAND, BOUCK & LEE, INC. 1994)

(1.13) GROUNDWATER ELEV. (1994)

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-8
EXISTING SITE CONDITIONS
OU#1 - SWMU 30
FORMER INCINERATOR AREA
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



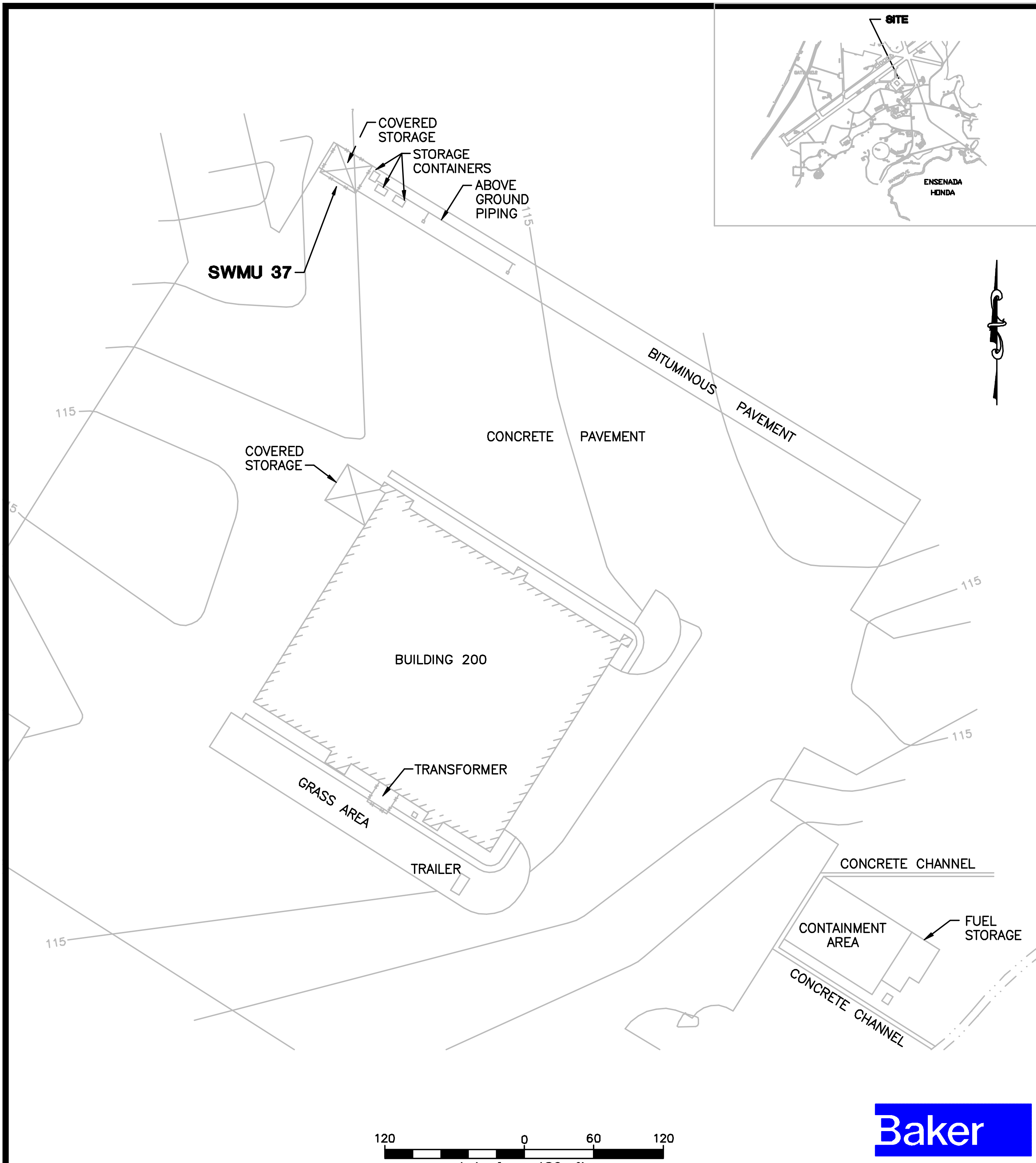
LEGEND

110 SURFACE ELEVATION CONTOUR

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-9
EXISTING SITE CONDITIONS
OU#1 – SWMU 31 WASTE OIL COLLECTION AREA AND
SWMU 32 BATTERY COLLECTION BUILDING 31

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Baker
Baker Environmental, Inc.

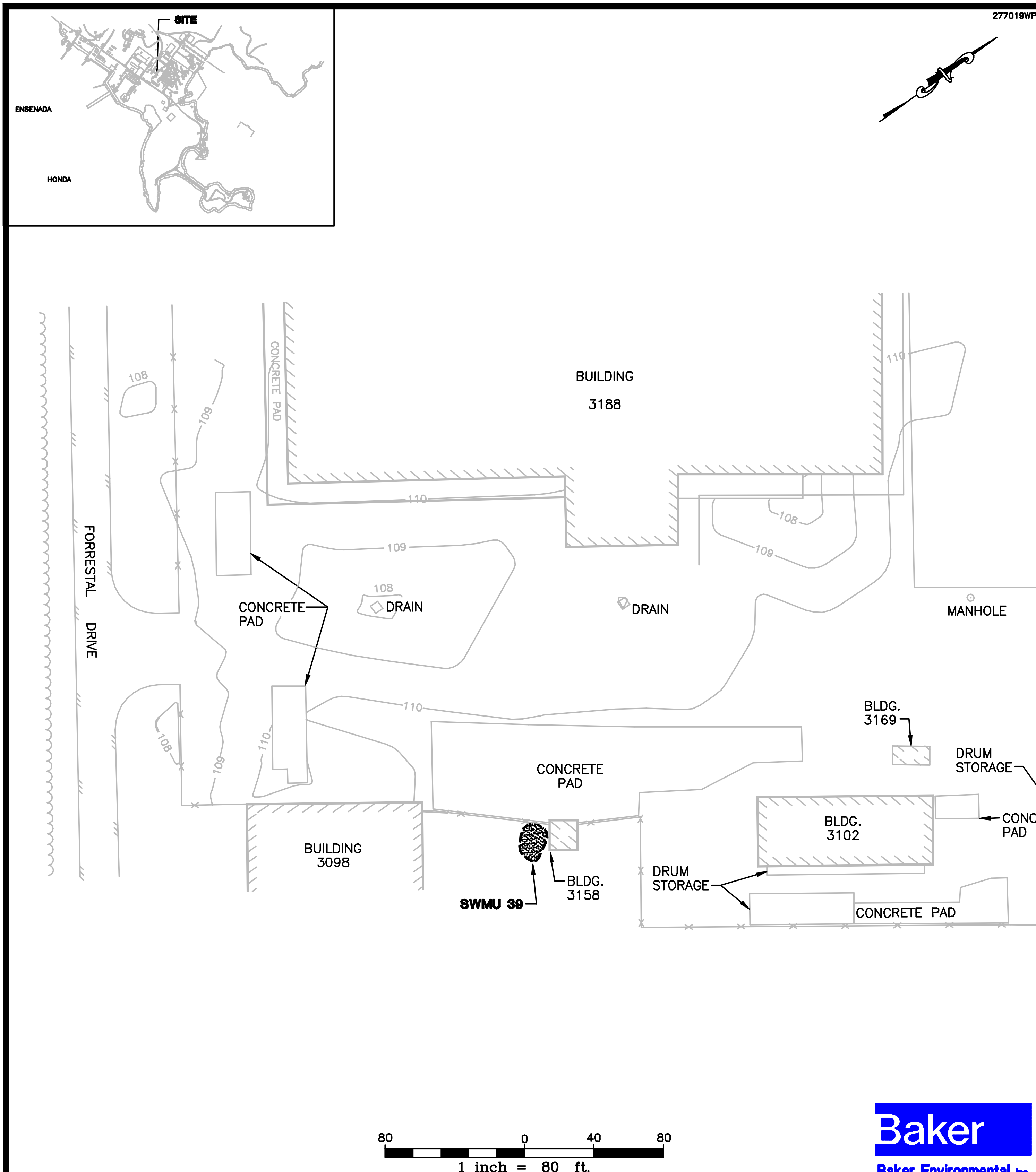
LEGEND

115 SURFACE ELEVATION CONTOUR

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-10
EXISTING SITE CONDITIONS
OU#1 - SWMU 37
WASTE OIL STORAGE AREA/BUILDING 200

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



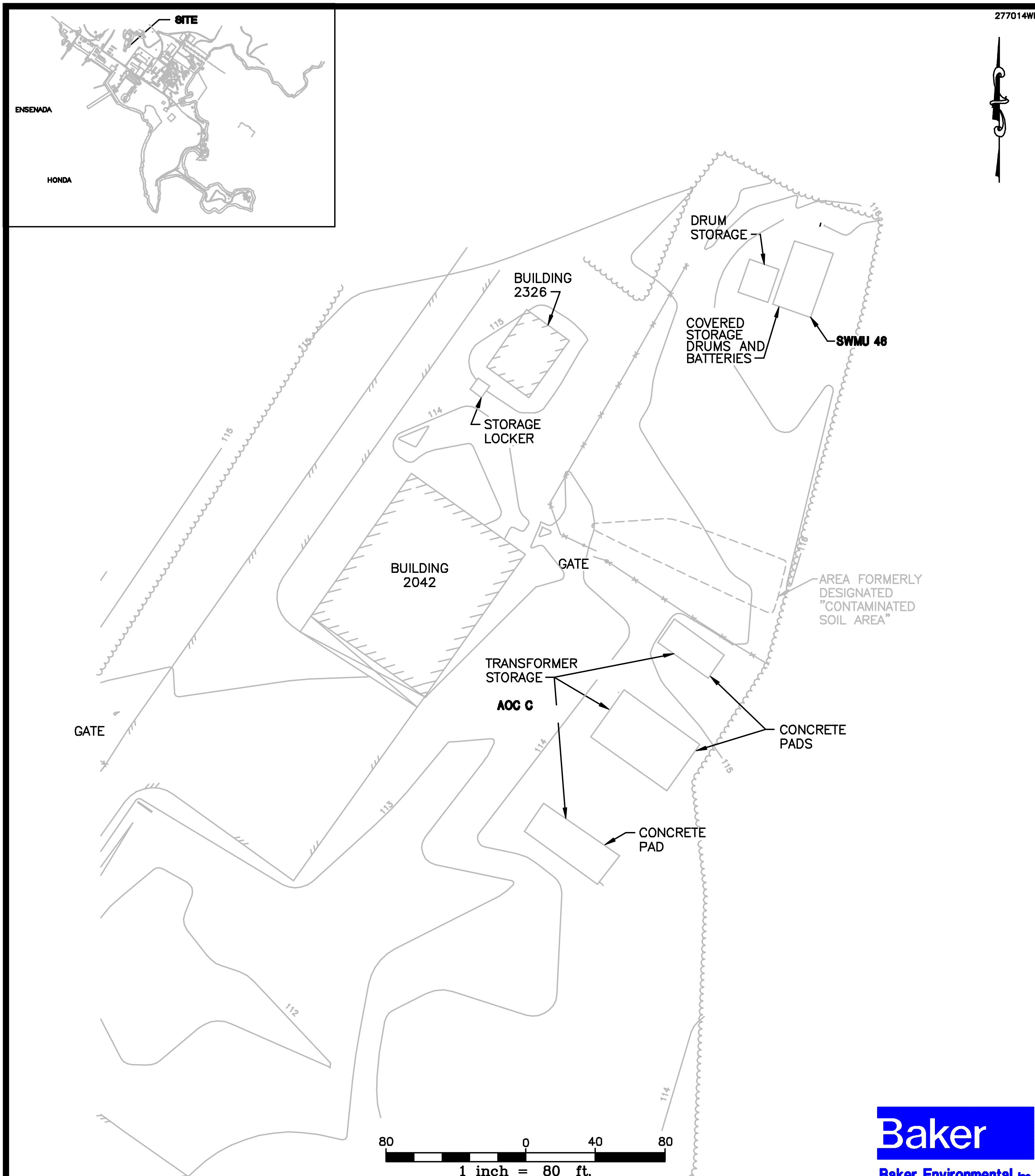
LEGEND

111 SURFACE ELEVATION CONTOUR

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-11
EXISTING SITE CONDITIONS
OU#1 – SWMU 39
FORMER BATTERY DRAIN AREA/
BUILDING 3158

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



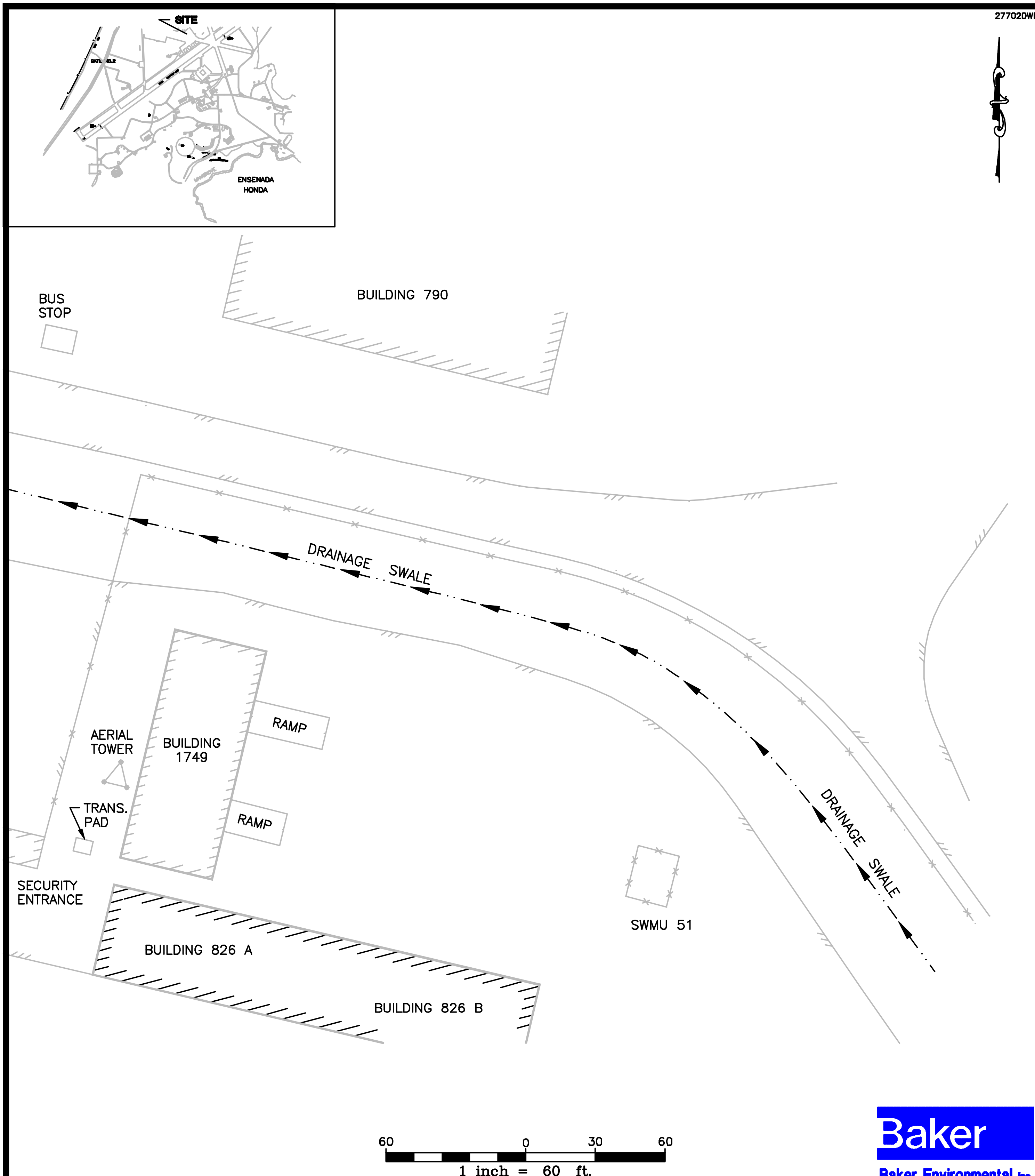
LEGEND

115 SURFACE ELEVATION CONTOUR

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-12
EXISTING SITE CONDITIONS
OU#1 - SWMU 46 POLE STORAGE YARD
AOC C TRANSFORMER STORAGE PAD

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



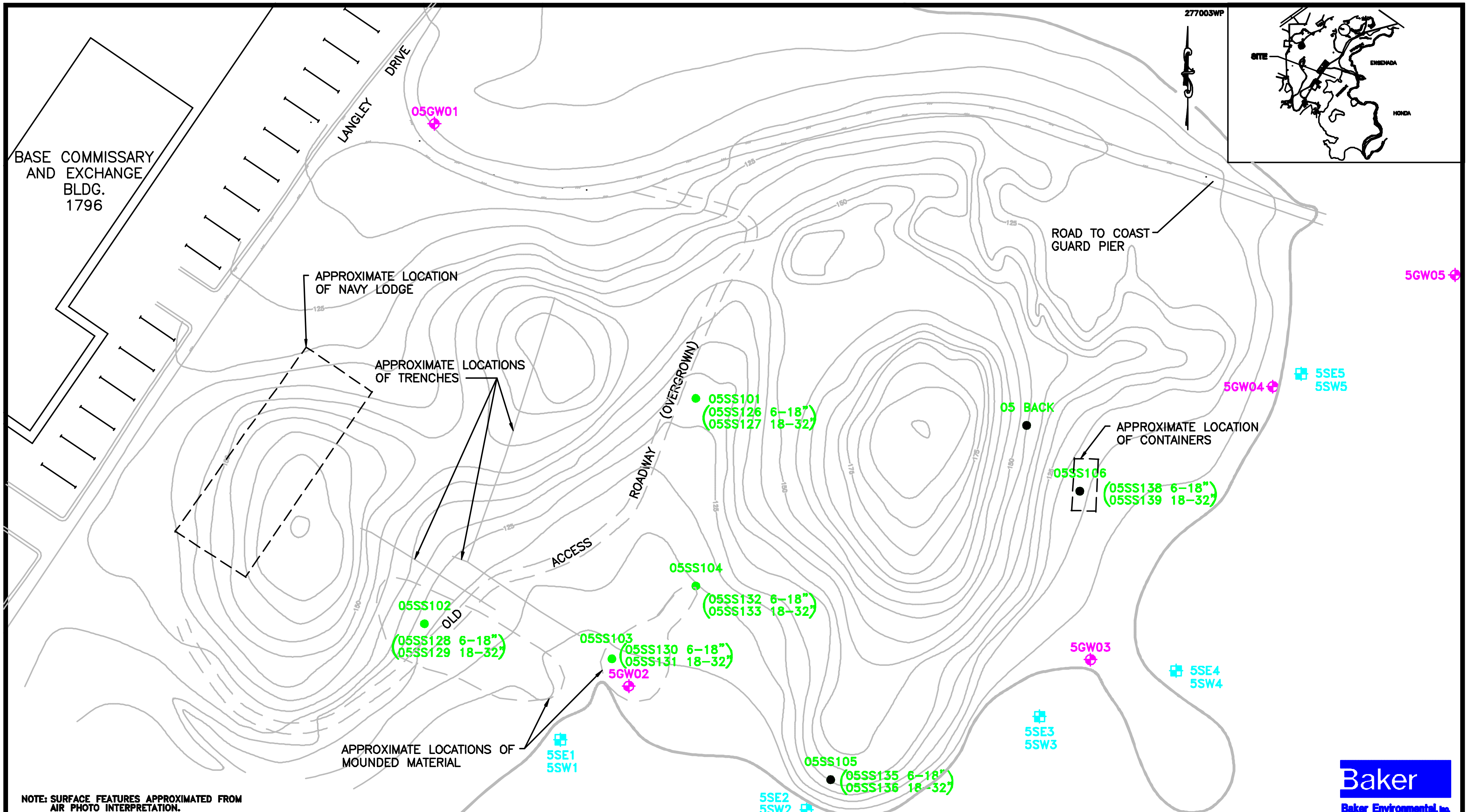
LEGEND

DRAINAGE SWALE FLOW DIRECTION

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3-13
EXISTING SITE CONDITIONS
OU#1 – SWMU 51
NEW AIMD STORAGE PAD/BUILDING 379

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

- EXISTING MONITORING WELL LOCATION (CONFIRMATION STUDY)
- 1992 SOIL SAMPLING LOCATIONS (APPROXIMATE)
- SEDIMENT/SURFACE WATER SAMPLE (SUPPLEMENTAL INVESTIGATION)
- SURFACE ELEVATION CONTOUR

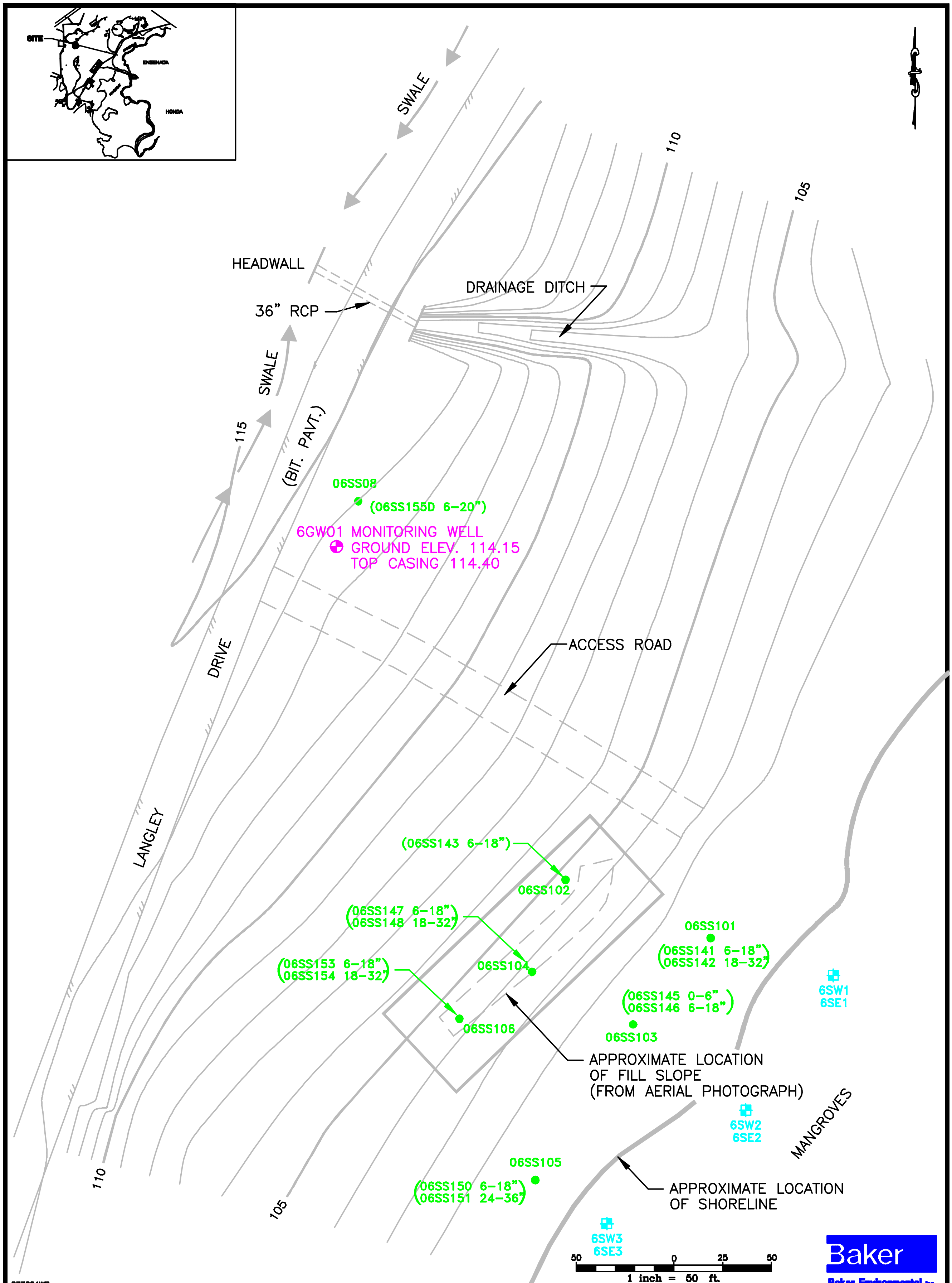
SOURCE: LANTDIV, FEB. 1992

160 0 80 160 320

1 inch = 160 ft.

FIGURE 3-14
EXISTING SITE CONDITIONS
OU#7 - SWMU 1
ARMY CREMATOR DISPOSAL SITE

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



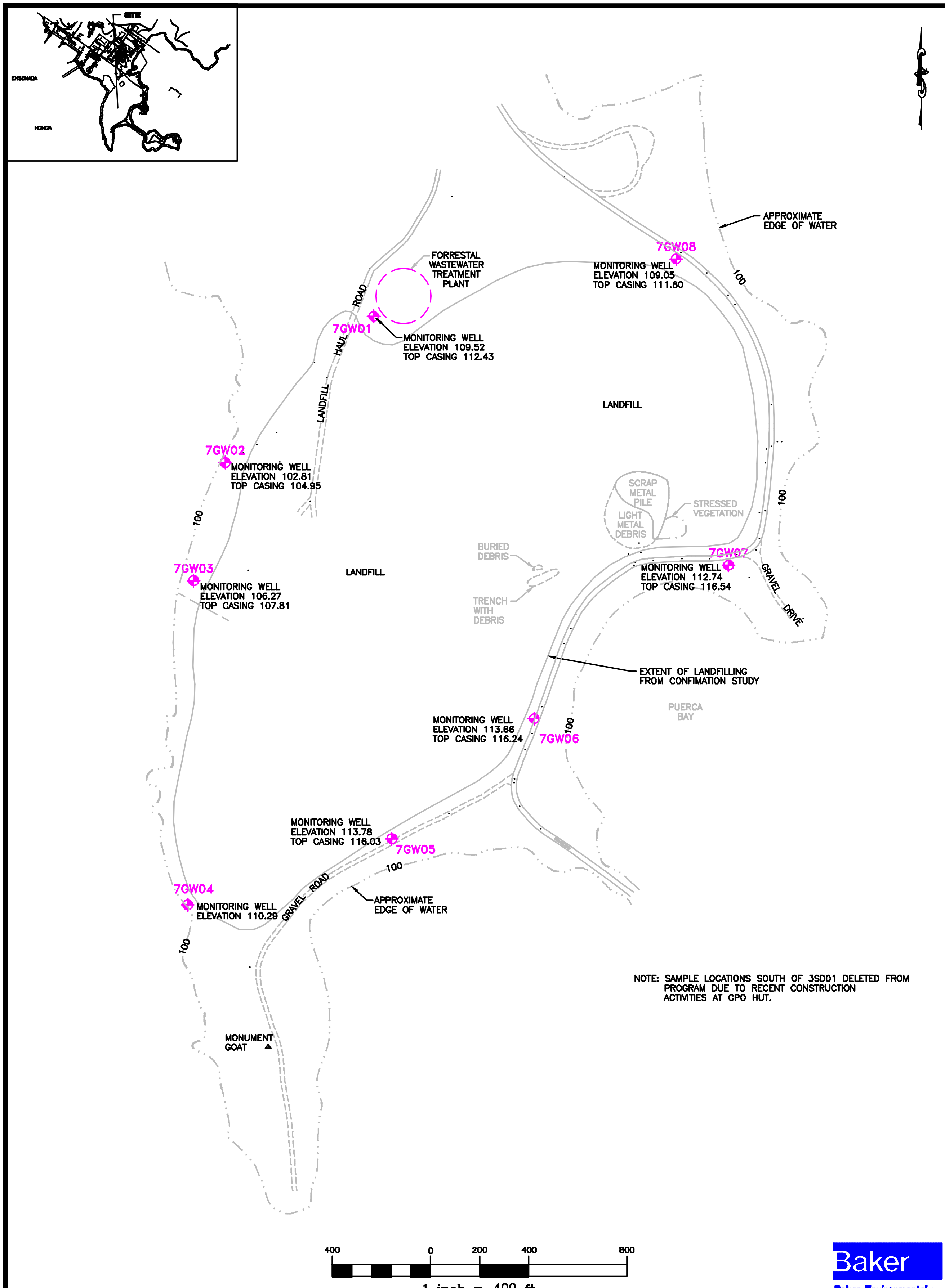
LEGEND

- 6GW01 EXISTING MONITORING WELL LOCATION
- 1992 SOIL SAMPLING LOCATIONS (APPROXIMATE)
- —110— SURFACE ELEVATION CONTOUR
- SURFACE WATER DRAINAGE DIRECTION
- SURFACE WATER/SEDIMENT SAMPLE (SUPPLEMENTAL INVESTIGATION)

SOURCE: LANTDIV, FEB. 1992

FIGURE 3-15
EXISTING SITE CONDITIONS
OU#7 – SWMU 2
LANGLEY DRIVE DISPOSAL SITE

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Baker

Baker Environmental, Inc.

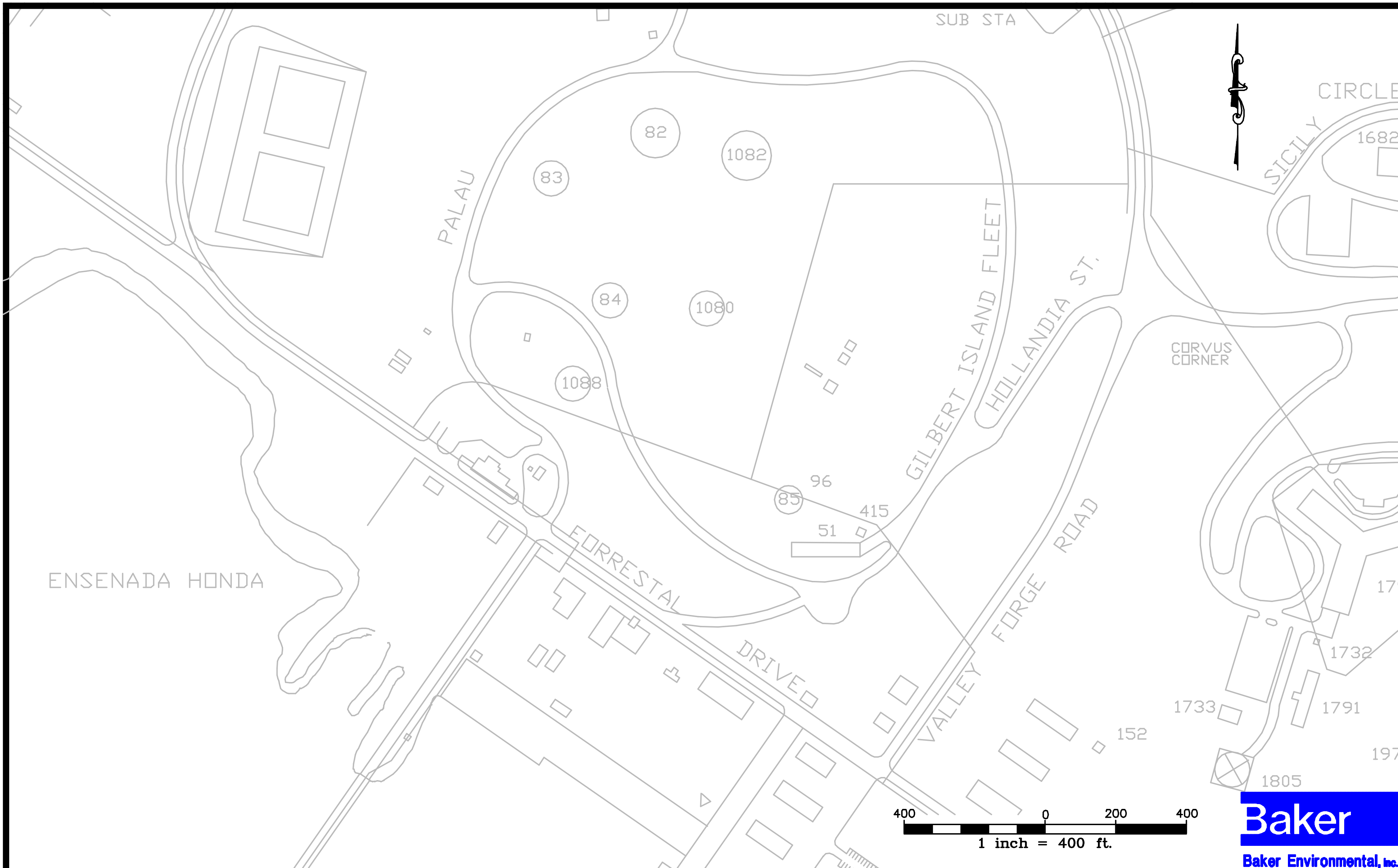
LEGEND

EXISTING MONITORING WELL LOCATION

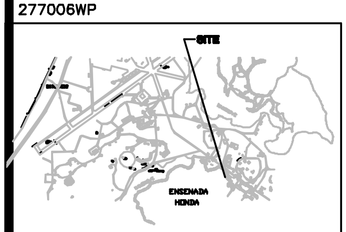
SOURCE: LANTDIV, FEB. 1992

FIGURE 3-16
EXISTING SITE CONDITIONS
OU#7 – SWMU 3
BASE LANDFILL

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

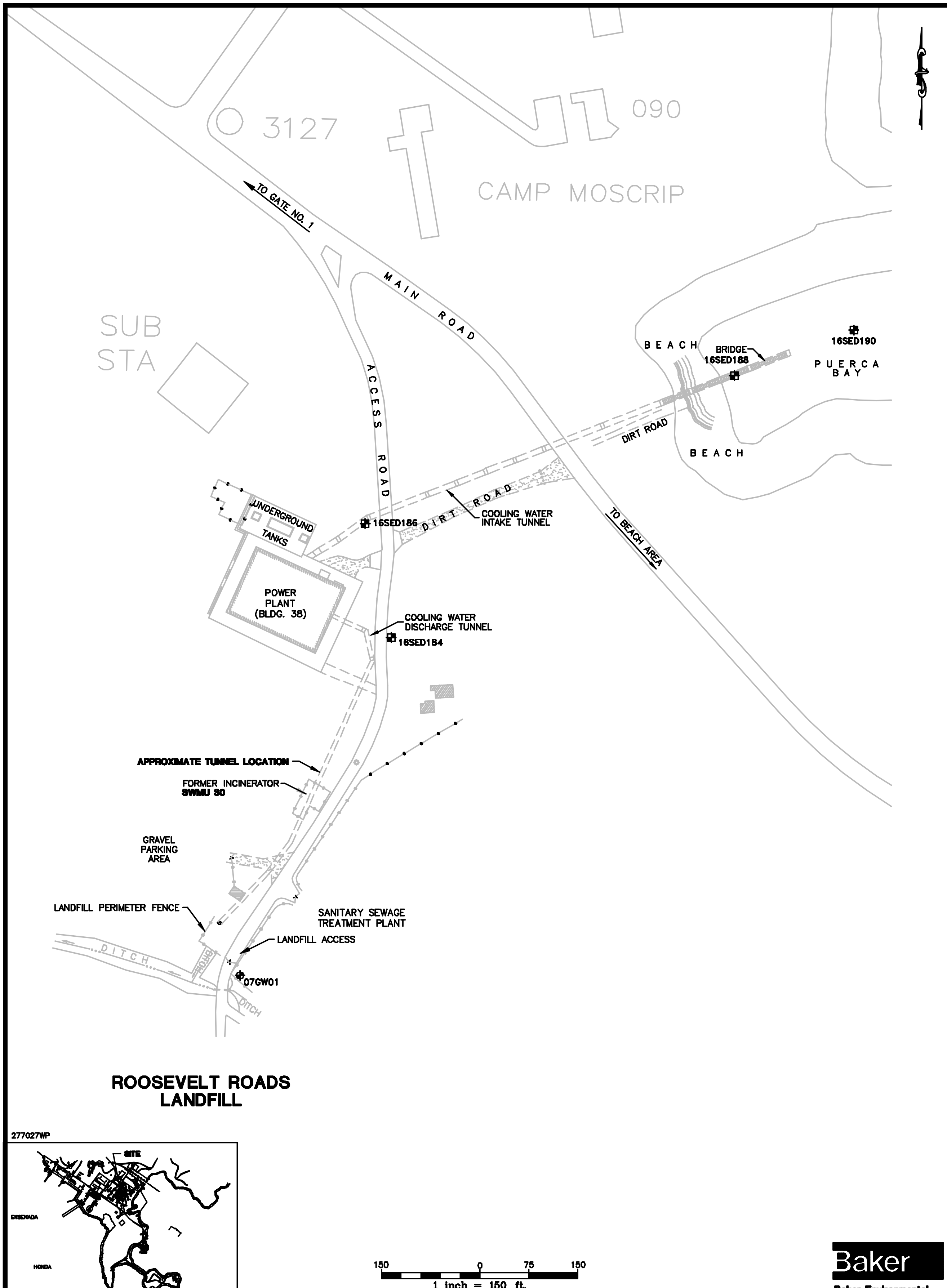


277006WP



LEGEND

FIGURE 3-17
EXISTING SITE CONDITIONS
OU#7 - SWMU 7 TOW WAY FUEL FARM
AOC D
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

07GW01 – EXISTING GROUNDWATER SAMPLE LOCATION

16SED184 – EXISTING SEDIMENT SAMPLE LOCATION

SOURCE: LANTDIV, FEB. 1992.

FIGURE 3–18
EXISTING SITE CONDITIONS
OU#7 – SWMU 11/45

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

4.0 RCRA FACILITY INVESTIGATION

This section describes the site investigation methods used in collecting environmental samples from various media: surface and subsurface soil, sediments, groundwater, and wipe samples. Table 4-1 presents the type and number of environmental samples collected from the various SWMUs/AOCs as well as the analytical parameters. In addition, a discussion is presented regarding field conditions during the sampling effort conducted at each location. Where applicable, any deviation from the original scope of work, as contained in the approved work plan, has been noted.

A sample numbering system was incorporated to assist in the identification of each sample. The number associated with each sample was comprised of three components, including:

- a site location prefix (i.e., 1 corresponds to SWMU 1, ACB signifies Area of Concern B, AC equates to Area of Concern C, AD refers to Area of Concern D)

- a media identifier (i.e., SS corresponds to surface soil, SD corresponds to sediment, GW or MW identifies groundwater, WS equates to wipe samples)

- a sequential sample location number (i.e., 01 corresponds to sample location number 1, etc.)

- a numerical suffix has been added to subsurface soil samples to signify sample depth

Therefore, sample number 25SS09 is associated with surface soil sample 09 obtained from SWMU 25.

4.1 <u>Soil Investigation</u>

Surface soil samples were collected at all sites with the exception of SWMU 10 (groundwater only) and the OU 7 sites (sediments only). Samples were collected using decontaminated stainless steel spoons. Prior to sample collection, all vegetation (grass and roots) was removed from the location. Surface soil samples collected in areas of asphalt paving were obtained immediately below the gravel sub-base. All surface soil samples were collected to a depth of one foot. In cases where samples were located in an area covered by asphalt, samples were collected from a one foot interval immediately below the asphalt and any sub-base. Soil collected for volatile organic analysis was placed directly into the laboratory prepared container without homogenizing to prevent volatilization. Soil collected for all other analyses was placed in disposable aluminum pans, homogenized and placed in associated containers in order of volatility; semivolatile organics (SVOCs), pesticides/polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), and finally inorganic analyses (metals, sulfides, and cyanide). All samples were kept in coolers on ice and maintained under strict chain-of-custody until delivered to the laboratory. Chain-of-custody forms are presented in Appendix A.

Subsurface soil samples were collected at SWMUs 31, 32, and 46 using direct-push technology (the GeoProbe System). The GeoProbe System involves the advancement of a small diameter sampling tube with a clear acetate liner. The sampling tube is advanced in two foot intervals using a hammer drill. At the end of each sample interval, the tube is extracted from the borehole and the liner removed. The liner is then capped and marked with boring number and depth interval. At some locations at the SWMUs it was necessary to advance two or more borings in close proximity to obtain sufficient sample volume. Geoprobe boring logs are presented in Appendix B.

At the completion of each soil boring and sample logging by the on-site geologist, each soil sample liner was emptied into a separate disposable aluminum pan for each sample depth. As with the surface soil samples, the VOC containers were filled first without homogenizing. The remaining portion of each sample was then homogenized prior to filling the remaining laboratory containers. These samples also were placed on ice and kept under strict chain-of-custody until delivered to the laboratory.

A soil gas survey was performed at SWMUs 14 and 26. Descriptions of sampling procedures for each soil gas survey are presented in Sections 4.8.1.5 (SWMU 14) and 4.8.1.9 (SWMU 26).

4.2 Sediment Investigation

Sediment samples were collected from AOC D (Ensenada Honda) and at SWMUs 13 and 25. At AOC D, samples were collected off-shore from SWMUs 1, 2, 3, 7, and 11. These samples were obtained using a sediment corer with acetate sleeves. The corer was advanced by hand into the sediments to a depth of up to one foot. The sleeves were then removed from the corer, capped and labeled. This procedure was repeated until a sufficient volume of sediment was obtained to fill all sample containers. Once sufficient volume was obtained, sediment from the sleeves were placed into a pie pan and sample containers filled in the same manner as surface and subsurface soil samples.

Sediment samples collected from surface drainage features (SWMUs 13 and 25) were collected in the same manner as those employed in surface soil sampling (using a stainless steel spoon). As with the other media sampled, all samples were placed in coolers on ice until delivered to the laboratory.

4.3 Groundwater Investigation

Groundwater samples were collected at two SWMUs; 10 and 30. At SWMU 10 groundwater samples were obtained using the GeoProbe System. At SWMU 30, two monitoring wells installed during previous UST program investigations wells were sampled using bailers.

Groundwater samples at SWMU 10 were collected by advancing the hollow-stem GeoProbe rods with disposable drive point approximately two to three feet into the water table (typically encountered at a depth of 12 feet below ground surface). The rods were then raised approximately six inches to one foot to allow groundwater to enter the rods. Flexible Teflon tubing was installed through the rods and connected to a peristaltic pump. Groundwater was then pumped directly into the sample containers beginning with those for organic analyses followed by the containers for inorganic analyses.

The two existing wells at SWMU 30, 1983-DW1 and 1983-MW3, were purged and sampled using disposable bailers. Each well was purged of a minimum of three well volumes with the field parameters of temperature, pH, and specific conductance collected after each volume. Once these parameters stabilized to within ten percent over three consecutive readings, the wells were sampled. Water from the wells was poured directly into the sample containers.

An in-situ hydraulic conductivity test (slug test) was conducted on the two newly installed monitoring wells (ACBMW01 and ACBMW03). Standard variations of the rising head test or falling head tests were conducted on each well. In this type of test, a solid slug of known dimensions is introduced below the water table or withdrawn quickly to induce a disturbance in the water column. Water level data was collected using In Situ Environmental Data Loggers equipped with pressure transducers. All downhole equipment was decontaminated using the same procedures as described in the Final SAP.

Data generated from the hydraulic conductivity tests was analyzed using the Geraghty and Miller aquifer test solver (AQTESOLV) program. This program uses the Bouwer and Rice (1967) method (for unconfined aquifers) for analysis of data. Section 5.0 discusses physical results of the groundwater investigation at AOC B and Appendix C includes Slug Test Data Results.

4.4 Concrete Pad Investigation

Wipe samples were collected on concrete pads which historically have stored transformers at SWMU 46 and AOC C. Prior to collection of the samples, each location was scraped using a putty knife to remove surface debris such as dried algae and dirt. A template (measuring 10 cm x 10 cm) was then placed on the concrete pad and the area inside the template wiped with hexane soaked gauze. The gauze was immediately returned to its glass container and labeled.

4.5 Analytical Program

The analytical program devised for this investigation included a variety of analytical suites; from the full Appendix IX parameter list where the possibility of unknown waste management was highest to limited analyses where waste streams were well documented. Table 4-1 presents those analyses performed on the samples of various media from each site investigated. Additionally, Table 4-2 provides a list of the individual compounds which make up the Appendix IX list. Analytical results of the individual samples are presented in Appendix D.

4.6 Quality Assurance/Quality Control (QA/QC) Program

Field QA/QC samples were collected during the sampling program to: 1) ensure that decontamination procedures were properly implemented (i.e., equipment rinsate blanks); 2) evaluate field methodology (i.e., duplicate samples); 3) establish field background conditions (i.e., field blanks); and, 4) evaluate whether cross-contamination occurred during sampling and/or shipping (i.e., trip blanks). These QA/QC samples are defined below:

- Duplicate Sample (D): Two samples collected simultaneously into separate containers from the same source under identical conditions. One duplicate sample was collected for every 10 (10 percent) environmental samples collected for each media type.

- Equipment Rinsate Sample (RB): Sample was obtained by running laboratory supplied deionized water over/through sample collection equipment after decontamination. Rinsate sample results are evaluated to determine if decontamination procedures were adequate.

- Field Blank (FB): Sample was obtained from each water source utilized during the field program including: store-bought distilled water used for decontamination of sampling equipment; and, potable water obtained from Building 31.

- Trip Blank (TB): Trip blanks were prepared at the laboratory and shipped with the sample containers. The trip blanks were packaged for shipment with the other VOC samples and submitted to the laboratory for analysis. At no time after their preparation were the trip blank sample containers opened before they reached the laboratory. At least one trip blank per shipping cooler was sent to the laboratory for VOC analysis.

A summary of QA/QC samples collected during this investigation is provided in Table 4-3. Analytical results for QA/QC samples are presented in Appendix D.

4.7 Decontamination Procedures

Decontamination procedures performed in the field were conducted in accordance with USEPA Region II guidelines. For routine sample collection equipment, the following steps were implemented:

- Clean with potable water and low-phosphate detergent
- Tap water rinse
- 10 percent nitric acid solution rinse
- Tap water rinse
- Methanol followed by a hexane or acetone rinse
- Analyte-free deionized water rinse
- Air dry
- Wrap in aluminum foil, shiny side out, for storage or transport

4.8 Field Conditions at OU 1, OU 6 and OU 7

The following sections discuss field conditions present at OUs 1, 6, and 7 during the sampling effort, including subsurface soil conditions, depth to groundwater, etc. Any deviations from the original scope of work as outlined in the Final Work Plans have been noted. Figures 4-1 to 4-18 present RFI sampling locations. It should be noted that previous sampling locations have been retained on these figures to show their relationship to the current sampling locations. However, sample numbers for previous sampling locations have been deleted on these figures to minimize confusion with RFI sample locations.

4.8.1 Operable Units 1 and 6

4.8.1.1 SWMU 6/AOC B - Building 145 Storage Area/Building 25

Sampling activities at SWMU 6 included the collection of five surface soils (two surface soils samples and three surface soil samples associated with the soil borings), three subsurface soils (one sample from three borings) and one surface water sample. Sample locations are presented on Figure 4-1. Subsurface samples were collected using standard drilling techniques (i.e., hollow-stem augers and split-spoon samples). The single surface water sample was collected from standing water observed at the east end of Building 145. All environmental samples collected from this SWMU were analyzed for the full Appendix IX parameter list as presented on Table 4-2.

Clay and silt were encountered in the SWMU 6 soil borings. Refusal was met at 52 feet below ground surface in Boring 6SB01. Borings 6SB02 and 03 were 10 feet deep and consisted of gravel to depth.

At AOC B (OU 6), seven surface soil, eight subsurface soil and two groundwater samples were obtained for chemical analyses. Surface soil was collected from the two soil borings, three monitoring well locations (one well was not installed) and two surface soil locations. Two subsurface soils were collected from well boring ACBMW01, ACBMW03, and the two soil borings. As presented on Figure 4-1, two soil borings were advanced through the foundation pad of former Building 25.

Additionally, two groundwater monitoring wells were installed; one to the south of Building 25 and one north of Building 145. A third monitoring well (ACBMW02) was scheduled to be installed at the location presented on Figure 4-1, but was eliminated from the scope of work due to the proposed location being adjacent to an existing IR Site 10 well, 10GW03. However, a surface soil sample was obtained from this location. As with the samples collected from SWMU 6, all AOC B samples were analyzed for the full Appendix IV parameter list.

In-situ hydraulic conductivity ("slug") tests were performed on the two newly installed monitoring wells at AOC B. Rising head tests were conducted at stations ACBMW01 and ACBMW03 to determine the hydraulic conductivity of the water-bearing zone. The field data was evaluated using the Geraghty and Miller aquifer test solver (AQTESOLV Version 2.01) which employed the Bouwer and Rice (1976) method for unconfined aquifers. Results of the tests indicated a hydraulic conductivity of 18.53 feet/day at ACBMW01 and 58.93 feet/day at ACBMW03. The calculated average hydraulic conductivity for the two wells is 47.99 feet/day or 1.70x10-2. This average value falls within the range of hydraulic conductivities for a fine-grained sand.

4.8.1.2 SWMU 10 - Substation 10/Building 2

A total of four borings for groundwater collection were originally intended to be advanced at this SWMU; however, only three borings (10HP01, 10HP02, and 10HP03) were advanced due to a lack of groundwater present at this location. Three attempts were made to advance a boring at the fourth location (north of Building 90); however, refusal was encountered at a depth of six feet with no groundwater observed. All borings at SWMU 10 were advanced using the GeoProbe System to assess the potential for PCBs in groundwater following the remediation of contaminated surface and shallow subsurface soils. Borings were advanced along the west side of Forrestal Drive towards Ensenada Honda (in the apparent downgradient direction) to determine if potential contaminants were present in groundwater. Sampling stations are presented on Figure 4-2.

Subsurface soil in the vicinity of the three borings consisted of silty clay, sandy silt, and silty, fine-grained sand, respectively. Refusal at apparent top of bedrock was encountered at depths of 14 feet (10HP01 and 10HP03) and 8 feet (10HP02).

Groundwater was obtained at a depth of 12 feet at 10HP01 and at 5.5 feet at 10HP02. After several attempts, sufficient groundwater was encountered at 10HP03 at a depth of 11 ft.

Of the three stations, only 10HP02, provided enough water to allow a full sample set (VOCs, SVOCs, and PCBs) to be obtained. At the remaining two stations, only VOCs were collected due to slow recharge.

4.8.1.3 SWMU 12 - Fire Training Pit Oil/Water Separator

A total of four surface soil samples were collected from this SWMU during two separate sampling events (Figure 4-3). The first event, in September 1995, included the collection of surface soil samples 12SS01 and 12SS02. The second event was conducted in March 1996 and included samples 12SS03 and 12SS04. These samples were obtained to determine if a release had occurred from the oil/water separator; and, if so, its affect on the surrounding surface soil. All samples were analyzed for VOCs, SVOC, PCBs, and TPH (gas and diesel fractions).

4.8.1.4 SWMU 13 - Old Pest Control Shop/Building 258

A total of nine surface soil samples and five sediment samples were collected from at this SWMU. Sample locations are presented on Figure 4-4. Of the nine surface soil samples, four samples (13SS01 through 13SS04) were collected from the area surrounding existing well 18GW02 and analyzed for arsenic only to address concerns arising from a single elevated arsenic level seen at this location during a previous investigation. The remaining surface soil samples were collected south of the concrete pad and analyzed for the full Appendix IX list.

Five sediment samples were collected along the drainage swale which parallels Forrestal Drive. These samples also were analyzed for the full Appendix IX list.

4.8.1.5 SWMU 14 - Fire Training Pit Area

A limited soil gas survey was conducted along the immediate perimeter of the Fire Training Pit. A total of 50 sampling nodes spaced along two concentric rings around the pit. The first ring was established three feet from the edge of the concrete apron while the second ring was established at a distance of 10 feet. Each ring contained 25 sampling nodes.

Each sampling node (generated by driving a metal pin one to two feet into the ground) was screened by inserting the tip of the photoionization detector (PID) and recording the results in a field log book. Soil gas measurements for SWMU 14 are presented on Table 4-4. A total of five surface soil samples (Figure 4-3) were collected at the locations which exhibited the highest PID reading which ranged from 21.14 parts per million (ppm) to 79.2 ppm. The five surface soil samples (14SS01 through 14SS05) were analyzed for VOCs, SVOCs, PCBs, and TPH (gas and diesel fractions).

4.8.1.6 SWMU 23 - Oil Spill Separator Tanks

Two surface soil samples were collected at the locations shown on Figure 4-5 to assess the potential for contamination of surface soil due to overflow from this unit. Samples 23SS01 and 23SS02 were analyzed for VOCs, SVOCs, and total petroleum hydrocarbons (TPH).

4.8.1.7 SWMU 24 - Oil Spill Oil/Water Separator

In conjunction with the sampling at SWMU 23, a single surface soil sample (24SS01) was collected at SWMU 24 as presented on Figure 4-5 in an area where noticeable staining was observed. This sample was analyzed for VOCs, SVOCs, and TPH.

4.8.1.8 SWMU 25 - DRMO Storage Yard

A total of nine surface soil samples and one sediment sample was collected at this SWMU to investigate an area of past releases observed to the west of Building 2009 (Figure 4-6). The single sediment sample (25SD01) was collected in the drainage swale adjacent to the area where surface samples were obtained to assess potential contaminant migration into the swale.

4.8.1.9 SWMU 26 - Building 544 Area

A 10-foot grid system was established for the purpose of conducting a soil gas survey at this site. The soil gas survey grid is presented on Figure 4-7. Since no detectable levels of volatile organic vapors were detected, five soil samples (26SS01 through 26SS05) were collected at the locations originally proposed in the Work Plan. To determine if the past storage of drums has affected surface soil at the site, three samples (26SS01 to 26SS03) were collected in the former storage area and two samples (26SS04 and 26SS05) were collected from the soil pile along the southeast perimeter. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals.

4.8.1.10 SWMU 30 - Former Incinerator

Six surface soil and two groundwater samples were collected at this site. The surface soil samples (30SS01 through 30SS06) were collected at the locations shown on Figure 4-8 to characterize potential surface soil contamination. Groundwater samples were obtained from two existing monitoring wells, 1983-DW1 and 1983-MW3, to assess whether non-petroleum contaminants have entered the groundwater (contamination by petroleum was previously confirmed during UST program investigations). Surface soil samples were analyzed for VOCs, SVOCs, and RCRA metals, whereas the groundwater samples were analyzed for the full Appendix IX list.

4.8.1.11 SWMU 31 - Waste Oil Collection Area/Building 31 and 2022

A series of eight surface soil samples and four subsurface soil samples taken in four shallow soil borings were obtained from this SWMU. Four surface soil samples, 31SS01 through 31SS04, were collected from the covered storage area located at the northwest corner of Building 31 (Figure 4-9). An additional four surface soil samples (31SB01 to 31SB04) were collected at the four soil borings advanced along the perimeter of the bermed storage pad situated adjacent to Building 2022. The surface soil samples collected at the boring locations were collected from directly below the asphalt and sub-base.

Subsurface samples from these borings included:

- 31SB01-02 (depth of 4 to 6 feet)
- 31SB02-03 (depth of 6 to 8 feet)
- 31SB03-04 (depth of 8 to 10 feet)
- 31SB04-02 (depth of 4 to 6 feet)

One subsurface sample, from each boring was collected from directly above bedrock. The Work Plans originally called for the collection of two subsurface soil samples; however, the shallow depth to bedrock prevented the collection of the second sample. All soil samples collected from this site were analyzed for the full Appendix IX list, as well as TPH.

Subsurface soil at SWMU 31 consisted primarily of silty, fine-grained sand with varying amounts of clay and rock fragments. Each of the four borings were terminated at refusal without encountering groundwater. Boring depths ranged from 6 feet at 31SB04 to 10 feet at 31SB03.

4.8.1.12 SWMU 32 - PWD Storage Yard/Battery Collection Area/Building 31

To assess this site for potential environmental impacts from past operations, a series of four soil borings were advanced using the GeoProbe System as shown in Figure 4-9. In addition to collection of subsurface soil samples, surface soil samples (from 0 to 1 foot depth) also were obtained. As with the borings at SWMU 31, two subsurface samples were to be collected; however, the shallow depths to bedrock prevented the collection of the second sample. Each sample was analyzed for the full Appendix IX list and TPH.

Subsurface conditions at this SWMU were very similar to conditions at SWMU 31 except that refusal was encountered at shallower depths (from 2.0 feet at 32SB02 and 32SB03 to 4 feet at 32SB04). This condition would appear to make sense since this location is much closer to the toe of a hill than SWMU 31.

Subsurface samples from the four borings advanced at SWMU 32 (32SB01 through 32SB04) included:

- 32SB01-01 (depth of 0 to 2 feet)
- 32SB02-02 (depth of 0 to 2 feet)
- 32SB03-03 (depth of 0 to 2 feet)
- 32SB04-04 (depth of 2 to 4 feet)

4.8.1.13 SWMU 37 - Waste Oil Storage Area/Building 200

A total of four surface soil samples (37SS01 to 37SS04) were collected at this site at locations as presented in Figure 4-10. The Work Plans originally had proposed the collection of only three surface soil samples; however, visual inspection of the perimeter of the SWMU yielded stained soil opposite a drain necessitating the collection of one additional sample (37SS04). The four samples were analyzed for VOCs, SVOCs, and PCBs.

4.8.1.14 SWMU 39 - Former Battery Drain Area/Building 3158

Two surface soil samples (39SS01 and 39SS02) were obtained at the locations presented on Figure 4-11. Both samples were analyzed for RCRA metals only.

4.8.1.15 SWMU 46 - Pole Storage Yard Covered Pad

The assessment of SWMU 46 involved the collection of eleven surface soil samples, four subsurface soil samples and two wipe samples. Nine surface soil samples were collected at the locations shown on Figure 4-12. Of these nine samples, two (46SS01 and 46SS02) were analyzed for the full Appendix IX list while the remaining samples were analyzed for VOCs, SVOCs, PCBs, and RCRA metals. Two additional surface soil samples were collected in conjunction with the two soil borings in the area between SWMU 46 and AOC C.

Subsurface samples collected from the two borings at SWMU 46 (46SB01 and 46SB02) included:

- 46SB01-03 (depth of 4 to 6 feet)
- 46SB01-06 (depth of 10 to 11 feet)
- 46SB02-03 (depth of 4 to 6 feet)
- 46SB02-06 (depth of 10 to 12 feet)

Of the four subsurface soil samples obtained from the two borings, two (46SB01-06 and 46SB02-03) were analyzed for the full Appendix IX list while the remaining two samples were analyzed for VOCs, SVOCs, PCBs, and RCRA metals.

Two wipe samples (46WS01 and 46WS02) from the covered, concrete pad were submitted for PCB analysis.

Subsurface soils at the site consisted of an upper zone of silt and clay to a depth of approximately seven feet followed by a clayey silt and sand zone; groundwater was not encountered in either boring. Refusal (presumably at bedrock) was encountered at a depths of 11 and 12 feet at 46SB01 and 46SB02, respectively.

4.8.1.16 SWMU 51 - New AIMD Storage Pad/Building 379

A series of five surface soil samples were collected at SWMU 51. These samples, 51SS01 through 51SS05, were analyzed for VOCs and SVOCs only. Locations of the surface soil samples are shown on Figure 4-13.

4.8.1.17 Area of Concern (AOC) C - Transformer Storage Pad

Activities conducted at this site included the collection of 12 surface soil samples and seven PCB wipe samples from the three storage pads. The locations of the samples are presented on Figure 4-12. Of the 12 surface soil samples, three (ACSS01, 02, and 03) were analyzed for the full Appendix IX list while the remaining nine samples (ACSS04 through ACSS12) were analyzed for VOCs, SVOCs, PCBs, and RCRA metals.

4.8.2 Operable Unit 7

The sediments of Ensenada Honda, which comprise AOC D, are of concern based on: 1) recurring soil spills in the harbor; 2) presence of outfalls which have formerly discharged wastes containing hazardous constituents; 3) possibility of fuel-contaminated groundwater discharging at the Tow Way Fuel Farm; and 4) presence of three landfills abutting the Honda which may be discharging hazardous constituents through erosional flow or subsurface leachate migration.

Investigation of the sediments was designed around the existing SWMUs which essentially ring the Honda (SWMUs 1, 2, 3, 7, and 11/45). Sampling conducted off-shore from the SWMUs was selected based on the likelihood that the most severely impacted sediments would be immediately off-shore from the potential sources of contaminants. Sampling for AOC D in this manner was contained within the approved RFI project plans.

This section of the report, summarizing investigatory efforts for AOC D (Operable Unit 7), is presented by SWMU, (referencing the SWMUs immediately adjacent to the Honda at specific locations). This reflects the manner in which field investigations were conducted and allows for ease of presentation. It should be noted; however, that risks posed by the Honda (Section 6.0) were assessed for the entire Operable Unit.

4.8.2.1 SWMU 1 - Army Cremator Disposal Site

Three sediment samples (1SD01 to 1SD03) were collected at this site at the locations presented on Figure 4-14. These samples were obtained at the boundary between land and the mangrove swamps in an attempt to determine if releases from the former disposal area were impacting the mangrove swamps. The sediment samples were analyzed for the full Appendix IX list, nitramine compounds, and asbestos.

4.8.2.2 SWMU 2 - Langley Drive Disposal Site

Similar to the sampling scheme associated with SWMU 1, three sediment samples were collected at this site (Figure 4-15). These samples (2SD01 to 2SD03) also were analyzed for the full Appendix IX list, nitramine compounds, and asbestos.

4.8.2.3 SWMU 3 - Base Landfill

A total of 17 samples were to be collected; however, the locations of two samples were in an area which had recently been filled in. This area, located along the northeast corner of the SWMU, apparently has been receiving fill to extend the shoreline away from the CPO Hut. Therefore, a total of 15 sediment samples (3SD01 to 3SD15) were obtained along the perimeter of this SWMU at the locations shown in Figure 4-16. All samples were analyzed for the full Appendix IX list, nitramine compounds, and asbestos.

4.8.2.4 SWMU 7 - Tow Way Fuel Farm

Only four of the five sediment samples originally included in the work plan were collected from Ensenada Honda. The fifth sample location, off the Army pier, was situated in an area which had been dredged to allow access to the pier. Hence, any potentially contaminated sediments have been removed; thus, the fifth sample was not collected. The four sediment samples (7SD01 to 7SD04) were analyzed for the full Appendix IX list. Figure 4-17 shows indicates the sediment sample locations.

4.8.2.5 SWMU 11/45 - Old Power Plant/Building 38

Three sediment samples were collected associated with SWMU 11. The workplan indicated that the samples should be taken near the discharge tunnel outfall. This could not be located and the sampling points were moved to Puerca Bay at the terminus of the intake tunnel. While the originally planned sampling locations were not sampled, samples from SWMU 3 (specifically samples 3SD02 and 3SD03) are located in the general area where the discharge tunnel should have its outfall. As shown on Figure 4-18, samples 11SD01 through 11SD03 were analyzed for VOCs, SVOCs, PCBs, and RCRA metals.

SECTION 4.0 TABLES

TABLE 4-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAMS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SWMU/AOC	MEDIA	NUMBER OF SAMPLES	ANALYSIS	ANALYTICAL METHOD
1	Surface Soil	16	Appendix IX (1) Explosives Asbestos	See (1) 8330 600/M4-E2-020
	Subsurface Soil	16	Appendix IX (1) Explosives Asbestos	See (1) 8330 600/M4-E2-020
	Sediment	3 (from Ensenada Honda) 3 (from surface drainage)	Appendix IX (1) Explosives Asbestos Total Organic Carbon	See (1) 8330 600/M4-E2-020 415.1
	Surface Water	3 (surface drainage)	Appendix IX (1) Explosives Asbestos Hardness	See (1) 8330 600/M4-E2-020 130.2
	Groundwater	8	Appendix IX (1) Explosives Asbestos Sodium pH Specific Conductance Temperature	See (1) 8330 600/M4-E2-020 6010/7770 9040 9050 170.1
2	Surface Soil	8	Appendix IX (1) Explosives Asbestos	See (1) 8330 600/M4-E2-020
	Subsurface Soil	16	Appendix IX (1) Explosives Asbestos	See (1) 8330 600/M4-E2-020
	Sediment	2 (from Ensenada Honda) 3 (from surface drainage)	Appendix IX (1) Explosives Asbestos Total Organic Carbon	See (1) 8330 600/M4-E2-020 415.1

Note: (1) List of Appendix IX parameters and method numbers presented on Table 9-1.

TABLE 4-1 (CONTINUED)

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAMS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SWMU/AOC	MEDIA	NUMBER OF SAMPLES	ANALYSIS	ANALYTICAL METHOD
2	Surface Water	3 (from surface drainage)	Appendix IX (1) Explosives Asbestos Hardness	See (1) 8330 600/M4-E2-020 130.2
	Groundwater	4	Appendix IX (1) Explosives Asbestos pH Specific Conductance Temperature	See (1) 8330 600/M4-E2-020 9040 9050 170.1
		1	Corrective Measures Data: Eh Total Organic Carbon Chemical Oxygen Demand Total Suspended Solids	 - - 415.1 SM 508B EPL 160.2
3	Surface Soil	16	Appendix IX (1) Explosives Asbestos	See (1) 8330 600/M4-E2-020
	Subsurface Soil	12	Appendix IX (1) Explosives Asbestos	See (1) 8330 600/M4-E2-020
	Surface Water	5 (from leachate breakout) 5 (from surface drainage)	Appendix IX (1) Explosives Asbestos Hardness	See (1) 8330 600/M4-E2-020 130.2
	Sediment	17 (from bay) 5 (from leachate breakout) 5 (from surface drainage)	Appendix IX (1) Explosives Asbestos Total Organic Carbon	8240 8250 8080 415.1

List of Appendix IX parameters and method numbers presented on Table 9-1.

TABLE 4-1 (CONTINUED)

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAMS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SWMU/AOC	MEDIA	NUMBER OF SAMPLES	ANALYSIS	ANALYTICAL METHOD
3	Groundwater	8	Appendix IX (1) Explosives Asbestos pH Specific Conductance Temperature	See (1) 8330 600/M4-E2-020 9040 9050 170.1
7	Sediment	5	Appendix IX (1) Total Organic Carbon	See (1) 415.1
8	Subsurface Soil	21	Total Petroleum Hydrocarbons	Modified 8015
9	Surface Soil	6	Volatiles Semivolatiles RCRA Metals Total Petroleum Hydrocarbons	8240 8270 SW-846 Modified 8015
	Subsurface Soil	44	Volatiles Semivolatiles RCRA Metals Total Petroleum Hydrocarbons	8240 8270 SW-846 Modified 8015
		1	Corrective Measures Data: Grain Size (hydrometer) Moisture Content Total Organic Carbon pH Eh Biological Oxygen Demand Chemical Oxygen Demand Humic Content	 ASTM D422 ASTM D698 415.1 904.5 -- 405.1 SM 508B --

1) Appendix IX parameters and method numbers presented on Table 9-1.

TABLE 4-1 (CONTINUED)

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAMS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SWMU/AOC	MEDIA	NUMBER OF SAMPLES	ANALYSIS	ANALYTICAL METHOD
9	Groundwater	14	Volatiles Semivolatiles RCRA Metals pH Specific Conductance Temperature Total Petroleum Hydrocarbons	8240 8270 SW-846 9040 9050 170.1 Modified 8015
		1	Corrective Measures Data: Oil and Grease Total Suspended Solids pH Eh Total Organic Carbon Chemical Oxygen Demand Biological Oxygen Demand Nitrogen Phosphorous	 413.1 160.2 9045 - - 415.1 SW 508B 405.1 350.2 365.2
11/45	Concrete (Wipe Samples)	56	PCBs	8080
	Surface Soil	4	Volatiles Semivolatiles PCBs RCRA Metals	8240 8270 8080 SW-846
	Subsurface Soil	8	Volatiles Semivolatiles PCBs RCRA Metals	8240 8250 8080 SW-846
	Sediment (From Cooling Tunnels)	17	Volatiles Semivolatiles PCBs RCRA Metals	8240 8270 8080 SW-846
	Groundwater	8	Volatiles Semivolatiles PCBs RCRA Metals	8240 8270 8080 SW-846

Note: (1) Appendix IX parameters and method numbers presented on Table 9-1.

TABLE 4-1 (CONTINUED)

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAMS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SWMU/AOC	MEDIA	NUMBER OF SAMPLES	ANALYSIS	ANALYTICAL METHOD
AOC B	Surface Soil	7	Appendix IX (1) Asbestos Total Petroleum Hydrocarbons	See (1) 600/M4-E2-020 Modified 8015
	Subsurface Soil	10	Appendix IX (1) Total Petroleum Hydrocarbons	See (1) Modified 8015
		1	Corrective Measures Data: Grain Size (hydrometer) Moisture Content Total Organic Carbon pH Eh Biological Oxygen Demand Chemical Oxygen Demand Humic Content	 ASTM D422 ASTM D698 415.1 904.5 - - 405.1 SM 508B - -
	Groundwater	3	Appendix IX (1) Total Petroleum Hydrocarbons pH Specific Conductance Temperature	See (1) Modified 8015 9040 9050 170.1
		1	Corrective Measures Data: Eh Total Organic Carbon Chemical Oxygen Demand Total Suspended Solids	 - - 415.1 SM 508B 160.2
6	Surface Soil	5	Appendix IX (1)	See (1)
	Subsurface Soil	6	Appendix IX (1)	See (1)

Note: (1) Appendix IX parameters and method numbers presented on Table 9-1.

TABLE 4-1 (CONTINUED)

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAMS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SWMU/AOC	MEDIA	NUMBER OF SAMPLES	ANALYSIS	ANALYTICAL METHOD
10	Groundwater	4	Volatiles Semivolatiles PCB pH Specific Conductance	8240 8270 8080 9040 9050
12	Surface Soil	4	Volatiles Semivolatiles PCB Total Petroleum Hydrocarbons	8240 8270 8080 Modified 8015
13	Surface Soil	4	Appendix IX (1)	See (1)
		4	Arsenic	SW-846
	Sediment	5	Appendix IX (1)	See (1)
14	Surface Soil	5	Volatiles Semivolatiles PCBs Total Petroleum Hydrocarbons	8240 8270 8080 Modified 8015
23	Surface Soil	2	Volatiles Semivolatiles Total Petroleum Hydrocarbons	8240 8270 Modified 8015
24	Surface Soil	1	Volatiles Semivolatiles Total Petroleum Hydrocarbons	8240 8250 Modified 8015
25	Surface Soil	9	Appendix IX (1)	See (1)
	Sediment	1	Appendix IX (1)	See (1)

Note: (1) Appendix IX parameters and method numbers presented on Table 9-1.

TABLE 4-1 (CONTINUED)

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAMS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

26	Surface Soil	5	Appendix IX (1)	See (1)
30	Surface Soil	2	Appendix IX (1)	See (1)
		3	Volatiles Semivolatiles RCRA Metals	8240 8270 SW-846
	Groundwater	2	Appendix IX	See (1)
31	Surface Soil	4 Bldg. 2022	Appendix IX Total Petroleum Hydrocarbons	See (1) Modified 8015
	Subsurface Soil	8 Bldg. 2022	Appendix IX Total Petroleum Hydrocarbons	See (1) Modified 8015
	Surface Soil	4 Bldg. 31	Appendix IX (1) Total Petroleum Hydrocarbons	See (1) Modified 8015
32	Surface Soil	4	Volatiles Semivolatiles PCBs RCRA Metals	8240 8270 8080 SW-846
	Subsurface Soil	8	Volatiles Semivolatiles PCBs RCRA Metals	8240 8270 8080 SW-846
	Sediment	1	Appendix IX (1)	See (1)
37	Surface Soil	3	Volatiles Semivolatiles PCBs	8240 8270 8080
39	Surface Soil	2	RCRA Metals	SW-846
46	Surface Soil	3	Appendix IX (1)	See (1)
		9	Volatiles Semivolatiles PCBs RCRA Metals	8240 8270 8080 SW-846
	Subsurface Soil	2	Appendix IX (1)	See (1)
		2	Volatiles Semivolatiles PCBs RCRA Metals	8240 8270 8080 SW-846
	Concrete (Wipe Samples)	2	PCBs	8080

Note: Appendix IX parameters and method numbers presented on Table 9-1.

TABLE 4-1 (CONTINUED)

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAMS
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

51	Surface Soil	5	Volatiles Semivolatiles	8240 8270
AOC C	Surface Soil	3	Appendix IX (1)	See (1)
		9	Volatiles Semivolatiles PCBs RCRA Metals	8240 8270 8080 SW-846
	Concrete (Wipe Samples)	12	PCBs	8080
Background	Surface Soil	4	Appendix IX (1)	8240
	Subsurface Soil	8	Appendix IX (1)	8080
	Groundwater	4	Appendix IX (1)	

Note: (1) Appendix IX parameters and method numbers presented on Table 9-1.

TABLE 4-2

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	100	100	8240
Acetonitrile	100	100	8240
Acrolein	5	5	8240
Acrylonitrile	5	5	8240
Methyl Chloride	100	100	8240
Benzene	5	5	8240
Bromodichloromethane	10	10	8240
Bromoform	5	5	8240
Bromomethane	10	10	8240
Carbon Disulfide	5	5	8240
Carbon Tetrachloride	5	5	8240
Chlorobenzene	5	5	8240
2-Chloro-1,3-butadiene	5	5	8240
Chloroethane	10	10	8240
Chlorodibromomethane	5	5	8240
Chloroform	5	5	8240
Chloromethane	10	10	8240
3-Chloropropene	5	5	8240
1,2-Dibromo-3-chloropropane	5	5	8240
Dibromomethane	5	5	8240
trans-1,4-dichloro-2butene	100	100	8240
Dichlorodifluoromethane	5	5	8240
Dibromomethane	5	5	8240
1,1-Dichloroethane	5	5	8240
1,2-Dichloroethane	5	5	8240
trans-1,2-Dichloroethylene	5	5	8240
1,1-Dichloroethylene	5	5	8240
Dichloromethane	5	5	8240
1,2-Dichloropropane	5	5	8240
cis-1,3-Dichloropropene	5	5	8240
trans-1,3-Dichloropropene	5	5	8240
1,4-Dioxane	150	150	8240

TABLE 4-2 (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	5	8240
Ethyl cyanide	100	100	8240
Ethyl methacrylate	5	5	8240
2-Hexanone	50	50	8240
Iodomethane	5	5	8240
Isobutyl alcohol	50	50	8240
Methacrylonitrile	100	100	8240
Methyl ethyl ketone	100	100	8240
Methyl methacrylate	5	50	8240
4-Methyl-2-pentanone	50	50	8240
Pentachloroethane	10	10	8240
Styrene	5	5	8240
1,1,1,2-Tetrachloroethane	5	5	8240
1,1,2,2-Tetrachloroethane	5	5	8240
Tetrachloroethene	5	5	8240
Toluene	5	5	8240
1,1,1-Trichloroethane	5	5	8240
1,1,2-Trichloroethane	5	5	8240
Trichloroethene	5	5	8240
Trichlorofluoromethane	5	NA	8240
1,2,3-Trichloropropane	5	5	8240
Vinyl Acetate	50	50	8240
Vinyl Chloride	10	10	8240
Xylene	5	5	8240

* 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 4-2 (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	660	8270
Acenaphthylene	10	660	8270
Acetophenone	10	NA	8270
2-Acetylaminofluorene	20	NA	8270
4-Aminobiphenyl	20	NA	8270
Aniline	10	NA	8270
Anthracene	10	660	8270
Aramite	20	NA	8270
Benzo(a)anthracene	10	660	8270
Benzo(b)fluoranthene	10	660	8270
Benzo(k)fluoranthene	10	660	8270
Benzo(g,h,i)perylene	10	660	8270
Benzo(a)pyrene	10	660	8270
Benzyl alcohol	20	1,300	8270
Bis(2-chloroethoxyl)methane	10	660	8270
Bis(2-chloroethyl)ether	10	660	8270
Bis(2-chloro-1-methyl ethyl)ether	10	660	8270
Bis(2-ethylhexyl)phthalate	10	660	8270
4-Bromophenyl phenyl ether	10	660	8270
Butyl benzyl phthalate	10	660	8270
p-Chloroaniline	20	1,300	8270
Chlorobenzilate	10	NA	8270
p-Chloro-m-cresol	20	1,300	8270
2-chloronaphthalene	10	660	8270
2-Chlorophenol	10	660	8270
4-chlorophenyl phenyl ether	10	660	8270
Chrysene	10	660	8270
o,m,p-Cresol	10	660	8270
Diallate	10	NA	8270
Dibenzofuran	10	660	8270
Di-n-butyl phthalate	10	660	8270
Dibenzo(a,h)anthracene	10	660	8270

TABLE 4-2 (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	660	8270
m-Dichlorobenzene	10	660	8270
p-Dichlorobenzene	10	660	8270
3,3'-Dichlorobenzidine	20	1,300	8270
2,4-Dichlorophenol	10	660	8270
2,6-Dichlorophenol	10	NA	8270
Diethylphthalate	10	660	8270
Dimethoate	20	NA	8270
p-(Dimethylamino)azobenzene	10	NA	8270
7,12-Dimethyl benz(a)anthracene	10	NA	8270
3,3-Dimethyl benzidine	10	NA	8270
dimethylphenenthylamine	10	NA	8270
2,4-dimethylphenol	10	660	8270
Dimethyl phthalate	10	660	8270
m-Dinitrobenzene	20	NA	8270
4,6-Dinitro-o-cresol	50	3,300	8270
2,4-Dinitrophenol	50	3,300	8270
2,4-Dinitrotoluene	10	660	8270
2,6-dinitrotoluene	10	660	8270
Di-n-octylphthalate	10	660	8270
Diphenylamine	10	NA	8270
Di-n-propylnitrosamine	10	NA	8270
Ethylmethanesulfonate	20	NA	8270
Fluoranthene	10	660	8270
Fluorene	10	660	8270
Hexachlorobenzene	10	660	8270
Hexachlorobutadiene	10	660	8270
Hexachlorocyclopentadiene	10	660	8270
Hexachloroethane	10	660	8270
Hexachloropropene	10	NA	8270
Indeno(1,2,3-dc)pyrene	10	660	8270
Isodrin	20	NA	8270

TABLE 4-2 (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	660	8270
Isosafrole	10	NA	8270
Kepone	20	NA	8270
Methapyrilene	100	NA	8270
3-Methylcholanthrene	10	NA	8270
Methyl methanesulfonate	10	NA	8270
2-Methylnaphthalene	10	660	8270
Naphthalene	10	660	8270
1,4-Naphthoquinone	10	NA	8270
1-Naphthylamine	10	NA	8270
2-Naphthylamine	10	NA	8270
o-Nitroaniline	50	3,300	8270
m-Nitroaniline	50	3,300	8270
p-Nitroaniline	20	NA	8270
Nitrobenzene	10	660	8270
o-Nitrophenol	10	660	8270
p-Nitrophenol	50	3,300	8270
4-Nitroquinoline-1-oxide	40	NA	8270
n-Nitrosodi-n-butylamine	10	NA	8270
n-Nitrosodiethylamine	20	NA	8270
n-Nitrosodimethyllamine	20	NA	8270
n-Nitrosodiphenylamine	10	660	8270
n-Nitrosomethylethylamine	20	NA	8270
n-Nitrosomorpholine	10	NA	8270
n-Nitrosopiperidine	20	NA	8270
n-Nitrosopyrrolidine	40	NA	8270
5-Nitro-o-toluidine	10	NA	8270
Pentachlorbenzene	10	NA	8270
Pentachloronitrobenzene	20	NA	8270
Pentachlorophenol	50	3,300	8270
Phenacetin	20	ND	8270
Phenanthrene	10	660	8270

TABLE 4-2 (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	660	8270
Phorate	10	NA	8270
p-Phenylenediamine	10	NA	8270
2-PicolinPronamidee	10	NA	8270
Pyrene	10	660	8270
Pyridine	10	NA	8270
Safrole	10	NA	8270
1,2,4,5-Tetrachlorobenzene	10	NA	8270
2,3,4,6-Tetrachlorophenol	10	N A	8270
o-Toluidine	10	NA	8270
1,2,4-Trichlorobenzene	10	660	8270
2,4,5-Trichlorophenol	10	660	8270
2,4,6-Trichlorophenol	10	660	8270
O,O,O-Triethyl-Phosphorotrioate	10	NA	8270
sym-Trinitrobenzene	10	660	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.

TABLE 4-2 (CONTINUED)

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

Pesticides	Quantitation Limits[1]		Method Number
	Water (µg/L)	Low Soil (µg/kg)	
Aldrin	0.04	2.7	8080
alpha-BHC	0.03	2	8080
beta-BHC	0.06	4	8080
delta-BHC	0.09	6	8080
Lindane	0.05	1.7	8080
Chlordane	0.14	9.4	8080
4,4'-DDT	0.12	8	8080
4,4'-DDE	0.04	2.7	8080
4,4'-DDD	0.11	7.4	8080
Dieldrin	0.02	1.3	8080
Endosulfan I	0.14	9.4	8080
Endosulfan II	0.04	2.7	8080
Endosulfan sulfate	0.66	44	8080
Endrin	0.06	4	8080
Toxaphene	2.4	160	8080
Endrin Aldehyde	0.1	3.3	8080
Heptachlor	0.03	2	8080
Heptachlor epoxide	0.83	56	8080
Methyoxychlor	1.8	120	8080
Aroclor-1016	NA	NA	8080
Aroclor-1221	NA	NA	8080
Aroclor-1232	NA	NA	8080
Aroclor-1242	0.65	44	8080
Aroclor-1248	NA	NA	8080
Aroclor-1254	NA	NA	8080
Aroclor-1260	NA	NA	8080

(1) Practical Quantitation Limits taken from "Test Methods for Evaluating Solid Wastes," USEPA, SW-846, November 1986.

NA = Not Available

TABLE 4-2 (CONTINUED)

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

Dioxins (SW-846 Method 8280)	Quantitation Limits(1)		Method Number
	Water (µg/L)	Low Soil (µg/kg)	
PCDD's	0.01	NA	8280
PCDF's	0.01	NA	8280
2,3,7,8-TCDD	0.005	0.17	8280

TABLE 4-2 (CONTINUED)

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

Analyte	Method Number	MDL (µg/L)	Method Description
Antimony	6010	32	Inductively Cupled Plasma
Arsenic	7060	1	AA Graphite Furnace
Barium	6010	2	Inductively Coupled Plasma
Beryllium	6010	0.3	Inductively Coupled Plasma
Cadmium	6010	4	Inductively Coupled Plasma
Chromium	6010	7	Inductively Coupled Plasma
Cobalt	6010	7	Inductively Coupled Plasma
Copper	6010	6	Inductively Coupled Plasma
Lead	7421	1	AA Graphite Furnace
Mercury	7470	0.2	Cold Vapor AA
Nickel	6010	40	Inductively Doupled Plasma
Selenium	7741	2	AA Graphite Furnace
Silver	6010	7	Inductively Coupled Plasma
Thallium	7841	1	AA Graphite Furnace
Tin	6010	1,000	Inductively Coupled Plasma
Vanadium	6010	8	Inductively Cuopled Plasma
Zinc	6010	2	Inductively Coupled Plasma
Cyanide	9010	5	Colorimetric
Sulfide	9030	1,000	Titrimetric, Iodine

TABLE 4-2 (CONTINUED)

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

Chlorinated Herbicides	Practical Quantitation Limits		Method Number
	Water (µg/L)	Soil/Sediment (µg/kg)	
2,4-Dichlorophenoxyacetic acid	12	804	8150
Dinoseb	0.7	46.9	8150
2,4,5-T	2	134	8150
Silvex	1.7	11.4	8150

TABLE 4-3

SUMMARY OF QA/QC SAMPLES
CTO-0277, RFI REPORT
OU #1, 6, AND 7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

QA Sample	No.	Sample No.
Trip Blank	10	TB01-09 and TB19
Rinsate Blank	2	RB01, RB02
Field Blank	2	FB01, FB02
Dupicates	9	10HP03D, 13SS07D, 25SS04D, 26SS04D, 46SS07D, 46SB01-03D, ACSS05D, 35D01D, 25D03D
MS/MSDs	10	6SS01D, ACBSB01-00D, 10HP03, 25SS04D, 25SS04, 26SS04D, 26SS04, 46SS08, 46SB01-03D, 2SD03D, 3SD01, 3SD01D

TABLE 4-4

PHOTOIONIZATION DETECTOR MEASUREMENT RESULTS
SWMU 12 SOIL GAS SURVEY
CTO-0277, RFI REPORT
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

LOCATION	TIME	PID READING	COMMENTS
A1, A2	1321, 1322	0.5, 0.5	
B1, B2	1322, 1323	0.4, 0.5	
C1, C2	1323, 1323	0.4, 0.4	
D1, D2	1323, 1324	0.4, 0.5	
E1, E2	1325, 1325	0.5, 0.4	
F1, F2	1325, 1325	0.5, 0.5	
G1, G2	1326, 1326	0.5, 0.5	
H1, H2	1326, 1327	0.8, 0.5	
I1, I2	1328, 1330	3.2, 0.5	
J1, J2	1330, 1334	**79.2**, 2.1	Sample 14SS04-00 (Grass is dead)
K1, K2	1335, 1336	**49.7**, 1.4	Sample 14SS05-00 (Grass is stressed)
L1, **L2**	1337, 1337	4.8, **21.0**	Sample 14SS06-00 (Grass is stressed)
M1, M2	1338, 1341	**64.5**, 2.1	Sample 14SS07-00
N1, N2	1341, 1342	1.5, 3.1	
O1, O2	1343, 1344	1.0, 15.1	
P1, P2	1345, 1346	1.8, 1.2	
Q1, Q2	1347, 1347	1.0, 0.8	
R1, R2	1348, 1349	0.8, 0.9	
S1, S2	1350, 1350	0.9, 0.9	
T1, T2	1350, 1351	0.9, 0.8	
U1, U2	1352, 1352	1.0, 1.0	
V1, V2	1353, 1353	1.0, 0.9	
W1, **W2**	1354, 1354	1.0, **34.5**	Sample 14SS08-00
X1, X2	1359, 1359	1.9, 1.2	
Y1, Y2	1359, 1400	1.3, 1.2	

Notes:

All concentrations in parts per million (ppm)

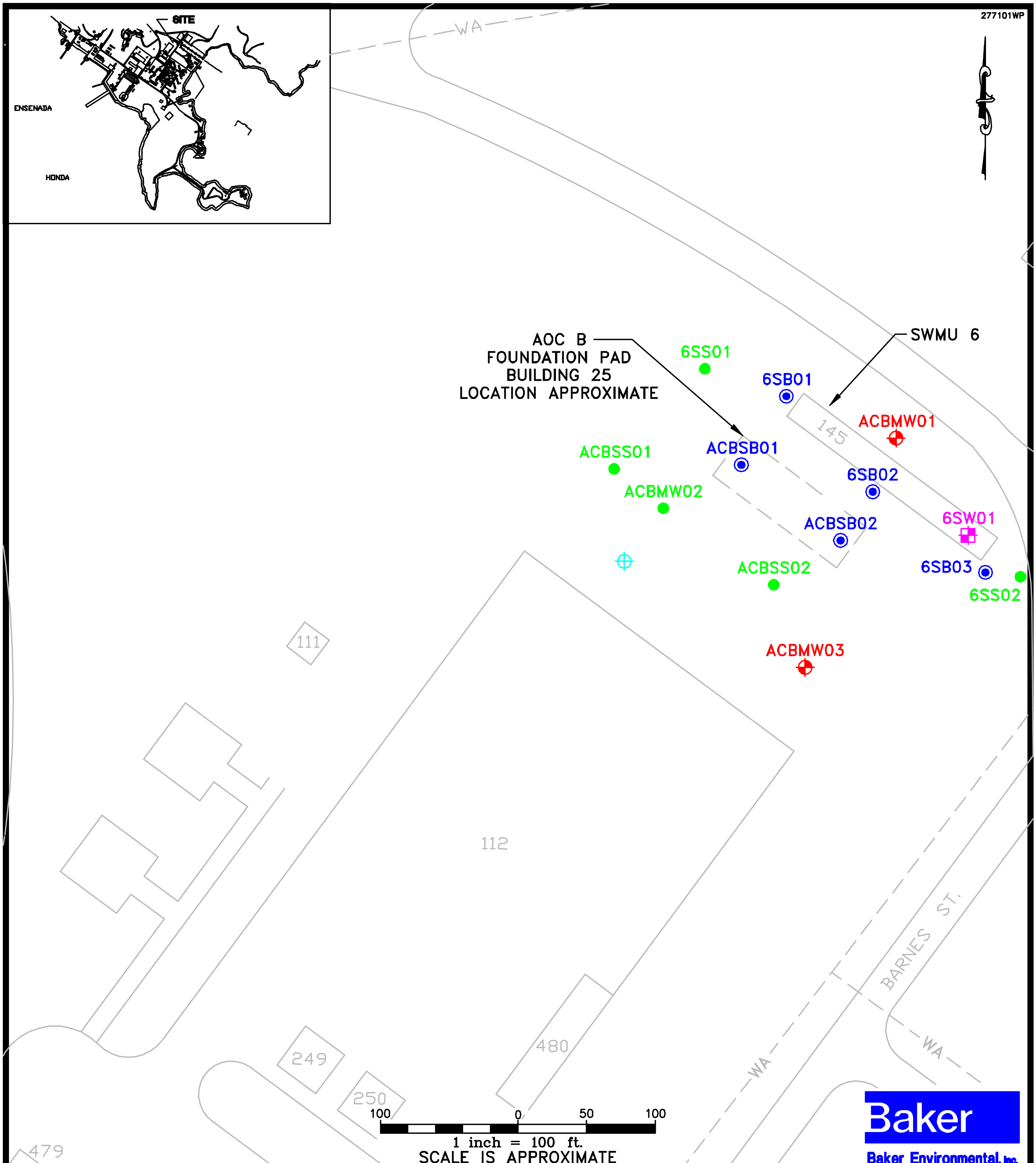
HNu Background Measurement = 0.6 ppm

Highlighted location/concentration submitted for chemical analysis

A1, B1, etc. samples obtained 3 feet from edge of concrete pit.

A2, B2, etc. samples obtained 10 feet from edge of concrete pit.

SECTION 4.0 FIGURES



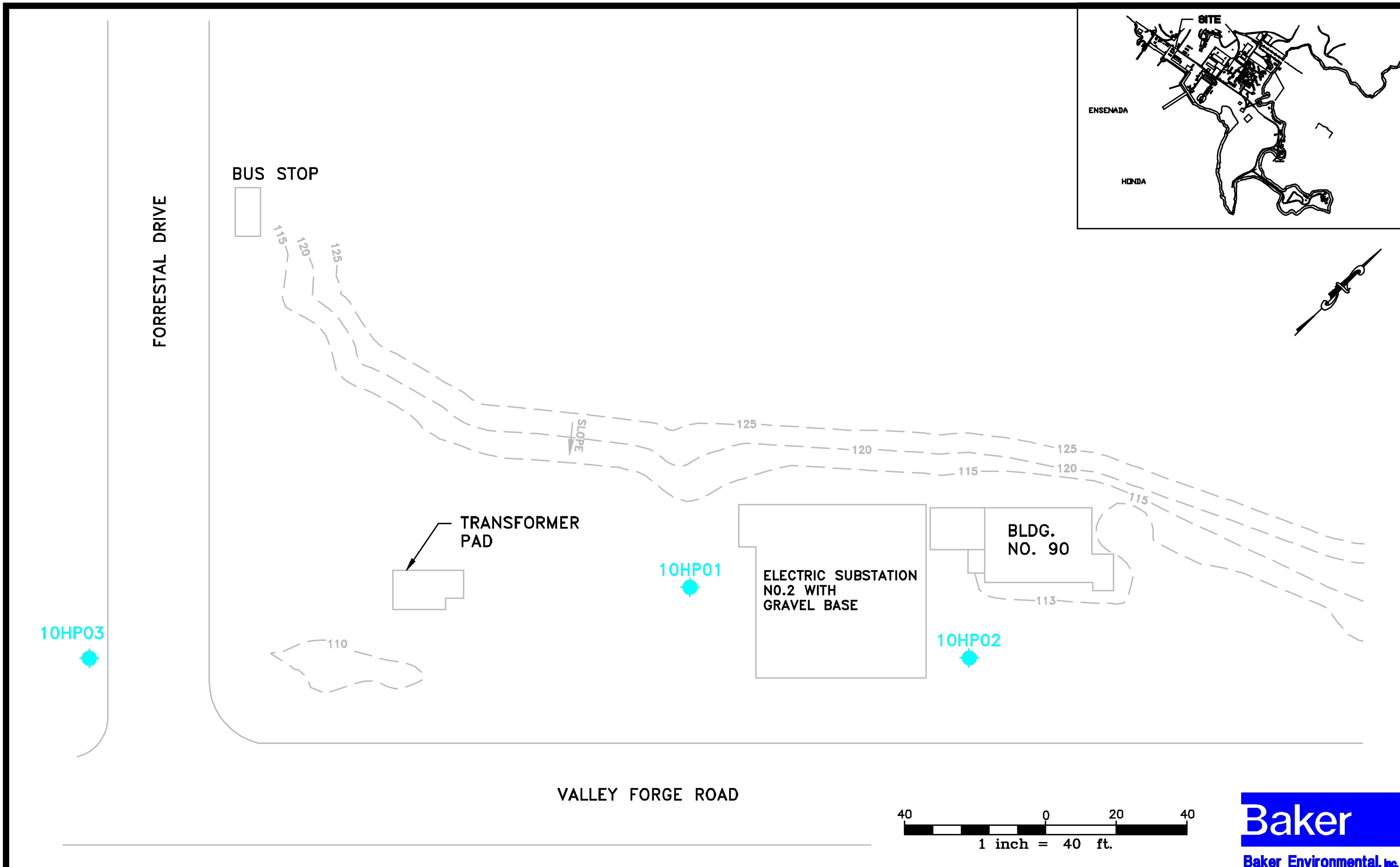
LEGEND

249	STATION STRUCTURE
—WA— —	WATERLINE
	EXISTING MONITORING WELL LOCATION (IR SITE 10 INVESTIGATION)
	MONITORING WELL LOCATION (3/96)
	SOIL BORING LOCATION (3/96)
	SOIL SAMPLING LOCATION (3/96)
	SURFACE WATER LOCATION (3/96)

SOURCE: STATION PUBLIC WORKS BASE MAP, FEB. 1992
SOURCE: BAKER ENVIRONMENTAL GPS SURVEY, NOV. 1992

FIGURE 4-1
SAMPLING LOCATIONS
OU#1 – SWMU 6 AND AOC B
BUILDING 25 STORAGE AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

120 – ESTIMATED CONTOUR LINE WITH ELEVATION

– BUILDING OR STRUCTURE

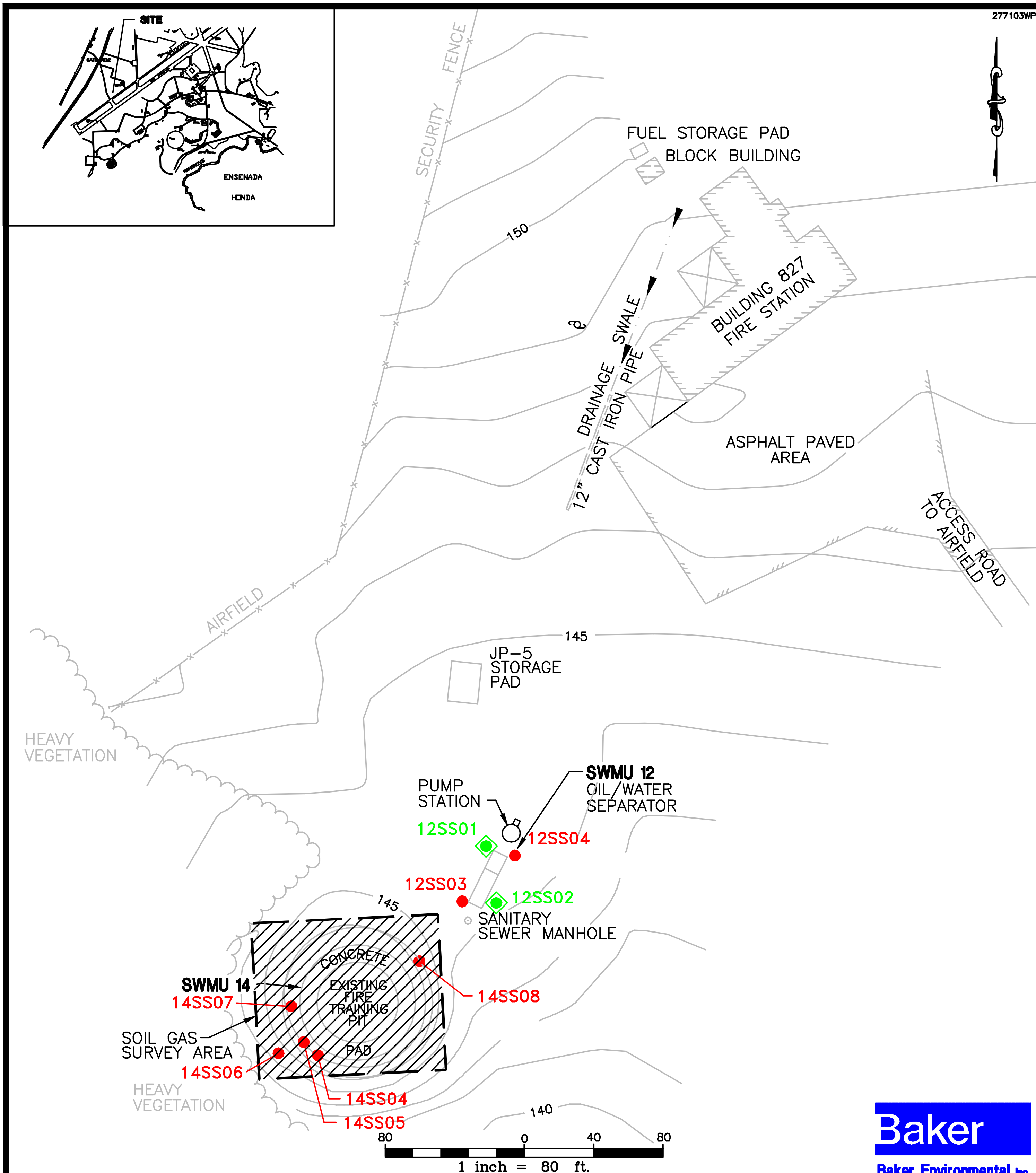
– HYDROPUNCH SAMPLE LOCATION (3/96)

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4–2
SAMPLING LOCATIONS
OU#1–SWMU 10 SUBSTATION 2/BUILDING 90

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

277102WP



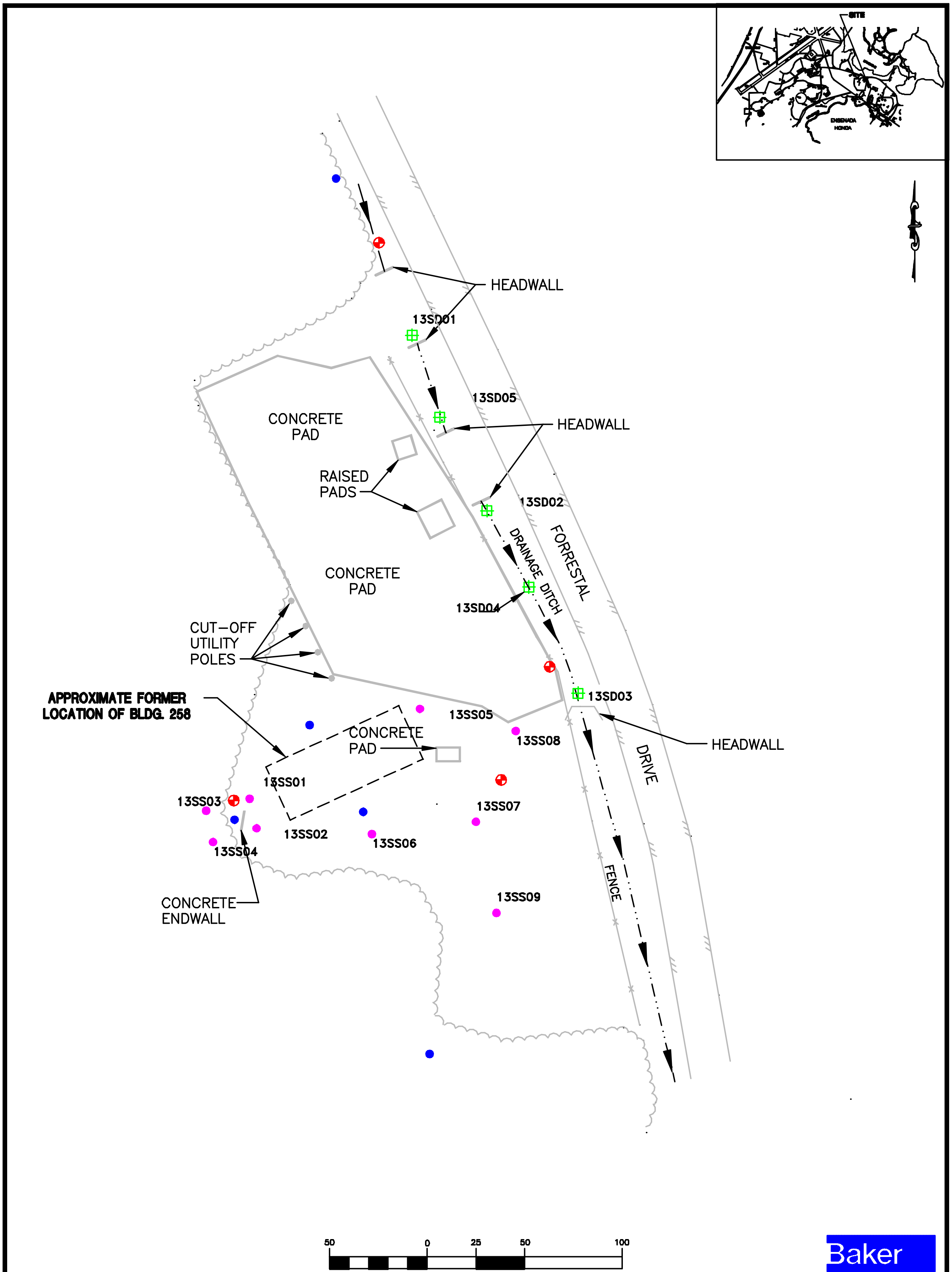
LEGEND

- 145 SURFACE ELEVATION CONTOUR
- SURFACE WATER DRAINAGE DIRECTION
- SURFACE SOIL SAMPLE COLLECTED (9-95)
- SURFACE SOIL SAMPLE COLLECTED (3-22-96)
- AREA OF SOIL GAS SURVEY

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-3
SAMPLING LOCATIONS
OU#1 - SWMU 12-FIRE TRAINING PIT OIL/WATER SEPARATOR AND SWMU 14 - FIRE TRAINING PIT AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



277104WP

Baker
Baker Environmental, Inc.

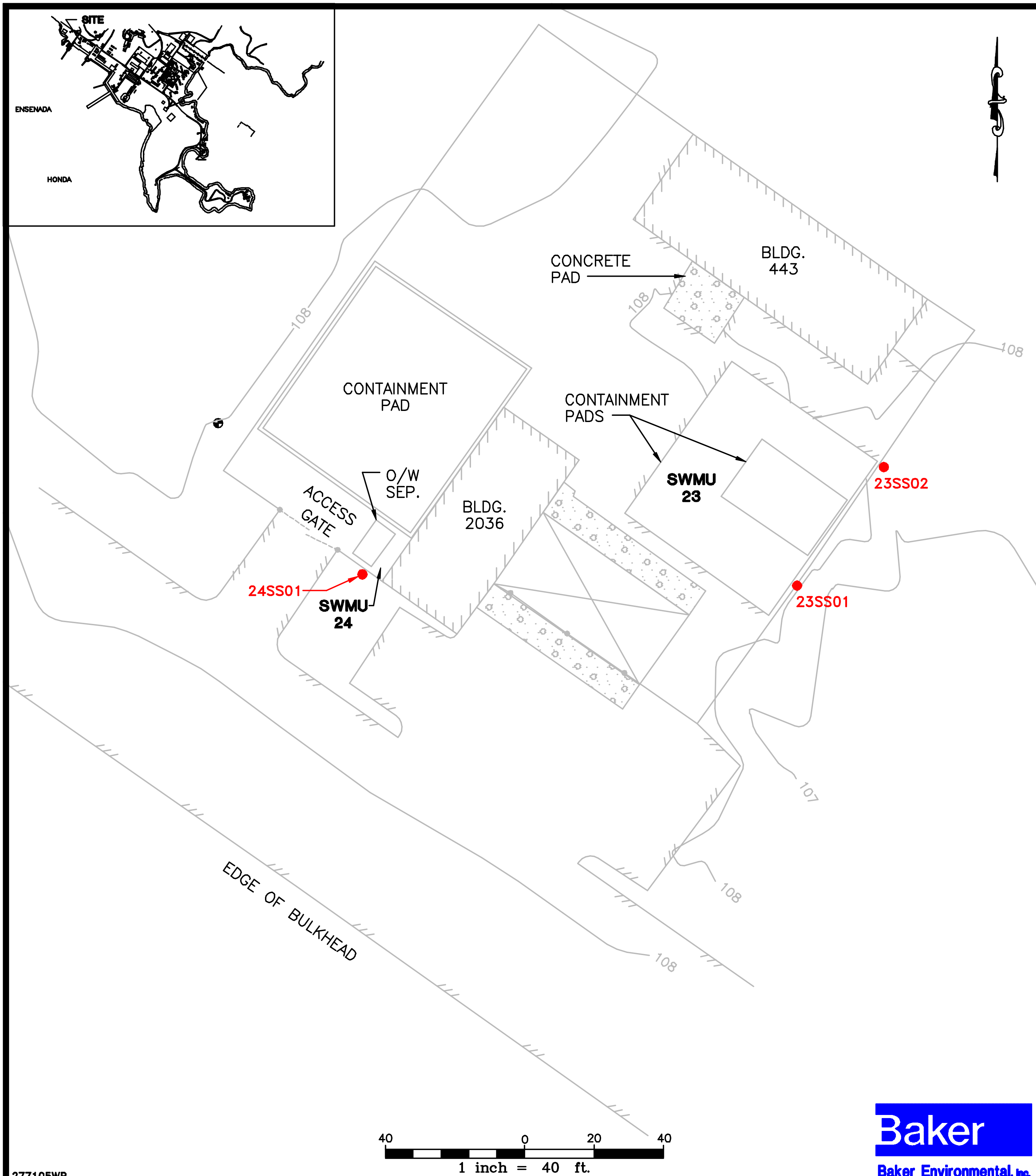
LEGEND

- EXISTING MONITORING WELL LOCATION (CONFIRMATION STUDY)
- 1992 SOIL SAMPLE LOCATIONS (APPROXIMATE)
- 1992 SEDIMENT SAMPLE LOCATION
- DRAINAGE DITCH/SURFACE DRAINAGE FLOW DIRECTION
- SEDIMENT SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION (OCT. 1995)

SOURCE: BAKER ENVIRONMENTAL, INC., MAY 1994

FIGURE 4-4
SAMPLING LOCATIONS
OU#1 – SWMU 13
PEST CONTROL SHOP AND SURROUNDING AREAS

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

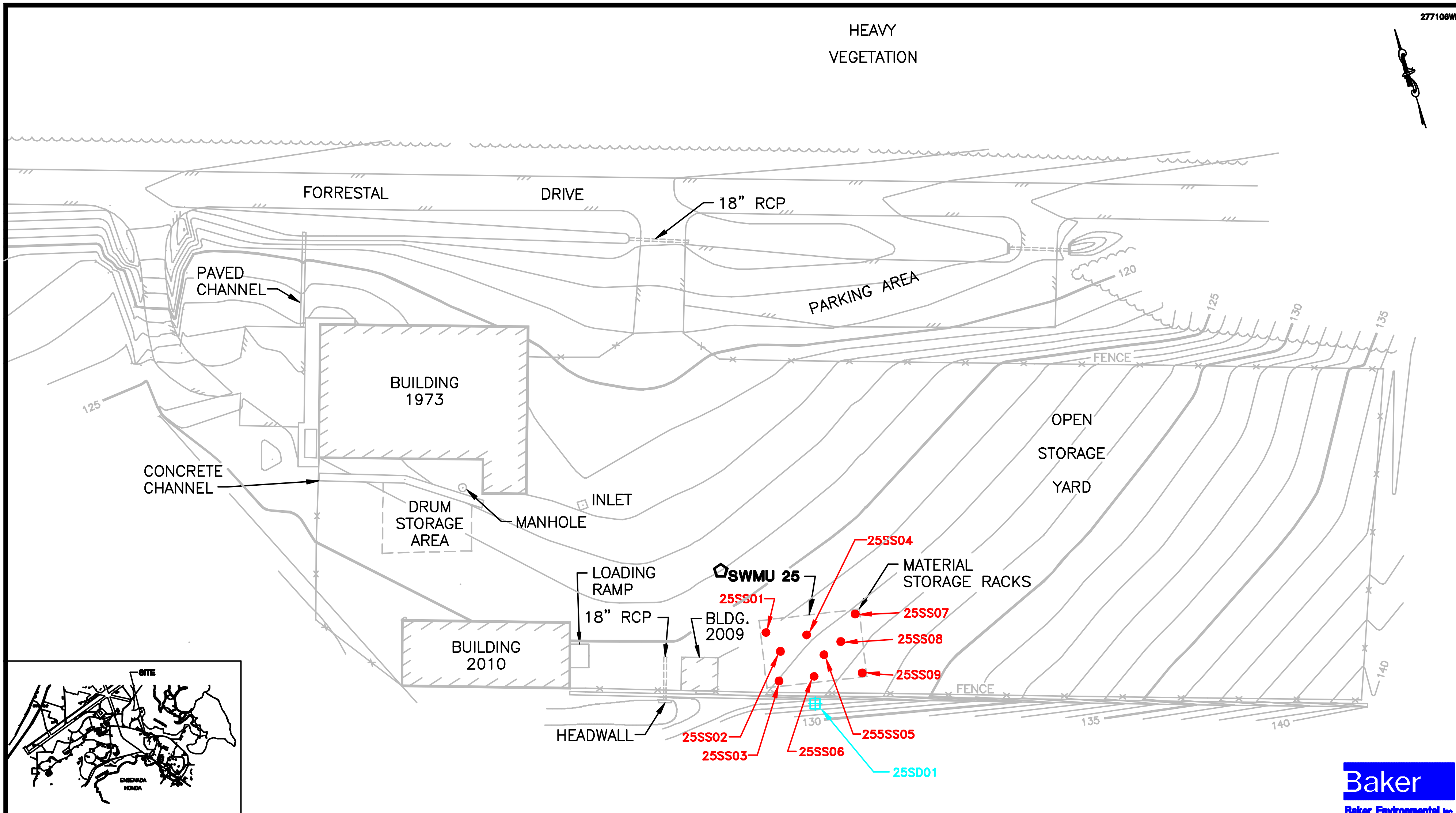


LEGEND

108	SURFACE ELEVATION CONTOUR
	EXISTING MONITORING WELL LOCATION
	SOIL SAMPLING LOCATION (3/96)

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-5
SAMPLING LOCATIONS
OU#1 – SWMUs 23 AND 24
OIL SPILL SEPARATOR TANKS AND
OIL/WATER SEPARATOR
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

130 SURFACE ELEVATION CONTOUR

AREA OF STAINING APPROXIMATED FROM 1988 RFA PHOTO

SOIL SAMPLING LOCATION

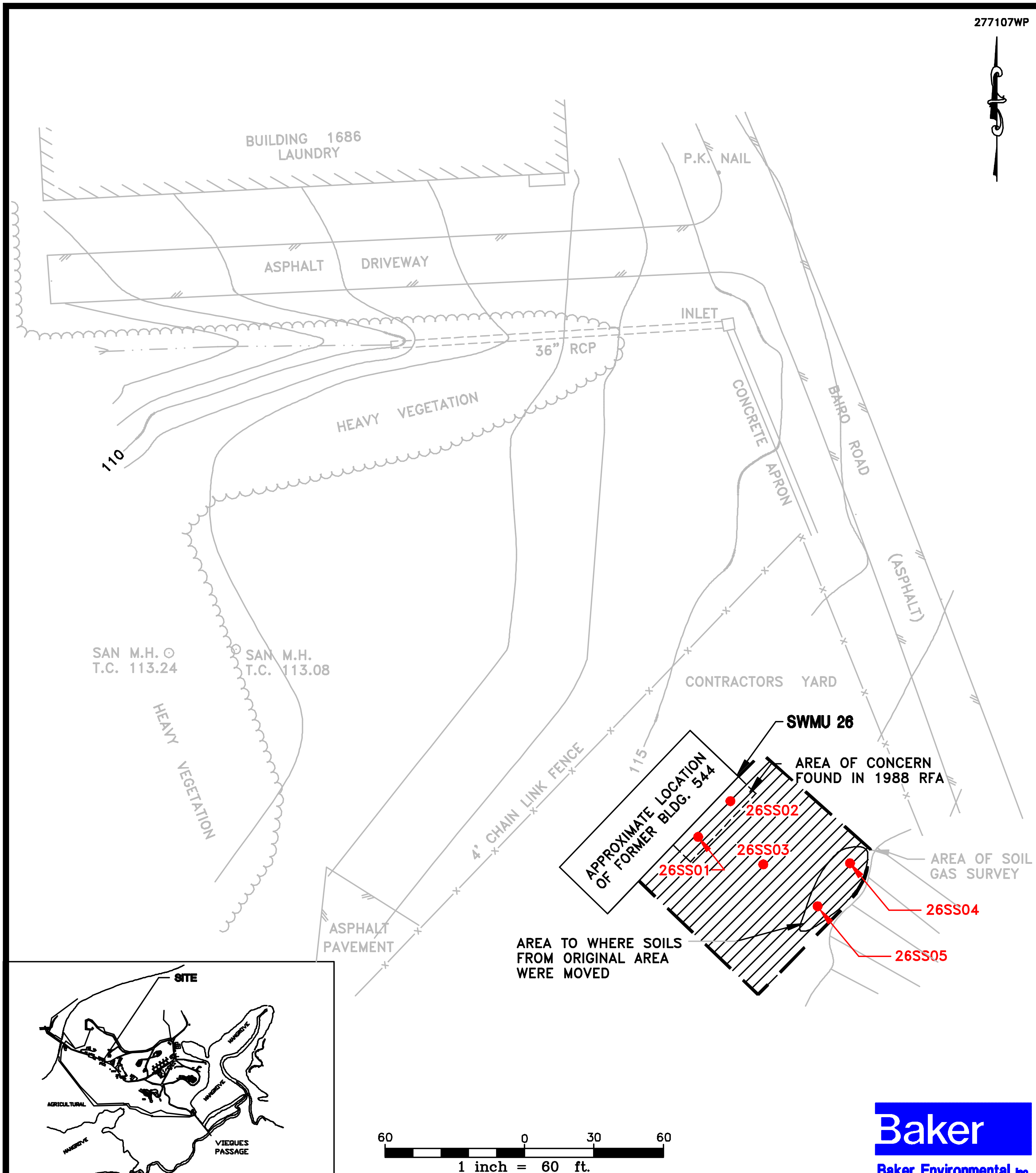
SEDIMENT SAMPLE LOCATION

60 0 30 60 120

1 inch = 60 ft.

FIGURE 4-6
SAMPLING LOCATIONS
OU#1 – SWMU 25
DRMO STORAGE YARD

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



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Baker Environmental, Inc.

LEGEND

110 SURFACE ELEVATION CONTOURS

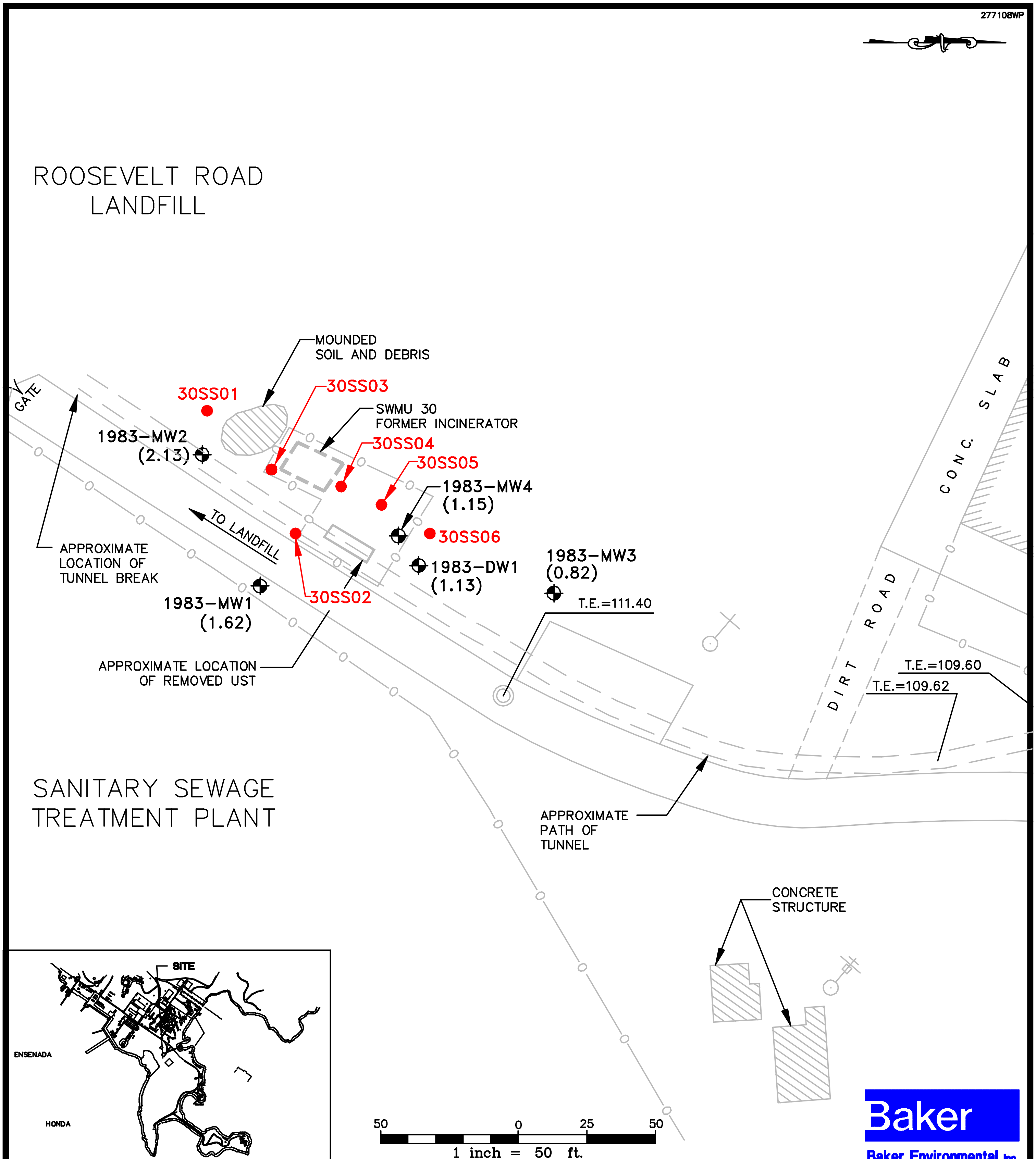
SOIL SAMPLING LOCATION

AREA OF SOIL GAS SURVEY

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-7
SAMPLING LOCATIONS
OU#1 – SWMU 26
BUILDING 544 AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

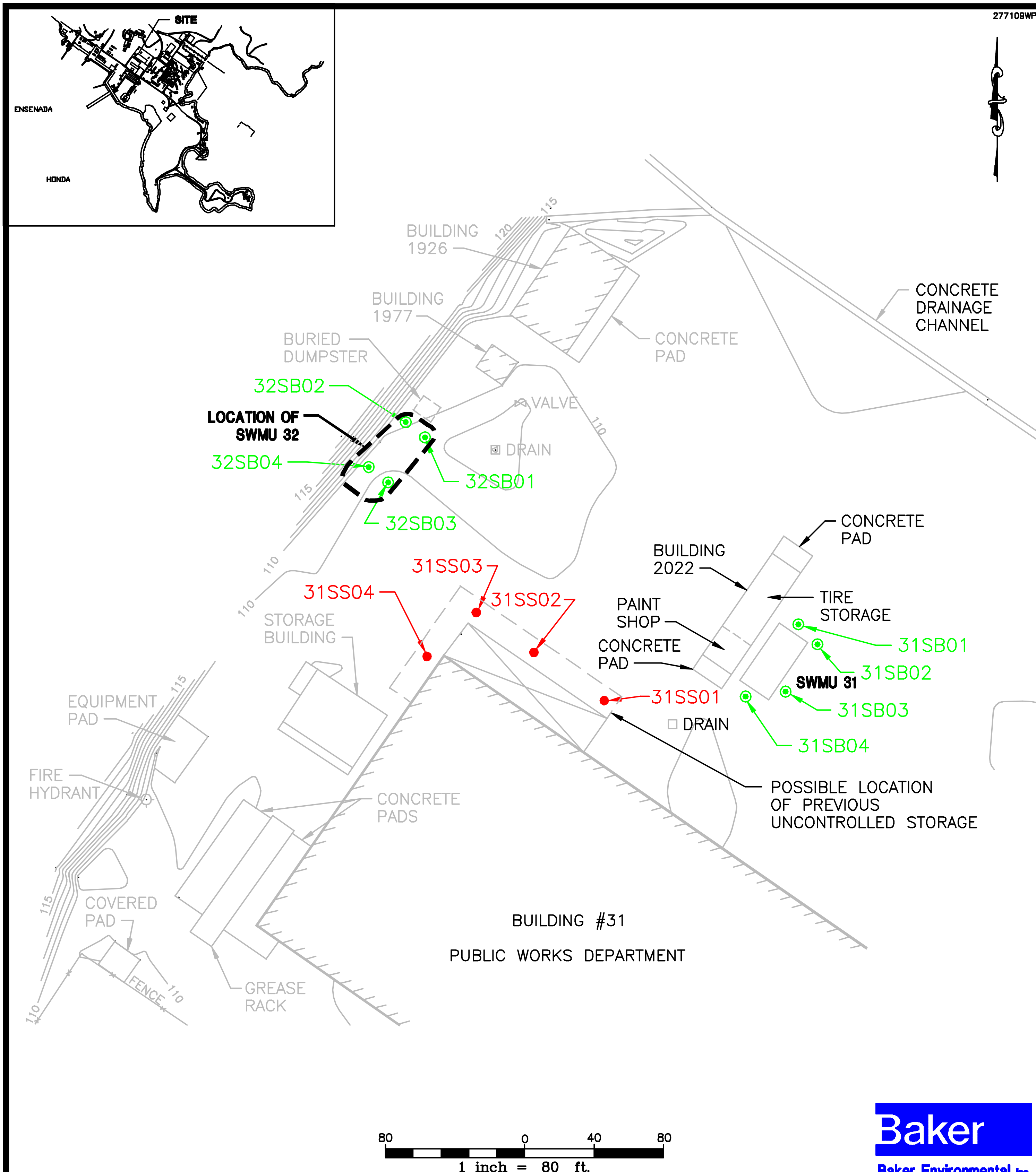


LEGEND

- EXISTING MONITORING WELL LOCATION (BLASLAND, BOUCK & LEE, INC. 1994)
- (1.13) GROUNDWATER ELEV. (1994)
- SURFACE SOIL SAMPLE LOCATION (3/96)

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-8
SAMPLING LOCATIONS
OU#1 – SWMU 30
FORMER INCINERATOR AREA
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Baker

Baker Environmental, Inc.

LEGEND

110 SURFACE ELEVATION CONTOUR

SOIL BORING LOCATION

SOIL SAMPLING LOCATION

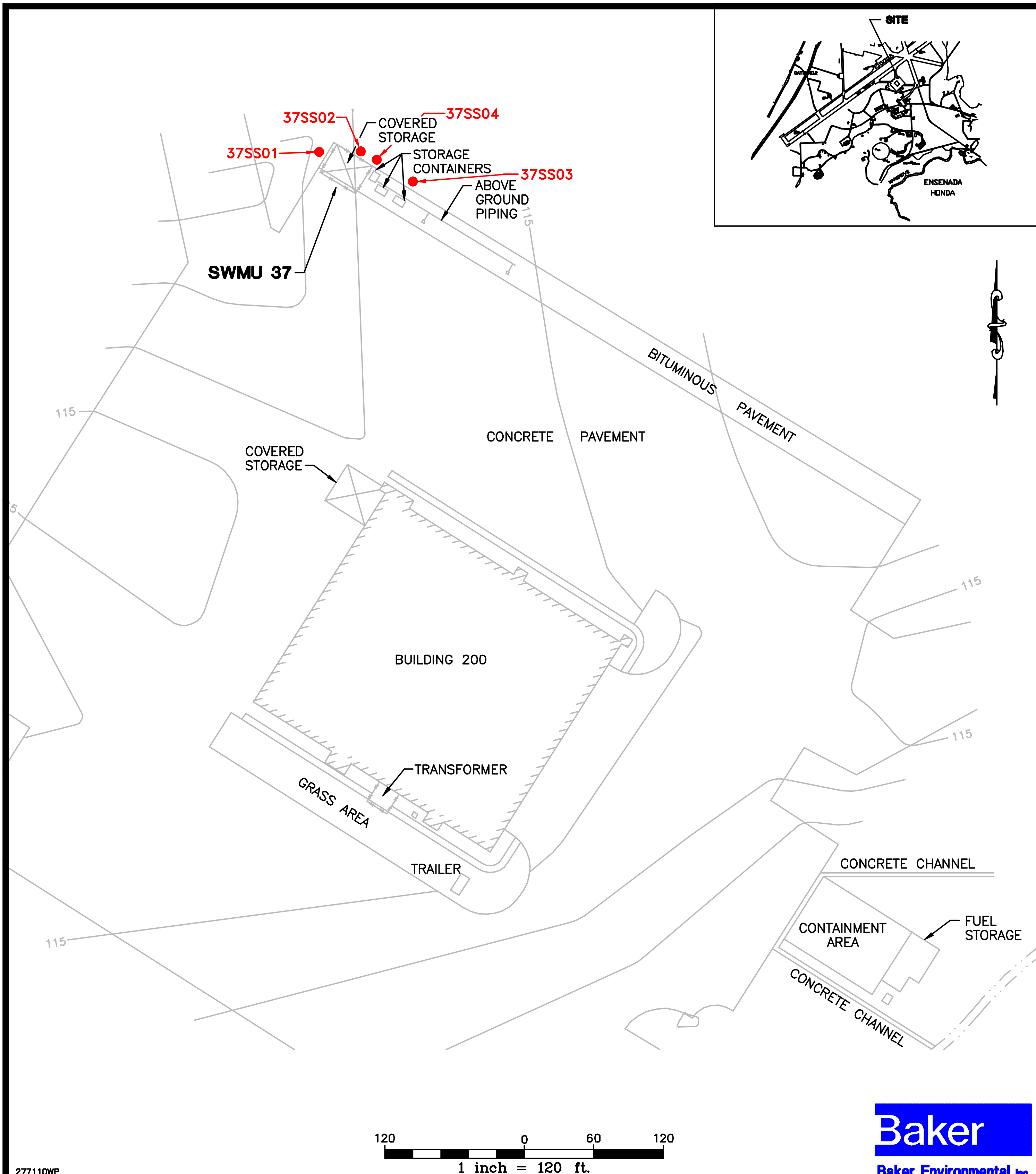
SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-9

SAMPLING LOCATIONS

OU#1 – SWMU 31 WASTE OIL COLLECTION AREA AND SWMU 32 BATTERY COLLECTION BUILDING 31

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

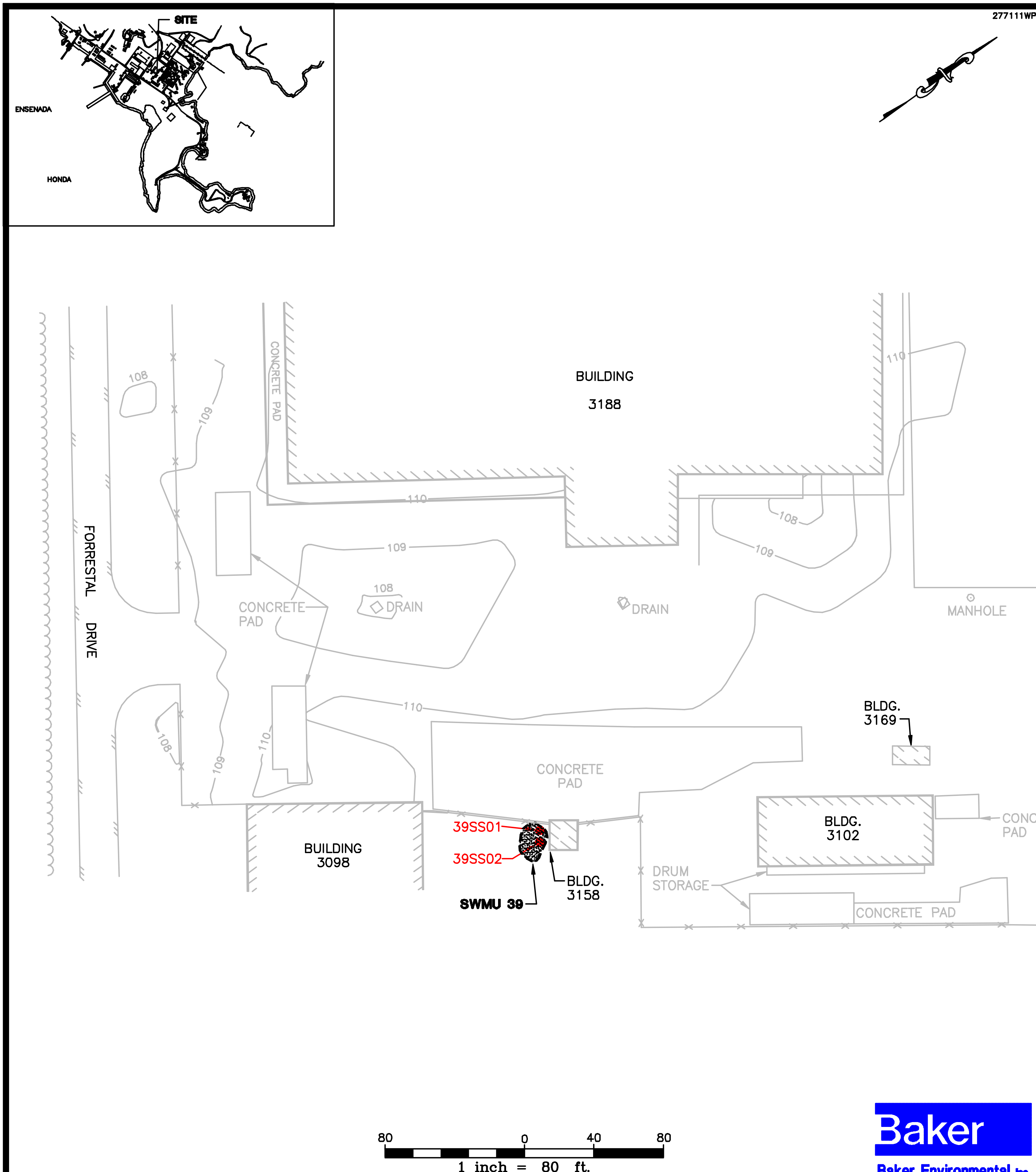
115 SURFACE ELEVATION CONTOUR

● SOIL SAMPLING LOCATION (3/96)

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-10
SAMPLING LOCATIONS
OU#1 – SWMU 37
WASTE OIL STORAGE AREA/BUILDING 200

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Baker
Baker Environmental, Inc.

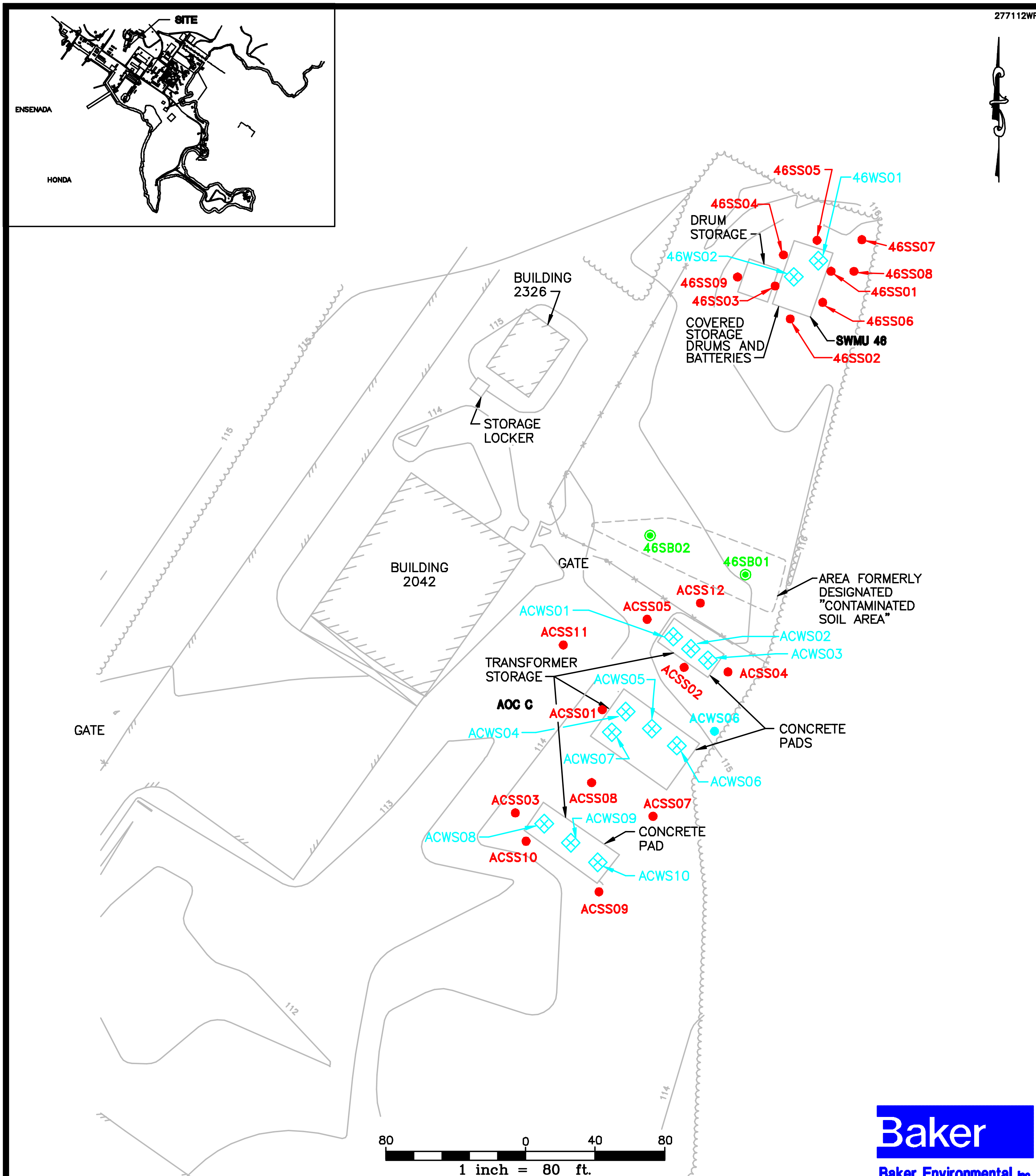
LEGEND

111 SURFACE ELEVATION CONTOUR

● SOIL SAMPLING LOCATION (3/96)

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-11
SAMPLE LOCATIONS
OU#1 – SWMU 39
FORMER BATTERY DRAIN AREA/
BUILDING 3158
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

115 SURFACE ELEVATION CONTOUR

SOIL BORING LOCATION (3/96)

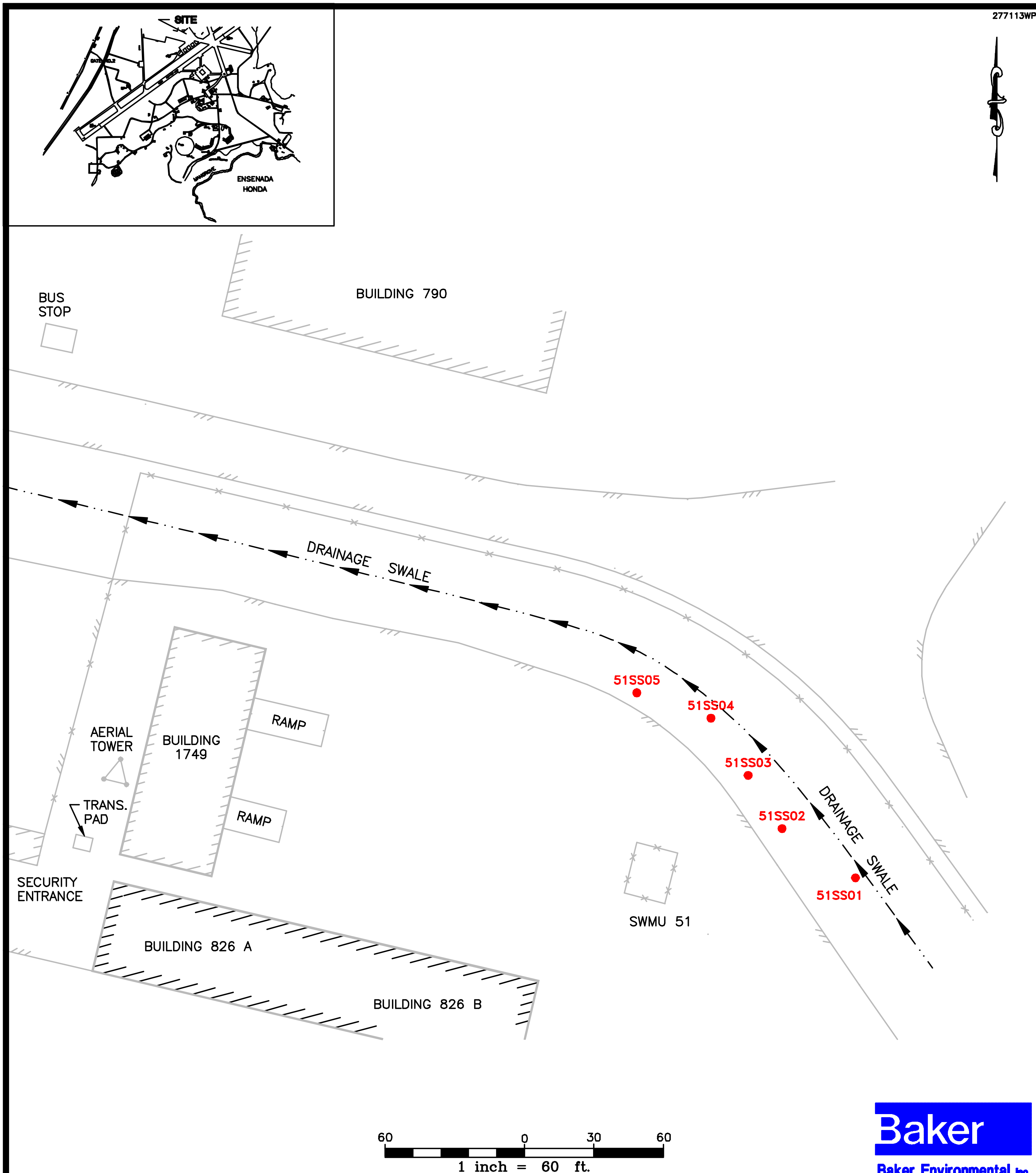
SOIL SAMPLING LOCATION (3/96)

WIPE SAMPLE LOCATION (3/96)

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-12
SAMPLING LOCATIONS
OU#1 – SWMU 46 POLE STORAGE YARD
AND AOC C TRANSFORMER STORAGE PAD

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

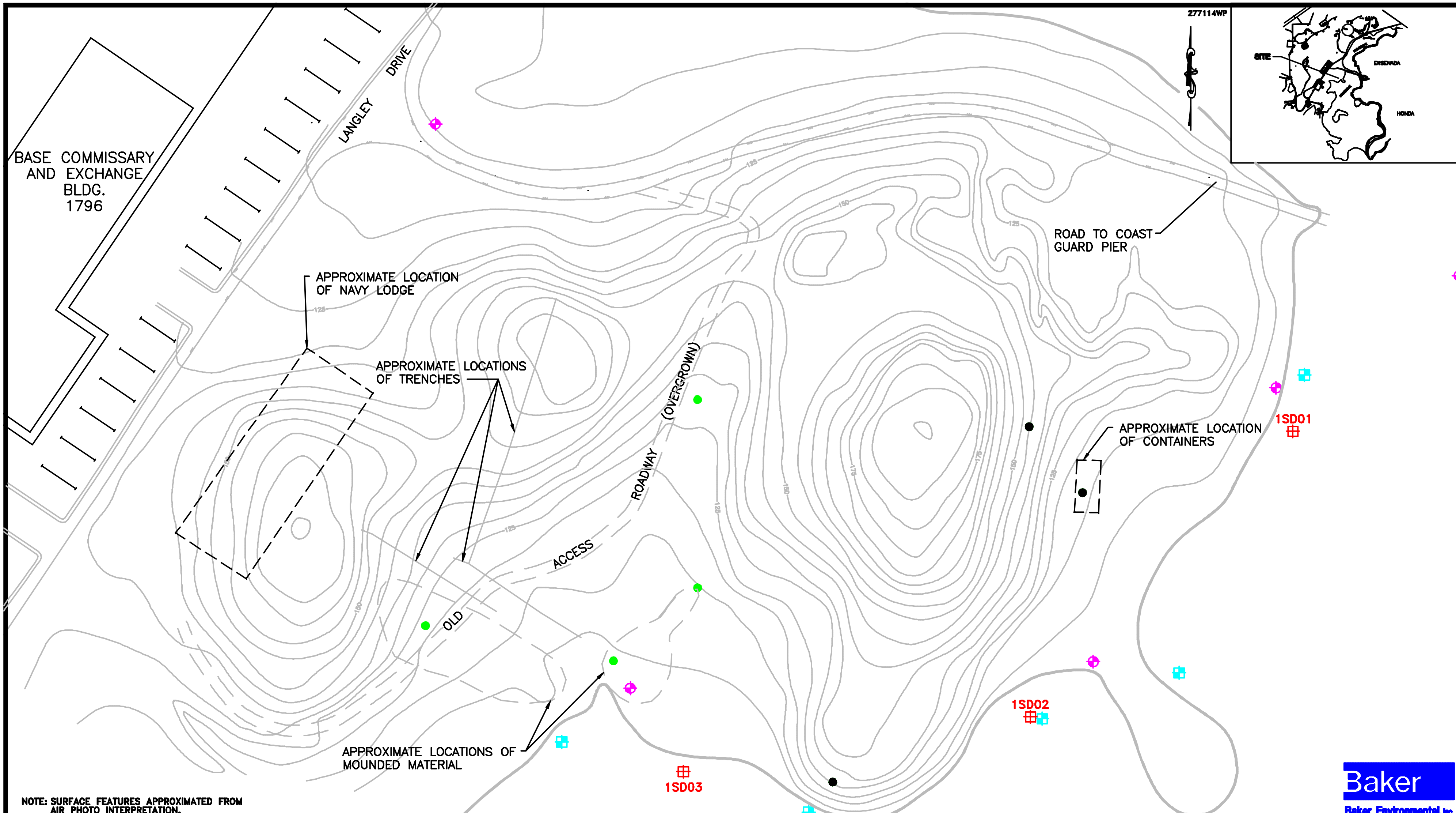
● SOIL SAMPLING LOCATION (3/96)

◄ · — DRAINAGE SWALE FLOW DIRECTION

SOURCE: LANTDIV, FEB. 1992.

FIGURE 4-13
SAMPLING LOCATIONS
OU#1 – SWMU 51
NEW AIMD STORAGE PAD/BUILDING 379

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

- SURFACE ELEVATION CONTOUR
- EXISTING MONITORING WELL LOCATION (CONFIRMATION STUDY)
- 1992 SOIL SAMPLING LOCATIONS (APPROXIMATE)
- SEDIMENT/SURFACE WATER SAMPLE (SUPPLEMENTAL INVESTIGATION)
- SEDIMENT SAMPLE LOCATION

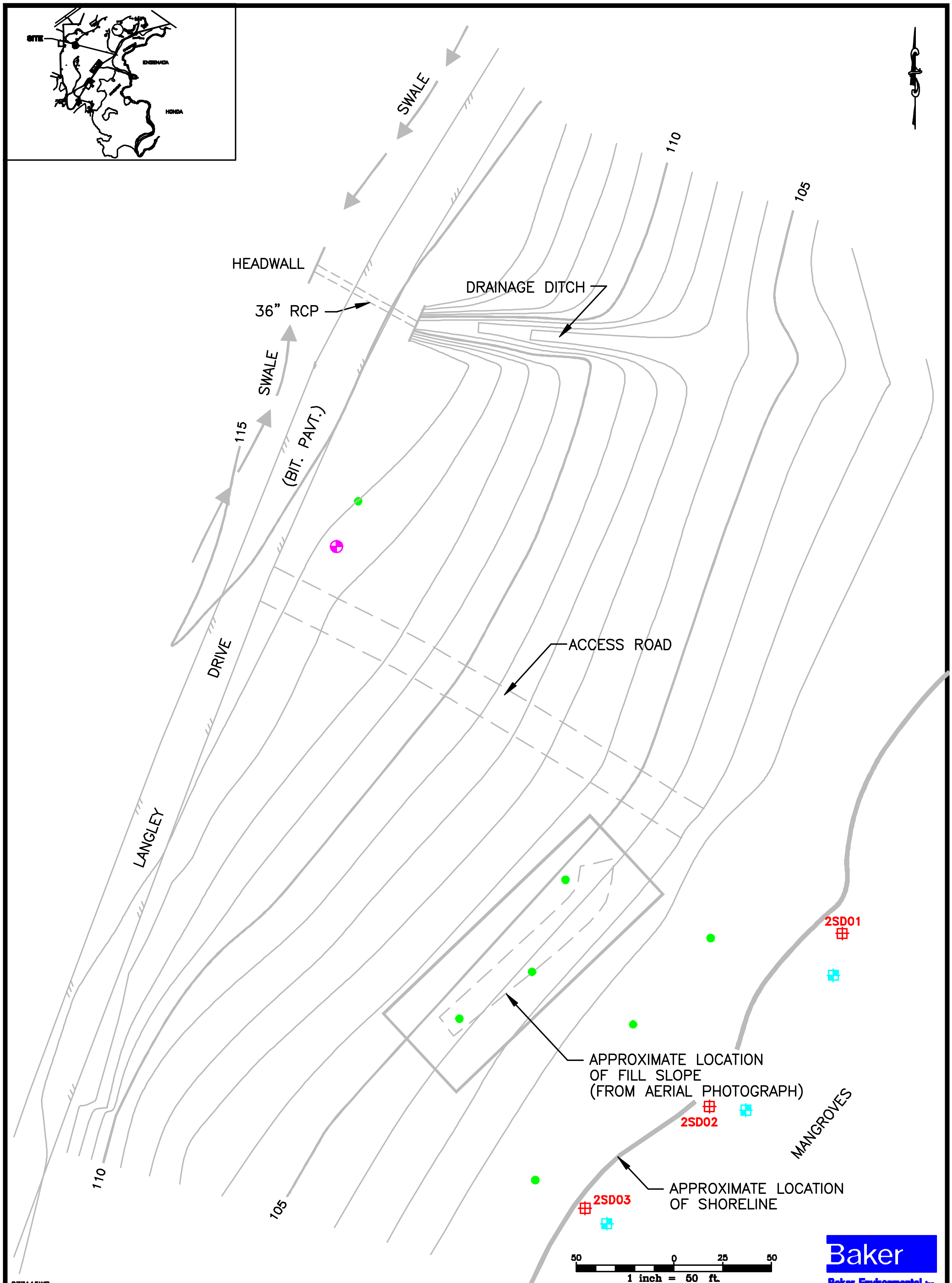
SOURCE: LANTDIV, FEB. 1992

160 0 80 160 320

1 inch = 160 ft.

FIGURE 4-14
SAMPLING LOCATIONS
OU#7 – SWMU 1
ARMY CREMATOR DISPOSAL SITE

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



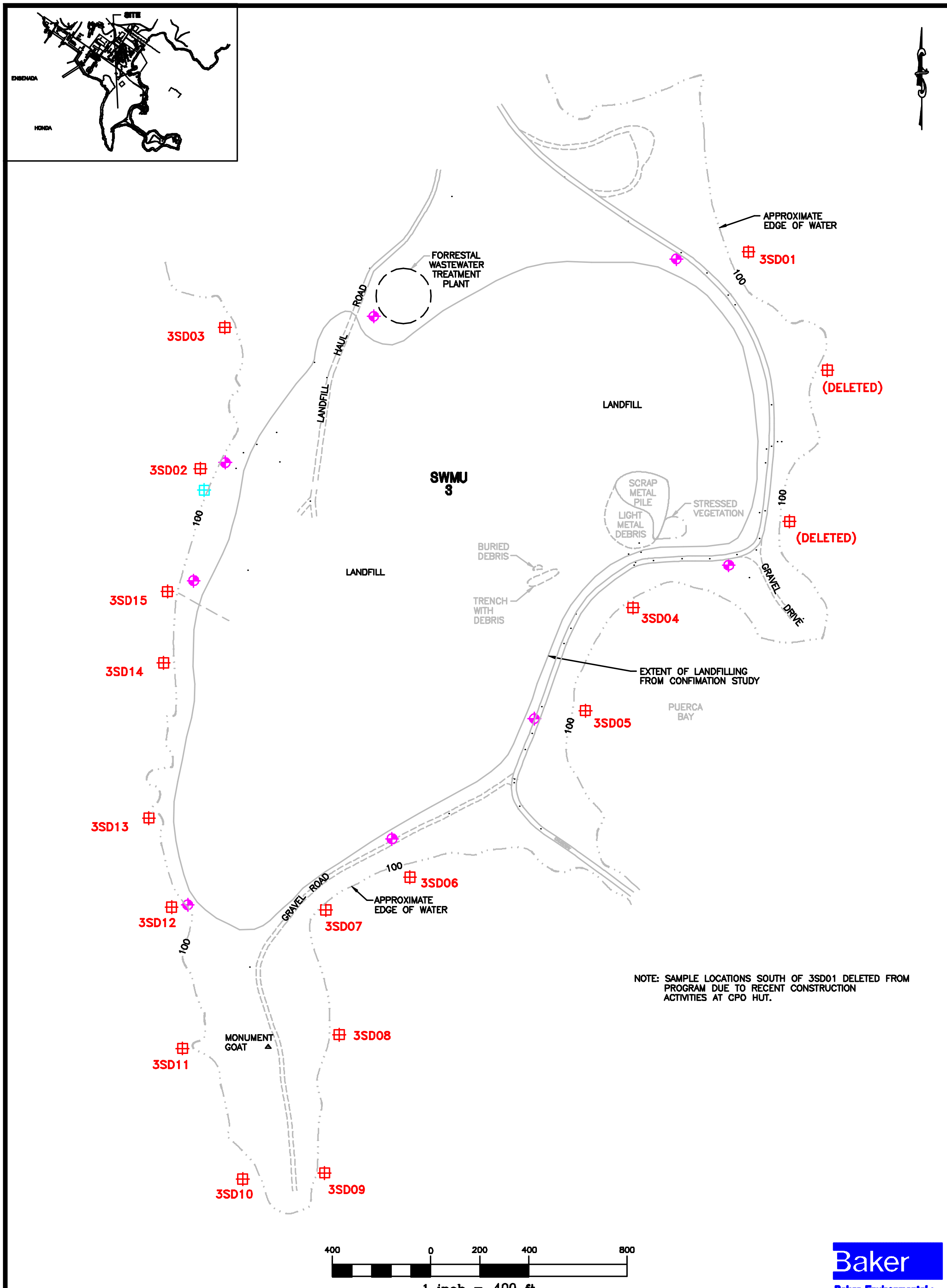
LEGEND

- 110 SURFACE ELEVATION CONTOUR
- SURFACE WATER DRAINAGE DIRECTION
- EXISTING MONITORING WELL LOCATION
- 1992 SOIL SAMPLING LOCATIONS (APPROXIMATE)
- SURFACE WATER/SEDIMENT SAMPLE (SUPPLEMENTAL INVESTIGATION)
- SEDIMENT SAMPLE LOCATION

SOURCE: LANTDIV, FEB. 1992

FIGURE 4-15
SAMPLING LOCATIONS
OU#7 – SWMU 2
LANGLEY DRIVE DISPOSAL SITE

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



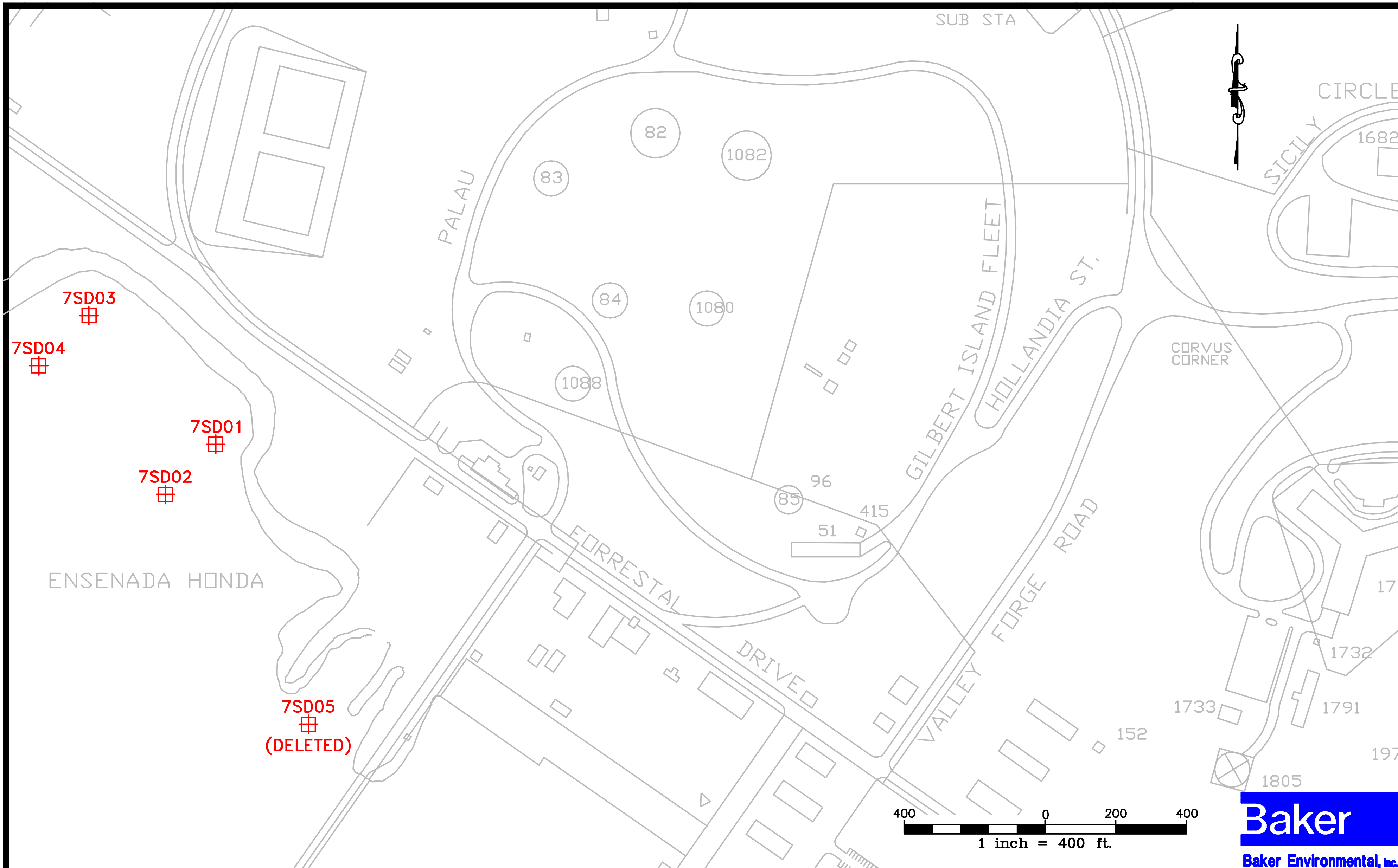
LEGEND

- EXISTING SEDIMENT SAMPLE LOCATION
- EXISTING MONITORING WELL LOCATION
- SEDIMENT SAMPLE LOCATION

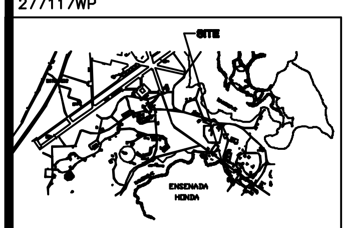
SOURCE: LANTDIV, FEB. 1992

FIGURE 4-16
SAMPLING LOCATIONS
OU#7 – SWMU 3
BASE LANDFILL

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



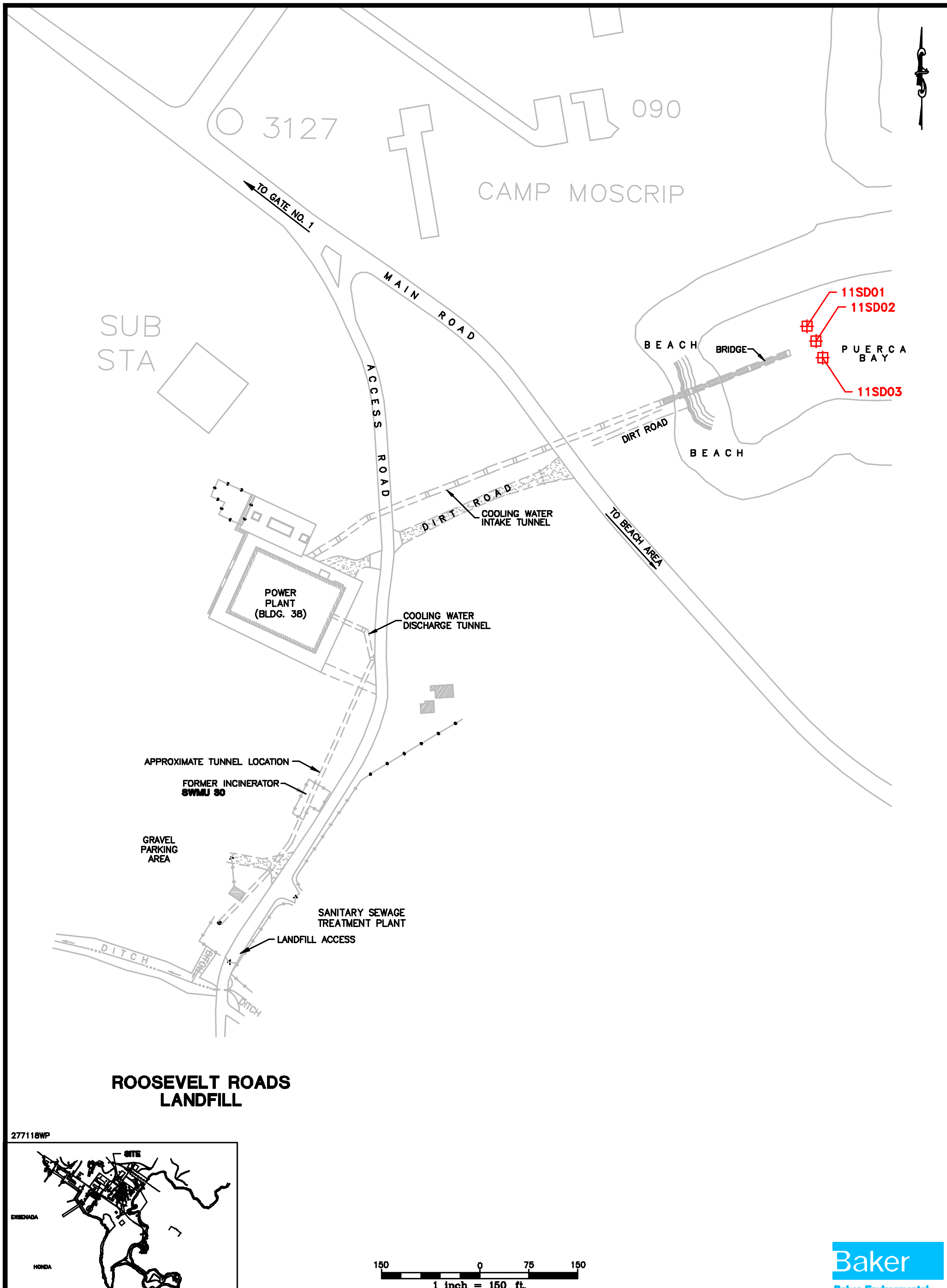
277117WP



LEGEND

⊞ – SEDIMENT SAMPLE LOCATION

FIGURE 4-17
SAMPLING LOCATIONS
OU#7 – SWMU 7 TOW WAY FUEL FARM
AOC D
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



Baker
Baker Environmental, Inc.

LEGEND

SEDIMENT SAMPLE LOCATION

FIGURE 4-18
SAMPLING LOCATIONS
OU#7 – SWMU 11/45

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

5.0 RESULTS OF THE RCRA FACILITY INVESTIGATION

This section presents an overview of analytical results obtained as part of the RFI performed at the various sites to characterize the nature of potential site contamination. Each SWMU/AOC has been discussed on an individual basis.

Appendices A, B, C, and D present the Chain-of-Custody forms, geoprobe boring logs, slug test data results, and analytical results, respectively. Figures 5-1 through 5-19 show a graphical display of those organic and/or inorganic contaminants which have been selected as Contaminants of Potential Concern (COPCs) as they occur throughout OU 1 and 6 soils, sediment and/or groundwater. Figures 5-20 through 5-24 provide a graphical depiction of organic and/or inorganic contaminants which have been selected as COPCs as they occur throughout OU 7 sediments. COPCs are discussed in more detail in Section 6.0, Health and Environmental Assessment. Please note that those constituents (and concentrations) which exceed an established criteria have been italicized in each figure.

Positive detections of organic and inorganic compounds according to media are presented in summary tables; Tables 5-1 through 5-41 present OU 1 and 6 results, and Tables 5-42 through 5-43 present OU 7 results. QA/QC samples results are found in Appendix D. All Tables and Figures are presented at the end of this section.

5.1 Quality Assurance Results

Quality Control samples include trip blanks, equipment (rinsate) blanks, field (ambient conditions) blanks and duplicate samples. The following subsections discuss the results of the quality control sampling performed during the RFI. This information is important from the standpoint of data quality and useability.

5.1.1 Data Validation Report

The quality of organic analytical data was evaluated by the following parameters: GC/MS tuning and performance, internal standards, initial calibrations, continuing calibrations, surrogate spikes, matrix spikes, laboratory and field blanks, compound identification, and compound quantification.

The quality of inorganic analytical data was evaluated by the following parameters: initial and continuing calibrations, interference check samples, matrix spikes, laboratory control samples, ICP serial dilutions, and compound quantitation.

Several analytical results were qualified as estimated (J) because the reported concentrations were less than the required detection limits or the quality control criteria were not met. Some samples are qualified as "N" which indicates a tentatively identified compound. Parameters that were analyzed, but were not detected, were qualified with a "U" where the associated numerical value is the sample detection limit.

Sixteen (16) organic compounds (15 VOCs and one pesticide) were qualified as rejected (R) as noted in the validator's report. Rejected organic compounds and affected samples include:

- Isobutyl alcohol
  - Surface Soil samples from SWMU 14, 26, 30, 31, and 46; AOC B and C
  - Subsurface Soil samples from SWMU 31, and 46; AOC B
  - Sediment samples from SWMU 25; AOC D
  - Groundwater samples from SWMU 10; AOC B

- Pentachloronitrobenzene
  - Surface Soil samples from SWMU 23, 24, 32, 37, 46; AOC C
  - Subsurface Soil samples from SWMU 32 and 46
  - Groundwater samples from SWMU 10

- O-toluidine
  - Surface Soil samples from SWMU 12

- Hexachlorophene
  - Surface Soil samples from SWMU 12, 23, 24, 30, 32; AOC C
  - Subsurface Soil samples from SWMU 32
  - Groundwater samples from SWMU 30

- 1,4-Dioxane
  - Surface Soil samples from SWMU 12

- 2-Picoline
  - Surface Soil samples from SWMU 12

- 4-Nitroquinoline-1-oxide
  - Surface Soil samples from SWMU 23, 24, 26, 46; AOC B, AOC C
  - Subsurface Soil samples from AOC B
  - Sediment samples from SWMU 13; AOC D
  - Groundwater samples from AOC B

- Propionitrile (ethyl cyanide)
  - Surface soil samples from SWMU 30, 32; AOC B
  - Subsurface Soil samples from SWMU 32, 46
  - Sediment samples from SWMU 25; AOC D
  - Groundwater samples from SWMU 30

- 3'3-Dimthylbenzidine
  - Surface Soil samples from SWMU 26, 31, 46; AOC B
  - Subsurface Soil samples from SWMU 31, 46
  - Sediment samples from SWMU 25; AOC D
  - Groundwater samples from SWMU 30

- Acrolein
  - Surface Soil samples from SWMU 26, 51
  - Sediment samples from AOC D

- Carbon tetrachloride
  - Groundwater samples from SWMU 30

- Trans,1,4-Dichloro-2-butene
  - Surface Soil samples from SWMU 32, 51
  - Sediment samples from AOC D

- Acetone
  - Surface Soil samples from SWMU 51

- Acrylonitrile
  - Surface Soil samples from SWMU 51

- 1,2,4,5-Tetrachlorobenzene
  - Surface Soil samples from AOC B

- 4,4'-DDT
  - Surface Soil samples from AOC B

Volatile Organic Compounds qualified as rejected have not been considered as a significant data gap because VOCs are not deemed environmental contaminants at any SWMU or AOC. The above list of rejected VOCs represent mostly rare constituents which were not detected in adjacent samples collected at the study sites. Acetone is a common laboratory contaminant and is not assumed to be related to past activities based on the detected concentrations. 4,4-DDT was present in other samples in sufficient quantity to determine the impact of this constituent at AOC B.

Two inorganic compounds (mercury and selenium) were qualified as rejected (R). The CRDL standard for mercury was below 50 percent; therefore, all non-detected results were rejected. Affected samples include the following:

- Surface Soil Samples from SWMUs 30, 32, 39, 46 and AOC C
- Subsurface Soil Samples from SWMU 32
- Sediment Samples from SWMU 11/45

The rejected mercury and selenium sample results are not considered as significant data gaps because other samples exhibited these analytes in sufficient quantity (or they were not detected in adjacent samples) to generate conclusions regarding their impact to the study area.

The preparation blank contamination for selenium in soils was 0.28 mg/kg; therefore, all positive results below 10 time this value were rejected. Affected samples include the following:

- Surface and Subsurface Soil Samples from SWMU 32
- Sediment Samples from SWMU 11/45

In addition, total selenium was rejected in rinsate blank (RB01), because the preparation blank contamination was 3.4 µg/L. The RB01 value of 2.8 µg/L is less than 10 times the preparation blank value; and, therefore has been rejected. All other data collected during this investigation are acceptable for use as part of this study and have been presented as such.

5.1.2 Trip Blanks

Analytical results of trip blanks were utilized to assess possible contamination of sample containers prior to use; during transport to and storage during the study areas, and possible cross-contamination of samples during transport back to the analytical laboratory. In addition, the trip blanks were used to assess whether the contaminants detected were representative of conditions at the site. For compounds detected in both environmental samples and trip blanks (or blanks of any kind) to be attributed to site contamination, the concentration in the environmental sample must be, at a minimum, ten times greater than the concentration detected in the blank for common laboratory contaminants (USEPA, 1991). Concentrations of certain parameters detected in environmental samples which are not commonly associated with laboratory contaminants, and which were less than five times that of the maximum associated blank, were not assumed to be detected.

Ten trip blanks were included in coolers with samples sent to the laboratory for volatile organic analysis. Only 4-methyl-2-pentenone was present in one trip blank (TB02) at a concentration of 10 µg/L. This low concentration is most likely are due to slight laboratory-related contamination as this compound did not show up in environmental samples.

5.1.3 Field Blanks

Field blanks are samples which are collected in the field during related sampling activities. Because field blanks and environmental samples are collected under similar conditions, the results of the field blank analyses are used to indicate the presence of external contaminants that may have been introduced into the samples during collection. In addition, field blanks are utilized to determine constituents present in the decontamination water. Field blank contamination during transport is evaluated by trip blank results.

Two field blanks were obtained in association with RFI field activities. FB01 and FB02 were obtained from store-bought bottled water and tap water obtained from the base Public Works, respectively.

Chloroform was detected in both samples with a maximum concentration of 150 µg/L present in FB02 (obtained from the tap located in Building 31). In addition, bromodichloromethane was found in FB02. Cadmium, copper and zinc were present in FB01 and antimony, barium, copper lead, mercury and zinc were present in FB02.

5.1.4 Equipment Blanks (Rinsates)

Results from the analyses of the equipment blanks were used to assess the efficiency of the equipment decontamination procedures in preventing cross-contamination between samples and to assess whether the contaminants detected in the environmental samples were contributed by the sampling equipment or were representative of conditions at the individual areas of study.

Two rinsate samples (RB01 and RB02) were obtained during the RFIs collected by rinsing stainless steel sampling utensils with laboratory-grade deionized water.

VOCs, SVOCs, PCBs, RCRA metals, and cyanide were analyzed. No constituents were found above detection limits in RB01. Only silver was present in RB02 at a concentration of 6.1 µg/L.

5.1.5 Field Replicates (Soil)

The field replicate is a second sample (or set of samples) collected from one sample location and labeled for the laboratory as if it were a unique sample. The results of the field replicate analyses are used to assess the precision of the field sampling methods as well as a check on the analytical procedures. The results are mathematically compared to determine the relative percent difference of the soil/sediment sample and associated replicate. Relative percent difference (RPD) is a measure of the precision of the sample results. Soil/sediment data with an RPD of less than 35 percent can be considered reliable because soil/sediment is not a homogeneous media.

If RPD results exceeded the quality control limit applied to soil/sediment, there were no results to report; therefore, no data were qualified based on the RPD. Where replicate results exceeded recommended criteria, results were considered estimated and biased according to the recovery of analytical spike results. The RPDs for some of the replicate compounds exceeded the percent advisory quality control; and, therefore have been qualified as estimated (J) based on the data validator's evaluation. In general, the difference between the environmental sample and the field replicate are acceptable and have been qualified accordingly.

Replicate soil (or sediment) sample results have been presented with the associated environmental sample result.

5.1.6 Field Duplicates (Water)

The results of the field duplicate analyses were used to assess the precision of the laboratory and the consistency in the field sampling methods. Groundwater data with an RPD less than 20 percent can be considered reliable. If RPD results exceeded the quality control limit applied to water, there were no results to report; therefore, no data were qualified based on the RPD. Where duplicate results exceeded recommended criteria, results were considered estimated and biased according to the recovery of analytical spike results. The RPDs for some of the duplicate compounds exceeded the percent advisory quality control; and, therefore have been qualified as estimated (J) based on the data validator's evaluation. In general, the difference between the environmental sample and the field duplicate are acceptable and have been qualified accordingly.

Duplicate groundwater sample results have been presented with the associated environmental sample result.

5.1.7 Matrix Spike/Matrix Spike Duplicate

Matrix spike/matrix spike duplicates (MS/MSDs) are the formulas for calculating confidence limits and the coefficient of variation. The confidence limit should be determined for all data. A matrix spike describes a procedure in which a target compound at a known concentration is added to the sample during laboratory preparation to measure the accuracy of the analysis procedure. A matrix spike duplicate is a second run to determine the precision of the analysis.

5.2 <u>Analytical Results at Operable Units 1 and 6</u>

The subsections which follow present analytical results for samples collected from those SWMU/AOCs which make up OUs 1 and 6. This data includes soil, sediment, and groundwater sampling results. The environmental media were analyzed for various chemical constituents including:

- Appendix IX metals
- RCRA metals
- Arsenic
- Explosives
- Asbestos

- ! Total organic carbon (TOC)
- ! Total petroleum hydrocarbons (TPH)

The analytical program for each SWMU/AOC was specifically designed based on the type of unit involved and the known/possible waste streams received. Duplicate sample results have been presented with the associated environmental sample result.

Tables 5-1 through 5-41 summarize analytical results of the RFI conducted at Operable Unit 1. Each table presents detected constituents for a specific media and compares the results against established criteria including Risk-Based Concentrations (RBCs) for Industrial and Residential scenarios for soil, Maximum Contaminant Levels (MCLs) and tapwater RBCs for groundwater, and sediment screening values (SSVs) and soil RBCs for sediments. Surface water was evaluated against Ambient Water Quality Criteria. Dioxin in surface soil samples from AOC B was compared to a Toxicity Factor (TF) which was generated based on the dioxin relationship with 2,3,7,8-TCDD.

USEPA Region III Risk-Based Concentrations (RBCs) - RBCs were derived by USEPA Region III and are updated semiannually in tabular format. RBCs are derived using conservative, USEPA-promulgated, default exposure assumption values and the most recent toxicological criteria available. RBC values for carcinogens and noncarcinogens are based on a target incremental lifetime cancer risk (ILCR) of 1×10^{-6} and a target hazard quotient (HQ) of 1.0, respectively. For potential carcinogens, the toxicity criteria applicable to the derivation of RBCs are chronic oral and inhalation cancer slope factors; for noncarcinogens, they are oral and inhalation reference doses. These toxicity criteria are subject to change as more updated information and results from the most recent toxicological/epidemiological studies become available. Therefore, the use of toxicity criteria in the derivation of RBCs requires that the screening concentrations be updated periodically to reflect changes in the toxicity criteria. The RBCs used in this report were issued by USEPA Region III for January to June 1996 (USEPA, 1996).

The Region III RBC values used in this baseline RA include those derived for tap water (based on ingestion and inhalation pathways) and soil (based on the ingestion pathway residential and industrial land use scenarios). Both the residential and industrial soil COC screening values are presented in this baseline RA; however, in text, the residential values were actually used in selecting Soil COPCs, since they are lower, and consequently, more conservative than the industrial values.

Residential soil RBCs were also used in identifying COPCs for sediment. Tap water COC screening values presented in this baseline RA were used for selecting Groundwater COPCs.

Federal Ambient Water Quality Criteria (AWQC) - AWQC are non-enforceable regulatory guidelines and are of primary utility in assessing acute and chronic toxic effects in aquatic organisms for surface water bodies. AWQCs consider acute and chronic effects in both freshwater and saltwater aquatic life, and potential carcinogenic and noncarcinogenic health effects in humans from ingestion of both water (2 liters/day) and aquatic organisms (6.5 grams/day), or from ingestion of organisms alone (6.5 grams/day). The AWQCs for protection of human health for potential carcinogenic substances are based on the USEPA's specified incremental cancer risk range of one additional case of cancer in an exposed population of 10,000,000 to 100,000 persons (i.e., the 1.0×10^{-07} to 1.0×10^{-05} range). The AWQCs established for the protection of human health include values for the consumption of water and organisms, and the consumption of only organisms.

Sediment Screening Values - At present, promulgated sediment COC values or quality criteria do not exist to protect human health. However, sediment screening values (SSVs) have been published (Long, et al., 1995) for evaluating the potential for chemical constituents in sediment to cause adverse biological effects. This screening method was developed through evaluation of biological effects data for aquatic (marine and freshwater) organisms that were obtained through equilibrium partitioning calculations, spiked-sediment bioassays, and concurrent biological and chemical field surveys. For each constituent having sufficient data available, the concentrations causing adverse biological effects were arrayed and the lower 10 percentile (called an Effects Range-Low, or ER-L) and the median (called an Effects Range-Median, or ER-M) were determined. If contaminant concentrations are above the ER-M, adverse effects on the biota are considered probable.

According to USEPA Region III, exceedences of the ER-M would constitute a chemical's retention as a COPC. Therefore, constituents detected in the sediment at Site 9 were compared to the SSV ER-Ms to determine if any criteria were exceeded.

Maximum Contaminant Levels(MCLs) - MCLs are potentially enforceable standards for public water supplies promulgated under the Safe Drinking Water Act and are designed for the protection of human health. MCLs have been adopted as enforceable standards for public drinking water systems and apply to drinking water supplies consumed by a minimum of 25 persons. They have been developed for the prevention of human health effects associated with lifetime exposure (70 year lifetime) of an average adult (70 kg) consuming 2 liters of water per day. MCLs also consider the technical and economic feasibility of removing the constituent from a public water supply (USEPA, 1995a).

5.2.1 SWMU 6 - Building 145 Storage Area/AOC B Soil and Groundwater Investigation Results

5.2.1.1 Surface Soil Investigation Results

A total of four surface soil samples were obtained at this location. Two surface soil samples (6SS01 and 6SS02) were obtained in the vicinity of Building 145 (SWMU 6); two surface soil samples (ACBSS01 and ACBSS02) were collected in association with AOC B (OU 6).

Fourteen surface soil samples (including two duplicates) were obtained fro analyses of the Appendix IX list, percent solids, and TPH. Two VOCs (1,2-dichloroethene [total] and xylene [total] were present in two samples and one sample, respectively in concentrations of 8 µg/kg and 2J µg/kg.

Twenty-one SVOCs were present in at least one sample obtained from this location. The number of samples in which the constituent was found is also noted as follows: Naphthalene (1); 2-methylnaphthalene (1); acenaphthalene (4); phenanthrene (7); anthracene (4); di-n-butylphthalate; fluoranthene (10); pyrene (10); butylhexylphthalate (3); benzo(a)anthracene (9); chrysene (10); bis(2-ethylhexyl)phthalate (5); benzo(b)fluoranthene (8); benzo(k)fluoranthene (7); benzo(a)pyrene (8); indeno (1,2,3-cd)pyrene (8); dibenzo(a,h)anthracene (3); benzo(g,h,i)perylene (7); carbazole (4); benzoic acid (1); and acetophenone (1).

Four pesticides were detected, including heptachlor epoxide (found in two samples in concentrations ranging from 1.7 NJ µg/kg to 2.6 µg/kg); 4,4'-DDE in six samples ranging from 11J µg/kg to 22,000 µg/kg; 4,4'-DDD in four samples ranging from 5.9 NJ µg/kg to 18,000 µg/kg; and 4,4'-DDT in four samples ranging from 13J µg/kg to 14,000 µg/kg. The duplicate of sample ACBSB01 exhibited the highest concentrations of DDE, DDD, and DDT.

Two dioxin constituents (total HXCDD and HXCDF) were found in three samples (6SB01-00, 6SS01, and 6SS01D). Concentrations ranged from 0.25J µg/kg to 0.76J µg/kg and 0.17J µg/kg to 0.26J µg/kg, respectively.

Table 5-1 presents Detected Concentrations of Organics in SWMU 6/AOC B Surface Soils.

Arsenic, barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were detected in all the samples. Cadmium was found in 13 of the 14 samples. Mercury and tin were present in nine and eight samples, respectively. Antimony was found in seven samples; selenium (2), and cyanide in one sample. Concentrations ranged from 0.6 mg/kg (arsenic) to 1,0303 mg/kg (copper). Sample 6SB01-00 exhibited the highest concentrations of five metals, including: arsenic, copper, lead, mercury, and zinc. Table 5-2 shows Detected Concentrations of Inorganics in SWMU 6/AOC B Surface Soils.

Percent solids ranged from 88.8 (ACBSS01) to 97.1 (ACBSS02-00).

Gasoline was present in only one sample (ACBSB02-00) at 36 µg/kg.

5.2.1.2 Subsurface Soil Investigation Results

Fourteen subsurface soil samples (including one duplicate) were collected and analyzed for Appendix I. Acetone was found in three samples and ranged from 14J µg/kg to 32J µg/kg. In addition, xylene (total) was present in one sample (ACBSB02-01) at 6 µg/kg).

Di-n-butylphthalate was detected in three samples ranging from 49J µg/kg to 140J µg/kg. Bis(2-ethylhexyl)phthalate was found in sample ACBMW03-01 at 36J µg/kg. Seven SVOCs were present in sample ACBSB02-02 including: phenanthrene; fluoranthene; pyrene; benzo(a)anthracene; chrysene; benzo(b)fluoranthene; and benzo(a)pyrene. Concentrations ranged from 36J µg/kg (bis[2-ethylhexyl]phthalate) to 140J µg/kg (fluoranthene).

Heptachlor epoxide was detected in one sample (ACBMW01-05) at 1.6J µg/kg. Alpha- and gamma-chlordane were present in sample ACBSB02-02 at 21 µg/kg and 17 µg/kg, respectively.

Sample ACBSB01-02 exhibited the greatest concentrations of 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT (2,600 µg/kg, 9,600 µg/kg and 2,800 µg/kg, respectively).

Table 5-3 presents Detected Concentrations of Organics in SWMU 6/AOC B Subsurface Soils.

Barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were detected in all 14 subsurface soil samples. Other metals present include cadmium (8); arsenic, beryllium and tin (6); antimony and silver (5); selenium and thallium (2); and mercury and cyanide (1). Concentrations ranged from 0.09 mg/kg (thallium) to 336 mg/kg (copper).

Table 5-4 presents Detected Concentrations of Inorganics in SWMU 6/AOC B Subsurface Soils.

Percent solids ranged from 77 (ACBMW03-05) to 94.6 (ACBSB02-01). Total Organic Carbon (TOC) was analyzed in sample ACBMW03-05 at 0.26 percent. Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) also were analyzed in this sample. Concentrations were present at 120 mg/kg and 7,300 mg/kg, respectively.

5.2.1.3 <u>Groundwater Investigation Results</u>

Two groundwater samples were obtained at this location and analyzed for the Appendix IX list. No organic constituents were present in samples ACBMW01 and ACBMW03.

Total arsenic, barium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc were present in both samples. Beryllium was found in ACBMW01 only. Of the dissolved fraction, only barium, copper, vanadium and zinc were detected in both samples. Dissolved beryllium, and lead were present in one sample each (ACBMW01 and ACBMW03, respectively).

TOC was present in sample ACBMW01 at 4.5 mg/L. Chemical oxygen demand (COD) was analyzed in ACBMW01 at 41 mg/L and total suspended solids were present at 8,300 mg/L. Sample ACBMW03 was not analyzed for these parameters. Sulfide and TPH were not detected in either sample.

Detected Concentrations of Inorganics in SWMU 6/AOC B Subsurface Soils is provided in Table 5-5.

5.2.1.4 Surface Water Investigation Results

One sample (6SW01) was obtained from standing water observed at Building 145. This sample was analyzed for the Appendix IX list.

Volatile organics were not present in this sample.

Seven Trace SVOCs were detected, including: phenol; fluoranthene; pyrene; chrysene; benzo(b)fluoranthene; benzoic acid; and, acetophenone. Concentrations ranged from 1J µg/L to 4 J µg/L. Only 4,4'-DDE was found in this sample at a concentration of 0.52 µg/L. No PCBs were present. Total HXCDF also was present at 0.001J µg/L. Table 5-6 shows Detected Concentrations of Organics in SWMU 6/AOC B Surface Water.

Ten total metals were detected, including: arsenic; barium; cadmium; chromium; copper; lead; mercury; vanadium; zinc; and cyanide. Table 5-7 presents Detected Concentrations of Inorganics in SWMU 6/AOC B Surface Water.

5.2.1.5 Summary of Soil and Water Investigations

As shown in Tables 5-1 through 5-7, no VOCs exceeded RBC values in surface soil samples. Benzo(a)pyrene was above the residential RBC (88 µg/kg) in six samples and the industrial RBC (780 µg/kg) in two samples. Benzo(a)anthracene, benzo(b)fluoranthene and dibenzo(a,h)anthracene were greater than the residential RBC values of 880 µg/kg (former two compounds) and 88 µg/kg (latter compound). Two samples (ACBSB01-00 and ACBSB01-00D) found 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT in concentrations above the residential RBC values of 1,900 µg/kg, 2,700 µg/kg, and 1,900 µg/kg, respectively. The industrial RBC concentration of 17,000 µg/kg for 4,4'-DDE was exceeded in both of these samples. Dioxins were evaluated against a toxicity factor (TF) based on the dioxin's relationship to 2, 3, 7, 8-TCDD. Three surface soil sample concentrations (6SB01-00, 6SS01, and 6SS01D) exceeded both maximum and minimum evaluation TFs (0.004 and 0.0004 µg/kg, respectively).

No VOCs or SVOCs exceeded RBC values in any of the subsurface soil samples. However, 4,4-DDE, 4,4'-DDD, and 4,4'-DDT were above the residential RBC values in sample ACBSB01-02. Beryllium concentrations were greater than the residential RBC values of 0.15 mg/kg in five subsurface soil samples but were below the industrial RBC concentration. Arsenic also was present above the residential RBC of 0.43 mg/kg in four samples.

Tap water RBCs and MCLs were not exceeded in groundwater samples collected at this location.

The surface water sample was evaluated against Federal Ambient Water Quality Criteria (AWQC CFR, December 1992). Criteria was exceeded for 4,4'-DDE, by an order of magnitude. Arsenic and mercury AWQC values of 0.14 each also were exceeded in this sample. The sample concentration for mercury (22 µg/L) was almost two orders of magnitude greater than the AWQC.

5.2.2 SWMU 10 - Substation 10/Building 2 Groundwater Investigation Results

This site has undergone a soils removal action to address PCB contamination. The removal action did not include sampling of groundwater; therefore, it was included as a requirement for Phase I RFI activities.

Three groundwater samples (10HP01, 10HP02, and 10HP03) were obtained using the Geoprobe System. Sample 10HP02 was analyzed for VOCs, SVOCs, and PCBs. Samples 10HP01 and 10HP03 were analyzed for VOCs only due to an insufficient volume of available groundwater.

Acetone, methylene chloride, chloroform and 1-butanone were the only VOCs detected in the groundwater samples collected at this SWMU. Phenol, di-n-butylphthalate and acetophenone were present in the duplicate of 10HP03; however, only di-n-butylphthalate was detected in the associated environmental sample.

PCBs, the contaminant of potential concern at this site, were not detected in the single sampling location at which a sufficient volume of groundwater was present. It should be noted that 10HP02 (the sample containing no PCBs) is located immediately adjacent to the area where deepest excavation to remove PCB-contaminated soil occurred. 10HP02 is also assumed to be situated downgradient of the building, based on the local site topography. These factors, in conjunction with the apparent relative dearth of groundwater in the area, would indicate that PCBs do not represent a problem in groundwater.

As shown in Table 5-8, chloroform exceeds the tap water RBC by approximately an order of magnitude in sample 10HP03/D; however, this compound was also detected in both field blank samples (refer to Section 5.1.3). Acetophenone also is present above the RBC for tap water by an order of magnitude. This constituent is found in perfumes, does not appear to be site-related and is probably a laboratory artifact. Figure 5-4 presents COPCs in Groundwater at SWMU 10.

5.2.3 SWMU 12 - Fire Training Pit Oil/Water Separator Soil Investigation Results

Two soil samples were obtained and analyzed for SVOC, PCBs, total petroleum hydrocarbons (TPH), and gasoline at this location. VOCs, PCBs and TPH were not detected in either sample. Gasoline was present in each soil sample (12SS03 and 12SS04) at 0.032 and 0.033 mg/kg, respectively. Figure 5-5 presents gasoline in surface soil at SWMU 12.

5.2.4 SWMU 13 - Old Pest Control Shop/Building 258 Soil and Sediment Investigation Results

5.2.4.1 <u>Soil Investigation Results</u>

Nine surface soil samples were obtained during the RFI; four samples (13SS01 through 13SS04) were analyzed for arsenic only. The remaining five surface soil samples analyzed for the full Appendix IX list. Table 5-9 presents Detected Organic Compounds in SWMU 13 Surface Soils.

Volatile organic compounds were not found in any of the five surface soil samples analyzed for the full Appendix IX. Semivolatile organic constituents were found in samples 13SS08 (12 SVOCs) and 13SS06 (11 SVOCs) as shown on Table 5-9. Fluoranthene, pyrene, benzo(a)anthracene, chrysene, bis(2-ethylhexyl)phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene were detected in samples 13SS06 and 13SS08. Fluoranthene also was present in sample 13SS09. Benzoic acid and butylbenzylphthalate were detected in only one sample (13SS05). Phenanthrene and anthracene were present in 13SS08.

Bis(2-ethylhexyl)phthalate was also found in 13SS05. Benzo(b)fluoranthene also was detected in 13SS09. SVOCs were not present in sample 13SS07 or its associated duplicate sample.

4,4'-DDE was present in all of the soil samples ranging in concentration from 97 µg/kg (13SS06) to 7,600 µg/kg (13SS08). 4,4'-DDD was detected only in sample 13SS09 at a concentration of 710 µg/kg. 4,4'-DDT was found in all samples (except the duplicate of 13SS07) ranging in concentration from 31 mg/kg in 13SS06 to 6,000 µg/kg in 13SS08.

Dioxin constituents were analyzed in samples obtained from this SWMU. Total HXCDD was present in only two samples 13SS05 and 13SS08 in concentrations of 0.18J µg/kg and 0.17k µg/kg, respectively. Total PECDF was present in samples 13SS06 and 13SS09 at 0.22J µg/kg and 11J µg/kg, respectively. Total HXCDF was detected in all samples except 13SS07 and the associated duplicate at concentrations ranging from 0.09J µg/kg in 13SS09 to 0.8J µg/kg in 13SS05.

Table 5-10 presents Detected Concentrations of Inorganics in SWMU 13 Surface Soils. Arsenic was found in each of the four samples analyzed specifically for arsenic, and ranged from 0.66J mg/kg in 13SS03 to 12.4J in 13SS01 mg/kg. Total arsenic, barium, cadmium, cobalt, chromium, copper, nickel, lead, vanadium, and zinc were present in each of the remaining samples. Mercury was detected only in 13SS05 only at a concentration of 0.13 mg/kg. Tin was found in every sample except 13SS05 at concentrations ranging from 1.7 mg/kg (13SS06) to 56.8 mg/kg (13SS08).

5.2.4.2 Sediment Investigation Results

Five sediment samples (13SD05 to 13SD05) were collected along the drainage swale which parallels Forrestal Drive and analyzed for the full Appendix IX list. Tables 5-11 and 5-12 present Detected Concentrations of Organics and Inorganics in SWMU 13 Sediments, respectively.

Acetone and 2-butanone were present in only two samples (13SD03 and 13SD04). Acetone concentrations were 94 µg/kg and 100J µg/kg, respectively. 2-butanone was present at 27 µg/kg and 33J µg/kg, respectively. In both cases, sample 13SD04 indicated the greatest concentration of the detected VOCs.

Fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene and indeno(1,2,3-cd)pyrene were present in 13SD02 and 13SD05 with sample 13SD05 showing the greatest concentrations of these SVOCs. Pyrene and chrysene also were detected in 13SD03. Benzo(b)fluoranthene also was present in samples 13SD03 and 13SD04. Chlorobenzilate was detected in only one sample (13SD04). With one exception, none of the detected SVOCs were found to exceed published criteria.

4,4'-DDE was present in each sediment sample in concentrations ranging from 47 µg/kg (13SD01) to 12,000 µg/kg (13SD04). 4,4'-DDD was detected in three samples with the highest concentration in sample 13SD02 (24,000 µg/kg). 4,4'-DDT was present in all samples except 13SD01 ranging in concentration from 42 µg/kg (13SD05) to 52,000 µg/kg (13SD03).

Total arsenic, barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were present in each sediment sample. Cadmium and tin were found in all samples except 13SD05. Mercury was detected in only one sample (13SD03) at a concentrations of 0.42 mg/kg. Selenium was detected in three of the five samples at concentrations ranging from 0.87J mg/kg in 13SD02 and 13SD04 to 1.4J mg/kg in 13SD05.

Cyanide and sulfide were analyzed in the sediment samples at this SWMU. Cyanide was not found in any sample. Sulfide was detected in three of the five samples at concentrations ranging from 42.3J mg/kg (13SD02) to 103J mg/kg (13SD04).

5.2.4.3 Summary of Soil and Sediment Investigations

Benzo(a)pyrene concentrations were above the residential RBC value of 88 µg/kg in soil samples 13SS06 and 13SS08. 4,4'-DDE and 4,4'-DDT concentrations exceeded the residential RBC value of 1900 µg/kg for each compound in samples 13SS05, 13SS08, and 13SS09. Arsenic exceeded the industrial RBC value of 3.8 mg/kg in sample 13SS01 and 132206 at concentrations of 12.4 and 4.5 mg/kg, respectively. All sample concentrations were greater than the residential RBC for arsenic (0.43 mg/kg). Lead slightly exceeded the residential RBC value in 13SS05. Figure 5-6 presents Surface Soil COPCs.

Benzo(a)pyrene concentrations were greater than the residential RBC value in two sediment samples. 4,4'-DDE exceeded the ER-M value (27 µg/kg) in all five sediment samples. In addition, 4,4'-DDT was present above the ER-M (46.1 µg/kg) in three of the five samples and above the ER-L (1.58 µg/kg) in sample 15SD05. Figure 5-7 shows Sediment COPCs.

5.2.5 SWMU 14 - Fire Training Pit Area

Five soil samples (14SS04 through 14SS08) were obtained from this SWMU and analyzed for VOCs and SVOCs only. None of the constituents comprising these analytical suites were detected in any sample collected from this location.

5.2.6 SWMU 23 - Oil Spill Separator Tanks Soil Investigation Results

Two surface soil samples (23SS01 and 23SS02) were analyzed for VOCs, SVOCs, and total petroleum hydrocarbons (TPH). Trace chloroform was present in both samples which most likely was caused by contamination not related to the site as chloroform also was present in the field blank sample. Trace concentrations of trichloroethene and toluene were detected in 23SS01 only.

Only bis(2-ethylhexyl)phthalate (a ubiquitous laboratory artifact) was found in each sample with the highest concentration detected at 490J µg/kg in 23SS02. Benzo(g,h,i)perylene was present in 23SS01 only. Phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene were detected in 23SS02 at concentrations ranging from 360J µg/kg (benzo(a)pyrene) to 1,000J µg/kg (fluoranthene).

Diesel range organic constituents were present in both samples at concentrations of 6.1 mg/kg and 14 mg/kg, respectively. Gasoline range hydrocarbons were not detected.

Only benzo(a)pyrene was present in a concentration which exceeded the residential RBC value of 88 µg/kg. Table 5-13 presents Detected Concentrations of Organics in SWMU 23 Surface Soils. Figure 5-8 shows the Surface Soil COPC.

5.2.7 SWMU 24 - Oil Spill Oil/Water Separator Soil Investigation Results

A single surface soil sample (24SS01) was collected at SWMU 24 and analyzed for VOCs, SVOCs, and TPH. Trace chloroform and trichloroethene (TCE) were detected in this sample. In addition, dimethylphthalate and bis(2-ethylhexyl)phthalate were present. TCE and bis(2-ethylhexyl)phthalate may be present due to laboratory influences and chloroform was present in the field blank sample. TPH (diesel range organics and gasoline) were not detected in this sample. (See Table 5-14).

5.2.8 SWMU 25 - DRMO Storage Yard Soil and Sediment Investigation Results

One sediment sample was analyzed for VOCs, SVOCs, metals, cyanide and sulfide. Nine surface soil samples (25SS01 to 09) were obtained for analyses of Appendix IX constituents.

5.2.8.1 <u>Soil Investigation Results</u>

Volatile organics were not detected in any surface soil samples obtained from this location.

Bis(2-ethylhexyl)phthalate was detected in nine samples ranging in concentrations from 110J µg/kg (25SS01) to 77,000 µg/kg (25SS05). Benzoic acid, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, di-n-octylphthalate, benzo(b)pyrene, and indeno(1,2,3-cd)pyrene were present in only two samples. Butylbenzylphthalate and benzo(g,h,i)perylene were detected in only one sample each (25SS08 at 10J µg/kg and 25SS04 at 94J µg/kg, respectively).

4,4'-DDT was present in three samples in concentrations ranging from 4.7J µg/kg to 9.3 µg/kg (25SS06). 4,4'-DDE was found in only sample (25S08) at 5.1J µg/kg. PCBs, orthopesticides, herbicides, and dioxin constituents were not detected in any sample.

Barium, cadmium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were present in all samples. Tin was found in eight of the samples, and arsenic in five samples. Mercury and silver were detected in one sample each (25SS02 and 25SS03, respectively). Cyanide was found in only one sample (25SS08) at 1.7J mg/kg.

Tables 5-15 and 5-16 present Detected Concentrations of Organics and Inorganics in SWMU 25 Surface Soils, respectively.

5.2.8.2 Sediment Investigation Results

Table 5-17 indicates that of the organic constituents, only acetone and benzoic acid were present at concentrations of 9J µg/kg and 72J µg/kg, respectively. All eleven metals were detected in this sample, as shown in Table 5-18. Concentrations ranged from 0.19 mg/kg (beryllium) to 137J mg/kg (vanadium). Cyanide and sulfide were not detected.

5.2.8.3 Summary of Soil and Sediment Investigations

Bis(2-ethylhexyl)phthalate exceeded the residential RBC in only one soil sample (252205); Benzo(a)pyrene was present above the residential RBC of 88 µg/kg in sample 252204 and its associated duplicate sample. Arsenic was the only metal which exceeded the residential RBCs established for soil in four of the nine samples collected during the RFI. Figure 5-9 shows Surface Soil COPCs at this location.

Neither organic compounds detected in the sediment exceeded criteria. However, copper and nickel concentrations were detected above the ER-L values of 270 mg/kg and 51.6 mg/kg, respectively. Figure 5-10 shows Sediment COPCs.

5.2.9 SWMU 26 - Building 544 Area Soil Investigation Results

A soil gas survey was performed at this location as part of the RFI. Seventy-seven (77) sampling points were arranged in a grid pattern in the area shown on Figure 4-7. All but one sample measured zero above the background volatile concentration. One sample measured only 0.1 ppm above background.

Five surface soil samples also were obtained at this SWMU: 26SS01 through 26SS03 were collected in the former storage area and 26SS04 and 26SS05, were collected from the soil pile along the southeast perimeter. Each sample was analyzed for Appendix IX constituents. Tables 5-19 and 5-20 present Detected Concentrations of Organics and Inorganics in SWMU 26 Surface Soils, respectively.

VOCs were not detected in any surface soil samples collected during the RFI, confirming the absence of VOCs noted during the soil gas survey performed at this location.

Nine SVOCs were present in at least one soil sample. Bis(2-ethylhexyl)phthalate was present in four samples and ranged from 47J µg/kg (26SS02) to 150J µg/kg (26SS01). Chrysene was detected in three samples and ranged from 51J µg/kg (26SS03) to 150J µg/kg (26SS05). Phenanthrene, fluoranthene, pyrene, benzo(b)fluoranthene and benzo(a)pyrene were found in 26SS04D (duplicate) and 26SS05.

4,4'-DDT was present in only one sample (26SS01) at a concentration of 21 µg/kg.

Barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were found in each sample (including the duplicate of 26SS04). Arsenic was found in all samples except the duplicates sample and exceeded the residential RBC value in three samples (26SS01, 26SS02, and 26SS03). Beryllium was present in each sample except 26SS03. Beryllium concentrations also were above the residential RBC value in three samples (23SS01, 26SS04D and 26SS05). Antimony and tin were detected in only two of the samples. Selenium was present in four of the samples, including the duplicate. Cadmium was present in 26SS03 only.

In summary, only two constituents (arsenic and beryllium) exceeded residential soil RBC values at this former drum storage location as shown on Figure 5-11.

5.2.10 SWMU 30 - Former Incinerator Soil and Groundwater Investigation Results

5.2.10.1 Soil Investigation Results

The six surface soil samples (30SS01 through 30SS06) were collected at this location. Surface soil samples were analyzed for VOCs, SVOCs, and RCRA metals. Tables 5-21 and 5-22 present Detected Concentrations of Organics and Inorganics in SWMU 30 Surface Soils, respectively.

Acetone was detected in sample 30SS04. Trace xylene was present in three of the samples.

Only samples 30SS03 and 30SS04 were analyzed for pesticides/PCBs. Aroclor-1260 was detected in each sample at 200 µg/kg and 250 µg/kg, respectively.

Arsenic, barium, chromium, and lead were detected in each sample. Beryllium, cadmium, cobalt, copper, nickel, vanadium, and zinc were analyzed and detected in samples 30SS03 and 30SS04 only. Mercury was detected in 30SS04 at a concentration of 0.46 mg/kg. Silver was found in only one sample (30SS01) at 1 mg/kg.

5.2.10.2 Groundwater Investigation Results

Groundwater samples were collected from two existing monitoring wells, 1983-DW1 and 1983-MW3 and were analyzed for the full Appendix IX list. Table 5-23 indicates Detected Concentrations of Inorganics in SWMU 30 Groundwater.

No organic constituents were present in either of the groundwater samples. Total antimony, barium, cobalt, copper, vanadium, and zinc were found in each sample. Total arsenic, chromium, lead, and nickel were detected in sample 1983MW3 and total mercury was found in 1983DW1.

Dissolved constituents found in each sample include barium, cobalt, copper, vanadium and zinc. In addition, dissolved antimony and mercury were present in 1983DW1 and dissolved arsenic was found in 1983MW3.

Cyanide and sulfide were not detected in either groundwater sample.

5.2.10.3 Summary of Soil and Groundwater Investigations

Two soil samples exceeded the residential RBC (83 µg/kg) for Aroclor-1260, but were well below the industrial RBC value of 740 µg/kg. All six soil samples were detected above the RBC residential value for arsenic (0.43 mg/kg); however, each were below the industrial RBC of 3.8 mg/kg.

Total arsenic was detected in 1983MW3 above the tapwater RBC of 0.445 µg/L by an order of magnitude, but was well below the groundwater MCL of 50 µg/L. Both sample concentrations were greater than the tapwater RBC value of 15 µg/L and the MCL of 6 µg/L. The zinc concentration in sample 1983DW1 was approximately seven times greater than the tapwater RBC of 11, 000 µg/L.

Dissolved fraction results indicate arsenic greater than tapwater RBCs in sample 1983MW3 and antimony above both criteria in sample 1983DW1.

Figure 5-12 presents Surface Soil and Groundwater COPCs at SWMU 30.

5.2.11 SWMU 31 - Waste Oil Collection Area/Buildings 31 and 2022 Soil Investigation Results

Four surface soil samples, 31SS01 through 31SS04 were collected from the covered storage area located at the northwest corner of Building 31. All surface soil samples collected from this site were analyzed for the full Appendix IX list and TPH.

Four additional surface soil samples (31SB01 through 31SB04) were collected at the locations of the four soil borings advanced along the perimeter of the bermed storage pad adjacent to Building 2022. Four shallow soil boring samples (31SB01-02, 31SB02-3, 31SB03-4, and 31SB04-2) were also obtained. All soil samples collected from this site were analyzed for the full Appendix IX list as well as TPH.

Tables 5-24 and 5-25 present Detected Concentrations of Organics and Inorganics in SWMU 31 Surface Soils and Tables 5-26 and 5-27 present Detected Concentrations of Organics and Inorganics in SWMU 31 Subsurface Soils. Results are presented here by building, by media.

5.2.11.1 <u>Building 31 Surface Soil Investigation Results</u>

Methylene chloride was present in one surface soil sample at 42 µg/kg. Six SVOCs (2-methylnaphthalene, phenanthrene, fluoranthene, pyrene, butylbenzylphthalate and bis(2-ethylhexyl)phthalate were detected in sample 31SS02 at concentrations ranging from 46J µg/kg (phenanthrene) to 700 µg/kg (bis[2-ethylhexyl]phthalate). Only bis(2-ethylhexyl)phthalate was found in each of the other three surface soil samples and at lower concentrations than that found in sample 31SS02.

4'4-DDE and 4,4'-DDD were found in two samples (31SS02 and 31SS04) with the higher concentrations found in sample 31SS02. Aroclor-1260 was detected in samples 31SS01 and 31SS02 at concentrations of 23 µg/kg and 230 µg/kg, respectively.

Dioxin compounds (total PECDD, HXCDD, TCDF, PECDF and HXCDF) were present in surface soil sample 31SS04 in concentrations ranging from 0.17J µg/kg (total TCDF) to 43 µg/kg (total HXCDF). In addition, trace total HXCDF was found in sample 31SS02 at 0.06J µg/kg.

Barium, chromium, cobalt, copper, lead, nickel, vanadium and zinc were detected in all samples. Arsenic was found in two samples; cadmium selenium and silver were present in only one sample each.

5.2.11.2 <u>Building 2022 Surface Soil Investigation Results</u>

Bis(2-ethylhexyl)phthalate was the only SVOC present in the surface soil samples associated with the soil borings at this location. 4,4'-DDE and 4,4'-DDD were found in surface soil sample 31SB01-00 at concentrations of 2.7 µg/kg and 3.5 µg/kg, respectively. Barium, beryllium, cobalt, chromium, copper, nickel, lead, vanadium, and zinc were found in each of the surface samples associated with the soil borings. Antimony, and tin were present in three samples and silver, selenium, and thallium were detected in one only sample.

5.2.11.3 <u>Building 2022 Subsurface Soil Investigation Results</u>

Butylbenzylphthalate and bis(2-ethylhexyl)phthalate were detected in one subsurface soil boring sample (31SB02-03) at concentrations of 84J µg/kg and 79J µg/kg, respectively. Metals and number of times found in the subsurface soil samples include: barium, beryllium, cobalt, chromium, copper, nickel, lead, vanadium, and zinc (4); antimony (3); and, selenium and tin (2).

5.2.11.4 Summary of Soil Investigations

In the surface soil samples obtained in association with Building 31, only 4,4'-DDD was present (found in one sample [31SS02]) at a concentration which exceeded the residential RBC value for soil (83 µg/kg). Criteria for comparison to dioxin data was not found. Arsenic exceeded residential RBCs for soil in samples 31SS02 and 31SS04.

Soil boring samples associated with Building 2022 indicated only beryllium above the residential RBC value (0.15 mg/kg) in both surface and subsurface soil samples. Concentrations ranged from 0.16 mg/kg in sample 31SB04-02 to 0.34 mg/kg in sample 31SB02-03. Figures 5-13 and 5-14 show Surface Soil COPCs and Subsurface Soil COPCs, respectively.

5.2.12 SWMU 32 - PWD Storage Yard/Battery Collection Area/Building 31 Soil Investigation Results

Four surface and four subsurface soil samples were obtained from this location. Each sample was analyzed for the full Appendix IX list and TPH.

5.2.12.1 Surface Soil Investigation Results

No VOCs were detected in any surface soil samples.

Only surface sample 32SS02 was found to contain SVOCs, including; fluoranthene, pyrene, butylbenzylphthalate, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene.

Total petroleum hydrocarbons were not present in the SWMU 32 soil surface soil samples.

Aroclor-1254 was detected in sample 32SS03 at a concentration of 2600 µg/kg.

Arsenic, barium, chromium and lead were found in each sample. Cadmium was detected in only two of the four samples: samples 32SS01 and 32SS04 at 0.53J mg/kg and 1.2J mg/kg, respectively.

5.2.12.2 Subsurface Soil Investigation Results

No sample was found to contain VOCs.

Bis(2-ethylhexyl)phthalate (a common laboratory artifact) was the only SVOC detected in the four subsurface soil samples. This constituent was found in sample 32SB04 at 290J µg/kg. TPH and PCBs were not present in subsurface soil samples obtained from this SWMU.

Barium, chromium, and lead were detected in each of the four samples. However, only arsenic and silver were present in one sample (32SB02 and 32SB01, respectively).

5.2.12.3 Summary of Soil Investigation

Aroclor-1254 was present in sample 32SS03 at a concentration above the residential soil RBC value of 1,600 µg/kg but well below the industrial RBC of 41,000 µg/kg. Arsenic concentrations were greater than the residential RBC value of 0.43 mg/kg in three samples (32SS01, 32SS02, and 32SS04). In addition, arsenic only slightly exceeded the residential RBC value of 0.43 mg/kg in the soil boring sample 32SB02, and was well below the industrial RBC value of 3.8 mg/kg.

Tables 5-28 through 5-31 present Detected Concentrations of Organics and Inorganics in SWMU 32 Surface and Subsurface Soils, respectively. Figures 5-13 and 5-14 present Surface and Subsurface Soil COPCs, respectively.

5.2.13 SWMU 37 - Waste Oil Storage Area/Building 200 Soil Investigation Results

A total of four surface soil samples (37SS01 through 37SS04) were collected and analyzed for VOCs, SVOCs, and PCBs. Table 5-32 presents Detected Concentrations of Organics in SWMU 37 Surface Soils.

Eighteen SVOCs were detected in at least one sample including: 3-and/or 4-methylphenol, benzoic acid, phenanthrene, anthracene, fluoranthene, pyrene, butylbenzylphthalate, benzo(a)anthracene, chrysene, bis(2-ethylhexyl)phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene, methyl methacrylate, and eremite. Sample 37SS03 exhibited the greatest number of SVOCs of the four samples ranging from 72J µg/kg to 2,100 µg/kg. Of the 17 SVOCs detected in sample 37SS03, the seven constituents with the highest concentrations (over 1,000 µg/kg) include fluoranthene, pyrene, butylbenzylphthalate, chrysene, bis(2-ethylhexyl)phthalate, benzo(b)fluoranthene, and benzo(k)fluoranthene. Benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene each exceeded the residential soil RBC values, but were well below the industrial RBC.

Aroclor-1260 was present in two samples (37SS02 and 37SS03) at concentrations of 91 µg/kg and 55 µg/kg, respectively. The 37SS02 concentration exceeded the residential RBC value of 83 µg/kg, but was well below the industrial RBC value (740 µg/kg).

Figure 5-15 presents Surface Soil COPCs at SWMU 37.

5.2.14 SWMU 39 - Former Battery Drain Area/Building 3158 Soil Investigation Results

The RFI conducted at this SWMU consisted of the collection of two surface soil samples (39SS01 and 39SS02). Both samples were analyzed for the RCRA metals only. Arsenic, barium, cadmium, chromium, lead, and selenium were detected in each sample in concentrations ranging from 0.24J mg/kg (selenium) to 76.3 mg/kg (lead). As shown in Table 5-33, only arsenic exceeded the residential RBC value for soils. However, soil concentrations were below the industrial RBC. Figure 5-16 shows Surface Soil COPCs at SWMU 39.

5.2.15 SWMU 46 - Pole Storage Yard Covered Pad Soil and Concrete Investigation Results

The assessment of SWMU 46 involved the collection of eleven surface soil samples and four subsurface soil samples. Nine surface soil samples were collected at this SWMU. Of these nine locations, two (46SS01 and 46SS02) were analyzed for the full Appendix IX list while the remaining samples were analyzed for VOCs, SVOCs, PCBs, and RCRA metals. Two additional surface soil samples were collected at the locations of the two soil borings. Tables 5-34 through 5-37 present Detected Concentrations of Organics and Inorganics in SWMU 46 Surface and Subsurface Soils.

5.2.15.1 Surface Soil Investigation Results

Both carbon disulfide and xylene (total) were detected in sample 46SS03. In addition, xylene was found in 46SS05.

Fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene were present in seven of the nine surface soil samples. Benzo(k)fluoranthene was detected in six samples; phenanthrene and benzo(g,h,i)perylene in three samples; dibenzo(a,h)anthracene in two samples; and 2,4-dimethylphenol, anthracene, and butylbenzylphthalate were present in one sample. Sample 46SS01 exhibited the greatest number of maximum SVOC concentrations at this location.

Aroclor-1260 was found in all samples in concentrations ranging from 59 µg/kg (46SSS09) to 3,600 µg/kg (46SS01).

Barium, chromium, and lead were present in all samples; arsenic in seven samples. Of the two samples analyzed for all metals, cobalt, copper, nickel, vanadium and zinc were found in each and was detected in the greatest concentration in 46SS01. Beryllium and tin were only present in sample 46SS02.

Cyanide and sulfide were not detected in either of the two samples analyzed for these parameters.

5.2.15.2 Subsurface Soil Investigation Results

Of the four subsurface soil samples obtained from the two borings, two (46SB01-06 and 46SB02-03) were analyzed for the full Appendix IX list while the remaining two samples were analyzed for VOCs, SVOCs, PCBs, and RCRA metals.

Trace carbon disulfide was detected in sample 46SB01-03D.

Phenol was present in 46SB02-05 at 289J µg/kg and bis(2-ethylhexyl)phthalate was present in 46SB01-06 and 46SB02-03 at 150J µg/kg and 3,600 µg/kg, respectively.

PCBs were not detected in any of the subsurface soil samples obtained at SWMU 46.

Barium, chromium, and lead were found in all four samples and the associated duplicate. Arsenic and selenium each were present in one sample. Silver was present in two samples, including the duplicate of 46SB01-03. Cobalt, copper, nickel, vanadium and zinc were analyzed (and detected) in samples 46SB01-06 and 46SB02-03 only.

5.2.15.3 Concrete Investigation Results

PCBs were not found in either of the two wipe samples (46WS01 and 46WS02) collected at this site.

5.2.15.4 Summary of Soil and Concrete Investigations

Benzo(a)pyrene detected in surface soil sample 46SS01 was present in a concentration above the industrial soil RBC value of 780 µg/kg. Benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and dibenzo(a,h)anthracene were detected in concentrations exceeding the residential RBC values in several samples as shown in Table 5-31. Aroclor-1260 concentrations were greater than the industrial RBC value of 740 µg/kg in three surface soil samples and more than the residential RBC value of 83 µg/kg in 6 other samples. Arsenic concentrations were greater than the residential RBC in five samples and beryllium slightly exceeded the residential RBC in sample 46SS02 only.

Of the soil boring samples, no organic compounds exceeded criteria. However, arsenic was above the residential soil value in sample 46SB02-03.

PCBs were not found in either of the two wipe samples (46WS01 and 46WS02) collected during the RFI.

Figure 5-17 presents Surface Soil COPCs at SWMU 45.

5.2.16 SWMU 51 - New AIMD Storage Pad/Building 379 Soil Investigation Results

Five surface soil samples (51SS01 through 51SS05) were analyzed for VOCs and SVOCs only at SWMU 51. Table 5-38 presents Detected Concentrations of Organics in SWMU 51 Surface Soils.

Trace total xylene was detected in two of the five samples at a concentration of 2J µg/kg each.

Benzoic acid, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, bis(2-ethylhexyl)phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, methyl methacrylate, and n-nitrosodimethylamine were detected in at least one surface soil sample. Of the 13 SVOCs listed above, ten were found in the sample from station 51SS04; however, maximum concentrations primarily were present in 51SS05 where eight SVOCs were detected.

As shown in Figure 5-18, only n-nitrosodimethylamine, present in sample 51SS02 at 95J µg/kg, was detected in a concentration greater than the residential RBC value of 13 µg/kg and slightly below the industrial soil RBC value of 110 µg/kg.

5.2.17 Area of Concern (AOC) C - Transformer Storage Pad Soil and Concrete Investigation Results

Twelve (12) surface soil samples were obtained at this location. Three surface soil samples (ACSS01, 02, and 03) were analyzed for the full Appendix IX list while the remaining nine samples (ACSS04 to ACSS12) were analyzed for VOCs, SVOCs, PCBs, and RCRA metals. Ten wipe samples of the concrete pad were obtained for PCB analysis.

Tables 5-39, 5-40, and 5-41 present Detected Concentrations of Organics and Inorganics in SWMU 55 AOC C Surface Soils, and Detected Concentrations of PCBs in SWMU 55 Concrete, respectively.

5.2.17.1 Soil Investigation Results

Methylene chloride, total xylene and trichlorofluoromethane were detected in surface soil samples at AOC C, including: methylene chloride (6), xylene (1), trichlorofluoromethane (1).

SVOCs present in soil samples and number of times detected, include: fluoranthene (5); pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene (4); bis(2-ethylhexyl)phthalate and benzo(k)fluoranthene (3); and, benzoic acid, phenanthrene di-n-butylphthalate, butylbenzylphthalate, di-n-octyl phthalate, and dibenzo(a,h)anthracene (1).

Sample ACSS03 exhibited 4,4'-DDE, -DDD, and -DDT, ketone, alpha and gamma chlordane. Aroclor-1260 was present in nine samples. Concentrations ranged from 74 µg/kg (ACSS11) to 5,200,000 µg/kg (ACSSS05D).

Total TCDF, PECDF, and HXCDF (dioxin constituents) were present in the sample ACSS02. Total HXCDF also was found in ACSS03 at 0.14J µg/kg in concentrations of 1J µg/kg, 2.4 µg/kg and 2 µg/kg, respectively.

Arsenic, barium, chromium, and lead were present in each of the 12 samples; cadmium and selenium were detected in five samples and two samples, respectively. In addition, Beryllium, cobalt, copper, nickel and vanadium were found in samples ACSS01, 02, and 03). Mercury was detected at a concentration of 0.33 mg/kg in ACSS03. Antimony and tin also were present in this sample.

Cyanide was detected at 0.97 mg/kg in sample ACSS03.

5.2.17.2 Concrete Investigation Results

Six of the ten samples exhibited concentrations of Aroclor-1260 above the detection limit of 1 µg/wipe. These ranged from 1 µg/wipe in sample ACWS04 to 130,000 µg/wipe in ACWS01.

5.2.17.3 Summary of Soil and Concrete Investigations

Benzo(a)pyrene exceeded the residential RBC value of 88 µg/kg in two samples (ACSS02 and ACSS11). Pesticides including 4,4'-DDE, 4,4'-DDT and alpha and gamma chlordane which were detected in ACSS03 exceeded residential RBCs. In addition, ketone was found in greater concentration than the industrial soils RBC value of 320 µg/kg in this sample. Aroclor-1260 was found in a concentration greater than the residential RBC value of 83 µg/kg in three samples (ACSS01, ACSS06 and ACSS12). Those samples exceeding the industrial RBC value of 740 µg/kg include ACSS02, ACSS04, and ACSS05 (as well as the associated duplicate sample). Concentrations of Aroclor-1260 are almost two orders of magnitude greater than the RBC value at location ACSS05, and one order of magnitude greater at location ACSS02.

Dioxin constituents primarily were present in sample ACSS02.

Arsenic, detected in samples ACSS03 and ACSS05D, exceeded the industrial soil RBC value of 3.8 mg/kg and the residential RBC concentration of 0.43 mg/kg in all other soil samples. Beryllium concentrations in samples ACSS01 and ACSS02 were greater than the RBC value of 0.15 mg/g and lead concentrations were above residential RBCs in three samples (ACSS03, ACSS05 and ACSS05D).

Figure 5-19 presents Surface Soil COPCs at AOC C.

Six of 10 wipe samples indicated the presence of Aroclor-1260 in concentrations ranging from 1 µg/wipe (ACWS04) to 130,000 µg/wipe (ACWS01).

5.3 Analytical Results at Operable Unit 7

Operable Unit 7 comprises the sediments of Ensenada Honda. Those sites investigated include SWMUs 1, 2, 3, 7, and 11. Activities conducted at each SWMU are discussed in the sections which follow. A discussion summarizing a comparison of results to criteria is provided in Section 5.3.6. Tables 5-42 and 5-43 summarize Detected Concentrations of Organics and Inorganics, respectively, in Ensenada Honda Sediments. Please note that no explosive constituents were detectd in any of the OU 7 sediment samples.

5.3.1 SWMU 1 - Army Cremator Disposal Site Sediment Investigation Results

Three sediment samples were collected at this site. Each of the three samples were analyzed for the full Appendix IX list along with nitramine compounds and asbestos.

Trace tetrachloroethene (2J µg/kg) was present in two of the three samples.

Bis(2-ethylhexyl)phthalate was found in two of the samples (1SD01 and 1SD03) at 110J µg/kg and 110J µg/kg, respectively. At the concentrations seen, the most likely source of this compound is laboratory contamination as no other SVOCs were detected.

Pesticides/PCBs, herbicides and dioxin were not detected in these samples.

Barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were present in each sample. Arsenic and selenium were detected in two samples, and silver was found in only one sample.

5.3.2 SWMU 2 - Langley Drive Disposal Site Sediment Investigation Results

Three sediment samples were analyzed for the full Appendix IX list, nitramine compounds, and asbestos.

The duplicate of sample 2SD03 exhibited 2-butanone at a concentration of 11J µg/kg. No other VOCs were detected in the three sediment samples.

Phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, and bis(2-ethylhexyl)phthalate were present in two samples. Concentrations ranged from 290 µg/kg (phenanthrene) to 2,200 µg/kg (pyrene). Anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene were present in sample 2SD03 and the associated duplicate. Dibenzo(a,h)anthracene, benzo(g,h,i)perylene, and carbazole were present in the duplicate sample only.

Beta-BHC was detected in sample 2SD03D (duplicate) and 4,4'-DDE was found in both the environmental and duplicate sample at station 2SD03.

Herbicides were not present in any sample.

Total PECDD, HXCDD, and HXCDF were detected in 2SD03 and/or the duplicate sample in concentrations of 0.26J µg/kg, 2.5/3.3 µg/kg, and 0.91J/1J µg/kg, respectively. Sample concentrations exceed the industrial and residential RBC values for these constituents.

Arsenic, barium, chromium, cobalt, copper, lead, nickel, vanadium and zinc were present in each sample. Mercury and tin were found in two samples plus the duplicate. Cadmium and selenium were present in one sample each.

Sulfide was detected at 296J mg/kg and 55J mg/kg in 2SD02 and 2SD03D.

5.3.3 SWMU 3 - Base Landfill Sediment Investigation Results

Fifteen (15) sediment samples were collected along the perimeter of this SWMU. Each sample was analyzed for the full Appendix IX list, nitramine compounds, and asbestos.

Acetone was found in only one sample at this SWMU (3SD13) at a concentration of 26 µg/kg indicating a probable laboratory contaminant.

Detected SVOCs (and number of samples where present) include: phenol (4); benzoic acid (5); and, bis(2-ethylhexyl)phthalate (4).

Pesticides/PCBs and Herbicides were not found in the samples analyzed. However, Total HXCDD was present at 1J µg/kg in sample 3SD15.

Barium, copper, lead, vanadium and zinc were present in all 15 sediment samples. Arsenic was found in 13 samples; chromium and nickel in eight samples; and, beryllium, cobalt, selenium and tin in two samples.

Sulfide was found in seven samples at concentrations ranging from 59.3J mg/kg (3SD15)in 3SD03 to 242J mg/kg in 3SD12).

5.3.4 SWMU 7 - Tow Way Fuel Farm Sediment Investigation Results

Four sediment samples were collected from this location and analyzed for the full Appendix IX list. Acetone was present in three of the four samples ranging in concentrations of 43 µg/kg (7SD03) to 120 µg/kg (7SD01).

Benzoic acid was detected in each of the samples; indeno(1,2,3-cd)pyrene in three samples; phenanthrene, fluoranthene, pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene and indeno(1,2,3-cd)pyrene in two samples (7SD01 and 7SD02); and, benzo(a)anthracene and benzo(g,h,i)perylene in one sample (7SD01).

Pesticides, PCBs and dioxins were not found in the samples obtained from this location.

2,4,5-TP (Silvex) was detected in sample 7SD04 at 40J µg/kg which is well below the industrial and residential RBC values for silvex.

Arsenic, barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were present in each of the four sediment samples. Cadmium, silver, and tin each were present in one sample.

5.3.5 SWMU 11/45 - Old Power Plant/Building 38 Sediment Investigation Results

Three sediment samples were collected near the terminus of the intake tunnel in Puerca Bay because the discharge tunnel in Ensenada Honda could not be located. Samples 11SD01 through 11SD03 were analyzed for VOCs, SVOCs, PCBs, and RCRA metals.

Carbon disulfide was present in each sample at concentrations ranging from 4J µg/kg to 15 µg/kg.

Acenaphthylene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene and benzo(g,h,i)perylene were found in each of the three sediment samples. Concentrations ranged from 67 µg/kg of acenaphthylene in 11SD02 to 24,000 µg/kg of benzo(b)fluoranthene in 11SD01.

PCBs were not detected at these sample locations.

Arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver were analyzed. All metals, except cadmium and silver, were detected in the samples. As discussed in Section 5.1.1, mercury and selenium results were rejected by the laboratory.

5.3.6 OU 7 Summary of Sediment Investigation Results

Figures 5-20 to 5-24 present SWMUs 1, 2, 3, 7, and 11/45 COPCs in OU 7 Sediments. The following section discuss, by parameter, those constituents which exceed the established criteria used to evaluate the sediment sample results.

5.3.6.1 Volatile Organic Compounds

VOCs were not detected above established criteria (ER-M, ER-L, industrial soil RBCs and/or residential soil RBCs) in any OU 7 sediment samples.

5.3.6.2 Semivolatile Organic Compounds

No sediment SVOC sample concentrations exceeded the evaluation criteria at SWMUs 1 and 3.

The following focuses on those constituents which have been found in greater concentration than the more conservative ER-L and residential RBC values. Of the three sediment samples obtained at SWMU 2, the following SVOCs were present above the associated ER-L value in each sample: phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, and chrysene. In addition, benzo(a)pyrene was detected above the ER-L value in two samples; and fluorene and dibenzo(a,h)anthracene were found greater than the ER-L in one SWMU 2 sediment sample. Those SVOCs which exceeded the residential RBC values (including the number of samples) are: benzo(a)anthracene (2); benzo(b)fluoranthene (2); benzo(a)pyrene (2); indeno(1,2,3-cd)pyrene (1); and dibenzo(a,h)anthracene(1).

One sample obtained at SWMU 7 exceeded criteria. The chrysene ER-L value of 384 µg/kg was exceeded in sample 7SD01. The residential RBC value of 88 µg/kg was also found in greater concentration in this sample.

The following SVOCs were found to exceed applicable criteria at SWMU 11. Acenaphthylene, benzo(a)pyrene and dibenzo(a,h)anthracene concentrations exceeded the ER-L values of 44 µg/kg, 430 µg/kg, and 63.4 µg/kg, respectively, in the three sediment samples obtained at SWMU 11. In addition, anthracene, benzo(a)anthracene, and chrysene concentrations were greater than the ER-L values of 85.3 µg/kg, 261 µg/kg, and 384 µg/kg, respectively, in two of the three sediment samples collected at SWMU 11. Six SVOCs including benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene exceeded residential soil RBCs in sample 11SD01. Benzo(a)pyrene and dibenzo(a,h)anthracene concentrations were detected greater than residential soil RBCs in samples 11SD02 and 11SD03. Benzo(b)fluoranthene also was found in greater concentration than the RBC value in sample 11SD03.

5.3.6.2 Pesticides/PCBs

Only 4,4'-DDE was present in concentrations greater than the ER-L value of 2.2 µg/kg in the environmental and associated duplicate sample obtained from location 2SD03.

5.3.6.3 Dioxin

Sample 3SD15 (SWMU 3) exhibited total HXCDD at a concentration above the industrial RBC value. In addition, total HXCDD and HXCDF were found above industrial RBCs in both the environmental sample and associated duplicate at location 2SD03 (SWMU 2). Total PECDD also was present above the industrial RBC value in the duplicate sample.

5.3.6.4 Metals

Copper exceeded the ER-L value in sample 1SD02.

Copper, lead, mercury, and zinc were present in concentrations greater than the ER-L value at two SWMU 2 locations (2SD02 and 2SD03). In addition, cadmium exceeded criteria in sample 2SD02.

Beryllium was found in a concentrations above the residential RBC in two samples collected at SWMU 3 (3SD07 and 3SD12). Copper was present above the ER-L in sample 3SD14.

Arsenic concentrations were above ER-L values in two of the four samples obtained at SWMU 7. In addition, copper exceeded the ER-L in one sample at this location.

Arsenic exceeded the ER-L in two samples at SWMU 11 (11SD02 and 11SD03) and lead was found above the ER-L in sample 11SD01.

SECTION 5.0 TABLES

TABLE 5-1
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACBSB01-00		ACBSB01-00D		ACBSB02-00		ACBSS01		ACBSS02-00	
SAMPLE DATE	Soils	Soils	03/26/96		03/26/96		03/26/96		03/19/96		03/19/96	
VOLATILES (ug/kg)												
1,2-DICHLOROETHENE (TOTAL)	18000000	700000	5	U	5	U	5	U	6	U	5	U
XYLENE (TOTAL)	1.00E+09	160000000	5	U	5	U	8		6	U	5	U
SEMIVOLATILES (ug/kg)												
NAPHTHALENE	82000000	3100000	340	U	350	U	1800	U	370	U	340	U
2-METHYLNAPHTHALENE	82000000	3100000	340	U	350	U	1800	U	370	U	340	U
ACENAPHTHYLENE	61000000	2300000	340	U	350	U	1800	U	370	U	340	U
4-CHLOROPHENYL-PHENYLETHER	NA	NA	340	U	350	U	1800	U	370	U	340	U
PHENANTHRENE	61000000	2300000	340	U	350	U	1800	U	370	U	170	J
ANTHRACENE	610000000	23000000	340	U	350	U	1800	U	370	U	340	U
DI-N-BUTYLPHTHALATE	200000000	7800000	77	J	350	U	350	J	370	U	340	U
FLUORANTHENE	82000000	3100000	80	J	100	J	1800	U	86	J	390	
PYRENE	61000000	2300000	42	J	62	J	1800	U	76	J	360	
BUTYLBENZYLPHTHALATE	410000000	16000000	340	U	350	U	1800	U	370	U	340	U
BENZO(A)ANTHRACENE	7800	880	38	J	47	J	1800	U	370	U	150	J
CHRYSENE	780000	88000	45	J	70	J	1800	U	51	J	250	J
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	340	U	350	U	1800	U	370	U	340	U
BENZO(B)FLUORANTHENE	7800	880	340	U	350	U	1800	U	56	J	200	J
BENZO(K)FLUORANTHENE	78000	8800	340	U	350	U	1800	U	370	U	100	J
BENZO(A)PYRENE	780	88	340	U	350	U	1800	U	39	J	140	J
INDENO(1,2,3-CD)PYRENE	7800	880	340	U	43	J	1800	U	370	U	78	J
DIBENZO(A,H)ANTHRACENE	780	88	340	U	350	U	1800	U	370	U	340	U
BENZO(G,H,I)PERYLENE	61000000	2300000	340	U	350	U	1800	U	370	U	79	J
CARBAZOLE	290000	32000	340	U	350	U	1800	U	370	U	340	U
BENZOIC ACID	1.00E+09	310000000	1700	U	1800	U	8800	U	1900	U	1700	U
ACETOPHENONE	200000000	7800000	340	U	350	U	1800	U	370	U	340	U

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling efforts.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NOTES
ug/kg = micrograms per kilogram.
Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-1
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACBSB01-00		ACBSB01-00D		ACBSB02-00		ACBSS01		ACBSS02-00	
SAMPLE DATE	Soils	Soils	03/26/96		03/26/96		03/26/96		03/19/96		03/19/96	
PESTICIDE/PCBS (ug/kg)												
HEPTACHLOR EPOXIDE	630	70	210	U	210	U	42	U	2.6		4	U
4,4'-DDE	17000	1900	19000		22000		15	J	40		8.1	U
4,4'-DDD	24000	2700	17000		18000		40		5.9	NJ	8.1	U
4,4'-DDT	17000	1900	11000		14000		13	J	19	J	8.1	U
DIOXIONS (ug/kg)												
TOTAL HXCDD	0.004	0.0004	0.43	U	0.12	U	0.21	U	0.08	U	0.15	U
TOTAL HXCDF	0.004	0.0004	0.33	U	0.11	U	0.15	U	0.09	U	0.13	U

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J = Analyte present. Reported value may not be accurate or precise.
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Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-1
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACB-MW01-00		ACBMW02-00		ACBMW03-00		6SB01-00		6SB02-00	
SAMPLE DATE	Soils	Soils	03/19/96		03/19/96		03/19/96					
VOLATILES (ug/kg)												
1,2-DICHLOROETHENE (TOTAL)	18000000	700000	5	U	5	U	5	U	2	J	5	U
XYLENE (TOTAL)	1.00E+09	160000000	5	U	5	U	5	U	5	U	5	U
SEMIVOLATILES (ug/kg)												
NAPHTHALENE	82000000	3100000	350	U	340	U	340	U	210	J	340	U
2-METHYLNAPHTHALENE	82000000	3100000	350	U	340	U	340	U	78	J	340	UJ
ACENAPHTHYLENE	61000000	2300000	350	U	340	U	340	U	35	J	340	U
4-CHLOROPHENYL-PHENYLETHER	NA	NA	350	U	340	U						
PHENANTHRENE	61000000	2300000	350	U	340	U	71	J	130	J	340	U
ANTHRACENE	610000000	23000000	350	U	340	U	340	U	61	J	340	U
DI-N-BUTYLPHTHALATE	200000000	7800000	350	U	340	U	340	U	38	J	340	U
FLUORANTHENE	82000000	3100000	350	U	340	U	150	J	500		340	U
PYRENE	61000000	2300000	350	U	340	U	140	J	570		340	U
BUTYLBENZYLPHTHALATE	410000000	16000000	350	U	340	U	340	U	340	U	340	U
BENZO(A)ANTHRACENE	7800	880	350	U	340	U	67	J	150	J	340	U
CHRYSENE	780000	88000	350	U	340	U	95	J	200	J	340	U
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	350	U	340	U	340	U	1000		340	U
BENZO(B)FLUORANTHENE	7800	880	350	U	340	U	91	J	460		340	U
BENZO(K)FLUORANTHENE	78000	8800	350	U	340	U	45	J	190	J	340	U
BENZO(A)PYRENE	780	88	350	U	340	U	69	J	290	J	340	U
INDENO(1,2,3-CD)PYRENE	7800	880	350	U	340	U	46	J	150	J	340	U
DIBENZO(A,H)ANTHRACENE	780	88	350	U	340	U	340	U	340	U	340	U
BENZO(G,H,I)PERYLENE	61000000	2300000	350	U	340	U	46	J	120	J	340	U
CARBAZOLE	290000	32000	350	U	340	U	340	U	74	J	340	U
BENZOIC ACID	1.00E+09	310000000	1700	U	1700	U	1700	U	1700	UJ	1700	UJ
ACETOPHENONE	200000000	7800000	350	U	340	U	340	U	300	J	340	U

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling efforts.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NOTES
ug/kg = micrograms per kilogram.
Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-1
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACB-MW01-00		ACBMW02-00		ACBMW03-00		6SB01-00		6SB02-00	
SAMPLE DATE	Soils	Soils	03/19/96		03/19/96		03/19/96					
PESTICIDE/PCBS (ug/kg)												
HEPTACHLOR EPOXIDE	630	70	4.1	U	40	U	1.7	NJ	42	U	4.1	U
4,4'-DDE	17000	1900	8.3	U	21	J	8.2	U	11	J	8.2	U
4,4'-DDD	24000	2700	8.3	U	81	U	8.2	U	84	U	8.2	U
4,4'-DDT	17000	1900	8.3	U	81	U	1.7	R	84	U	8.2	U
DIOXIONS (ug/kg)												
TOTAL HXCDD	0.004	0.0004	0.11	U	0.1	U	0.23	U	0.25	J	0.3	U
TOTAL HXCDF	0.004	0.0004	0.09	U	0.07	U	0.2	U	0.26	J	0.24	U

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling efforts.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-1
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	Industrial Soils	Residential Soils	6SB03-00		6SS01		6SS01D		6SS02		number exceeding Industrial Soils	number exceeding Residential Soils
VOLATILES (ug/kg)												
1,2-DICHLOROETHENE (TOTAL)	18000000	700000	5	U	5	U	5	U	2	J	0/14	0/14
XYLENE (TOTAL)	1.00E+09	160000000	5	U	5	U	5	U	5	U	0/14	0/14
SEMIVOLATILES (ug/kg)												
NAPHTHALENE	82000000	3100000	340	U	340	U	340	U	340	U	0/14	0/14
2-METHYLNAPHTHALENE	82000000	3100000	340	UJ	340	UJ	340	UJ	340	UJ	0/14	0/14
ACENAPHTHYLENE	61000000	2300000	340	U	350		280	J	42	J	0/14	0/14
4-CHLOROPHENYL-PHENYLETHER	NA	NA									NA	NA
PHENANTHRENE	61000000	2300000	60	J	210	J	110	J	240	J	0/14	0/14
ANTHRACENE	610000000	23000000	340	U	370		320	J	77	J	0/14	0/14
DI-N-BUTYLPHTHALATE	200000000	7800000	340	U	340	U	37	J	340	U	0/14	0/14
FLUORANTHENE	82000000	3100000	360		3200		1100		890		0/14	0/14
PYRENE	61000000	2300000	350		4200		1700		840		0/14	0/14
BUTYLBENZYLPHTHALATE	410000000	16000000	340	U	49	J	150	J	100	J	0/14	0/14
BENZO(A)ANTHRACENE	7800	880	170	J	2400		1300		430		0/14	2/14
CHRYSENE	780000	88000	340	J	3300		2300		880		0/14	0/14
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	45	J	170	J	120	J	59	J	0/14	0/14
BENZO(B)FLUORANTHENE	7800	880	310	J	4300		3500		840		0/14	2/14
BENZO(K)FLUORANTHENE	78000	8800	160	J	1300		1000		380		0/14	0/14
BENZO(A)PYRENE	780	88	160	J	1800		1600		380		2/14	6/14
INDENO(1,2,3-CD)PYRENE	7800	880	120	J	790		660		250	J	0/14	0/14
DIBENZO(A,H)ANTHRACENE	780	88	340	U	180	J	140	J	50	J	0/14	2/14
BENZO(G,H,I)PERYLENE	61000000	2300000	100	J	630		540		220	J	0/14	0/14
CARBAZOLE	290000	32000	340	U	330	J	210	J	61	J	0/14	0/14
BENZOIC ACID	1.00E+09	310000000	1700	U	410	J	1700	UJ	1700	UJ	0/14	0/14
ACETOPHENONE	200000000	7800000	340	U	340	U	340	U	340	U	0/14	0/14

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling efforts.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.
NOTES
ug/kg = micrograms per kilogram.
Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-1
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	6SB03-00		6SS01		6SS01D		6SS02		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils									Industrial Soils	Residential Soils
PESTICIDE/PCBS (ug/kg)												
HEPTACHLOR EPOXIDE	630	70	21	U	41	U	41	U	5.6	R	0/13	0/13
4,4'-DDE	17000	1900	42	U	82	U	82	U	42	U	2/14	2/14
4,4'-DDD	24000	2700	42	U	82	U	82	U	42	U	0/14	2/14
4,4'-DDT	17000	1900	42	U	82	U	82	U	42	U	0/13	2/13
DIOXIONS (ug/kg)												
TOTAL HXCDD	0.004	0.0004	0.07	U	0.76	J	0.74	J	0.1	U	3/14	3/14
TOTAL HXCDF	0.004	0.0004	0.08	U	0.23	J	0.17	J	0.07	U	3/14	3/14

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling efforts.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-2
DETECTED CONCENTRATIONS OF INORGANICS ANALYTES
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACBSB01-00		ACBSB01-00D		ACBSB02-00		ACBSS01		ACBSS02-00	
SAMPLE DATE	Soils	Soils	03/26/96		03/26/96		03/26/96		03/19/96		03/19/96	
TOTAL METALS (mg/kg)												
ANTIMONY, TOTAL	820	31	1.2	UJ	2	UJ	1.4	UJ	2.2	UJ	1.6	J
ARSENIC, TOTAL	3.8	0.43	4.2	J	4.7	J	1.3	J	1		0.72	
BARIUM, TOTAL	140000	5500	76.1		71		49.5		90	J	38.7	J
BERYLLIUM, TOTAL	1.3	0.15	0.05	U	0.08	U	0.05	U	0.44		0.06	U
CADMIUM, TOTAL	1000	39	1.4		1.5		0.85		0.52		0.88	
CHROMIUM, TOTAL	10000	390	16		12.9		13.6		23.5	J	31.9	J
COBALT, TOTAL	120000	4700	19.1	J	16.1	J	15.3		30.2	J	14	J
COPPER, TOTAL	82000	3100	123		113		167	J	167		64.6	
LEAD, TOTAL	NA	400	34.2		50.1		23.2		16.6		7.9	
MERCURY, TOTAL	610	23	0.05	U	0.06		0.05	U	0.04	U	0.09	J
NICKEL, TOTAL	41000	1600	12.1		9.8		14.8		14.6		12.3	
SELENIUM, TOTAL	10000	390	0.27	U	0.19	UJ	0.17	UJ	0.5	J	0.14	UJ
TIN, TOTAL	1000000	47000	0.64	U	1.2		1.5		1.2	U	0.83	U
VANADIUM, TOTAL	14000	550	113		98.3		89.5		172		82.2	
ZINC, TOTAL	610000	23000	246	J	221	J	291	J	108	J	43.5	J
CYANIDE, TOTAL	41000	1600	0.36	U	0.46	U	0.48	U	1.8		0.44	U

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-2
DETECTED CONCENTRATIONS OF INORGANICS ANALYTES
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACBMW01-00		ACBMW02-00		ACBMW03-00		6SB01-00		6SB02-00	
SAMPLE DATE	Soils	Soils	03/19/96		03/19/96		03/19/96					
TOTAL METALS (mg/kg)												
ANTIMONY, TOTAL	820	31	1.6	UJ	1.9	UJ	2	UJ	4.1	J	3.6	J
ARSENIC, TOTAL	3.8	0.43	2.9		1.4		2.5		10		0.6	
BARIUM, TOTAL	140000	5500	111	J	39.7	J	13	J	98.8		98.5	
BERYLLIUM, TOTAL	1.3	0.15	0.55		0.13		0.28		0.27		0.3	
CADMIUM, TOTAL	1000	39	0.65		0.38		0.43		0.67		0.19	U
CHROMIUM, TOTAL	10000	390	19.3	J	34.7	J	6.7	J	28.6	J	22.8	J
COBALT, TOTAL	120000	4700	18.4	J	12.3	J	1.8	J	10.2		18	
COPPER, TOTAL	82000	3100	137		58.4		11.4		1030		87.3	
LEAD, TOTAL	NA	400	4.2		9.7		10.5		225		9.7	
MERCURY, TOTAL	610	23	0.05	U	0.04	U	0.07	J	12.6		0.28	
NICKEL, TOTAL	41000	1600	12.4		13.2		3.2		9.6		16.5	
SELENIUM, TOTAL	10000	390	0.38	J	0.15	UJ	0.68	UJ	0.13	UJ	0.14	UJ
TIN, TOTAL	1000000	47000	1.4		1	U	1.1	U	1.2		0.91	U
VANADIUM, TOTAL	14000	550	87.9		88.5		13.9		71.2		98.5	
ZINC, TOTAL	610000	23000	88.2	J	63.3	J	25.1	J	335		67.7	
CYANIDE, TOTAL	41000	1600	0.5	U	0.4	U	0.39	U	0.37	U	0.42	U

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-2
DETECTED CONCENTRATIONS OF INORGANICS ANALYTES
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	Industrial Soils	Residential Soils	6SB03-00		6SS01		6SS01D		6SS02		number exceeding Industrial Soils	number exceeding Residential Soils
TOTAL METALS (mg/kg)												
ANTIMONY, TOTAL	820	31	3.6	J	5.2	J	3.1	J	4.4	J	0/14	0/14
ARSENIC, TOTAL	3.8	0.43	3.4		5.3		3.7		5.7		5/14	14/14
BARIUM, TOTAL	140000	5500	53.9		68.2		69.1		74.8		0/14	0/14
BERYLLIUM, TOTAL	1.3	0.15	0.16		0.25		0.27		0.28		0/14	9/14
CADMIUM, TOTAL	1000	39	1.3		0.51		0.51		0.52		0/14	0/14
CHROMIUM, TOTAL	10000	390	15.7	J	30.8	J	29.7	J	27.7	J	0/14	0/14
COBALT, TOTAL	120000	4700	7.7		11		10.3		17.3		0/14	0/14
COPPER, TOTAL	82000	3100	91.9		203		166		116		0/14	0/14
LEAD, TOTAL	NA	400	50.4		112		131		49.7		NA	0/14
MERCURY, TOTAL	610	23	1.3		4.1		5		0.08		0/14	0/14
NICKEL, TOTAL	41000	1600	5.5		14.5		11.7		11.3		0/14	0/14
SELENIUM, TOTAL	10000	390	0.17	UJ	0.34	UJ	0.75	UJ	0.15	UJ	0/14	0/14
TIN, TOTAL	1000000	47000	1.6		2.7		1.5		1.2		0/14	0/14
VANADIUM, TOTAL	14000	550	49.4		69.1		73.8		101		0/14	0/14
ZINC, TOTAL	610000	23000	105		195		208		125		0/14	0/14
CYANIDE, TOTAL	41000	1600	0.45	U	0.44	U	0.5	U	0.52	U	0/14	0/14

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-3
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACBSB01-01		ACBSB01-02		ACBSB02-01		ACBSB02-02		ACB-MW01-04	
SAMPLE DATE	Soils	Soils	03/26/96		03/26/96		03/26/96		03/26/96		03/20/96	
SAMPLE DEPTH (feet)	[ug/kg]	[ug/kg]	0-2		2-4		0-2		2-4		6-8	
VOLATILES (ug/kg)												
ACETONE	200000000	7800000	12	U	11	U	10	U	12	U	16	
XYLENE (TOTAL)	1.00E+09	160000000	6	U	6	U	6		6	U	6	U
SEMIVOLATILES (ug/kg)												
PHENANTHRENE	61000000	2300000	380	U	360	U	350	U	42	J	390	U
DI-N-BUTYLPHTHALATE	200000000	7800000	380	U	360	U	140	J	380	U	49	J
FLUORANTHENE	82000000	3100000	380	U	360	U	350	U	140	J	390	U
PYRENE	61000000	2300000	380	U	360	U	350	U	59	J	390	U
BENZO(A)ANTHRACENE	7800	880	380	U	360	U	350	U	57	J	390	U
CHRYSENE	780000	88000	380	U	360	U	350	U	60	J	390	U
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	380	U	360	U	350	U	380	U	390	U
BENZO(B)FLUORANTHENE	7800	880	380	U	360	U	350	U	70	J	390	U
BENZO(A)PYRENE	780	88	380	U	360	U	350	U	48	J	390	U
PESTICIDE/PCBS (ug/kg)												
HEPTACHLOR EPOXIDE	630	70	4.5	U	220	U	21	U	4.7	U	4.6	U
4,4'-DDE	17000	1900	300		2600		42	U	1.9		9.3	U
4,4'-DDD	24000	2700	180		9800		42	U	1.2	J	9.3	U
4,4'-DDT	17000	1900	180		2800		42	U	9.3	U	9.3	U
ALPHA-CHLORDANE	4400	490	45	U	2200	U	210	U	21		46	U
GAMMA-CHLORDANE	4400	490	45	U	2200	U	210	U	17		46	U

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-3
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACB-MW01-05		ACBMW03-01		ACBMW03-02		6SB01-01		6SB01-02	
SAMPLE DATE	Soils	Soils	03/20/96		03/25/96		03/25/96					
SAMPLE DEPTH (feet)	[ug/kg]	[ug/kg]	8-10		0-2		2-4					
VOLATILES (ug/kg)												
ACETONE	200000000	7800000	12	U	11	UJ	12	UJ	32	J	14	J
XYLENE (TOTAL)	1.00E+09	160000000	6	U	5	U	6	U	6	U	5	U
SEMIVOLATILES (ug/kg)												
PHENANTHRENE	61000000	2300000	400	U	360	U	380	U	380	U	350	U
DI-N-BUTYLPHTHALATE	200000000	7800000	400	U	360	U	380	U	380	U	54	J
FLUORANTHENE	82000000	3100000	400	U	360	U	380	U	380	U	350	U
PYRENE	61000000	2300000	400	U	360	U	380	U	380	U	350	U
BENZO(A)ANTHRACENE	7800	880	400	U	360	U	380	U	380	U	350	U
CHRYSENE	780000	88000	400	U	360	U	380	U	380	U	350	U
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	400	U	36	J	380	U	380	U	350	U
BENZO(B)FLUORANTHENE	7800	880	400	U	360	U	380	U	380	U	350	U
BENZO(A)PYRENE	780	88	400	U	360	U	380	U	380	U	350	U
PESTICIDE/PCBS (ug/kg)												
HEPTACHLOR EPOXIDE	630	70	1.6	J	4.3	U	4.6	U	4.5	U	4.2	U
4,4'-DDE	17000	1900	6.7		8.6	U	9.2	U	9.1	U	8.5	U
4,4'-DDD	24000	2700	9.5	U	8.6	U	9.2	U	9.1	U	8.5	U
4,4'-DDT	17000	1900	9.5	U	8.6	U	9.2	U	9.1	U	8.5	U
ALPHA-CHLORDANE	4400	490	47	U	43	U	46	U	45	U	42	U
GAMMA-CHLORDANE	4400	490	47	U	43	U	46	U	45	U	42	U

TABLE 5-3
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE SAMPLE DEPTH (feet)	Industrial Soils [ug/kg]	Residential Soils [ug/kg]	6SB02-01		6SB03-01		6SB03-01D		6SB03-03		number exceeding Industrial Soils [ug/kg]	number exceeding Residential Soils [ug/kg]
VOLATILES (ug/kg)												
ACETONE	200000000	7800000	11	UJ	11	UJ	11	UJ	11	UJ	0/14	0/14
XYLENE (TOTAL)	1.00E+09	160000000	5	U	6	U	5	U	5	U	0/14	0/14
SEMIVOLATILES (ug/kg)												
PHENANTHRENE	61000000	2300000	360	U	360	U	360	U	360	U	0/14	0/14
DI-N-BUTYLPHTHALATE	200000000	7800000	360	U	360	U	360	U	360	U	0/14	0/14
FLUORANTHENE	82000000	3100000	360	U	360	U	360	U	360	U	0/14	0/14
PYRENE	61000000	2300000	360	U	360	U	360	U	360	U	0/14	0/14
BENZO(A)ANTHRACENE	7800	880	360	U	360	U	360	U	360	U	0/14	0/14
CHRYSENE	780000	88000	360	U	360	U	360	U	360	U	0/14	0/14
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	360	UJ	360	UJ	360	UJ	360	UJ	0/14	0/14
BENZO(B)FLUORANTHENE	7800	880	360	U	360	U	360	U	360	U	0/14	0/14
BENZO(A)PYRENE	780	88	360	U	360	U	360	U	360	U	0/14	0/14
PESTICIDE/PCBS (ug/kg)												
HEPTACHLOR EPOXIDE	630	70	4.4	U	4.4	U	4.3	U	4.3	U	0/14	0/14
4,4'-DDE	17000	1900	8.8	U	8.8	U	8.6	U	1.4	J	0/14	1/14
4,4'-DDD	24000	2700	8.8	U	8.8	U	8.6	U	1.4	J	0/14	1/14
4,4'-DDT	17000	1900	8.8	U	8.8	U	8.6	U	8.6	U	0/14	1/14
ALPHA-CHLORDANE	4400	490	44	U	44	U	43	U	43	U	0/14	0/14
GAMMA-CHLORDANE	4400	490	44	U	44	U	43	U	43	U	0/14	0/14

TABLE 5-4
DETECTED CONCENTRATIONS OF INORGANICS ANALYTES
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACBSB01-01		ACBSB01-02		ACBSB02-01		ACBSB02-02		ACB-MW01-04	
SAMPLE DATE	Soils	Soils	03/26/96		03/26/96		03/26/96		03/26/96		03/20/96	
SAMPLE DEPTH (feet)	[mg/kg]	[mg/kg]	0-2		2-4		0-2		2-4		6-8	
TOTAL METALS (mg/kg)												
ANTIMONY, TOTAL	820	31	2.1	UJ	3.1	J	1.5	UJ	2.2	UJ	3.6	J
ARSENIC, TOTAL	3.8	0.43	0.96	J	0.13	UJ	0.14	UJ	0.15	UJ	1.4	
BARIUM, TOTAL	140000	5500	50		89		94.2		91.4		53.3	J
BERYLLIUM, TOTAL	1.3	0.15	0.32		0.07	U	0.06	U	0.09	U	0.69	
CADMIUM, TOTAL	1000	39	0.42		0.67		0.42		0.24	U	0.18	U
CHROMIUM, TOTAL	10000	390	25.6		29.2		81.2		15.5		41.4	J
COBALT, TOTAL	120000	4700	11	J	25.9	J	23.3	J	30.2	J	31.8	J
COPPER, TOTAL	82000	3100	124		163		151		157		78.4	
LEAD, TOTAL	NA	400	3.9		12.1		2.3		5.7		5.7	
MERCURY, TOTAL	610	23	0.05	U	0.05	U	0.05	U	0.05	U	0.06	U
NICKEL, TOTAL	41000	1600	9.3		22.7		15.6		15.2		35.8	
SELENIUM, TOTAL	10000	390	1.2	J	0.48	UJ	0.49	UJ	0.22	UJ	0.21	U
SILVER, TOTAL	10000	390	0.33	U	0.49		0.39		0.34	U	0.25	U
THALLIUM, TOTAL	NA	NA	0.08	U	0.14		0.09		0.08	U	0.2	UJ
TIN, TOTAL	1000000	47000	1.1	U	0.95	U	0.8	U	1.2	U	0.86	U
VANADIUM, TOTAL	14000	550	204		134		120		101		146	
ZINC, TOTAL	610000	23000	46.9	J	132	J	70.9	J	58.2	J	65.4	J
CYANIDE, TOTAL	41000	1600	0.48	U	0.47	U	0.47	U	0.53	U	0.53	U

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-4
DETECTED CONCENTRATIONS OF INORGANICS ANALYTES
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACB-MW01-05		ACBMW03-01		ACBMW03-02		6SB01-01		6SB01-02	
SAMPLE DATE	Soils	Soils	03/20/96		03/20/96		03/20/96					
SAMPLE DEPTH (feet)	[mg/kg]	[mg/kg]	8-10		0-2		2-4					
TOTAL METALS (mg/kg)												
ANTIMONY, TOTAL	820	31	1.8	J	1.4	UJ	2.3	UJ	3.8	J	2.3	J
ARSENIC, TOTAL	3.8	0.43	0.45	U	0.49	UJ	0.29	UJ	0.93		0.6	U
BARIUM, TOTAL	140000	5500	86.2	J	110		87.1		90		84.6	
BERYLLIUM, TOTAL	1.3	0.15	0.05	U	1.1		0.14		0.24		0.23	
CADMIUM, TOTAL	1000	39	0.22		0.18		0.54		0.22	U	0.17	U
CHROMIUM, TOTAL	10000	390	6.8	J	9.8		45.3		18.5	J	17.6	J
COBALT, TOTAL	120000	4700	12.9	J	51.3	J	19.7	J	15.3		10.7	
COPPER, TOTAL	82000	3100	92.7		336		126		70.5		56.1	
LEAD, TOTAL	NA	400	1.5		3.3	J	22	J	5.9		0.94	
MERCURY, TOTAL	610	23	0.04	U	0.04	UJ	0.04	UJ	0.04	U	0.04	U
NICKEL, TOTAL	41000	1600	6.1		13.4		12.5		9.3		4.8	
SELENIUM, TOTAL	10000	390	0.12	UJ	0.66	J	0.39	U	0.19	UJ	0.83	UJ
SILVER, TOTAL	10000	390	0.2	U	0.23	U	0.41		0.31	U	0.24	U
THALLIUM, TOTAL	NA	NA	0.12	U	0.07	U	0.1	U	0.18	UJ	0.16	UJ
TIN, TOTAL	1000000	47000	1.4		0.77	U	2.2		1.1	U	0.83	U
VANADIUM, TOTAL	14000	550	111		168		104		79.4		62.3	
ZINC, TOTAL	610000	23000	70.6	J	93.5	J	123	J	48.8		56.3	
CYANIDE, TOTAL	41000	1600	0.59	U	0.44		0.41	U	0.5	U	0.43	U

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-4
DETECTED CONCENTRATIONS OF INORGANICS ANALYTES
AOC B SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	6SB02-01		6SB03-01		6SB03-01D		6SB03-03		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils									Industrial	Residential
SAMPLE DEPTH (feet)	[mg/kg]	[mg/kg]									Soils	Soils
TOTAL METALS (mg/kg)												
ANTIMONY, TOTAL	820	31	2.2	UJ	2.1	UJ	2.1	UJ	2	UJ	0/14	0/14
ARSENIC, TOTAL	3.8	0.43	1.2	J	0.09	UJ	0.17	J	0.34	J	0/14	4/14
BARIUM, TOTAL	140000	5500	68.7		37.4		92.8		66.4		0/14	0/14
BERYLLIUM, TOTAL	1.3	0.15	0.1	U	0.09	U	0.09	U	0.09	U	0/14	5/14
CADMIUM, TOTAL	1000	39	0.26	U	0.24	U	0.31		0.32		0/14	0/14
CHROMIUM, TOTAL	10000	390	13.8	J	6.3	J	23.5	J	13	J	0/14	0/14
COBALT, TOTAL	120000	4700	17		18.8		16.9		10.7		0/14	0/14
COPPER, TOTAL	82000	3100	118		107		122		60		0/14	0/14
LEAD, TOTAL	NA	400	9.6		2.1		2.5		1.8		NA	0/14
MERCURY, TOTAL	610	23	0.2		0.05	U	0.04	U	0.04	U	0/14	0/14
NICKEL, TOTAL	41000	1600	10.9		6.9		12.6		8.8		0/14	0/14
SELENIUM, TOTAL	10000	390	0.15	UJ	0.15	UJ	0.14	UJ	0.13	UJ	0/14	0/14
SILVER, TOTAL	10000	390	0.36	U	0.33	U	0.57		0.54		0/14	0/14
THALLIUM, TOTAL	NA	NA	0.09	U	0.09	U	0.09	U	0.09	U	NA	NA
TIN, TOTAL	1000000	47000	1.7		1.5		2.3		1.8		0/14	0/14
VANADIUM, TOTAL	14000	550	108	J	48.4	J	88.2	J	59.1	J	0/14	0/14
ZINC, TOTAL	610000	23000	60.9		43		71.4		52.2		0/14	0/14
CYANIDE, TOTAL	41000	1600	0.49	U	0.52	U	0.46	U	0.4	U	0/14	0/14

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-5
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC B GROUNDWATER
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Tap Water	MCL	ACBMW01		ACBMW03		number exceeding Tap Water	number exceeding MCL
SAMPLE DATE			03/30/96		03/30/96			
TOTAL METALS (ug/L)								
ARSENIC, TOTAL	0.0445	50	5.8	J	3.6		2/2	0/2
BARIUM, TOTAL	2600	2000	2210		342		0/2	1/2
BERYLLIUM, TOTAL	0.016	4	5.9		1.1	U	1/2	1/2
CHROMIUM, TOTAL	180	100	168		34.4		0/2	1/2
COBALT, TOTAL	2200	NA	162		73.9		0/2	NA
COPPER, TOTAL	1500	1300	2480		429		1/2	1/2
LEAD, TOTAL	NA	15	6.5	J	19.1	J	NA	1/2
MERCURY, TOTAL	11	2	0.19		0.23		0/2	0/2
NICKEL, TOTAL	730	100	199		25.4		0/2	1/2
VANADIUM, TOTAL	260	NA	790		326		2/2	NA
ZINC, TOTAL	11000	NA	2020		275		0/2	NA
DISSOLVED METALS (ug/L)								
BARIUM, SOLUBLE	2600	2000	333		61.8		0/2	0/2
BERYLLIUM, SOLUBLE	0.016	4	1.9		1.1	U	1/2	0/2
COPPER, SOLUBLE	1500	1300	10.6		3.6		0/2	0/2
LEAD, SOLUBLE	NA	15	1.2	UJ	17.5	J	NA	1/2
VANADIUM, SOLUBLE	260	NA	7		11.2		0/2	NA
ZINC, SOLUBLE	11000	NA	8.9		4.7		0/2	NA

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES

ug/l = micrograms per liter.

NA = Not analyzed.

Region III RBC Tap Water USEPA 1996A.
MCL USEPA Febuary, 1996C.

TABLE 5-6
DETECTED CONCENTRATIONS OF ORGANICS COMPOUNDS
AOC B SURFACE WATER
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Ambiant	6-SW01		
SAMPLE DATE	WQS			
SEMIVOLATILES (ug/L)				
PHENOL	21000	1	J	0/1
FLUORANTHENE	300	1	J	0/1
PYRENE	960	1	J	0/1
CHRYSENE	0.0028	1	J	0/1
BENZO(B)FLUORANTHENE	0.0028	1	J	0/1
BENZOIC ACID	NA	4	J	0/1
ACETOPHENONE	NA	2	J	0/1
PESTICIDE/PCBS (ug/L)				
4,4'-DDE	0.00059	0.52		1/1
DIOXIN (ug/L)				
TOTAL HXCDF	NA	0.001	J	0/1

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.

NOTES
ug/l = micrograms per liter.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-7
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC B SURFACE WATER
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Ambiant	6-SW01		
SAMPLE DATE	WQS			
TOTAL METALS (ug/L)				
ARSENIC, TOTAL	0.14	5		1/1
BARIUM, TOTAL	NA	116		0/1
CADMIUM, TOTAL	NA	3.6		0/1
CHROMIUM, TOTAL	NA	6.7		0/1
COPPER, TOTAL	NA	1170		0/1
LEAD, TOTAL	NA	735		0/1
MERCURY, TOTAL	0.14	22		1/1
VANADIUM, TOTAL	NA	7.1		0/1
ZINC, TOTAL	NA	572		0/1
CYANIDE, TOTAL	700	66.6	J	0/1

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.

NOTES
ug/l = micrograms per liter.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-8
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 10 GROUNDWATER
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Tap Water	MCL	10HP01	10HP02	10HP03	10HP03D	number exceeding	number exceeding
SAMPLE DATE		Groundwater	10/25/95	10/25/95	10/26/95	10/26/95	Tap Water	MCL Groundwater
VOLATILES (ug/L)								
METHYLENE CHLORIDE	4.1	NA	5 U	62	5 U	5 U	1/4	NA
ACETONE	3700	NA	98	32 U	5 U	10 U	0/4	NA
CHLOROFORM	0.15	100	5 U	18 U	14	13	2/4	0/3
2-BUTANONE	1900	NA	4 J	36 U	10 U	10 U	0/4	NA
SEMIVOLATILES (ug/L)								
PHENOL	22000	NA	NA	NA	10 U	65	0/2	NA
DI-N-BUTYLPHTHALATE	3700	NA	NA	NA	1 J	3 J	0/2	NA
ACETOPHENONE	0.042	NA	NA	NA	10 U	4 J	1/2	NA

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES

ug/l = micrograms per liter.

NA = Not analyzed.

Region III RBC Tap Water USEPA 1996A.
MCL USEPA Febuary, 1996C.

TABLE 5-9
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 13 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	13SS05		13SS06		13SS07		13SS07D		13SS08	
SAMPLE DATE	Soils	Soils	10/24/95		10/24/95		10/24/95		10/24/95		10/24/95	
SEMIVOLATILES (ug/kg)												
BENZOIC ACID	1.00E+09	310000000	650	J	2000	U	1800	U	1800	U	2200	U
PHENANTHRENE	61000000	2300000	370	U	390	U	360	U	360	U	270	J
ANTHRACENE	610000000	23000000	370	U	390	U	360	U	360	U	59	J
FLUORANTHENE	82000000	3100000	370	U	170	J	360	U	360	U	340	J
PYRENE	61000000	2300000	370	U	180	J	360	U	360	U	290	J
BUTYLBENZYLPHTHALATE	410000000	16000000	45	J	390	U	360	U	360	U	450	U
BENZO(A)ANTHRACENE	7800	880	370	U	270	J	360	U	360	U	160	J
CHRYSENE	780000	88000	370	U	370	J	360	U	360	U	150	J
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	94	J	39	J	360	U	360	U	110	J
BENZO(B)FLUORANTHENE	7800	880	370	U	620		360	U	360	U	210	J
BENZO(K)FLUORANTHENE	78000	8800	370	U	290	J	360	U	360	U	96	J
BENZO(A)PYRENE	780	88	370	U	440		360	U	360	U	140	J
INDENO(1,2,3-CD)PYRENE	7800	880	370	U	260	J	360	U	360	U	82	J
DIBENZO(A,H)ANTHRACENE	780	88	370	U	57	J	360	U	360	U	450	U
BENZO(G,H,I)PERYLENE	61000000	2300000	370	U	220	J	360	U	360	U	83	J
PESTICIDE/PCBS (ug/kg)												
4,4'-DDE	17000	1900	2100		97		590		340		7600	
4,4'-DDD	24000	2700	4500	U	93	U	88	U	440	U	11000	U
4,4'-DDT	17000	1900	2300		31		46		440	U	6000	
DIOXIN (ug/kg)												
TOTAL HXCDD	NA	NA	0.18	J	0.15	U	0.13	U	0.16	U	0.17	J
TOTAL PECDF	NA	NA	0.16	U	0.22	J	0.1	U	0.09	U	0.13	U
TOTAL HXCDF	NA	NA	0.8	J	0.15	J	0.11	U	0.13	U	0.41	J

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-9
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 13 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	13SS09		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/24/95		Industrial	Residential
					Soils	Soils
SEMIVOLATILES (ug/kg)						
BENZOIC ACID	1.00E+09	310000000	1800	U	0/6	0/6
PHENANTHRENE	61000000	2300000	370	U	0/6	0/6
ANTHRACENE	610000000	23000000	370	U	0/6	0/6
FLUORANTHENE	82000000	3100000	38	J	0/6	0/6
PYRENE	61000000	2300000	370	U	0/6	0/6
BUTYLBENZYLPHTHALATE	410000000	16000000	370	U	0/6	0/6
BENZO(A)ANTHRACENE	7800	880	370	U	0/6	0/6
CHRYSENE	780000	88000	370	U	0/6	0/6
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	370	U	0/6	0/6
BENZO(B)FLUORANTHENE	7800	880	47	J	0/6	0/6
BENZO(K)FLUORANTHENE	78000	8800	370	U	0/6	0/6
BENZO(A)PYRENE	780	88	370	U	0/6	2/6
INDENO(1,2,3-CD)PYRENE	7800	880	370	U	0/6	0/6
DIBENZO(A,H)ANTHRACENE	780	88	370	U	0/6	0/6
BENZO(G,H,I)PERYLENE	61000000	2300000	370	U	0/6	0/6
PESTICIDE/PCBS (ug/kg)						
4,4'-DDE	17000	1900	3100		0/6	3/6
4,4'-DDD	24000	2700	710		0/6	0/6
4,4'-DDT	17000	1900	2500		0/6	3/6
DIOXIN (ug/kg)						
TOTAL HXCDD	NA	NA	0.12	U	NA	NA
TOTAL PECDF	NA	NA	11	J	NA	NA
TOTAL HXCDF	NA	NA	0.09	J	NA	NA

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
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NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-10
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 13 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	13SS05		13SS06		13SS07		13SS08		13SS09		13SS07D	
SAMPLE DATE	Soils	Soils	10/24/95		10/24/95		10/24/95		10/24/95		10/24/95		10/24/95	
INORGANICS (mg/kg)														
Arsenic	3.8	0.43	3.1	J	4.5	J	3.6	J	1.9	J	1.8	J	3.6	J
Barium	140000	5500	36.6		61.4		46.9		57.1		37.6		52.5	
Cadmium	1000	39	0.52	J	1		0.66	J	0.44	J	0.61	J	0.5	J
Cobalt	120000	4700	4.9		9.5		9.5		10.8		8.4		8.2	
Chromium	10000	390	9.9		20.4		14.8		18.9		14.3		12.9	
Copper	82000	3100	39.5		64.5		61.1		59.2		46.5		61.3	
Mercury	610	23	0.13		0.051	U	0.043	U	0.05	U	0.048	U	0.054	U
Nickel	41000	1600	4.7		10.5		9.3		10.3		8.9		8.2	
Lead	NA	400	413		77.8		65.8		122		48.1		34.3	
Tin	1000000	47000	1.6	U	5		1.7		56.8		2.8		2.6	
Vanadium	14000	550	32.2	J	64	J	59.2	J	57.2	J	57.2	J	55.5	J
Zinc	610000	23000	340	J	144	J	91.8	J	126	J	50.6	J	62	J

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-10
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 13 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	Industrial Soils	Residential Soils	13SS01 10/24/95		13SS02 10/24/95		13SS03 10/24/95		13SS04 10/24/95		number exceeding Industrial Soils	number exceeding Residential Soils
INORGANICS (mg/kg)												
Arsenic	3.8	0.43	12.4	J	0.66	J	3.4	J	1.6	J	2/10	10/10
Barium	140000	5500	NA		NA		NA		NA		0/6	0/6
Cadmium	1000	39	NA		NA		NA		NA		0/6	0/6
Cobalt	120000	4700	NA		NA		NA		NA		0/6	0/6
Chromium	10000	390	NA		NA		NA		NA		0/6	0/6
Copper	82000	3100	NA		NA		NA		NA		0/6	0/6
Mercury	610	23	NA		NA		NA		NA		0/6	0/6
Nickel	41000	1600	NA		NA		NA		NA		0/6	0/6
Lead	NA	400	NA		NA		NA		NA		NA	1/6
Tin	1000000	47000	NA		NA		NA		NA		0/6	0/6
Vanadium	14000	550	NA		NA		NA		NA		0/6	0/6
Zinc	610000	23000	NA		NA		NA		NA		0/6	0/6

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-11
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 13 SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	**ERL** Sediments	ERM Sediments	Industrial Soils	Residential Soils	13SD01 10/24/95		13SD02 10/24/95		13SD03 10/24/95		13SD04 10/24/95		13SD05 10/24/95	
VOLATILES (ug/kg)														
ACETONE	NA	NA	2.2E+08	7800000	36	U	29	U	94		100	J	37	U
2-BUTANONE	NA	NA	1.0E+09	47000000	16	U	15	U	27		33	J	25	U
SEMIVOLATILES (ug/kg)														
FLUORANTHENE	600	5100	82000000	3100000	520	U	120	J	560	U	870	U	190	J
PYRENE	665	2600	61000000	2300000	520	U	140	J	58	J	870	U	220	J
BENZO(A)ANTHRACENE	261	1600	7800	880	520	U	73	J	560	U	870	U	170	J
CHRYSENE	384	2800	780000	88000	520	U	150	J	78	J	870	U	290	J
BIS(2-ETHYLHEXYL)PHTHALATE	NA	1900 (1)	410000	46000	520	U	100	J	73	J	870	U	840	U
BENZO(B)FLUORANTHENE	NA	3200 (2)	780000	880	520	U	270	J	110	J	180	J	750	J
BENZO(K)FLUORANTHENE	NA	NA	78000	8800	520	U	110	J	560	U	870	U	390	J
BENZO(A)PYRENE	430	1600	780	88	520	U	91	J	560	U	870	U	390	J
INDENO(1,2,3-CD)PYRENE	1700	9600	7800	880	520	U	79	J	560	U	870	U	370	J
BENZO(G,H,I)PERYLENE	NA	670 (1)	61000000	2300000	520	U	500	U	560	U	870	U	370	J
CHLOROBENZILATE	NA	NA	21000	2400	520	U	500	U	560	U	640	J	840	U
PESTICIDE/PCBS (ug/kg)														
4,4'-DDE	2.2	27	17000	1900	**47**		**4100**		**6300**		**12000**		**93**	
4,4'-DDD	2 (3)	20 (3)	24000	2700	130	U	**24000**		**4300**		**34000**		200	U
4,4'-DDT	1.58	46.1	17000	1900	130	U	**1700**		**52000**		**700**		**42**	

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Long and Morgan, 1990

TABLE 5-11
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 13 SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	number exceeding **ERL** Sediments	number exceeding ERM Sediments	number exceeding Industrial Soils	number exceeding Residential Soils
VOLATILES (ug/kg)				
ACETONE	NA	NA	0/5	0/5
2-BUTANONE	NA	NA	0/5	0/5
SEMIVOLATILES (ug/kg)				
FLUORANTHENE	0/5	0/5	0/5	0/5
PYRENE	0/5	0/5	0/5	0/5
BENZO(A)ANTHRACENE	0/5	0/5	0/5	0/5
CHRYSENE	0/5	0/5	0/5	0/5
BIS(2-ETHYLHEXYL)PHTHALATE	NA	0/5	0/5	0/5
BENZO(B)FLUORANTHENE	NA	0/5	0/5	0/5
BENZO(K)FLUORANTHENE	NA	NA	0/5	0/5
BENZO(A)PYRENE	0/5	0/5	0/5	2/5
INDENO(1,2,3-CD)PYRENE	0/5	0/5	0/5	0/5
BENZO(G,H,I)PERYLENE	NA	0/5	0/5	0/5
CHLOROBENZILATE	NA	NA	0/5	0/5
PESTICIDE/PCBS (ug/kg)				
4,4'-DDE	5/5	5/5	0/5	3/5
4,4'-DDD	3/5	3/5	2/5	3/5
4,4'-DDT	4/5	3/5	1/5	1/5

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Long and Morgan, 1990

TABLE 5-12
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 13 SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	**ERL** Sediments	ERM Sediments	Industrial Soils	Residential Soils	13SD01 10/24/95	13SD02 10/24/95	13SD03 10/24/95	13SD04 10/24/95	13SD05 10/24/95
INORGANICS (mg/kg)									
Arsenic	8.2	70	610	23	2.1 J	1.1 J	1.3 J	1.4 J	0.84 J
Barium	500 (1)	NA	140000	5500	43	34.3	38.9	69.2 J	62.5 J
Cadmium	1.2	9.6	1000	39	0.26 J	0.57 J	**1.6**	0.7 J	0.45 UJ
Chromium	81	370	10000	390	21.8	15.4	25.4	17.9 J	20.2 J
Cobalt	NA	NA	120000	4700	21.3	11.5	9.9	14 J	26.3 J
Copper	34	270	82000	3100	**45.9**	**39.9**	**52.9**	**74.7** J	**70** J
Lead	46.7	218	400	400	25.8	38.4	**121**	**63.5** J	**50.5** J
Mercury	0.15	0.71	610	23	0.08 U	0.06 U	**0.42**	0.1 UJ	0.13 UJ
Nickel	20.9	51.6	41000	1600	9.1	8.8	12.9	10.2 J	12.9 J
Selenium	NA	1 (2)	10000	390	0.87 J	0.21 U	0.31 U	0.87 J	1.4 J
Tin	NA	NA	1000	47000	2.9	3.6	6.9	7.9 J	3.9 UJ
Vanadium	NA	NA	14000	550	173 J	57.1 J	62.4 J	80.9 J	119 J
Zinc	150	410	610000	23000	59.5 J	69 J	**189** J	141 J	105 J

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Sullivan et al., 1985
(2) USEPA Region III, 1995

TABLE 5-12
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 13 SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	number exceeding **ERL** Sediments	number exceeding ERM Sediments	number exceeding Industrial Soils	number exceeding Residential Soils
INORGANICS (mg/kg)				
Arsenic	0/5	0/5	0/5	0/5
Barium	0/5	NA	0/5	0/5
Cadmium	0/5	1/5	0/5	0/5
Chromium	0/5	0/5	0/5	0/5
Cobalt	NA	NA	0/5	0/5
Copper	0/5	5/5	0/5	0/5
Lead	0/5	3/5	0/5	0/5
Mercury	0/5	1/5	0/5	0/5
Nickel	0/5	0/5	0/5	0/5
Selenium	NA	1/5	0/5	0/5
Tin	NA	NA	0/5	0/5
Vanadium	NA	NA	0/5	0/5
Zinc	0/5	1/5	0/5	0/5

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Sullivan et al., 1985
(2) USEPA Region III, 1995

TABLE 5-13
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 23 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	23SS01		23SS02		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/24/95		10/24/95		Industrial	Residential
							Soils	Soils
VOLATILES (ug/kg)								
CHLOROFORM	940000	100000	1	J	2	J	0/2	0/2
TRICHLOROETHENE	520000	58000	3	J	8	U	0/2	0/2
TOLUENE	410000000	16000000	2	J	8	UJ	0/2	0/2
SEMIVOLATILES (ug/kg)								
PHENANTHRENE	61000000	2300000	380	U	410	J	0/2	0/2
FLUORANTHENE	82000000	3100000	380	U	1000	J	0/2	0/2
PYRENE	61000000	2300000	380	U	700	J	0/2	0/2
BENZO(A)ANTHRACENE	7800	880	380	U	470	J	0/2	0/2
CHRYSENE	780000	88000	380	U	540	J	0/2	0/2
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	69	J	490	J	0/2	0/2
BENZO(B)FLUORANTHENE	7800	880	380	U	430	J	0/2	0/2
BENZO(K)FLUORANTHENE	78000	8800	380	U	440	J	0/2	0/2
BENZO(A)PYRENE	780	88	380	U	360	J	0/2	1/2
BENZO(G,H,I)PERYLENE	61000000	2300000	70	J	2500	U	0/2	0/2
TPH (mg/kg)								
Diesel Range Organics	NA	NA	6.1		14		NA	NA

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES

ug/kg = micrograms per kilogram.
mg/kg = milligrams per kilogram.
NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-14
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 24 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	24SS01		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/24/95		Industrial	Residential
					Soils	Soils
VOLATILES (ug/kg)						
CHLOROFORM	940000	100000	1	J	0/1	0/1
TRICHLOROETHENE	520000	58000	2	J	0/1	0/1
SEMIVOLATILES (ug/kg)						
DIMETHYLPHTHALATE	1.00E+09	780000000	55	J	0/1	0/1
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	140	J	0/1	0/1

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-15
ETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 25 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	25SS01		25SS02		25SS03		25SS04		25SS04D	
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95		10/25/95		10/25/95	
SEMIVOLATILES (ug/kg)												
BENZOIC ACID	1000000000	310000000	1800	U	1800	U	1800	U	1800	U	82	J
PHENANTHRENE	61000000	2300000	360	U	360	U	350	U	170	J	130	J
FLUORANTHENE	82000000	3100000	360	U	360	U	350	U	320	J	200	J
PYRENE	61000000	2300000	360	U	360	U	350	U	240	J	200	J
BUTYLBENZYLPHTHALATE	410000000	16000000	360	U	360	U	350	U	350	U	350	U
BENZO(A)ANTHRACENE	7800	880	360	U	360	U	350	U	130	J	81	J
CHRYSENE	780000	88000	360	U	360	U	350	U	140	J	100	J
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	110	J	360	U	140	J	20000		11000	
DI-N-OCTYL PHTHALATE	41000000	1600000	360	U	360	U	350	U	350	U	75	J
BENZO(B)FLUORANTHENE	7800	880	360	U	360	U	350	U	230	J	130	J
BENZO(K)FLUORANTHENE	78000	8800	360	U	360	U	350	U	66	J	74	J
BENZO(A)PYRENE	780	88	360	U	360	U	350	U	120	J	93	J
INDENO(1,2,3-CD)PYRENE	7800	880	360	U	360	U	350	U	99	J	60	J
BENZO(G,H,I)PERYLENE	61000000	2300000	360	U	360	U	350	U	94	J	350	U
PESTICIDE/PCBS (ug/kg)												
4,4'-DDE	17000	1900	8.7	U	8.5	U	42	U	83	U	43	U
4,4'-DDT	17000	1900	8.7	U	8.5	U	42	U	83	U	43	U

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-15
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 25 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	25SS05	25SS06	25SS07	25SS08	25SS09
SAMPLE DATE	Soils	Soils	10/25/95	10/25/95	10/25/95	10/25/95	10/25/95
SEMIVOLATILES (ug/kg)							
BENZOIC ACID	1000000000	310000000	1800 U	1800 U	1800 U	1800 U	74 J
PHENANTHRENE	61000000	2300000	360 U	360 U	370 U	360 U	370 U
FLUORANTHENE	82000000	3100000	360 U	360 U	370 U	360 U	370 U
PYRENE	61000000	2300000	360 U	360 U	370 U	360 U	370 U
BUTYLBENZYLPHTHALATE	410000000	16000000	360 U	360 U	370 U	100 J	370 U
BENZO(A)ANTHRACENE	7800	880	360 U	360 U	370 U	360 U	370 U
CHRYSENE	780000	88000	360 U	360 U	370 U	360 U	370 U
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	77000	700	170 J	350 J	24000
DI-N-OCTYL PHTHALATE	41000000	1600000	460 J	360 U	370 U	360 U	370 UJ
BENZO(B)FLUORANTHENE	7800	880	360 UJ	360 U	370 U	360 U	370 UJ
BENZO(K)FLUORANTHENE	78000	8800	360 UJ	360 U	370 U	360 U	370 UJ
BENZO(A)PYRENE	780	88	360 UJ	360 U	370 U	360 U	370 UJ
INDENO(1,2,3-CD)PYRENE	7800	880	360 UJ	360 U	370 U	360 U	370 UJ
BENZO(G,H,I)PERYLENE	61000000	2300000	360 UJ	360 U	370 U	360 U	370 UJ
PESTICIDE/PCBS (ug/kg)							
4,4'-DDE	17000	1900	42 U	43 U	8.7 U	5.1 J	44 U
4,4'-DDT	17000	1900	42 U	9.3	6.2	4.7 J	44 U

QUALIFIER DEFINITIONS

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NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-15
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 25 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	25SS01	25SS02	25SS03	25SS04	25SS04D
SAMPLE DATE	Soils	Soils	10/25/95	10/25/95	10/25/95	10/25/95	10/25/95
SEMIVOLATILES (ug/kg)							
BENZOIC ACID	1000000000	310000000	NA	NA	NA	NA	NA
PHENANTHRENE	61000000	2300000	NA	NA	NA	NA	NA
FLUORANTHENE	82000000	3100000	NA	NA	NA	NA	NA
PYRENE	61000000	2300000	NA	NA	NA	NA	NA
BUTYLBENZYLPHTHALATE	410000000	16000000	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	7800	880	NA	NA	NA	NA	NA
CHRYSENE	780000	88000	NA	NA	NA	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	NA	NA	NA	NA	NA
DI-N-OCTYL PHTHALATE	41000000	1600000	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	7800	880	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	78000	8800	NA	NA	NA	NA	NA
BENZO(A)PYRENE	780	88	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	7800	880	NA	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	61000000	2300000	NA	NA	NA	NA	NA
PESTICIDE/PCBS (ug/kg)							
4,4'-DDE	17000	1900	NA	NA	NA	NA	NA
4,4'-DDT	17000	1900	NA	NA	NA	NA	NA

QUALIFIER DEFINITIONS

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NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-15
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 25 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	25SS05	25SS06	25SS07	25SS09	25SS08
SAMPLE DATE	Soils	Soils	10/25/95	10/25/95	10/25/95	10/25/95	10/25/95
SEMIVOLATILES (ug/kg)							
BENZOIC ACID	1000000000	310000000	NA	NA	NA	NA	NA
PHENANTHRENE	61000000	2300000	NA	NA	NA	NA	NA
FLUORANTHENE	82000000	3100000	NA	NA	NA	NA	NA
PYRENE	61000000	2300000	NA	NA	NA	NA	NA
BUTYLBENZYLPHTHALATE	410000000	16000000	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	7800	880	NA	NA	NA	NA	NA
CHRYSENE	780000	88000	NA	NA	NA	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	NA	NA	NA	NA	NA
DI-N-OCTYL PHTHALATE	41000000	1600000	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	7800	880	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	78000	8800	NA	NA	NA	NA	NA
BENZO(A)PYRENE	780	88	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	7800	880	NA	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	61000000	2300000	NA	NA	NA	NA	NA
PESTICIDE/PCBS (ug/kg)							
4,4'-DDE	17000	1900	NA	NA	NA	NA	NA
4,4'-DDT	17000	1900	NA	NA	NA	NA	NA

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
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NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-15
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 25 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	Industrial	Residential
			Soils	Soils
SEMIVOLATILES (ug/kg)				
BENZOIC ACID	1000000000	310000000	0/10	0/10
PHENANTHRENE	61000000	2300000	0/10	0/10
FLUORANTHENE	82000000	3100000	0/10	0/10
PYRENE	61000000	2300000	0/10	0/10
BUTYLBENZYLPHTHALATE	410000000	16000000	0/10	0/10
BENZO(A)ANTHRACENE	7800	880	0/10	0/10
CHRYSENE	780000	88000	0/10	0/10
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	0/10	1/10
DI-N-OCTYL PHTHALATE	41000000	1600000	0/10	0/10
BENZO(B)FLUORANTHENE	7800	880	0/10	0/10
BENZO(K)FLUORANTHENE	78000	8800	0/10	0/10
BENZO(A)PYRENE	780	88	0/10	2/10
INDENO(1,2,3-CD)PYRENE	7800	880	0/10	0/10
BENZO(G,H,I)PERYLENE	61000000	2300000	0/10	0/10
PESTICIDE/PCBS (ug/kg)				
4,4'-DDE	17000	1900	0/10	0/10
4,4'-DDT	17000	1900	0/10	0/10

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-16
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 25 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	25SS01		25SS02		25SS03		25SS04		25SS04D		25SS05	
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95		10/25/95		10/25/95		10/25/95	
INORGANICS (mg/kg)														
Arsenic	3.8	0.43	0.57	UJ	0.75	J	0.25	UJ	1.9	J	1.2	J	0.4	J
Barium	140000	5500	27.8		9.4		11.7		32.1		20.5		11.6	
Cadmium	1000	39	1.3		0.37	J	2.7		0.38	J	0.43	J	1	
Chromium	10000	390	14.7		14		18.9		7.2		6.9		16.9	
Cobalt	120000	4700	18.9		17.9		21.2		7.6		7.1		20.6	
Copper	82000	3100	69		63.4		89.5		21.4		22.2		77.7	
Lead	NA	400	8.6		2.8		10.5		10.7		26.7		6	
Mercury	610	23	0.047	U	0.12		0.039	U	0.042	U	0.046	U	0.045	U
Nickel	41000	1600	41.3		37.9		44		11.2		11.1		44.2	
Silver	10000	390	0.29	U	0.18	U	0.38		0.18	U	0.22	U	0.24	U
Tin	1000000	47000	3		1.5		2.7		1.7		1.4	U	2.2	
Vanadium	14000	550	108	J	108	J	134	J	47.7	J	35.6	J	119	J
Zinc	610000	23000	54	J	40.2	J	73.5	J	68.7	J	122	J	78.3	J
Cyanide, Total	41000	1600	0.46	UJ	0.38	UJ	0.4	UJ	0.5	UJ	0.41	UJ	0.39	UJ

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-16
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 25 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	25SS06		25SS07		25SS08		25SS09		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95		10/25/95		Industrial Soils	Residential Soils
INORGANICS (mg/kg)												
Arsenic	3.8	0.43	0.22	UJ	0.19	UJ	0.31	UJ	2.1	J	0/10	4/10
Barium	140000	5500	17.9		24.6		15.3		26.3		0/10	0/10
Cadmium	1000	39	0.61	J	1.4		2		1.3		0/10	0/10
Chromium	10000	390	19.8		45.7		95.5		28.1	J	0/10	0/10
Cobalt	120000	4700	19.8		21		19.3		18.5		0/10	0/10
Copper	82000	3100	61.1		70.4		62.4		60		0/10	0/10
Lead	NA	400	13		14.6		10.3		47.4		NA	0/10
Mercury	610	23	0.041	U	0.043	U	0.041	U	0.05	U	0/10	0/10
Nickel	41000	1600	38.2		50.8		43.9		36.3		0/10	0/10
Silver	10000	390	0.3	U	0.3	U	0.23	U	0.24	U	0/10	0/10
Tin	1000000	47000	2.5		5		1.4	U	1.8	J	0/10	0/10
Vanadium	14000	550	127	J	127	J	97.8	J	95.2	J	0/10	0/10
Zinc	610000	23000	68.4	J	124	J	68.7	J	79.7	J	0/10	0/10
Cyanide, Total	41000	1600	0.48	UJ	0.38	UJ	1.7	J	0.47	U	0/10	0/10

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-17
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 25 SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	**ERL** Sediments	ERM Sediments	Industrial Soils	Residential Soils	25SD01 10/25/95		number exceeding **ERL** Sediments	number exceeding ERM Sediments	number exceeding Industrial Soils	number exceeding Residential Soils
VOLATILES (ug/kg)										
ACETONE	NA	NA	228000000	7800000	9	J	NA	NA	0/1	0/1
SEMIVOLATILES (ug/kg)										
BENZOIC ACID	NA	650	1000000000	310000000	72	J	NA	0/1	0/1	0/1

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC indusrtial/residential USEPA 1996A

TABLE 5-18
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 25 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	**ERL**	ERM	Industrial	Residential	25SD01		number exceeding	number exceeding	number exceeding	number exceeding
SAMPLE DATE	Sediments	Sediments	Soils	Soils	10/25/95		**ERL** Sediments	ERM Sediments	Industrial Soils	Residential Soils
INORGANICS (mg/kg)										
Silver	1	3.7	10000	390	0.3		0/1	0/1	0/1	0/1
Arsenic	8.2	70	610	23	0.91	J	0/1	0/1	0/1	0/1
Barium	500 (1)	NA	140000	5500	95.1		0/1	NA	0/1	0/1
Beryllium	NA	360 (2)	1.3	0.15	0.19		NA	0/1	0/1	1/1
Cobalt	NA	NA	120000	4700	29.2		NA	NA	0/1	0/1
Chromium	81	370	10000	390	42.7	J	0/1	0/1	0/1	0/1
Copper	34	270	82000	3100	**66.6**		1/1	0/1	0/1	0/1
Nickel	20.9	51.6	41000	1600	**35.2**		1/1	0/1	0/1	0/1
Lead	46.7	218	400	400	2.4		0/1	0/1	0/1	0/1
Vanadium	NA	NA	14000	550	137	J	NA	NA	0/1	0/1
Zinc	150	410	610000	23000	95.5	J	0/1	0/1	0/1	0/1

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Sullivan et al., 1985
(2) Tetra Tech, Inc., 1986

TABLE 5-19
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 26 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	26SS01	26SS02	26SS03	26SS04	26SS04D
SAMPLE DATE	Soils	Soils	10/29/95	10/28/95	10/29/95	10/29/95	10/29/95
SEMIVOLATILES (ug/kg)							
PENTACHLOROPHENOL	48000	5300	2000 U	2000 U	1900 U	2000 U	2000 U
PHENANTHRENE	61000000	2300000	410 U	400 U	380 U	400 U	40 J
FLUORANTHENE	82000000	3100000	410 U	400 U	380 U	400 U	67 J
PYRENE	61000000	2300000	410 U	400 U	380 U	400 U	58 J
BENZO(A)ANTHRACENE	7800	880	410 U	400 U	380 U	400 U	41 J
CHRYSENE	780000	88000	410 U	400 U	51 J	400 U	45 J
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	150 J	47 J	48 J	72 J	400 U
BENZO(B)FLUORANTHENE	7800	880	410 U	400 U	380 U	400 U	54 J
BENZO(A)PYRENE	780	88	410 U	400 U	380 U	400 U	41 J
PESTICIDE/PCBS (ug/kg)							
4,4'-DDT	17000	1900	21	48 U	91 U	93 U	49 U

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-19
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 26 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	26SS05		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/29/95		Industrial	Residential
					Soils	Soils
SEMIVOLATILES (ug/kg)						
PENTACHLOROPHENOL	48000	5300	170	J	0/6	0/6
PHENANTHRENE	61000000	2300000	290	J	0/6	0/6
FLUORANTHENE	82000000	3100000	460		0/6	0/6
PYRENE	61000000	2300000	330	J	0/6	0/6
BENZO(A)ANTHRACENE	7800	880	390	U	0/6	0/6
CHRYSENE	780000	88000	150	J	0/6	0/6
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	390	U	0/6	0/6
BENZO(B)FLUORANTHENE	7800	880	100	J	0/6	0/6
BENZO(A)PYRENE	780	88	60	J	0/6	0/6
PESTICIDE/PCBS (ug/kg)						
4,4'-DDT	17000	1900	93	U	0/6	0/6

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-20
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 26 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	26SS01		26SS02		26SS03		26SS04		26SS04D	
SAMPLE DATE	Soils	Soils	10/29/95		10/28/95		10/29/95		10/29/95		10/29/95	
INORGANICS (mg/kg)												
Antimony	820	31	2.3	UJ	2.4	UJ	2	UJ	2.5	UJ	1.4	
Arsenic	3.8	0.43	0.83	J	1.2	J	0.84	J	0.29	J	0.75	UJ
Barium	140000	5500	181		179		186		178		258	
Beryllium	1.3	0.15	0.17		0.11		0.09	U	0.12		0.4	
Cadmium	1000	39	0.35		0.21	U	0.18	U	0.23	U	0.48	U
Chromium	10000	390	23.1		24.8		17.2		9.2		14.6	
Cobalt	120000	4700	21.7		18.9		14.5		13		22.9	
Copper	82000	3100	113		112		86		81.1		132	
Lead	NA	400	21.4		28.5		15.7		8.4		11	
Nickel	41000	1600	10		11.6		11		5.3		7.1	
Selenium	10000	390	0.61		0.86		0.56	U	0.44	J	1.8	J
Tin	1000000	47000	2.9		1.8	U	3.1		2.5		3.8	
Vanadium	14000	550	120		129		103		79.6		139	
Zinc	610000	23000	67.4		80.6		53.2		34.9		47	

TABLE 5-20
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 26 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	26SS05		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/29/95		Industrial	Residential
					Soils	Soils
INORGANICS (mg/kg)						
Antimony	820	31	1.9		0/6	0/6
Arsenic	3.8	0.43	0.94	J	0/6	4/6
Barium	140000	5500	233		0/6	0/6
Beryllium	1.3	0.15	0.35		0/6	3/6
Cadmium	1000	39	0.4	U	0/6	0/6
Chromium	10000	390	13.3		0/6	0/6
Cobalt	120000	4700	17.6		0/6	0/6
Copper	82000	3100	104		0/6	0/6
Lead	NA	400	22.5		NA	0/6
Nickel	41000	1600	7.3		0/6	0/6
Selenium	10000	390	1.3	UJ	0/6	0/6
Tin	1000000	47000	1.1	U	0/6	0/6
Vanadium	14000	550	107		0/6	0/6
Zinc	610000	23000	69.5		0/6	0/6

TABLE 5-21
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 30 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	30SS01	30SS02	30SS03	30SS04	30SS05
SAMPLE DATE	Soils	Soils	10/25/95	10/25/95	10/25/95	10/25/95	10/25/95
VOLATILES (ug/kg)							
ACETONE	200000000	7800000	12 U	11 U	12 U	10 J	11 U
XYLENE (TOTAL)	1.00E+09	160000000	3 J	3 J	6 U	6 U	1 J
PESTICIDE/PCBS (ug/kg)							
AROCLOR-1260	740	83	NA	NA	200	250	NA

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-21
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 30 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	30SS06		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/25/95		Industrial	Residential
					Soils	Soils
VOLATILES (ug/kg)						
ACETONE	200000000	7800000	16	U	0/6	0/6
XYLENE (TOTAL)	1.00E+09	160000000	6	UJ	0/6	0/6
PESTICIDE/PCBS (ug/kg)						
AROCLOR-1260	740	83	NA		0/2	2/2

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

TABLE 5-22
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 30 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	30SS01		30SS02		30SS03		30SS04		30SS05	
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95		10/25/95		10/25/95	
INORGANICS (mg/kg)												
Arsenic	3.8	0.43	0.58	J	1.5	J	1.5		0.79	J	0.45	J
Barium	140000	5500	103		36.5		34.2		59.7		93.7	
Beryllium	1.3	0.15	NA		NA		0.14		0.15		NA	
Cadmium	1000	39	0.42	UJ	0.38	UJ	1	J	0.24	J	0.38	UJ
Chromium	10000	390	11.2	J	6.8	J	9.3	J	16.6	J	6.9	J
Cobalt	120000	4700	NA		NA		6.2		9		NA	
Copper	82000	3100	NA		NA		53		68.3		NA	
Lead	NA	400	55.6	J	53.5		101		20.9		6.9	J
Mercury	610	23	0.06	R	0.06	R	0.06	U	0.46		0.14	R
Nickel	41000	1600	NA		NA		6.1		7.5		NA	
Selenium	10000	390	0.33	J	0.2	J	1.1	U	0.89	U	0.15	UJ
Silver	10000	390	1		0.49	U	0.23	U	0.3	U	0.49	U
Vanadium	14000	550	NA		NA		43.1	J	65.8	J	NA	
Zinc	610000	23000	NA		NA		79.6	J	46.5	J	NA	

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
R = Unreliable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-22
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 30 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	30SS06		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/25/95		Industrial	Residential
					Soils	Soils
INORGANICS (mg/kg)						
Arsenic	3.8	0.43	1.6	J	0/6	6/6
Barium	140000	5500	24.3		0/6	0/6
Beryllium	1.3	0.15	NA		0/2	0/2
Cadmium	1000	39	0.4	UJ	0/6	0/6
Chromium	10000	390	4.7	J	0/6	0/6
Cobalt	120000	4700	NA		0/2	0/2
Copper	82000	3100	NA		0/2	0/2
Lead	NA	400	19.4		NA	0/6
Mercury	610	23	0.06	R	0/2	0/2
Nickel	41000	1600	NA		0/2	0/2
Selenium	10000	390	0.95	J	0/6	0/6
Silver	10000	390	0.52	U	0/6	0/6
Vanadium	14000	550	NA		0/2	0/2
Zinc	610000	23000	NA		0/2	0/2

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
R = Unreliable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-23
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 30 GROUNDWATER
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Tap Water	MCL	1983DW1		1983MW3		number exceeding	number exceeding
SAMPLE DATE		Groundwater	10/31/95		10/31/95		Tap Water	MCL Groundwater
INORGANICS (ug/L)								
ARSENIC, TOTAL	0.0445	50	1.6	U	4.4		1/2	0/2
BARIUM, TOTAL	2600	2000	51.2		173		0/2	0/2
COBALT, TOTAL	2200	NA	2.5		5.9		0/2	NA
CHROMIUM, TOTAL	180	100	4.6	U	6.6		0/2	0/2
COPPER, TOTAL	1500	1300	10		28.2		0/2	0/2
MERCURY, TOTAL	11	2	0.23	J	0.1	U	0/2	0/2
NICKEL, TOTAL	730	100	3.7	U	4.2		0/2	0/2
LEAD, TOTAL	NA	15	0.8	UJ	1.5	J	NA	0/2
ANTIMONY, TOTAL	15	6	16.2		31.5		2/2	2/2
VANADIUM, TOTAL	260	NA	17.8		208		0/2	NA
ZINC, TOTAL	11000	NA	72000		20.4		1/2	NA
ARSENIC, SOLUBLE	0.0445	50	1.6	U	3		1/2	0/2
BARIUM, SOLUBLE	2600	2000	47.3		108		0/2	0/2
COBALT, SOLUBLE	2200	NA	3.4		4.2		0/2	NA
COPPER, SOLUBLE	1500	1300	3.1		2.1		0/2	0/2
MERCURY, SOLUBLE	11	2	0.18	J	0.1	U	0/2	0/2
ANTIMONY, SOLUBLE	15	6	23.3		12.3	U	1/2	1/2
VANADIUM, SOLUBLE	260	NA	16.9		177		0/2	NA
ZINC, SOLUBLE	11000	NA	27.6		4.4		0/2	NA

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessar
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/l = micrograms per liter.

NA = Not analyzed.

Region III RBC Tap Water USEPA 1996A.
MCL USEPA Febuary, 1996C.

TABLE 5-24
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 31 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	31SS01		31SS02		31SS03		31SS04		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/31/95		10/31/95		10/31/95		10/31/95		Industrial Soils	Residential Soils
VOLATILES (ug/kg)												
METHYLENE CHLORIDE	760000	85000	6	U	5	U	42		6	U	0/4	0/4
SEMIVOLATILES (ug/kg)												
2-METHYLNAPHTHALENE	82000000	3100000	380	U	120	J	350	U	3600	U	0/4	0/4
PHENANTHRENE	61000000	2300000	380	U	52	J	350	U	3600	U	0/4	0/4
FLUORANTHENE	82000000	3100000	380	U	46	J	350	U	3600	U	0/4	0/4
PYRENE	61000000	2300000	380	U	96	J	350	UJ	3600	U	0/4	0/4
BUTYLBENZYLPHTHALATE	410000000	16000000	380	U	190	J	350	UJ	3600	U	0/4	0/4
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	200	J	700		100	J	610	J	0/4	0/4
PESTICIDE/PCBS (ug/kg)												
4,4'-DDE	17000	1900	9.2	U	46		NA		11	J	0/3	0/3
4,4'-DDD	24000	2700	9.2	U	58		NA		30		0/3	0/3
AROCLOR-1260	740	83	23		230		NA		880	U	0/3	1/3
DIOXIN (ug/kg)												
TOTAL PECDD	not found	not found	0.13	U	0.09	U	0.07	U	0.74	J	not found	not found
TOTAL HXCDD	not found	not found	0.1	U	0.06	U	0.06	U	12		not found	not found
TOTAL TCDF	not found	not found	0.06	U	0.05	U	0.04	U	0.17	J	not found	not found
TOTAL PECDF	not found	not found	0.07	U	0.06	U	0.06	U	3.1		not found	not found
TOTAL HXCDF	not found	not found	0.1	U	0.06	J	0.06	U	43		not found	not found

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-25
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 31 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	31SS01		31SS02		31SS04		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/31/95		10/31/95		10/31/95		Industrial Soils	Residential Soils
INORGANICS (mg/kg)										
Arsenic	3.8	0.43	0.16	UJ	0.52	J	1.3	J	0/3	2/3
Barium	140000	5500	63.3		46.6		110		0/3	0/3
Cadmium	1000	39	0.47	U	0.44	U	0.42	J	0/3	0/3
Chromium	10000	390	25.8		15.8		13.6		0/3	0/3
Cobalt	120000	4700	27.6		10		14.5		0/3	0/3
Copper	82000	3100	101		76.8		162		0/3	0/3
Lead	NA	400	2.2		31.4	J	55.4	J	NA	0/3
Nickel	41000	1600	20.4		26		7.9		0/3	0/3
Selenium	10000	390	0.21	J	0.14	UJ	0.12	UJ	0/3	0/3
Silver	10000	390	0.54		0.33	U	0.23	U	0/3	0/3
Vanadium	14000	550	206		68.6		81.8		0/3	0/3
Zinc	610000	23000	78		56.7		50		0/3	0/3

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
R = Unreliable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-26
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 31 SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	31SB01-02		31SB01-00		31SB02-03		31SB02-00		31SB03-04	
SAMPLE DATE	Soils	Soils	10/29/95		10/29/95		10/29/95		10/29/95		10/29/95	
INORGANICS (mg/kg)												
Silver	10000	390	0.31	UJ	0.32	UJ	0.35	UJ	0.39	J	0.33	UJ
Barium	140000	5500	85.3		40.4		27.5		111		102	
Beryllium	1.3	0.15	0.27		0.22		0.34		0.25		0.21	
Cobalt	120000	4700	18.3		12.7		11.4		11.7		14.5	
Chromium	10000	390	50.7		19.8		29.6		10.9		20	
Copper	82000	3100	101		146		134		89.7		181	
Nickel	41000	1600	22.1		9		196		10		22.5	
Lead	NA	400	1.1	J	14.1		1.1	J	1.2	J	3.2	
Antimony	820	31	1.4		1.3		2.8		2.7		2.2	
Selenium	10000	390	1.2	UJ	1.2	J	1.2	J	1.3	UJ	1.3	J
Tin	1000000	47000	1.1	U	1.1	U	1.2	U	3		2	
Thallium	NA	NA	0.13	UJ	0.1	UJ	0.13	UJ	0.15	UJ	0.13	UJ
Vanadium	14000	550	141		91.7		135		116		115	
Zinc	610000	23000	46.1		53.8		58.9		46.9		69.1	

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-26
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 31 SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	31SB03-00		31SB04-02		31SB04-00		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/29/95		10/29/95		10/29/95		Industrial	Residential
									Soils	Soils
INORGANICS (mg/kg)										
Silver	10000	390	0.35	UJ	0.31	UJ	0.31	UJ	0/8	0/8
Barium	140000	5500	95.7		117		95.2		0/8	0/8
Beryllium	1.3	0.15	0.24		0.16		0.17		0/8	8/8
Cobalt	120000	4700	20.6		20.7		21.3		0/8	0/8
Chromium	10000	390	47.9		38		30.8		0/8	0/8
Copper	82000	3100	202		82.4		70.6		0/8	0/8
Nickel	41000	1600	22.3		12.6		10.7		0/8	0/8
Lead	NA	400	1.1	J	0.6	J	1.2	J	NA	0/8
Antimony	820	31	1.4	U	1.2	U	2.2		0/8	0/8
Selenium	10000	390	1.2	UJ	1.3	UJ	1.3	UJ	0/8	0/8
Tin	1000000	47000	2.3		2		2.1		0/8	0/8
Thallium	NA	NA	0.2	J	0.14	UJ	0.15	UJ	NA	NA
Vanadium	14000	550	181		123		121		0/8	0/8
Zinc	610000	23000	182		59.8		46.2		0/8	0/8

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-27
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 31 SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	31SB01-02	31SB01-00	31SB02-03	31SB02-00	31SB03-04
SAMPLE DATE	Soils	Soils	10/29/95	10/29/95	10/29/95	10/29/95	10/29/95
SEMIVOLATILES (ug/kg)							
BUTYLBENZYLPHTHALATE	410000000	16000000	380 U	380 U	84 J	390 U	400 U
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	380 U	380 U	79 J	390 U	400 U
PESTICIDE/PCBS (ug/kg)							
4,4'-DDE	17000	1900	18 U	2.7	49 U	9.3 U	9.4 U
4,4'-DDD	24000	2700	18 U	3.5	49 U	9.3 U	9.4 U
TPH (mg/kg)							
Diesel Range Organics	NA	NA	4.8 U	4.9 U	4.9 U	4.7 U	37

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-27
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 31 SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	31SB03-00		31SB04-02		31SB04-00		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/29/95		10/29/95		10/29/95		Industrial Soils	Residential Soils
SEMIVOLATILES (ug/kg)										
BUTYLBENZYLPHTHALATE	410000000	16000000	400	U	370	U	380	U	0/8	0/8
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	400	U	370	U	41	J	0/8	0/8
PESTICIDE/PCBS (ug/kg)										
4,4'-DDE	17000	1900	9.4	U	8.8	U	44	U	0/8	0/8
4,4'-DDD	24000	2700	9.4	U	8.8	U	44	U	0/8	0/8
TPH (mg/kg)										
Diesel Range Organics	NA	NA	10		6.6	U	4.9	U	NA	NA

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-28
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 32 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	32SS01		32SS02		32SS03		32SS04		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/26/95		10/26/95		10/26/95		10/26/95		Industrial	Residential
											Soils	Soils
SEMIVOLATILES (ug/kg)												
FLUORANTHENE	82000000	3100000	1800	U	65	J	370	U	1900	U	0/4	0/4
PYRENE	61000000	2300000	1800	U	75	J	370	U	1900	U	0/4	0/4
BUTYLBENZYLPHTHALATE	410000000	16000000	1800	U	61	J	370	U	1900	U	0/4	0/4
CHRYSENE	780000	88000	1800	U	41	J	370	U	1900	U	0/4	0/4
BENZO(B)FLUORANTHENE	7800	880	1800	U	49	J	370	U	1900	U	0/4	0/4
BENZO(K)FLUORANTHENE	78000	8800	1800	U	43	J	370	U	1900	U	0/4	0/4
BENZO(A)PYRENE	780	88	1800	U	46	J	370	U	1900	U	0/4	0/4
INDENO(1,2,3-CD)PYRENE	7800	880	1800	U	43	J	370	U	1900	U	0/4	0/4
BENZO(G,H,I)PERYLENE	61000000	2300000	1800	U	51	J	370	U	1900	U	0/4	0/4
PCB (ug/kg)												
AROCLOR-1254	41000	1600	37	U	37	U	2600		38	U	0/4	1/4

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-29
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 32 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	32SS01		32SS02		32SS03		32SS04		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/26/95		10/26/95		10/26/95		10/26/95		Industrial Soils	Residential Soils
INORGANICS (mg/kg)												
Arsenic	3.8	0.43	0.52	J	0.62	J	0.23	J	2	J	0/4	3/4
Barium	140000	5500	127		70		88.1		40.8		0/4	0/4
Cadmium	1000	39	0.53	J	0.38	UJ	0.38	UJ	1.2	J	0/4	0/4
Chromium	10000	390	18.5		13.1		10		13		0/4	0/4
Lead	NA	400	85.7		59.4		17.4		141		NA	0/4

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-30
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 32 SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	32SB01	32SB02	32SB03	32SB04	number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/26/95	10/26/95	10/27/95	10/27/95	Industrial Soils	Residential Soils
SEMIVOLATILES (ug/kg)								
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	380 U	NA	380 U	290 J	0/3	0/3

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-31
DETECTED CONCENTRATIONS OF inORGANIC ANALYTES
SWMU 32 SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	32SB01		32SB02		32SB03		32SB04		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/26/95		10/26/95		10/27/95		10/27/95		Industrial Soils	Residential Soils
INORGANICS (mg/kg)												
Arsenic	3.8	0.43	0.2	UJ	0.45	J	0.21	UJ	0.21	UJ	0/4	1/4
Barium	140000	5500	81.7		69.8		91.6		53.9		0/4	0/4
Chromium	10000	390	14.8		15		25		19.3		0/4	0/4
Lead	NA	400	0.92		42.8		1.4		19.3		NA	0/4
Silver	10000	390	0.63	J	0.48	UJ	0.51	UJ	0.52	UJ	0/4	0/4

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-32
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 37 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	37SS01	37SS02	37SS03	37SS04	number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/26/95	10/25/95	10/25/95	10/26/95	Industrial	Residential
							Soils	Soils
SEMIVOLATILES (ug/kg)								
3- AND/OR 4-METHYLPHENOL	10000000	390000	380 U	420 U	130 J	2100 U	0/4	0/4
BENZOIC ACID	1.00E+09	310000000	47 J	110 J	150 J	11000 U	0/4	0/4
PHENANTHRENE	61000000	2300000	380 U	420 U	270 J	2100 U	0/4	0/4
ANTHRACENE	610000000	23000000	380 U	420 U	72 J	2100 U	0/4	0/4
FLUORANTHENE	82000000	3100000	380 U	420 U	1500	2100 U	0/4	0/4
PYRENE	61000000	2300000	380 U	420 U	2100	2100 U	0/4	0/4
BUTYLBENZYLPHTHALATE	410000000	16000000	190 J	420 U	1200	2100 U	0/4	0/4
BENZO(A)ANTHRACENE	7800	880	380 U	420 U	660	2100 U	0/4	0/4
CHRYSENE	780000	88000	380 U	420 U	1300	2100 U	0/4	0/4
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	330 J	87 J	1400	2100 U	0/4	0/4
BENZO(B)FLUORANTHENE	7800	880	380 U	49 J	1300	250 J	0/4	1/4
BENZO(K)FLUORANTHENE	78000	8800	380 U	420 U	1100	2100 U	0/4	0/4
BENZO(A)PYRENE	780	88	380 U	420 U	730	2100 U	0/4	1/4
INDENO(1,2,3-CD)PYRENE	7800	880	380 U	420 U	530 J	270 J	0/4	0/4
DIBENZO(A,H)ANTHRACENE	780	88	380 U	420 U	120 J	2100 U	0/4	1/4
BENZO(G,H,I)PERYLENE	61000000	2300000	380 U	420 U	600 J	380 J	0/4	0/4
METHYL METHACRYLATE	160000000	6300000	67 J	420 U	650 U	2100 U	0/4	0/4
ARAMITE	230000	26000	760 U	830 U	240 J	4200 U	0/4	0/4
PCB (ug/kg)								
AROCLOR-1260	740	83	38 U	91	55	43 U	0/4	1/4

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-33
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 39 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	39SS01		39SS02		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		Industrial	Residential
							Soils	Soils
INORGANICS (mg/kg)								
Arsenic	3.8	0.43	3.5	J	3.2	J	0/2	2/2
Barium	140000	5500	21.2		26.7		0/2	0/2
Cadmium	1000	39	1.3	J	2.8	J	0/2	0/2
Chromium	10000	390	10.6	J	15.8	J	0/2	0/2
Lead	NA	400	46.3		76.3		NA	0/2
Selenium	10000	390	0.25	J	0.24	J	0/2	0/2

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-34
DETECTED CONCENTRATIONS OF ORGANIC PARAMETERS
SWMU 46 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	46SS01		46SS02		46SS03		46SS04		46SS05		46SS06	
SAMPLE DATE	Soils	Soils	10/26/95		10/26/95		10/26/95		10/26/95		10/26/95		10/26/95	
VOLATILES (ug/kg)														
CARBON DISULFIDE	200000000	7800000	6	UJ	5	U	2	J	8	U	6	U	7	U
XYLENE (TOTAL)	1.00E+09	160000000	6	UJ	5	U	3	J	8	UJ	2	J	7	U
SEMIVOLATILES (ug/kg)														
2,4-DIMETHYLPHENOL	41000000	1600000	420	U	93	J	420	U	500	U	410	U	460	U
PHENANTHRENE	61000000	2300000	49	J	98	J	420	U	500	U	410	U	460	U
ANTHRACENE	610000000	23000000	420	U	45	J	420	U	500	U	410	U	460	U
FLUORANTHENE	82000000	3100000	440		350	J	150	J	500	U	130	J	73	J
PYRENE	61000000	2300000	1100	J	880	J	130	J	500	U	120	J	75	J
BUTYLBENZYLPHTHALATE	410000000	16000000	150	J	350	UJ	420	U	500	U	410	U	460	U
BENZO(A)ANTHRACENE	7800	880	880	J	550	J	76	J	500	U	86	J	57	J
CHRYSENE	780000	88000	890	J	760	J	120	J	500	U	110	J	76	J
BENZO(B)FLUORANTHENE	7800	880	1200	J	840	J	110	J	500	U	130	J	80	J
BENZO(K)FLUORANTHENE	78000	8800	790	J	410	J	140	J	500	U	120	J	460	U
BENZO(A)PYRENE	780	88	890	J	560	J	86	J	500	U	120	J	62	J
INDENO(1,2,3-CD)PYRENE	7800	880	550	J	360	J	66	J	500	U	410	U	460	U
DIBENZO(A,H)ANTHRACENE	780	88	420	UJ	100	J	420	U	500	U	410	U	460	U
BENZO(G,H,I)PERYLENE	61000000	2300000	420	UJ	340	J	76	J	500	U	410	U	460	U
PESTICIDE/PCBS (ug/kg)														
AROCLOR-1260	740	83	3600		390		190		560		1200		1000	

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-34
DETECTED CONCENTRATIONS OF ORGANIC PARAMETERS
SWMU 46 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	46SS07		46SS07D		46SS08		46SS09		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/26/95		10/26/95		10/26/95		10/26/95		Industrial Soils	Residential Soils
VOLATILES (ug/kg)												
CARBON DISULFIDE	200000000	7800000	6	U	6	U	6	UJ	6	U	0/10	0/10
XYLENE (TOTAL)	1.00E+09	160000000	6	U	6	UJ	6	UJ	6	U	0/10	0/10
SEMIVOLATILES (ug/kg)												
2,4-DIMETHYLPHENOL	41000000	1600000	420	U	430	U	430	U	360	U	0/10	0/10
PHENANTHRENE	61000000	2300000	71	J	430	U	430	U	360	U	0/10	0/10
ANTHRACENE	610000000	23000000	420	U	430	U	430	U	360	U	0/10	0/10
FLUORANTHENE	82000000	3100000	410	J	69	J	430	U	360	U	0/10	0/10
PYRENE	61000000	2300000	390	J	67	J	430	U	360	U	0/10	0/10
BUTYLBENZYLPHTHALATE	410000000	16000000	420	U	430	U	430	U	360	U	0/10	0/10
BENZO(A)ANTHRACENE	7800	880	410	J	82	J	430	U	360	U	0/10	0/10
CHRYSENE	780000	88000	470		97	J	430	U	360	U	0/10	0/10
BENZO(B)FLUORANTHENE	7800	880	400	J	100	J	430	U	360	U	0/10	1/10
BENZO(K)FLUORANTHENE	78000	8800	460		110	J	430	U	360	U	0/10	0/10
BENZO(A)PYRENE	780	88	320	J	100	J	430	U	360	U	1/10	5/10
INDENO(1,2,3-CD)PYRENE	7800	880	130	J	430	U	430	U	360	U	0/10	0/10
DIBENZO(A,H)ANTHRACENE	780	88	73	J	430	U	430	U	360	U	0/10	1/10
BENZO(G,H,I)PERYLENE	61000000	2300000	180	J	430	U	430	U	360	U	0/10	0/10
PESTICIDE/PCBS (ug/kg)												
AROCLOR-1260	740	83	240	J	110	J	160		59		3/10	9/10

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-35
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 46 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	46SS01		46SS02		46SS03		46SS04		46SS05		46SS06	
SAMPLE DATE	Soils	Soils	10/26/95		10/26/95		10/26/95		10/26/95		10/26/95		10/26/95	
INORGANICS (mg/kg)														
Arsenic	3.8	0.43	1.6	J	0.71		0.67	J	0.61	J	0.52	J	0.35	J
Barium	140000	5500	110		41.6		83		108		56.7		120	
Beryllium	1.3	0.15	0.12	U	0.18		NA		NA		NA		NA	
Cadmium	1000	39	0.45		0.36		0.43	UJ	0.51	UJ	0.42	UJ	0.47	UJ
Cobalt	120000	4700	30		6.4		NA		NA		NA		NA	
Chromium	10000	390	24.3	J	3.1	J	15.3		19.7		9.7		19.5	
Copper	82000	3100	106		20.2		NA		NA		NA		NA	
Nickel	41000	1600	14.8		2.4		NA		NA		NA		NA	
Lead	NA	400	15.4	J	36.3		28.7	J	15.7	J	9.4	J	11.2	J
Tin	1000000	47000	2.2	UJ	1.9	J	NA		NA		NA		NA	
Vanadium	14000	550	179	J	45.5	J	NA		NA		NA		NA	
Zinc	610000	23000	241	J	36.2	J	NA		NA		NA		NA	

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-35
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 46 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	46SS07	46SS07D	46SS08	46SS09	number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/26/95	10/26/95	10/26/95	10/26/95	Industrial Soils	Residential Soils
INORGANICS (mg/kg)								
Arsenic	3.8	0.43	0.19 UJ	0.19 UJ	0.2 UJ	0.23 J	0/10	5/10
Barium	140000	5500	155	148	173	171	0/10	0/10
Beryllium	1.3	0.15	NA	NA	NA	NA	0/2	1/2
Cadmium	1000	39	0.43 UJ	0.43 UJ	0.44 UJ	0.37 UJ	0/10	0/10
Cobalt	120000	4700	NA	NA	NA	NA	0/2	0/2
Chromium	10000	390	11.3	18.1	14	2.4	0/10	0/10
Copper	82000	3100	NA	NA	NA	NA	0/2	0/2
Nickel	41000	1600	NA	NA	NA	NA	0/2	0/2
Lead	NA	400	5.1 J	4.4 J	7.6 J	3 J	NA	0/10
Tin	1000000	47000	NA	NA	NA	NA	0/2	0/2
Vanadium	14000	550	NA	NA	NA	NA	0/2	0/2
Zinc	610000	23000	NA	NA	NA	NA	0/2	0/2

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-36
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 46 SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	46-SB01-06	46-SB02-03	46SB01-03	46SB01-03D	46SB02-05	number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/31/95	10/31/95	10/27/95	10/27/95	10/31/95	Industrial Soils	Residential Soils
VOLATILES (ug/kg)									
CARBON DISULFIDE	200000000	7800000	6 U	7 U	6 U	2 J	6 U	0/5	0/5
SEMIVOLATILES (ug/kg)									
PHENOL	1.00E+09	47000000	400 U	470 U	430 U	430 U	280 J	0/5	0/5
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	150 J	3600	430 U	430 U	430 U	0/5	0/5

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-37
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
SWMU 46 SUBSURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	46SB01-03		46SB01-03D		46-SB01-06		46-SB02-03		46SB02-05		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/31/95		10/31/95		10/27/95		10/27/95		10/31/95		Industrial Soils	Residential Soils
INORGANICS (mg/kg)														
Arsenic	3.8	0.43	0.23	UJ	0.23	UJ	0.17	UJ	0.68	J	0.23	UJ	0/5	1/5
Barium	140000	5500	220	J	214	J	114		49.8		113	J	0/5	0/5
Chromium	10000	390	10.6		11.8		11.1		30.7		9.2		0/5	0/5
Cobalt	120000	4700	NA		NA		34		7.4		NA		0/2	0/2
Copper	82000	3100	NA		NA		69		66.8		NA		0/2	0/2
Lead	NA	400	1.8	J	0.85	J	0.86		3.3		1.8	J	NA	0/5
Nickel	41000	1600	NA		NA		23.4		9.8		NA		0/2	0/2
Selenium	10000	390	0.2	UJ	0.21	UJ	0.63	U	0.88		0.21	UJ	0/5	0/5
Silver	10000	390	0.56	U	2.8	J	0.35	U	0.3	U	2	J	0/5	0/5
Vanadium	14000	550	NA		NA		118		243		NA		0/2	0/2
Zinc	610000	23000	NA		NA		86.8		57.4		NA		0/2	0/2

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-38
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
SWMU 51 SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	51SS01		51SS02		51SS03		51SS04		51SS05		number exceeding Industrial Soils	number exceeding Residential Soils
SAMPLE DATE	Soils	Soils	10/26/95		10/26/95		10/26/95		10/26/95		10/26/95			
VOLATILES (ug/kg)														
XYLENE (TOTAL)	1.00E+09	160000000	6	UJ	6	UJ	2	J	2	J	6	U	0/5	0/5
SEMIVOLATILES (ug/kg)														
BENZOIC ACID	1.00E+09	310000000	1900	U	110	J	56	J	2000	U	2200	U	0/5	0/5
PHENANTHRENE	61000000	2300000	380	U	410	U	63	J	47	J	79	J	0/5	0/5
FLUORANTHENE	82000000	3100000	380	U	45	J	59	J	75	J	93	J	0/5	0/5
PYRENE	61000000	2300000	49	J	72	J	130	J	110	J	140	J	0/5	0/5
BENZO(A)ANTHRACENE	7800	880	380	U	410	U	420	U	42	J	48	J	0/5	0/5
CHRYSENE	780000	88000	380	U	410	U	59	J	56	J	62	J	0/5	0/5
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	130	J	79	J	110	J	140	J	150	J	0/5	0/5
BENZO(B)FLUORANTHENE	7800	880	380	U	410	U	420	U	42	J	50	J	0/5	0/5
BENZO(K)FLUORANTHENE	78000	8800	380	U	410	U	420	U	41	J	49	J	0/5	0/5
BENZO(A)PYRENE	780	88	380	U	410	U	420	U	46	J	440	U	0/5	0/5
BENZO(G,H,I)PERYLENE	61000000	2300000	43	J	55	J	77	J	56	J	440	U	0/5	0/5
METHYL METHACRYLATE	160000000	6300000	310	U	410	U	59	J	400	U	440	U	0/5	0/5
N-NITROSODIMETHYLAMINE	110	13	380	U	95	J	420	U	400	U	440	U	0/5	1/5

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-39
DETECTED CONCENTRATIONS OF ORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS01		ACSS02		ACSS03		ACSS04		ACSS05	
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95					
VOLATILES (ug/kg)												
METHYLENE CHLORIDE	760000	85000	6	U	7	U	7	U	28		17	U
XYLENE (TOTAL)	1.00E+09	160000000	6	U	7	U	7	UJ	9	U	8	UJ
TRICHLOROFLUOROMETHANE	610000000	23000000	12	U	15	U	13	U	4	J	8	UJ
SEMIVOLATILES (ug/kg)												
BENZOIC ACID	1.00E+09	310000000	2000	U	25000	U	710	J	2900	U	140000	U
PHENANTHRENE	61000000	2300000	400	U	5000	U	440	U	63	J	2800	U
DI-N-BUTYLPHTHALATE	200000000	7800000	400	U	5000	U	4800		580	U	2800	U
FLUORANTHENE	82000000	3100000	400	U	5000	U	210	J	150	J	2800	U
PYRENE	61000000	2300000	400	U	5000	U	210	J	120	J	2800	U
BUTYLBENZYLPHTHALATE	410000000	16000000	400	U	5000	U	1100		580	U	2800	U
BENZO(A)ANTHRACENE	7800	880	400	U	5000	U	77	J	54	J	2800	U
CHRYSENE	780000	88000	400	U	5000	U	160	J	97	J	2800	U
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	400	U	5000	U	19000		580	U	2800	U
DI-N-OCTYL PHTHALATE	41000000	1600000	400	U	5000	U	170	J	580	U	2800	U
BENZO(B)FLUORANTHENE	7800	880	400	U	5000	U	480		100	J	2800	U
BENZO(K)FLUORANTHENE	78000	8800	400	U	5000	U	440	U	93	J	2800	U
BENZO(A)PYRENE	780	88	400	U	5000	U	120	J	76	J	2800	U
INDENO(1,2,3-CD)PYRENE	7800	880	400	U	5000	U	74	J	48	J	2800	U
DIBENZO(A,H)ANTHRACENE	780	88	400	U	5000	U	440	U	580	U	2800	U
BENZO(G,H,I)PERYLENE	61000000	2300000	400	U	5000	U	440	U	63	J	2800	U

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-39
DETECTED CONCENTRATIONS OF ORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS01		ACSS02		ACSS03		ACSS04	ACSS05
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95			
PESTICIDE/PCBS (ug/kg)										
4,4'-DDE	17000	1900	49	U	5900	U	2700		NA	NA
4,4'-DDD	24000	2700	49	U	5900	U	240		NA	NA
4,4'-DDT	17000	1900	49	U	5900	U	5400		NA	NA
KEPONE	320	35	49	UJ	5900	UJ	2500		NA	NA
ALPHA-CHLORDANE	4400	490	250	U	29000	U	840	J	NA	NA
GAMMA-CHLORDANE	4400	490	250	U	29000	U	760	J	NA	NA
AROCLOR-1260	740	83	170		140000		10000	U	NA	NA
PCB										
AROCLOR-1260	740	83	NA		NA		NA		1100	4900000
DIOXIN (ug/kg)										
TOTAL TCDF	not found	not found	0.05	U	1	J	0.07	U	NA	NA
TOTAL PECDF	not found	not found	0.06	U	2.4		0.08	U	NA	NA
TOTAL HXCDF	not found	not found	0.13	U	2		0.14	J	NA	NA

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
ug/kg = micrograms per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-39
DETECTED CONCENTRATIONS OF ORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS05D		ACSS06		ACSS07		ACSS08		ACSS09	
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95		10/25/95		10/25/95	
VOLATILES (ug/kg)												
METHYLENE CHLORIDE	760000	85000	48	J	14	U	26		24		17	J
XYLENE (TOTAL)	1.00E+09	160000000	10	UJ	3	J	6	U	6	U	6	UJ
TRICHLOROFLUOROMETHANE	610000000	23000000	10	UJ	6	U	6	U	6	U	6	UJ
SEMIVOLATILES (ug/kg)												
BENZOIC ACID	1.00E+09	310000000	15000	U	1900	U	2200	U	2000	U	2200	U
PHENANTHRENE	61000000	2300000	3100	U	380	U	450	U	390	U	440	U
DI-N-BUTYLPHTHALATE	200000000	7800000	3100	U	380	U	450	U	390	U	440	U
FLUORANTHENE	82000000	3100000	410	J	170	J	450	U	390	U	440	U
PYRENE	61000000	2300000	3100	U	200	J	450	U	390	U	440	U
BUTYLBENZYLPHTHALATE	410000000	16000000	3100	U	380	U	450	U	390	U	440	U
BENZO(A)ANTHRACENE	7800	880	3100	U	68	J	450	U	390	U	440	U
CHRYSENE	780000	88000	3100	U	150	J	450	U	390	U	440	U
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	3100	U	380	U	450	U	390	U	160	J
DI-N-OCTYL PHTHALATE	41000000	1600000	3100	U	380	U	450	U	390	U	440	U
BENZO(B)FLUORANTHENE	7800	880	3100	U	130	J	450	U	390	U	440	U
BENZO(K)FLUORANTHENE	78000	8800	3100	U	120	J	450	U	390	U	440	U
BENZO(A)PYRENE	780	88	3100	U	65	J	450	U	390	U	440	U
INDENO(1,2,3-CD)PYRENE	7800	880	3100	U	40	J	450	U	390	U	440	U
DIBENZO(A,H)ANTHRACENE	780	88	3100	U	380	U	450	U	390	U	440	U
BENZO(G,H,I)PERYLENE	61000000	2300000	420	J	43	J	450	U	390	U	440	U

TABLE 5-39
DETECTED CONCENTRATIONS OF ORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS05D	ACSS06	ACSS07	ACSS08	ACSS09
SAMPLE DATE	Soils	Soils	10/25/95	10/25/95	10/25/95	10/25/95	10/25/95
PESTICIDE/PCBS (ug/kg)							
4,4'-DDE	17000	1900	NA	NA	NA	NA	NA
4,4'-DDD	24000	2700	NA	NA	NA	NA	NA
4,4'-DDT	17000	1900	NA	NA	NA	NA	NA
KEPONE	320	35	NA	NA	NA	NA	NA
ALPHA-CHLORDANE	4400	490	NA	NA	NA	NA	NA
GAMMA-CHLORDANE	4400	490	NA	NA	NA	NA	NA
AROCLOR-1260	740	83	NA	NA	NA	NA	NA
PCB							
AROCLOR-1260	740	83	5200000	180	43 U	38 U	79
DIOXIN (ug/kg)							
TOTAL TCDF	not found	not found	NA	NA	NA	NA	NA
TOTAL PECDF	not found	not found	NA	NA	NA	NA	NA
TOTAL HXCDF	not found	not found	NA	NA	NA	NA	NA

TABLE 5-39
DETECTED CONCENTRATIONS OF ORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS10		ACSS11		ACSS12		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/26/95		Industrial	Residential
									Soils	Soils
VOLATILES (ug/kg)										
METHYLENE CHLORIDE	760000	85000	13	U	17		15	U	0/13	0/13
XYLENE (TOTAL)	1.00E+09	160000000	6	UJ	6	U	6	U	0/13	0/13
TRICHLOROFLUOROMETHANE	610000000	23000000	6	U	6	U	6	U	0/13	0/13
SEMIVOLATILES (ug/kg)										
BENZOIC ACID	1.00E+09	310000000	2100	U	1800	U	2000	U	0/13	0/13
PHENANTHRENE	61000000	2300000	430	U	370	U	400	U	0/13	0/13
DI-N-BUTYLPHTHALATE	200000000	7800000	430	U	370	U	400	U	0/13	0/13
FLUORANTHENE	82000000	3100000	430	U	240	J	400	U	0/13	0/13
PYRENE	61000000	2300000	430	U	430		400	U	0/13	0/13
BUTYLBENZYLPHTHALATE	410000000	16000000	430	U	370	U	400	U	0/13	0/13
BENZO(A)ANTHRACENE	7800	880	430	U	150	J	400	U	0/13	0/13
CHRYSENE	780000	88000	430	U	480		400	U	0/13	0/13
BIS(2-ETHYLHEXYL)PHTHALATE	410000	46000	100	J	370	U	400	U	0/13	0/13
DI-N-OCTYL PHTHALATE	41000000	1600000	430	U	370	U	400	U	0/13	0/13
BENZO(B)FLUORANTHENE	7800	880	430	U	360	J	400	U	0/13	0/13
BENZO(K)FLUORANTHENE	78000	8800	430	U	330	J	400	U	0/13	0/13
BENZO(A)PYRENE	780	88	430	U	220	J	400	U	0/13	2/13
INDENO(1,2,3-CD)PYRENE	7800	880	430	U	120	J	400	U	0/13	0/13
DIBENZO(A,H)ANTHRACENE	780	88	430	U	47	J	400	U	0/13	0/13
BENZO(G,H,I)PERYLENE	61000000	2300000	430	U	140	J	400	U	0/13	0/13

TABLE 5-39
DETECTED CONCENTRATIONS OF ORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS10	ACSS11	ACSS12	number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/25/95	10/25/95	10/26/95	Industrial	Residential
						Soils	Soils
PESTICIDE/PCBS (ug/kg)							
4,4'-DDE	17000	1900	NA	NA	NA	0/3	1/3
4,4'-DDD	24000	2700	NA	NA	NA	0/3	0/3
4,4'-DDT	17000	1900	NA	NA	NA	0/3	1/3
KEPONE	320	35	NA	NA	NA	1/3	1/3
ALPHA-CHLORDANE	4400	490	NA	NA	NA	0/3	1/3
GAMMA-CHLORDANE	4400	490	NA	NA	NA	0/3	1/3
AROCLOR-1260	740	83	NA	NA	NA	1/3	2/3
PCB							
AROCLOR-1260	740	83	41 U	74	170	3/10	5/10
DIOXIN (ug/kg)							
TOTAL TCDF	not found	not found	NA	NA	NA	not found	not found
TOTAL PECDF	not found	not found	NA	NA	NA	not found	not found
TOTAL HXCDF	not found	not found	NA	NA	NA	not found	not found

TABLE 5-40
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS01		ACSS02		ACSS03		ACSS04		ACSS05	
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95		10/25/95		10/25/95	
METALS (mg/kg)												
Arsenic, Total	3.8	0.43	0.77		1.4		19.2		1.1	J	3.2	J
Barium, Total	140000	5500	53.6		65.7		108		78.2		55.5	
Beryllium, Total	1.3	0.15	0.19		0.27		0.14		NA		NA	
Cadmium, Total	1000	39	0.61	J	0.49	J	5.5		0.59	UJ	1.8	J
Cobalt, Total	120000	4700	13.4		9.8		21.6		NA		NA	
Chromium, Total	10000	390	15.6	J	10.8	J	131	J	22.9	J	23.1	J
Copper, Total	82000	3100	117		173		249		NA		NA	
Mercury, Total	610	23	0.06	U	0.05	U	0.33		0.09	R	0.08	R
Nickel, Total	41000	1600	9.5		8.3		28.3		NA		NA	
Lead, Total	NA	400	10.8	J	12.2	J	718		195		581	
Antimony, Total	820	31	1.7	UJ	2.8	UJ	15.7	J	NA		NA	
Selenium, Total	10000	390	1.2	U	1.3	U	1.5	U	0.23	UJ	0.21	UJ
Tin, Total	1000000	47000	1.3	UJ	2.2	UJ	6	J	NA		NA	
Vanadium, Total	14000	550	103	J	86.7	J	59.8	J	NA		NA	
Zinc, Total	610000	23000	90	J	86.9	J	1830	J	NA		NA	
Cyanide, Total	41000	1600	0.57	U	0.71	U	0.97		NA		NA	

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
R = Unreliable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-40
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS5D		ACSS06		ACSS07		ACSS08		ACSS09	
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/25/95		10/25/95		10/25/95	
METALS (mg/kg)												
Arsenic, Total	3.8	0.43	4	J	1.3	J	1.2	J	1.5	J	1.3	J
Barium, Total	140000	5500	63.4		16.4		14.4		25.2		81	
Beryllium, Total	1.3	0.15	NA		NA		NA		NA		NA	
Cadmium, Total	1000	39	1.5	J	0.4	UJ	0.45	UJ	0.41	UJ	0.45	UJ
Cobalt, Total	120000	4700	NA		NA		NA		NA		NA	
Chromium, Total	10000	390	26.4	J	13.7	J	16.6	J	14.6	J	16.6	J
Copper, Total	82000	3100	NA		NA		NA		NA		NA	
Mercury, Total	610	23	0.09	R	0.06	R	0.07	R	0.06	U	0.07	R
Nickel, Total	41000	1600	NA		NA		NA		NA		NA	
Lead, Total	NA	400	456		4.9	J	75.8		2.3	J	116	
Antimony, Total	820	31	NA		NA		NA		NA		NA	
Selenium, Total	10000	390	0.24	UJ	0.19	J	0.3	J	0.16	UJ	0.17	UJ
Tin, Total	1000000	47000	NA		NA		NA		NA		NA	
Vanadium, Total	14000	550	NA		NA		NA		NA		NA	
Zinc, Total	610000	23000	NA		NA		NA		NA		NA	
Cyanide, Total	41000	1600	NA		NA		NA		NA		NA	

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
R = Unreliable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-40
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC C SURFACE SOIL
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	Industrial	Residential	ACSS10		ACSS11		ACSS12		number exceeding	number exceeding
SAMPLE DATE	Soils	Soils	10/25/95		10/25/95		10/26/95		Industrial Soils	Residential Soils
METALS (mg/kg)										
Arsenic, Total	3.8	0.43	1.8	J	3.4	J	0.67	J	2/13	13/13
Barium, Total	140000	5500	66.5		40.2		75.4		0/13	0/13
Beryllium, Total	1.3	0.15	NA		NA		NA		0/3	2/3
Cadmium, Total	1000	39	0.44	UJ	0.38	UJ	0.41	UJ	0/13	0/13
Cobalt, Total	120000	4700	NA		NA		NA		0/3	0/3
Chromium, Total	10000	390	7.1	J	11	J	26.3		0/13	0/13
Copper, Total	82000	3100	NA		NA		NA		0/3	0/3
Mercury, Total	610	23	0.06	R	0.06	R	0.06	R	0/4	0/4
Nickel, Total	41000	1600	NA		NA		NA		0/3	0/3
Lead, Total	NA	400	6	J	15.1		12.1	J	NA	3/13
Antimony, Total	820	31	NA		NA		NA		0/3	0/3
Selenium, Total	10000	390	0.17	UJ	0.14	UJ	0.16	UJ	0/13	0/13
Tin, Total	1000000	47000	NA		NA		NA		0/3	0/3
Vanadium, Total	14000	550	NA		NA		NA		0/3	0/3
Zinc, Total	610000	23000	NA		NA		NA		0/3	0/3
Cyanide, Total	41000	1600	NA		NA		NA		0/3	0/3

QUALIFIER DEFINITIONS

J = Analyte present. Reported value may not be accurate or precise.
R = Unreliable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC Industrial/residential USEPA 1996A.

TABLE 5-41
DETECTED CONCENTRATIONS OF PCBs
AOC C CONCRETE
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	ACWS01	ACWS02	ACWS03	ACWS04	ACWS05	ACWS06	ACWS07	ACWS08	ACWS09	ACW10
SAMPLE DATE	10/28/95	10/28/95	10/28/95	10/28/95	10/28/95	10/28/95	10/28/95	10/28/95	10/28/95	10/28/95
PCB (ug/wipe)										
Aroclor-1260	130000	720	560	1	220	1 U	1 U	1 U	1.6	1 U

NOTES

Region III RBC indusrtial/residential USEPA 1996A

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	**ERL**	ERM	Industrial	Residential	7SD01		7SD02		7SD03		7SD04		3SD01		3SD01D	
SAMPLE DATE	Sediment	Sediment	Soils	Soils	10/27/95		10/27/95		10/27/95		10/27/95		10/29/95		10/29/95	
VOLATILES (ug/kg)																
ACETONE	NA	NA	2.00E+08	7800000	120		50		43		15	U	14	U	14	U
CARBON DISULFIDE	NA	NA	200000000	7800000	8	U	8	U	8	U	7	U	7	U	7	U
2-BUTANONE	NA	NA	1000000000	47000000	15	U	16	U	16	U	15	U	14	U	14	U
TETRACHLOROETHENE	NA	140 (1)	110000	12000	8	U	8	U	8	U	7	U	7	U	7	U
SEMIVOLATILES (ug/kg)																
PHENOL	NA	420 (1)	1000000000	47000000	500	U	500	U	520	U	480	U	450	U	450	U
BENZOIC ACID	NA	650 (2)	1000000000	310000000	<u>870</u>	J	<u>680</u>	J	<u>790</u>	J	<u>960</u>	J	2300	U	2200	U
ACENAPHTHYLENE	44	640	120000000	4700000	500	U	500	U	520	U	480	U	450	U	450	U
FLUORENE	19	540	82000000	3100000	500	U	500	U	520	U	480	U	450	U	450	U
PHENANTHRENE	240	1500	61000000	2300000	66	J	86	J	520	U	480	U	450	U	450	U
ANTHRACENE	85.3	1100	610000000	23000000	500	U	500	U	520	U	480	U	450	U	450	U
FLUORANTHENE	600	5100	82000000	3100000	230	J	120	J	520	U	480	U	450	U	450	U
PYRENE	665	2600	610000000	2300000	270	J	150	J	520	U	480	U	450	U	450	U
BENZO(A)ANTHRACENE	261	1600	7800	880	69	J	500	U	520	U	480	U	450	U	450	U
CHRYSENE	384	2800	780000	88000	**470**	J	140	J	520	U	480	U	450	U	450	U
BIS(2-ETHYLHEXYL)PHTHALATE	NA	1900 (1)	410000	46000	500	U	500	U	520	U	480	U	450	U	450	U
BENZO(B)FLUORANTHENE	NA	3200 (2)	7800	880	390	J	150	J	520	U	480	U	450	U	450	U
BENZO(K)FLUORANTHENE	NA	NA	78000	8800	230	J	72	J	520	U	480	U	450	U	450	U
BENZO(A)PYRENE	430	1600	780	88	$\boxed{150}$	J	64	J	520	U	480	U	450	U	450	U
INDENO(1,2,3-CD)PYRENE	NA	600 (1)	7800	880	110	J	51	J	55	J	480	U	450	U	450	U
DIBENZO(A,H)ANTHRACENE	63.4	260	780	88	500	U	500	U	520	U	480	U	450	U	450	U
BENZO(G,H,I)PERYLENE	NA	670 (1)	61000000	2300000	86	J	500	U	520	U	480	U	450	U	450	U
P-DIMETHYLAMINOAZOBENZENE	NA	NA	NA	NA	1000	U	1000	U	1000	U	970	U	900	U	900	U
CARBAZOLE	NA	NA	290000	32000	500	U	500	U	520	U	480	U	450	U	450	U

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
NOTES
ug/kg = micrograms per kilogram.
NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Sullivan et al., 1985
(4) Value for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	**ERL**	ERM	Industrial	Residential	7SD01	7SD02	7SD03	7SD04	3SD01	3SD01D
SAMPLE DATE	Sediment	Sediment	Soils	Soils	10/27/95	10/27/95	10/27/95	10/27/95	10/29/95	10/29/95
PESTICIDE/PCBS (ug/kg)										
BETA-BHC	50 (3)(4)	NA	NA	NA	60 U	60 U	64 U	58 U	26 U	27 U
4,4'-DDE	2.2	27	17000	1900	120 U	120 U	130 U	120 U	53 U	54 U
HERBICIDES (ug/kg)										
2,4,5-TP (SILVEX)	NA	NA	16000000	630000	100 U	100 U	100 U	40 J	84 U	84 U
DIOXIN (ug/kg)										
TOTAL PECDD	0.001 (3)(5)	NA	0.9	0.1	0.22 U	0.18 U	0.08 U	0.16 U	0.18 U	0.2 U
TOTAL HXCDD	0.001 (3)(5)	NA	0.9	0.1	0.21 U	0.22 U	0.1 U	0.13 U	0.19 U	0.16 U
TOTAL HXCDF	0.001 (3)(5)	NA	0.9	0.1	0.15 U	0.17 U	0.09 U	0.09 U	0.17 U	0.18 U

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NOTES
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Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
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(3) Sullivan et al., 1985
(4) Value for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	3SD02	3SD03	3SD04	3SD05	3SD06	3SD07	3SD08	3SD09
SAMPLE DATE	10/29/95	10/29/95	10/27/95	10/27/95	10/27/95	10/27/95	10/28/95	10/28/95
VOLATILES (ug/kg)								
ACETONE	19 U	20 U	17 U	26 U	15 U	18 U	26 U	18 U
CARBON DISULFIDE	8 U	8 U	9 U	8 U	7 U	8 U	10 U	9 U
2-BUTANONE	15 U	16 U	17 U	15 U	15 U	16 U	20 U	18 U
TETRACHLOROETHENE	8 U	8 U	9 U	8 U	7 U	8 U	10 U	9 U
SEMIVOLATILES (ug/kg)								
PHENOL	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
BENZOIC ACID	2500 U	2600 U	3600	770 J	770 J	570 J	3300 U	3000 U
ACENAPHTHYLENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
FLUORENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
PHENANTHRENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
ANTHRACENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
FLUORANTHENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
PYRENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
BENZO(A)ANTHRACENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
CHRYSENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
BIS(2-ETHYLHEXYL)PHTHALATE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
BENZO(B)FLUORANTHENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
BENZO(K)FLUORANTHENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
BENZO(A)PYRENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
INDENO(1,2,3-CD)PYRENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
DIBENZO(A,H)ANTHRACENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
BENZO(G,H,I)PERYLENE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U
P-DIMETHYLAMINOAZOBENZENE	1000 U	1000 U	1100 U	1000 U	950 U	1000 U	1300 U	1200 U
CARBAZOLE	500 U	520 U	560 U	510 U	480 U	520 U	660 U	590 U

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NOTES
ug/kg = micrograms per kilogram.
NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Sullivan et al., 1985
(4) Value for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	3SD02	3SD03	3SD04	3SD05	3SD06	3SD07	3SD08	3SD09
SAMPLE DATE	10/29/95	10/29/95	10/27/95	10/27/95	10/27/95	10/27/95	10/28/95	10/28/95
PESTICIDE/PCBS (ug/kg)								
BETA-BHC	30 U	31 U	33 U	31 U	28 U	32 U	39 U	36 U
4,4'-DDE	60 U	63 U	66 U	61 U	57 U	64 U	79 U	71 U
HERBICIDES (ug/kg)								
2,4,5-TP (SILVEX)	99 U	100 U	110 U	100 U	94 U	100 U	130 U	120 U
DIOXIN (ug/kg)								
TOTAL PECDD	0.18 U	0.14 U	0.19 U	0.29 U	0.15 U	0.15 U	0.27 U	0.26 U
TOTAL HXCDD	0.18 U	0.12 U	0.21 U	0.27 U	0.17 U	0.12 U	0.28 U	0.31 U
TOTAL HXCDF	0.18 U	0.11 U	0.18 U	0.27 U	0.14 U	0.14 U	0.25 U	0.26 U

QUALIFIER DEFINITIONS
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NOTES
ug/kg = micrograms per kilogram.
NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
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(3) Sullivan et al., 1985
(4) Valve for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	3SD10		3SD11		3SD12		3SD13		3SD14		3SD15		11SD01		11SD02	
SAMPLE DATE	10/27/95		10/28/95		10/28/95		10/28/95		10/28/95		10/28/95		10/28/95		10/28/95	
VOLATILES (ug/kg)																
ACETONE	22	U	16	U	93		26		18	U	19	U	22	U	37	U
CARBON DISULFIDE	9	U	8	U	10	U	12	U	8	U	8	U	4	J	15	
2-BUTANONE	19	U	16	U	19	U	25	U	16	U	16	U	17	U	16	U
TETRACHLOROETHENE	9	U	8	U	10	U	12	U	8	U	8	U	8	U	8	U
SEMIVOLATILES (ug/kg)																
PHENOL	420	J	160	J	800		810	U	100	J	530	U	5500	U	540	U
BENZOIC ACID	2400	J	2600	U	3100	U	4100	U	2600	U	2700	U	28000	U	2700	U
ACENAPHTHYLENE	630	U	520	U	620	U	810	U	520	U	530	U	**1800**	J	**67**	J
FLUORENE	630	U	520	U	620	U	810	U	520	U	530	U	5500	U	540	U
PHENANTHRENE	630	U	520	U	620	U	810	U	520	U	530	U	5500	U	540	U
ANTHRACENE	630	U	520	U	620	U	810	U	520	U	530	U	**2200**	J	82	J
FLUORANTHENE	630	U	520	U	620	U	810	U	520	U	530	U	**660**	J	85	J
PYRENE	630	U	520	U	620	U	810	U	520	U	530	U	**6000**		88	J
BENZO(A)ANTHRACENE	630	U	520	U	620	U	810	U	520	U	530	U	**3700**	J	110	J
CHRYSENE	630	U	520	U	620	U	810	U	520	U	530	U	**10000**		320	J
BIS(2-ETHYLHEXYL)PHTHALATE	630	U	130	J	64	J	200	J	520	U	59	J	5500	U	97	J
BENZO(B)FLUORANTHENE	630	U	520	U	620	U	810	U	520	U	530	U	24000		850	
BENZO(K)FLUORANTHENE	630	U	520	U	620	U	810	U	520	U	530	U	21000		740	
BENZO(A)PYRENE	630	U	520	U	620	U	810	U	520	U	530	U	**23000**		**690**	
INDENO(1,2,3-CD)PYRENE	630	U	520	U	620	U	810	U	520	U	530	U	10000		410	J
DIBENZO(A,H)ANTHRACENE	630	U	520	U	620	U	810	U	520	U	530	U	**4200**	J	**170**	J
BENZO(G,H,I)PERYLENE	630	U	520	U	620	U	810	U	520	U	530	U	11000		450	J
P-DIMETHYLAMINOAZOBENZENE	1300	U	1000	U	1200	U	1600	U	1000	U	1100	U	5500	U	540	J
CARBAZOLE	630	U	520	U	620	U	810	U	520	U	530	U	NA		NA	

QUALIFIER DEFINITIONS
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U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
NOTES
ug/kg = micrograms per kilogram.
NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Sullivan et al., 1985
(4) Value for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	3SD10		3SD11		3SD12		3SD13		3SD14		3SD15		11SD01	11SD02
SAMPLE DATE	10/27/95		10/28/95		10/28/95		10/28/95		10/28/95		10/28/95		10/28/95	10/28/95
PESTICIDE/PCBS (ug/kg)														
BETA-BHC	38	U	32	U	37	U	49	U	31	U	32	U	NA	NA
4,4'-DDE	75	U	63	U	74	U	97	U	62	U	63	U	NA	NA
HERBICIDES (ug/kg)														
2,4,5-TP (SILVEX)	130	U	100	U	130	U	160	U	100	U	110	U	NA	NA
DIOXIN (ug/kg)														
TOTAL PECDD	0.17	U	0.15	U	0.27	U	0.4	U	0.19	U	0.18	U	NA	NA
TOTAL HXCDD	0.2	U	0.12	U	0.17	U	0.38	U	0.23	U	**1**	J	NA	NA
TOTAL HXCDF	0.2	U	0.17	U	0.16	U	0.28	U	0.16	U	0.22	U	NA	NA

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
NOTES
ug/kg = micrograms per kilogram.
NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Sullivan et al., 1985
(4) Valve for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	11SD03	1SD01	1SD02	1SD03	2SD01	2SD02	2SD03	2SD03D
SAMPLE DATE	10/28/95	10/30/95	10/30/95	10/30/95	10/31/95	10/31/95	10/31/95	10/31/95
VOLATILES (ug/kg)								
ACETONE	17 U	18 U	14 U	22 U	30 U	42 U	33 U	51 U
CARBON DISULFIDE	6 J	6 U	7 U	8 U	9 U	12 U	8 U	7 U
2-BUTANONE	17 U	12 U	14 U	16 U	17 U	24 U	16 U	11 J
TETRACHLOROETHENE	8 U	6 U	2 J	2 J	9 U	12 U	8 U	7 U
SEMIVOLATILES (ug/kg)								
PHENOL	83 J	410 U	470 U	530 U	560 U	780 U	540 U	470 U
BENZOIC ACID	2800 U	2100 U	2300 U	2700 U	2800 U	3900 U	2700 U	2300 U
ACENAPHTHYLENE	**120** J	410 U	470 U	530 U	560 U	780 U	540 U	470 U
FLUORENE	560 U	410 U	470 U	530 U	560 U	780 U	540 U	**62** J
PHENANTHRENE	70 J	410 U	470 U	530 U	560 U	**290** J	**630**	**1900**
ANTHRACENE	**150** J	410 U	470 U	530 U	560 U	780 U	**95** J	**300** J
FLUORANTHENE	280 J	410 U	470 U	530 U	560 U	**960**	**1900**	**3500**
PYRENE	530 J	410 U	470 U	530 U	560 U	**1200**	**2200**	**5500**
BENZO(A)ANTHRACENE	**300** J	410 U	470 U	530 U	560 U	**530** J	**970**	**2200**
CHRYSENE	**620**	410 U	470 U	530 U	560 U	**720** J	**1200**	**2600**
BIS(2-ETHYLHEXYL)PHTHALATE	140 J	130 J	470 U	110 J	200 J	880	540 U	470 U
BENZO(B)FLUORANTHENE	**1600**	410 U	470 U	530 U	560 U	780 U	**1800**	**2700**
BENZO(K)FLUORANTHENE	1400	410 U	470 U	530 U	560 U	780 U	140 J	1400
BENZO(A)PYRENE	**1400**	410 U	470 U	530 U	560 U	780 U	**920**	**1900**
INDENO(1,2,3-CD)PYRENE	690	410 U	470 U	530 U	560 U	780 U	90 J	1000
DIBENZO(A,H)ANTHRACENE	**280** J	410 U	470 U	530 U	560 U	780 U	540 U	**260** J
BENZO(G,H,I)PERYLENE	780	410 U	470 U	530 U	560 U	780 U	540 U	870
P-DIMETHYLAMINOAZOBENZENE	560 U	830 U	930 U	1100 U	1100 U	1600 U	1100 U	940 U
CARBAZOLE	NA	410 U	470 U	530 U	560 U	780 U	540 U	65 J

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
NOTES
ug/kg = micrograms per kilogram.
NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
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(4) Value for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	11SD03	1SD01		1SD02		1SD03		2SD01		2SD02		2SD03		2SD03D	
SAMPLE DATE	10/28/95	10/30/95		10/30/95		10/30/95		10/31/95		10/31/95		10/31/95		10/31/95	
PESTICIDE/PCBS (ug/kg)															
BETA-BHC	NA	4.8	U	5.6	U	32	U	34	U	92	U	65	U	22	
4,4'-DDE	NA	9.7	U	11	U	64	U	68	U	180	U	**29**		**33**	
HERBICIDES (ug/kg)															
2,4,5-TP (SILVEX)	NA	83	U	93	U	110	U	110	U	150	U	110	U	93	U
DIOXIN (ug/kg)															
TOTAL PECDD	NA	0.14	U	0.15	U	0.21	U	0.19	U	0.2	U	0.24	U	0.26	J
TOTAL HXCDD	NA	0.15	U	0.19	U	0.24	U	0.2	U	0.23	U	2.5		3.3	
TOTAL HXCDF	NA	0.13	U	0.13	U	0.22	U	0.19	U	0.2	U	0.91	J	1	J

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
NOTES
ug/kg = micrograms per kilogram.
NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Sullivan et al., 1985
(4) Valve for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	number exceeding **ERL** Sediment	number exceeding ERM Sediment	number exceeding Industrial Soils	number exceeding Residential Soils
VOLATILES (ug/kg)				
ACETONE	NA	NA	NA	0/30
CARBON DISULFIDE	NA	NA	NA	0/30
2-BUTANONE	NA	NA	NA	0/30
TETRACHLOROETHENE	NA	0/30	NA	0/30
SEMIVOLATILES (ug/kg)				
PHENOL	NA	1/30	NA	0/30
BENZOIC ACID	NA	8/30	NA	0/30
ACENAPHTHYLENE	3/30	1/30	0/30	0/30
FLUORENE	1-30	0/30	0/30	0/30
PHENANTHRENE	3/30	1/30	0/30	0/30
ANTHRACENE	4/30	0/30	0/30	0/30
FLUORANTHENE	4/30	0/30	0/30	0/30
PYRENE	4/30	2/30	0/30	0/30
BENZO(A)ANTHRACENE	5/30	2/30	0/30	2/30
CHRYSENE	6/30	1/30	0/30	0/30
BIS(2-ETHYLHEXYL)PHTHALATE	NA	0/30	1/30	4/30
BENZO(B)FLUORANTHENE	NA	1/30	1/30	1/30
BENZO(K)FLUORANTHENE	NA	NA	0/30	1/30
BENZO(A)PYRENE	5/30	2/30	4/30	6/30
INDENO(1,2,3-CD)PYRENE	NA	3/30	1/30	2/30
DIBENZO(A,H)ANTHRACENE	4/30	3/30	1/30	4/30
BENZO(G,H,I)PERYLENE	0/30	3/30	0/30	0/30
P-DIMETHYLAMINOAZOBENZENE	NA	NA	NA	NA
CARBAZOLE	0/27	0/27	0/27	0/27

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NOTES
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NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Sullivan et al., 1985
(4) Value for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-42
DETECTED CONCENTRATIONS OF ORGANIC COMPOUNDS
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID SAMPLE DATE	number exceeding **ERL** Sediment	number exceeding ERM Sediment	number exceeding Industrial Soils	number exceeding Residential Soils
PESTICIDE/PCBS (ug/kg)				
BETA-BHC	0/27	NA	NA	NA
4,4'-DDE	2/27	2/27	0/27	0/27
HERBICIDES (ug/kg)				
2,4,5-TP (SILVEX)	NA	NA	0/27	0/27
DIOXIN (ug/kg)				
TOTAL PECDD	1/27	NA	1/27	1/27
TOTAL HXCDD	3/27	NA	2/27	2/27
TOTAL HXCDF	2/27	NA	2/27	2/27

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
NOTES
ug/kg = micrograms per kilogram.
NA = Not analyzed.
Region III RBC indusrtial/residential USEPA 1996A
(1) Tetra Tech, Inc., 1986
(2) USEPA Region III, 1995
(3) Sullivan et al., 1985
(4) Valve for gamma - BHC (lindane)
(5) Value for total TCDD and TCDF dioxin

TABLE 5-43
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	**ERL**	ERM	Industrial	Residential	7SD01		7SD02		7SD03		7SD04	
SAMPLE DATE	Sediment	Sediment	Soils	Soils	10/27/95		10/27/95		10/27/95		10/27/95	
TOTAL METALS (mg/kg)												
Arsenic, Total	8.2	70	610	23	**8.5**		**9.8**		3.2		3.4	
Barium, Total	500 (2)	NA	140000	5500	11.1		14		7.5		8.1	
Beryllium, Total	NA	360 (3)	1.3	0.15	0.11	U	0.14	U	0.12	U	0.12	U
Cadmium, Total	1.2	9.6	1000	39	0.22	U	0.3	U	0.86		0.25	U
Chromium, Total	81	370	10000	390	15.9		15.2		7.9		5.5	
Cobalt, Total	NA	NA	120000	4700	4.6		3.1		1.8		1.4	
Copper, Total	34	270	82000	3100	**34.1**		21.5		7.4		5	
Lead, Total	46.7	218	400	400	13.8		17.6		1.2		0.85	
Mercury, Total	0.15	0.71	610	23	0.11	U	0.05	U	0.08	U	0.07	U
Nickel, Total	20.9	51.6	41000	1600	4.5		4.1		2.7		2.2	
Selenium, Total	NA	1 (3)	10000	390	0.63	U	0.74	U	0.74	U	0.79	U
Silver, Total	1	3.7	10000	390	0.3	U	0.41	U	0.34	U	0.63	
Tin, Total	NA	NA	1000000	47000	1.9	U	2.6	U	3.3		2.1	U
Vanadium, Total	NA	NA	14000	550	63.1		44.5		32.3		17.7	
Zinc, Total	150	410	610000	23000	35.9	J	32.7	J	8.3	J	5.1	J
WET CHEMISTRY (mg/kg)												
Sulfide	NA	NA	NA	NA	44.2		445		37.4	U	34.7	U

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UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Sullivan et al., 1985
(2) Tetra Tech, Inc., 1986

TABLE 5-43
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	3SD01		3SD02		3SD01D		3SD03		3SD04		3SD05	
SAMPLE DATE	10/29/95		10/29/95		10/29/95		10/29/95		10/27/95		10/27/95	
TOTAL METALS (mg/kg)												
Arsenic, Total	1.8		5	J	1.7		4.3		1.4		0.89	U
Barium, Total	9.3		9.1		8.6		9.1		7.5		8.2	
Beryllium, Total	0.18	U	0.19	U	0.16	U	0.2	U	0.21	U	0.21	U
Cadmium, Total	2.5	U	2.6	U	2.3	U	2.8	U	2.9	U	3	U
Chromium, Total	5.1		14.7		5		15.3		5		5.8	
Cobalt, Total	1.3		4.7		1.2	U	4.6		1.5	U	1.6	
Copper, Total	13.8		28		12.9		29.1		19.3		14.8	
Lead, Total	1.2	J	1.8	J	0.89	J	1.7	J	1.8	J	0.36	J
Mercury, Total	0.06	U	0.08	U	0.07	U	0.073	U	0.074	U	0.055	U
Nickel, Total	2.2	U	4.2		2	U	4.3		2.6	U	2.6	U
Selenium, Total	0.61	UJ	0.9	UJ	0.73	UJ	1.6	UJ	1.6	UJ	1.8	J
Silver, Total	1.9	UJ	2	UJ	1.8	UJ	2.1	UJ	2.2	UJ	2.3	UJ
Tin, Total	6.8	U	7.1	U	6.2	U	7.5	U	7.8	U	8.1	U
Vanadium, Total	6.2		33.6		5.5		27.7		7.2		5	
Zinc, Total	2.9		18.4		3.4		20.2		7.9		3	
WET CHEMISTRY (mg/kg)												
Sulfide	33.9	U	90.8		33.3	U	139		42.2	U	37.1	U

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U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
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NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Sullivan et al., 1985
(2) Tetra Tech, Inc., 1986

TABLE 5-43
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	3SD06		3SD07		3SD08		3SD09		3SD10		3SD11	
SAMPLE DATE	10/27/95		10/27/95		10/28/95		10/28/95		10/27/95		10/28/95	
TOTAL METALS (mg/kg)												
Arsenic, Total	0.94	U	1.1		2.1		3.2		0.9		0.82	
Barium, Total	6.3		8.4		8.3		8.6		7		9	
Beryllium, Total	0.16	U	0.2		0.19	U	0.2	U	0.15	U	0.16	U
Cadmium, Total	2.3	U	2.4	U	2.6	U	2.9	U	0.33	U	0.33	U
Chromium, Total	3.7		8.2		3.9		3.1	U	7.6		5	
Cobalt, Total	1.2	U	1.7		1.4	U	1.5	U	1.5		1.6	
Copper, Total	11.4		20.9		16.6		15.2		7.9		9.4	
Lead, Total	0.7	J	0.96	J	1.2	J	0.76	J	2		0.73	
Mercury, Total	0.073	U	0.059	U	0.08	U	0.075	U	0.08	U	0.07	U
Nickel, Total	2	U	2.1	U	2.3	U	2.5	U	2.7		1.8	
Selenium, Total	1.4	UJ	1.4	UJ	2.2	UJ	1.7	UJ	0.89		0.62	U
Silver, Total	1.7	UJ	1.8	UJ	2	UJ	2.2	UJ	0.45	U	0.45	U
Tin, Total	6.1	U	6.5	U	7.1	U	7.7	U	2.8	U	2.8	U
Vanadium, Total	7.1		19.7		12.7		13.4		20.2		19.6	
Zinc, Total	3.6		8.3		6.4		6.8		9.6		6.8	
WET CHEMISTRY (mg/kg)												
Sulfide	35.5	U	37.7	U	69.4		44.9	U	69.1	J	69.9	J

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UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

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TABLE 5-43
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	3SD12		3SD13		3SD14		3SD15		11SD01		11SD02	
SAMPLE DATE	10/28/95		10/28/95		10/28/95		10/28/95		10/28/95		10/28/95	
TOTAL METALS (mg/kg)												
Arsenic, Total	1.4		0.57		0.97	J	3.8	J	5.8	J	**9.2**	J
Barium, Total	13.2		6.6		15		16.9		12.4		10.6	
Beryllium, Total	0.26		0.23	U	0.12	U	0.14	U	NA		NA	
Cadmium, Total	0.38	U	0.48	U	0.24	U	0.3	U	0.56	UJ	0.55	UJ
Chromium, Total	13		6.8		19.8		18.8		8.4	J	4	J
Cobalt, Total	5.3		0.93		6.8		7.3		NA		NA	
Copper, Total	18.7		11.4		**38.4**		25.7		NA		NA	
Lead, Total	0.96		1.1		2.1		1.6		**194**	J	38.7	J
Mercury, Total	0.09	U	0.12	U	0.06	U	0.08	U	0.08	R	0.17	R
Nickel, Total	7.1		3.2		7.6		10.6		NA		NA	
Selenium, Total	1	U	1.1	U	0.74	U	0.68	U	0.71	R	0.45	R
Silver, Total	0.53	U	0.66	U	0.34	U	0.42	U	0.73	UJ	0.71	UJ
Tin, Total	3.4		4.2		2.1	U	2.6	U	NA		NA	
Vanadium, Total	29		12.2		66.9		40.2		NA		NA	
Zinc, Total	15.2		10.3		29.8		16.7		NA		NA	
WET CHEMISTRY (mg/kg)												
Sulfide	242	J	58.4	UJ	102	J	59.3	J	NA		NA	

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NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Sullivan et al., 1985
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TABLE 5-43
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	11SD03	1SD01	1SD02	1SD03	2SD01	2SD02
SAMPLE DATE	10/28/95	10/30/95	10/30/95	10/30/95	10/31/95	10/31/95
TOTAL METALS (mg/kg)						
Arsenic, Total	**13.2** J	0.19 UJ	0.43 J	0.32 J	2 J	7 J
Barium, Total	10	122	147	129	12.1	55.9 J
Beryllium, Total	NA	0.1 U	0.1 U	0.12 U	0.11 U	0.21 UJ
Cadmium, Total	0.57 UJ	0.4 U	0.44 U	0.52 U	0.46 U	**1.2** J
Chromium, Total	4.2 J	15.1	38.9	18.3	6.6	18.7 J
Cobalt, Total	NA	6.4	28	4.6	1.2	4.6 J
Copper, Total	NA	14.5	**110**	21.5	8.2	**332** J
Lead, Total	26.2 J	1.5	2.9	4.3	3.8	**339** J
Mercury, Total	0.09 R	0.062 U	0.06 U	0.054 U	0.06 U	**0.8** J
Nickel, Total	NA	3.1	16.7	5	2.4	7.8 J
Selenium, Total	0.27 UJ	0.18 UJ	0.35 J	0.41 J	0.25 UJ	0.35 UJ
Silver, Total	0.73 UJ	0.31 U	0.37	0.39 U	0.35 U	0.69 UJ
Tin, Total	NA	1.7 U	1.9 U	2.2 U	2 U	13.5 J
Vanadium, Total	NA	65.3	220	101	15	37.1 J
Zinc, Total	NA	9.9	32.3	21.6	9.6	**432** J
WET CHEMISTRY (mg/kg)						
Sulfide	NA	31.1 U	33.8 UJ	45.2 J	41.9 UJ	296 J

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UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
mg/kg = milligrams per kilogram.

NA = Not analyzed.

Region III RBC indusrtial/residential USEPA 1996A

(1) Sullivan et al., 1985
(2) Tetra Tech, Inc., 1986

TABLE 5-43
DETECTED CONCENTRATIONS OF INORGANIC ANALYTES
AOC D SEDIMENTS
CTO-0277 RFI REPORT OU#1 AND OU#7
NAVAL STATION ROOSEVELT ROADS, PUERTO RICO

SAMPLE ID	2SD03		2SD03D		number exceeding	number exceeding	number exceeding	number exceeding
SAMPLE DATE	10/31/95		10/31/95		**ERL**	ERM	Industrial	Residential
					Sediment	Sediment	Soils	Soils
TOTAL METALS (mg/kg)								
Arsenic, Total	7.6	J	6.2	J	4/30	0/30	0/30	0/30
Barium, Total	59.4		49.8		0/30	NA	0/30	0/30
Beryllium, Total	0.13	U	0.11	U	NA	0/30	0/30	2/30
Cadmium, Total	0.55	U	0.47	U	1/30	0/30	0/30	0/30
Chromium, Total	34.7		23.1		0/30	0/30	0/30	0/30
Cobalt, Total	7.9		7.9		NA	NA	0/30	0/30
Copper, Total	**830**		**384**		6/30	3/30	0/30	0/30
Lead, Total	**202**	J	**144**	J	4/30	1/30	0/30	0/30
Mercury, Total	**2.7**		**2.6**		3/30	3/30	0/30	0/30
Nickel, Total	9.1		6.7		0/30	0/30	0/30	0/30
Selenium, Total	0.15	J	0.34	J	NA	1/30	0/30	0/30
Silver, Total	0.42	U	0.36	U	0/30	0/30	0/30	0/30
Tin, Total	13.7		9.4		NA	NA	0/30	0/30
Vanadium, Total	79.2		57.1		NA	NA	0/30	0/30
Zinc, Total	**401**		**281**		3/30	1/30	0/30	0/30
WET CHEMISTRY (mg/kg)								
Sulfide	34.8	UJ	55	J	NA	NA	NA	NA

QUALIFIER DEFINITIONS
J = Analyte present. Reported value may not be accurate or precise.
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U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.
UJ = Not detected. Quantitation limit may be inaccurate or imprecise.

NOTES
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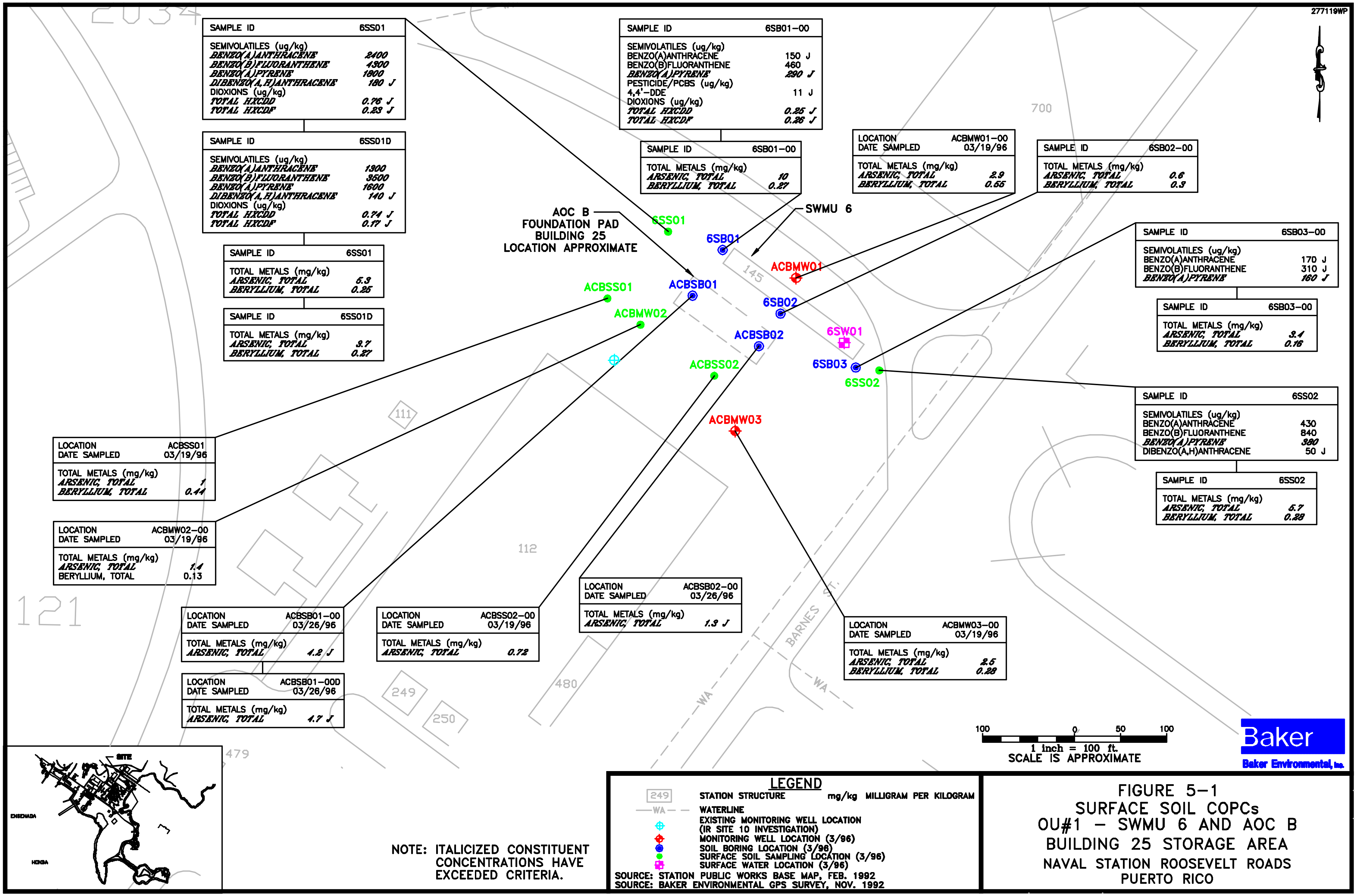
NA = Not analyzed.

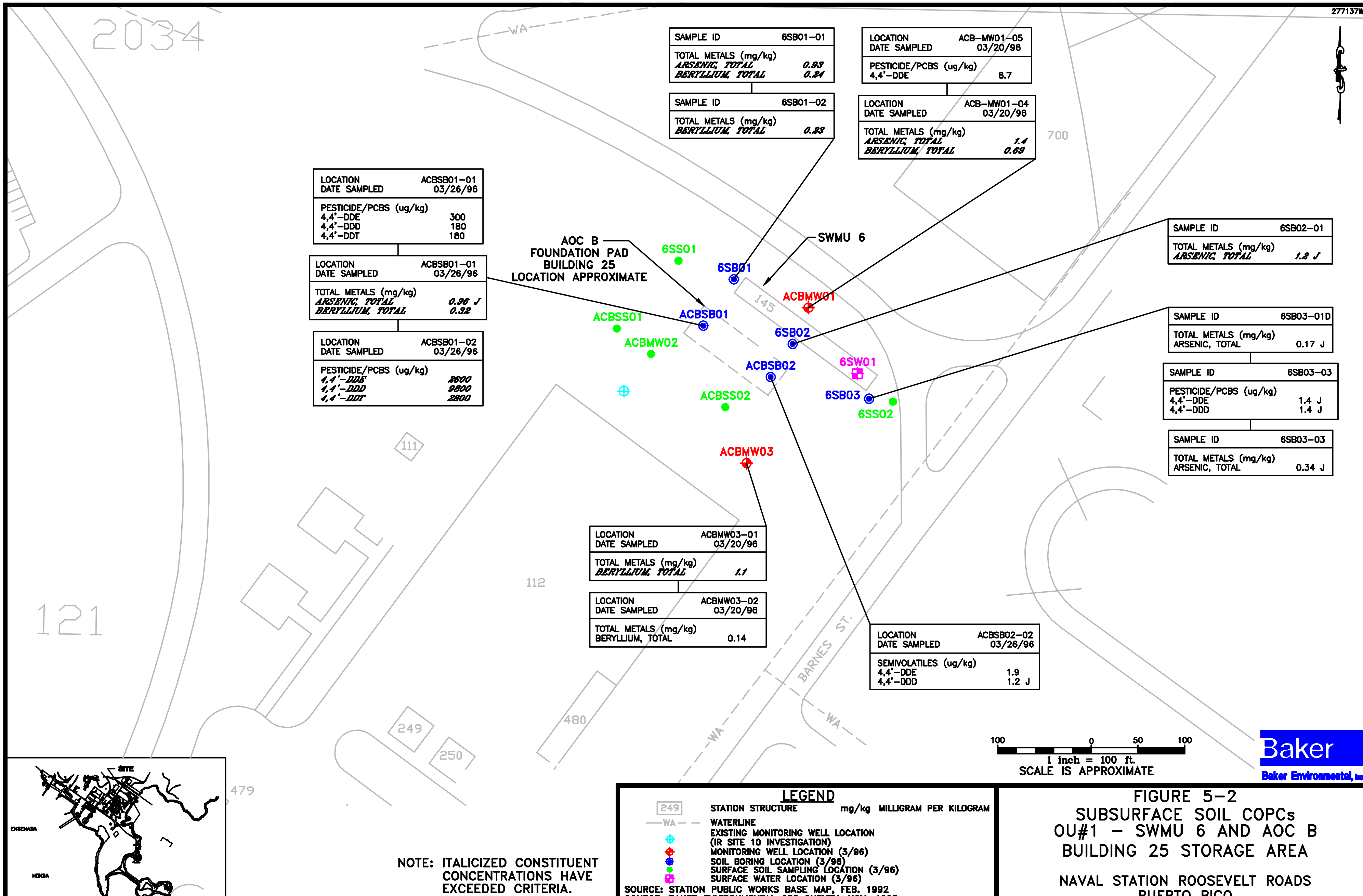
Region III RBC indusrtial/residential USEPA 1996A

(1) Sullivan et al., 1985
(2) Tetra Tech, Inc., 1986

SECTION 5.0 FIGURES



277119WP
SAMPLE ID 6SS01
SEMIVOLATILES (ug/kg)
BENZO(A)ANTHRACENE 2400
BENZO(B)FLUORANTHENE 4300
BENZO(A)PYRENE 1800
DIBENZO(A,H)ANTHRACENE 180 J
DIOXIONS (ug/kg)
TOTAL HXCDD 0.76 J
TOTAL HXCDF 0.23 J
SAMPLE ID 6SS01D
SEMIVOLATILES (ug/kg)
BENZO(A)ANTHRACENE 1300
BENZO(B)FLUORANTHENE 3500
BENZO(A)PYRENE 1600
DIBENZO(A,H)ANTHRACENE 140 J
DIOXIONS (ug/kg)
TOTAL HXCDD 0.74 J
TOTAL HXCDF 0.17 J
SAMPLE ID 6SS01
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 6.3
BERYLLIUM, TOTAL 0.25
SAMPLE ID 6SS01D
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 3.7
BERYLLIUM, TOTAL 0.27
SAMPLE ID 6SB01-00
SEMIVOLATILES (ug/kg)
BENZO(A)ANTHRACENE 150 J
BENZO(B)FLUORANTHENE 460
BENZO(A)PYRENE 290 J
PESTICIDE/PCBS (ug/kg)
4,4'-DDE 11 J
DIOXIONS (ug/kg)
TOTAL HXCDD 0.25 J
TOTAL HXCDF 0.26 J
SAMPLE ID 6SB01-00
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 10
BERYLLIUM, TOTAL 0.27
LOCATION ACBMW01-00
DATE SAMPLED 03/19/96
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 2.9
BERYLLIUM, TOTAL 0.55
SAMPLE ID 6SB02-00
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 0.6
BERYLLIUM, TOTAL 0.3
SAMPLE ID 6SB03-00
SEMIVOLATILES (ug/kg)
BENZO(A)ANTHRACENE 170 J
BENZO(B)FLUORANTHENE 310 J
BENZO(A)PYRENE 160 J
SAMPLE ID 6SB03-00
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 3.4
BERYLLIUM, TOTAL 0.16
SAMPLE ID 6SS02
SEMIVOLATILES (ug/kg)
BENZO(A)ANTHRACENE 430
BENZO(B)FLUORANTHENE 840
BENZO(A)PYRENE 380
DIBENZO(A,H)ANTHRACENE 50 J
SAMPLE ID 6SS02
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 5.7
BERYLLIUM, TOTAL 0.28
AOC B
FOUNDATION PAD
BUILDING 25
LOCATION APPROXIMATE
SWMU 6
6SS01
6SB01
ACBMW01
ACBSS01
ACBSB01
ACBMW02
6SB02
6SW01
ACBSB02
ACBSS02
6SB03
6SS02
ACBMW03
145
700
111
112
121
249
250
480
479
BARNES ST.
WA
LOCATION ACBSS01
DATE SAMPLED 03/19/96
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 1
BERYLLIUM, TOTAL 0.44
LOCATION ACBMW02-00
DATE SAMPLED 03/19/96
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 1.4
BERYLLIUM, TOTAL 0.13
LOCATION ACBSB01-00
DATE SAMPLED 03/26/96
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 4.2 J
LOCATION ACBSB01-00D
DATE SAMPLED 03/26/96
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 4.7 J
LOCATION ACBSS02-00
DATE SAMPLED 03/19/96
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 0.72
LOCATION ACBSB02-00
DATE SAMPLED 03/26/96
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 1.3 J
LOCATION ACBMW03-00
DATE SAMPLED 03/19/96
TOTAL METALS (mg/kg)
ARSENIC, TOTAL 2.5
BERYLLIUM, TOTAL 0.28
100 0 50 100
1 inch = 100 ft.
SCALE IS APPROXIMATE
Baker
Baker Environmental, Inc.
SITE
ENSENADA
HONDA
NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.
LEGEND
249 STATION STRUCTURE
mg/kg MILLIGRAM PER KILOGRAM
WA WATERLINE
EXISTING MONITORING WELL LOCATION (IR SITE 10 INVESTIGATION)
MONITORING WELL LOCATION (3/96)
SOIL BORING LOCATION (3/96)
SURFACE SOIL SAMPLING LOCATION (3/96)
SURFACE WATER LOCATION (3/96)
SOURCE: STATION PUBLIC WORKS BASE MAP, FEB. 1992
SOURCE: BAKER ENVIRONMENTAL GPS SURVEY, NOV. 1992
FIGURE 5-1
SURFACE SOIL COPCs
OU#1 - SWMU 6 AND AOC B
BUILDING 25 STORAGE AREA
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



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NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

LEGEND

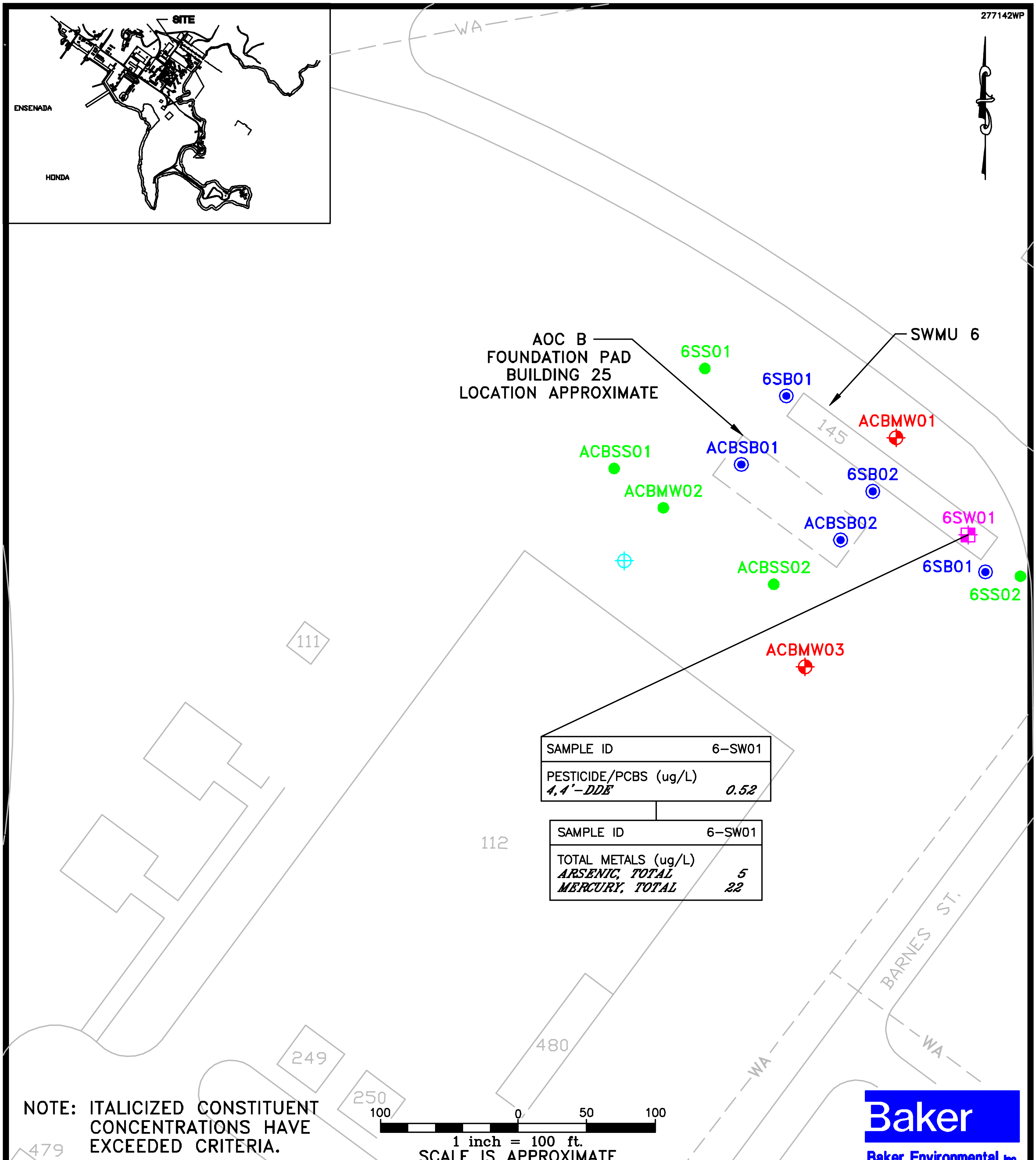
- 249 STATION STRUCTURE
- —WA— WATERLINE
- EXISTING MONITORING WELL LOCATION (IR SITE 10 INVESTIGATION)
- MONITORING WELL LOCATION (3/96)
- SOIL BORING LOCATION (3/96)
- SURFACE SOIL SAMPLING LOCATION (3/96)
- SURFACE WATER LOCATION (3/96)

mg/kg MILLIGRAM PER KILOGRAM

SOURCE: STATION PUBLIC WORKS BASE MAP, FEB. 1992
SOURCE: BAKER ENVIRONMENTAL GPS SURVEY, NOV. 1992

FIGURE 5-2
SUBSURFACE SOIL COPCs
OU#1 – SWMU 6 AND AOC B
BUILDING 25 STORAGE AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



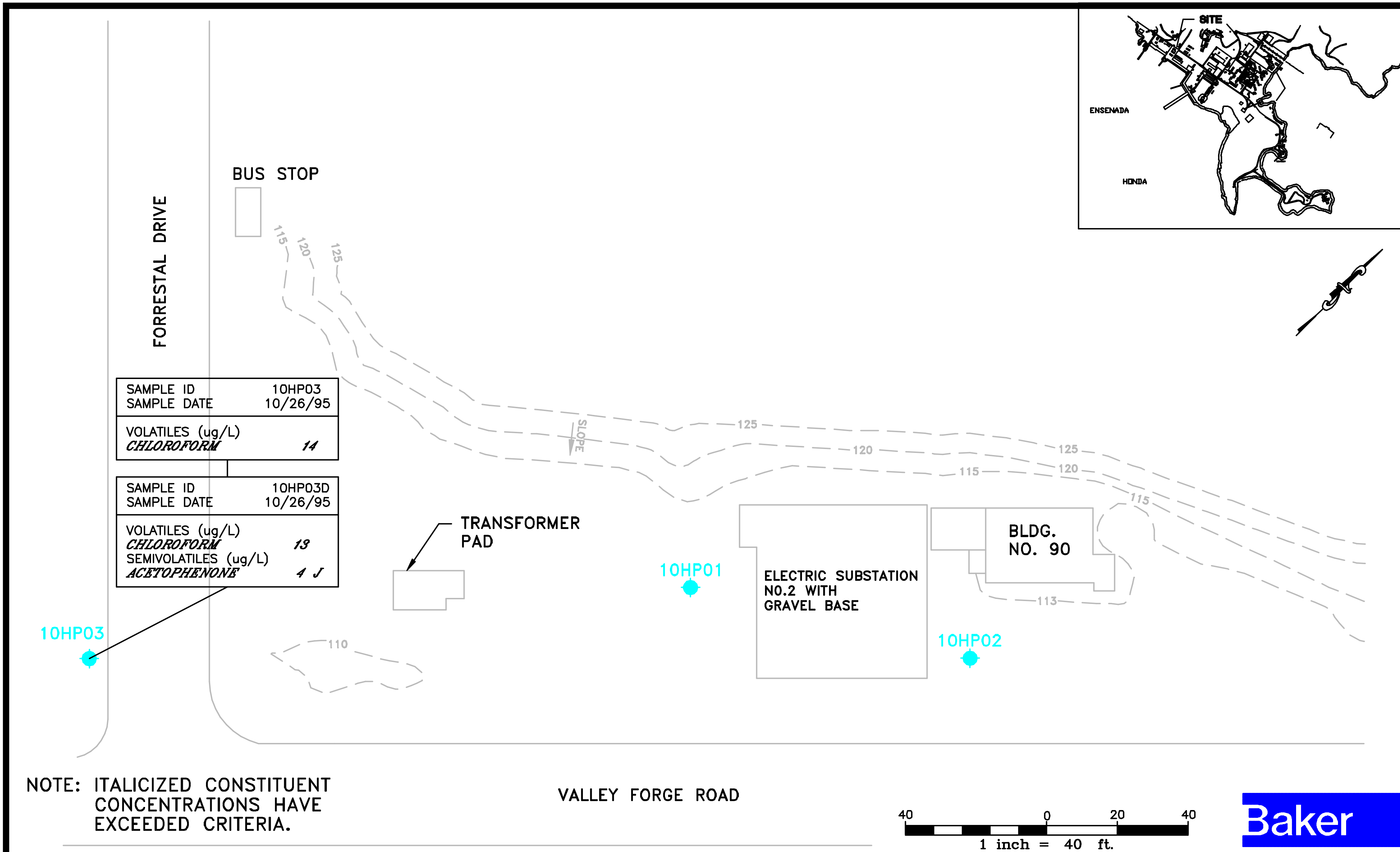
NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

LEGEND

249	STATION STRUCTURE
—WA—	WATERLINE
	EXISTING MONITORING WELL LOCATION (IR SITE 10 INVESTIGATION)
	MONITORING WELL LOCATION (3/96)
	SOIL BORING LOCATION (3/96)
	SURFACE SOIL SAMPLING LOCATION (3/96)
	SURFACE WATER LOCATION (3/96)
ug/L	MICROGRAMS PER LITER

SOURCE: STATION PUBLIC WORKS BASE MAP, FEB. 1992
SOURCE: BAKER ENVIRONMENTAL GPS SURVEY, NOV. 1992

FIGURE 5-3
SURFACE WATER CONSTITUENTS EXCEEDING CRITERIA
OU#1 – SWMU 6 AND AOC B
BUILDING 25 STORAGE AREA
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

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LEGEND

120 – ESTIMATED CONTOUR LINE WITH ELEVATION

– BUILDING OR STRUCTURE

– HYDROPUNCH SAMPLE LOCATION (3/96)

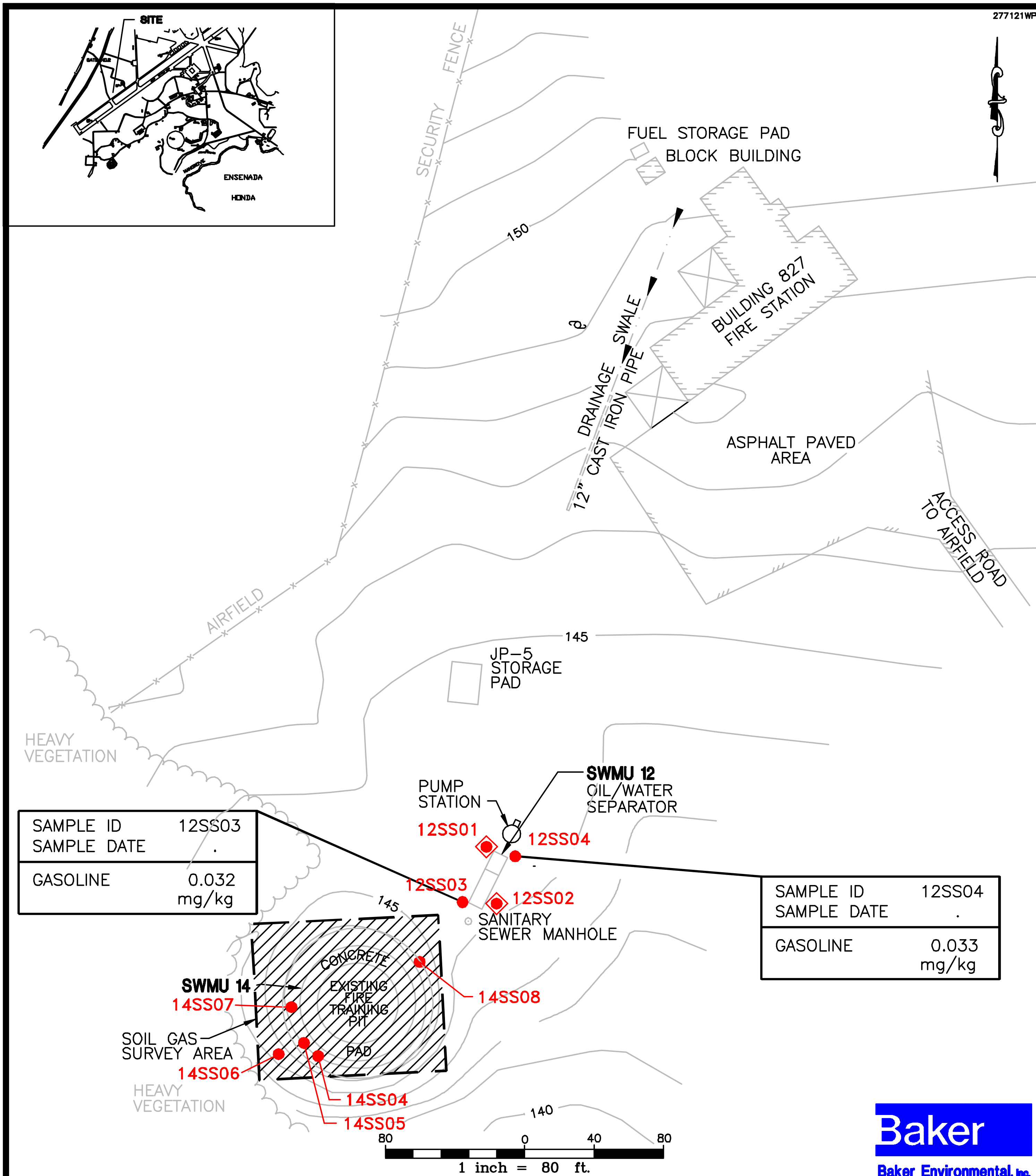
ug/L – MICROGRAMS PER LITER

SOURCE: LANTDIV, FEB. 1992.

FIGURE 5-4
GROUNDWATER COPCs
OU#1-SWMU 10 SUBSTATION 2/BUILDING 90

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

277120WP



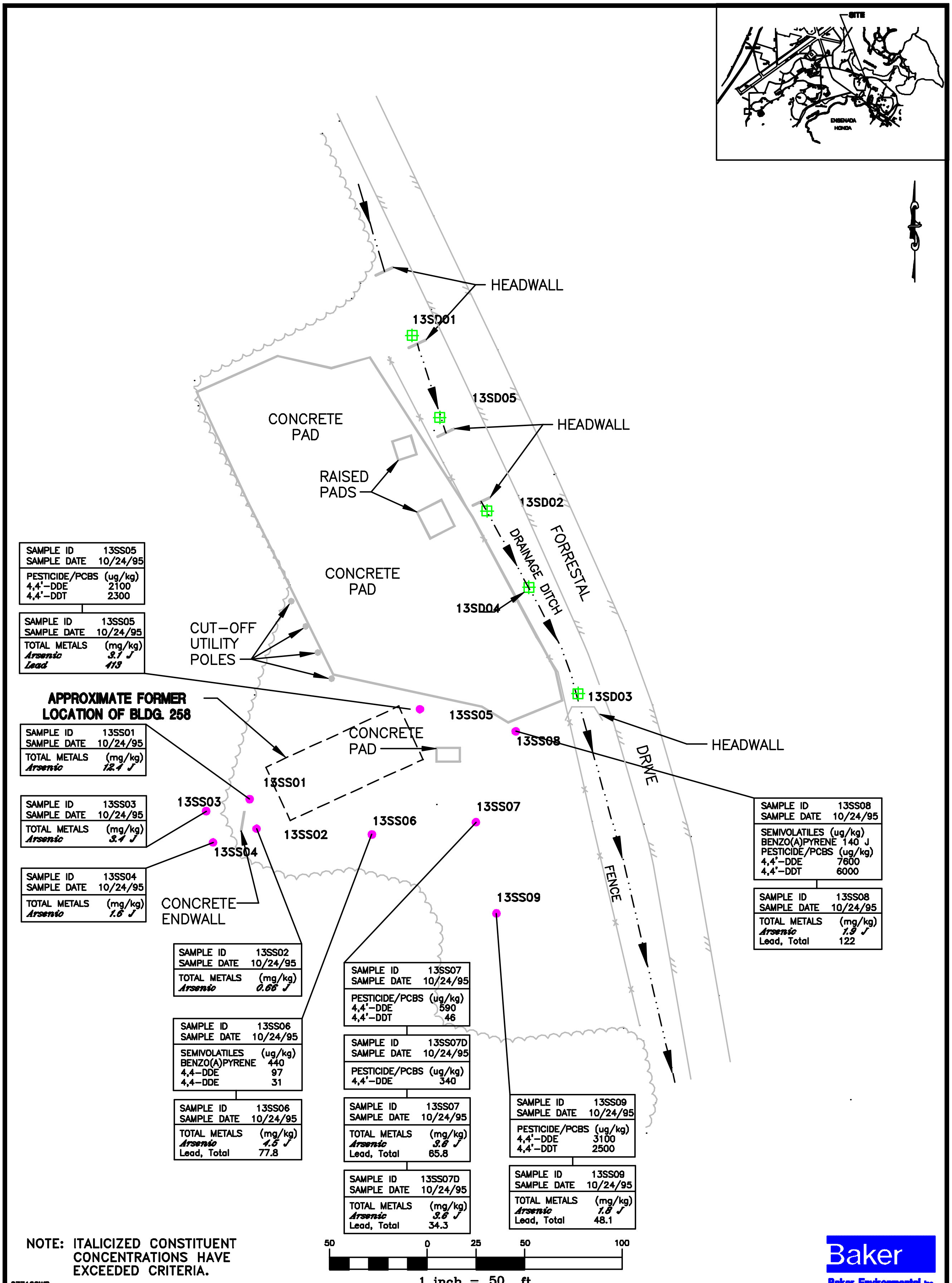
LEGEND

- 145 SURFACE ELEVATION CONTOUR
- SURFACE WATER DRAINAGE DIRECTION
- SURFACE SOIL SAMPLE COLLECTED (9-95)
- SURFACE SOIL SAMPLE COLLECTED (3-22-96)
- AREA OF SOIL GAS SURVEY
- mg/kg MILLIGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992.

FIGURE 5-5
GASOLINE IN SURFACE SOIL
OU#1 - SWMU 12-FIRE TRAINING PIT OIL/WATER SEPARATOR AND SWMU 14 - FIRE TRAINING PIT AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

277122WP

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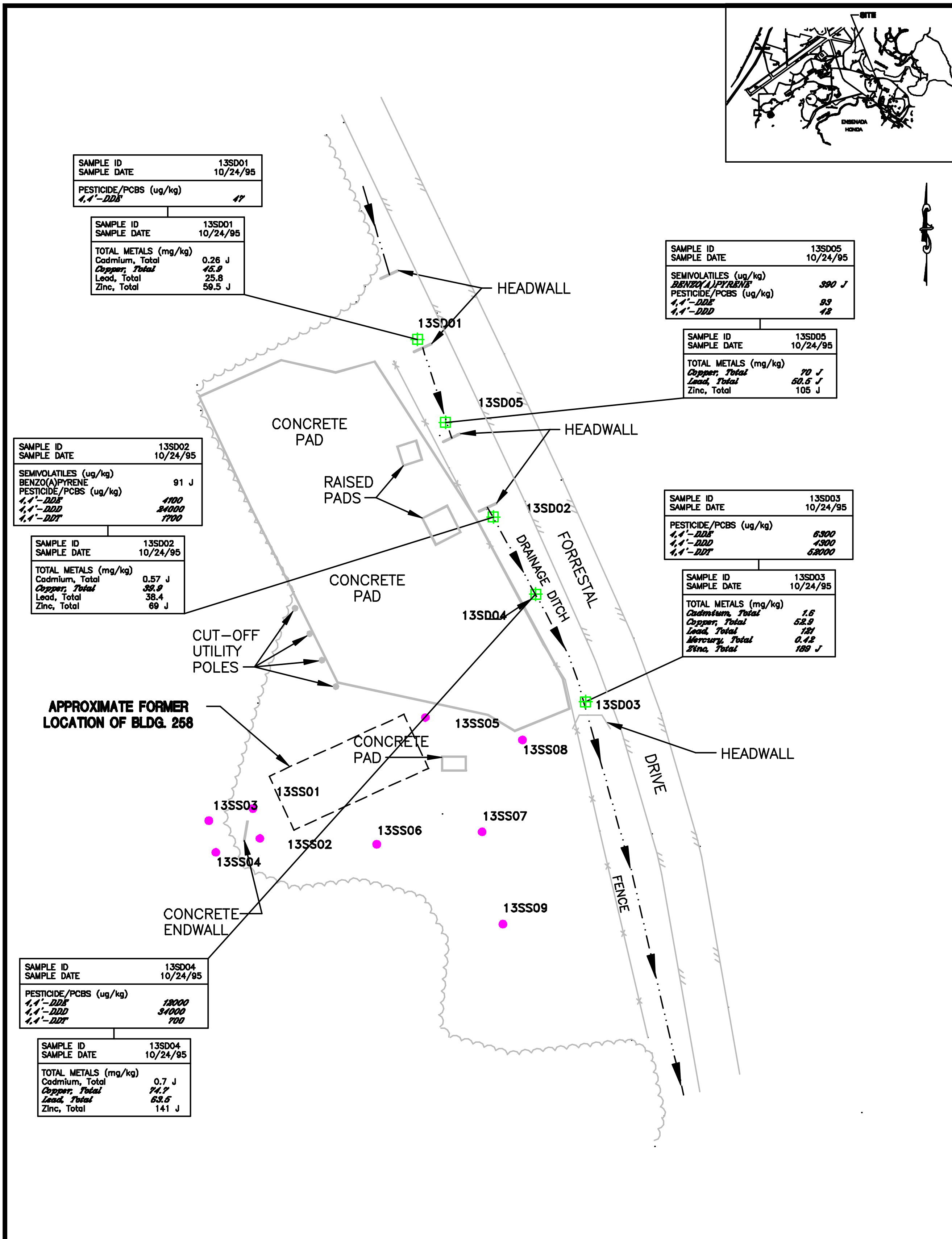
LEGEND

- DRAINAGE DITCH/SURFACE DRAINAGE FLOW DIRECTION
- SEDIMENT SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION (OCT. 1995)
- mg/kg MILLIGRAM PER KILOGRAM
- ug/kg MICROGRAM PER KILOGRAM

SOURCE: BAKER ENVIRONMENTAL, INC., MAY 1994

FIGURE 5-6
SURFACE SOIL COPCs
OU#1 - SWMU 13
PEST CONTROL SHOP AND SURROUNDING AREAS

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

50 0 25 50 100

1 inch = 50 ft.

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277138WP

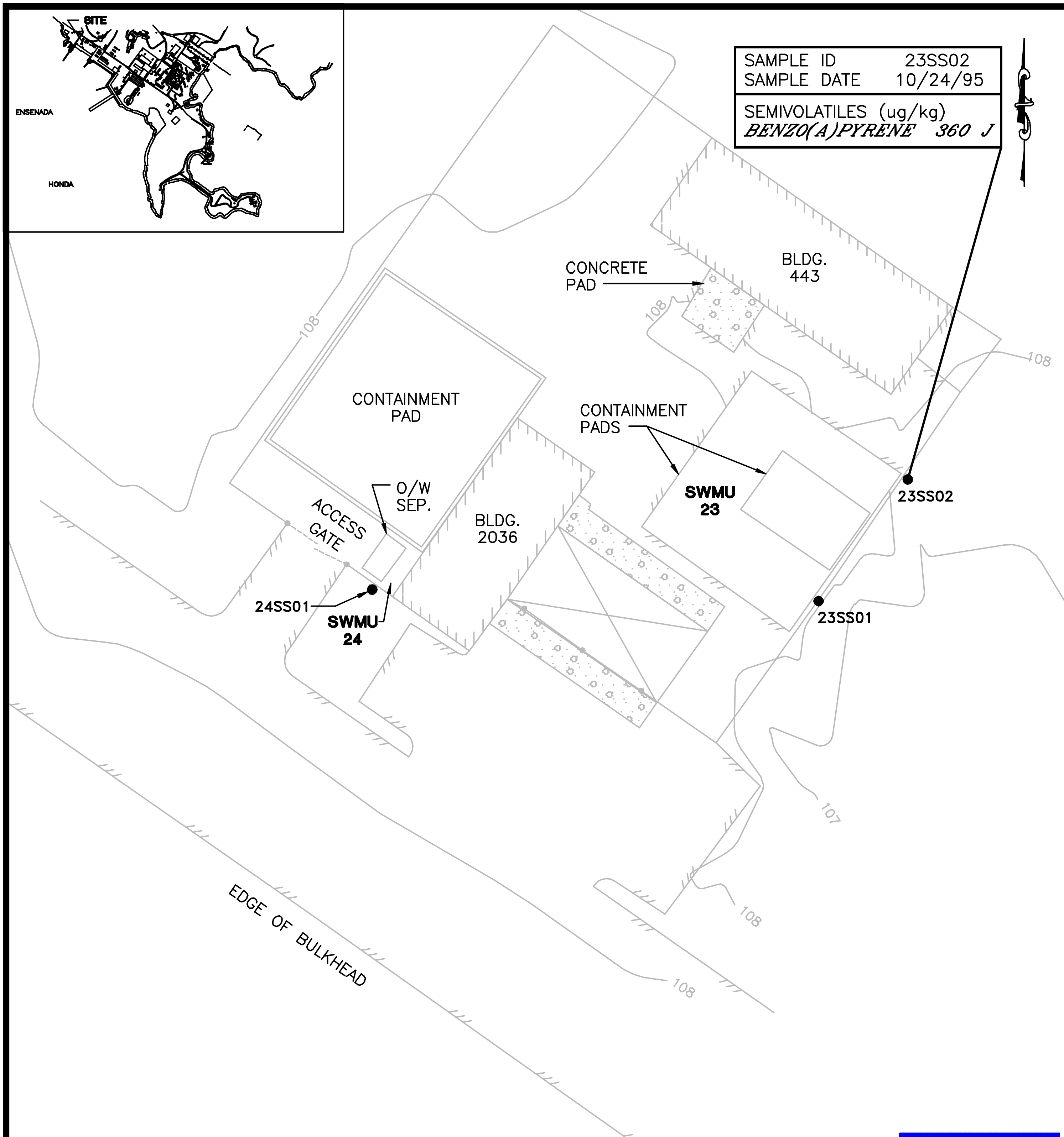
LEGEND

- DRAINAGE DITCH/SURFACE DRAINAGE FLOW DIRECTION
- SEDIMENT SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION (OCT. 1995)
- ug/kg MICROGRAM PER KILOGRAM

SOURCE: BAKER ENVIRONMENTAL, INC., MAY 1994

FIGURE 5-7
SEDIMENT COPCs
OU#1 – SWMU 13
PEST CONTROL SHOP AND SURROUNDING AREAS

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

277123WP

40 0 20 40
1 inch = 40 ft.

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LEGEND

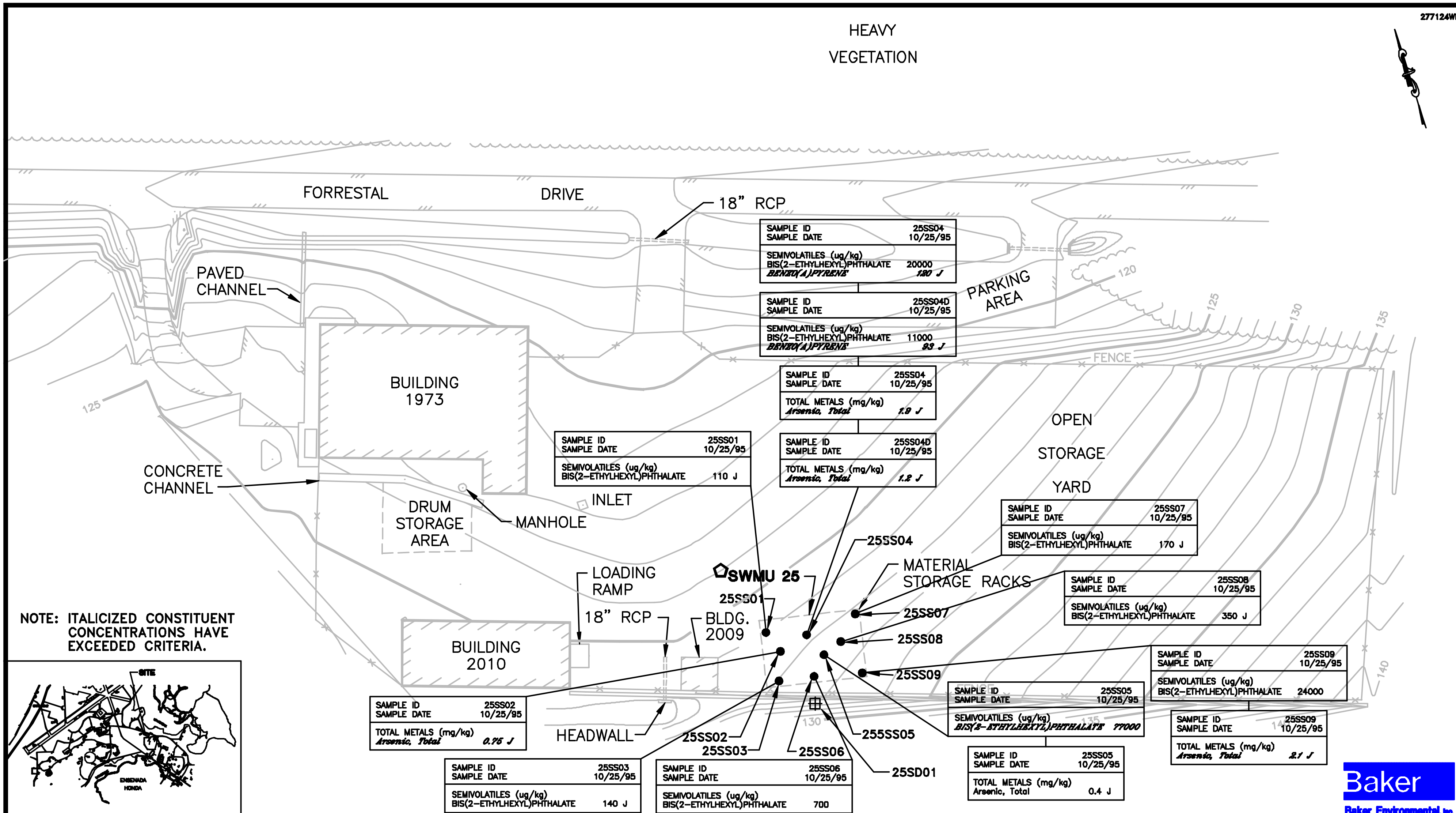
108 SURFACE ELEVATION CONTOUR

● SOIL SAMPLING LOCATION (3/96)

ug/kg MICROGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992.

FIGURE 5-8
SURFACE SOIL COPCs
OU#1 – SWMUs 23 AND 24
OIL SPILL SEPARATOR TANKS AND OIL/WATER SEPARATOR
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

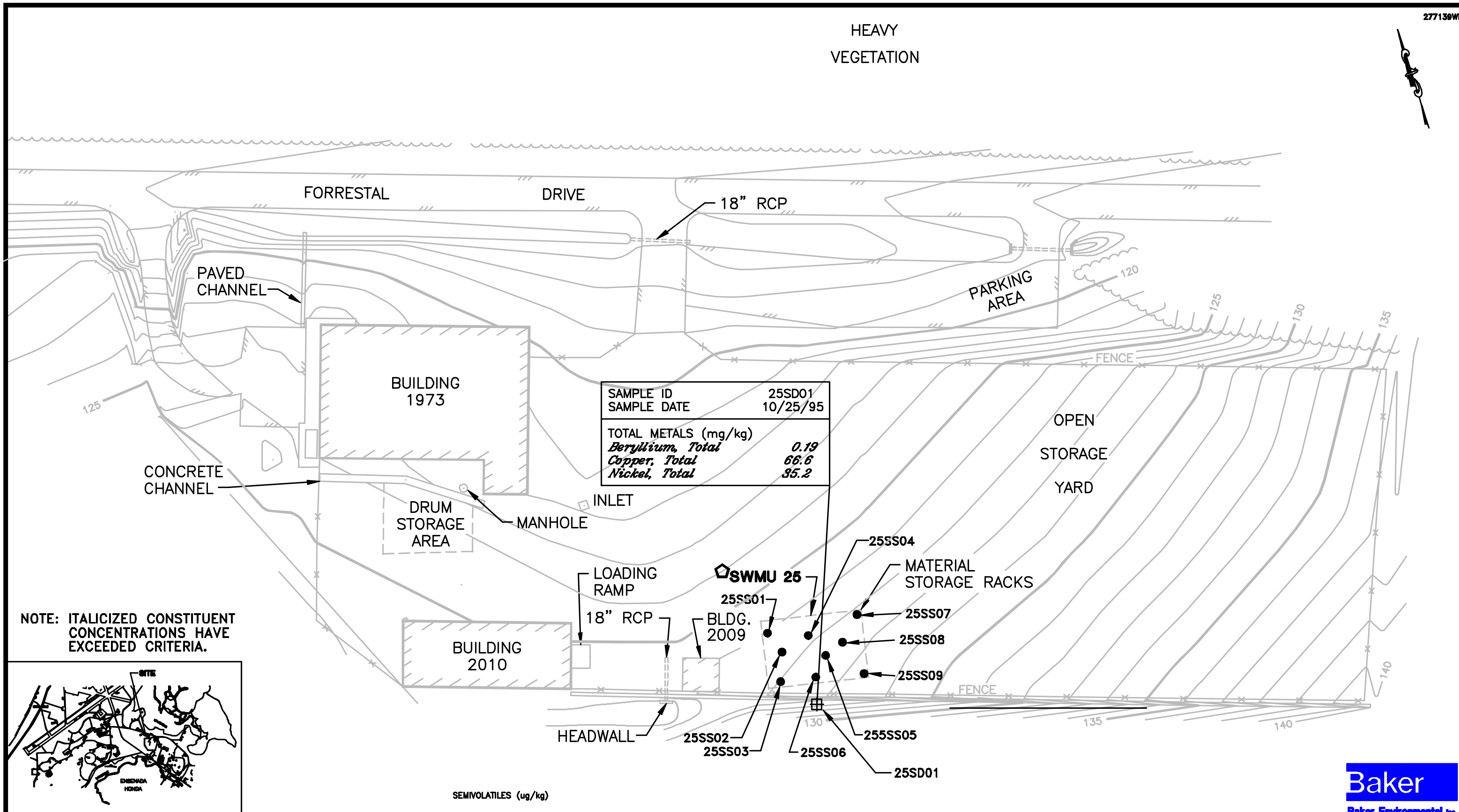
- 130 SURFACE ELEVATION CONTOUR
- AREA OF STAINING APPROXIMATED FROM 1988 RFA PHOTO
- SOIL SAMPLING LOCATION
- SEDIMENT SAMPLE LOCATION
- ug/kg MICROGRAM PER KILOGRAM
- mg/kg MILLIGRAM PER KILOGRAM

60 0 30 60 120

1 inch = 60 ft.

FIGURE 5-9
SURFACE SOIL COPCs
OU#1 – SWMU 25
DRMO STORAGE YARD

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



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LEGEND

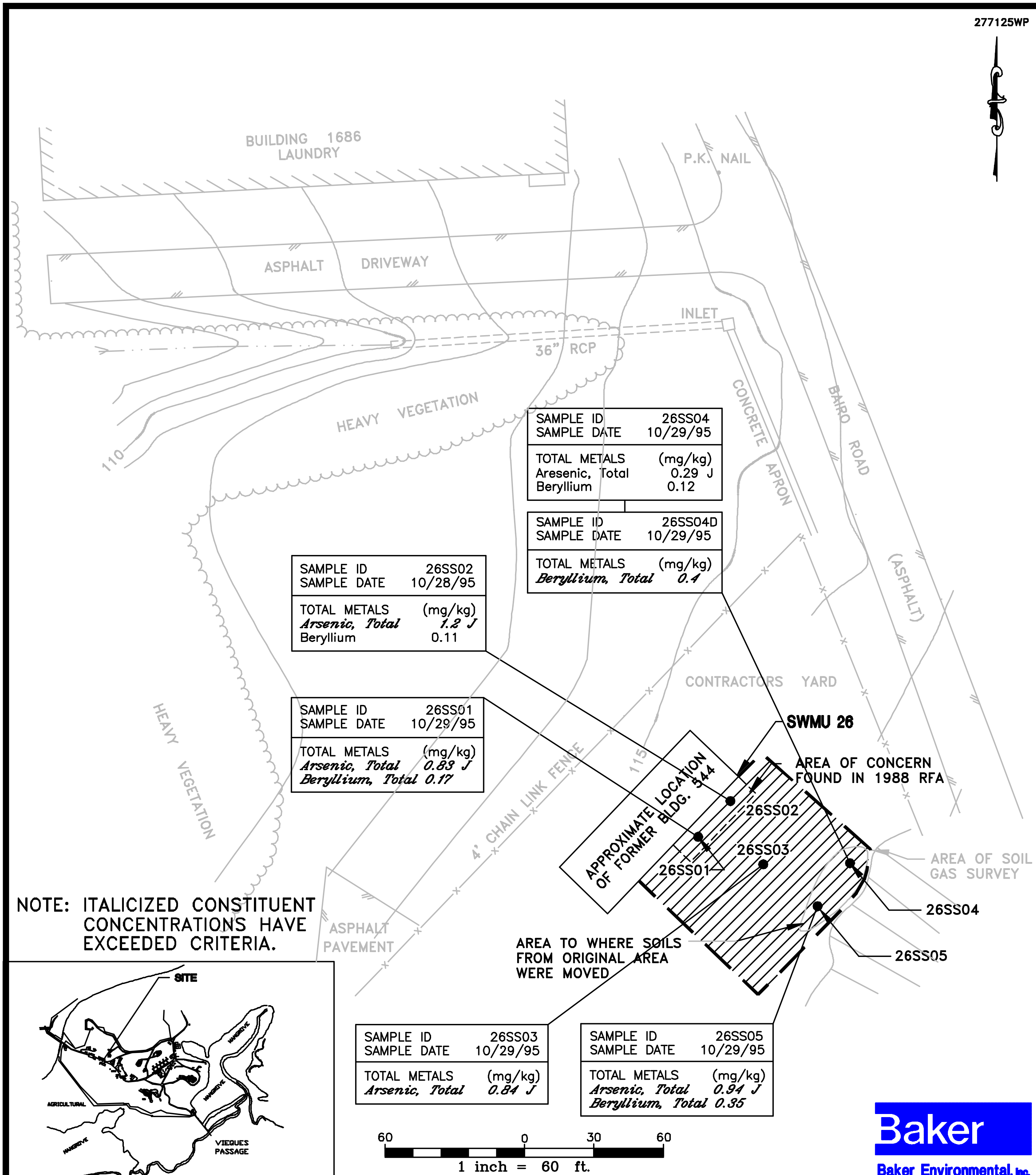
130	SURFACE ELEVATION CONTOUR
⬠	AREA OF STAINING APPROXIMATED FROM 1988 RFA PHOTO
●	SOIL SAMPLING LOCATION
⊞	SEDIMENT SAMPLE LOCATION
mg/kg	MILLIGRAM PER KILOGRAM

60 0 30 60 120

1 inch = 60 ft.

FIGURE 5-10
SEDIMENT COPCs
OU#1 – SWMU 25
DRMO STORAGE YARD

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

110 SURFACE ELEVATION CONTOURS

● SOIL SAMPLING LOCATION

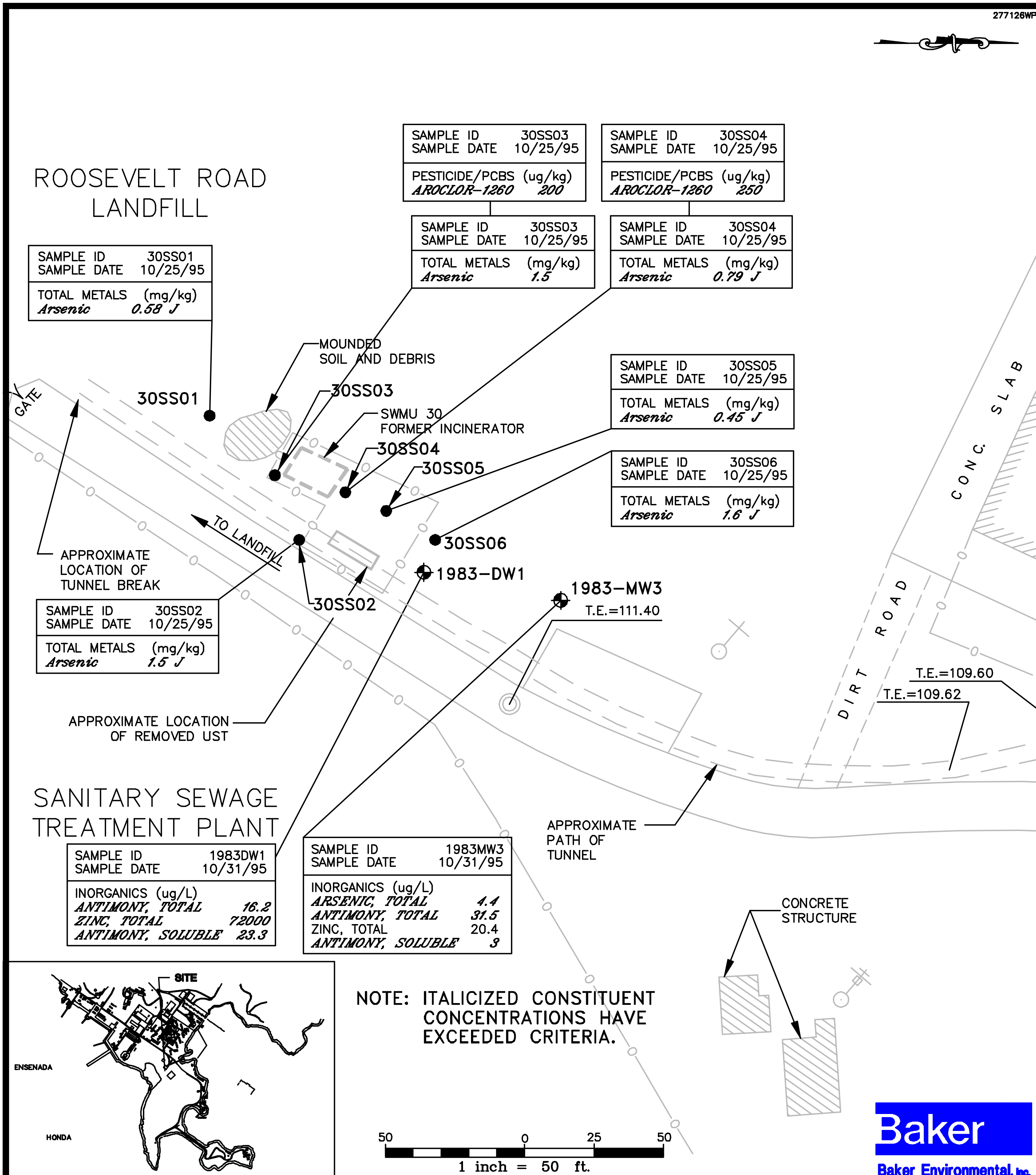
AREA OF SOIL GAS SURVEY

mg/kg MILLIGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992.

FIGURE 5-11
SURFACE SOIL COPCs
OU#1 – SWMU 26
BUILDING 544 AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

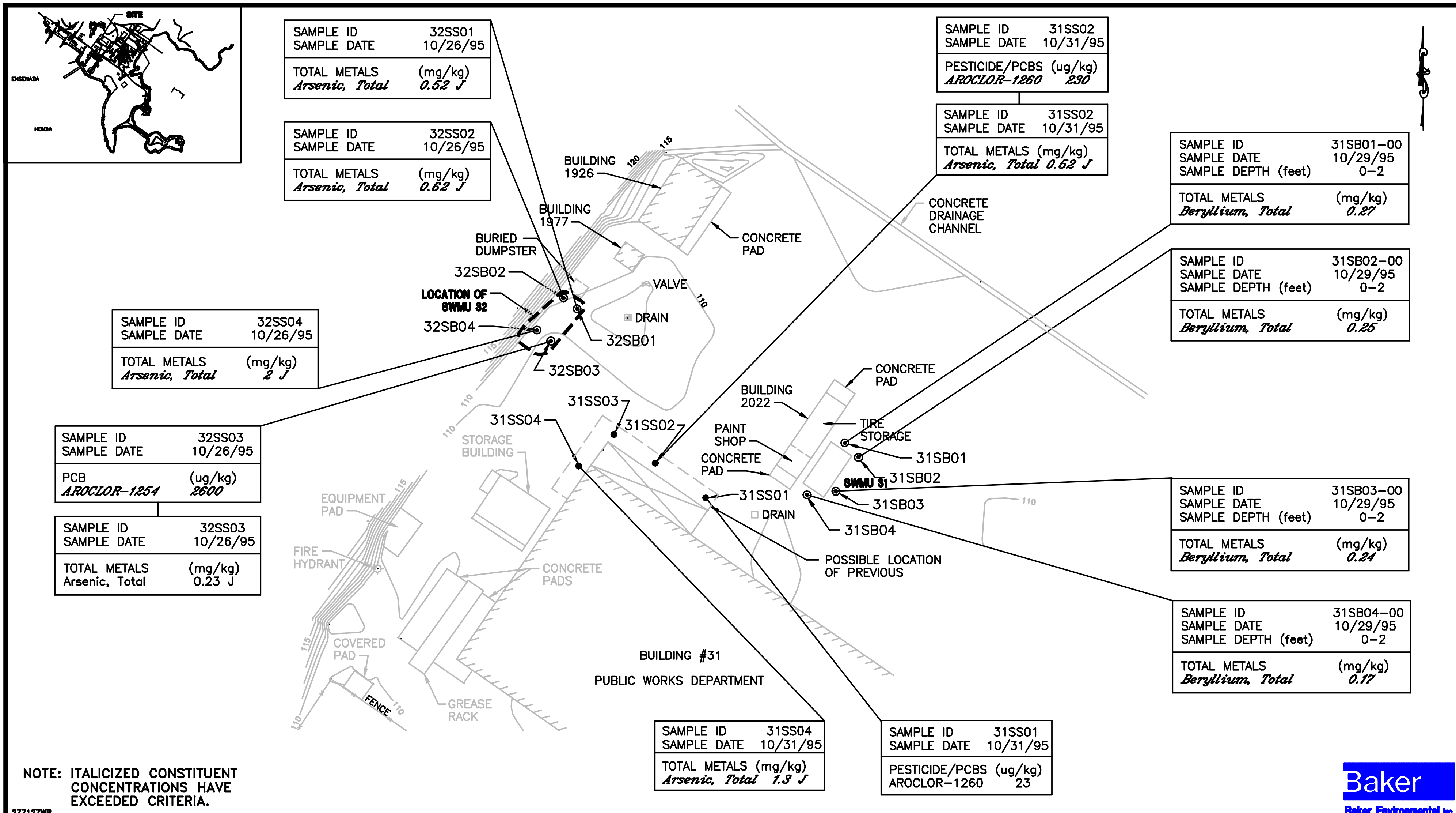
- EXISTING MONITORING WELL LOCATION (BLASLAND, BOUCK & LEE, INC. 1994)
- SURFACE SOIL SAMPLE LOCATION (3/96)

ug/L	MICROGRAM PER LITER
mg/kg	MILLIGRAM PER KILOGRAM
ug/kg	MICROGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992.

FIGURE 5-12
SURFACE SOIL AND GROUNDWATER COPCs
OU#1 – SWMU 30
FORMER INCINERATOR AREA

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

- 110 SURFACE ELEVATION CONTOUR
- ◉ SOIL BORING LOCATION
- ● SOIL SAMPLING LOCATION
- ug/kg MICROGRAM PER KILOGRAM
- mg/kg MILLIGRAM PER KILOGRAM

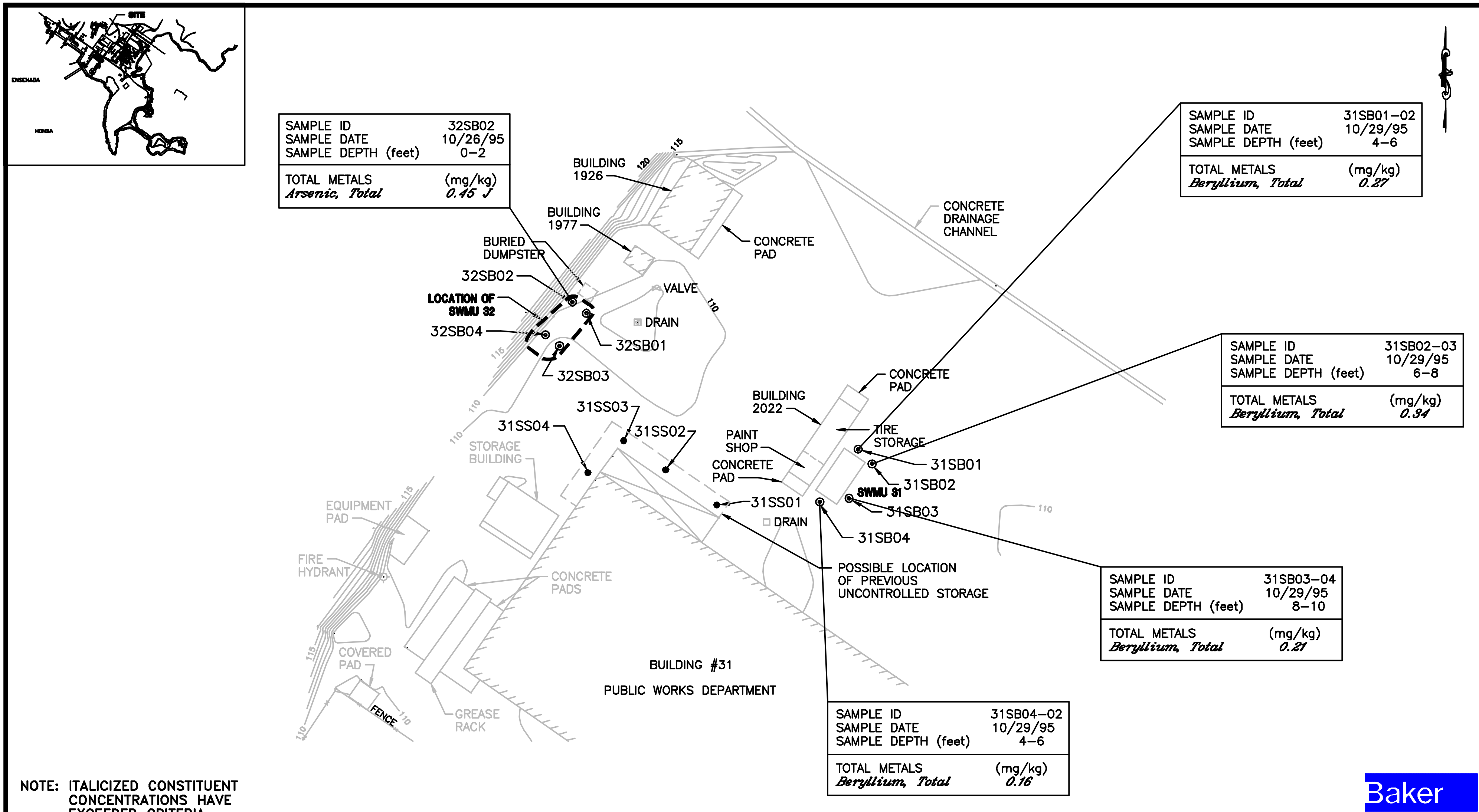
SOURCE: LANTDIV, FEB. 1992.

80 0 40 80 160

1 inch = 80 ft.

FIGURE 5-13
SURFACE SOIL COPCs
OU#1 – SWMU 31 WASTE OIL COLLECTION AREA AND
SWMU 32 BATTERY COLLECTION BUILDING 31

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

277140WP

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LEGEND

110 SURFACE ELEVATION CONTOUR

◎ SOIL BORING LOCATION

● SOIL SAMPLING LOCATION

mg/kg MILLIGRAM PER KILOGRAM

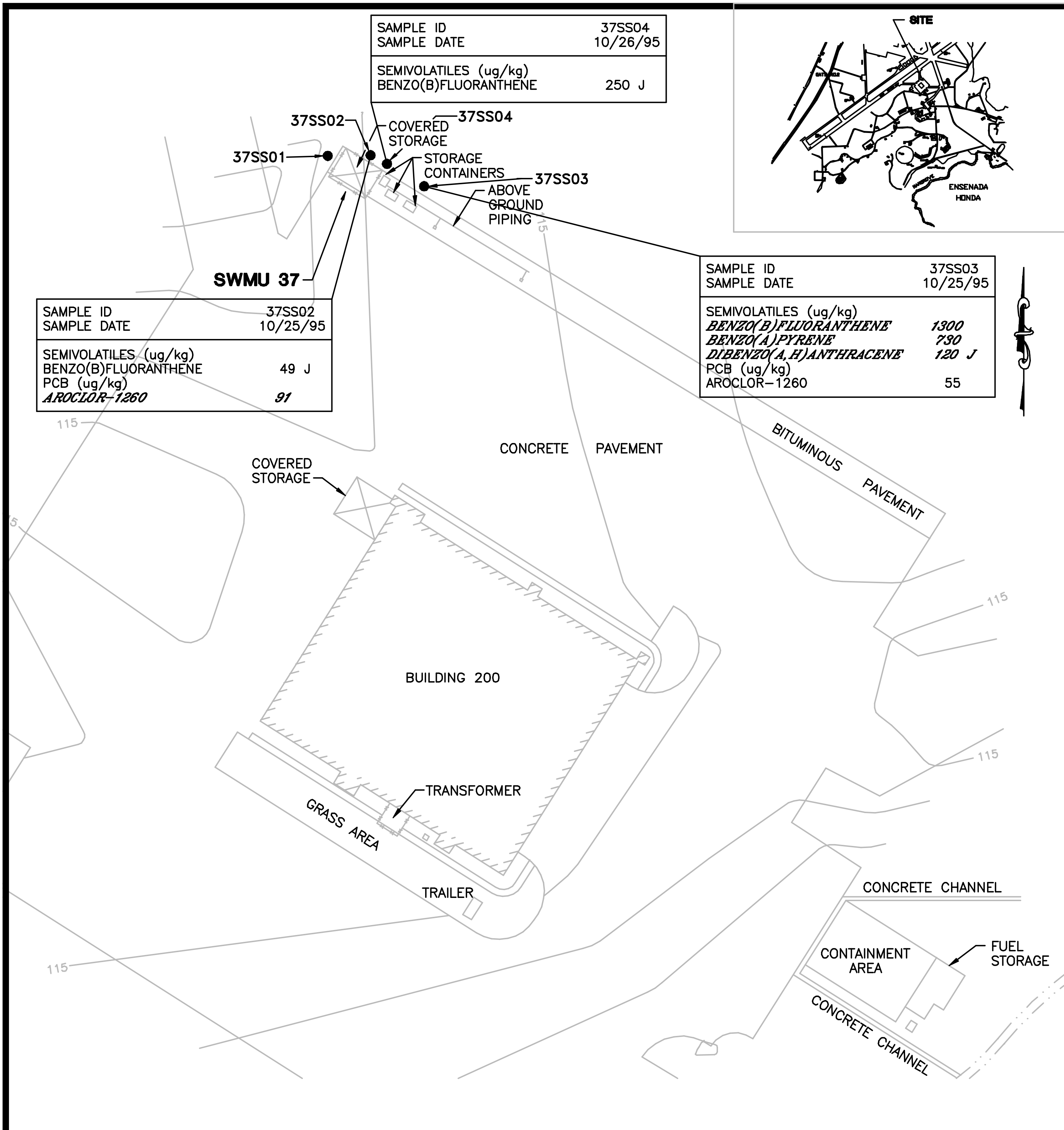
SOURCE: LANTDIV, FEB. 1992.

80 0 40 80 160

1 inch = 80 ft.

FIGURE 5-14
SUBSURFACE SOIL COPCs
OU#1 – SWMU 31 WASTE OIL COLLECTION AREA AND SWMU 32 BATTERY COLLECTION BUILDING 31

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

120 0 60 120
1 inch = 120 ft.

277128WP

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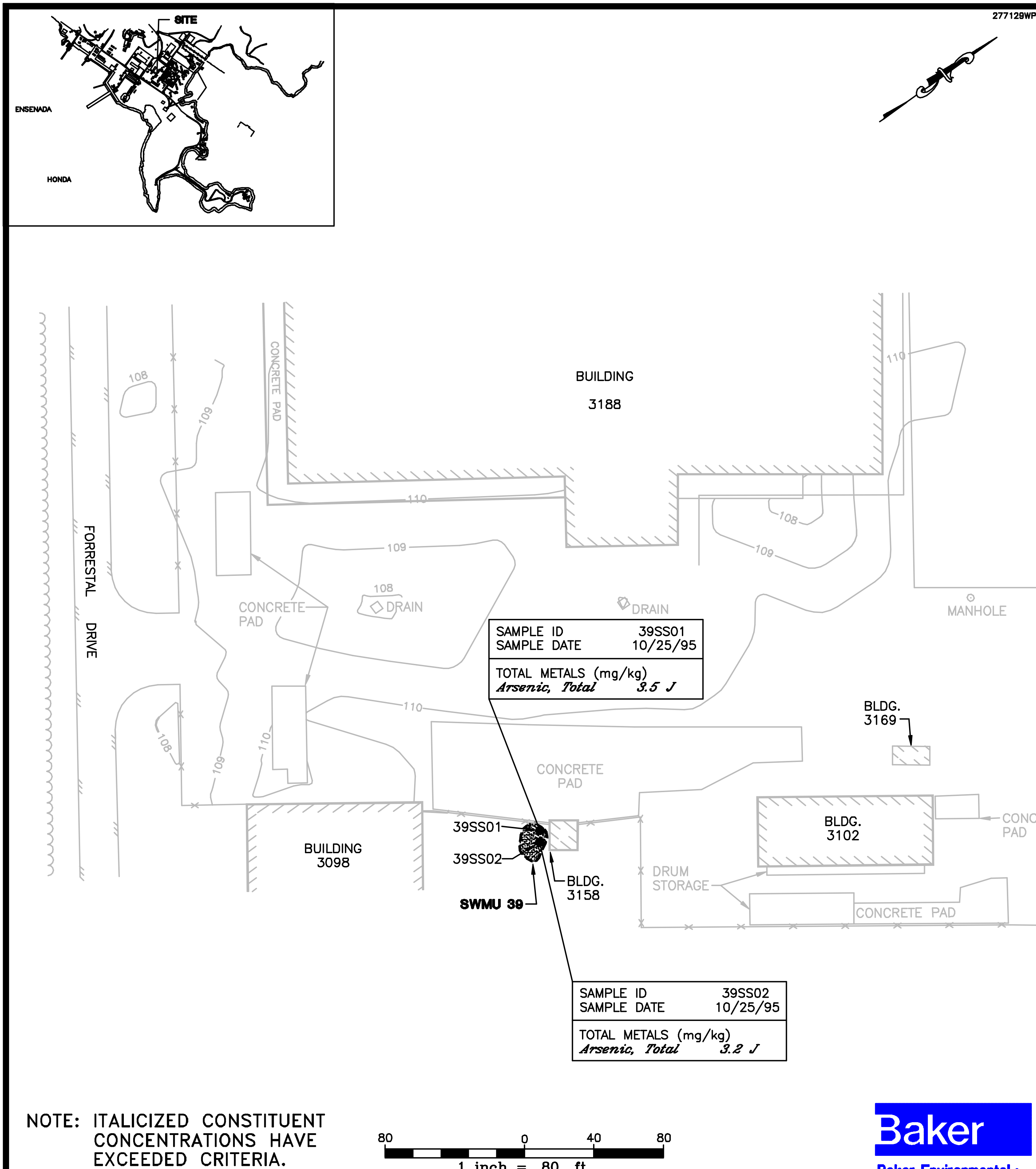
LEGEND

- 115 SURFACE ELEVATION CONTOUR
- ● SOIL SAMPLING LOCATION (3/96)
- ug/kg MICROGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992.

FIGURE 5-15
SURFACE SOIL COPCs
OU#1 - SWMU 37
WASTE OIL STORAGE AREA/BUILDING 200

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

Baker
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LEGEND

111 SURFACE ELEVATION CONTOUR

● SOIL SAMPLING LOCATION (3/96)

mg/kg MILLIGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992.

FIGURE 5-16
SURFACE SOIL COPCs
OU#1 – SWMU 39
FORMER BATTERY DRAIN AREA/
BUILDING 3158
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

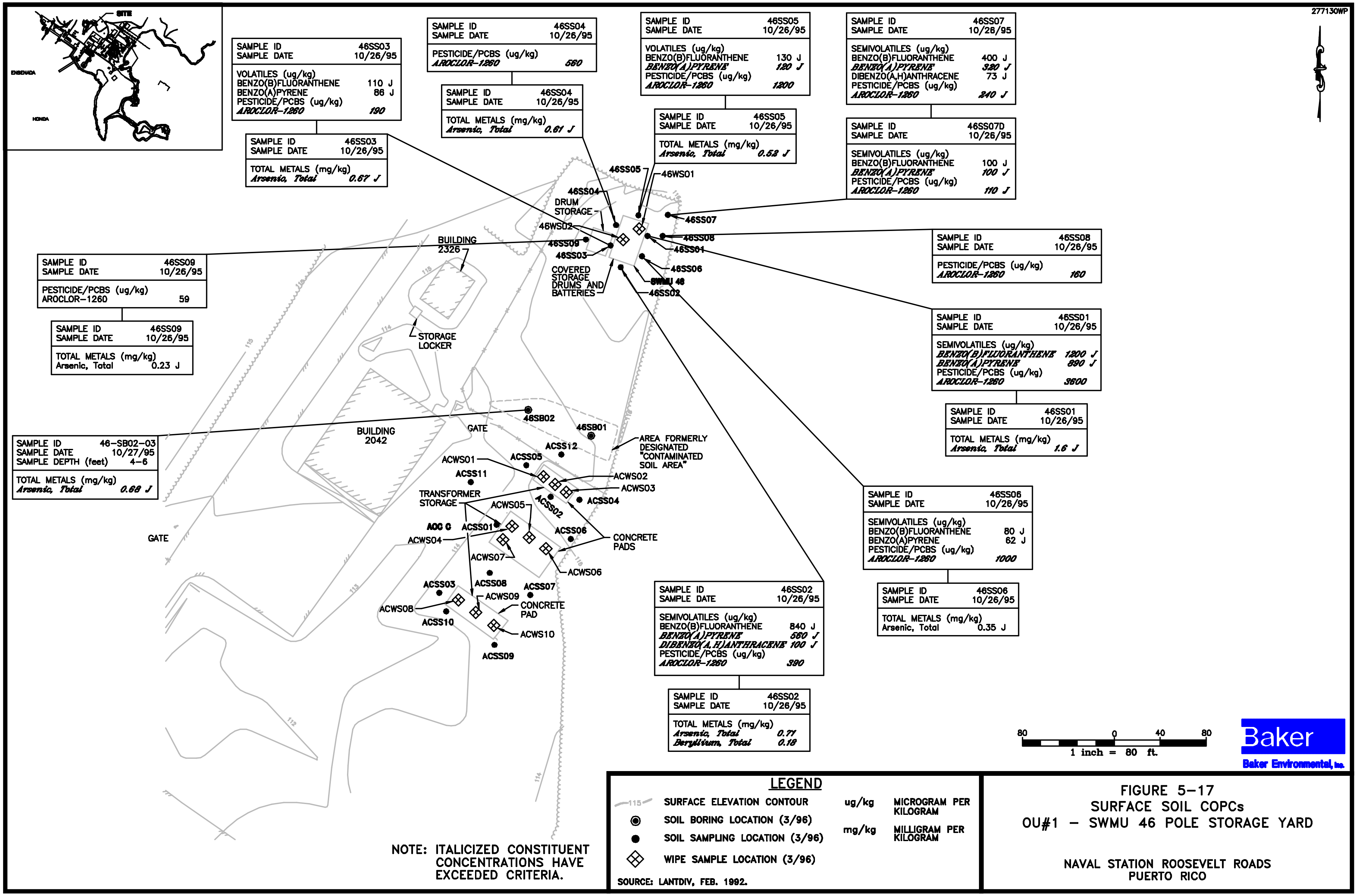
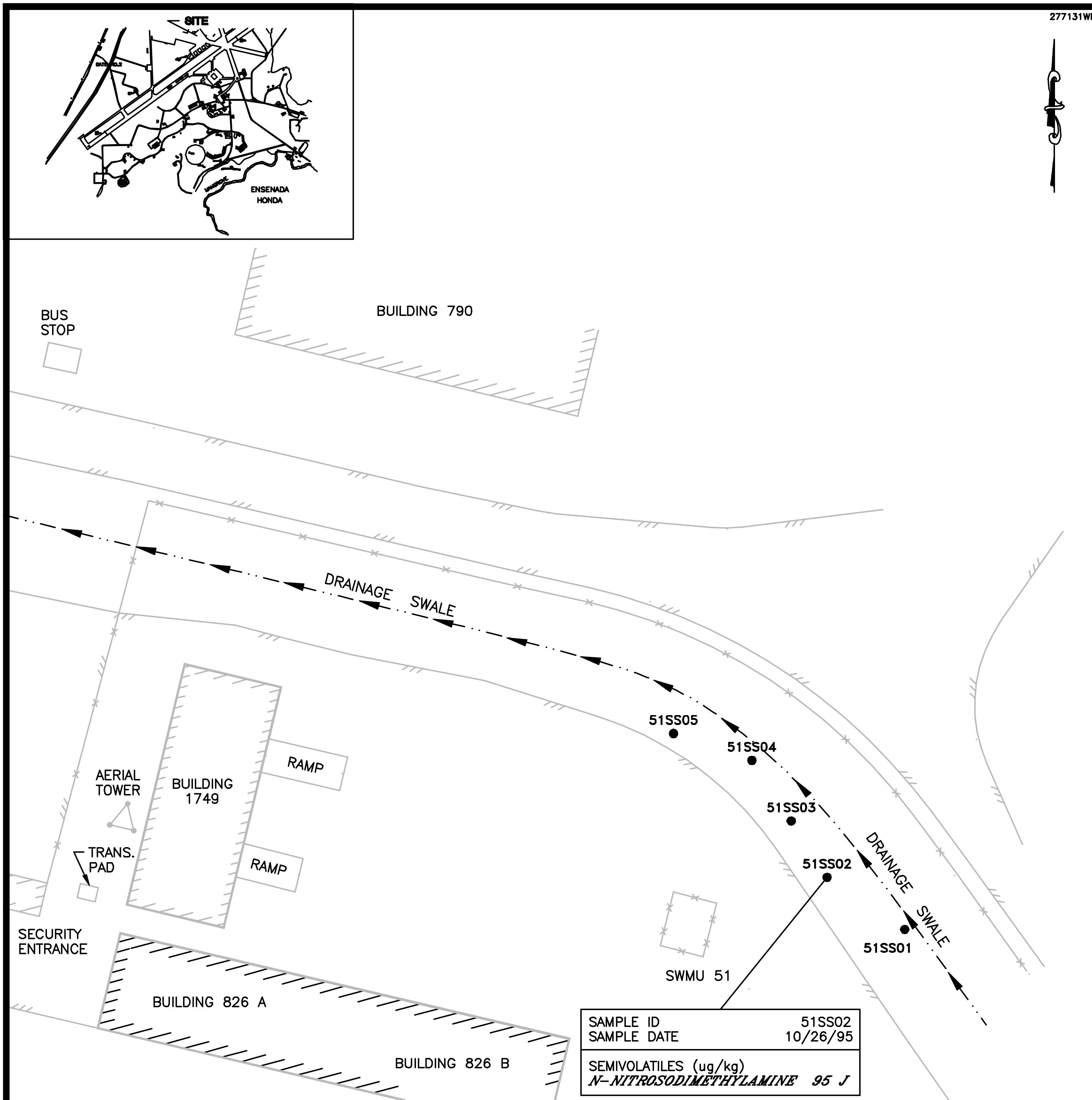


FIGURE 5-17
SURFACE SOIL COPCs
OU#1 – SWMU 46 POLE STORAGE YARD

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

60 0 30 60
1 inch = 60 ft.

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LEGEND

● SOIL SAMPLING LOCATION (3/96)

◄·— DRAINAGE SWALE FLOW DIRECTION

ug/kg MICROGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992.

FIGURE 5-18
SURFACE SOIL COPCs
OU#1 - SWMU 51
NEW AIMD STORAGE PAD/BUILDING 379

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

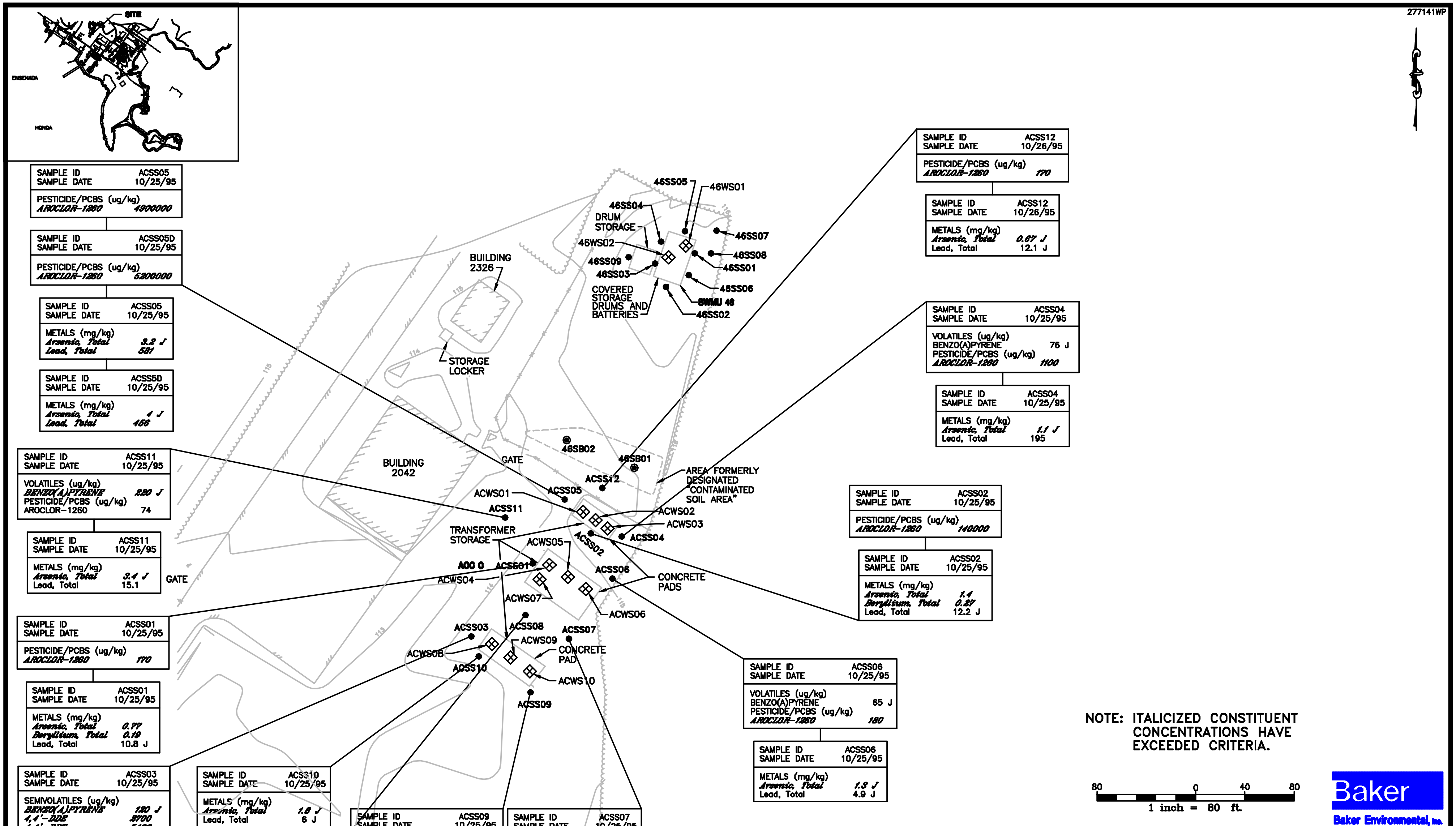
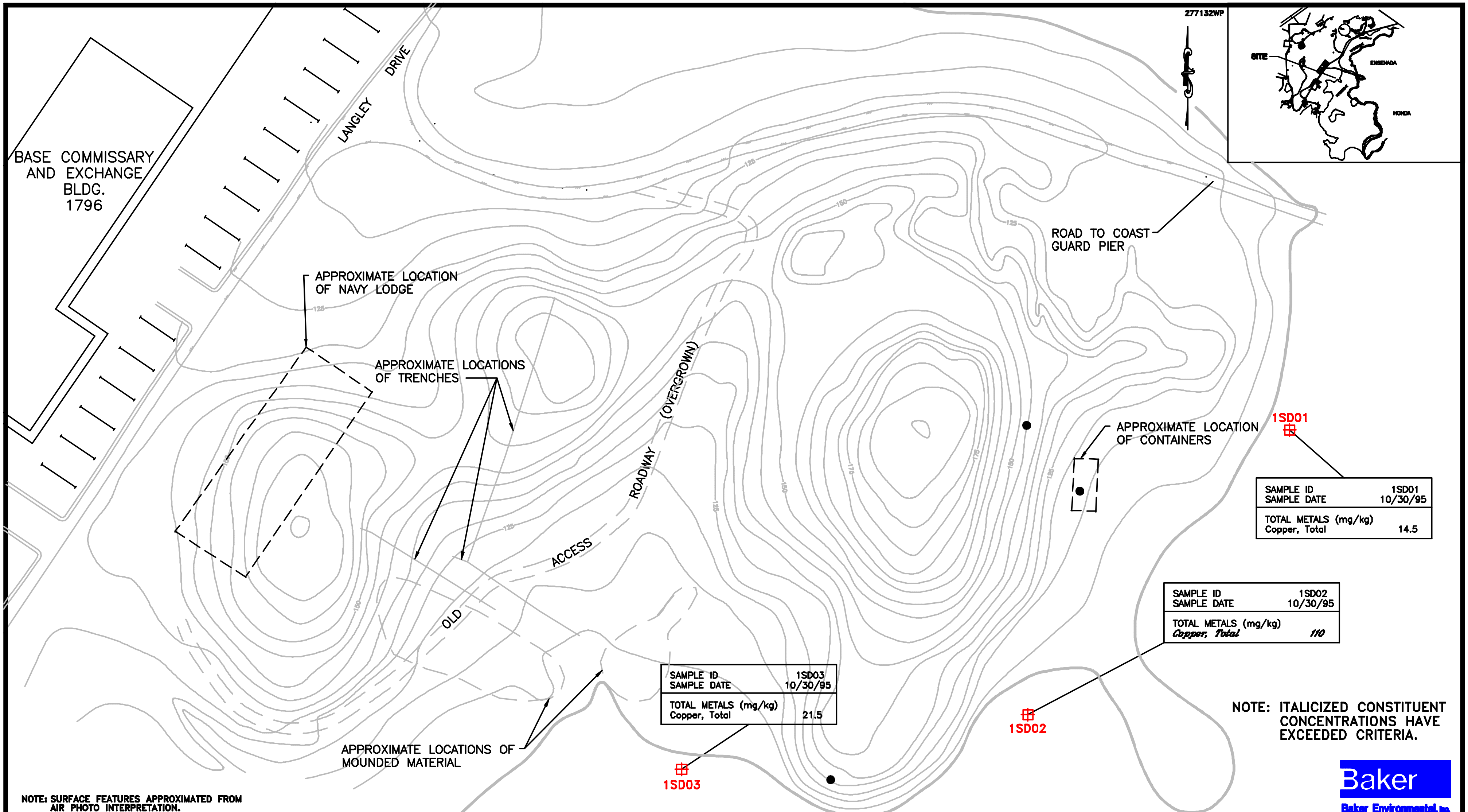


FIGURE 5-19
SURFACE SOIL COPCs
OU#1 – AOC C TRANSFORMER STORAGE PAD
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



LEGEND

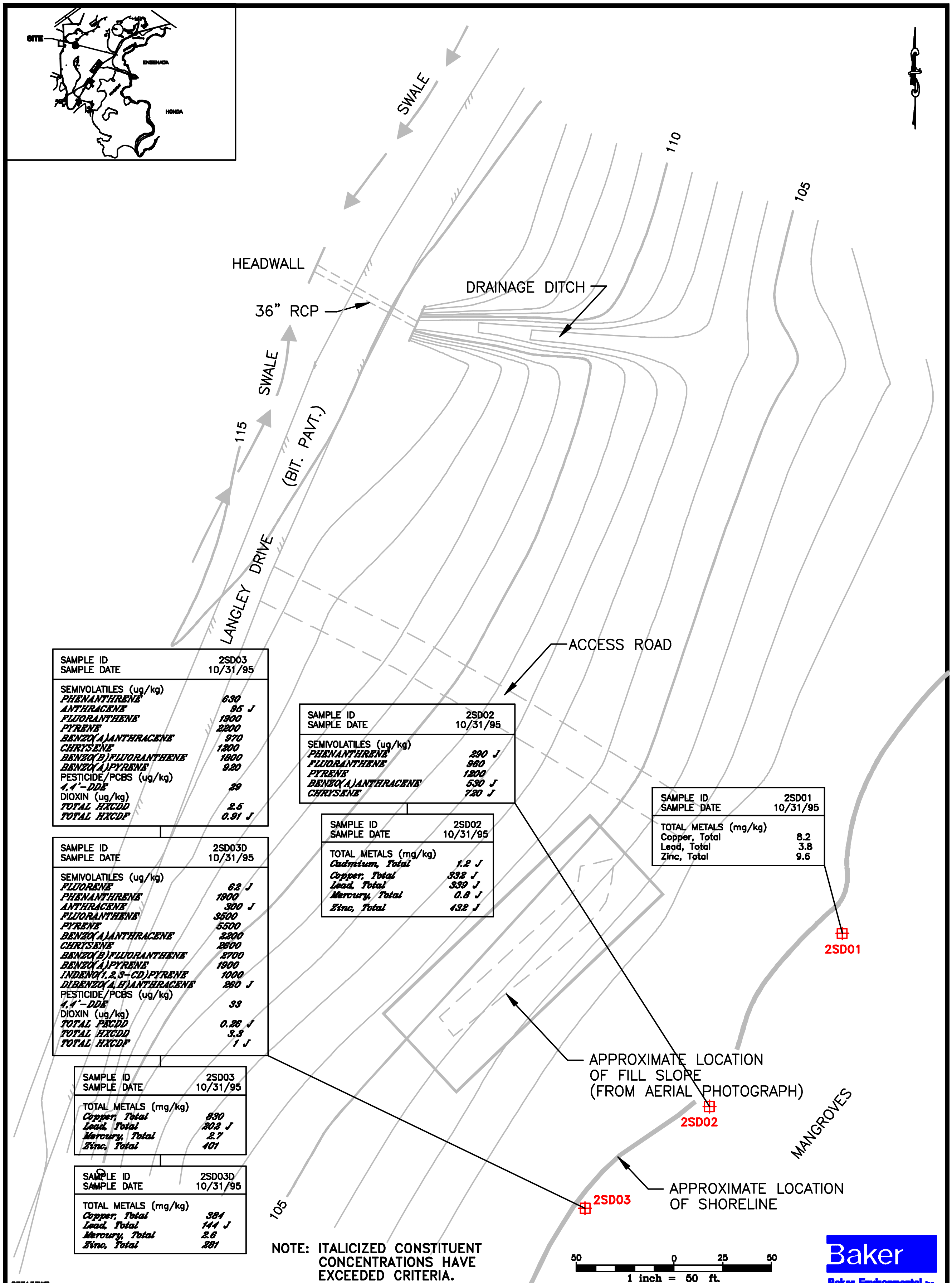
SURFACE ELEVATION CONTOUR
SEDIMENT SAMPLE LOCATION
mg/kg MILLIGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992

160 0 80 160 320
1 inch = 160 ft.

FIGURE 5-20
SEDIMENT COPCs
OU#7 - SWMU 1
ARMY CREMATOR DISPOSAL SITE

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



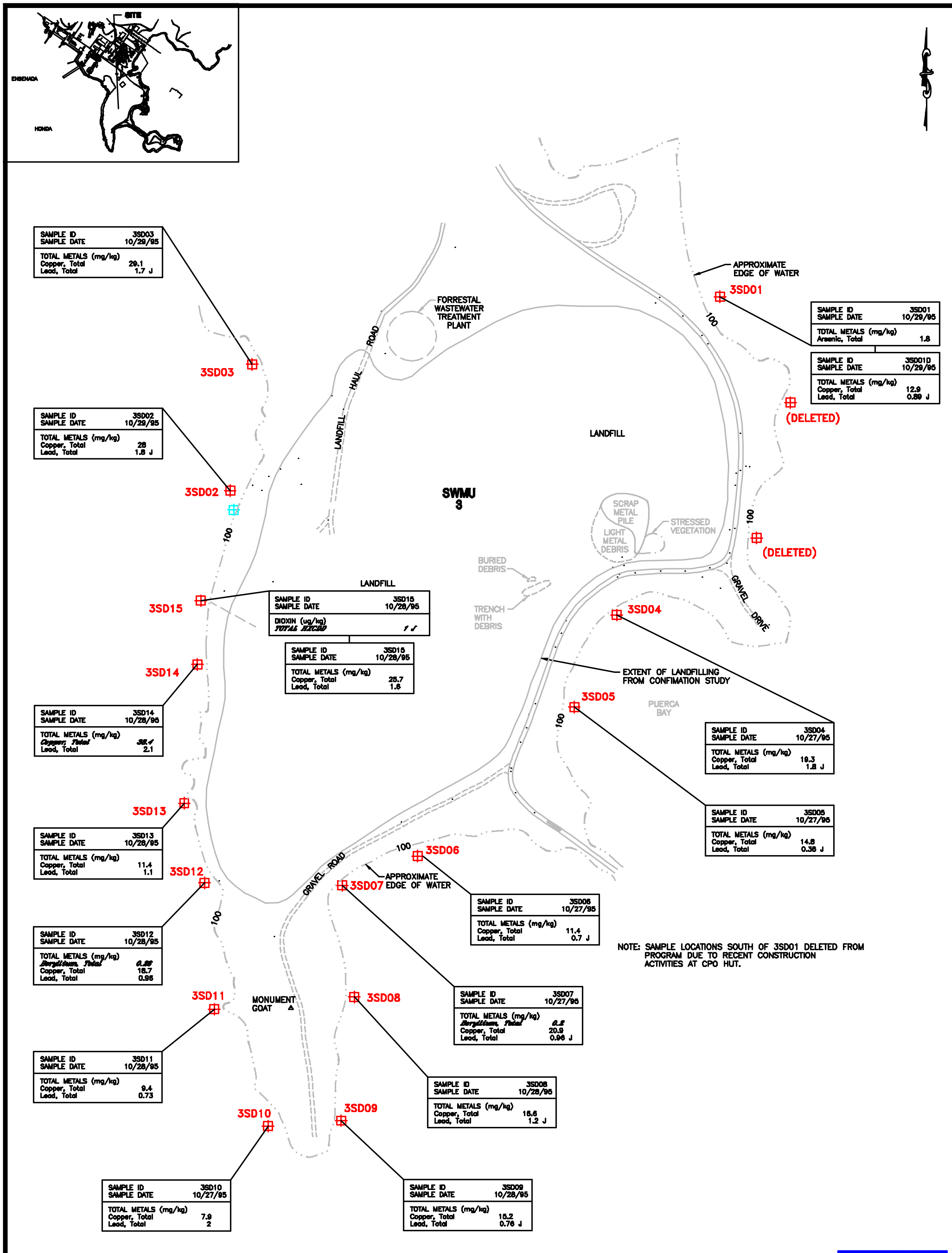
LEGEND

—110—	SURFACE ELEVATION CONTOUR
→	SURFACE WATER DRAINAGE DIRECTION
⊞	SEDIMENT SAMPLE LOCATION
ug/kg	MICROGRAM PER KILOGRAM
mg/kg	MILLIGRAM PER KILOGRAM

SOURCE: LANTDIV, FEB. 1992

FIGURE 5-21
SEDIMENT COPCs
OU#7 – SWMU 2
LANGLEY DRIVE DISPOSAL SITE

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

277134WP

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LEGEND

EXISTING SEDIMENT SAMPLE LOCATION

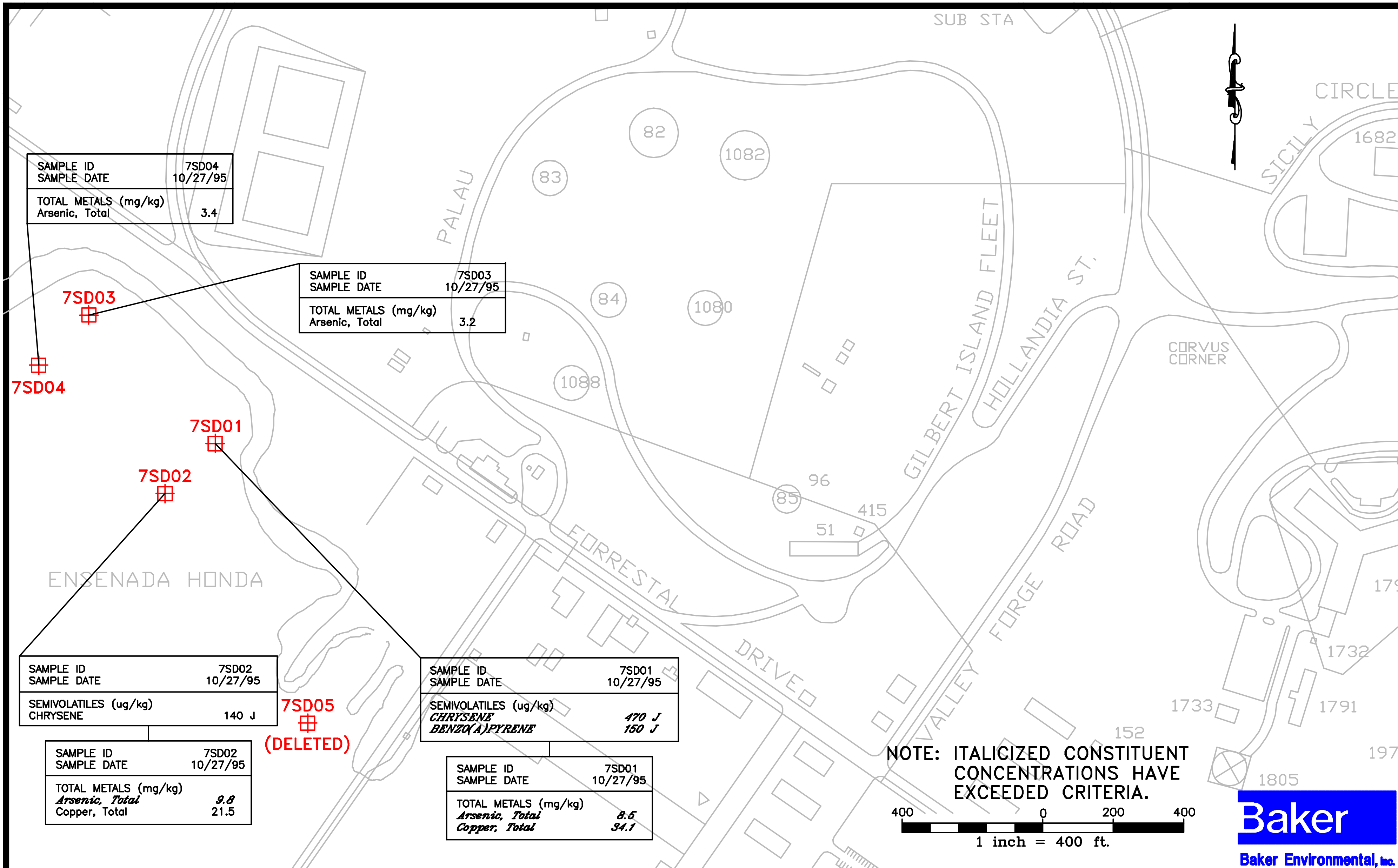
SEDIMENT SAMPLE LOCATION

mg/kg MILLIGRAM PER KILOGRAM

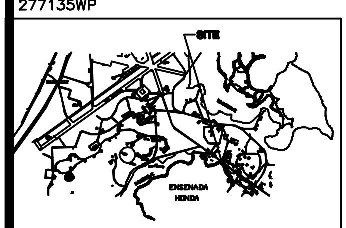
SOURCE: LANTDIV, FEB. 1992

FIGURE 5-22
SEDIMENT COPCs
OU#7 – SWMU 3
BASE LANDFILL

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



277135WP

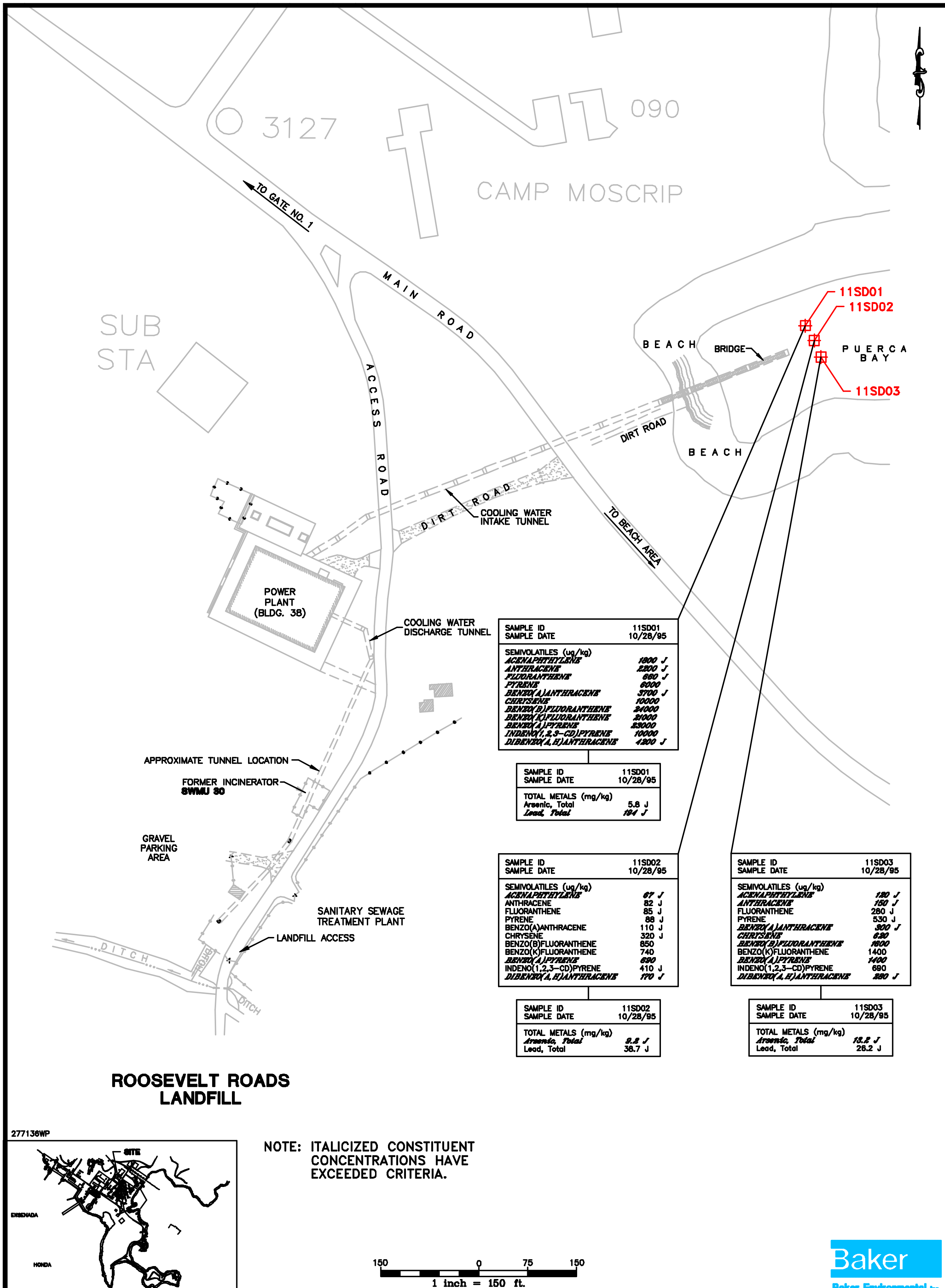


LEGEND

⊞ – SEDIMENT SAMPLE LOCATION
mg/kg – MILLIGRAM PER KILOGRAM
ug/kg – MICROGRAM PER KILOGRAM

FIGURE 5-23
SEDIMENT COPCs
OU#7 – SWMU 7 TOW WAY FUEL FARM

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO



SAMPLE ID	11SD01
SAMPLE DATE	10/28/95
SEMIVOLATILES (ug/kg)	
ACENAPHTHYLENE	*1800 J*
ANTHRACENE	*2200 J*
FLUORANTHENE	*660 J*
PYRENE	*6000*
BENZO(A)ANTHRACENE	*3700 J*
CHRYSENE	*10000*
BENZO(B)FLUORANTHENE	*24000*
BENZO(K)FLUORANTHENE	*21000*
BENZO(A)PYRENE	*23000*
INDENO(1,2,3-CD)PYRENE	*10000*
DIBENZO(A,H)ANTHRACENE	*4200 J*

SAMPLE ID	11SD01
SAMPLE DATE	10/28/95
TOTAL METALS (mg/kg)	
Arsenic, Total	5.8 J
Lead, Total	*194 J*

SAMPLE ID	11SD02
SAMPLE DATE	10/28/95
SEMIVOLATILES (ug/kg)	
ACENAPHTHYLENE	*67 J*
ANTHRACENE	82 J
FLUORANTHENE	85 J
PYRENE	88 J
BENZO(A)ANTHRACENE	110 J
CHRYSENE	320 J
BENZO(B)FLUORANTHENE	850
BENZO(K)FLUORANTHENE	740
BENZO(A)PYRENE	*690*
INDENO(1,2,3-CD)PYRENE	410 J
DIBENZO(A,H)ANTHRACENE	*170 J*

SAMPLE ID	11SD02
SAMPLE DATE	10/28/95
TOTAL METALS (mg/kg)	
Arsenic, Total	*9.2 J*
Lead, Total	38.7 J

SAMPLE ID	11SD03
SAMPLE DATE	10/28/95
SEMIVOLATILES (ug/kg)	
ACENAPHTHYLENE	*120 J*
ANTHRACENE	*150 J*
FLUORANTHENE	280 J
PYRENE	530 J
BENZO(A)ANTHRACENE	*300 J*
CHRYSENE	*620*
BENZO(B)FLUORANTHENE	*1600*
BENZO(K)FLUORANTHENE	1400
BENZO(A)PYRENE	*1400*
INDENO(1,2,3-CD)PYRENE	690
DIBENZO(A,H)ANTHRACENE	*280 J*

SAMPLE ID	11SD03
SAMPLE DATE	10/28/95
TOTAL METALS (mg/kg)	
Arsenic, Total	*13.2 J*
Lead, Total	26.2 J

NOTE: ITALICIZED CONSTITUENT CONCENTRATIONS HAVE EXCEEDED CRITERIA.

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LEGEND

SEDIMENT SAMPLE LOCATION

ug/kg MICROGRAM PER KILOGRAM

mg/kg MILLIGRAM PER KILOGRAM

FIGURE 5-24
SEDIMENT COPCs
OU#7 - SWMU 11/45

NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

6.0 HEALTH AND ENVIRONMENTAL ASSESSMENT

This Section presents the Health and Environmental Assessment (HEA) prepared as part of the Phase I RFI being conducted at eighteen SWMUs (designated Nos. 1, 2, 3, 7, 10, 11, 13, 23, 24, 25, 26, 30, 31, 32, 37, 39, 46, and 51) and three AOCs (designated AOCs B, C and D) identified as Operable Units (OUs) 1, 6 and 7 at NSRR, Puerto Rico. Descriptions and historical background for each SWMU and AOC were and provided in previous sections of this RFI report. This HEA was conducted using the following USEPA Documentation: Interim Final RCRA Facility Investigation Guidance, Volume I of IV: Development of an RFI Work Plan and General Considerations for the RCRA Facility Investigations, May 1989 (USEPA, 1989c); Risk Assessment Guidance for Superfund (RAGS), Volume I. Human Health Evaluation Manual (Part A), Interim Final, December 1989 (USEPA, 1989b); Selecting Exposure Routes and Contaminants of Concern, by Risk-Based Screening (SCCRBS), dated January 1993 (USEPA, 1993) and the USEPA Region III Risk-Based Concentration Table, January - June 1996 (USEPA, 1996a).

6.1 Overview of the HEA

The HEA consists of two components. The first component, Section 6.2, presents the quantitative baseline human health risk assessment (HHRA); the second component, Section 6.3, presents the qualitative ecological risk assessment (ERA). The purpose of the HEA is to evaluate the potential human health and ecological risks posed by the presence of chemicals of potential concern (COPCs) detected in the environmental media investigated at each SWMU and AOC. COPCs were identified by sample concentration comparisons with established human health and environmental standards and criteria in Section 5.0 of this RFI report. A chemical was identified as a COPC in a given medium, for further evaluation in this HEA, if at least one detected concentration of that chemical exceeded an appropriate corresponding standard and/or criterion. Any SWMU/AOC, for which at least one COPC was identified, was retained for evaluation in this HEA to assess the necessity of further investigative action in a more detailed quantitative HHRA or ERA, as well as a Corrective Measures Study (CMS). Further action is recommended for a SWMU/AOC if the results of this HEA demonstrate that potentially unacceptable human or ecological risks may be associated with an environmental medium within the boundary of that SWMU/AOC. The remaining SWMUs/AOCs, for which no COPCs were identified in Section 5.0, do not require evaluation in this

HEA since all detected sample concentrations are within the acceptable limits defined by the comparisons with human health and ecological standards/criteria.

6.2 Baseline Human Health Risk Assessment

The HHRA component of the HEA quantitatively evaluates the potential risks associated with exposures to environmental media that would result from existing conditions, assuming that no remedial action is undertaken, within the boundary of each SWMU and AOC. The HHRA considers the most likely routes of potential human exposure for both current and future risk scenarios. The HHRA was conducted in accordance with USEPA's (1989b) Risk Assessment Guidance for Superfund (RAGS), Volume I. Human Health Evaluation Manual (Part A), Interim Final, December 1989.

The HHRA is comprised of six sections. Section 6.2.1 summarizes the selection of COPCs identified in the investigated media at each SWMU and AOC. Sections 6.2.2 and 6.2.3 present the Exposure Assessment and Toxicity Assessment, respectively. The Risk Characterization of each SWMU and AOC is presented in Section 6.2.4. Section 6.2.5 presents sources of uncertainty inherent in the estimation of inferential potential human health risks. Finally, a brief overall summary of the HHRA is provided in Section 6.2.6.

6.2.1 Summary of Chemicals of Potential Concern

The selection of COPCs was based on information provided in Section 5.0 of this RFI report, which discussed the laboratory analytical results acquired for each SWMU and AOC and compared detected sample concentrations with the appropriate human health and ecological standards/criteria. As stated previously, any exceedence of a standard/criterion by a chemical concentration resulted in the consideration of that chemical as a COPC in the given medium and SWMU/AOC for further evaluation in this HHRA.

The environmental media investigated at each SWMU and AOC includes the following: surface soil in SWMUs 13, 23, 24, 25, 26, 30, 31, 32, 37, 39, 46, and 51 as well as in AOCs B and C; subsurface soil in SWMUs 31, 32 and 46 and AOC B; groundwater in SWMU 30 and AOC B; and sediment in SWMUs 1, 2, 3, 7, 11/45, 13, and 25 and AOC D. It should be noted that AOC D is inclusive of

SWMUS 1, 2, 3, 7, and 11/45, which are located around the Ensenada Honda. These SWMUs were evaluated both individually and collectively as AOC D. One surface water sample was collected from the floor of Building 145 in SWMU 6; however, since the quantity of water was very small and was formed by accumulated rain water, the sample was not considered to represent a source of surface water exposure to individuals in the area. Therefore, data acquired for this sample were not used for evaluation in this HHRA.

Human health screening criteria applied to detected soil and groundwater sample data included risk-based concentrations (RBCs), derived by USEPA Region III (USEPA, 1996a). The RBCs were derived by Region III using conservative default exposure pathways and assumptions, and correspond to a target cancer risk level of 1 x 10^{-6} for carcinogens and a target hazard quotient of 1.0 for noncarcinogens (a more detailed discussion of Region III RBCs is provided in Section 5.0). The soil RBCs protective of direct contact exposures were derived under both industrial and residential scenarios and are similar to those derived and presented in USEPA's Soil Screening Guidance (USEPA, 1994a). However, soil RBCs protective of future groundwater use were not compared to soil concentrations measured at the SWMUs/AOCs since it is highly unlikely that groundwater will ever be utilized for potable use. In addition, none of the environmentally immobile organic COPCs that were identified in surface and subsurface soils (which included SVOCs, dioxins/furans, pesticides, and PCBs) were identified as COPCs in the groundwater samples collected from SWMUs 30 and AOC B. The RBCs applied to groundwater concentrations were derived for residential use of tap water. Currently, no human health screening criteria have been established for evaluating exposures to sediment; therefore, sediment screening values (SSVs) which include Effects Range - Low (ER-Ls) and Effects Range - Median (ER-Ms) values, as well as Region III residential soil RBCs were applied to detected sediment concentrations. It is important to note that the comparison criteria do not necessarily represent clean-up target levels that must be achieved through the implementation of corrective measures, but rather, they establish presumptive levels that indicate whether or not a closer examination of a particular SWMU or AOC is necessary.

The COPCs identified in Section 5.0 for surface soil, subsurface soil and groundwater, and sediment are summarized by SWMU and AOC in Tables 6-1, 6-2 and 6-3, respectively. Although the COPCs were evaluated by SWMU and AOC in this HHRA, the following provides an overall summary of COPCs selected throughout OUs 1, 6 and 7 at NSRR. Surface soil COPCs identified throughout OUs 1, 6 and 7 included SVOCs, specifically, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, bis(2-ethylhexyl)phthalate, and N-nitrosodimethylamine; the pesticides 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, alpha-chlordane, gamma-chlordane, and kepone; the PCBs Aroclor-1254 and Aroclor-1260; and the metals arsenic, beryllium, lead, and zinc. OUs 1, 6 and 7 subsurface soil COPCs included 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, antimony, arsenic, and beryllium. OUs 1, 6 and 7 groundwater COPCs (identified only for SWMU 30) included total and dissolved antimony, total and dissolved arsenic, and total zinc. Sediment COPCs included carcinogenic and noncarcinogenic PAHs, dioxins and furans (total pentachlorinated dibenzo-p-dioxins [PeCDD], total hexachlorinated dibenzo-p-dioxins [HxCDD] and total hexachlorinated dibenzofurans [HxCDF]), 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, arsenic, beryllium, cadmium, copper, lead, mercury, nickel, and zinc. It should be noted that the detected concentrations of dioxins/furans did not exceed corresponding criteria, they were still retained as COPCs in this HHRA due to carcinogenic potency.

As a result of the preliminary comparative screening of SWMUs and AOCs in Section 5.0, no exceedences of standards/criteria were noted for detected Hydropunch and surface soil concentrations in SWMU 10 (Substation 2/Building 90), except for acetophenone and chloroform concentrations detected in Hydropunch samples which exceeded tap water RBCs. Acetophenone is not a SWMU-related constituent, since it is most commonly used in the formulation of perfume fragrances. The detection of this compound is unexplainable, unless it may have been the result of field or laboratory personnel wearing heavy perfumes. Chloroform, which was also detected at concentrations in the SWMU 10 Hydropunch samples exceeding the tap water RBC, was detected in a field blank at a concentration of 150 µg/L. The maximum chloroform concentration detected at SWMU 10 was 14 µg/L. Therefore, since acetophenone is not a SWMU-related constituent, and since chloroform was detected in a field blank at a concentration greater than ten times the maximum sample concentration, these compounds were not retained as COPCs for SWMU 10. In addition, no exceedences of standards/criteria were noted for surface soil concentrations detected in SWMU 24 (Oil Spill Oil/Water Separator). Therefore, SWMUs 10 and 24 have not been retained for further quantitative evaluation in this HHRA. However, all remaining SWMUs/AOCs have been retained for further evaluation in this HHRA due to exceedences of the applied standards/criteria.

6.2.2 Exposure Assessment

The exposure assessment addresses each potential current and future exposure pathway in surface soil, subsurface soil, groundwater, and sediment. To assess whether human exposure could occur at the various SWMUs and AOCs in the absence of remedial action, an exposure assessment which identifies potential exposure pathways and receptors was conducted. The following four elements were considered to ascertain whether a complete exposure pathway was present (USEPA, 1989b):

- A source and potential mechanism of chemical release
- An environmental retention or transport medium
- A point of potential human contact with the contaminated medium
- An exposure route (e.g., ingestion) at the contact point

The exposure scenarios discussed represent USEPA's Reasonable Maximum Exposure (RME). Relevant equations for assessing intakes and exposure factors were obtained from RAGS (USEPA, 1989b), Exposure Factors Handbook (USEPA, 1989a), Dermal Exposure Assessment: Principles and Applications, Interim Report (USEPA, 1992a), and Standard Default Exposure Factors, Interim Final (USEPA, 1991a).

6.2.2.1 Potential Human Receptors and Exposure Pathways

NSRR currently operates, and will continue to operate, as a key Naval Station providing full support for Atlantic Fleet weapons training and development activities. Current potential human receptors being evaluated in this HHRA for possible exposures to COPCs detected in environmental media are limited to on-site adult workers, and adult and adolescent (ages 7 through 15 years old) recreational users of the marina in the Ensenada Honda. The on-site workers are assumed to be civilian and/or military personnel who may perform various maintenance and manual labor activities at NSRR. These activities may result in direct contact exposures to surface soil (0 to 6 inches) and possibly to sediment at the various SWMUs and AOCs. Potential exposures to COPCs in the surface soil may occur via the pathways of accidental ingestion, dermal contact and the inhalation of fugitive dusts emanating from areas of low vegetative cover and no pavement. Potential exposures to COPCs identified in sediments may occur via the pathways of accidental ingestion and dermal contact.

The individuals being considered as recreational users are primarily limited to those who recreate in the non-restricted marina area of the Ensenada Honda. This group encompasses both military and non-military adults and younger family members (adolescents evaluated) who may boat, swim or fish in the non-restricted area. Since no surface water samples were collected, these receptor groups are being evaluated for only sediment exposures. Although the primary area of concern for these individuals is the non-restricted area of the marina, between SWMUs 2 and 7, it will be assumed for the sake of conservatism that some of these recreational users may trespass into restricted areas. Therefore, recreational users will be evaluated for potential sediment exposures in all SWMUs and AOCs where sediment has been observed and investigated. These include SWMUs 1, 2, 3, 7, 11/45, 13, 25, and AOC D. Although SWMUs 13 and 25 are not considered to be recreational areas, they were evaluated as such for the sake of health conservatism. AOC D, which is comprised of the Ensenada Honda sediments, includes the sediments of SWMUs 1, 2, 3, 7, and 11/45. These SWMUs abut the Honda and may have affected the sediments of this AOC from possible releases. Therefore, recreational users are being evaluated for potential exposures to sediment COPCs at each SWMU individually, as well as collectively as AOC D. In addition to AOC D, sediment exposures are being evaluated at SWMUs 13 (Old Pest Control Shop/Building 258) and 25 (DRMO Storage Yard). Potential exposures to sediments in these areas may occur via the pathways of accidental ingestion and dermal contact.

Currently, there are no facilities for personnel housing located at any of the sites included in this study. The area will not be developed for personnel housing in the future because of the Station's mission and the need to keep the “industrial” area in close proximity to the Ensenada Honda for continued support of the fleet. Although future residential development of any SWMU and AOC is highly unlikely, future residential exposures to adult and young child (ages 1 through 6 years old) receptors were evaluated as the most conservative (worst-case) scenario. Future residents are being evaluated for accidental ingestion, dermal and inhalation (fugitive dusts) exposures to surface soil; accidental ingestion and dermal exposures to sediments; and ingestion and dermal exposures to groundwater used as drinking water. Although sediment exposures were evaluated for recreational users, future residents were evaluated for exposures to sediments during recreation activities in the Ensenada Honda and other areas where sediment was identified, i.e., the drainage ditches in SWMUs 13 and 25. SWMUs 13 and 25 are not considered to be recreational areas; however, they were evaluated as such for the sake of health conservatism. Currently, groundwater at NSRR is not being utilized as potable water due to poor quality and low yields, it will be conservatively assumed that child and adult residents will be exposed to dissolved inorganic COPCs identified in the groundwater at SWMU 30 (Former Incinerator), the only SWMU investigated for possible groundwater contamination. Total inorganic results were not evaluated since dissolved inorganic results are considered to be more representative of drinking water conditions at the tap. No organic COPCs were identified in groundwater samples collected from this SWMU.

In addition to the future residents, future construction workers that may perform excavation and related construction activities, were evaluated as potential receptors. Generally, it was assumed that the majority of COPC exposures to this receptor would be due to direct contact with excavated subsurface soil. It was also assumed that direct contact exposures to surface soil COPCs would occur; however, the amount of surface soil exposures was assumed to be insignificant, relative to the subsurface soil exposures. Therefore, future construction workers were only evaluated for subsurface soil exposures, via the pathways of accidental ingestion, dermal contact and the inhalation of fugitive dusts emanating from excavated subsurface soils at a construction site. The subsurface soil exposures were evaluated for construction workers at SWMUs 31 (Waste Oil Collection Area/Building 31 and 2022), 32 (PWD Storage Yard/Battery Collection Area/Building 31), 46 (Pole Storage Yard Covered Pad), and AOC B.

In summary, based on information available regarding the physical features, site setting, site historical activities, and current and expected land uses, the following potential human receptor groups and exposure pathways were evaluated in this HHRA:

! Current on-site adult workers:

    < Accidental ingestion of surface soil
    < Dermal contact with surface soil
    < Accidental ingestion of sediment
    < Dermal contact with sediment

! Current adult and adolescent (7-15 years old) recreational users:

    < Accidental ingestion of sediment
    < Dermal contact with sediment

! Future on-site adult and child (1-6 years old) residents:

    < Accidental ingestion of surface soil
    < Dermal contact with surface soil
    < Inhalation of fugitive dusts emanating from surface soil
    < Ingestion of groundwater used as drinking water
    < Dermal contact with groundwater while bathing
    < Accidental ingestion of sediment

< Dermal contact with sediment

! Future on-site adult construction workers:

< Accidental ingestion of subsurface soil

< Dermal contact with subsurface soil

< Inhalation of fugitive dust emanating from excavated subsurface soil

6.2.2.2 Conceptual Site Model

Development of a conceptual site model of potential exposure is critical in evaluating all potential exposures for the aforementioned human receptors. The conceptual site model describes the area of concern in terms of potential sources of contamination, release mechanisms, affected media, and all potential routes of migration of the contaminants present.

The primary sources of contamination are the possible spills and releases into the environment that occurred at the various SWMUs and AOCs in OUs 1, 6 and 7 that are being evaluated in this HHRA. The primary current and future release mechanisms being considered in this HHRA include: surface runoff from SWMUs to surface soil in other areas, as well as to Ensenada Honda surface water and sediments, leaching of contaminants from surface to subsurface soils and groundwater; contaminant migration through groundwater and possible discharge into the Honda; and fugitive dust generation from surface soil and future excavated subsurface soil (However, it should be noted that current surface generation of fugitive dusts may be hindered to a great extent by existing vegetation.).

6.2.2.3 Concentrations Used in the Estimate of Exposure

The chemical concentrations used in the estimation of chronic daily intakes (CDIs) and dermally absorbed doses (DADs) for each medium are considered to be representative of the types of potential exposure encountered by each receptor. Exposure can occur discretely or at a number of locations depending on the type of scenario considered for a given receptor. Furthermore, certain environmental media such as groundwater are migratory and detected chemical concentrations may change frequently over time. Soil and sediment are, by nature, less transitory. The manner in which environmental data are represented also depends on the number of samples and sampling locations available for a given area and a given medium. Therefore, determining appropriate exposure concentrations to be used in estimating CDIs and DADs can be a major source of uncertainty.

In order to account for the uncertainty and to be health protective, USEPA risk assessment guidance (USEPA, 1989b) requires that an upper bound estimate of the arithmetic mean concentration, the 95 percent upper confidence limit of the arithmetic mean (95%UCL), be used to calculate CDIs and DADs. This estimate, which should be in the high end of the concentration frequency distribution, is called the reasonable maximum exposure (RME) concentration. The RME concentration is defined as the highest concentration that could reasonably be expected to be contacted via a given pathway over a long-term exposure period. However, a general rule of thumb in estimating the 95%UCL concentration is that the data set for which the 95%UCL is being calculated should consist of at least ten samples. Often, small data sets of concentrations exhibiting large standard deviations about the mean may result in the exceedence of the maximum detected concentration by the 95%UCL. In these situations, the maximum is then used as the exposure concentration. Therefore, to be health-conservative, and since the data sets acquired for most of the SWMUs during the Phase I RFI are relatively small, the maximum detected concentration is being used as the representative exposure concentration for all COPC data sets being evaluated in this HHRA.

6.2.2.4 Calculation of Chronic Daily Intakes

In order to numerically estimate the risks for current and future human receptors at the various SWMUs/AOCs in OUs 1, 6 and 7, a CDI or DAD must be estimated for each COPC in every retained exposure pathway. Both the CDI and DAD are chemical intakes, expressed in terms of dose; however, the different terms refer to different pathways of exposure. The CDI term is used to describe chemical intake via the oral and inhalation pathways; the DAD term is used to describe chemical intake via dermal absorption. The CDI/DAD for each COPC is calculated by combining the concentration term with assumed or known conservative exposure factors that describe the rates, frequency and duration of exposure. Since the CDI/DAD is a dose term, body weight of the receptor is also incorporated into the calculation, and the long-term exposure is divided by the total number of days in the averaging period. Thus, the unit obtained for the CDI/DAD resulting from chemical exposure is mg/kg/day. Appendix F contains the specific CDI/DAD calculations for each exposure scenario of interest. These equations were adopted from USEPA's Risk Assessment Guidance for Superfund, Volume I (USEPA, 1989b).

CDIs/DADs for potential carcinogens, which tend exhibit non-threshold effects (e.g., tumor development) following long-term exposure, were calculated so that the duration of exposure is averaged over the course of a lifetime (70 years, or 25,550 days).

Exposures to noncarcinogens, on the other hand, tend to result in observable threshold effects. Therefore, CDIs/DADs for noncarcinogens were estimated using the concept of an average annual exposure. The intake incorporates terms describing the exposure time and/or frequency that represent the number of hours per day and the number of days per year that exposure occurs. In general, noncarcinogenic risks for many exposure routes (e.g., soil ingestion) are greater for children than adults because of the differences in body weights, similar exposure frequencies, and higher ingestion rates.

The subsections which follow present the equations and input parameters used in the calculation of CDIs/DADs for each potential exposure pathway being evaluated for the various SWMUs/AOCs. Input parameters were taken from USEPA's default exposure factors guidelines where available and applicable. All inputs not defined by USEPA were derived from USEPA documents concerning exposure or were the result of best professional judgment.

6.2.2.4.1 Surface/Subsurface Soil and Sediment

Accidental Ingestion of Soil/Sediment

The daily intake associated with the potential accidental ingestion of COPCs detected in soil or sediment was calculated using the following equation (USEPA, 1989b):

$$CDI = \frac{Cs \ x \ IR \ x \ FI \ x \ CF \ x \ EF \ x \ ED}{BW \ x \ AT}$$

Where:

CDI	=	Chronic Daily Intake, milligram per kilogram day (mg/kg-day)
Cs	=	Chemical concentration in soil or sediment, mg/kg
IR	=	Ingestion rate, mg/day
FI	=	Fraction Ingested, unitless
CF	=	Conversion factor, 10^{-6} kg/mg

EF	=	Frequency of exposure, days/year
ED	=	Exposure duration, years
BW	=	Average body weight, kg
AT	=	Averaging time, days

Dermal Contact with Soil/Sediment

The absorbed dose associated with the potential dermal contact of COPCs in soil and sediment was calculated using the following equation (USEPA, 1989b):

$$DAD = \frac{Cs \ x \ AF \ x \ ABS \ x \ CF \ x \ SA \ x \ EF \ x \ ED}{BW \ x \ AT}$$

Where:

DAD	=	Dermally absorbed dose, mg/kg-day
Cs	=	Chemical concentration in the soil or sediment, mg/kg
AF	=	Adherence factor, milligram per square centimeter day (mg/cm^2-day)
ABS	=	Absorbed fraction, unitless
CF	=	Conversion factor, 10^{+6} mg/kg
SA	=	Surface area of exposed skin, cm^2
EF	=	Exposure frequency, days/year
ED	=	Exposure duration, years
BW	=	Average body weight, kg
AT	=	Averaging time, days

Inhalation of Fugitive Dust

The daily intake resulting from the inhalation of COPCs adsorbed onto fugitive dust particulates was estimated using the following equation (USEPA, 1989b):

$$CDI = \frac{Ca \ x \ RR \ x \ ET \ x \ EF \ x \ ED}{BW \ x \ AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Ca	=	Chemical concentration in air as fugitive dust,(mg/m^3)
RR	=	Respiration rate, m^3/day
ET	=	Exposure time, hours/day
EF	=	Frequency of exposure, days/year
ED	=	Exposure duration, years
BW	=	Average body weight, kg
AT	=	Averaging time, days

The air concentration *(Ca*) of a chemical in fugitive dust emissions was estimated from the following equation, as determined by Cowherd (1985), and provided by the USEPA (1991b).

$$Ca = Cs \ x \ 1/PEF$$

Where:

Cs	=	Concentration of chemical in the soil, mg/kg
PEF	=	Particulate emission factor, 6.79 x 10^{+8} m^3/kg

6.2.2.4.2 Groundwater

Ingestion of Potable Groundwater

The daily intake associated with the direct potential ingestion of the COPCs in groundwater under a potable use scenario was calculated using the following equation (USEPA, 1989b):

$$CDI = \frac{Cw \ x \ IR \ x \ EF \ x \ ED}{BW \ x \ AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Cw	=	Chemical concentration in water, milligrams per liter (mg/L)
IR	=	Ingestion rate, L/day
EF	=	Frequency of exposure, days/year
ED	=	Exposure duration, years
BW	=	Average body weight, kg
AT	=	Averaging time, days

Dermal Contact with Groundwater

The absorbed dose associated with potential dermal contact with COPCs in groundwater (while bathing) or incidental contact with surface water was calculated using the following equation (USEPA, 1989b):

$$DAD = \frac{Cw \ x \ SA \ x \ PC \ x \ ET \ x \ EF \ x \ ED \ x \ CF}{BW \ x \ AT}$$

Where:

DAD	=	Dermally absorbed dose, mg/kg-day
Cw	=	Concentration in water, mg/L
SA	=	Surface area of exposed skin, cm^2
PC	=	Permeability constant, cm/hr

ET	=	Exposure time, hours/day
EF	=	Exposure frequency, days/year
ED	=	Exposure duration, years
CF	=	Conversion factor, 0.001 L/cm^3
BW	=	Average body weight, kg
AT	=	Averaging time, days

6.2.2.5 Exposure Factors Used To Derive Chronic Daily Intakes

Tables 6-4, 6-5, 6-6, and 6-7 present the exposure factors used in the estimation of potential CDIs/DADs for COPCs retained for current on-site workers, current recreational users, future residents, and future construction workers, respectively. USEPA promulgated exposure factors are used in conjunction with USEPA standard default exposure factors for the RME scenarios. Furthermore, when USEPA exposure factors are not available, best professional judgment and site-specific information are used to derive a conservative and defensible value.

6.2.3 Toxicity Assessment

Section 6.2.2 presented potential exposure pathways and receptors for this HHRA. This section will review the available toxicological information for COPCs retained for quantitative evaluation.

An important component of the RA is the relationship between the dose of a compound (amount to which an individual or population is potentially exposed) and the potential for adverse health effects resulting from exposure to that dose. Dose-response relationships provide a means by which potential public health impacts may be evaluated. Standard reference doses (RfDs) and/or carcinogenic slope factors (CSFs) have been developed for many of the COPCs. This section provides a brief description of these parameters.

6.2.3.1 Reference Doses

The RfDs and Reference Concentrations (RfCs for inhalation) are developed for chronic and/or subchronic human exposure to chemicals and are based solely on the noncarcinogenic effects of chemical substances. These values are defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of adverse effects during a lifetime. The RfD is expressed as dose (mg) per unit body weight (kg) per unit time (day). The RfC is expressed as dose (mg) per cubic meter of air (m^3).

6.2.3.2 Carcinogenic Slope Factors

CSFs are used to estimate an upper!bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen (USEPA, 1989b). This factor is reported in units of $(mg/kg/day)^{-1}$, or kg-day/mg, and is derived through an assumed low-dosage, linear, multistage model and an extrapolation from high to low dose-responses determined from animal studies. The value used in reporting the slope factor is the 95% UCL.

CSFs can also be derived from USEPA promulgated unit risk values for air and/or water. CSFs derived from unit risks cannot, however, be applied to environmental media other than the medium considered in the unit risk estimate.

Slope factors are also accompanied by weight-of-evidence classifications which designate the strength of the evidence that the COPC is a potential human carcinogen.

6.2.3.3 Sources of Toxicity Criteria

Quantitative indices of toxicity and USEPA weight-of-evidence classifications are presented in Table 6-8 for the identified COPCs. The hierarchy (USEPA, 1989b) for choosing these values was:

! Integrated Risk Information System (IRIS) (USEPA, 1996b)
! Health Effects Assessment Summary Table (HEAST) (USEPA, 1995b)
! National Center for Environmental Assessment (NCEA)

The IRIS data base is updated monthly and contains both verified RfDs, RfCs and CSFs. The USEPA has formed an RfD work group to review existing data used to derive RfDs and RfCs. Once this task has been completed the verified RfD appears in IRIS. Like the RfD Work Group, the USEPA has also formed the Carcinogen Risk Assessment Verification Endeavor (CRAVE) Work group to review and validate toxicity values used in developing CSFs. Once the slope factors have been verified via extensive peer review, they also appear in the IRIS data base.

HEAST, on the other hand, provides both interim (unverified) and verified RfDs, RfCs and CSFs. This document is published quarterly and incorporates any applicable changes to its data base.

Detailed toxicity information regarding the COPCs is provided in the toxicological profiles presented in Appendix E of this report.

6.2.3.4 Dermal Absorption Efficiency

Many of the RfDs and CSFs are derived from oral toxicological studies based on administered dose, and do not account for the amount of a substance that can penetrate exchange boundaries after contact (e.g., absorbed dose). As a result, there is very little information available regarding dermal toxicity criteria. Therefore, in order to account for a difference in toxicity between an administered dose and an absorbed dose, the RfDs and CSFs (that were based on an administered dose) were adjusted, as described by the USEPA (USEPA, 1989b), using experimentally-derived oral absorption efficiencies. The adjustment for the oral RfD that would correspond to a dermally absorbed dose is represented by multiplying the RfD by an oral absorption efficiency. The adjustment for the oral CSF that would correspond to the dermally absorbed dose is represented by dividing the CSF by an oral absorption efficiency. The oral absorption efficiencies were obtained from sources such as the NCEA, IRIS, ATSDR toxicological profiles, toxicology publications, toxicology references, and USEPA Regional Offices. In some instances, published information was not available to determine the absorption efficiency. On these occasions, the following USEPA Region IV default values were used:

- 50% - SVOCs, pesticides and PCBs
- 20% - Inorganics

The absorption efficiencies used in this HHRA for evaluating dermal exposures to COPCs in environmental media at the various SWMUs/AOCs in OUs 1, 6 and 7 are presented in Table 6-8.

6.2.3.5 Evaluation of Dioxins/Furans

Dioxins are a class of compounds that contain the dibenzo-p-dioxin nucleus; furans are a class of compounds that contain the dibenzofuran nucleus. The chlorinated dioxins and furans, which are of toxicological concern, are those compounds where the nuclei are substituted with chloride ions at different positions in the benzene and furan rings, respectively. As many as eight positions are available for chlorine substitution on each of the dibenzo-p-dioxin and dibenzofuran nuclei. The chlorinated compounds are called polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Approximately 75 congeners of the PCDDs and 135 congeners of the PCDFs are known to exist. Of these, seven of the PCDDs and ten of the PCDFs are considered to be carcinogens of the greatest toxicological concern, with the lesser chlorinated compounds being the most carcinogenically potent. The compound 2,3,7,8-tetrachlorinated dibenzo-p-dioxin (2378-TCDD) is the most studied and is considered the most carcinogenically potent of all the PCDDs and PCDFs.

Exposure to 2378-TCDD, which is classified as a class B2 carcinogen by the U.S. EPA, results in adverse effects to the liver and adipose tissue, with the liver being the most sensitive target organ. 2378-TCDD also impacts the immune system, causes reproductive effects, and is teratogenic (Lappenbusch, 1988). Currently, the oral and inhalation cancer slope factor (CSF) established by the U.S. EPA for 2378 TCDD is 1.56×10^5 $(mg/kg/day)^{-1}$. This slope factor was derived based upon the development of respiratory system and liver tumors in laboratory rats.

Since CSFs have not been derived by the U.S. EPA for the remaining six PCDDs and ten PCDFs that are also of toxicological significance, a procedure has been developed which incorporates the cancer potencies of these compounds relative to that of 2378-TCDD to obtain 2378-TCDD toxic equivalent concentrations (TEC). This is done by multiplying the measured concentration of each congener by its established relative potency factor, or toxic equivalency factor (TEF).

Although analyses of individual congeners were not performed for samples collected from the sites included in this study, concentrations of total PCDDs/PCDFs were detected in sediment samples collected from SWMUs 2 and 3. The total PCDDs/PCDFs (and respective TEFs) detected at these SWMUs included total pentachlorinated dibenzo-p-dioxins (total PeCDD; TEF = 0.5), total hexachlorinated dibenzo-p-dioxins (total HxCDD; TEF = 0.10) and total hexachlorinated dibenzofurans (total HxCDF; TEF = 0.10).

6.2.4 Risk Characterization

The risk characterization combines the selected COPCs, the exposure assessment, and the toxicity assessment to produce a quantitative estimate of current potential human health risks associated with the various SWMUs/AOCs in OUs 1, 6 and 7. Human health risks were estimated for both carcinogenic and noncarcinogenic COPCs.

6.2.4.1 Carcinogenic Compounds

Quantitative risk calculations for potentially carcinogenic compounds estimate inferentially (versus probabilistically) the potential excess incremental lifetime cancer risk (ILCR) for an individual in a specified population. This unit of risk refers to a potential cancer risk that is above the background cancer risk in unexposed individuals. For example, an ILCR of 1×10^{-6} indicates that an exposed individual has an increased probability of one in one million of developing cancer subsequent to exposure, over the course of their lifetime.

The potential lifetime ILCR for an individual was estimated from the following relationship:

$$ILCR = \sum_{i=1}^{n} (CDI_i \text{ or } DAD_i) \times CSF_i$$

where the CSF_i is expressed as $(mg/kg/day)^{-1}$ for compound i, and the CDI_i and dermally absorbed dose (DAD_i) is expressed as mg/kg/day for compound i. Since the units of CSF are (mg chemical/kg body weight-day)$^{-1}$ and the units of intake or dose are [mg chemical/kg body weight-day], the ILCR value is dimensionless. The aforementioned equation was derived assuming that cancer is a nonthreshold process and that the potential excess risk level is proportional to the cumulative intake over a lifetime.

For quantitative estimation of risk, it is assumed that cancer risks from various exposure routes are additive. Estimated ILCR values have been compared to 1 x 10^{-6} to 1 x 10^{-4} which represents USEPA's acceptable (i.e., de minimis) target risk range (USEPA, 1990).

6.2.4.2 Noncarcinogenic Compounds

Noncarcinogenic compounds assume that a threshold toxicological effect exists. Therefore, the potential for noncarcinogenic effects are calculated by comparing (i.e., dividing) CDI_i and DAD_i levels with reference doses (RfDs) for each COPC.

Noncarcinogenic effects are estimated by calculating the hazard quotient (HQ) for individual chemicals and the hazard index (HI) for overall chemicals and pathways by the following equation:

$$HI = \sum_{i=1}^{n} HQ_i$$

where: $HQ_i = (CDI_i \text{ or } DAD_i)/RfD_i \text{ or } RfC_i$

An HQ is the ratio of the daily intake or absorbed dose to the reference dose (or reference concentration for inhalation exposure). CDI_i is the chronic daily intake (mg/kg/day) of contaminant i; DAD_i is the dermally absorbed dose (mg/kg/day) of contaminant i, and RfD_i is the reference dose (mg/kg/day) of the contaminant i over a prolonged period of exposure. RfC_i is the reference concentration used when determining exposure due to inhalation. Since the units of RfD are mg/kg-day and the units of CDI/DAD are mg/kg-day, the HQ and HI are dimensionless. To account for the additivity of noncarcinogenic risk following exposure to numerous chemicals, the HI, which is the sum of all the HQs, will be calculated. A ratio of 1.0 is used for examination of the HQ and HI. Ratios less than 1.0 indicate that adverse noncarcinogenic health effects are unlikely. Ratios greater than 1.0 indicate the potential for adverse noncarcinogenic health effects to occur at that exposure level and caution should be exercised. However, this does not mean that adverse effects will definitely be observed since the RfD incorporates safety and modifying factors to ensure that it is well below that dose for which adverse effects have been observed. This procedure assumes that the risks from exposure to multiple chemicals are additive, an assumption that is probably valid for compounds that have the same target organ or cause the same toxic effect.

6.2.4.3 Potential Human Health Effects

Potential carcinogenic and noncarcinogenic human health risks were estimated for human receptors under RME scenarios previously identified in Section 6.2.2. For each receptor, total carcinogenic and total noncarcinogenic risks were estimated by SWMU or AOC, and are presented in Tables 6-9 through 6-23 for only those scenarios that resulted in unacceptable risks, i.e., those scenarios for which carcinogenic and/or noncarcinogenic risks were estimated to exceed USEPA acceptable risk criteria, as described earlier in this section. In the tables, those subtotal and total risks exceeding USEPA acceptable risk criteria are shaded. No risk summary tables were prepared for those scenarios that were not found to be associated with unacceptable risks. The risk calculation spreadsheets showing the calculation of all CDIs, DADs, ILCRs, and HIs, by receptor, SWMU/AOC and pathway, are presented in Appendix F.

The following SWMUs are those for which no unacceptable human health risks were estimated: SWMUs 1, 3, 7, 10 (no COPCs), 23, 24 (no COPCs), 26, 30, 31, 37, 39, 46, and 51. The discussions in the subsections that follow focus only on the SWMUs/AOCs which may pose a potential adverse human health risk. The risks associated with each SWMU/AOC are discussed by receptor. It should be noted that potentially unacceptable risks were estimated for all receptors except for the future construction worker. Prior to the more detailed discussion of risks, the following list briefly summarizes receptors and those SWMUs/AOCs and media that may present unacceptable risks to those receptors:

Current On-site Workers
- SWMU 11 - Sediment
- AOC B - Surface Soil
- AOC C - Surface Soil

Current Recreational Users
- SWMU 2 - Sediment
- SWMU 11 - Sediment
- SWMU 13 - Sediment
- AOC D - Sediment

Future Residents

- SWMU 2 - Sediment
- SWMU 11 - Sediment
- SWMU 13 - Sediment
- SWMU 32 - Surface Soil
- SWMU 46 - Surface Soil
- AOC B - Surface Soil
- AOC C - Surface Soil
- AOC D - Sediment

6.2.4.3.1 Current On-site Workers

The following subsections describe the resultant risk values derived for exposures of current on-site adult workers. Potentially unacceptable risks were estimated for sediment and surface soil exposures to this receptor at SWMU 11 and AOC C, respectively. These risks are summarized in Tables 6-9 through 6-11.

SWMU 11 - Old Power Plant/Building 38

Table 6-9 shows that the total ILCR (7.0×10^{-4}) estimated for the on-site worker exposures to sediment in SWMU 11 exceeded USEPA's generally acceptable target risk range of 1×10^{-6} to 1×10^{-4}. This exceedence is due to predominantly to dermal exposures to benzo(a)pyrene, which contributed approximately 73 percent of the total ILCR. The total HI value estimated for on-site worker exposures to noncarcinogenic COPCs in SWMU 11 sediment is less than 1.0, indicating that the potential for the occurrence of adverse systemic effects is insignificant.

AOC B - Building 25

Table 6-10 shows that the total ILCR estimated for on-site worker (1.4×10^{-4}) exposures to surface soil in AOC B exceeded USEPA's generally acceptable target risk range of 1×10^{-6} to 1×10^{-4}. This exceedence is due to predominantly to dermal exposures to benzo(a)pyrene, beryllium, benzo(b)flouranthene, 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT, which contributed approximately 29 percent, 26 percent, 7 percent, 9 percent, 5 percent, and 6 percent, respectively, of the total ILCR.

The total HI value estimated for on-site worker exposures to noncarcinogenic COPCs in AOC B surface soil is less than 1.0, indicating that the potential for the occurrence of adverse systemic effects following surface soil exposure is insignificant.

AOC C - Transformer Storage Pad

Table 6-11 shows that the total ILCR (7.0 x 10^{-2}) estimated for the on-site worker exposures to surface soil in AOC C exceeded USEPA's generally acceptable target risk range of 1 x 10^{-6} to 1 x 10^{-4}. This exceedence is due to predominantly to accidental ingestion and dermal exposures to Aroclor-1260, which contributed greater than 99 percent of the ILCRs estimated for each pathway. The total HI value estimated for on-site worker exposures to noncarcinogenic COPCs in AOC C surface soil is less than 1.0, indicating that the potential for the occurrence of adverse systemic effects is insignificant.

6.2.4.3.2 Current Recreational Users

The following subsections describe the resultant risk values derived for exposures of current adult and adolescent recreational users. Potentially unacceptable risks were estimated for sediment exposures to these receptors at SWMUs 2, 11 and 13, as well as AOC C. These risks are summarized in Tables 6-12 through 6-15.

SWMU 2 - Langley Drive Disposal Site

Table 6-12 shows that the total ILCRs estimated for adult and adolescent recreational user (2.5 x 10^{-4} and 1.2 x 10^{-4}, respectively) exposures to sediment in SWMU 2 exceeded USEPA's generally acceptable target risk range of 1 x 10^{-6} to 1 x 10^{-4}. This exceedence is due to predominantly to dermal exposures to benzo(a)pyrene, total HxCDD, and PeCDD, which contributed approximately 41 percent, 25 percent and 10 percent, respectively, to the total ILCR. However, it should be noted that ILCRs estimated for each COPC individually were within USEPA's target risk range. The total HI value estimated for both adult and adolescent recreational user exposures to noncarcinogenic COPCs in SWMU 2 sediment is less than 1.0, indicating that the potential for the occurrence of adverse systemic effects following exposure is insignificant.

SWMU 11 - Old Power Plant/Building 38

Table 6-13 shows that the total ILCRs estimated for adult and adolescent recreational user (1.6×10^{-3} and 7.3×10^{-4}, respectively) exposures to sediment in SWMU 11 exceeded USEPA's generally acceptable target risk range of 1×10^{-6} to 1×10^{-4}. This exceedence is due to predominantly to dermal exposures to the PAHs benzo(a)pyrene and dibenzo(a,h)anthracene, which contributed approximately 73 percent and 13 percent, respectively, of the total ILCR. The total HI value estimated for both adult and adolescent recreational user exposures to noncarcinogenic COPCs in SWMU 11 sediment is less than 1.0, indicating that the potential for the occurrence of adverse systemic effects following exposure is insignificant.

SWMU 13 - Old Pest Control Shop/Building 258

Although SWMU 13 is not considered to be in a recreational area, trespassers may still access and directly contact environmental media in this SWMU on an infrequent basis. Therefore, for the sake of health conservatism, the recreational scenario was used to evaluate potential exposures to these individuals as adults and adolescents. Table 6-14 shows that the total ILCR (1.5×10^{-4}) estimated for adult recreational user exposures to ditch sediment in SWMU 13 exceeded USEPA's generally acceptable target risk range of 1×10^{-6} to 1×10^{-4}. This exceedence is due to predominantly to dermal exposures to 4,4'-DDE, 4,4'-DDT and benzo(a)pyrene, which contributed approximately 31 percent, 48 percent and 14 percent, respectively, of the total ILCR. However, it should be noted that ILCRs estimated for each COPC individually were within USEPA's target risk range. The total HI values estimated for both adult and adolescent recreational user exposures to noncarcinogenic COPCs in SWMU 13 sediment (1.1 and 1.7, respectively) exceeded USEPA's acceptable target value of 1.0. This exceedence is due predominantly to dermal exposures to 4,4'-DDT in sediment, which contributed approximately 84 percent of the total HI. However, since the individual HQ estimated for this COPC is less than the target value of 1.0, and since the target organs differ from those of the other systemic COPCs evaluated under this scenario (4,4'-DDT - liver; cadmium - renal cortex; copper - gastrointestinal system; mercury - kidney/nervous system; and zinc - blood), it is unlikely that there is any cumulative risk of adverse systemic effects following sediment exposures to the recreational user, as evaluated in this HHRA. In addition, it should be noted that based on the physical features and location of the ditch it is unlikely that whole-body dermal exposures would ever occur to a recreational user.

AOC D - Ensenada Honda Sediments

AOC D is comprised of Ensenada Honda sediments and includes SWMUs 1, 2, 3, 7, and 11. Table 6-15 shows that the total ILCRs estimated for adult and adolescent recreational user (1.8x 10^{-3} and 7.8 x 10^{-4}, respectively) exposures to sediment in AOC D exceeded USEPA's generally acceptable target risk range of 1 x 10^{-6} to 1 x 10^{-4}. This exceedence is due to predominantly to dermal exposures to benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(a,h)anthracene which contributed approximately 67 percent, 7 percent and 12 percent, respectively, to the total ILCR. The ILCRs estimated for each of these COPCs individually also exceeded USEPA's target risk range. The maximum concentrations of these PAHs used to estimate carcinogenic risks to AOC D sediments can be attributed to SWMU 11. The total HI value (1.1) estimated for adolescent recreational user exposures to noncarcinogenic COPCs in AOC D sediment exceeded USEPA's acceptable target value of 1.0. This exceedence is due predominantly to dermal exposures to mercury in SWMU 2 sediment, which contributed approximately 67 percent of the total HI. However, it should be noted that the HQs estimated for all noncarcinogenic COPCs individually under this scenario are less than 1.0. An analysis of target organs show that both mercury and cadmium affect the kidneys. However, the summing of the HQs estimated for these metals (0.73 and 0.12, respectively), yields an HI value of 0.85 for this target organ, which is less than 1.0. Therefore, it is unlikely that there is any cumulative risk of adverse systemic effects following sediment exposures to the adolescent recreational user, as evaluated in this HHRA.

6.2.4.3.3 Future Residents

The following subsections describe the resultant risk values derived for exposures of future adult and young child residents. Potentially unacceptable risks were estimated for sediment exposures to these receptors at SWMUs 2, 11, 13, 32, and 46, as well as AOCs B, C and D. These risks are summarized in Tables 6-16 through 6-23.

SWMU 2 - Langley Drive Disposal Site

Table 6-16 shows that the total ILCRs estimated for adult and young child residents (2.0 x 10^{-4} and 1.2 x 10^{-4}, respectively) exposures to sediment in SWMU 2 exceeded USEPA's generally acceptable target risk range of 1 x 10^{-6} to 1 x 10^{-4}. This exceedence is due to predominantly to dermal exposures to benzo(a)pyrene, total HxCDD, and PeCDD, which contributed approximately 40 percent, 25 percent and 10 percent, respectively, to the total ILCR. However, it should be noted that ILCRs estimated for each COPC individually were within USEPA's target risk range. The total HI value estimated for child resident exposures to noncarcinogenic COPCs in SWMU 2 sediment exceeded USEPA's acceptable target value of 1.0. This exceedence is due predominantly to dermal exposures to mercury in SWMU 2 sediment, which contributed approximately 81 percent of the total HI. However, it should be noted that the HQs estimated for all noncarcinogenic COPCs individually under this scenario are less than 1.0. An analysis of target organs show that both mercury and cadmium, which were COPCs evaluated for this SWMU, affect the kidneys. The summing of the HQs estimated for these metals (0.91 and 0.15, respectively), yields an HI value of 1.06 for this target organ, which exceeds the acceptable value of 1.0. Therefore, there may be a cumulative risk of adverse systemic effects to the kidneys following sediment exposures to the residential young child, as evaluated in this HHRA.

SWMU 11 - Old Power Plant/Building 38

Table 6-17 shows that the total ILCRs estimated for adult and young child residential (1.3×10^{-3} and 6.8×10^{-4}, respectively) exposures to sediment in SWMU 11 exceeded USEPA's generally acceptable target risk range of 1×10^{-6} to 1×10^{-4}. This exceedence is due to predominantly to dermal exposures to the PAHs benzo(a)pyrene and dibenzo(a,h)anthracene, which contributed approximately 72 percent and 13 percent, respectively, of the total ILCR. The total HI values estimated for both adult and child residential exposures to noncarcinogenic COPCs in SWMU 11 sediment are less than 1.0, indicating that the potential for the occurrence of adverse systemic effects following exposure is insignificant.

SWMU 13 - Old Pest Control Shop/Building 258

Table 6-18 shows that the total ILCR (1.4×10^{-4}) estimated for future adult residential exposures to ditch sediment in SWMU 13 exceeded USEPA's generally acceptable target risk range of 1×10^{-6} to 1×10^{-4}. This exceedence is due to predominantly to dermal exposures to 4,4'-DDE, 4,4'-DDT and benzo(a)pyrene, which contributed approximately 31 percent, 48 percent and 14 percent, respectively, of the total ILCR. However, it should be noted that ILCRs estimated for each COPC individually were within USEPA's target risk range. The total HI values estimated for both adult and young child residential exposures to noncarcinogenic COPCs in SWMU 13 sediment (1.1 and 2.5, respectively) exceeded USEPA's acceptable target value of 1.0. This exceedence is due predominantly to dermal exposures to 4,4'-DDT in sediment, which contributed approximately 84 percent of the total HI. However, since the individual HQ estimated for this COPC is less than the target value of 1.0, and since the target organs differ from those of the other systemic COPCs evaluated under this scenario (4,4'-DDT - liver; cadmium - renal cortex; copper - gastrointestinal system; mercury - kidney/nervous system; and zinc - blood), it is unlikely that there is any cumulative risk of adverse systemic effects following sediment exposures to the recreational user, as evaluated in this HHRA. In addition, it should be noted that based on the physical features and location of the ditch it is unlikely that whole-body dermal exposures would ever occur to a future resident.

SWMU 32 - PWD Storage Yard/Battery Collection Area/Building 31

Table 6-19 shows that the total ILCRs estimated for future adult and young child residential exposures to surface soil in SWMU 32 were within USEPA's generally acceptable target risk range of 1×10^{-6} to 1×10^{-4}. However, the total HI values estimated for both adult and young child residential exposures to noncarcinogenic COPCs in SWMU 32 surface soil (1.3 and 3.6, respectively) exceeded USEPA's acceptable target value of 1.0. This exceedence is due predominantly to dermal exposures to Aroclor-1254 in surface soil, which contributed greater than 95 percent of the total HI. This indicates that there may be a risk of adverse systemic effects following surface soil exposures to the residential young child, as evaluated in this HHRA.

SWMU 46 - Pole Storage Yard Covered Pad

Table 6-20 shows that the total ILCR estimated for adult residential (1.6×10^{-4}) exposures to surface soil in SWMU 46 exceeded USEPA's generally acceptable target risk range of 1×10^{-6} to 1×10^{-4}. This exceedence is due to predominantly to dermal exposures to Aroclor-1260 and benzo(a)pyrene, which contributed approximately 56 percent and 23 percent, respectively, of the total ILCR. The total HI values estimated for both adult and child residential exposures to noncarcinogenic COPCs in SWMU 46 surface soil are less than 1.0, indicating that the potential for the occurrence of adverse systemic effects following exposure is insignificant.

AOC B - Building 25

Table 6-21 shows that the total ILCRs estimated for future adult and child residential exposures to surface soil in AOC B (2.6 x 10^{-4} and 1.8 x 10^{-4}, respectively) exceeded USEPA's generally acceptable target risk range of 1 x 10^{-6} to 1 x 10^{-4}. This exceedence is due to predominantly to dermal exposures to benzo(a)pyrene, beryllium, benzo(b)flouranthene, 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT, which contributed approximately 29 percent, 26 percent, 7 percent, 9 percent, 5 percent, and 6 percent, respectively, of the total ILCR. In addition, the total HI value estimated for young child residential exposures to noncarcinogenic COPCs in AOC B surface soil (1.4) exceeded USEPA's acceptable target value of 1.0. This exceedence is due predominantly to ingestion and dermal exposures to 4,4'-DDT and arsenic in surface soil. For the ingestion pathway, these COPCs contributed approximately 46 percent and 54 percent, respectively, of the total ingestion HI. For the dermal pathway, these COPCs contributed approximately 72 percent and 26 percent, respectively, of the total dermal HI. Since 4,4'-DDT and arsenic target different organs of the body (the liver and skin, respectively), there is no cumulative risk of adverse systemic effects to the to the residential young child following surface soil exposures, as evaluated in this HHRA.

AOC C - Transformer Storage Pad

Table 6-22 shows that the total ILCRs estimated for future adult and child residential exposures to surface soil in AOC C (1.2 x 10^{-1} and 9.4 x 10^{-2}, respectively) exceeded USEPA's generally acceptable target risk range of 1 x 10^{-6} to 1 x 10^{-4}. This exceedence is due to predominantly to ingestion and dermal exposures to 5,200 mg/kg of Aroclor-1260 in the surface soil at location ACSS05, which contributed greater than 99 percent of the total ILCR. The total HI value estimated for young child residential exposures to noncarcinogenic COPCs in AOC C surface soil (2.4) exceeded USEPA's acceptable target value of 1.0. This exceedence is due predominantly to ingestion and dermal exposures to arsenic, 4,4'-DDT, alpha-chlordane, and gamma-chlordane in surface soil. For the ingestion pathway, these COPCs contributed approximately 63 percent, 11 percent, 14 percent, and 12 percent of the total ingestion HI. For the dermal pathway, these COPCs contributed approximately 25 percent, 14 percent, 32 percent, and 29 percent of the total dermal HI. Therefore, there may be a cumulative risk of adverse systemic effects to the to the residential young child following surface soil exposures, as evaluated in this HHRA.

AOC D - Ensenada Honda Sediments

AOC D is comprised mainly of Ensenada Honda sediments and includes SWMUs 1, 2, 3, 7, and 11. Table 6-23 shows that the total ILCRs estimated for adult and young child residential (1.8x 10^{-3} and 7.4 x 10^{-4}, respectively) exposures to sediment in AOC D exceeded USEPA's generally acceptable target risk range of 1 x 10^{-6} to 1 x 10^{-4}. This exceedence is due to predominantly to dermal exposures to benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(a,h)anthracene which contributed approximately 67 percent, 7 percent and 12 percent, respectively, to the total ILCR. The ILCRs estimated for each of these COPCs individually also exceeded USEPA's target risk range. The maximum concentrations of these PAHs used to estimate carcinogenic risks to AOC D sediments can be attributed to SWMU 11. The total HI value (1.7) estimated for residential child exposures to noncarcinogenic COPCs in AOC D sediment exceeded USEPA's acceptable target value of 1.0. This exceedence is due predominantly to dermal exposures to mercury in SWMU 2 sediment, which contributed approximately 67 percent of the total HI. However, it should be noted that the HQs estimated for all noncarcinogenic COPCs individually under this scenario are less than 1.0. An analysis of target organs show that both mercury and cadmium affect the kidneys; however, the summing of the HQs estimated for these metals (0.91 and 0.15, respectively), yields an HI value of 1.06 for this target organ, which exceeds the target value of 1.0. Therefore, there may be cumulative risk of adverse systemic effects to the kidneys following sediment exposures to the young child resident, as evaluated in this HHRA.

6.2.5 Sources of Uncertainty in the HHRA

Uncertainties are encountered throughout the process of performing a risk assessment. This section discusses the sources of uncertainty inherent in the following elements of the human health evaluation performed for the various SWMUs/AOCs:

- Sampling and analysis
- Selection of COPCs
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Chemicals not quantitatively evaluated

Uncertainties associated with this risk assessment are discussed in the following paragraphs. Table 6-24 summarizes the potential effects of certain uncertainties on the estimation of human health risks.

6.2.5.1 Sampling and Analysis

The development of a risk assessment depends on the reliability of, and uncertainties associated with, the analytical data available to the risk assessor. These, in turn, are dependent on the operating procedures and techniques applied to the collection of environmental samples in the field and their subsequent analyses in the laboratory. To minimize the uncertainties associated with sampling and analysis at OUs 1, 6 and 7, USEPA approved sampling and analytical methods were employed. Data were generated following RCRA methods of analysis for organics and inorganics, and were validated in accordance with USEPA Region II procedures. Samples were taken from locations specified in the approved Work Plan along with the necessary QA/QC samples.

Analytical data are limited by the precision and accuracy of the methods of analysis which are reflected by the Relative Percent Difference (RPD) of duplicate analyses and the percent recovery of spikes, respectively. In addition, the statistical methods used to compile and analyze the data (mean concentrations, detection frequencies) are subject to the overall uncertainty in data measurement. Furthermore, chemical concentrations in environmental media fluctuate over time and with respect to sampling location. Analytical data must be sufficient to consider the temporal and spatial characteristics of contamination at the site with respect to exposure.

6.2.5.2 Exposure Assessment

In performing exposure assessments, uncertainties arise from two main sources. First, uncertainties arise in estimating the fate of a compound in the environment, including estimating release and transport in a particular environmental medium. Second, uncertainties arise in the estimation of chemical intakes resulting from contact by a receptor with a particular medium.

To estimate an intake, certain assumptions must be made about exposure events, exposure durations, and the corresponding assimilation of constituents by the receptor. Exposure factors have been generated by the scientific community and have undergone review by the USEPA. The USEPA has published an Exposure Factors Handbook (USEPA, 1989a) which contains the best and latest values. Regardless of the validity of these exposure factors, they have been derived from a range of values generated by studies of limited numbers of individuals. In all instances, values used in this risk assessment, scientific judgments, and conservative assumptions agree with those of the USEPA.

The use of a RME approach, designed as not to underestimate daily intakes, was employed throughout this risk assessment. The use of maximum values as the concentration term in estimating the CDI or DAD for soil, groundwater and sediment exposure scenarios reduces the potential for underestimating exposure at Site 12.

6.2.5.3 Toxicological Assessment

In making quantitative estimates of the toxicity of varying dosages of compounds to human receptors, uncertainties arise from two sources. First, data on human exposure and the subsequent effects are usually insufficient, if they are at all available. Human exposure data usually lack adequate concentration estimations and suffer from inherent temporal variability. Therefore, animal studies are often used and new uncertainties arise from the process of extrapolating animal results to humans. Second, to obtain observable effects with a manageable number of experimental subjects, high doses of a compound are often used. In this situation, a high dose means that high exposures are used in the experiment with respect to most environmental exposures. Therefore, when applying the results of the animal experiment to the human condition, the effects at the high doses must be extrapolated to approximate effects at lower doses.

In extrapolating effects from high doses in animals to low doses in humans, scientific judgment and conservative assumptions are employed. In selecting animal studies for use in dose-response calculations, the following factors are considered:

- Studies are preferred where the animal closely mimics human pharmacokinetics.

- Studies are preferred where dose intake most closely mimics the intake route and duration for humans.

- ! Studies are preferred which demonstrate the most sensitive response to the compound in question.

For compounds believed to cause threshold effects (i.e., noncarcinogens) safety factors are employed in the extrapolation of effects from animals to humans and from high doses to low doses. In deriving carcinogenic potency factors, the 95% UCL value is promulgated by the USEPA to prevent underestimation of potential risk.

Further conservatism in the HHRA is also introduced through the use of experimentally-derived oral absorption efficiencies to account for a difference in the degree of toxicity between an administered dose and an absorbed dose. Equating the absorption efficiency of the dermal bi-phasic barrier to the absorption efficiency of the gastrointestinal lining is a very conservative approach that tends to overestimate the potential risk to human health.

In summary, the use of conservative assumptions, results in quantitative indices of toxicity that are not expected to underestimate potential toxic effects, but may overestimate these effects by an order of magnitude or more.

6.2.5.4 Human Health Risk Characterization

The risk characterization bridges the gap between potential exposure and the possibility of systemic or carcinogenic human health effects, ultimately providing impetus for the remediation of the site or providing a basis for no remedial action.

Uncertainties associated with risk characterization include the assumption of chemical additivity and the inability to predict synergistic or antagonistic interactions between COPCs. These uncertainties are inherent in any inferential risk assessment. USEPA promulgated inputs to the quantitative risk assessment and toxicological indices are calculated to be protective of the human receptor and to err conservatively, so as to not underestimate the potential human health risks.

6.2.5.5 COPCs Not Quantitatively Evaluated

Although lead concentrations were detected in soil and sediment samples throughout the investigated sites, no risk levels were quantitatively estimated for this inorganic in the HHRA due to a lack of available toxicological criteria. However, exceedences of the residential soil action level (400 mg/kg) in soil and sediment demonstrate that lead should be considered a possible contributor to human health risk only in surface soil at SWMU 13. Although lead was retained as a COPC for exceeding SSVs, it should not be considered a contributor to human health risk in sediment since the residential soil action level was not exceeded. The lack of promulgated toxicological indices for lead does not have significant effects on the underestimation of risk due to the presence of relatively high levels of other COPCs in environmental media, such as arsenic. This risk assessment has been performed using conservative exposure point concentrations, exposure scenarios (use of the groundwater aquifer as a drinking water source), and available toxicological information.

6.3 Ecological Risk Assessment

A qualitative ecological screening was conducted on the aquatic environment at each SWMU included in OUs 1, 6 and 7. Sediment samples collected from the Station were compared to sediment screening levels (SSLs) to determine potential risks to the aquatic environment. The SSLs are non-enforceable regulatory guidelines that have been compiled for evaluating the potential for chemical contaminants in sediment to cause adverse biological effects (Long et al., 1995). The lower ten percentile (ER-L) and the median percentile (ER-M) of biological effects have been developed for various contaminants. The concentrations below the ER-L represent a minimal-effects range (adverse effects would be rarely observed). The concentration above the ER-L, but below the ER-M represents a possible-effects range (adverse effects would occasionally occur). Finally, the concentration above the ER-M represents a probable-effects range (adverse effects would probably occur) (Long et al., 1995).

In addition to the above-mentioned SSLs, sediment screening levels developed by the USEPA Region III Biological Technical Assistance Group (BTAG) and apparent effects threshold (AET) values developed for the Pudget Sound (Tetra Tech, Inc., 1986) were used to assess sediment concentrations at the site. AETs are the concentrations of contaminants above which statistically significant biological effects always would be expected. Finally, the Wisconsin Department of

Natural Resources has developed interim criteria for in-water disposal of dredged sediment (Sullivan et al., 1985). However, these criteria were established using background concentration data and were not based on toxicity data.

The SSLs were used for comparative purposes to infer potential ecological risks. Contaminants that were detected at concentrations less than these screening levels were not retained as contaminants of concern since are not expected to pose a significant risk to the ecological population.

6.3.1 AOC D - Ensenada Honda Sediments

Overall, the aquatic environment within AOC D (as indicated by sampling performed at SWMUs 1,2,3,7, and 11/45) may potentially be adversely impacted by the sediment in these areas. SWMU 2 and SWMU 11/45 appear to have the greatest potential for exhibiting adverse effects. PAHs were highest in sediment collected from SWMU 11/45, inorganic compounds were highest in the sediments collected from SWMU 2, and dioxin was detected in the sediment collected from SWMUs 2 and 3. The following sections provide additional details on the aquatic assessment conducted on sediment sampling results at each SWMU within AOC D.

SWMU 1 - Former Cremator Disposal Site

There is a slight potential for risk to the aquatic environment at SWMU 1 from concentrations of cobalt, copper, and vanadium detected in the sediment. It is noted that cobalt and vanadium cannot be evaluated due to the lack of screening criteria for these inorganics. Also, copper concentrations exceeded ER-L values, but were below ER-M values, indicating a possibility for adverse effects to aquatic life.

SWMU 2 - Langley Drive Disposal Site

There is a potential for risk to the aquatic environment at SWMU 2 from concentrations of 2-butanone, PAHs, DDE, total PeCDD, total HxCDD, total HxCDF, cobalt, copper, lead, mercury, tin, vanadium, and zinc concentrations detected above ER-L values. Concentrations of benzo(a)anthracene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, copper, lead, mercury, and zinc exceeded ER-M values, indicating a probable risk to the aquatic environment. It is noted that 2-butanone, benzo(k)pyrene, carbazole, cobalt, tin, and vanadium are potential contaminants; however, there are no available screening levels to evaluate the detected concentrations.

<u>SWMU 3 - Base Landfill</u>

There is a slight potential for risk to the aquatic environment at SWMU 3 based on sediment concentrations of benzoic acid, phenol, total HxCDD, cobalt, copper, selenium, tin, and vanadium detected slightly above ER-L values. It is noted that benzoic acid, phenol, and selenium exceeded ER-M values, indicating a probable risk to the aquatic environment from these contaminants detected in the sediment. There are no available screening levels to evaluate the concentrations of cobalt, tin, and vanadium detected in the sediment.

<u>SWMU 7 - Tow Way Fuel Farm</u>

There is a slight potential for risk to the aquatic environment at SWMU 7 based on sediment concentrations of SVOCs, herbicides, and inorganics. Concentrations of benzo(k)fluoranthene, benzoic acid, chrysene, Silvex, arsenic, cobalt, copper, tin, and vanadium were detected in the sediment collected at SWMU 7 slightly greater than ER-L values. None of the detected contaminants exceeded ER-M values. To be conservative, benzo(k)fluoranthene, Silvex, cobalt, tin, and vanadium were retained as contaminants of potential concern because there are no screening levels available to indisputably eliminate these constituents from further evaluation.

<u>SWMU 11/45 - Old Power Plant/Building 38</u>

There is a potential for risk to the aquatic environment at SWMU 11/45 based on the concentrations of carbon disulfide, PAHs, arsenic, and lead detected above ER-L values. Concentrations of acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene exceed ER-M values, indicating a probable risk to the aquatic environment. It is noted that majority of high PAH concentrations were detected at one sampling station at SWMU 11/45 (11SD01). There are no available sediment screening levels for carbon disulfide, benzo(k)fluoranthene, and p-dimethylaminoazobenzene to evaluate the detected concentrations.

6.3.2 SWMU 13 - Old Pest Control Shop/Building 258

There is a potential for risk to the aquatic environment at SWMU 13 based on sediment concentrations of 2-butanone, benzo(k)fluoranthene, chlorobenzilate, DDD, DDE, DDT, cadmium, cobalt, copper, lead, mercury, selenium, tin, vanadium, and zinc detected above ER-L values. Concentrations of DDD, DDE, DDT, and selenium were detected above ER-M values, indicating a probable risk to the aquatic environment. Pesticides appear to be the contaminants of greatest concern at SWMU 13 because of the high concentrations detected in the sediment. It is noted that there are no screening levels available for 2-butanone, benzo(k)fluoranthene, chlorobenzilate, cobalt, tin, or vanadium to evaluate detected concentrations. It should also be noted that the sediment samples obtained for SWMU 13 were collected from a drainage ditch; therefore, application of aquatic SSLs introduces a high degree of conservatism into the qualitative assessment of ecological risks.

6.3.3 SWMU 25 - DRMO Storage Yard

There is a slight potential for risk to the ecological environment at SWMU 25 based on sediment concentrations of cobalt, copper, nickel, and vanadium detected above ER-L values. However, none of the detected concentrations exceed ER-M values. It is acknowledged that the ecological assessment at SWMU 25 is only based on one sediment sample obtained from a drainage ditch; therefore, application of aquatic SSLs introduces a high degree of conservatism into the qualitative assessment of ecological risks. Concentrations of cobalt, and vanadium do not have sediment screening levels to evaluate the detected concentrations.

6.4 <u>Summary of HEA Results</u>

This section summarizes the results of the HEA, and identifies SWMUs/AOCs that are associated with COPCs in environmental media that may pose potential human health and ecological risks. The Phase I RFI was conducted for the following SWMUs and AOCs at NSRR, Puerto Rico: SWMUs 1, 2, 3, 7, 10, 11, 13, 23, 24, 25, 26, 30, 31, 32, 37, 39, 46, and 51; and AOCs B, C and D. Descriptions and historical background for each SWMU and AOC were provided in the previous sections of this RFI report. The HEA consisted of two components. The first component, Section 6.2, was the quantitative baseline human health risk assessment (HHRA); the second component, Section 6.3, was the qualitative ecological risk assessment (ERA). The purpose of the HEA is to evaluate the potential human health and ecological risks posed by the presence of chemicals of potential concern (COPCs) detected in the environmental media investigated at each SWMU and AOC. Further action is recommended for a SWMU/AOC if the results of this HEA demonstrate that potentially unacceptable human or ecological risks may be associated with an environmental medium within the boundary of that SWMU/AOC.

6.4.1 Summary of Results of the Human Health Risk Assessment

COPCs were identified for each SWMU/AOC based on exceedences of standards/criteria in Section 5.0 of this RFI report, and are briefly summarized in Section 6.2.1, as well as Tables 6-1 through 6-3. COPCs were identified from surface soil, subsurface soil, groundwater and sediment samples collected throughout OUs 1, 6 and 7. Constituents identified as COPCs in each SWMU/AOC were retained for quantitative evaluation in the HHRA. The HHRA estimated potential carcinogenic and noncarcinogenic risks to potential current and future human receptors that would result from exposures to COPCs in the investigated environmental media at each SWMU/AOC. Current receptor groups evaluated included on-site adult workers, and adult and adolescent (ages 7-15 years old) recreational users of the Honda; future receptor groups evaluated included on-site adult and child (ages 1-6 years old) residents and construction workers. The human exposure pathways evaluated for each receptor were presented in Section 6.2.2.1. However, it should be noted that currently, there are no facilities for personnel housing within any of the investigated OUs, nor are any likely to be developed. It is highly improbable that any of the SWMUs/AOCs will be developed for residential/ military personnel housing in the future since the mission of NSRR is that of a key naval station providing full support for Atlantic Fleet weapons training and development activities, and the area surrounding Ensenada Honda (the harbor) is needed to support the mission. Although future residential development of any SWMU and AOC within OUs 1, 6 and 7 is highly unlikely, future residential exposures were evaluated as the most conservative (worst-case) scenario.

The results of the HHRA demonstrate that no unacceptable human health risks were estimated with COPCs identified in any environmental media within SWMUs 1, 3, 7, 10 (no COPCs), 23, 24 (no

COPCs), 26, 30, 31, 37, 39, 46, and 51. The following briefly summarizes those SWMUs/AOCs and COPCs that may pose unacceptable human health risks to the evaluated receptors.

SWMU 2 - Langley Drive Disposal Site

Potentially unacceptable carcinogenic risks were estimated for current recreational users and future residents that would result predominantly from whole-body dermal exposures to benzo(a)pyrene, PeCDD and HxCDD in sediment. The risks from these carcinogens would be due to cumulative effects, since the individual ILCRs were within USEPA's acceptable target risk range. The source of the dioxins is uncertain; however, it should be noted that dioxins are generally ubiquitous in the environment. Unacceptable noncarcinogenic risks were also estimated for future resident children that would result predominantly from whole-body dermal exposures to mercury in the sediment.

SWMU 11/45 - Old Power Plant/Building 38

Potentially unacceptable carcinogenic risks were estimated for current on-site workers and recreational users, as well as for future residents that would result predominantly from dermal exposures to the PAHs benzo(a)pyrene and dibenzo(a,h)anthracene in sediment.

SWMU 13 - Old Pest Control Shop/Building 258

Potentially unacceptable carcinogenic risks were estimated for current adult recreational users and future adult residents that would result predominantly from whole-body dermal exposures to benzo(a)pyrene, 4,4'-DDE and 4,4'-DDT in sediment. The risks from these carcinogens would be due to cumulative effects, since the individual ILCRs were within USEPA's acceptable target risk range. Unacceptable noncarcinogenic risks were also estimated for current adult and adolescent recreational users, as well as future adult and child residents that would result predominantly from whole-body dermal exposures to 4,4'-DDT in the sediment.

SWMU 32 - PWD Storage Yard/Battery Collection Area/Building 31

Potentially unacceptable noncarcinogenic risks were estimated for future adult and child residents that would result predominantly from accidental ingestion and dermal exposures to Aroclor-1254 in the surface soil.

SWMU 46 - Pole Storage Yard Covered Pad

Potentially unacceptable carcinogenic risks were estimated for future adult residents that would result predominantly from dermal exposures to Aroclor-1260 and benzo(a)pyrene in surface soil. The risks from these carcinogens would be due to cumulative effects, since the individual ILCRs were within USEPA's acceptable target risk range.

AOC B - Building 25

Potentially unacceptable carcinogenic risks were estimated for current on-site workers, as well as for future adult and young child residents, that would result predominantly from dermal exposures to benzo(a)pyrene, benzo(b)fluoranthene, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and beryllium in surface soil.

AOC C - Transformer Storage Pad

Potentially unacceptable carcinogenic risks were estimated for current on-site workers and future adult and young child residents that would result predominantly from accidental ingestion and dermal exposures to Aroclor-1260 (5,200 mg/kg) in surface soil. Unacceptable noncarcinogenic risks were also estimated for future adult and child residents that would result predominantly from accidental ingestion and dermal exposures to arsenic, 4,4'-DDT, alpha-chlordane, and gamma-chlordane in the surface soil (it should be noted that the reference dose for chlordane was used as a surrogate toxicity criterion in the evaluation of the alpha- and gamma-isomers).

AOC D - Ensenada Honda Sediments

AOC D is primarily comprised of the sediments of the Ensenada Honda, and is represented by sediments in SWMUs 1, 2, 3, 7, and 11/45. Only the current recreational users and future residents were evaluated for exposures to sediments in this AOC. Potentially unacceptable carcinogenic risks were estimated for these receptors that would result predominantly from whole-body dermal exposures to benzo(a)pyrene, benzo(b)flouranthene and dibenzo(a,h)anthracene in the sediments. The maximum concentrations of these PAHs detected in the SWMU 11/45 sediment contributed to the carcinogenic risk. Unacceptable noncarcinogenic risks were also estimated for the current recreational users and future residents that would result predominantly from dermal exposures to mercury in the SWMU 2 sediment.

6.4.2 Summary of Qualitative Ecological Risk Assessment

Overall, the aquatic environment within SWMUs 1, 2, 3, 7, 11/45, 13, and 25 potentially may be adversely impacted by the sediment in these areas. SWMUs 2, 11/45, and 13 appear to have the greatest potential to exhibit impact. The following subsections present a summary of the ecological screening conducted at each SWMU.

SWMU 1 - Former Cremator Disposal Site

There is a slight potential for risk to the aquatic environment at SWMU 1 from concentrations of cobalt, copper, and vanadium detected in the sediment.

SWMU 2 - Langley Drive Disposal Site

There is a potential for risk to the aquatic environment at SWMU 2 from concentrations of 2-butanone, PAHs, DDE, total PeCDD, total HxCDD, total HxCDF, cobalt, copper, lead, mercury, tin, vanadium, and zinc detected in the sediment samples collected. In particular, concentrations of benzo(a)anthracene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, copper, lead, mercury, and zinc pose the greatest risk to the aquatic community at SWMU 2.

SWMU 3 - Base Landfill

There is a slight potential for risk to the aquatic environment at SWMU 3 based on sediment concentrations of benzoic acid, phenol, total HxCDD, cobalt, copper, selenium, tin, and vanadium. Concentrations of benzoic acid, phenol, and selenium are the primary contaminants of concern.

SWMU 7 - Tow Way Fuel Farm

There is a slight potential for risk to the aquatic environment at SWMU 7 based on sediment concentrations of benzo(k)fluoranthene, benzoic acid, chrysene, Silvex, arsenic, cobalt, copper, tin, and vanadium.

SWMU 11/45 - Old Power Plant/Building 38

There is a potential for risk to the aquatic environment at SWMU 11/45 based on the concentrations of carbon disulfide, PAHs, arsenic, and lead detected in the sediment. In particular, concentrations of acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and pyrene may be impacting the aquatic environment.

SWMU 13 - Old Pest Control Shop/Building 258

There is a potential for risk to the aquatic environment at SWMU 13 based on sediment concentrations of 2-butanone, benzo(k)fluoranthene, chlorobenzilate, DDD, DDE, DDT, cadmium, cobalt, copper, lead, mercury, selenium, tin, vanadium, and zinc. The primary contaminants of concern at SWMU 13 include DDD, DDE, DDT, and selenium.

SWMU 25 - DRMO Storage Yard

There is a slight potential for risk to the ecological environment at SWMU 25 based on sediment concentrations of cobalt, copper, nickel, and vanadium.

SECTION 6.0 TABLES

TABLE 6-1

SUMMARY OF SURFACE SOIL COPCs [1]
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

COPCs	SWMU 13	SWMU 23	SWMU 25	SWMU 26	SWMU 30	SWMU 31	SWMU 32	SWMU 37	SWMU 39	SWMU 46	SWMU 51	AOC B	AOC C
Semivolatiles:													
Benzo(a)pyrene	X	X	X					X		X		X	X
Benzo(b)fluoranthene								X		X			
Bis(2-ethylhexyl)phthalate			X										
Dibenzo(a,h)anthracene								X		X			
N-Nitrosodimethylamine											X		
Pesticides:													
4,4'-DDE	X											X	X
4,4'-DDD												X	
4,4'-DDT	X											X	X
alpha-Chlordane													X
gamma-Chlordane													X
Kepone													X
PCBs: Aroclor-1254							X						
Aroclor-1260					X	X		X		X			X

TABLE 6-1 (Continued)

SUMMARY OF SURFACE SOIL COPCs [1]
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

COPCs	SWMU 13	SWMU 23	SWMU 25	SWMU 26	SWMU 30	SWMU 31	SWMU 32	SWMU 37	SWMU 39	SWMU 46	SWMU 51	AOC B	AOC C
Inorganics:													
Arsenic	X		X	X	X	X	X		X	X		X	X
Beryllium				X						X		X	X
Lead	X												X

Notes:

[1] Only the SWMUs and AOCs for which COPC were identified are presented in the table.
X Chemical identified as a COPC for SWMU/AOC.

TABLE 6-2

SUMMARY OF SUBSURFACE SOIL AND GROUNDWATER COPCs [1]
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

	Subsurface Soil COPCs				Groundwater COPCs
	SWMU 31	SWMU 32	SWMU 46	AOC B	SWMU 30
Pesticides:					
4,4'-DDE				X	
4,4'-DDD				X	
4,4'-DDT				X	
Inorganics:					
Total Antimony					X
Total Arsenic		X	X	X	X
Total Beryllium	X			X	
Total Zinc					X
Dissolved Antimony					X
Dissolved Arsenic					X

Notes:

(1) Only the SWMUs and AOCs for which COPC were identified are presented in the table.
X Chemical identified as a COPC for SWMU/AOC.

TABLE 6-3

SUMMARY OF SEDIMENT COPCs (1)
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

	SWMU 1	SWMU 2	SWMU 3	SWMU 7	SWMU 11	SWMU 13	SWMU 25	AOC D
Semivolatiles:								
Acenaphthylene					X			X
Anthracene		X			X			X
Benzo(a)anthracene		X			X			X
Benzo(a)pyrene		X		X	X	X		X
Benzo(b)fluoranthene		X			X			X
Benzo(k)fluoranthene					X			X
Chrysene		X		X	X			X
Dibenzo(a,h)anthracene		X			X			X
Fluoranthene		X			X			X
Fluorene		X						
Indeno(1,2,3-cd)pyrene		X			X			X
Phenanthrene		X						X
Pyrene		X			X			X
Dioxins/Furans								
Total PeCDD		X						X
Total HxCDD		X	X					X
Total HxCDF		X						X
Pesticides:								
4,4'-DDE		X				X		X
4,4'-DDD						X		
4,4'-DDT						X		

TABLE 6-3 (Continued)

SUMMARY OF SEDIMENT COPCs [1]
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

	SWMU 1	SWMU 2	SWMU 3	SWMU 7	SWMU 11	SWMU 13	SWMU 25	AOC D
Inorganics Arsenic				X	X			X
Beryllium			X				X	X
Cadmium		X				X		X
Copper	X	X	X	X		X	X	X
Lead		X	X		X	X		X
Mercury		X				X		X
Nickel							X	
Zinc		X				X		X

Notes:

(1) Only the SWMUs and AOCs for which COPC were identified are presented in the table.
X Chemical identified as a COPC for SWMU/AOC.

TABLE 6-4

EXPOSURE INPUT PARAMETERS FOR CURRENT ON-SITE WORKERS
SURFACE SOIL AND SEDIMENT
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Input Parameter	Media	Units	Input Values	Comments/References
ED, Exposure Duration	All Media	years	25	USEPA, 1991a
IR, Ingestion Rate	Soil/Sediment	mg/day	100	USEPA, 1991a
	Surface Water	L/day	0.05	USEPA, 1989b
EF, Exposure Frequency	All Media	days/yr	250	Professional Judgment
AF, Adherence Factor	Soil/Sediment	mg/cm^2	1.0	USEPA, 1991/1992a
ABS, Dermal Absorption Factor for Organics/Inorganics	Soil/Sediment	unitless	Chemical-specific(1)	USEPA, 1995a
ET, Exposure Time	Soil	hrs/day	8	USEPA, 1991a
	Surface Water	hrs/day	2	Professional Judgment
SA, Surface Area	All Media	cm^2/day	5,300(2)	USEPA, 1992a
PC, Permeability Constant	Surface Water	cm/hr	Chemical-Specific	USEPA, 1992a
FI, Fraction Ingested	Soil/Sediment	unitless	1	USEPA, 1989b
AT_{nc}, Averaging Time - Noncarcinogens	All Media	days	9,125	USEPA, 1989b
AT_c, Averaging Time - Carcinogens	All Media	days	25,550	USEPA, 1989b
BW, Body Weight	All Media	kg	70	USEPA, 1989b
RR, Respiration Rate	Air	m^3/hr	1.25	USEPA, 1991a

Notes:

(1) The The following USEPA Region III default absorbance factors will be applied to estimate dermal intake of COPCs in soil and sediment (USEPA, 1995a):

SVOCs/Pesticides - 10%
Dioxins/Furans - 3% (USEPA, 1992a)
PCBs - 6%
Arsenic - 3.2%
Inorganics - 1%

(2) Skin surface area available for contact assuming an adult wears a short-sleeved shirt, short pants, and shoes.

References:

USEPA, 1995a. Assessing Dermal Exposure from Soil.

USEPA, 1992a. Dermal Exposure Assessment: Principles and Applications - Interim Report.

TABLE 6-4 (Continued)

**EXPOSURE INPUT PARAMETERS FOR CURRENT ON-SITE WORKERS
SURFACE SOIL AND SEDIMENT
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

References (Continued):

USEPA, 1991a. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors." Interim Final.

USEPA, 1989a. Exposure Factors Handbook.

USEPA, 1989b. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A) Interim Final.

TABLE 6-5

EXPOSURE INPUT PARAMETERS FOR
FUTURE ADULT AND ADOLESCENT RECREATIONAL USERS
SEDIMENT
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Input Parameter	Units	Input Values		Comments/References
		Adolescent (7-15 years)	Adult	
ED, Exposure Duration	year	9	30	Professional Judgment
EF, Exposure Frequency	days/year	104[(1)]	104[(1)]	Professional Judgment
IR, Ingestion Rate	mg/day	100	100	USEPA, 1989b
SA, Surface Area	cm^2	15,700[(2)]	20,000[(2)]	USEPA, 1989a/1992a
FI, Fraction Ingested	unitless	0.5	0.5	Professional Judgment
ABS, Absorption Factor	unitless	Chemical Specific[(3)]	Chemical Specific[(3)]	USEPA, 1995a
AF, Adherence Factor	mg/cm^2	1	1	USEPA, 1992a
BW, Body Weight	kg	37	70	USEPA, 1989b
AT_{nc}, Averaging Time - Noncarcinogens	day	3,285	10,950	USEPA, 1989b
AT_c, Averaging Time - Carcinogens	day	25,550	25,550	USEPA, 1989b

Notes:

(1) Frequency conservatively assumes 2 days per weekend, every weekend for 12 months.

(2) Total body surface area is conservatively assumed to be available for exposure.

(3) The following USEPA Region III default absorbance factors will be applied to estimate dermal intake of COPCs in soil and sediment (USEPA, 1995a):
- SVOCs/Pesticides - 10%
- Dioxins/Furans - 3% (USEPA, 1992a)
- PCBs - 6%
- Arsenic - 3.2%
- Inorganics - 1%

References:

USEPA, 1995a. Assessing Dermal Exposure from Soil.

USEPA, 1992a. Dermal Exposure Assessment: Principles and Applications - Interim Report.

USEPA, 1991a. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors." Interim Final.

USEPA, 1989a. Exposure Factors Handbook.

USEPA, 1989b. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A) Interim Final.

TABLE 6-6

EXPOSURE INPUT PARAMETERS FOR FUTURE CONSTRUCTION WORKERS
SUBSURFACE SOIL
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Input Parameter	Units	Input Values	Comments/References
ED, Exposure Duration	years	1	USEPA, 1991a
EF, Exposure Frequency	days/year	250	USEPA, 1991a
ET, Exposure Time	hrs/day	8	USEPA, 1991a
IR, Ingestion Rate	mg/day	480	USEPA, 1991a
SA, Exposed Surface Area	cm^2/day	4,100(1)	USEPA, 1992a
RR, Respiration Rate	m^3/hr	1.25	USEPA, 1989a
FI, Fraction Ingested	unitless	1.0	Professional Judgment
ABS, Dermal Absorption Factor	unitless	Chemical-specific(2)	USEPA, 1995a
AF, Adherence Factor	mg/cm^2	1	USEPA, 1991a/1992a
BW, Body Weight	kg	70	USEPA, 1989b
AT_{nc}, Averaging Time - Noncarcinogens	days	365	USEPA, 1989b
AT_c, Averaging Time - Carcinogens	days	25,550	USEPA, 1989b

Notes:

(1) Skin surface area available for contact for an individual wearing a sleeveless shirt, long pants, and shoes.

(2) The following USEPA Region III default absorbance factors will be applied to estimate dermal intake of COPCs in soil and sediment (USEPA, 1995a):
Arsenic - 3.2%
Inorganics - 1%

References:

USEPA, 1995a. Assessing Dermal Exposure from Soil.

USEPA, 1992a. Dermal Exposure Assessment: Principles and Applications - Interim Report.

USEPA, 1991a. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors." Interim Final.

USEPA, 1989a. Exposure Factors Handbook.

USEPA, 1989b. Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A) Interim Final.

TABLE 6-7

EXPOSURE INPUT PARAMETERS FOR FUTURE RESIDENT CHILDREN AND ADULTS
SURFACE SOIL, GROUNDWATER AND SEDIMENT
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Input Parameter	Media	Units	Input Values		Comments/References
			Child (1 to 6 years)	Adult	
ED, Exposure Duration	All Media	years	6	24	USEPA, 1991a
EF, Exposure Frequency	Soil/Groundwater	days/year	350	350	USEPA, 1991a
	Sediment	days/year	104[(1)]	104[(1)]	Professional Judgment
ET, Exposure Time	Groundwater	hrs/day	0.2	0.2	USEPA, 1989a
IR, Ingestion Rate	Groundwater	L/day	1	2	USEPA, 1991a
	Soil/Sediment	mg/day	200	100	USEPA, 1989b
SA, Surface Area	Groundwater/ Sediment	cm^2	8,023 [(2)]	20,000[(2)]	USEPA, 1992a
	Soil	cm^2	2,006[(3)]	5,300[(3)]	USEPA, 1989a and 1992a
RR, Respiration Rate	Air (Fugitive Dusts)	m^3/hr	0.83	0.83	USEPA, 1991a
FI, Fraction Ingested	Soil/Sediment	unitless	1.0	1.0	USEPA, 1989b/ Professional Judgement
ABS, Absorbance Factor	Soil/Sediment	unitless	Chemical Specific[(4)]	Chemical Specific[(4)]	USEPA, 1995a
AF, Adherence Factor	Soil/Sediment	mg/cm^2	1	1	USEPA, 1992b
BW, Body Weight	All Media	kg	15	70	USEPA, 1989b
PC, Permeability Constant	Groundwater	cm/hr	Chemical-Specific	Chemical-Specific	USEPA, 1992a
AT_{nc}, Averaging Time - Noncarcinogens	All Media	day	2,190	8,760	USEPA, 1989b
AT_c, Averaging Time - Carcinogens	All Media	day	25,550	25,550	USEPA, 1989b

Notes:

(1) Frequency conservatively assumes 2 days per weekend, every weekend for 12 months.

(2) Represents total body surface area.

(3) Represents approximately 25% of the total body surface area.

TABLE 6-7 (Continued)

EXPOSURE INPUT PARAMETERS FOR FUTURE RESIDENT CHILDREN AND ADULTS
SURFACE SOIL, GROUNDWATER AND SEDIMENT
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

(4) The following USEPA Region III default absorbance factors will be applied to estimate dermal intake of COPCs in soil and sediment (USEPA, 1995a):

SVOCs/Pesticides - 10%
Dioxins/Furans - 3% (USEPA, 1992a)
PCBs - 6%
Arsenic - 3.2%
Inorganics - 1%

References:

USEPA, 1995a. Assessing Dermal Exposure from Soil.

USEPA, 1993b. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure

USEPA, 1992a. Dermal Exposure Assessment: Principles and Applications – Interim Report.

USEPA, 1991a. Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors." Interim Final.

USEPA, 1989a. Exposure Factors Handbook.

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TABLE 6-8

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Constituents	Oral CSF (mg/kg/day)$^{-1}$	Inhalation CSF (mg/kg/day)$^{-1}$	Oral RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Oral Absorption Factors	WOE	Target Organ (Systemic Toxicants)	Critical Effect (Systemic Toxicants)
Semivolatiles:								
Acenaphthylene[1]	--	--	4.0E-02 (i)	--	50%	D	--	--
Anthracene	--	--	3.0E-01 (i)	--	50%	D	None observed	--
Benzo(a)anthracene	7.3E-01 (e)	6.1E-01 (e)	--	--	50%	B2	--	--
Benzo(a)pyrene	7.3 (i)	6.1 (w)	--	--	50%	B2	--	--
Benzo(b)fluoranthene	7.3E-01 (e)	6.1E-01 (e)	--	--	50%	B2	--	--
Benzo(k)fluoranthene	7.3E-02 (e)	6.1E-02 (e)	--	--	50%	B2	--	--
Bis(2-ethylhexyl)phthalate	1.40E-02 (i)	--	2.00E-02 (i)	--	50%	B2	Liver	Increased liver weight
Chrysene	7.3E-03 (i)	6.1E-03 (e)	--	--	50%	B2	--	--
Dibenzo(a,h)anthracene	7.3 (e)	6.1 (e)	--	--	50%	B2	--	--
Fluoranthene	--	--	4.00E-02 (i)	--	50%	D	Kidney, liver, blood	Nephropathy, weight changes, hematological changes

TABLE 6-8 (Continued)

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Constituents	Oral CSF (mg/kg/day)-1	Inhalation CSF (mg/kg/day)-1	Oral RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Oral Absorption Factors	WOE	Target Organ (Systemic Toxicants)	Critical Effect (Systemic Toxicants)
Fluorene	--	--	4.00E-02 (i)	--	50%	D	Erythrocytes	Decreased counts
Indeno(1,2,3-cd)pyrene	7.3E-01 (e)	6.1E-01 (e)	--	--	50%	B2	--	--
Phenanthrene[1]	--	--	4.00E-02 (i)	--	50%	D	--	--
Pyrene	--	--	3.00E-02 (i)	--	50%	D	Kidney	Adverse Effects
Dioxins/Furans:								
Total PeCDD[2]	1.56E+05 (i)	1.16E+05 (i)	--	--	90%	B2	--	--
Total HxCDD[2]	1.56E+05 (i)	1.16E+05 (i)	--	--	90%	B2	--	--
Total HxCDF[2]	1.56E+05 (i)	1.16E+05 (i)	--	--	90%	B2	--	--
Pesticides:								
4,4'-DDE	3.4E-01 (a)	--	--	--	90%	B2	--	--
4,4'-DDD	2.4E-01 (i)	--	--	--	90%	B2	--	--
4,4'-DDT	3.4E-01 (i)	3.4E-01 (i)	5.00E-04 (i)	--	90%	B2	Liver	Lesions
alpha-Chlordane[3]	1.3E+00 (i)	1.29E+00 (i)	6.00E-05 (i)	--	50%	B2	Liver	Lesions

TABLE 6-8 (Continued)

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Constituents	Oral CSF (mg/kg/day)$^{-1}$	Inhalation CSF (mg/kg/day)$^{-1}$	Oral RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Oral Absorption Factors	WOE	Target Organ (Systemic Toxicants)	Critical Effect (Systemic Toxicants)
gamma-Chlordane(3)	1.3E+00 (i)	1.29E+00 (i)	6.00E-05 (i)	--	50%	B2	Liver	Lesions
Kepone	1.8E+01 (e)	--	--	--	50%	B2	--	--
PCBs:								
Aroclor-1254(4)	7.7 (i)	--	2.00E-05(3) (i)	--	89%	B2	Immune System	Toxicity
Aroclor-1260(4)	7.70 (i)	--	--	--	89%	B2	--	--
Inorganics:								
Antimony	--	--	4.00E-04 (i)	--	20%	D	Whole Body/Blood	Increased Mortality/ Altered Chemistry
Arsenic	1.5 (i)	15.1 (i)	3.00E-04 (i)	--	95%	A	Skin	Keratosis/ Hyperpigmentation
Beryllium	4.30 (i)	8.40 (i)	5.00E-03 (i)	--	1%	B2	--	None Observed
Cadmium (water)	--	6.30 (i)	5.00E-04 (i)	--	5%	B1	Renal Cortex	Significant Proteinuria
Cadmium (food)	--	6.30 (i)	1.00E-03 (i)	5.71E-05 (e)	2.5%	B1	Renal Cortex	Significant Protenuria
Copper	--	--	4.00E-02 (e)	--	60%	D	Gastrointestinal System	Irritation
Lead	--	--	--	--	--	B2	--	--

TABLE 6-8 (Continued)

HUMAN HEALTH RISK ASSESSMENT TOXICITY FACTORS
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Constituents	Oral CSF (mg/kg/day)⁻¹	Inhalation CSF (mg/kg/day)⁻¹	Oral RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Oral Absorption Factors	WOE	Target Organ (Systemic Toxicants)	Critical Effect (Systemic Toxicants)
Mercury	--	--	3.00E-04 (h)	8.57E-05 (h)	15%	D	Kidney/ Nervous System	Adverse Effects/ Neurotoxicity
Nickel	--	--	2.00E-02 (i)	--	4.3%	D	Major Whole Body Organs	Decreased Weight
Zinc	--	--	3.00E-01 (i)	--	25%	D	Blood	Decreased Blood Enzyme

Notes:

(1) Toxicity criteria for naphthalene used in the absence of chemical-specific toxicity criteria.
(2) Toxicitiy criteria for 2,3,7,8-TCDD used in the absence of congener-specific toxicity criteria. In addition, 2,3,7,8-TCDD toxicity equivalent factors (TECs) of 0.5, 0.10 and 0.10 were applied to detected total PeCDD, total HxCDD and total HxCDF concentrations in calculations of risk.
(3) Toxicity criteria for chlordane used in the absence of chemical-specific toxicity criteria.
(4) Cancer slope factor for polychlorinated biphenyls used for Aroclor-1254 and Aroclor-1260.
i = Integrated Risk Information System (IRIS), 1996.
e = EPA-NCEA (as cited from USEPA, Region III RBC Tables, January-June 1996).
h = Health Effects Assessment Summary Tables (HEAST), May, 1995.
a = HEAST Alternative Method, 1995.
w = Withdrawn from IRIS or HEAST.
-- = Information not published

TABLE 6-9

INCREMENTAL LIFETIME CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs) FOR CURRENT ON-SITE WORKERS SWMU11 NAVAL STATION ROOSEVELT ROADS PUERTO RICO

Medium/Pathway	Current On-site Worker	
	ILCR	HI
Sediment		
Ingestion	4.3×10^{-5}	0.02
Dermal Contact	6.6×10^{-4}	0.06
TOTAL	7.0×10^{-4} (1)	0.08

Notes:

(1) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene (73% risk contribution) in sediment.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-10

INCREMENTAL LIFETIME CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR CURRENT ON-SITE WORKERS
AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Medium/Pathway	Current On-site Worker	
	ILCR	HI
Surface Soil		
Ingestion	1.2×10^{-5}	0.03
Dermal Contact	1.3×10^{-4}	0.02
Inhalation(1)	9.5×10^{-9}	<0.01
TOTAL	1.4×10^{-4} (2)	0.05

Notes:

(1) Inhalation of fugitive dusts.
(2) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene, beryllium, benzo(b)fluoranthene, 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT, (29%, 26%, 7%, 9%, 5%, and 6% risk contributions, respectively) in surface soil. However, the individual ILCRs for these COPCs are within USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-11

INCREMENTAL LIFETIME CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR CURRENT ON-SITE WORKERS
AOC C
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

Medium/Pathway	Current On-site Worker	
	ILCR	HI
<u>Surface Soil</u>		
Ingestion	7.0×10^{-3}	0.05
Dermal Contact	6.3×10^{-2}	0.04
Inhalation(1)	1.5×10^{-8}	<0.01
TOTAL	7.0×10^{-2} (2)	0.09

Notes:

(1) Inhalation of fugitive dusts.
(2) Total ILCR exceeded USEPA's target risk range due to ingestion and dermal exposures to Aroclor-1260 (greater than 99% risk contribution for both pathways) in surface soil.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-12

**INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR CURRENT ADULT AND ADOLESCENT RECREATIONAL USERS
SWMU 2
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

	Recreational Users			
	Adult		Adolescent	
Pathway	ICR	HI	ICR	HI
Sediment				
Ingestion	9.4×10^{-6}	<0.01	5.3×10^{-6}	0.01
Dermal Contact	2.4×10^{-4}	0.60	1.1×10^{-4}	0.90
TOTAL	2.5×10^{-4} (1)	0.60	1.2×10^{-4} (1)	0.91

Notes:

(1) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene, total HxCDD and total PeCDD (41%, 25% and 10% risk contributions, respectively) in sediment. However, individual ILCRs are within USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-13

**INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR CURRENT ADULT AND ADOLESCENT RECREATIONAL USERS
SWMU 11
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

	Recreational Users			
	Adult		Adolescent	
Pathway	ICR	HI	ICR	HI
<u>Sediment</u>				
Ingestion	2.2×10^{-5}	<0.01	1.2×10^{-5}	0.02
Dermal Contact	1.6×10^{-3}	0.13	7.2×10^{-4}	0.19
TOTAL	1.6×10^{-3} (1)	0.13	7.3×10^{-4} (1)	0.21

Notes:

(1) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene and dibenzo(a,h)anthracene (73% and 13% risk contributions, respectively) in sediment.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-14

**INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR CURRENT ADULT AND ADOLESCENT RECREATIONAL USERS
SWMU 13
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

Pathway	Recreational Users			
	Adult		Adolescent	
	ICR	HI	ICR	HI
<u>Sediment</u>				
Ingestion	3.0×10^{-6}	0.02	1.7×10^{-6}	0.04
Dermal Contact	1.5×10^{-4}	1.1	6.5×10^{-5}	1.7
TOTAL	1.5×10^{-4} (1)	1.1 (2)	6.7×10^{-5}	1.7 (3)

Notes:

(1) Total ILCR exceeded USEPA's target risk range due to dermal exposures to 4,4'DDE, 4,4'DDT and benzo(a)pyrene (31%, 48% and 14% risk contributions, respectively) in sediment. However, individual ILCRs are within USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

(2) Total HI exceeded USEPA's acceptable target value of 1.0 due to dermal exposure to 4,4'DDT (84% risk contribution). However, the HQ for this compound is less than 1.0.

(3) Total HI exceeded USEPA's acceptable target value of 1.0 due to dermal exposure to 4,4'DDT (84% risk contribution). The HQ for this compound was also greater than 1.0.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-15

INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR CURRENT ADULT AND ADOLESCENT RECREATIONAL USERS
AOC D
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

	Recreational Users			
	Adult		Adolescent	
Pathway	ICR	HI	ICR	HI
<u>Sediment</u>				
Ingestion	2.9×10^{-5}	0.02	1.7×10^{-5}	0.03
Dermal Contact	1.8×10^{-3}	0.73	7.8×10^{-4}	1.1
TOTAL	1.8×10^{-3} (1)	0.73	7.8×10^{-4} (1)	1.1 (2)

Notes:

(1) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene, dibenzo(a,h)anthracene and benzo(b)fluoranthene (67%, 12% and 7% risk contributions, respectively) in sediment. Individual ILCRs also exceeded USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4} for adults.

(2) Total HI exceeded USEPA's acceptable target value of 1.0 due to dermal exposure to mercury (67% risk contribution) in sediment. However, the HQs for this element are less than 1.0.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-16

INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS
SWMU 2
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

	Residents			
	Adult		Young Child	
Pathway	ICR	HI	ICR	HI
Sediment				
Ingestion	1.5×10^{-5}	0.01	3.5×10^{-5}	0.13
Dermal Contact	1.9×10^{-4}	0.60	9.0×10^{-5}	1.1
TOTAL	2.0×10^{-4} (1)	0.61	1.2×10^{-4} (1)	1.2 (2)

Notes:

(1) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene, total HxCDD and total PeCDD (40%, 25% and 10% risk contributions, respectively) in sediment. However, individual ILCRs are within USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}. For child, pathway risks are within USEPA's acceptable target risk range.

(2) Total HI exceeded USEPA's acceptable target value of 1.0 due to dermal exposure to mercury (81% risk contribution) in sediment. However, the HQs for this element are less than 1.0.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-17

INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS
SWMU 11
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

	Residents			
	Adult		Young Child	
Pathway	ICR	HI	ICR	HI
<u>Sediment</u>				
Ingestion	3.5×10^{-5}	0.02	8.1×10^{-5}	0.17
Dermal Contact	1.3×10^{-3}	0.13	6.0×10^{-4}	0.24
TOTAL	1.3×10^{-3} (1)	0.15	6.8×10^{-4} (1)	0.41

Notes:

(1) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene, and dibenzo(a,h)anthracene (72% and 13% risk contributions, respectively) in sediment. Individual ILCRs for these compounds exceeded USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-18

INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs) FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS SWMU 13 NAVAL STATION ROOSEVELT ROADS PUERTO RICO

	Residents			
	Adult		Young Child	
Pathway	ICR	HI	ICR	HI
Surface Soil				
Ingestion	7.1×10^{-6}	0.04	1.6×10^{-5}	0.36
Dermal Contact	3.5×10^{-5}	0.14	1.5×10^{-5}	0.24
Inhalation (1)	1.1×10^{-8}	--	1.2×10^{-8}	--
Subtotal	4.2×10^{-5}	0.18	3.1×10^{-5}	0.60
Sediment				
Ingestion	4.9×10^{-6}	0.04	1.1×10^{-5}	0.42
Dermal Contact	1.2×10^{-4}	1.1	5.4×10^{-5}	2.1
Subtotal	1.6×10^{-4}	1.1	6.5×10^{-5}	2.5
TOTAL	1.4×10^{-4} (2)	1.3 (3)	9.6×10^{-5}	3.1 (4)

Notes:

(1) Inhalaton of fugitive dust.

(2) Total ILCR exceeded USEPA's target risk range due to dermal exposures to 4,4'DDE, 4,4'DDT and benzo(a)pyrene (31%, 48% and 14% risk contributions, respectively) in sediment. However, individual ILCRs are within USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

(3) Total HI exceeded USEPA's acceptable target value of 1.0 due to dermal exposure to 4,4'DDT (84% risk contribution). However, the HQ for this compound is less than 1.0.

(4) Total HI exceeded USEPA's acceptable target value of 1.0 due to dermal exposure to 4,4'DDT (84% risk contribution). The HQ for this compound was also greater than 1.0.

-- Scenario not evaluated due to lack of available toxicity criteria.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-19

INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS
SWMU 32
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO

	Residents			
	Adult		Young Child	
Pathway	ICR	HI	ICR	HI
Surface Soil				
Ingestion	1.1×10^{-5}	0.19	2.5×10^{-5}	1.7
Dermal Contact	5.9×10^{-5}	1.1	2.6×10^{-5}	1.9
Inhalation (1)	1.2×10^{-9}	--	1.2×10^{-9}	--
TOTAL	7.0×10^{-5}	1.3 (2)	5.1×10^{-5}	3.6 (2)

Notes:

(1) Inhalation of fugitive dusts.

(2) Total HI exceeded USEPA's acceptable target value of 1.0 due to ingestion and dermal exposures to Aroclor-1254 (greater than 95% risk contributions for both pathways) in surface soil.

-- Scenario not evaluated due to lack of available toxicity criteria.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-20

**INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS
SWMU 46
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

Pathway	Residents			
	Adult		Young Child	
	ICR	HI	ICR	HI
Surface Soil				
Ingestion	1.8×10^{-5}	<0.01	4.3×10^{-5}	0.07
Dermal Contact	1.4×10^{-4}	0.02	6.2×10^{-5}	0.03
Inhalation (1)	4.3×10^{-9}	<0.01	5.0×10^{-9}	<0.01
TOTAL	1.6×10^{-4} (2)	0.02	1.0×10^{-4}	0.10

Notes:

(1) Inhalation of fugitive dusts.

(2) Total ILCR exceeded the upper limit of USEPA's target risk range due to dermal exposures to Aroclor-1260 and benzo(a)pyrene (56% and 23% risk contributions, respectively) in surface soil. However, the individual ILCRs for these compounds are within USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-21

**INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS
AOC B
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

	Residents			
	Adult		Young Child	
Pathway	ICR	HI	ICR	HI
Surface Soil				
Ingestion	3.2×10^{-5}	0.08	7.6×10^{-5}	0.79
Dermal Contact	2.3×10^{-4}	0.32	1.0×10^{-4}	0.56
Inhalation (1)	2.5×10^{-8}	<0.01	3.0×10^{-8}	<0.01
TOTAL	2.6×10^{-4} (2)	0.40	1.8×10^{-4} (2)	1.4 (3)

Notes:

(1) Inhalation of fugitive dusts.

(2) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene, beryllium, benzo(b)fluoranthene, 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT, (29%, 26%, 7%, 9%, 5%, and 6% risk contributions, respectively) in surface soil. However, the individual ILCRs for these COPCs are within USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4}.

(3) Total HI estimated for child exceeded USEPA's acceptable target value of 1.0 due to ingestion exposures to 4,4'-DDT and arsenic (46% and 54% risk contributions, respectively), and also to dermal exposure to 4,4'-DDT and arsenic (72% and 26% risk contributions, respectively) in surface soil. However, the total HIs estimated for the individual exposure pathways are less than 1.0.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-22

**INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS
AOC C
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

Pathway	Residents			
	Adult		Young Child	
	ICR	HI	ICR	HI
Surface Soil				
Ingestion	1.9×10^{-2}	0.14	4.4×10^{-2}	1.3
Dermal Contact	1.0×10^{-1}	0.63	5.0×10^{-2}	1.1
Inhalation (1)	4.1×10^{-8}	<0.01	4.7×10^{-8}	<0.01
TOTAL	1.2×10^{-1} (2)	0.77	9.4×10^{-2} (2)	2.4 (3)

Notes:

(1) Inhalation of fugitive dusts.

(2) Total ILCR exceeded USEPA's target risk range due to ingestion and dermal exposures to Aroclor-1260 (greater than 99% risk contribution for both pathways) in surface soil.

(3) Total HI exceeded USEPA's acceptable target value of 1.0 due to the ingestion of arsenic, 4,4'-DDT, alpha-chlordane, and gamma-chlordane (63%, 11%, 14%, and 12% risk contribution, respectively) in surface soil. The dermal pathway also contributed to the exceedence of USEPA's acceptable target value due to the presence of arsenic, 4,4'-DDT, alpha-chlordane, and gamma-chlordane (25%, 14%, 32%, and 29% risk contribution, respectively) in surface soil. However, the HQs estimated for the individual COPCs were less than 1.0.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-23

**INCREMENTAL CANCER RISKS (ILCRs) AND HAZARD INDICES (HIs)
FOR FUTURE ADULT AND YOUNG CHILD RESIDENTS
AOC D
NAVAL STATION ROOSEVELT ROADS
PUERTO RICO**

	Residents			
	Adult		Young Child	
Pathway	ICR	HI	ICR	HI
<u>Sediment</u>				
Ingestion	4.7×10^{-5}	0.03	1.1×10^{-4}	0.3
Dermal Contact	1.4×10^{-3}	0.73	6.6×10^{-4}	1.4
TOTAL	1.4×10^{-3} (1)	0.76	7.4×10^{-4} (1)	1.7 (2)

Notes:

(1) Total ILCR exceeded USEPA's target risk range due to dermal exposures to benzo(a)pyrene, dibenzo(a,h)anthracene and benzo(b)fluoranthene (67%, 12% and 7% risk contributions, respectively) in sediment. Individual ILCRs also exceeded USEPA's acceptable target risk range of 1×10^{-6} to 1×10^{-4} for adults.

(2) Total HI exceeded USEPA's acceptable target value of 1.0 due to dermal exposure to mercury (67% risk contribution) in sediment. However, the HQs for this element are less than 1.0.

Shading indicates exceedence of USEPA acceptable target risk criteria by total risk value.

TABLE 6-24

SUMMARY OF UNCERTAINTIES IN THE RESULTS OF THE HUMAN HEALTH RISK ASSESSMENT NAVAL STATION ROOSEVELT ROADS PUERTO RICO

	Potential Magnitude for Over-Estimation of Risks	Potential Magnitude for Under-Estimation of Risks	Potential Magnitude for Over or Under-Estimation of Risks
Environmental Sampling and Analysis Sufficient samples may not have been taken to characterize the media being evaluated.			Low
Systematic or random errors in the chemical analysis may yield erroneous data.			Low
Selection of COPCs The use of USEPA Region III COPC screening concentrations in selecting COPCs in soil, groundwater and sediments.			Low
The use of SSVs in selecting COPCs for human health evaluation.	Low		
Exposure Assessment The standard assumptions regarding body weight, exposure period, life expectancy, population characteristics, and lifestyle may not be representative of the actual exposure situations.			Moderate
The use of the maximum detected concentration in the estimation of the RME.	Moderate		
Assessing future residential property use when the likelihood of residential development is low.	High		
The amount of media intake is assumed to be constant and representative of any actual exposure.			Low
Toxicological Assessment Toxicological indices derived from high dose animal studies, extrapolated to low dose human exposure.	Moderate		
Lack of promulgated toxicological indices for lead.		Low	
Risk Characterization Assumption of additivity in the quantitation of cancer risks without consideration of synergism, antagonism, promotion and initiation.			Moderate
Assumption of additivity in the estimation of systemic health effects without consideration of synergism, antagonism, etc.			Moderate

TABLE 6-24 (Continued)

SUMMARY OF UNCERTAINTIES IN THE RESULTS OF THE HUMAN HEALTH RISK ASSESSMENT NAVAL STATION ROOSEVELT ROADS PUERTO RICO

	Potential Magnitude for Over-Estimation of Risks	Potential Magnitude for Under-Estimation of Risks	Potential Magnitude for Over or Under-Estimation of Risks
Additivity of risks by individual exposure pathways (dermal and ingestion and inhalation).	Low		Low
No quantitative evaluation of risks resulting from lead exposures.		Low	

Notes:

Low - Assumptions categorized as "low" may effect risk estimates by less than one order of magnitude.

Moderate - Assumptions categorized as "moderate" may effect estimates of risk by between one and two orders of magnitude.

High - Assumptions categorized as "high" may effect estimates of risk by more than two orders of magnitude.

Reference:

Risk Assessment Guidance for Superfund, Volume 1, Part A: Human Health Evaluation Manual. USEPA, 1989b.

7.0 CONCLUSIONS AND RECOMMENDATIONS

There have been Phase I RFIs conducted at OU 1, 6, and 7 which encompassed the SWMUs and AOCs where this type of initial investigation was mandated in the Final RCRA Permit. The investigations were conducted in accordance with the EPA approved workplan and, therefore, provide the information that is required to determine whether an individual SWMU or AOC requires further RFI efforts. In all cases, the various potentially impacted environmental media were sampled and these samples were analyzed in a third party laboratory. Analytical results were subjected to third party, independent, data validation. The data was subsequently compared to various applicable criteria and were fully assessed in terms of risk posed to human health or the environment. Based on the analytical results and risk assessments, conclusions regarding releases to the environment can be drawn.

7.1 Phase I RFI Conclusions and Recommendations for OU 1

The conclusions and recommendations have been broken down by SWMU to allow ease of review. Operable Unit 1 is comprised of SWMUs 6, 10, 12, 13, 14, 23, 24, 25, 26, 30, 31, 32, 37, 39, 46 and 51. Also included in OU 1 is AOC C. Each of these SWMUs/ AOCs is discussed separately.

7.1.1 SWMU 6 - Building 145

This SWMU has been incorporated into OU 6 because of its location and the fact that the investigations intended for the site jointly assess AOC B. Therefore, SWMU 6 will be discussed with OU 6.

7.1.2 SWMU 10 - Substation 2/Building 90

Conditions Found

This site was known to have a PCB contamination problem in the soils prior to issuance of the RCRA Permit for NSRR. An Interim Remedial Action was undertaken in 1995 to remove the PCB contaminated soils. The closeout report (OHM Remediation Services and Metcalf & Eddy, Inc., 1995) was provided to the EPA in May of 1995. Goals established in the EPA approved workplans for the Interim Remedial Action were achieved, thereby mitigating the risks posed by the soils. This left the underlying groundwater as the only potentially affected media for which no information was available. Therefore, a Phase I RFI for groundwater was undertaken at SWMU 10.

PCBs were not detected in the groundwater at this site in the one sample upon which analysis for PCBs was conducted. Originally, three samples were to be analyzed for PCBs; however, two of the sampling points failed to produce sufficient water for analysis.

Mitigating Factors

The sample which was analyzed for PCBs is immediately adjacent to and downgradient from the area where deepest excavation was necessary to remove PCB contaminated soil. Bedrock is extremely shallow in the area (0-10 feet) and groundwater occurrence is limited as seen from the two sampling points which contained insufficient water for sampling. There are no groundwater users between the site and Ensenada Honda since the water is brackish and unsuited for use.

There were some VOCs and SVOCs found in the three samples. Compounds seen (e.g. acetone, methylene chloride [known ubiquitous laboratory artifacts], chloroform [found in the blank samples] and di-n-butylphthalate [plastizier]) do not appear to be site related and are more likely sampling and laboratory artifacts.

Conclusion

There is no evidence of groundwater impact related to the waste management activities which took place at this SWMU.

Recommendation

No further RFI or Corrective Measure Evaluation is needed for SWMU 10.

7.1.3 SWMU 12 - Fire Training Pit Oil/Water Separator

Conditions Found

A total of four samples were taken from the soil immediately surrounding the unit. There were no signs of spills or releases at the time of the investigation. The risk assessment identified no COPCs for this unit. Extremely low levels of gasoline were detected in two samples.

Mitigating Factors

The area is well managed and only used infrequently during training exercises. This minimizes the potential for overtopping and release of potential contaminants. The presence of the low levels of gasoline range petroleum hydrocarbons are likely an indication of lawn maintenance rather than a release from the unit in which gasoline is not now burned.

Conclusion

There is no evidence of release associated with this SWMU.

Recommendation

No further RFI or Corrective Measure Evaluation is needed for this SWMU.

7.1.4 SWMU 13 - Old Pest Control Shop/Building 258

This area has been previously investigated and indications were that releases of pesticides had occurred. It was the purpose of the Phase I RFI to confirm the findings of the previous work.

Two environmental media were sampled: surface soil; and sediment (from an associated drainage ditch). SVOCs and pesticides above applicable criteria were found in both media. It is likely that the SVOCs present result from past pesticide management practices. Often, pesticides were mixed with oil to increase their ability to adhere to vegetation and reduce percolation into the subsurface. The SVOCs probably result from this process, with any VOCs originally present having long since volatilized or degraded. In addition, arsenic, at levels above the residential RBC, was found in the area where elevated levels of arsenic were previously seen. Both the environmental and human health risk assessments concluded there were unacceptable risks.

Mitigating Factors

The primary carcinogenic risk driver at the site is potential exposure to unacceptable levels of pesticides and benzo(a)pyrene in the ditch sediment for "current adult recreational users" and "future adult residents." The waterway investigated is a drainage ditch which is ephemeral and not subject to recreational use. The area in question is remote from any base housing and is surrounded by industrial use property. This effectively limits any possibility of future use as a residential area.

Noncarcinogenic risks were unacceptable for "current adult and adolescent recreational users" as well as "future adult and child residents" based on potential dermal exposure to 4,4'-DDT, DDE and benzo pyrene in sediment. As indicated previously, the area is not recreational and future residential use is highly unlikely.

It should be noted that no unacceptable human health risks were calculated for any constituents in the soil (including arsenic).

The environmental risk assessment concluded that impact to the environment was likely as a result of pesticides and SVOCs in the sediments. Natural processes of biodegradation do act on the SVOCs and pesticides, albeit very slowly. It is expected that, given enough time, the levels of the COPCs will decline, certainly below calculated risk levels. Also, the mobility of pesticides and SVOCs is very low indicating that the potential for further migration is relatively small. Finally, there is no significant aquatic community in this drainage since it is often dry.

Conclusions

Past pesticide management at this site has impacted surface soils and drainage ditch sediments. Unacceptable environmental and human health risks are posed by the SVOC and pesticide levels seen in sediments.

Recommendations

1. Based on the findings of the Phase I RFI, there are two recommendations for further activities at this SWMU:
   - Install downgradient monitoring wells to assess whether contamination in the surface soils/sediments has migrated to the water table.
   - Sample sediments further downgradient of the former building location to assess how for contaminants may have migrated.

2. There is no unacceptable risk posed by the surface soils (including the somewhat elevated arsenic concentration area); therefore, no further action in the form of additional characterization or corrective measure is required for soils.

3. Following the completion of additional ditch sediment characterization, the Navy will assess site conditions. Should it appear warranted, an Interim Corrective Measure addressing sediment contamination may be proposed. This step will only be taken after full consultation with the EPA.

7.1.5 SWMU 14 - Fire Training Pit Area

Conditions Found

A total of five soil sampling locations were selected based on the results of a soil gas monitoring program. No VOCs or SVOCs were found in any sample.

Mitigating Factors

No release was evident.

Conclusions

There has been no release of hazardous waste or hazardous constituents from this unit.

Recommendations

No further action, either characterization or corrective measure, is needed at this SWMU.

7.1.6 SWMU 23 - Oil Spill Separator Tanks

Conditions Found

One soil sample exhibited a concentration of benzo(a)pyrene that exceeded the residential RBC; however, this concentration did not trigger an unacceptable human health risk. Diesel range hydrocarbons were found at low levels in both samples.

Mitigating Factors

The area is immediately adjacent to the pier in an industrial zone. Because of its location, the site will never be utilized for residential development. Benzo(a)pyrene was detected below the industrial RBC. The compounds detected are amenable to biodegradation as a natural process, albeit a slow one. There were no visible signs of releases.

Conclusions

The concentrations of TPH and other miscellaneous organic constituents is evidence of deminimus releases from the unit probably in the form of minimal splashing during operations.

Recommendations

No further characterization efforts or corrective measures are required at this unit. It is recommended that some type of splash guard be installed on the southeast side of the containment pad area do prevent minor releases of petroleum product.

7.1.7 SWMU 24 - Oil Spill Oil/Water Separator and Adjoining Pad

Conditions Found

The only constituent found in the soil sample which cannot be explained as a laboratory artifact or that was not also found in associated blank samples was a trace level of trichloroethene in the single sample taken. No levels of TPH were detected.

Mitigating Factors

The area of grass adjoining the oil water separator is extremely small and is directly in the middle of an industrial use area. When not in use, the area is fenced in, preventing casual contact. The risk assessment did not identify any COPCs. Finally, trichloroethene is not a constituent of the wastes managed in the unit, which are limited to fuels spilled and subsequently recovered and may be present as a result of hand equipment clean-up.

Conclusions

There is no evidence of significant releases from this unit.

Recommendations

No further site characterization or corrective measures evaluation is required.

7.1.8 SWMU 25 - DRMO Storage Yard

Conditions Found

Bis (2-ethylhexyl) phthalate and benzo(a)pyrene exceeded the residential RBC in one soil sample each. Arsenic exceeded the residential RBC in four of nine soil samples. None of these constituents exceeded the industrial RBC. No unacceptable human health risk was posed by the constituents detected.

The sediment sample generated no human health risk but does have the minor potential for ecological impact.

Mitigating Factors

The area is totally devoted to industrial use with essentially no potential for development into residential use. Pavement has been completed over much of the area, and the remainder is scheduled to be paved in the near future. The concentration of SVOCs seen in the soil (at levels below their industrial RBCs) will continue to be reduced by natural, in situ, biodegradation. A similar fate will be meet by the compounds found in the sediment.

Conclusions

There is no evidence of a significant release or potential for a future release from this SWMU. Constituents that were identified were at levels below the applicable industrial RBC.

Recommendations

Based on the findings of the Phase I RFI and the mitigating factors, there is no need for further site characterization or corrective measure evaluation at this SWMU.

7.1.9 SWMU 26 - Building 544 Area

Conditions Found

Metals, SVOCs and pesticides were detected at various concentrations in the study area. Only two constituents (arsenic and beryllium) exceeded the applicable residential RBC in soil. No constituents exceeded their industrial RBCs. No unacceptable human health or ecological risks were calculated for the site.

Mitigating Factors

The area is in a remote section of the base, well away from any family residential areas. Most recently, the general area was used as a contractor laydown area for some nearby construction. This has been completed and the area is presently clean and unused.

Conclusions

No risk is posed by the constituents which are present at the site. The drums originally causing this area to be labeled a SWMU have long since been removed so there is no potential for a future release.

Recommendations

No further site characterization or corrective measures evaluation efforts are necessary at this SWMU.

7.1.10 SWMU 30 - Former Incinerator Area

Conditions Found

Trace organics (probable laboratory and/or decontamination artifacts) were found in one soil sample. Aroclor - 1260 was detected below the residential RBC in two soil samples. Various metals were detected in all surface soil samples. All detected constituents were present at concentrations below the applicable residential RBC, with the exception of the PCB, which was well below the industrial RBC, but slightly above the residential.

No unacceptable human health risk was calculated for any constituents in surface soils or groundwater.

Mitigating Factors

This SWMU occupies a thin strip of land between a steep rock slope and the Base Landfill access road. Immediately across the road is the wastewater treatment plant and 100 yards down the road is the start of the Base landfill. Given these conditions, the site will not be subjected to development for residential use.

Conclusions

Based on the lack of calculated risk, there appears to be no significant release associated with this SWMU. The incinerator has remained unused for years and will not be used in the future; thereby, removing the potential for future release.

Recommendations

There are no further site characterization or corrective measure evaluation efforts required at this unit.

7.1.11 SWMU 31 - Waste Oil Collection Area/Buildings 31 and 2022

Conditions Found

Building 31

Building 31 samples showed detections of some SVOCs and pesticides in soils. Dioxins were found in one sample at low levels. Various metals and metalloids were detected, as would be expected in total constituent analyses. Only one sample showed 4,4'-DDD at levels exceeding the applicable residential RBC (the industrial RBC was not exceeded). Arsenic exceeded the residential RBC (but not the industrial) in two samples. Aroclor 1260 was present on two samples below the residential RBC. No unacceptable human health risk was calculated for these samples.

Building 2022

SVOCs were detected at low levels in various soil samples as were metals. Beryllium, the only constituent to exceed the residential RBC, is consistently present in the subsurface samples. It did not exceed the industrial RBC. No unacceptable human health risks were calculated for this unit.

Mitigating Factors

Building 31

The area is now primarily used for the storage of vehicles and is entirely within an industrial area. There is no potential for future release since the materials once stored there were removed long ago.

Building 2022

The area is being totally reconstructed as part of a MCON project associated with a base-wide SPCC upgrade. {Note: this planned construction was reported in the "RCRA Facility Permit Required Quarterly Progress Report" for the period of November 1, 1995 to January 31, 1996.} When constructed, the potential for future releases form the unit will be minimized. The entire area around the pad is paved, thus allowing no pathway for exposure to subsurface soils.

Conclusions

There is some evidence of minor releases from the two areas comprising SWMU 31; however, no human health risks were calculated and all constituents detected were at levels well below their respective industrial RBCs.

Recommendations

There is no further need for site characterization or corrective measure evaluation efforts at this SWMU.

7.1.12 SWMU 32 - PWD Storage Yard/Battery Collection Area/Building 31

Conditions Found

Surface soil contained a number of SVOCs at levels below their residential RBCs. Miscellaneous metals were also detected at levels expected for total constituent analyses of soils. Aroclor-1254 exceeded the residential RBC, but was two orders of magnitude below the industrial RBC. Arsenic exceeded the residential RBC in four samples, but was detected at concentrations well below the industrial RBC.

The human health risk assessment concluded that "Potentially unacceptable noncarcinogenic risks were estimated for future adult and child residents that would result predominately from accidental ingestion and dermal exposures to Aroclor-1254 in the surface soil."

Mitigating Factors

The area constituting SWMU 32 is fully within the Public Works storage yard, an industrial use area located within the primary industrial/warehouse area of the base. As such, there are no plans to develop the site for residential use, nor is there any scenario under which this can be reasonably envisioned. There is no potential for future releases from the area since the material stored there, which caused the site to be classified as a SWMU, has long since been removed.

Conclusions

Evidence of previous minor releases from this site was found during the Phase I RFI . All constituents detected were below industrial RBCs. No unacceptable risk is posed by the site since there is no reasonable scenario under which this site would be used for residential development.

Recommendations

The prior minor releases evident at this SWMU do not require remediation based on the lack of risk posed by the concentrations present (which, it should be noted, will slowly decrease over time through the process of natural biodegradation). Therefore, there are no further site characterization or corrective measure evaluation efforts required at this SWMU.

7.1.13 SWMU 37 - Waste Oil Storage Area/Building 200

Conditions Found

A significant number of SVOCs were detected in surface soils. A small subset of this number exceeded the applicable residential RBCs. Aroclor-1260 was detected in two samples, one detected concentration exceeded the residential RBC. No constituent found at the SWMU exceeded its industrial RBC. No unacceptable human health risks were calculated for this SWMU.

Mitigating Factors

The site is in the "air ops" area, where access is severely restricted. Since it is adjacent to active flight lines, no residential development will occur.

The contaminants seen are organics and are, therefore, subject to natural attenuation through biodegradation. This process will reduce the concentrations of the compounds over time (albeit slowly) further reducing any risk.

Conclusions

There appear to have been minor releases of petroleum products to the surface soils immediately adjacent to the storage unit. The concentrations seen do not indicate a pattern of disposal or widespread spillage, but are more likely to represent minor container transference spills. The potential for continuing or future release is relatively high.

Recommendations

Further site characterization is not necessary at this site based on the low levels of constituents detected. Also, no corrective measures appear warranted since no compounds exceed their respective industrial RBCs.

Based on the potential for future release, one recommendation is made regarding the unit. Containment dikes should be placed on the pavement in the area southeast of the "covered storage"area. This would minimize the risk of spills reaching the soils and would make clean-up of any operational spillage within the unit much easier to address.

7.1.14 SWMU 39 - Building 3158 - Former Battery Drain Area

Conditions Found

Miscellaneous metals and metalloids were detected on the surface soil samples from this SWMU. Only arsenic in a single sample exceeded the residential RBC (but not the industrial RBC). No unacceptable human health risk was calculated for soils at this SWMU.

Mitigating Factors

This SWMU is located within the Seabee industrial compound where the heavy equipment is staged for maintenance activities. There are no plans to use the area for residential development nor is there any reasonable scenario under which this would be considered.

Conclusions

There is no evidence of release from this unit and no potential for future release since the unit is no longer used for battery management.

Recommendations

No further site characterization or corrective measure evaluation efforts are required at this unit.

7.1.15 SWMU 46 - Pole Storage Yard Covered Pad

Conditions Found

A number of surface soil samples contained levels of SVOCs that exceeded their respective residential RBCs. Arcolor 1260 concentrations exceeded the industrial RBC in three samples and the residential RBC in six other samples. The human health risk assessment found that "Potentially unacceptable carcinogenic risks were estimated for future adult residents that would result predominantly form dermal exposures to Aroclor-1260 and benzo(a)pyrene in surface soils." There was no unacceptable risk posed to the on-site worker based on the concentrations seen.

The two borings, made in the "Area Formerly Designated Contaminated Soil Area", detected only one instance of arsenic above its residential RBC.

Mitigating Factors

SWMU 46 is located in a small area with steep slopes rising vertically on two sides and Building 2326 on another side. The site is within the industrial area of the base and is not amenable to being used for residential development because of its location and smallness of area. The area is totally enclosed by a secure fence.

The contaminants seen are subject to natural biodegradation processes in the soil. Over time, the concentrations of the compounds will decrease through these processes, albeit slowing and relatively unpredictably.

Conclusions

The findings of the Phase I RFI indicate that releases from the unit have occurred. The only calculated risk to human health that proved unacceptable was for future residents; no unacceptable risk was calculated for on-site workers. The site is not amenable to development as a residential area; therefore, no unacceptable risk is posed by the site.

No releases were detected in the area formerly designated "Contaminated Soil Area."

Recommendations

No remediation of the detected releases appears warranted, since there is no unacceptable risk. Therefore, there are no further site characterization or corrective measure evaluation efforts required for this SWMU.

7.1.16 SWMU 51 - New AIMD Storage Pad/Building 379

Conditions Found

A number of semi-volatile constituents were detected (primarily in two adjacent samples) in the surface soils immediately off the paved area. Only one SVOC (n-nitrosodimethylamine) exceeded its residential RBC; however, did not exceed the industrial RBC. No unacceptable human health risks were estimated for this SWMU.

Mitigating Factors

The entire area surrounding the storage pad comprising SWMU 51 is paved, heavily used for operations equipment parking, and heavily trafficked by vehicles and equipment. The SVOCs seen in the samples are likely a result of the area's use rather than a release from the SWMU itself. Similar profiles of SVOC detections are often seen in drainage ditches along roadways and parking lots and result largely from vehicle exhaust.

SVOCs are subject to natural biodegradation and the concentrations seen should decrease over time. The area is certainly one of industrial use, and no compound was found to be in exceedance of its industrial RBC. There were no visible signs of ongoing or former releases associated with the SWMU seen during the investigation.

Conclusions

The detected constituents appear to be related to general site use rather than a release from the SWMU. No unacceptable risk was calculated for the samples.

Recommendations

No further site characterization or corrective measure evaluation efforts are required for this SWMU based on the findings of the Phase I RFI.

7.1.17 AOC C - Transformer Storage Pads

Conditions Found

Contamination was found in surface soils surrounding the three storage pads primarily consisting of SVOCs, pesticides and Aroclor-1260.

Since the investigations were completed, site conditions have significantly been altered. The base operation contractor was told to clean debris from the area (primarily consisting of miscellaneous electrical equipment [no transformers] and telephone poles) in preparation for the upcoming hurricane season. These instructions were somewhat overzealously taken and heavy equipment was used to scrape 0-12 inches of soil from around the pads. This resulted in one large pile of soil and vegetation and one smaller pile (approximately 10 cubic yards) that had some black staining. The smaller pile has been placed in a sealed roll-off box and will undergo detailed characterization when disposal contractors needs have been established. The larger pile has been sampled (both for PCB and for the TCLP) and the analytical results are pending.

Mitigating Factors

The changed site conditions have essentially nullified the investigation results (except for the concrete wipe sampling) since all the samples were from surface soils and virtually all the locations had at least some soils stripped from them.

Conclusions

Risks associated with PCBs and pesticides were found to be unacceptable for some scenarios; however, the soils presenting these risks have been removed and are being characterized for disposal. Additional investigations need to be performed to characterize the new site conditions.

Recommendations

The investigations originally proposed should be reperformed (with the exception of concrete wipe sampling) to characterize present site conditions.

7.2 Operable Unit 6 - Building 25 Area

This OU includes AOC B, the Building 25 area and SWMU 6 (Building 145).

Conditions Found

Twenty-one SVOCs were found at varying concentrations in the surface soil samples. Benzo(a)pyrene exceeded the residential RBC in six samples and the industrial RBC in two samples. Other semi-volatiles and pesticides exceeded residential RBCs with two samples containing 4,4'-DDT above the industrial RBC.

Fourteen subsurface soil samples were obtained. No VOCs or SVOCs were found at levels exceeding their residential RBC. 4,4'-DDE, 4,4'-DDD and 4,4'-DDT exceeded their residential RBCs in a single sample. Beryllium and arsenic exceeded residential RBCs in approximately one-third of the samples.

No exceedances of tapwater RBCs or Federal MCLs were found in groundwater.

A sample of standing water was taken from within Building 145. 4,4'-DDE, arsenic and mercury exceeded Federal Ambient Water Quality Criteria.

The human health risk assessment found: "Potentially unacceptable carcinogenic risks were estimated for future adult residents that would result predominantly form dermal exposures to benzo(a)pyrene, benzo(b)fluoranthene, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and beryllium in surface soil. The risks from these carcinogens would be due to cumulative effects, since the individual ILCRs were within USEPA's acceptable target risk range."

Mitigating Factors

The site is located within the industrial portion of the base. There are no plans to utilize the area for residential development, nor is any scenario for this reasonable, considering its location. The site is bounded by Army reserve facilities, base warehouses, and the DRMO scrap metal yard. Based on this, consideration of human health risk to residents should only be given for comparison purposes, as it is not really an applicable scenario for the site. It should be noted that the risk scenarios for on-site workers and possible construction workers were also considered. The site posed no unacceptable risk to these populations.

The site is presently used for the storage of large construction equipment and other bulky materials (e.g. navigational aids, pontoons). It is fenced and locked at all times, except when items are being placed in or taken from the area. The ends of Building 145 are covered by secured chain link fencing. These security precautions ensure unwanted access is effectively limited. Also, the present use does not hold the potential for future releases.

The SVOC and pesticides found in the area are amenable to degradation over time by natural biological processes. While the time it will take to lower the concentrations is unpredictable, eventual degradation will occur.

Finally, the "surface water" that was sampled is not a surface water body and is not in any way connected to one. It is simply the water which collects in the lowest point of Building 145 that enters through the building's end and open access areas on the "roof." Based on this comparison of concentrations seen to Ambient Water Quality Criteria are really not applicable.

Conclusions

There is some evidence of releases to soils at the site based on the environmental sampling performed. Building 25 (now demolished) was the former Public Works Department and, as such, would have been likely to have quantities of fuels, oils and possibly pesticides. The SVOC profile is generally indicative of typical old fuel oil spills which have been subjected to extensive weathering.

Recommendations

Based on the type and concentration of contaminants seen and the lack of an unacceptable human health risk to reasonably expected site users, no further site characterization or corrective measures evaluation efforts appear warranted at this site.

7.3 Operable Unit 7 - AOC D - Ensenada Honda Sediments

Conditions Found

Sediment sampling was performed immediately off-shore of SWMUs 1, 2, 3, 7 and 11 as was proposed in the approved RFI workplans. Each of these areas will be individually discussed.

SWMU 1 - Former Cremator Disposal Site

Three sediment samples were collected. No VOCs, SVOCs, pesticides, PCBs, herbicides, asbestos, explosives or dioxins were detected (other than laboratory artifacts). Metals and metalloids were found as would be expected in total constituent analysis of sediments. There were no unacceptable human health risks calculated for this SWMU. Slight potential risk for the aquatic environment was posed by concentrations of cobalt, copper and vanadium.

SWMU 2 - Langley Drive Disposal Area

Three sediment samples were also collected off-shore from this SWMU. Numerous SVOCs (primarily PAHs) were detected in the southerly two samples. Metals also were detected (most in the range expected for total constituent analysis of sediments).

Unacceptable risks to human health were calculated for dermal exposures to benzo(a)pyrene, PeCDD, and HxCDD by current recreational users and future residents. Ecological risk potential is present resulting from the concentrations of PAHs, pesticides, dioxin and a number of metals.

SWMU 3 - Base Landfill

A total of fifteen sediment samples were collected adjacent to the Base Landfill. Miscellaneous detections of SVOCs were found at low levels and in varying locations. The only persistently detected analytes were copper and lead. No unacceptable human health risk was calculated for the Base Landfill sediments. A slight potential risk to the aquatic environment is posed by concentrations of various sediment components.

SWMU 7 - Two Way Fuel Farm

Four sediment samples were collected off-shore from the Tow Way Fuel Farm. The findings of note include detectable concentrations of acetone (probable laboratory artifact), SVOCs and metals/metalloids. No unacceptable human health risks were calculated for the sediments associated with this SWMU. There is a slight potential risk to the aquatic environment.

SWMU 11 - Old Power Plant/Building 38

Three sediment samples were collected near the intake tunnel mouth. Low levels of carbon disulfide were detected in each sample. Numerous PAHs and other SVOCs were also detected. As would be expected with total constituent analysis of sediments, various metals and metalloids were detected. Unacceptable human health risks were calculated for dermal exposures to benzo(a) pyrene and dibenzo(a,h)anthracene for zcurrent on-site workers (e.g, Navy Seals), current recreational users and future residents. Potential aquatic risk is present as a result of the concentrations of some constituents in the sediments.

Mitigating Factors

Ensenada Honda is used as the harbor for the Roosevelt Roads installation. As such, it receives a significant volume of shipping traffic related to base activities. There is marina used for pleasure craft located between SWMUs 2 and 7 - the only non-restricted area at the Honda.

The risk scenarios used, especially those for recreational users and future residents, are extreme worst case. Development of any shoreline for residential use is extremely unlikely for two reasons.

First, Ensenada Honda is a military harbor. Second, what area is not utilized presently for industrial-type activities is occupied by mangroves which are classed as "sensitive environments" and, as such, are very limited in their development options. Certainly, filling in of the mangrove area for construction would not be approved (however this would cover the sediment).

Recreation in the Honda is limited to boating and some fishing. There are no swimming areas within the area. In fact, recreational use is restricted in much of the Honda because of ship traffic and security reasons. All the areas sampled are included in these restricted waters. Dermal contact to sediments, which is the primary exposure route upon which human health risks were calculated, therefore, extremely unlikely especially considering the scenario's assumed exposure frequency and duration. Also, SWMU 2 exhibited the highest potential risk in the Honda. The sampling points here are 200-500 feet away from open water, with the intervening area densely covered by mangroves. This makes exposure to the sediments that much more unlikely.

The primary human health risks were posed by organic constituents. All of the organics detected are acted upon by natural biological processes which reduce over time (unpredictably and slowly for some compounds) the concentrations in sediments. This will result in a continuing reduction in risk as time goes on assuming so continuing release.

Finally, given the relatively low risks posed to humans and the environment, any remedial efforts made would likely be more damaging to the environment than the risks currently posed. It would certainly be unwise to remove "sensitive environment" mangroves to get at some sediments posing relatively low risk.

Conclusions

The sediments in Ensenada Honda show some apparent contamination related to operations at Roosevelt Roads; however, potential impacts are largely predicted to be ones affecting the aquatic environment rather than posing human health risks. It appears that the sediments immediately off-shore from SWMU 2 are the most affected, but it is unknown at this point whether the contamination seen is related to the SWMU or the oil spills which reached into the mangroves (originally, this area was part of Installation Restoration Site 14).

The sediments at SWMUs 1, 3 and 7 show some minor exceedances, but do not exhibit a pattern of contamination and pose essentially no unacceptable human health risk and only a very slight potential impact to the aquatic environment. The analytical results for sediments at SWMU 1 and 3 do not point to the landfills as a past or continuing source of contaminants but more reflect the fact that the Honda has been used over many years as a harbor. SWMU 7 sediments, while not posing a significant risk to either human health or the environment, do contain some constituents which are likely to be related to either spills at the Tow Way or other releases of petroleum products to the harbor.

SWMU 11/45 sediments from Puerca Bay contain significant levels of some contaminants which pose some risks to both human health and the aquatic environment.

Recommendations

No further site characterization or corrective measures evaluation efforts are required for the sediments associated with SWMUs 1 (Cremator Disposal Area), 3 (Base Landfill) and 7 (Tow Way Fuel Farm) based on the findings of the Phase 1 RFI.

SWMU 2 sediments appear to require additional characterization in order to understand the source of contamination. This would best be done when the full RFI for SWMU 2 is being conducted. At that time, analytical results will be available for environmental sampling of surface, subsurface and groundwater at the SWMU. These results can then be compared to those of the sediments to assess whether the SWMU is the source. In addition, sediment samples should be obtained from the harbor side of the mangroves to see if a similar pattern of contamination is present there.

SWMU 11/45 sediments should be further investigated. Additional inshore and offshore (from the tunnels mouth) samples should be taken to assess the extent of sediment contamination in the area.

SECTION 7.0 TABLES

TABLE 7-1

SUMMARY OF FURTHER ACTION RECOMMENDATIONS

Solid Waste Management Unit/Area of Concern	Further RFI Required	No Further Investigations Required	Comments
1 - Former Cremator Disposal Site (Sediments Only)			See AOC D
2 - Langley Drive Disposal Site (Sediments Only)			See AOC D
3 - Base Landfill (Sediments Only)			See AOC D
6 - Building 145			See AOC B
7 - Tow Way Road Fuel Farm (Sediments Only)			See AOC C
10 - Substation 2/Building 90 (Groundwater Only)		X	No evidence of groundwater impact
11 - Old Power Plant/Building 38 (Sediments Only)			See AOC D
12 - Fire Training Pit Oil/Water Separator		X	No evidence of release
13 - Old Pest Control Shop/Building 258	X		Groundwater and sediment sampling- Possible Interim Corrective Measure
14 - Fire Training Pit Area		X	No contaminants detected
23 - Oil Spill Separator Tanks		X	No significant release
24 - Oil Spill Oil/Water Separator and Adjoining Pad		X	No significant release
25 - DRMO Storage Yard		X	No unacceptable risk present
26 - Building 544 Area		X	No unacceptable risk present
30 - Former Incinerator Area		X	No unacceptable risk present
31 - Waste Oil Collection Area Buildings 31 & 2022		X	No unacceptable risk present
32 - PWD Storage Yard/Battery Collection Area/Building 31		X	No unacceptable risk to an industrial site
37 - Waste Oil Storage Area/Building 200		X	No unacceptable risk present
39 - Building 3158/Former Battery Drain Area		X	No releases detected

TABLE 7-1 (continued)

SUMMARY OF FURTHER ACTION RECOMMENDATIONS

Solid Waste Management Unit/Area of Concern	Further RFI Required	No Further Investigations Required	Comments
46 - Pole Storage Yard Covered Pad		X	No unacceptable risk present
51 - New AIMD Storage Pad/Building 379		X	No unacceptable risk present
B - Building 25		X	No unacceptable risk present
C - Transformer Storage Pad	X		Re-characterization of the area is required
D - Sediments	X		Additional sampling at SWMU 2 and 11

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