

EVALUATION OF DATA FROM FIRST AND SECOND ROUNDS OF  
VERIFICATION SAMPLE COLLECTION AND ANALYSIS

CONFIRMATION STUDY TO DETERMINE POSSIBLE  
DISPERSION AND MIGRATION OF SPECIFIC CHEMICALS--  
U.S. NAVAL STATION ROOSEVELT ROADS, PUERTO RICO,  
AND U.S. NAVAL AMMUNITION FACILITY, VIEQUES

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## 1.0 INTRODUCTION

This report presents a tabulated evaluation of the data which was generated by the first and second rounds of verification sample collection and analysis of the Confirmation Study of U.S. Naval Station (NAVSTA), Roosevelt Roads, Puerto Rico, and U.S. Naval Ammunition Facility (NAF), Vieques. The objective of this Confirmation Study is to determine if specific toxic or hazardous materials have contaminated the environment at the Navy activities and may include consideration of various remedial alternatives. The Confirmation Study is part of the Navy Assessment and Control of Installation Pollutants (NACIP) program designed to identify contamination of Navy lands resulting from past operations and to institute corrective measures, as needed. The NACIP program consists of three distinct phases:

1. Initial Assessment--performing record searches and personnel interviews to collect and evaluate all evidence supporting the existence of a contamination problem at an installation.
2. Confirmation--performing onsite investigations including physical and analytical monitoring to confirm or refute the existence of contamination, and if necessary, recommending both interim and long-term corrective measures.
3. Corrective Measures--instituting needed interim and/or long-term remedial measures to control and mitigate contamination.

The first phase, or the Initial Assessment Study (IAS) of NAVSTA Roosevelt Roads and NAF Vieques was conducted in 1984. Results of the IAS showed that sufficient evidence exists to indicate the potential presence of contaminants that might pose an imminent health or environmental threat on or off the

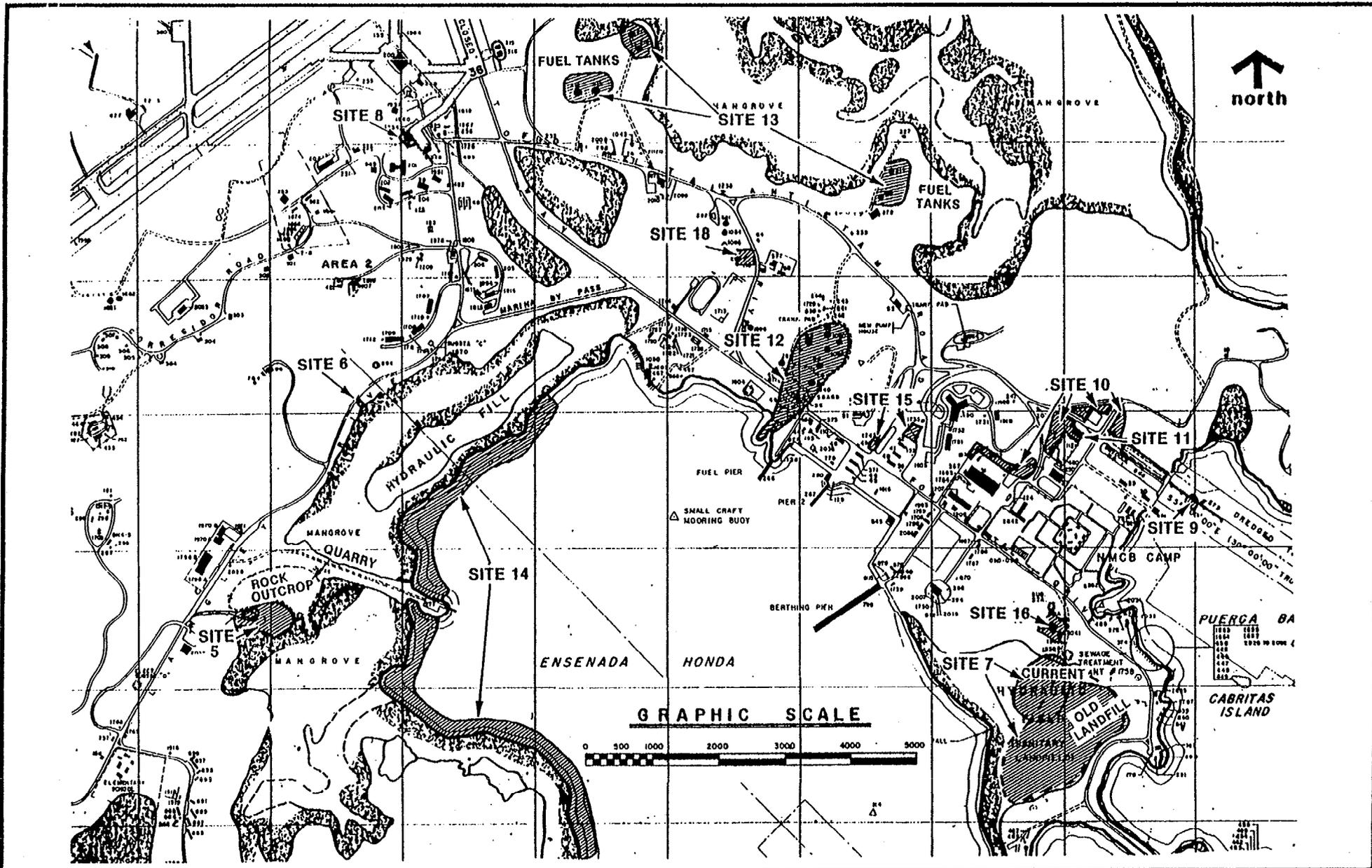
Naval facilities. These sites are therefore, being investigated in this Confirmation Study

The study is performed in sequential efforts, termed Steps, and are defined below.

<u>Step</u>	<u>Description</u>
IA	Verification of existence of contamination.
IB	Characterization of extent and rate of migration of contaminants, geohydrological, geophysical, and other factors.
II	Evaluation of alternatives to achieve compliance, preparation of cost estimates, and project effectiveness of alternatives.
III	Preparation of site operation and draft Government project documentation with cost estimate(s) satisfactory for project funding requests.

The Verification Step of the study includes the installation of ground water monitor wells, and sampling and analysis of ground water, surface water, sediment, and soil. The Verification Step consists of three rounds of sampling and analysis to ensure that the data base will account for seasonal fluctuations in surface and ground water quality. The first round of Verification Step sampling and analysis was completed in May 1986, and the second round was completed in February 1987.

The NAVSTA Roosevelt Roads site locations are shown on Figure 1-1, and Figure 1-2 shows the locations of the NAF Vieques sites. In the Round 1 and Round 2 investigations, three sites



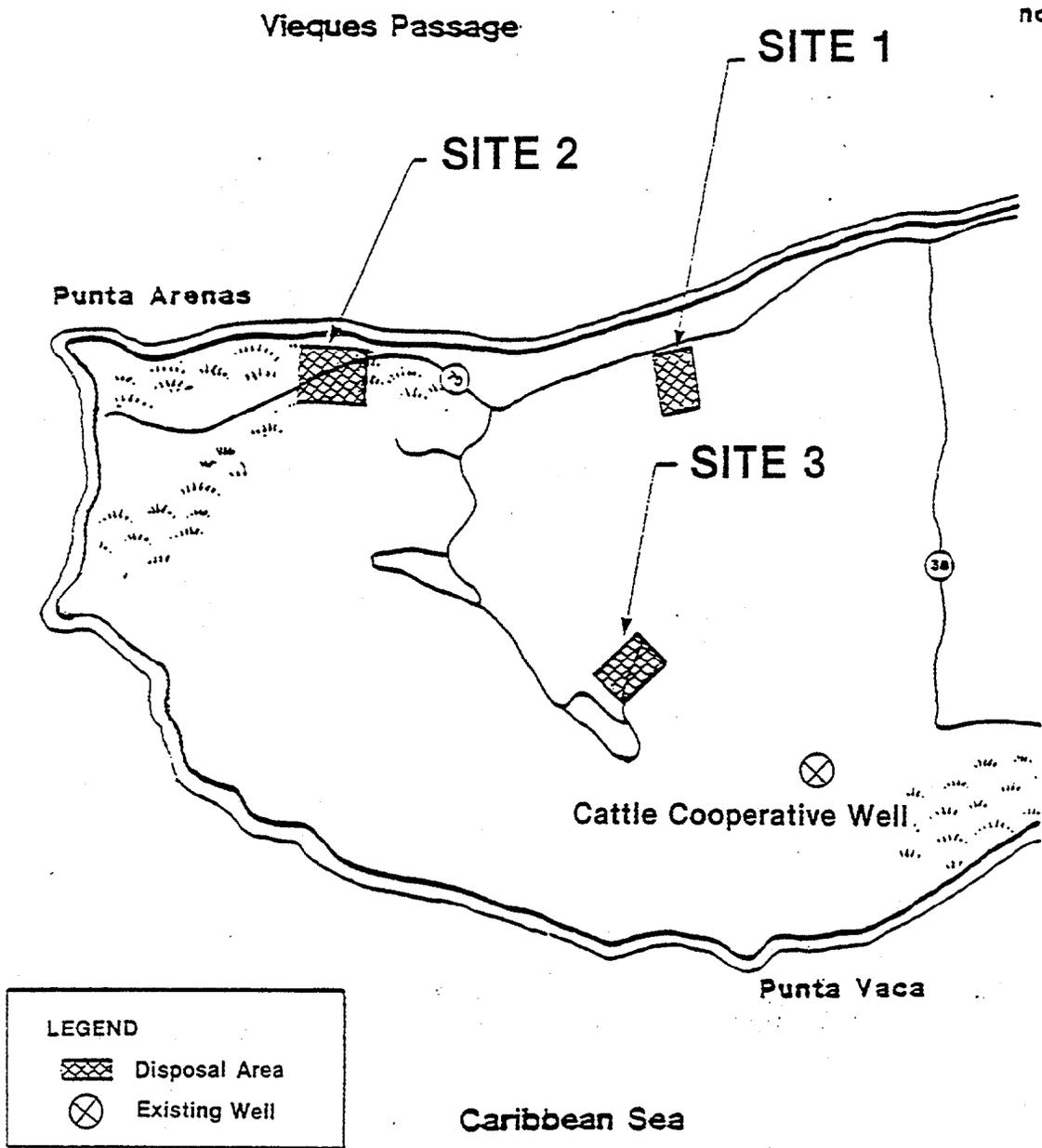
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Figure 1-1  
 SITE MAP SHOWING LOCATIONS OF SITES  
 OF POTENTIAL CONTAMINATION AT NAVAL  
 STATION ROOSEVELT ROADS, PUERTO RICO



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**LEGEND**

-  Disposal Area
-  Existing Well

SOURCES: NEESA, 1984b; ESE, 1985.

Figure 1-2  
SITE MAP SHOWING LOCATIONS OF SITES  
OF POTENTIAL CONTAMINATION AT NAVAL  
AMMUNITION FACILITY, VIEQUES



CONFIRMATION STUDY  
U.S. NAVAL COMPLEX  
PUERTO RICO

of potential contamination were investigated at NAF Vieques. These sites are listed below:

<u>Site Number</u>	<u>Name</u>
1	Quebrada Disposal Site
2	Mangrove Disposal Site
3	IRFNA/MAF-4 Disposal Site

At NAVSTA Roosevelt Roads, a total of twelve sites of potential contamination were investigated in Round 1. These sites are listed below:

<u>Site Number</u>	<u>Name</u>
5	Army Cremator Disposal Area
6	Langley Drive Disposal Site
7	Station Landfill
8	Drone Washdown
9	PCB Disposal, Dry Dock Area
10	Building 25 Storage Area
12	Tow Way Road Fuels Farm
13	Tanks 210 to 217
14	Ensenada Honda Shoreline and Mangroves
15	Substation 2
16	Old Power Plant, Building 38
18	Pest Control Shop and Surrounding Area

Of the twelve sites listed above, two of the sites (Sites 9 and 14) were not investigated in the Round 2 investigation because the Round 1 data indicated the absence of any significant contamination at these sites. In addition, the Confirmation Study of two of the sites (Sites 15 and 16) proceeded from Step IA Verification to Step IB Characterization because of the nature of contamination detected at these two sites in Round 1. Consequently, the investigations of Sites 15 and 16 are documented in two

separate reports entitled "Remedial Action Alternatives Analysis for Substation 2, Site 15" and "Remedial Action Alternatives Analysis for Old Power Plant, Building 38, Site 16", rather than in this report.

During the Round 1 and Round 2 investigations of these fifteen sites at NAVSTA Roosevelt Roads and NAF Vieques sites, 45 ground water monitor wells were installed and samples of ground water, surface water, sediment, and soil were collected for laboratory analysis. Table 1-1 presents site-specific information relative to the number of monitor wells installed, the type and number of samples collected for analysis, and the analytical constituents for each sample type.

Section 2.0 presents a discussion of the criteria and standards that were used in the evaluation of the concentration data for the samples collected at NAVSTA Roosevelt Roads, and NAF Vieques. A computer printout of the complete analytical data base is provided in a supplemental appendix under separate cover. The evaluation of the data is presented in Section 3.0, and recommendations for additional monitoring in Round 3 of the Verification Step of the Confirmation Study are described in Section 4.0.

Table 1-1. Summary Table of Rounds One and Two Verification Sampling and Analysis, NAVSTA Roosevelt Roads and NAF Vieques Confirmation Study

SITE NO. / SAMPLING ROUND NO.	WELLS INSTALLED	GROUND WATER SAMPLES	SURFACE WATER SAMPLES	SEDIMENT SAMPLES	SOIL SAMPLES	ANALYTICAL CONSTITUENTS <sup>a</sup>
NAF Vieques						
1/1	3	3	0	3	6	pH, oil and grease, VOA, MEK, MIBK, EDB, Cr (total and hexavalent), xylene, Pb
1/2	0	3	0	0	0	pH, Priority Pollutant scan, MEK, MIBK, EDB, Cr hexavalent, xylene
2/1	0	0	5	5	8	pH, Cr (total and hexavalent), Pb, VOA, xylene, MEK, MIBK
2/2	0	0	5	5	0	pH, Cr (total and hexavalent), Pb, VOA, xylene, MEK, MIBK
3/1	0	0	0	0	0	
3/2	0	1	0	0	0	pH, Priority Pollutant scan
NAVSTA Roosevelt Roads						
5/1	5	5	5	5	0	pH, Priority Pollutant scan, Cr hexavalent, xylene, MEK, MIBK, EDB
5/2	0	5	5	5	0	pH, Priority Pollutant scan, Cr hexavalent, xylene, MEK, MIBK, EDB
6/1	0	0	3	3	15	pH, Priority Pollutant scan, Cr hexavalent, xylene, MEK, MIBK, EDB
6/2	1	1	3	3	---	pH, Priority Pollutant scan, xylene, MEK, MIBK, EDB
	---	---	---	---	15	Pb
	---	---	---	---	2	EP Toxicity Test-Pb only
7/1	8	8	0	0	0	pH, Priority Pollutant scan, Cr hexavalent
	---	---	---	---	2	oil and grease, VOA, xylene, MEK, MIBK, EDB
7/2	2b	8	0	0	0	pH, Priority Pollutant scan, Cr hexavalent
8/1	0	0	3	3	1	Oil and grease, Pb, VOA, xylene, MEK, MIBK, EDB
8/2	0	0	5	3	0	Oil and grease, Pb, VOA, xylene, MEK, MIBK, EDB
9/1	0	0	4	30	0	PCBs
10/1	8	8	0	0	0	pH, Priority Pollutant scan, Cr hexavalent, xylene, MEK, MIBK, EDB
10/2	0	8	0	0	0	pH, Priority Pollutant scan, Cr hexavalent, xylene, MEK, MIBK, EDB

--- = not applicable

a = Key to Constituent Abbreviations.

EDB = ethylene dibromide

MIBK = methyl isobutyl ketone

Cr = chromium

PCBs = polychlorinated biphenyls

Pb = lead

VOA = volatile organic analysis

MEK = methyl ethyl ketone

GC = gas chromatograph

EPA Toxicity Test = Extraction procedure (EP) toxicity test as described in 40 CFR Part 261.25, Appendix II.

Priority Pollutant Scan = EPA Priority Pollutant list of 129 pollutants, excluding asbestos, cyanide, and dioxin.

b = Two replacement wells for wells which were installed during Round 1 but were damaged by landfill activities prior to Round 2.

Source: ESE, 1988.

Table 1-1 (Continued)

12/1	6	6	1	1	---	pH, VOA, EDB, xylene, oil and grease, Pb,
	---	---	---	---	2	EP Toxicity Test
	---	---	---	---	20	metals No analyses. Visual inspection for oil and measurement of thickness of oil layer.
12/2	0	6	1	---	---	pH, VOA, EDB, xylene, oil and grease, Pb, GC fingerprint
	---	---	---	1	---	pH, VOA, EDB, xylene, oil and grease, Pb
	---	---	---	---	52	No analyses. Visual inspection for oil and measurement of thickness of oil layer.
13/1	11	11	6	6	0	pH, VOA, Pb, oil and grease, EDB, xylene
13/2	0	11	6	6	0	pH, VOA, Pb, oil and grease, EDB, xylene MEK, MIBK
14/1	0	0	12	12	0	pH, VOA, Pb, oil and grease, EDB, xylene MEK, MIBK
18/1	0	0	2	2	15	Pesticides
18/2	3	3	0	0	0	Pesticides, VOA
	---	---	6	6	---	Pesticides

--- = not applicable

a = Key to Constituent Abbreviations.

EDB = ethylene dibromide

MIBK = methyl isobutyl ketone

Cr = chromium

PCBs = polychlorinated biphenyls

EPA Toxicity Test = Extraction procedure (EP) toxicity test as described in 40 CFR Part 261.25, Appendix II.

Priority Pollutant Scan = EPA Priority Pollutant list of 129 pollutants, excluding asbestos, cyanide, and dioxin.

Source: ESE, 1988.

## 2.0 CRITERIA AND STANDARDS

This section describes the various standards and criteria that were used in evaluating the concentration data for the environmental samples collected from NAVSTA Roosevelt Roads and NAF Vieques. The standards and criteria used in the data evaluation include the following:

- o Toxicity data presented by the U.S. Department of Health and Human Services (HHS) (1987);
- o Chronic Acceptable Intake (AIC) data presented by the U.S. Environmental Protection Agency (EPA) (1986);
- o Resource Conservation and Recovery Act Maximum Concentration Limits (RCRA MCLs) presented by EPA (1987);
- o Safe Drinking Water Act Maximum Contaminant Levels (SDWA MCLs) presented by EPA (1987c);
- o Ambient Water Quality Criteria (AWQC) presented by EPA (1980a, 1987a);
- o Maximum Contaminant Levels presented by the Puerto Rico Department of Health (PRDOH) (1983);
- o Background element concentration ranges in soils presented by the U.S. Geological Survey (USGS) (1984);
- o Designated levels in a solid to protect ground water for a hypothetical average site in California presented by the California Regional Water Quality Control Board (CRWQCB) (1986); and
- o Hazardous waste total threshold limit concentrations (TTL) developed by the State of California Department of Health Services (DHS), and presented by the CRWQCB (1986).

These criteria and standards are discussed in the following paragraphs.

## 2.1 TOXICITY DATA

Toxicity data used in the data evaluation includes data for rats, mice, and humans. Most studies in the published literature report exposures of experimental animals in which the test substances were introduced primarily through the mouth (Oral). Other routes of exposure include inhalation (INH), intravenous (ITR), implantation (IMP), and unknown (UNK).

Various abbreviations are used to describe the administered dose reported in the literature. These terms indicate whether the dose caused death (LD) or other toxic effects (TD), and whether it was administered as a lethal concentration (LC) or toxic concentration (TC) in inhaled air. In general, the term "Lo" is used where the number of subjects studied was not a significant number from the population, or the calculated percentage of subjects showing an effect was listed as 100. The following terms are used in the data evaluation:

TDLo -- Toxic Dose Low - the lowest dose of a substance introduced by any route, other than inhalation, over any given period of time and reported to produce any toxic effect in humans or tumorigenic or reproductive effects in animals.

TCLo -- Toxic Concentration Low - the lowest concentration of a substance in air to which humans or animals have been exposed for any given period of time that has produced any toxic effect in humans or tumorigenic or reproductive effects in animals.

LDLo -- Lethal Dose Low - the lowest dose (other than LD<sub>50</sub>) of a substance introduced by any route, other than inhalation, over any given period of time and reported to have caused death in humans or animals.

LD50 -- Lethal Dose Fifty - a calculated dose of a substance which is expected to cause the death of 50 percent of an entire defined experimental animal population. It is determined from the exposure to the substance by any route other than inhalation of a significant number from that population.

The doses reported in the data evaluation are expressed in terms of the quantity administered per unit body weight, or quantity per skin surface area, or quantity per unit volume of the respired air. In addition, the duration of time over which the dose was administered is also listed, as needed. Doses are generally expressed as milligrams per kilogram (mg/kg). However, in some cases grams or micrograms per kilogram are shown (g/kg or u/kg, respectively).

Where the duration of exposure is available, time is presented as minutes (M), hours (H), days (D), weeks (W), or years (Y). Additionally, continuous exposure (C) indicates that the exposure was continuous over the time administered, such as ad libitum feeding studies or 24-hour, 7-day per week inhalation exposures. Intermittent exposure (I) indicates that the dose was administered during discrete periods, such as daily, twice weekly, etc. When exposure duration data are available, the toxicity data are presented in terms of a given dose (unit weight of contaminant per unit weight of subject) per duration of exposure (eg. mg/kg/YR).

Because the toxicity data is in terms of a given dose which produces a certain toxic effect in an animal or human, it cannot be directly compared to concentration data for the environmental samples collected from the sites of concern at NAVSTA Roosevelt Roads and NAF Vieques. However, in the absence of other criteria and standards, the toxicity data

does provide a means for evaluating contaminant concentrations in environmental samples.

## 2.2 CHRONIC ACCEPTABLE INTAKE DATA

Chronic Acceptable Intake (AIC) data (EPA, 1986) are long-term acceptable oral intake levels for noncarcinogenic effects. These values are used in risk characterization, and are presented in milligrams of constituent per kilogram of body weight per day (mg/kg/day). As with the toxicity data described above, the AIC data cannot be compared directly to contaminant concentration data for environmental samples. However, it does provide a means of evaluating concentration data in the absence of other criteria and standards.

## 2.3 RCRA MAXIMUM CONCENTRATION LIMITS

The RCRA ground water protection standards include standards for eight metals and six pesticides, in terms of contaminant concentration in ground water. These standards were used in the evaluation of contaminant concentrations in samples of ground water collected from the sites of concern at NAVSTA Roosevelt Roads and NAF Vieques.

## 2.4 SDWA MAXIMUM CONTAMINANT LEVELS

The National Interim Drinking Water Standards promulgated by EPA under the authority of the Safe Drinking Water Act (SDWA) include maximum contaminant levels (MCLs) for 23 elements and compounds. These MCLs are presented in terms of contaminant concentration in water, and were used in evaluating contaminant concentrations in surface and ground water.

## 2.5 AMBIENT WATER QUALITY CRITERIA

The Ambient Water Quality Criteria (AWQC) were established by EPA under the Clean Water Act. The AWQC are presented as specific contaminant concentrations in water which, if exceeded, can be expected to cause a toxic effect in humans.

The criteria for suspect or proven carcinogens are presented as concentrations in water associated with a range of estimated incremental cancer risks to humans. The range of concentrations corresponds to incremental cancer risks of  $10^{-7}$  to  $10^{-5}$  (one additional case of cancer in populations ranging from 10 million to 100,000, respectively). However, the concentration criteria associated with this range of estimated incremental cancer risks was developed by EPA for information purposes only; methods do not exist to establish the presence of a threshold for carcinogenic effects. The AWQC presented in the evaluation of the concentration data for the samples collected from the sites of concern at NAVSTA Roosevelt Roads and NAF Vieques correspond to the  $10^{-6}$  incremental cancer risks.

#### 2.6 PUERTO RICO DEPARTMENT OF HEALTH MAXIMUM CONTAMINANT LEVELS

The public drinking water maximum contaminant levels (MCLs) enforced by the Puerto Rico Department of Health under the authority of the Commonwealth of Puerto Rico Administrative Order Number 10 are generally the same as those promulgated by EPA under the authority of the Safe Drinking Water Act, as described in Section 2.4. These MCLs were used in the evaluation of contaminant concentration data for samples of surface and ground water.

#### 2.7 BACKGROUND ELEMENT CONCENTRATION RANGES IN SOILS

Background element concentration ranges in soils and surficial materials for 50 elements are provided in the USGS Professional Paper 1270, 1984. The concentration ranges are based on soil sampling and analyses throughout the conterminous United States. These data are used to evaluate contaminant concentrations in samples of soil and sediment collected from the sites of concern at NAVSTA Roosevelt Roads and NAF Vieques.

## 2.8 DESIGNATED LEVELS IN A SOLID

As defined by the State of California (Marshack, 1987), a designated level is the concentration of a constituent contained in a solid waste that provides a site-specific indication of the water quality impairment potential of the waste. If measured concentrations of a constituent in a waste exceed the designated level, the waste is assumed to pose a water quality threat at the site in question. The designated levels used in the data evaluation are provided by the State of California Water Quality Control Board (1986), as examples for preliminary assessment of a hypothetical average disposal or contaminated site in California. Although these designated levels are established for use only in the preliminary assessment of an average site in the State of California, they do provide a means for evaluating constituent concentrations in soil at a potentially contaminated site.

## 2.9 HAZARDOUS WASTE TOTAL THRESHOLD LIMIT CONCENTRATIONS

Hazardous waste total threshold limit concentrations (TTLC) were established by the California Department of Health Services (DHS) to determine the disposal requirements for a given waste. For example, a waste with a constituent concentration that exceeds the TTLC must not be disposed in an underdesigned landfill where the waste may pose a public health threat. Although the TTLC were developed for use in the State of California, they provide useful means for evaluating the constituent concentrations detected in the soil samples from NAVSTA Roosevelt Roads and NAF Vieques.

### 3.0 DATA EVALUATION

As described in Section 1.0, this section presents the tabulated evaluation of the analytical data from the first and second rounds of verification sample collection and analysis relative to available standards and criteria. Concentration data are tabulated only for the constituents that were detected in the samples from the various sites. The complete data base is provided in the supplemental appendix under separate cover.

Along with the sample concentration data, available standards and criteria described in Section 2.0 are presented for each constituent detected in a given sample. However, for some of the analytical constituents, there are no available standards, criteria, or toxicological data.

In the data evaluation tables, samples are identified by an alpha-numeric sample number that describes the location and type of sample. In general, the first character coincides with the site number, such as "6" for Site 6. However, for some of the sample identification numbers the first character is "R" which stands for NAVFAC Roosevelt Roads. After the site number, a letter code indicates the sample media as follows:

- S - soil,
- SE - sediment,
- GW - ground water (from a monitoring well),
- PW - ground water (from a potable well), and
- SW - surface water

Next, for each sample medium, every sample location within the site is assigned a number. In addition, if soil is sampled at various depths, each 1-foot (ft) interval is composited and assigned a letter, with "A" signifying the 0- to 1-ft depth

interval, "B" signifying the 1- to 2-ft depth interval, and "C" signifying the 2- to 3-ft depth interval. Composite soil samples identified with an "N" indicate the compositing of soil samples collected at 2-ft depth intervals to the depth at which natural soil is encountered. This composite soil sample collection technique was utilized at sites where waste burial or deposition as fill material was performed. Composite soil samples identified with a "C" indicate the compositing of several surficial soil samples within a given area suspected of being subject to surface spillage of wastes. For example, sample "R6S010B" provides the following identification:

- R - NAVFAC Roosevelt Roads,
- 6 - Site 6,
- S - soil,
- 010 - tenth soil sampling location at Site 6, and
- B - sample interval from 1-2 ft below the ground surface.

The following sections provide a discussion of the data evaluation for each of the sites of concern at NAVSTA Roosevelt Roads and NAF Vieques.

### 3.1 QUEBRADA DISPOSAL SITE, SITE 1

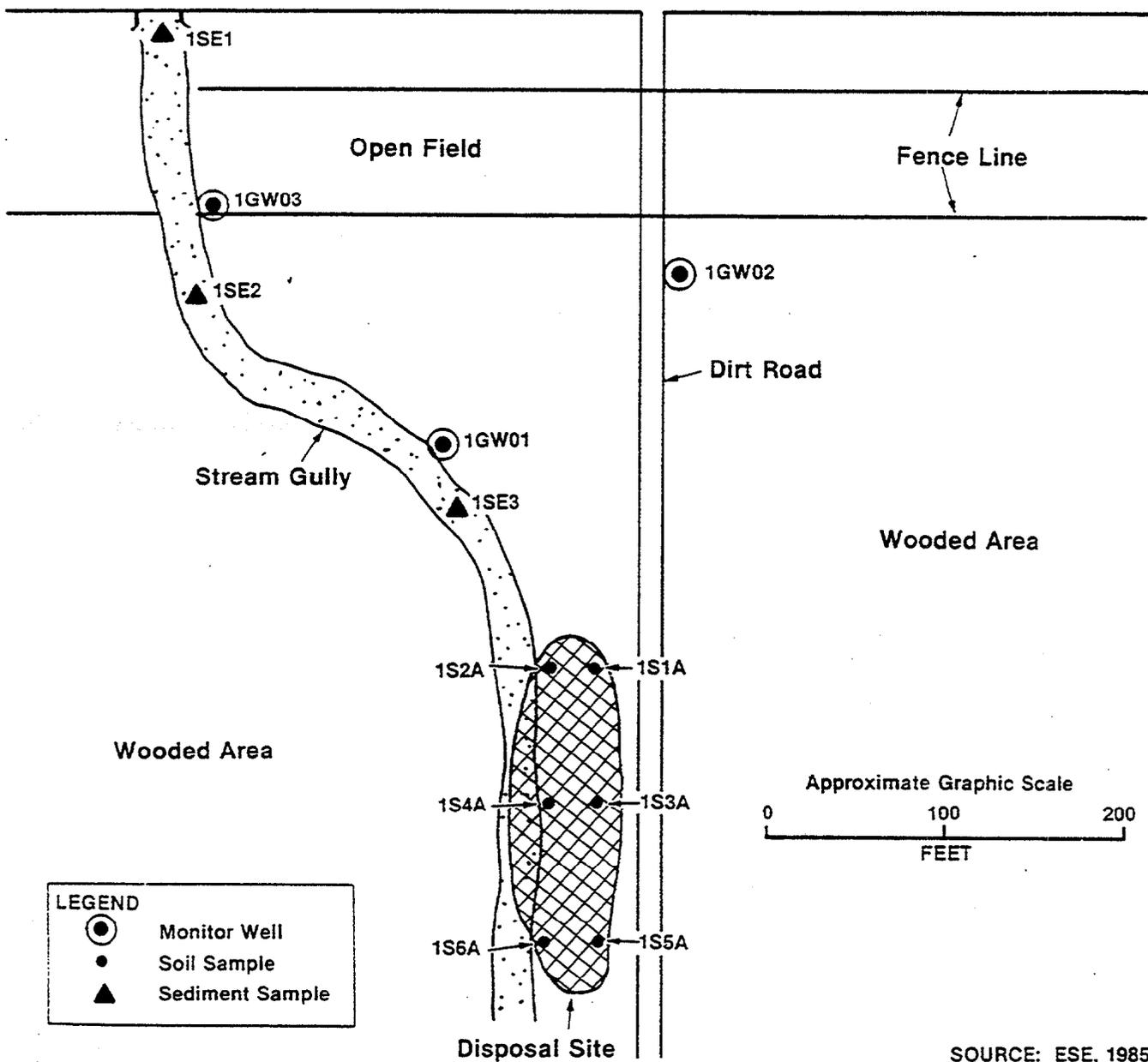
Round 1 sampling locations at Site 1 are shown in Figure 3-1. These sampling locations included three shallow monitor wells, which were installed as part of the Round 1 effort. Sediment and soil samples were also collected from the Quebrada Disposal Site during Round 1. The Round 1 sediment and soil sampling data are presented in Table 3-1. As shown, no elevated levels of any of the constituents of concern were detected.

In the Round 2 investigation of Site 1, additional soil and sediment sampling was not performed because no elevated levels

Vieques Passage

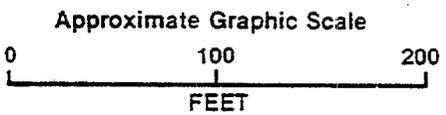


Route 70



**LEGEND**

-  Monitor Well
-  Soil Sample
-  Sediment Sample



SOURCE: ESE. 1985.

Figure 3-1  
ROUND 1 SAMPLING LOCATIONS AT  
SITE 1, QUEBRADA DISPOSAL SITE,  
VIEQUES



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Table 3-1. NAF Vieques Confirmation Study, Round One Soil and Sediment Sampling Results, Site 1, Quebrada Disposal Site

Constituent	Round I Concentrations						Chemical Toxicity Parameter				
							Toxicity Data	AIC mg/kg/day	Designated levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
SEDIMENT											
Sample Number:	1SE1	1SE2	1SE3								
Oil & Grease (ug/g, dry)	63	86	120								
Chromium (Total) (ug/g, dry)	6.48	4.48	4.48								
SOIL											
Sample Number:	1S1A	1S2A	1S3A	1S4A	1S5A	1S6A					
Oil & Grease (ug/g, dry)	189	201	226	195	188	88					
Chromium (Total) (ug/g, dry)	26.3	18.5	26.8	24.8	25.0	25.2					

N/A = Not Analyzed

NR = Not Reported

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.

Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

of any constituents of concern were detected in the Round 1 soil and sediment sampling and analysis. However, the three monitor wells shown in Figure 3-1 were resampled in the Round 2 investigation. Table 3-2 presents the concentration data for ground water samples collected during Rounds 1 and 2. The data shows that metals concentrations in the ground water samples exceeded drinking water criteria and ambient water quality criteria in both the Round 1 and Round 2 investigations.

### 3.2 MANGROVE DISPOSAL SITE, SITE 2

Round 1 sampling locations at Site 2 are shown in Figure 3-2. During Round 1, soil, sediment, and surface water samples were collected and analyzed. Table 3-3 presents the concentration data for the soil samples. As shown, no elevated levels of any of the constituents of concern were detected in the soil. For this reason, additional soil sampling was not performed in the Round 2 investigation. However, the Round 1 surface water and sediment sampling locations were resampled in the Round 2 investigation. Table 3-4 presents the Rounds 1 and 2 sediment sampling results, and Table 3-5 presents the Rounds 1 and 2 surface water sampling results. Chromium and lead were found in the Round 1 and Round 2 sediment samples. However, the levels were not significant when compared to background element concentrations found in soils. Levels of lead were higher for all Round 2 sediment samples with the exception of sample 2SE3. Seasonal fluctuations and slightly different sampling locations may account for this variation.

With regard to surface water, chromium levels were slightly above detection limits in Round 1. However, chromium was not detected during Round 2. Total lead was detected in sample 2SW3 in Round 2, but in the remainder of the samples, lead was not detected. Chromium and lead concentrations found at Site

Table 3-2. NAF Vieques Confirmation Study, Rounds One and Two  
Ground Water Sampling Results, Site 1, Quebrada  
Disposal Site

Constituent	Round 1 Concentrations			Round 2 Concentrations			Chemical Toxicity Parameters					
	IGW1	IGW2	IGW3	IGW01	IGW02	IGW03	Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)
GROUND WATER												
Sample Number:	IGW1	IGW2	IGW3	IGW01	IGW02	IGW03						
Cadmium (ug/L)	N/A	N/A	N/A	13.0	6.0	6.0	UNK. LDLo (man) = 15 mg/kg	0.000290	10	10	10	10
Chromium (Total) (ug/L)	286	303	309	512	221	173	NR	0.00500	50	50	50	50
Chromium (+6) (ug/L)	--	--	--	73.2	--	--	NR	0.00500	50	50	50	50
Copper (ug/L)	N/A	N/A	N/A	629	121	128	Oral TDLo (hmn) = 120 ug/kg	0.0370	NR	(s) 1,000 (+, FCC)	12	NR
Nickel (ug/L)	N/A	N/A	N/A	215	108	74.0	ITR. LDLo (rat) = 12 mg/kg	0.0100	NR	NR	13.4	NR
Zinc (ug/L)	N/A	N/A	N/A	400	113	193	INH. TCLo (hmn) = 124 mg/M3/50M	0.210	NR	(s) 5,000 (+, FCC)	110	NR

-- = Not Detected.

N/A = Not Analyzed.

NR = Not Reported.

LDLo = Lethal Dose Low

TDLo = Toxic Dose Low

TCLo = Toxic Concentration Low

hmn = Human

UNK = Unknown

ITR = Intravenous

INH = Inhalation

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

RCRA MCL = RCRA Maximum Concentration Limits.

MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.

AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.

PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

Source: ESE, 1988

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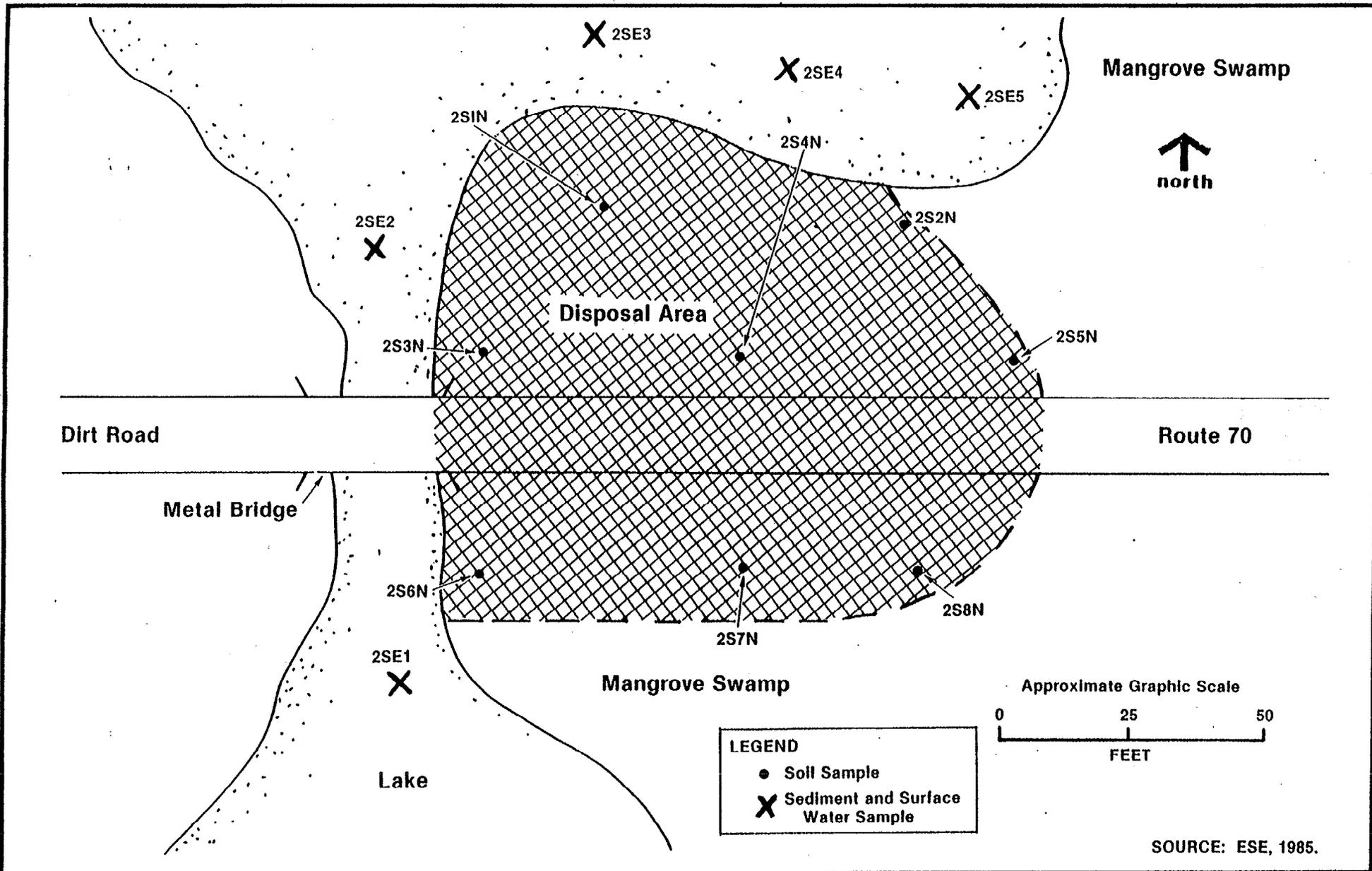


Figure 3-2  
 ROUND 1 SAMPLING LOCATIONS AT SITE 2,  
 MANGROVE DISPOSAL SITE, VIEQUES



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Table 3-3. NAF Vieques Confirmation Study, Round One Soil Sampling Results, Site 2, Mangrove Disposal Site

Constituent	Round 1 Concentrations						Chemical Toxicity Parameter				
							Toxicity Data	AIC mg/kg/day	Designated levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
SOIL											
Sample Number:	2S1N	2S2N	2S3N	2S4N	2S5N	2S6N					
Chromium (Total) (ug/g, dry)	26.3	18.5	26.8	24.8	25.0	25.2	NR	0.00500	500	500	1 - 2000
Lead (ug/g, dry)	232	--	10.2	345	--	6.42	Oral TDLo (wmn) = 450 mg/kg/6y	0.00140	500	1000	<10 - 700
Sample Number:	2S7N	2S8N									
Chromium (Total) (ug/g, dry)	48.2	24.2	NR								
Lead (ug/g, dry)	--	--	Oral TDLo (wmn) = 450 mg/kg/6y								

-- = Not Detected.

NR = Not Reported

TDLo = Toxic Dose Low

wmn = Woman

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.

Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

Table 3-4. NAF Vieques Confirmation Study, Rounds One and Two Sediment Sampling Results, Site 2, Mangrove Disposal Site

Constituent	Round 1 Concentrations					Round 2 Concentrations					Chemical Toxicity Parameter				
											Toxicity Data	AIC mg/kg/day	Designated levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
SEDIMENT															
Sample Number:	2SE1	2SE2	2SE3	2SE4	2SE5	2SE01	2SE02	2SE03	2SE04	2SE05					
Chromium (Total) (ug/g, dry)	12.6	32.9	88.4	5.28	16.2	36.2	9.38	16.0	8.13	8.49	NR	0.00500	500	500	1 - 2000
Lead (ug/g, dry)	--	--	53.2	16.9	63.9	2.82	3.15	25.0	219	312	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	500	1000	<10 - 700

-- = Not Detected.

NR = Not Reported

TDLo = Toxic Dose Low

wmn = Woman

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.

Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

Table 3-5. NAF Vieques Confirmation Study, Rounds One and Two  
Surface Water Sampling Results, Site 2, Mangrove  
Disposal Site

Constituent	Round 1 Concentrations										Round 2 Concentrations										Chemical Toxicity Parameters					
	2SW1		2SW2		2SW3		2SW4		2SW5		2SW01		2SW02		2SW03		2SW04		2SW05		Toxicity Data	AIC mg/kg/d	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)
SURFACE WATER																										
Sample Number:	2SW1		2SW2		2SW3		2SW4		2SW5		2SW01		2SW02		2SW03		2SW04		2SW05							
Chromium (Total) (ug/L)	3.00	4.00	3.00	3.00	3.00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NR	0.00500	50	50	50	50	
Lead (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	--	8.4	--	--	--	--	--	Oral TDLo (wmn) = 450mg/kg/6Y	0.00140	50	50	50	50	

-- = Not Detected.  
 NR = Not Reported.  
 TDLo = Toxic Dose Low.  
 wmn = Woman  
 AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

Source: ESE, 1988

2 meet ambient water quality criteria, as well as drinking water criteria.

3.3 IRFNA/MAF-4 DISPOSAL SITE, SITE 3,  
Figure 3-3 shows the location of the IRFNA/MAF-4 Disposal Site. Round 2 sampling efforts at this site were limited to ground water sampling from a nearby existing well. A sample was not collected during Round 1.

Total zinc was the only constituent detected in the ground water at Site 3. The detected level of 469 ug/L is well below the National Secondary Drinking Water Standard of 5,000 ug/L.

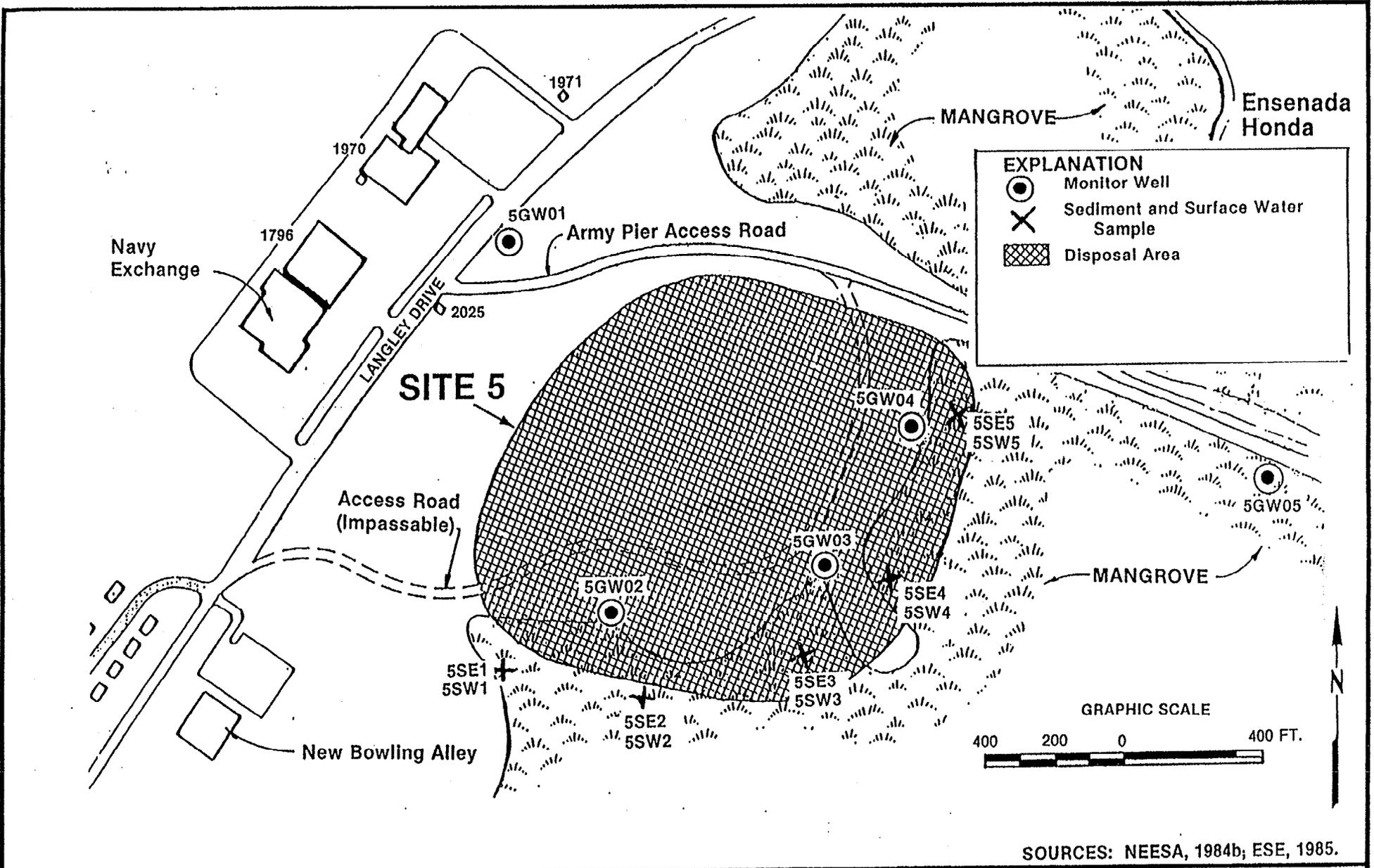
#### 3.4 ARMY CREMATOR DISPOSAL AREA, SITE 5

The sampling locations for Rounds 1 and 2 are shown in Figure 3-4. Surface water, sediment, and ground water samples were collected and analyzed in both Rounds 1 and 2. Sampling locations were the same for Rounds 1 and 2. Table 3-6 presents the concentration data for Rounds 1 and 2 sediment samples at the Army Cremator Disposal Area. During Round 1 sampling, the pesticide BHC,D was detected at low levels in one sample (5SE02). In addition, other pesticides (DDE,PP' and DDT,PP') were detected in three other samples (5SE01, 5SE03 AND 5SE04) during Round 2. The Round 2 levels detected are low relative to California Total Threshold Limits. Various metals were also detected in all of the sediment samples, but only antimony and selenium in some samples exceeded element background concentrations found in soils (USGS, 1984).

During Round 2, phenols were detected in samples 5SE02 through 5SE05 at levels between 2,500 and 29,800 ug/k, but are likely attributable to naturally occurring phenolic compounds present in mangrove environments rather than past waste disposal.



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**Figure 3-4**  
**ROUNDS 1 AND 2 SAMPLING LOCATIONS AT SITE 5,**  
**ARMY CREMATOR DISPOSAL AREA**



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Table 3-6. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Sediment Sampling Results, Site 5, Army Cremator Disposal Area

Constituent	Round 1 Concentrations					Round 2 Concentrations					Chemical Toxicity Parameters				
											Toxicity Data	AIC mg/kg/day	Designated levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
SEDIMENT															
Sample Number:	5SE1	5SE2	5SE3	5SE4	5SE5	5SE01	5SE02	5SE03	5SE04	5SE05					
Bis(2-eth'hex')phthalate (mg/kg, dry)	0.01	--	--	--	--	--	--	--	--	--	Oral TDLo (man) = 143 mg/kg	0.0200	4200	NR	NR
Di-n-octylphthalate (mg/kg, dry)	1	4	0.5	--	0.5	--	--	--	--	--	Oral LD50 (mus) = 6513 mg/kg	NR	NR	NR	NR
BHC,D (ug/g, dry)	--	1.03	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 1000 mg/kg	NR	50	NR	NR
Methylene Chloride (ug/kg, dry)	--	--	--	--	--	3600	--	--	--	--	Oral LD50 (rat) = 2136 mg/kg	NR	NR	NR	NR
DDE,PP' (ug/kg, dry)	--	--	--	--	--	32.4	--	--	272	--	Oral LD50 (rat) = 880 mg/kg	NR	NR	1.0	NR
DDT,PP' (ug/kg, dry)	--	--	--	--	--	--	--	138	--	--	UNK, LDLo (man) = 221 mg/kg	0.000500	0.000240	1.0	NR
Antimony (mg/kg, dry)	3.8	5.2	5.1	24	7.3	--	--	--	--	--	Oral LD50 (rat) = 7 gm/kg	0.000400	1460	500	<1 - 8.8
Arsenic (ug/g, dry)	14.4	--	13.4	32.0	22.0	4.47	6.05	5.58	3.78	3.45	Oral TDLo (man) = 7857 mg/kg/55Y-1	NR	500	500	<0.1 - 97
Beryllium (mg/kg, dry)	--	--	--	1.33	0.954	--	--	--	--	--	INH, TCLo (hmn) = 300 mg/M3	0.000500	0.068	75	<1 - 15
Cadmium (ug/g, dry)	--	--	--	--	--	3.04	3.13	2.40	1.28	1.63	Oral LD50 (rat) = 225 mg/kg	0.000290	100	100	NR
Chromium (Total) (ug/g, dry)	21.9	28.4	29.3	54.1	33.5	51.4	23.8	19.6	10.2	34.7	NR	0.00500	500	500	1 - 2000
Chromium (+6) (ug/g)	N/A	N/A	N/A	N/A	N/A	--	--	13.8	--	--	NR	0.00500	500	500	NR
Copper (ug/g, dry)	36.8	54.7	43.4	119	78.8	72.1	97.3	73.5	36.1	54.7	Oral TDLo (hmn) = 120 ug/kg	0.0370	20000	2500	<1 - 700
Lead (ug/g, dry)	76.4	--	21.0	--	--	10.1	19.2	21.6	11.0	--	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	500	1000	<10 - 700
Mercury (ug/g, dry)	0.109	--	--	--	--	--	--	--	--	--	INH, TCLo (wmn) = 150 ug/M3/46D	0.00200	20	20	<0.01 - 4.6
Nickel (ug/g, dry)	6.72	11.8	8.77	22.3	15.6	14.4	--	--	8.45	--	ITR, LDLo (rat) = 12 mg/kg	0.0100	0.134	2000	<5 - 700
Silver (mg/g, dry)	--	--	--	--	--	--	--	1.20	--	--	IMP, TDLo (rat) = 2400 mg/kg	0.00300	500	500	NR
Selenium (mg/kg, dry)	19.8	31.3	27.4	85.4	49.7	3.47	6.50	--	1.09	5.51	Oral LD50 (rat) = 6700 mg/kg	0.00300	100	100	<0.1 - 4.3
Zinc (ug/g, dry)	25.9	42.8	32.8	72.8	50.8	75.7	98.1	89.5	51.5	50.2	INH, TCLo (man) = 124 mg/M3/50M	0.210	200000	5000	<5 - 2900
Phenols (ug/kg, dry)	N/A	N/A	N/A	N/A	N/A	--	29800	5980	2500	5710	NR	NR	NR	NR	NR

-- = Not Detected.

N/A = Not Analyzed

NR = Not Reported

LD50 = Lethal Dose Fifty

LDLo = Lethal Dose Low

TDLo = Toxic Dose Low

TCLo = Toxic Concentration Low

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.

Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

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Methylene chloride was detected at 3,600 ug/kg in sample 5SE01 during Round 2.

Table 3-7 presents concentration data for surface water samples collected from the Army Cremator Disposal Area. As shown in Table 3-7, arsenic, copper, nickel and selenium were detected at levels exceeding ambient water quality criteria. In addition, low levels of bis(2-ethyl hexyl) phthalate were detected during both Rounds 1 and 2, and low levels of di-n-octylphthalate were detected during Round 1. Phenols were detected in all the Round 2 surface water samples, which are likely attributable to naturally occurring phenolic compounds.

Table 3-8 presents the ground water concentration data for Site 5. As shown in Table 3-8, some metals concentrations detected in the ground water samples exceed drinking water criteria. In addition, low levels of organic compounds were detected in some of the samples. Phenols were detected at levels between 30 and 800 ug/L in all Round 2 ground water samples, which are likely attributable to naturally occurring phenolic compounds.

### 3.5 LANGLEY DRIVE DISPOSAL SITE, SITE 6

In Rounds 1 and 2 of the investigation of Site 6, soil, surface water, and sediment samples were collected and analyzed. Figure 3-5 shows the locations of the Round 1 sampling locations. The Round 1 surface water/sediment sampling locations shown in Figure 3-5 were resampled in Round 2. Also, some of the Round 1 soil sampling locations were resampled in Round 2 along with additional Round 2 soil sampling locations. The Round 2 soil sampling locations are shown in Figure 3-6.

Table 3-9 presents the Round 1 and Round 2 sediment and soil sampling data. The sediment sampling data shows that phenols

Table 3-7. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Surface Water Sampling Results, Site 5, Army Cremator Disposal Area

Constituent	Round 1 Concentrations					Round 2 Concentrations					Chemical Toxicity Parameters					
	Concentrations					Concentrations					Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)
SURFACE WATER																
Sample Number:	5SW1	5SW2	5SW3	5SW4	5SW5	5SW01	5SW02	5SW03	5SW04	5SW05						
Bis(2-eth'hex')phthalate (ug/L)	1	1	2	--	1	1.7	--	1.6	2.4	10	Oral TDLo (man) = 143 mg/kg	0.0200	NR	NR	NR	NR
Di-n-octylphthalate (ug/L)	1	7	4	--	2	--	--	--	--	--	Oral LD50 (mus) = 6,513 mg/kg	NR	NR	NR	NR	NR
Arsenic (ug/L)	102	105	97.0	96.0	104	--	--	--	--	--	Oral TDLo (man) = 7857 mg/kg/55-1	NR	50	50	0.0022	50
Chromium (Total) (ug/L)	--	--	7.49	6.0	6.39	108	3.7	12.4	7.7	1.05	NR	0.00500	50	50	50	50
Copper (ug/L)	2.0	--	--	--	--	--	--	24.8	--	--	Oral TDLo (hmn) = 120 ug/kg	0.0370	NR	(s) 1,000	(+, FCC) 12	NR
Nickel (ug/L)	--	--	--	--	33.6	--	--	--	--	--	INTR. LDLo (rat) = 12 mg/kg	0.0100	NR	NR	13.4	NR
Selenium (ug/L)	--	--	--	--	--	181	11.0	14.9	8.0	221	Oral LD50 (rat) = 6700 mg/kg	0.00300	10	10	10	10
Silver (ug/L)	--	--	--	--	--	28.8	--	3.8	--	28.9	IMP. TDLo (rat) = 2400 mg/kg	0.00300	50	50	50	50
Thallium (ug/L)	83.3	86.7	89.1	116	111	--	--	--	--	--	Oral LDLo (man) = 5714 ug/kg	0.000400	NR	NR	13	NR
Zinc (ug/L)	15.0	16.1	4.31	19.9	5.01	--	--	20.8	--	--	INH. TCLo (hmn) = 124 mg/M3/50M	0.210	NR	(s) 5,000	(+, FCC) 110	NR
Phenols (ug/L)	N/A	N/A	N/A	N/A	N/A	540	29	57	33	130	NR	NR	NR	NR	NR	NR

-- = Not Detected.  
N/A = Not Analyzed.  
NR = Not Reported.

LD50 = Lethal Dose Fifty  
LDLo = Lethal Dose Low  
TDLo = Toxic Dose Low  
TCLo = Toxic Concentration Low

mus = Mouse  
hmn = Human  
wmn = Woman

INH = Inhalation  
ITR = Intravenous  
IMP = Implant

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

RCRA MCL = RCRA Maximum Concentration Limits.

MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.

AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.

PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

\* = Limit for Total Trihalomethanes (sum of Bromodichloromethane, Bromoform, Chloroform, Dibromochloromethane)

Source: ESE, 1988

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Table 3-8. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Ground Water Sampling Results, Site 5,

Constituent	Round 1 Concentrations					Round 2 Concentrations					Chemical Toxicity Parameters					
	5GW1	5GW2	5GW3	5GW4	5GW5	5GW01	5GW02	5GW03	5GW04	5GW05	Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)
<b>GROUND WATER</b>																
Sample Number	5GW1	5GW2	5GW3	5GW4	5GW5	5GW01	5GW02	5GW03	5GW04	5GW05						
Bis(2-eth'hex')phthalate (ug/L)	--	--	--	1	2	--	--	1.5	1.0	22	Oral TDLo (man) = 143 mg/kg	0.0200	NR	NR	NR	NR
Chloroform (ug/L)	0.54	--	--	--	--	--	--	--	--	--	Oral LDLo (hmn) = 140 mg/kg	0.0100	NR	*100	0.19	*100
Pentachlorophenol (ug/L)	22	11	12	25	--	--	--	--	--	--	Oral LDLo (hmn) = 29 mg/kg	0.0300	NR	NR	1010	NR
1,1,2,2-Te'ch'ethane (ug/L)	1.1	--	--	--	--	--	--	--	--	--	Oral TDLo (hmn) = 30 mg/kg	NR	NR	NR	0.17	NR
Arsenic (ug/L)	20.5	--	93.4	88.6	83.9	2.5	--	--	--	--	Oral TDLo (man) = 7857 mg/kg/55-1	NR	50	50	0.0022	50
Beryllium (ug/L)	--	--	--	5.06	--	--	--	--	--	--	INH. TCLo (hmn) = 300 mg/M3	0.000500	NR	NR	0.0068	NR
Chromium (Total) (ug/L)	3.25	6.05	18.1	26.9	28.4	16.0	9.7	205	178	163	NR	0.00500	50	50	50	50
Chromium (+6) (ug/L)	--	--	22.0	--	34.6	--	--	--	--	110	NR	0.00500	50	50	50	50
Copper (ug/L)	23.9	58.2	1850	113	55.8	--	9.2	1780	--	154	Oral TDLo (hmn) = 120 ug/kg	0.0370	NR	(s) 1,000	(+,FCC) 12	NR
Nickel (ug/L)	--	4.32	46.3	48.0	12.6	--	--	34.1	17.8	20.5	ITR. LDLo (rat) = 12 mg/kg	0.0100	NR	NR	13.4	NR
Selenium (ug/L)	--	--	--	--	--	10.5	9.5	359	310	122	Oral LD50 (rat) = 6700 mg/kg	0.00300	10	10	10	10
Silver (ug/L)	--	--	--	--	--	--	3.7	37.7	24.7	37.6	IMP. TDLo (rat) = 2400 mg/kg	0.00300	50	50	50	50
Thallium (ug/L)	10.6	9.64	4310	3860	3450	--	--	--	--	69.4	Oral LDLo (man) = 5714 ug/kg	0.000400	NR	NR	13	NR
Zinc (ug/L)	33.2	56.1	124	4580	76.3	35.0	--	222	2.0	192	INH. TCLo (hmn) = 124 mg/M3/50M	0.210	NR	(s) 5,000	(+,FCC) 110	NR
Phenols (ug/L)	N/A	N/A	N/A	N/A	N/A	76	30	350	800	220	NR	NR	NR	NR	NR	NR

-- = Not Detected.  
 N/A = Not Analyzed.  
 NR = Not Reported.

LD50 = Lethal Dose Fifty  
 LDLo = Lethal Dose Low  
 TDLo = Toxic Dose Low  
 TCLo = Toxic Concentration Low

hmn = Human  
 INH = Inhalation  
 ITR = Intravenous  
 IMP = Implant

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10-6 cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.  
 \* = Limit for Total Trihalomethanes (sum of Bromodichloromethane, Bromoform, Chloroform, Dibromochloromethane)

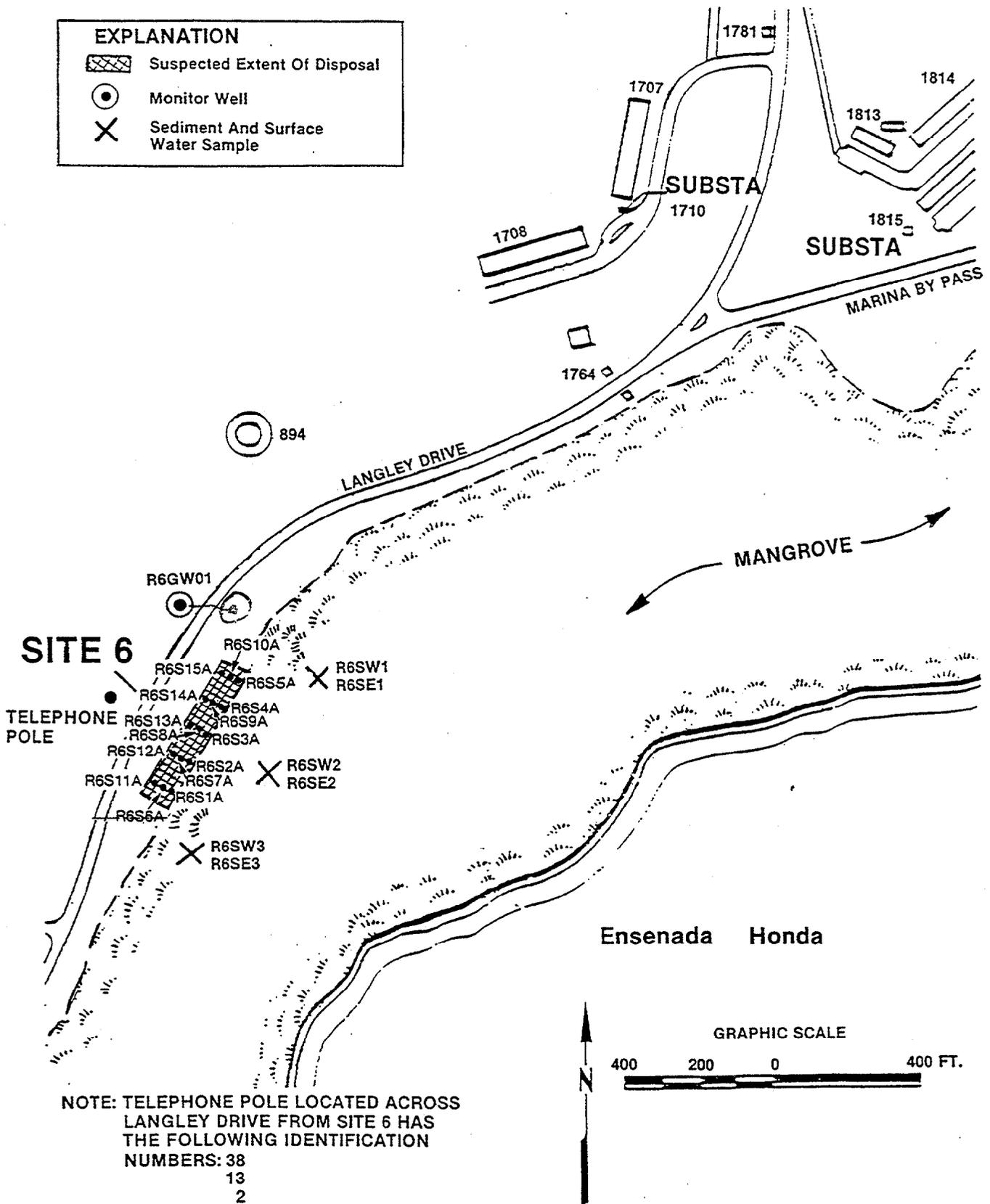
Source: ESE, 1988

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**EXPLANATION**

-  Suspected Extent Of Disposal
-  Monitor Well
-  Sediment And Surface Water Sample



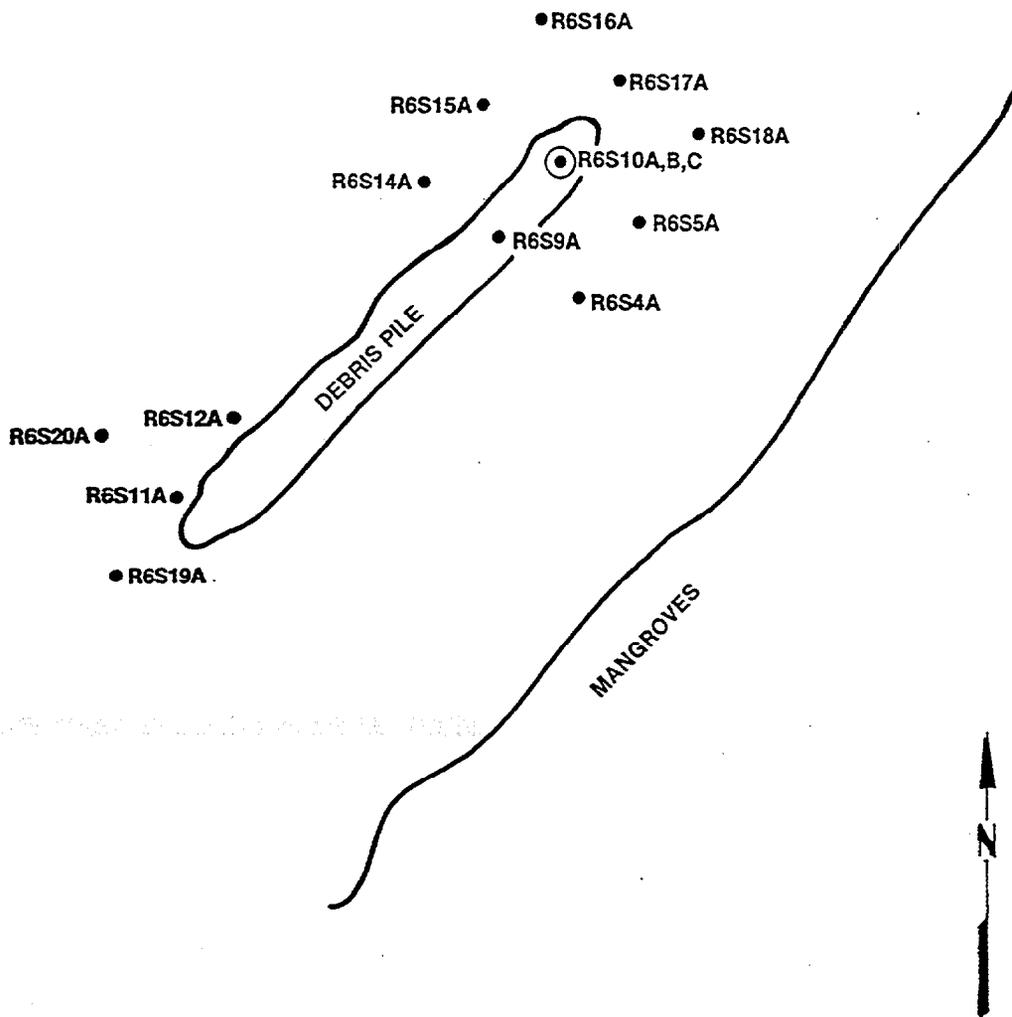
NOTE: TELEPHONE POLE LOCATED ACROSS LANGLEY DRIVE FROM SITE 6 HAS THE FOLLOWING IDENTIFICATION NUMBERS: 38  
13  
2

SOURCES: NEESA, 1984b; ESE, 1985.

Figure 3-5  
ROUND 1 SAMPLING LOCATIONS AT SITE 6,  
LANGLEY DRIVE DISPOSAL SITE



CONFIRMATION STUDY  
U.S. NAVAL COMPLEX  
PUERTO RICO



**EXPLANATION**

- Composite Soil Sample From 0 To 1 Ft. Depth
- ⊙ Composite Soil Samples From 0- To 1- Ft. Depth, 1- To 2- Ft. Depth, And 2- To 3- Ft. Depth (Total Of 3 Samples);

NOTE: Grid Spacing For Soil Sampling Locations Is 25 Feet

Figure 3-6  
 ROUND 2 SOIL SAMPLING LOCATIONS AT  
 SITE 6, LANGLEY DRIVE DISPOSAL SITE



CONFIRMATION STUDY  
 U.S. NAVAL COMPLEX  
 PUERTO RICO

Table 3-9. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Sediment and Soil Sampling Results, Site 6, Langley Drive Disposal Site

Constituent	Round 1 Concentrations						Round 2 Concentrations			Toxicity Data	Chemical Toxicity Parameters				
	Round 1 Concentrations			Round 2 Concentrations			AIC mg/kg/day	Designated Levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)		Element Concentration Ranges in Soils (ug/g)				
<b>SEDIMENT</b>															
Sample Number:	R6SE1	R6SE2	R6SE3				R6SE01	R6SE02	R6SE03						
Bis(2-eth'hex')phthalate (mg/kg, dry)	0.09	--	--				13	--	10	Oral TDLo (man) = 143 mg/kg	0.0200	4200	NR	NR	
Di-n-octylphthalate (mg/kg, dry)	0.3	0.2	0.2				--	--	--	Oral LD50 (rat) = 6513 mg/kg	NR	NR	NR	NR	
Methyl Ethyl Ketone (ug/g, dry)	--	--	1.6				--	--	--	Oral LD50 (rat) = 2737 mg/kg	0.0500	75	NR	NR	
Antimony (mg/kg, dry)	5.9	6.9	7.4				--	--	--	Oral LD50 (rat) = 7 gm/kg	0.000400	1460	500	<1 - 8.8	
Arsenic (ug/g, dry)	7.76	15.1	16.4				3.76	1.94	4.75	Oral TDLo (man) = 7857 mg/kg/55Y-1	NR	500	500	<0.1 - 97	
Beryllium (mg/kg, dry)	--	0.360	0.392				--	--	--	INH. TCLo (hmn) = 300 mg/M3	0.000500	0.068	75	<1 - 15	
Cadmium (ug/g, dry)	--	--	--				1.71	0.520	0.747	Oral LD50 (rat) = 225 mg/kg	0.000290	100	100	NR	
Chromium (Total) (ug/g, dry)	6.71	11.7	18.0				14.2	6.58	13.9	NR	0.00500	500	500	1 - 2000	
Copper (ug/g, dry)	9.10	20.4	26.4				35.9	10.9	57.5	Oral TDLo (hmn) = 120 ug/kg	0.0370	20000	2500	<1 - 700	
Lead (ug/g)	--	--	--				12.2	6.06	21.2	Oral TDLo (wmm) = 150 mg/kg/6Y	0.00140	500	1000	<10 - 700	
Mercury (ug/g, dry)	--	--	0.084				--	--	0.174	INH. TCLo (wmm) = 150 ug/M3/460	0.00200	20	20	<0.01 - 4.6	
Nickel (ug/g, dry)	3.46	5.62	7.45				--	--	--	ITR. LDLo (rat) = 12mg/kg	0.0100	0.134	2000	<5 - 700	
Selenium (mg/kg, dry)	7.02	16.3	19.4				1.92	0.851	--	Oral LD50 (rat) = 6700 mg/kg	0.00300	100	100	<0.1 - 4.3	
Zinc (ug/g, dry)	14.1	23.3	29.8				53.5	22.2	67.0	INH. TCLo (hmn) = 124 mg/M3/50M	0.210	200000	5000	<5 - 2900	
Phenols (ug/kg, dry)	N/A	N/A	N/A				6590	3670	5410	NR	NR	NR	NR	NR	
<b>SOIL</b>															
Sample Number:	R6S1A	R6S2A	R6S3A	R6S4A	R6S5A	R6S6A	R6S04A	R6S05A							
Benzo(a)anthracene (mg/kg, dry)	--	--	--	--	0.07	0.1	N/A	N/A		ITR. LDLo (mus) = 10 mg/kg	NR	2800	NR	NR	
Benzo(b)fluoranthene (mg/kg, dry)	--	--	--	--	0.06	0.2	N/A	N/A		NR	NR	2800	NR	NR	
Benzo(k)fluoranthene (mg/kg, dry)	--	--	--	--	0.04	0.09	N/A	N/A		NR	NR	2800	NR	NR	
Benzo(a)pyrene (mg/kg, dry)	--	--	--	--	0.04	0.2	N/A	N/A		NR	NR	2800	NR	NR	
Benzo(g,h,i)perylene (mg/kg, dry)	--	--	--	--	--	0.08	N/A	N/A		NR	NR	2800	NR	NR	
Bis(2-eth'hex')phthalate (mg/kg, dry)	--	--	0.05	--	0.06	0.2	N/A	N/A		Oral TDLo (man) = 143 mg/kg	0.0200	4200	NR	NR	
Chrysene (mg/kg, dry)	--	--	--	--	0.08	0.1	N/A	N/A		NR	NR	2800	NR	NR	
Di-n-octylphthalate (mg/kg, dry)	--	0.10	--	--	0.10	--	N/A	N/A		Oral LD50 (rat) = 6513 mg/kg	NR	NR	NR	NR	
Fluoranthene (mg/kg, dry)	--	--	--	--	0.06	0.2	N/A	N/A		Oral LD50 (rat) = 2000 mg/kg	NR	42.0	NR	NR	
Indeno(1,2,3-cd)pyrene (mg/kg, dry)	--	--	--	--	--	0.06	N/A	N/A		NR	NR	2800	NR	NR	
Phenanthrene (mg/kg, dry)	--	--	--	--	--	0.03	N/A	N/A		Oral LD50 (mus) = 700 mg/kg	NR	2800	NR	NR	
Pyrene (mg/kg, dry)	--	--	--	--	0.06	0.2	N/A	N/A		NR	NR	2800	NR	NR	
Antimony (mg/kg, dry)	11	10	10	9.4	18	28	N/A	N/A		Oral LD50 (rat) = 7 gm/kg	0.000400	1460	500	<1 - 8.8	
Arsenic (ug/g, dry)	16.6	57.1	15.9	22.5	35.5	12.7	N/A	N/A		Oral TDLo (man) = 7857 mg/kg/55Y-1	NR	500	500	<0.1 - 97	

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Table 3-9 (Continued)

Constituent	Round 1 Concentrations								Round 2 Concentrations								Chemical Toxicity Parameters				
	Round 1 Concentrations								Round 2 Concentrations								Toxicity Data	AIC mg/kg/day	Designated Levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
SOIL (Continued)																					
Sample Number:	R6S1A	R6S2A	R6S3A	R6S4A	R6S5A	R6S6A	R6S04A	R6S05A	R6S04A	R6S05A											
Beryllium (ug/g, dry)	--	1.01	0.276	0.623	1.11	0.289	N/A	N/A	N/A	N/A					INH. TLo (hmn) = 300 mg/M3	0.000500	0.068	75	<1 - 15		
Cadmium (ug/g, dry)	--	2.88	--	--	0.881	0.729	N/A	N/A	N/A	N/A					Oral LD50 (rat) = 225 mg/kg	0.000290	100	100	NR		
Chromium (Total) (ug/g, dry)	16.9	23.7	17.9	17.5	34.9	13.8	N/A	N/A	N/A	N/A					NR	0.00500	500	500	1 - 2000		
Copper (ug/g, dry)	22.6	50.3	20.6	26.2	380	51.0	N/A	N/A	N/A	N/A					Oral TDLo (hmn) = 120 ug/kg	0.0370	20000	2500	<1 - 700		
Lead (ug/g, dry)	--	--	--	--	222	--	316	376							Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	500	1000	<10 - 700		
Mercury (ug/g, dry)	0.052	--	--	--	0.714	0.991	N/A	N/A	N/A	N/A					Oral TDLo (wmn) = 150 mg/kg/6Y	0.00200	20	20	<0.01 - 4.6		
Nickel (ug/g, dry)	6.32	12.5	6.35	6.59	14.5	5.07	N/A	N/A	N/A	N/A					ITR. LDLo (rat) = 12mg/kg	0.0100	0.134	2000	<5 - 700		
Selenium (mg/kg, dry)	13.9	55.8	16.1	21.0	49.3	13.5	N/A	N/A	N/A	N/A					Oral LD50 (rat) = 6700 mg/kg	0.00300	100	100	<0.1 - 4.3		
Zinc (ug/g, dry)	28.3	71.7	31.9	48.2	329	81.5	N/A	N/A	N/A	N/A					INH. TLo (man) = 124 mg/M3/50M	0.210	200000	5000	<5 - 2900		
Sample Number:	R6S7A	R6S8A	R6S9A	R6S10A	R6S11A	R6S12A	R6S09A	R6S010A	R6S010B	R6S010C	R6S011A	R6S012A									
Benzo(a)anthracene (mg/kg, dry)	--	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				ITR. LDLo (mus) = 10 mg/kg	NR	2800	NR	NR	
Benzo(b)fluoranthene (mg/kg, dry)	--	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				NR	NR	2800	NR	NR	
Benzo(k)fluoranthene (mg/kg, dry)	--	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				NR	NR	2800	NR	NR	
Benzo(a)pyrene (mg/kg, dry)	--	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				NR	NR	2800	NR	NR	
Benzo(g,h,i)perylene (mg/kg, dry)	--	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				NR	NR	2800	NR	NR	
Bis(2-eth'hex')phthalate (mg/kg, dry)	0.05	--	0.08	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				Oral TDLo (man) = 143 mg/kg	0.0200	4200	NR	NR	
Chrysene (mg/kg, dry)	--	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				NR	NR	2800	NR	NR	
Di-n-octylphthalate (mg/kg, dry)	0.1	0.2	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				Oral LD50 (rat) = 6513 mg/kg	NR	NR	NR	NR	
Fluoranthene (mg/kg, dry)	0.02	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				Oral LD50 (rat) = 2000 mg/kg	NR	42.0	NR	NR	
Indeno(1,2,3-cd)pyrene (mg/kg, dry)	--	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				NR	NR	2800	NR	NR	
Phenanthrene (mg/kg, dry)	--	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				Oral LD50 (mus) = 700 mg/kg	NR	2800	NR	NR	
Pyrene (mg/kg, dry)	0.02	--	--	--	--	--	N/A	N/A	N/A	N/A	N/A	N/A				NR	NR	2800	NR	NR	
Antimony (mg/kg, dry)	27	51	15	17	9.5	9.1	N/A	N/A	N/A	N/A	N/A	N/A				Oral LD50 (rat) = 7 gm/kg	0.000400	1460	500	<1 - 8.8	
Arsenic (ug/g, dry)	134	30.9	54.1	35.7	25.5	88.2	N/A	N/A	N/A	N/A	N/A	N/A				Oral TDLo (man) = 7857 mg/kg/55Y-1	NR	500	500	<0.1 - 97	
Beryllium (ug/g, dry)	3.31	2.18	1.17	2.52	1.59	6.14	N/A	N/A	N/A	N/A	N/A	N/A				INH. TLo (hmn) = 300 mg/M3	0.000500	0.068	75	<1 - 15	
Cadmium (ug/g, dry)	2.41	1.54	1.12	1.69	0.872	2.41	N/A	N/A	N/A	N/A	N/A	N/A				Oral LD50 (rat) = 225 mg/kg	0.000290	100	100	NR	
Chromium (Total) (ug/g, dry)	39.0	36.0	78.2	39.2	50	58.4	N/A	N/A	N/A	N/A	N/A	N/A				NR	0.00500	500	500	1 - 2000	

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Table 3-9 (Continued)

Constituent	Round 1 Concentrations												Round 2 Concentrations												Chemical Toxicity Parameters				
	Round 1 Concentrations												Round 2 Concentrations												Toxicity Data	AIC mg/kg/day	Designated Levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
SOIL (Continued)																													
Sample Number:	R6S7A	R6S8A	R6S9A	R6S10A	R6S11A	R6S12A	R6S09A	R6S010A	R6S010B	R6S010C	R6S011A	R6S012A	R6S014A	R6S015A															
Copper (ug/g, dry)	823	163	107	383	211	527	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Oral TDLo (hmn) = 120 ug/kg	0.0370	20000	2500	<1 - 700										
Lead (ug/g, dry)	76.5	92.8	180	3040	568	197	988	250	199	63.6	35.1	214	N/A	N/A	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	500	1000	<10 - 700										
Lead (ug/L, Dissolved) EP-TOX Extraction	N/A	N/A	N/A	N/A	N/A	N/A	10.6	2.8	N/A	N/A	N/A	N/A	N/A	N/A	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	500 (ug/L) (Extractable)	5.0 (mg/L) (Soluble)	<10 - 700										
Mercury (ug/g, dry)	0.261	0.136	0.105	1.54	0.356	0.352	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Oral TDLo (wmn) = 150 mg/kg/6Y	0.00200	20	20	<0.01 - 4.6										
Nickel (ug/g, dry)	30.3	22.2	56.1	33.4	17.2	68.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ITR. LDLo (rat) = 12mg/kg	0.0100	0.134	2000	<5 - 700										
Selenium (mg/kg, dry)	80.5	65.1	44.6	93.9	65.4	426	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Oral LD50 (rat) = 6700 mg/kg	0.00300	100	100	<0.1 - 4.3										
Zinc (ug/g, dry)	439	520	339	758	475	949	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	INH. TCLO (man) = 124 mg/M3/50M	0.210	200000	5000	<5 - 2900										
Sample Number:	R6S13A	R6S14A	R6S15A																										
Benzo(a)anthracene (mg/kg, dry)	--	0.03	--	N/A	N/A																								
Benzo(b)fluoranthene (mg/kg, dry)	--	0.04	--	N/A	N/A																								
Benzo(k)fluoranthene (mg/kg, dry)	--	--	--	N/A	N/A																								
Benzo(a)pyrene (mg/kg, dry)	--	--	--	N/A	N/A																								
Benzo(g,h,i)perylene (mg/kg, dry)	--	--	--	N/A	N/A																								
Bis(2-eth'hex')phthalate (mg/kg, dry)	--	0.3	4	N/A	N/A																								
Chrysene (mg/kg, dry)	--	0.04	--	N/A	N/A																								
Di-n-octylphthalate (mg/kg, dry)	--	0.1	--	N/A	N/A																								
Fluoranthene (mg/kg, dry)	--	0.03	--	N/A	N/A																								
Indeno(1,2,3-cd)pyrene (mg/kg, dry)	--	--	--	N/A	N/A																								
Phenanthrene (mg/kg, dry)	--	--	--	N/A	N/A																								
Pyrene (mg/kg, dry)	--	0.03	--	N/A	N/A																								
Antimony (mg/kg, dry)	20	9.4	6.5	N/A	N/A																								
Arsenic (ug/g, dry)	--	7.24	34.9	N/A	N/A																								
Beryllium (mg/kg, dry)	14.9	1.61	1.39	N/A	N/A																								
Cadmium (mg/kg, dry)	0.762	2.71	0.577	N/A	N/A																								
Chromium (Total) (ug/g, dry)	75.2	35.2	18.6	N/A	N/A																								

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Table 3-9 (Continued)

Constituent	Round 1 Concentrations			Round 2 Concentrations						Chemical Toxicity Parameters					
	R6S13A	R6S14A	R6S15A	R6S014A	R6S015A	R6S016A	R6S017A	R6S018A	R6S019A	R6S020A	Toxicity Data	AIC mg/kg/day	Designated Levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
SOIL (Continued)															
Sample Number:	R6S13A	R6S14A	R6S15A	R6S014A	R6S015A	R6S016A	R6S017A	R6S018A	R6S019A	R6S020A					
Copper (ug/g, dry)	383	332	101	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Oral TDLo (hmn) = 120 ug/kg	0.0370	20000	2500	<1 - 700
Lead (ug/g, dry)	58.0	466	169	236	116	71.1	79.0	43.3	233	187	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	500	1000	<10 - 700
Mercury (ug/g, dry)	--	0.449	0.898	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Oral TDLo (wmn) = 150 mg/kg/6Y	0.00200	20	20	<0.01 - 4.6
Nickel (ug/g, dry)	165	32.3	23.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	INTR. LDLo (rat) = 12mg/kg	0.0100	0.134	2000	<5 - 700
Selenium (ug/g, dry)	--	68.5	60.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Oral LD50 (rat) = 6700 mg/kg	0.00300	100	100	<0.1 - 4.3
Zinc (ug/g, dry)	181	426	210	N/A	N/A	N/A	N/A	N/A	N/A	N/A	INH. TCLO (man) = 124 mg/M3/50M	0.210	200000	5000	<5 - 2900

-- = Not Detected.  
 N/A = Not Analyzed  
 NR = Not Reported  
 LD50 = Lethal Dose Fifty  
 LDLo = Lethal Dose Low  
 TDLo = Toxic Dose Low  
 TCLO = Toxic Concentration Low  
 hmn = Human  
 wmn = Woman  
 mus = Mouse  
 INH = Inhalation  
 ITR = Intravenous  
 AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.  
 Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

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were detected in all sediment samples at Site 6 during Round 2, but were likely attributable to naturally occurring phenolic compounds in the mangrove environment of Site 6. None of the other constituents of concern were detected in elevated levels in the sediments at Site 6.

With regard to the soil sampling data, some of the soil samples had elevated levels of lead, particularly in the vicinity of sample locations R6S10A and R6S11A. Therefore, the Round 2 investigation included the collection of an additional 15 soil samples for lead analysis near these sample locations. In addition, two of the 15 Round 2 soil samples (R6S9A and R6S10A) were subjected to the Extraction Procedure (EP) toxicity test. The Round 2 lead concentrations suggest that the elevated lead levels are restricted to the immediate area of sample locations R6S10A and R6S11A.

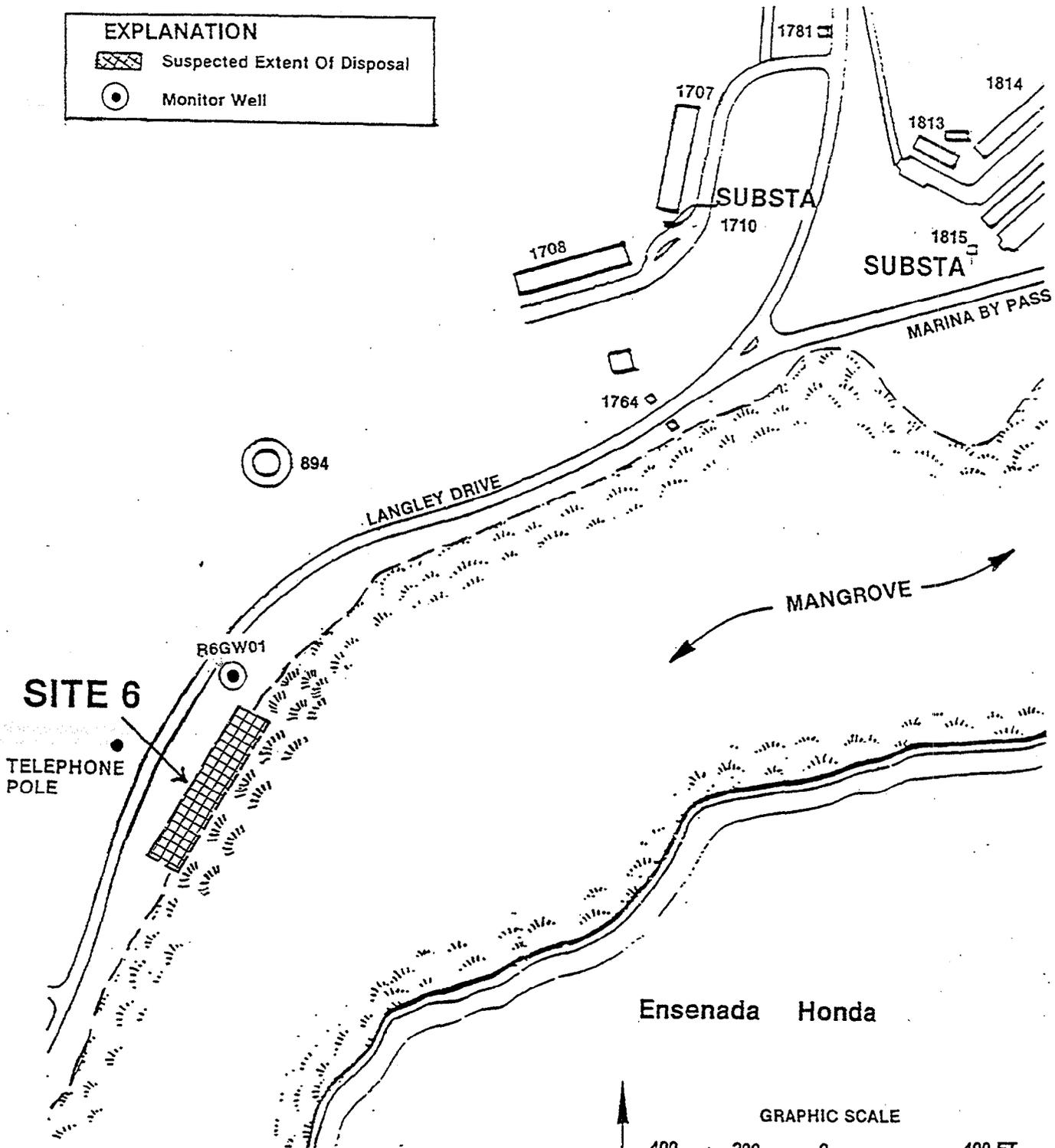
The EP toxicity data indicates that the EP toxicity test lead concentrations were 2.8 and 10.6 ug/L, which are below the maximum contaminant level of 50 ug/L lead. Therefore, the soil samples are not classified as a hazardous waste.

In the Round 2 investigation, a shallow ground monitor well as installed upgradient of Site 6. Figure 3-7 shows the location of this monitor well. Table 3-10 presents the Round 2 ground water sampling results, as well as the Round 1 and 2 surface water resampling results. The surface water data show that, in general, Round 2 metals levels were lower than Round 1 levels. However, chromium, copper, and selenium levels exceed ambient water quality criteria. Phenols were also detected in the Round 2 surface water samples, but are likely attributable to naturally occurring phenolic compounds in the mangrove environment.

**EXPLANATION**

 Suspected Extent Of Disposal

 Monitor Well



NOTE: TELEPHONE POLE LOCATED ACROSS LANGLEY DRIVE FROM SITE 6 HAS THE FOLLOWING IDENTIFICATION NUMBERS: 38  
13  
2

SOURCES: NEESA, 1984b; ESE, 1985.

Figure 3-7  
ROUND 2 GROUND WATER SAMPLING LOCATION  
AT SITE 6, LANGLEY DRIVE DISPOSAL SITE



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Table 3-10. NAVSTA Roosevelt Roads Confirmation Study, Surface Water and Ground Water Sampling Results, Site 6, Langley Drive Disposal Site

Constituent	Round 1 Concentrations			Round 2 Concentrations			Chemical Toxicity Parameters					
	R6SW1	R6SW2	R6SW3	R6SW01	R6SW02	R6SW03	Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)
SURFACE WATER												
Sample Number:	R6SW1	R6SW2	R6SW3	R6SW01	R6SW02	R6SW03						
Bis(2-eth'hex')phthalate (ug/L)	1	1	--	1.0	2.4	1.3	Oral TDLo (man) = 143 mg/kg	0.0200	NR	NR	NR	NR
Di-n-octylphthalate (ug/L)	2	--	2	--	--	--	Oral LD50 (mus) = 6,513 mg/kg	NR	NR	NR	NR	NR
Beryllium (ug/L)	23.6	50.6	24.7	--	--	--	INH. TCLo (hmn) = 300 mg/M3	0.000500	NR	NR	0.0068	NR
Cadmium (ug/L)	4.42	8.40	3.35	--	--	--	Oral LD50 (rat) = 225 mg/kg	0.0002900	10	10	10	10
Chromium (+6) (ug/L)	--	34.4	36.7	N/A	N/A	N/A	NR	0.00500	50	50	50	50
Chromium (Total) (ug/L)	318	611	339	97.4	107	116	NR	0.00500	50	50	50	50
Copper (ug/L)	354	966	516	--	--	67.8	Oral TDLo (hmn) = 120 ug/kg	0.0370	NR	(s) 1,000 (+, FCC) 12		NR
Lead (ug/L)	211	526	244	--	--	--	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	50	50	50	50
Mercury (ug/L)	0.856	0.997	0.997	--	--	--	INH. TCLo (wmn) = 150 ug/M3/46D	0.00200	2.0	2.0	0.144	2.0
Nickel (ug/L)	135	252	147	--	--	--	ITR. LDLo (rat) = 12 mg/kg	0.0100	NR	NR	13.4	NR
Selenium (ug/L)	278	--	549	162	191	241	Oral LD50 (rat) = 6700 mg/kg	0.00300	10	10	10	10
Silver (ug/L)	--	--	--	32.2	31.1	28.7	IMP. TDLo (rat) = 2400 mg/kg	0.00300	50	50	50	50
Thallium (ug/L)	29.3	28.6	19.2	--	--	--	Oral LDLo (man) = 5714 ug/kg	0.000400	NR	NR	13	NR
Zinc (ug/L)	558	1310	8.18	--	--	52.5	INH. TCLo (hmn) = 124 mg/M3/50M	0.210	NR	(s) 5,000 (+, FCC) 110		NR
Phenols (ug/L)	N/A	N/A	N/A	70	40	1200	NR	NR	NR	NR	NR	NR
GROUND WATER												
Sample Number				R6GW01								
Chloroform (ug/L)				1.7			Oral LDLo (hmn) = 140 mg/kg	0.0100	NR	*100	0.19	*100
Bis(2-eth'hex')phthalate (ug/L)				1.9			Oral TDLo (man) = 143 mg/kg	0.0200	NR	NR	NR	NR
Pentachlorophenol (ug/L)				11			Oral LDLo (hmn) = 29 mg/kg	0.0300	NR	NR	1010	NR
Aldrin (ug/L)				0.006			Oral LD50 (rat) = 39 mg/kg	0.0000300	NR	NR	NR	NR
Copper (ug/L)				6.1			Oral TDLo (hmn) = 120 ug/kg	0.0370	NR	(s) 1,000 (+, FCC) 12		NR
Lead (ug/L)				121			Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	50	50	50	50
Zinc (ug/L)				40.1			INH. TCLo (hmn) = 124 mg/M3/50M	0.210	NR	(s) 5,000 (+, FCC) 110		NR
Phenols (ug/L)				58			NR	NR	NR	NR	NR	NR

-- = Not Detected.  
 N/A = Not Analyzed.  
 NR = Not Reported.  
 LD50 = Lethal Dose Fifty  
 LDLo = Lethal Dose Low  
 TDLo = Toxic Dose Low  
 TCLo = Toxic Concentration Low

IMP = Implantation  
 INH = Inhalation  
 ITR = Intravenous  
 UKN = Unknown  
 mus = Mouse  
 hmn = Human  
 wmn = Woman

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.  
 \* = Limit for Total Trihalomethanes (sum of Bromodichloromethane, Bromoform, Chloroform, Dibromochloromethane).

The ground water data indicates the presence of low levels of organic compounds including pentachlorophenol and aldrin. In addition, the lead concentration exceeds drinking water standards.

### 3.6 STATION LANDFILL, SITE 7

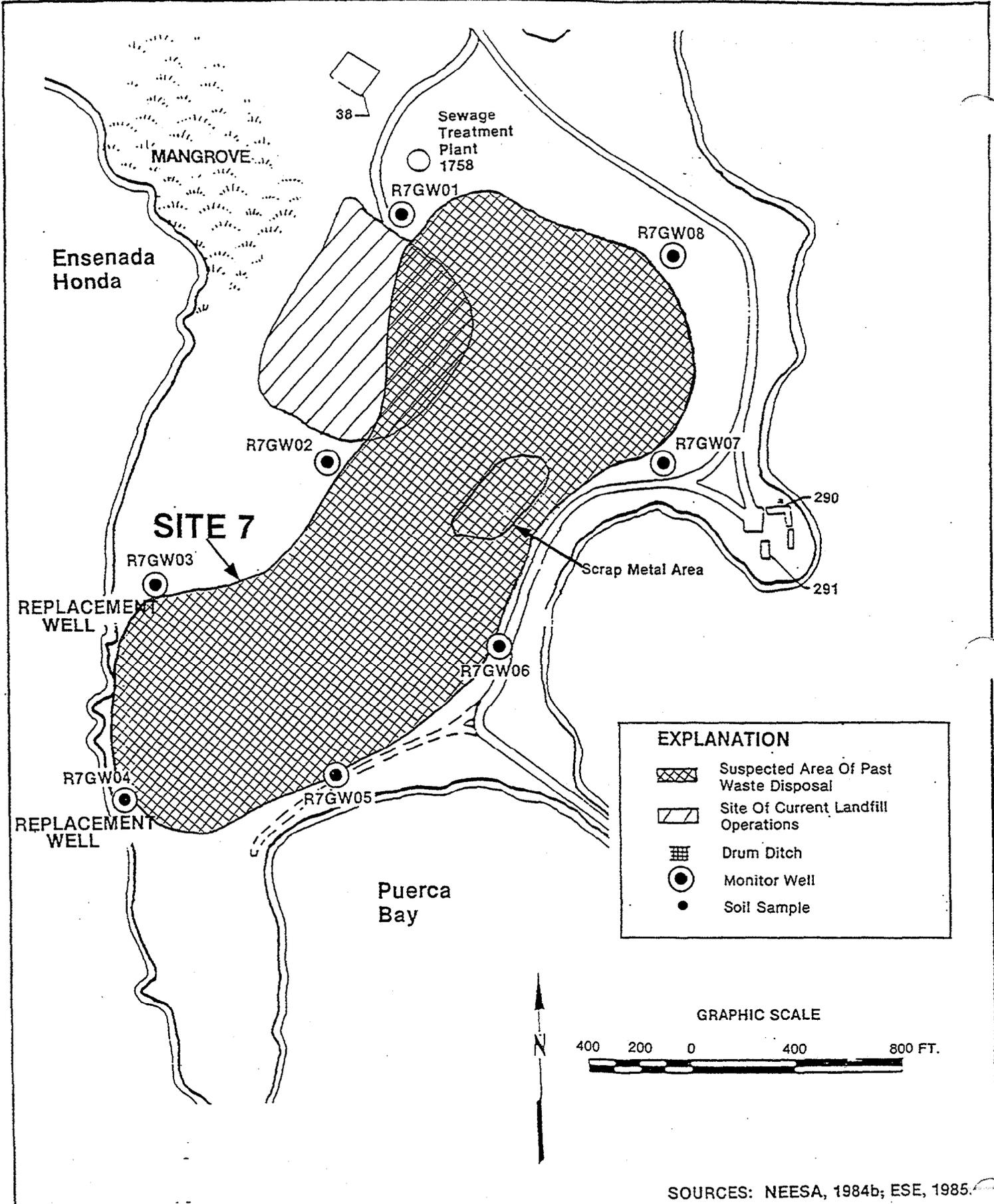
In the Round 1 investigation of Site 7, eight ground water monitor wells were installed, and samples of ground water were collected from each well and analyzed. In addition, three composite soil samples were collected from the Drum Ditch, a separate disposal area within Site 7. Figure 3-8 shows the location of the monitor wells and the soil sampling locations.

Table 3-11 presents the soil sampling results. As shown, only low levels of oil and grease were detected in the Drum Ditch.

In the Round 2 investigation, the eight monitor wells were resampled. Table 3-12 presents the ground water sampling results for the Round 1 and 2 investigations. As shown in Table 3-12, low levels of organic compounds, as well as metals concentrations exceeding drinking water criteria, were present in the ground water samples collected during both rounds of sampling. Metals levels were highest in the samples from the two wells nearest the scrap metal area, R7GW06 and R7GW07 (see Figure 3-8). Round 2 metals levels found in R7GW07 were markedly higher than Round 1 levels.

### 3.7 DRONE WASHDOWN, SITE 8

Sampling locations for Rounds 1 and 2 are shown on Figure 3-9. Surface water and sediment sample locations 8SW1/8SE1 through 8SW3/8SE3 were the same for both Rounds 1 and 2, but two additional surface water samples (8SW4 and 8SW5) were collected during Round 2. Soil sample location 8S1A was sampled only during Round 1, as a background sample.



SOURCES: NEESA, 1984b; ESE, 1985.

Figure 3-8  
ROUNDS 1 AND 2 SOIL AND GROUND  
WATER SAMPLING LOCATIONS AT SITE 7,  
STATION LANDFILL



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Table 3-11. NAVSTA Roosevelt Roads Confirmation Study, Soil  
 Sampling Results, Site 7, Station Landfill  
 Chemical Toxicity Parameters

Constituent	Round 1 Concentrations			Toxicity Data	AIC mg/kg/day	Designated Levels in a Solid (ug/g)	Threshold Limit Concentration (ug/g)	Element Concentration Ranges in Soils (ug/g)
	R7S1N	R7S2N	R7S3N					
Sample Number: Oil & Grease (ug/g, dry)	198	80	127	NR	NR	NR	NR	NR

NR = Not Reported.

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.

Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

Table 3-12. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Ground Water Sampling Results, Site 7, Station Landfill

Constituent	Round 1 Concentrations																Round 2 Concentrations																Chemical Toxicity Parameters							
	Round 1 Concentrations																Round 2 Concentrations																Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AHQC (ug/L)	PRDOH MCL (ug/L)		
GROUND WATER																																								
Sample Number:	R7GW1	R7GW2	R7GW3	R7GW4	R7GW5	R7GW6	R7GW7	R7GW8	R7GW01	R7GW02	R7GW03	R7GW04	R7GW05	R7GW06	R7GW07	R7GW08	R7GW1	R7GW2	R7GW3	R7GW4	R7GW5	R7GW6	R7GW7	R7GW8	R7GW01	R7GW02	R7GW03	R7GW04	R7GW05	R7GW06	R7GW07	R7GW08								
Chlorobenzene (ug/L)							89					180																							Oral LD50 (rat) = 5000 mg/kg	0.0270	NR	NR	NR	NR
Bis(2-eth'hex')phthalate 6 (ug/L)	6	1	3	5	2	3	8		1.5			1.7		5.3																				Oral TDLo (man) = 143 mg/kg	0.0200	NR	NR	NR	NR	
Butyl benz' phthalate (ug/L)	17		2	5		3	1	0.7																										Oral LD50 (rat) = 2330 mg/kg	NR	NR	NR	NR	NR	
Di-n-butylphthalate (ug/L)	2	0.9		0.7				1																										Oral TDLo (hmn) = 140 mg/kg	NR	NR	NR	NR	NR	
1,3-Dichlorobenzene (ug/L)								0.7																										NR	NR	NR	NR	400	NR	
1,2-Dichlorobenzene (ug/L)								0.9																										Oral LD50 (rat) = 500 mg/kg	NR	NR	NR	400	NR	
1,4-Dichlorobenzene (ug/L)				1.0				9				7.3																						Oral LD50 (rat) = 500 mg/kg	NR	NR	NR	400	NR	
1,1-Dichloroethane (ug/L)				2.3																														Oral LD50 (rat) = 725 mg/kg	NR	NR	NR	NR	NR	
Trans-1,2-Dichloroethene (ug/L)				1.5																														NR	NR	NR	NR	NR	NR	
Di-n-octylphthalate (ug/L)	1							0.8																										Oral LD50 (mus) = 6513 mg/kg	NR	NR	NR	NR	NR	
Antimony (ug/L)															1510																			Oral LD50 (rat) = 7 gm/kg	0.000400	NR	NR	146	NR	
Arsenic (ug/L)	73.6	58.6	121	87.0	84.9	93.9	46.1	120	9.6		2.2	20.9		10.9	7.8	7.7																		Oral TDLo (man) = 7857 mg/kg/55-1	NR	50	50	0.0022	50	
Beryllium (ug/L)	3.12					11.3	4.16	6.65						2.7	17.7																			INH, TLo (hmn) = 300 mg/M3	0.000500	NR	NR	0.0068	NR	
Chromium (+6) (ug/L)				46.0																														NR	0.00500	50	50	50	50	
Chromium (Total) (ug/L)	15.9	6.89	30.8	8.72	15.9	22.3	11.3	57.7	3.6	5.3	6.1	15.5		153	440	23.5																		NR	0.00500	50	50	50	50	
Copper (ug/l)	42.9	5.18	73.5	4.56	23.2	135	33.0	42.8	6.3	33.6	14.9	14.8	47.0	47.7	1820	167																		Oral TDLo (hmn) = 120 ug/kg	0.0370	NR	(s) 1,000 (+, FCC) 12	NR	NR	
Lead (ug/L)					424																													Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	50	50	50	50	
Nickel (ug/L)	11.5		14.3	10.2	10.0	13.5	12.2	18.7					13.5	54.8	225																			1TR, LDLo (rat) = 12 mg/kg	0.0100	NR	NR	13.4	NR	
Selenium (ug/L)						88.9			32.0	12.4		15.6	26.4	34.4																				Oral LD50 (rat) = 6700 mg/kg	0.00300	10	10	10	10	
Silver (ug/L)									39.0	12.6		40.2	39.7		369																				IMP, TDLo (rat) = 2400 mg/kg	0.00300	50	50	50	50
Thallium (ug/L)	187	187	1780	31.2	31.5	60.6	4.57	10.9	17.6			23.9	77.1	89.0		58.5																		Oral LD50 (man) = 5714 ug/kg	0.000400	NR	NR	13	NR	
Zinc (ug/L)	95.6	53.2	50.0	62.7	225	103	64.0	52.2	62.8		5.0	5.4		89.7	3510	41.5																		INH, TLo (hmn) = 124 mg/M3/50M	0.210	NR	(s) 5,000 (+, FCC) 110	NR	NR	
Phenols (ug/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	48	100	27	30	54	36	160	16																			NR	NR	NR	NR	NR	NR

-- = Not Detected.  
 N/A = Not Analyzed.  
 NR = Not Reported.  
 wmn = Woman  
 mus = Mouse  
 hum = Human

LD50 = Lethal Dose Fifty  
 LDLo = Lethal Dose Low  
 TDLo = Toxic Dose Low  
 TLo = Toxic Concentration Low  
 INH = Inhalation  
 IMP = Implantation  
 ITR = Intravenous

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.  
 AHQC = Ambient Water Quality Criteria is associated with 10-6 cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

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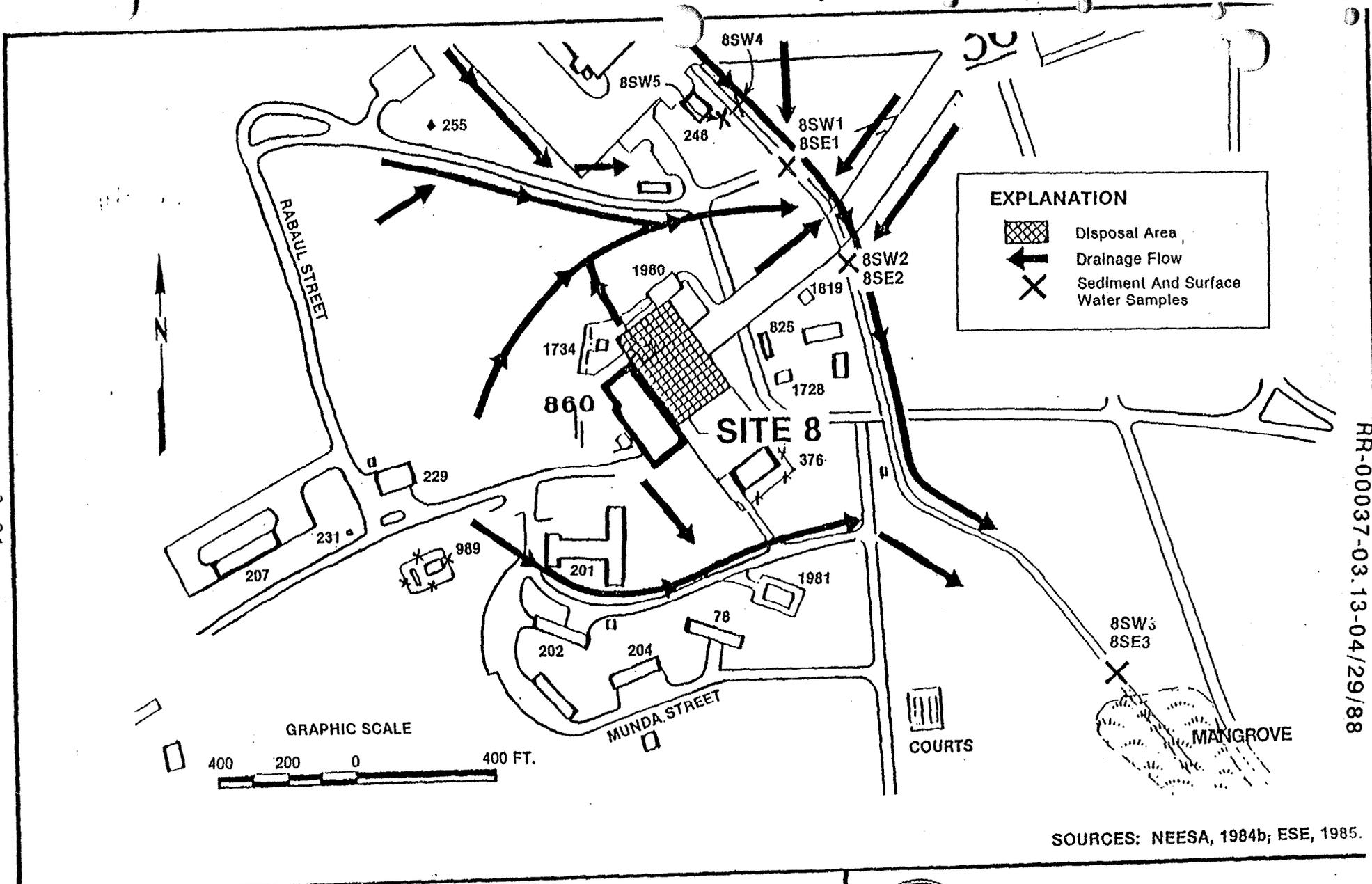


Figure 3-9  
ROUNDS 1 AND 2 SAMPLING LOCATIONS AT SITE 8,  
DRONE WASHDOWN



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Table 3-13 provides concentration data for Rounds 1 and 2 sediment samples, as well as the Round 1 soil sample. Only lead and oil and grease were detected in the sediment and soil samples. The Round 2 oil and grease levels were greatly reduced from Round 1, and lead levels were low during both Rounds 1 and 2.

Concentration data for Rounds 1 and 2 surface water samples are presented in Table 3-14. In contrast to the significant oil and grease levels found in Round 1 surface water samples, no oil and grease were detected in any of the Round 2 surface water samples. However, low levels of some organic compounds were detected in sample 8SW01.

### 3.8 PCB DISPOSAL, DRY DOCK AREA, SITE 9

In the Round 1 investigation, surface water and sediment samples were collected at Site 9 for PCB analysis. Figure 3-10 shows the surface water and sediment sampling locations. No PCBs were detected in any of the surface water or sediment samples. Visual inspection of the bottom of Puerca Bay directly adjacent to the pier in the dry dock area indicated that no 5-gallon metal cans, which allegedly contained PCB fluid and had been dropped in the water off the dry dock pier, were present. Only metal and glass drink containers were found on the bottom, along with other miscellaneous metal scrap.

### 3.9 BUILDING 25 STORAGE AREA, SITE 10

During the Round 1 investigation of Site 10, eight ground water monitor wells were installed at the site. Figure 3-11 shows the location of the monitor wells at Site 10. Ground water samples were collected from each of the wells for analysis in Round 1 and Round 2. Table 3-15 presents concentration data for the ground water samples collected

Table 3-13. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Sediment and Soil Sampling Results, Site 8, Drone Washdown

							Chemical Toxicity Parameter				
	Round 1			Round 2			Toxicity Data	AIC mg/kg/day	Designated levels in a solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
<b>SEDIMENT</b>											
Sample Number:	8SE1	8SE2	8SE3	8SE01	8SE02	8SE03					
Lead (ug/g, dry)	28.8	--	43.4	14.0	14.6	26.1	Oral TDLo (wmn) = 450 mg/kg/6y	0.001400	500	1000	<10 - 700
Oil & Grease (mg/kg)	4740	787	1670	247	69	306	NR	NR	NR	NR	NR
<b>SOIL</b>											
Sample Number:	8S1A										
Lead (ug/g, dry)	6.70						Oral TDLo (wmn) = 450 mg/kg/6y	0.001400	500	1000	<10 - 700
Oil & Grease (mg/kg)	8.21						NR	NR	NR	NR	NR

-- = Not Detected.

N/A = Not Analyzed

NR = Not Reported

TDLo = Toxic Dose Low

wmn = Woman

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.

Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

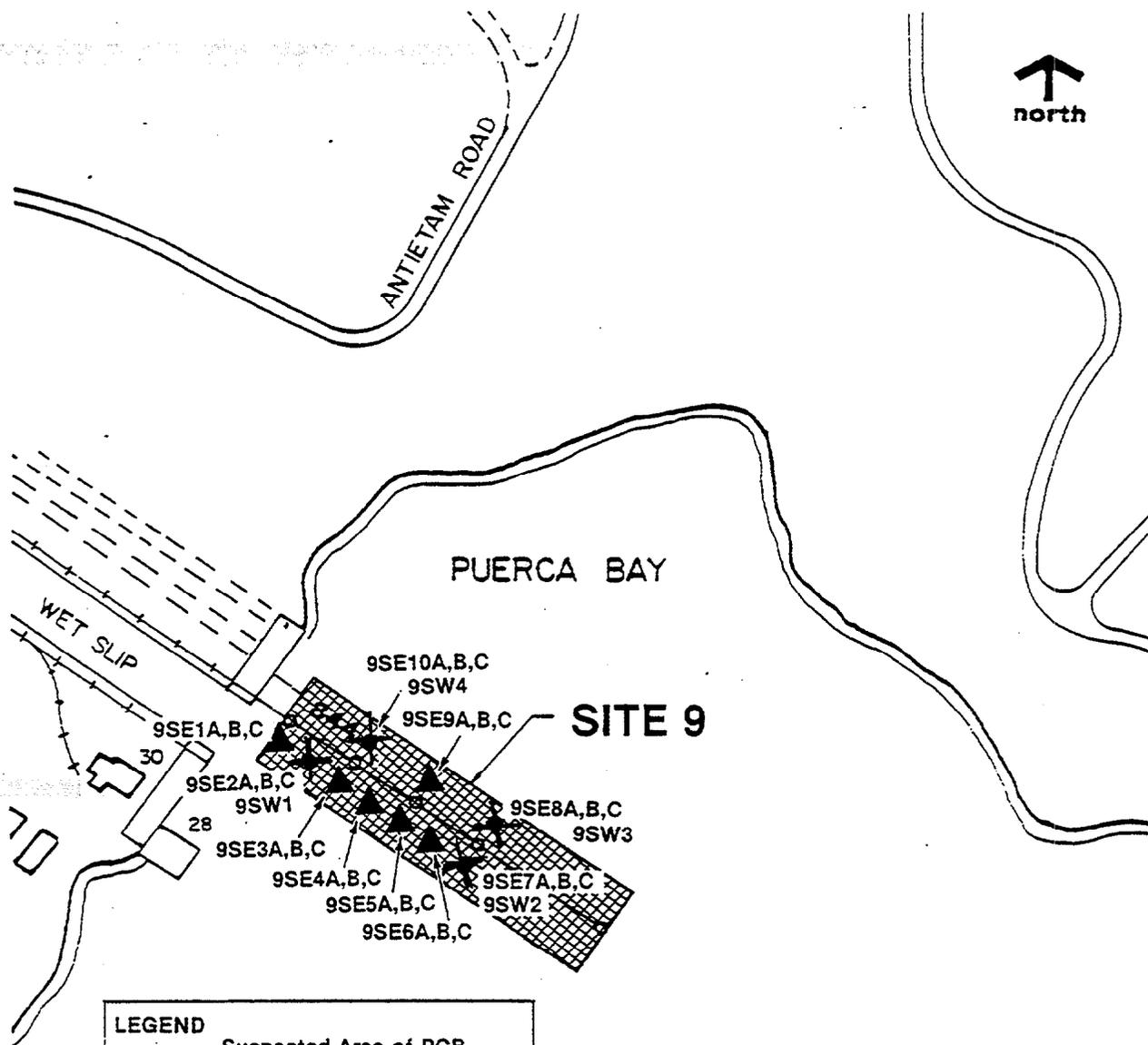
Table 3-14. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Surface Water Sampling Results, Site 8, Drone Washdown

Constituent	Round 1 Concentrations					Round 2 Concentrations					Chemical Toxicity Parameters					
	8SW1	8SW2	8SW3	8SW01	8SW02	8SW03	8SW04	8SW05	Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)		
SURFACE WATER																
Sample Number:	8SW1	8SW2	8SW3	8SW01	8SW02	8SW03	8SW04	8SW05								
Oil & Grease (ug/L)	5	102	98	--	--	--	--	--	NR	NR	NR	NR	NR	NR		
Benzene (ug/L)	--	--	--	1.1	--	--	--	--	Oral LD50 (rat) = 2800 ug/kg	NR	NR	NR	0.66	5.0		
Trichloroethene (ug/L)	--	--	--	1.1	--	--	--	--	Oral LD50 (mus) = 2402 mg/kg	NR	NR	NR	NR	NR		
Trichlorofluoromethane (ug/L)	--	--	--	3.6	--	--	--	--	INH. TC50 (hmn) = 50000 ppm/30M	NR	NR	NR	NR	NR		

-- = Not Detected.  
 NR = Not Reported.  
 LD50 = Lethal Dose Fifty  
 TC50 = Toxic Concentration Fifty  
 hmn = Human  
 mus = Mouse  
 INH = Inhalation  
 AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

Source: ESE, 1988

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**LEGEND**

-  Suspected Area of PCB Disposal and Possible Dispersal
-  Sediment Sample
-  Sediment and Surface Water Sample

**Recommended Sampling Plan:**

1. Visual
2. Sediment Core Sampling as Shown
3. Composite Sample from 0- to 1- Foot Depth, 1- to 2- Foot Depth, and 2- to 3- Foot Depth at Each Boring



SOURCES: NEESA, 1984b; ESE, 1985.

Figure 3-10  
 ROUND 1 SAMPLING LOCATIONS AT SITE 9,  
 PCB DISPOSAL, DRY DOCK AREA



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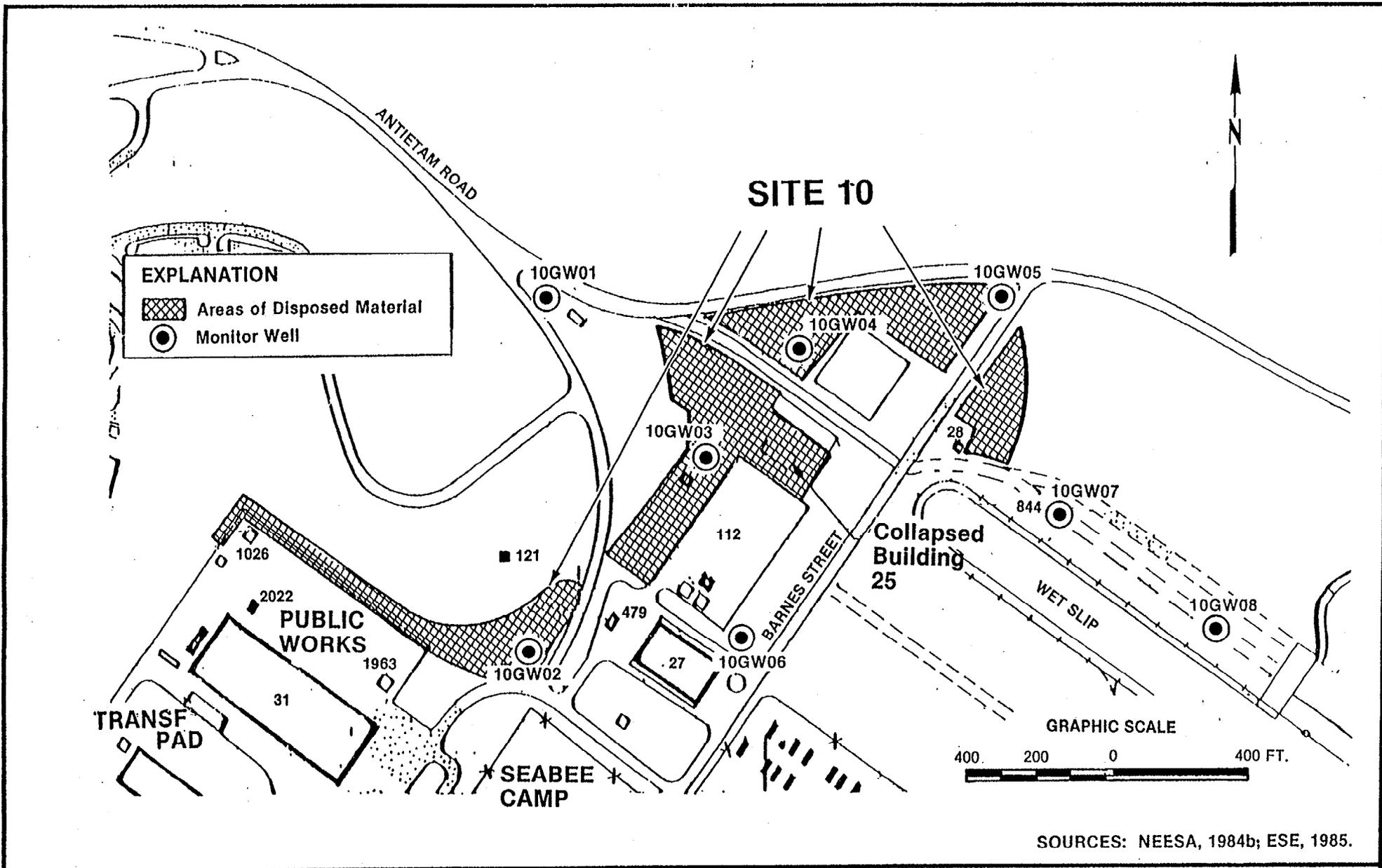


Figure 3-11  
 ROUNDS 1 AND 2 SAMPLING LOCATIONS AT SITE NO. 10,  
 BUILDING 25 STORAGE AREA



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 U.S. NAVAL COMPLEX  
 PUERTO RICO

during both rounds of sampling. As shown in Table 3-15, low levels of organic compounds were detected in the ground water samples. Additionally, some metals were detected at levels exceeding drinking water and ambient water quality criteria.

### 3.10 TOW WAY ROAD FUELS FARM, SITE 12

Sediment, surface water, and ground water sampling locations for the Tow Way Road Fuels Farm are shown in Figure 3-12. As shown in Figure 3-12, one surface water and one sediment sample were collected from Ensenada Honda directly offshore from Site 12. These samples were collected near the storm sewer outfall, which is the discharge point for the stormwater runoff from Site 12. The six monitor wells shown in Figure 3-12 were installed and sampled during Round 1. The Round 2 sediment, surface water, and ground water sample locations were the same as Round 1. Table 3-16 presents concentration data from Site 12. As shown in Table 3-16, oil and grease were not detected in the Round 2 sediment sample. This is in sharp contrast with the significant oil and grease concentration in the Round 1 sediment sample. Similarly, the surface water sample collected during Round 2 was free of oil and grease, but oil and grease were detected in the Round 1 surface water sample. Lead was detected in the Round 2 surface water sample, but the lead concentration is well below ambient water quality criteria.

Lead was detected in all the Round 2 ground water samples at concentrations below regulatory criteria. However, these lead levels are an increase from Round 1 where lead was not detected in any of the ground water samples. In contrast, oil and grease were not detected in any Round 2 ground water samples, but they were detected in all of the Round 1 ground water samples. It should be noted that during Round 1 sampling of monitor well 12GW06, a significant oil and grease

Table 3-15. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Ground Water Sampling Results, Site 10, Building 25 Storage Area

Constituent	Round 1 Concentrations		Round 2 Concentrations										Chemical Toxicity Parameters					
	10GWI	10GW2	10GW3	10GW4	10GW5	10GW6	10GW01	10GW02	10GW03	10GW04	10GW05	10GW06	Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)
ROUND WATER																		
Sample Number:	10GWI	10GW2	10GW3	10GW4	10GW5	10GW6	10GW01	10GW02	10GW03	10GW04	10GW05	10GW06	Oral LD50 (rat) = 108 mg/kg	NR	NR	NR	NR	NR
1,2-Dibromoethane (EDB, ug/L)	--	--	--	--	--	--	--	--	--	--	0.015	--	= 143 mg/kg	0.0200	NR	NR	NR	NR
Bis(2-ethylhexyl)phthalate 4 (ug/L)	--	--	--	--	--	--	--	1.5	1.8	4.2	1.1	--	Oral TDLo (man) = 2330 mg/kg	NR	NR	NR	NR	NR
Butyl benzophthalate (ug/L)	3	16	40	4	11	20	--	--	--	--	--	--	Oral LD50 (rat) = 2737 mg/kg	NR	NR	NR	NR	NR
Methyl Ethyl Ketone (ug/L)	--	--	--	9.3	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 7 gm/kg	0.0500	NR	NR	NR	NR
Antimony (ug/L)	--	--	--	129	78.6	87.6	--	--	--	--	--	--	Oral LD50 (rat) = 7857 mg/kg/55-1	0.000400	NR	NR	146	NR
Arsenic (ug/L)	119	--	--	--	105	--	--	--	--	--	4.4	--	Oral TDLo (man) = 300 mg/M3	NR	50	50	0.0022	50
Beryllium (ug/L)	17.3	3.2	16.8	26.0	4.25	23.3	--	--	--	--	--	--	INH. TCLO (hmn) = 15 mg/kg	0.000500	NR	NR	0.0068	NR
Cadmium (ug/L)	29.6	--	5.78	5.39	--	12.3	--	4.0	--	16.8	--	--	UKN. LDLo (man) = 15 mg/kg	0.000290	10	10	10	10
Chromium (+6) (ug/L)	--	--	--	--	--	42.9	--	--	30.6	23.0	--	--	NR	0.00500	50	50	50	50
Chromium (Total) (ug/L)	72.7	5.90	71.8	138	36.2	113	202	19.6	101	78.9	137	33.7	NR	0.00500	50	50	50	50
Copper (ug/L)	600	86.7	613	927	144	1550	464	207	205	624	520	652	Oral TDLo (hmn) = 120 ug/kg	0.0370	NR	(s) 1,000 (+, FCC)	12	NR
Lead (ug/L)	--	--	--	147	--	66.6	--	--	--	45.1	--	--	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	50	50	50	50
Mercury (ug/L)	0.309	--	0.527	0.309	--	0.309	--	--	--	--	--	--	INH. TCLO (wmn) = 150 ug/M3/460	0.00200	2.0	2.0	0.144	2.0
Nickel (ug/L)	171	9.90	94.8	97.3	27.1	130	88.6	28.6	43.9	44.1	58.1	17.7	ITR. LDLo (rat) = 12 mg/kg	0.0100	NR	NR	13.4	NR
Silver (ug/L)	--	--	--	--	--	--	24.3	6.2	26.5	8.0	10.8	33.8	IMP. TDLo (rat) = 2400 mg/kg	0.00300	50	50	50	50
Selenium (ug/L)	324	93.1	208	512	30.1	324	154	9.0	95.1	16.4	80.5	69.1	Oral LD50 (rat) = 6700 mg/kg	0.00300	10	10	10	10
Thallium (ug/L)	42.3	--	24.3	--	3.24	5.03	5.8	--	--	--	--	--	Oral LDLo (man) = 5714 ug/kg	0.000400	NR	NR	13	NR
Zinc (ug/L)	733	68.8	584	533	132	857	541	90.3	285	401	489	94.9	INH. TCLO (hmn) = 124 mg/M3/50M	0.210	NR	(s) 5,000 (+, FCC)	110	NR
Phenols (ug/L)	N/A	N/A	N/A	N/A	N/A	N/A	270	5.0	470	9.0	52	42	NR	NR	NR	NR	NR	NR

-- = Not Detected.  
 N/A = Not Analyzed.  
 NR = Not Reported.  
 LD50 = Lethal Dose Fifty  
 LDLo = Lethal Dose Low  
 TDLo = Toxic Dose Low  
 TCLO = Toxic Concentration Low  
 UKN = Unknown  
 INH = Inhalation  
 ITR = Intravenous  
 IMP = Implant  
 hmn = Human  
 wmn = Woman

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

Table 3-15 (Continued)

Constituent	Round 1 Concentrations		Round 2 Concentrations		Chemical Toxicity Parameters					
	106W7	106W8	106W07	106W08	Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)
<b>GROUND WATER</b>										
Sample Number:	106W7	106W8	106W07	106W08						
1,2-Dibromoethane (EDB) (ug/L)	--	--	--	--	Oral LD50 (rat) = 108 mg/kg	NR	NR	NR	NR	NR
Bis(2-eth'hex')phthalate (ug/L)	--	--	1.1	--	Oral TDLo (man) = 143 mg/kg	0.0200	NR	NR	NR	NR
Butyl benz'phthalate (ug/L)	16	15	--	--	Oral LD50 (rat) = 2330 mg/kg	NR	NR	NR	NR	NR
Methyl Ethyl Ketone (ug/L)	--	--	--	--	Oral LD50 (rat) = 2737 mg/kg	0.0500	NR	NR	NR	NR
Antimony (ug/L)	252	--	--	--	Oral LD50 (rat) = 7 gm/kg	0.000400	NR	NR	146	NR
Arsenic (ug/L)	--	--	--	--	Oral TDLo (man) = 7857 mg/kg/55-l	NR	50	50	0.0022	50
Beryllium (ug/L)	27.1	13.0	--	--	INH. TCLo (hmn) = 300 mg/M3	0.000500	NR	NR	0.0068	NR
Cadmium (ug/L)	3.05	5.57	--	--	UKN. LDLo (man) = 15 mg/kg	0.0002900	10	10	10	10
Chromium, (+6) (ug/L)	--	--	--	--	NR	0.00500	50	50	50	50
Chromium (Total) (ug/L)	179	112	33.2	177	NR	0.00500	50	50	50	50
Copper (ug/L)	549	481	78.9	633	Oral TDLo (hmn) = 120 ug/kg	0.0370	NR	(s) 1,000 (+, FCC)	12	NR
Lead (ug/L)	--	69.1	--	134	Oral TDLo (wmm) = 450 mg/kg/6Y	0.00140	50	50	50	50
Mercury (ug/L)	--	0.222	--	--	INH. TCLo (wmm) = 150 ug/M3/46D	0.00200	2.0	2.0	0.144	2.0
Nickel (ug/L)	99.2	73.8	--	57.9	ITR. LDLo (rat) = 12 mg/kg	0.0100	NR	NR	13.4	NR
Selenium (ug/L)	411	216	82.4	132	Oral LD50 (rat) = 6700 mg/kg	0.00300	10	10	10	NR
Silver (ug/L)	--	--	37.3	45.9	IMP. TDLo (rat) = 2400 mg/kg	0.00300	50	50	50	50
Thallium (ug/L)	3.24	112	--	63.3	Oral LDLo (man) = 5714 ug/kg	0.000400	NR	NR	NR	--
Zinc (ug/L)	489	672	45.1	557	INH. TCLo (hmn) = 124 mg/M3/50M	0.210	NR	5,000 (+, FCC)	110	NR
Phenols (ug/L)	N/A	N/A	9.0	85	NR	NR	NR	NR	NR	NR

-- = Not Detected.  
 N/A = Not Analyzed.  
 NR = Not Reported.  
 LD50 = Lethal Dose Fifty  
 LDLo = Lethal Dose Low  
 TDLo = Toxic Dose Low  
 TCLo = Toxic Concentration Low  
 UKN = Unknown  
 INH = Inhalation  
 ITR = Intravenous  
 IMP = Implant

hum = Human  
 wmm = Woman  
 mus = Mouse  
 AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

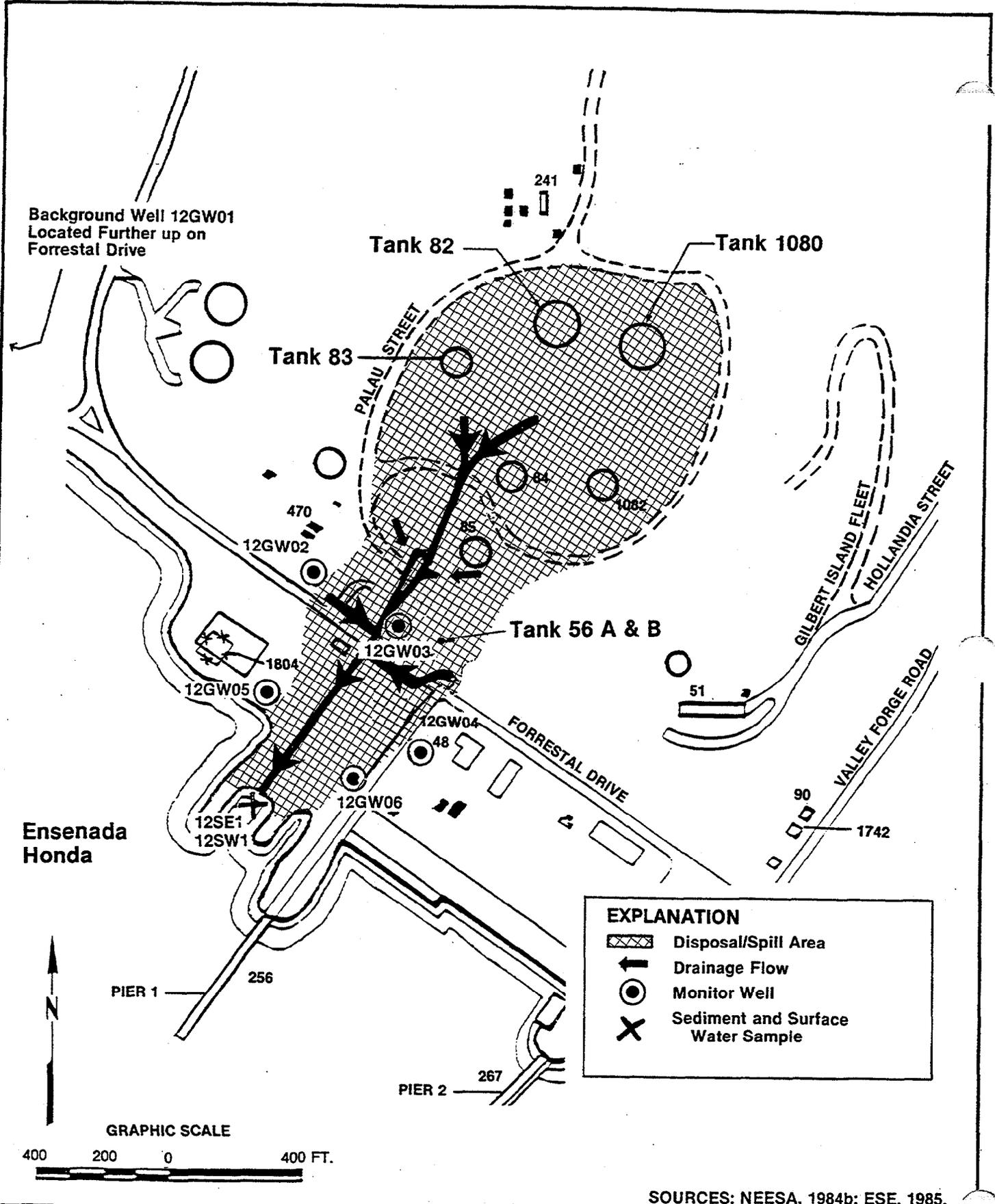


Figure 3-12  
 ROUNDS 1 AND 2 GROUND WATER, SURFACE WATER,  
 AND SEDIMENT SAMPLING LOCATIONS AT SITE 12,  
 TOW WAY ROAD FUELS FARM



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Table 3-16 NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Sediment, Surface Water, and Ground Water Sampling Results, Site 12, Tow Way Road Fuels Farm

Constituent	Concentrations		Chemical Toxicity Parameters																
	Round 1	Round 2	Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)											
<b>SEDIMENT</b>																			
Sample Number:	12SE1	12SE01																	
Oil & Grease (ug/g, dry)	3340	--	NR	NR	-----CRITERIA NOT AVAILABLE-----														
<b>SURFACE WATER</b>																			
Sample Number:	12SW1	12SW01																	
Oil & Grease (mg/L)	0.4	--	NR	NR	NR	NR	NR	NR											
Lead (ug/L)	--	11.4	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	50	50	50	50											
<b>GROUND WATER</b>																			
Sample Number:	12GW1	12GW2	12GW3	12GW4	12GW5	12GW6	12GW01	12GW02	12GW03	12GW04	12GW05	12GW06							
Benzene (ug/L)	--	2000	--	--	--	--	--	4100	--	--	--	--	--	Oral LD50 (rat) = 3800 mg/kg	NR	NR	NR	0.66	5.0
Toluene (ug/L)	--	400	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 3800 mg/kg	0.300	NR	NR	14300	NR
Oil & Grease (mg/L)	0.4	1	0.7	3	0.4	42	--	--	--	--	--	--	--	NR	NR	NR	NR	NR	NR
1,2-Dibromoethane (EDB, ug/L)	--	--	--	--	--	--	--	0.016	--	--	--	--	--	Oral LD50 (rat) = 108 mg/kg	NR	NR	NR	NR	NR
Lead (ug/L)	--	--	--	--	--	--	6.1	21.8	2.3	2.7	42.5	4.8	--	Oral TDLo (wmn) = 450 mg/kg/6Y	0.00140	50	50	50	50

-- = Not Detected.  
 N/A = Not Analyzed.  
 NR = Not Reported.  
 LD50 = Lethal Dose Fifty  
 TDLo = Toxic Dose Low  
 wmn = Woman  
 AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

Source: ESE, 1988

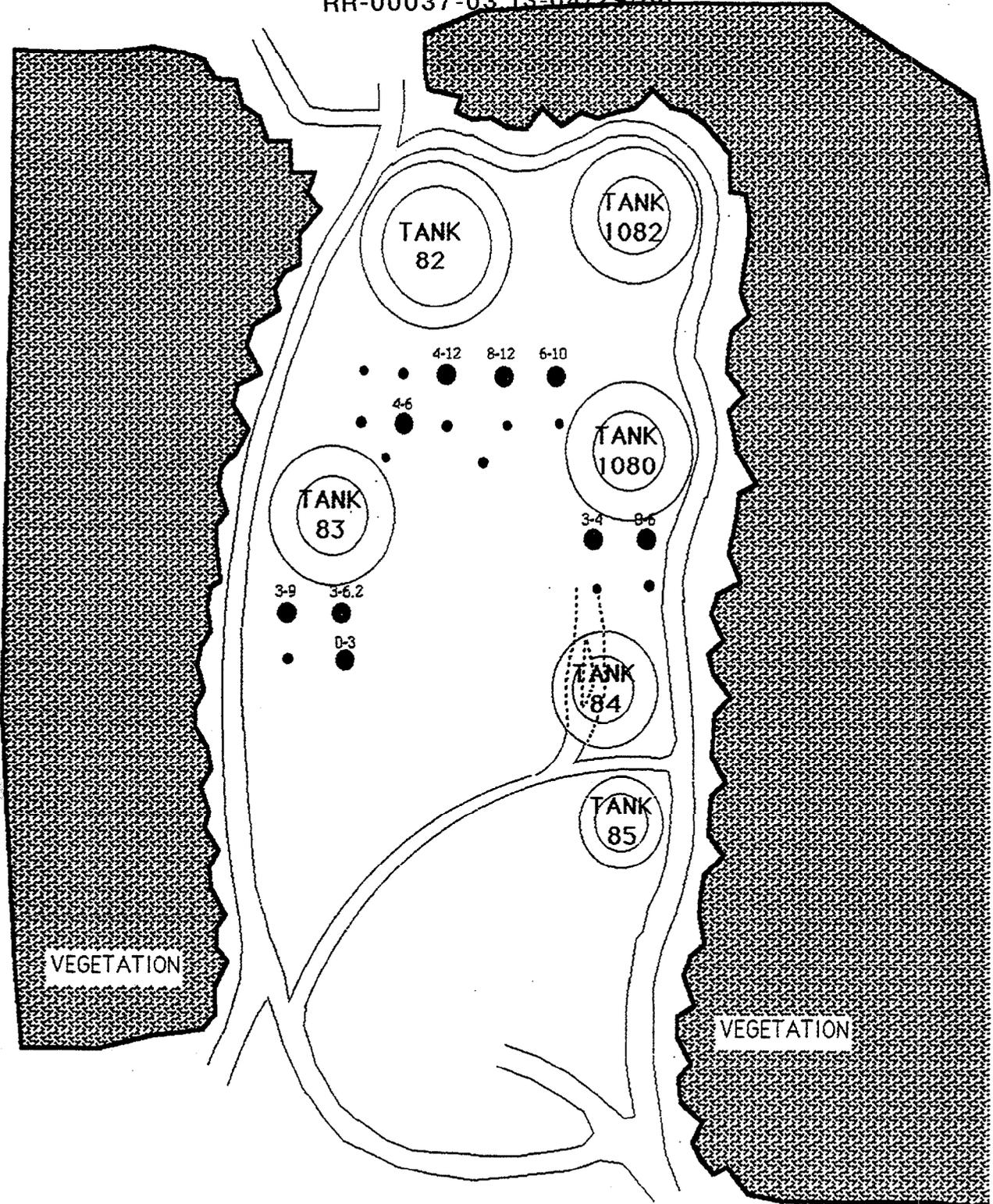
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concentration (42 mg/L) was detected, and a layer of black oil was found floating on the surface of the ground water.

High levels of benzene (2,000 and 4,100 mg/L) were detected in monitor well 12GW2, with the concentration increasing from Round 1 to Round 2. Toluene was also detected in monitor well 12GW2 in Round 1, but was not detected in Round 2. The compound 1,2-dibromoethane was detected in monitor well 12GW2 in Round 2.

In addition to the surface water, sediment, and ground water sampling performed in the Round 1 and 2 investigations, soil boring investigations of possible fuel contamination were also conducted. During Round 1, the soil boring investigation was restricted to the upper section of Site 12 in the area between the fuel tanks. Figure 3-13 shows the location of the Round 1 soil borings. The Round 1 soils investigation consisted of twenty soil borings to a depth of approximately 20 feet, with visual and odor observations for possible fuel contamination. As shown in Figure 3-13, fuel contamination was detected in nine of the twenty borings. Figure 3-13 shows that the depth of contamination varied, but did not extend below a depth of 12 feet.

In the Round 2 soil investigation an additional 29 borings were drilled in the upper section of Site 12, and 48 borings were drilled in the lower section of Site 12 near Ensenada Honda to further investigate the fuel contamination detected in monitor well 12GW06 during Round 1. Figures 3-14 and 3-15 show the Round 2 boring locations for the Site 12 upper and lower sections, respectively. The Round 2 investigation involved visual and odor observations of soil samples, as well as field measurements of organic vapors emitted by the soil samples with a photoionization detector (PID). Table 3-17



LEGEND:

- SOIL BORING WITH NO OIL DETECTED
- SOIL BORING WITH OIL FOUND IN 4- TO 12-FOOT DEPTH RANGE

0 100 200  
 APPROXIMATE SCALE  
 FEET



Figure 3-13  
 ROUND 1 SOIL BORING LOCATIONS  
 AT SITE 12, TOW WAY ROAD FUELS FARM



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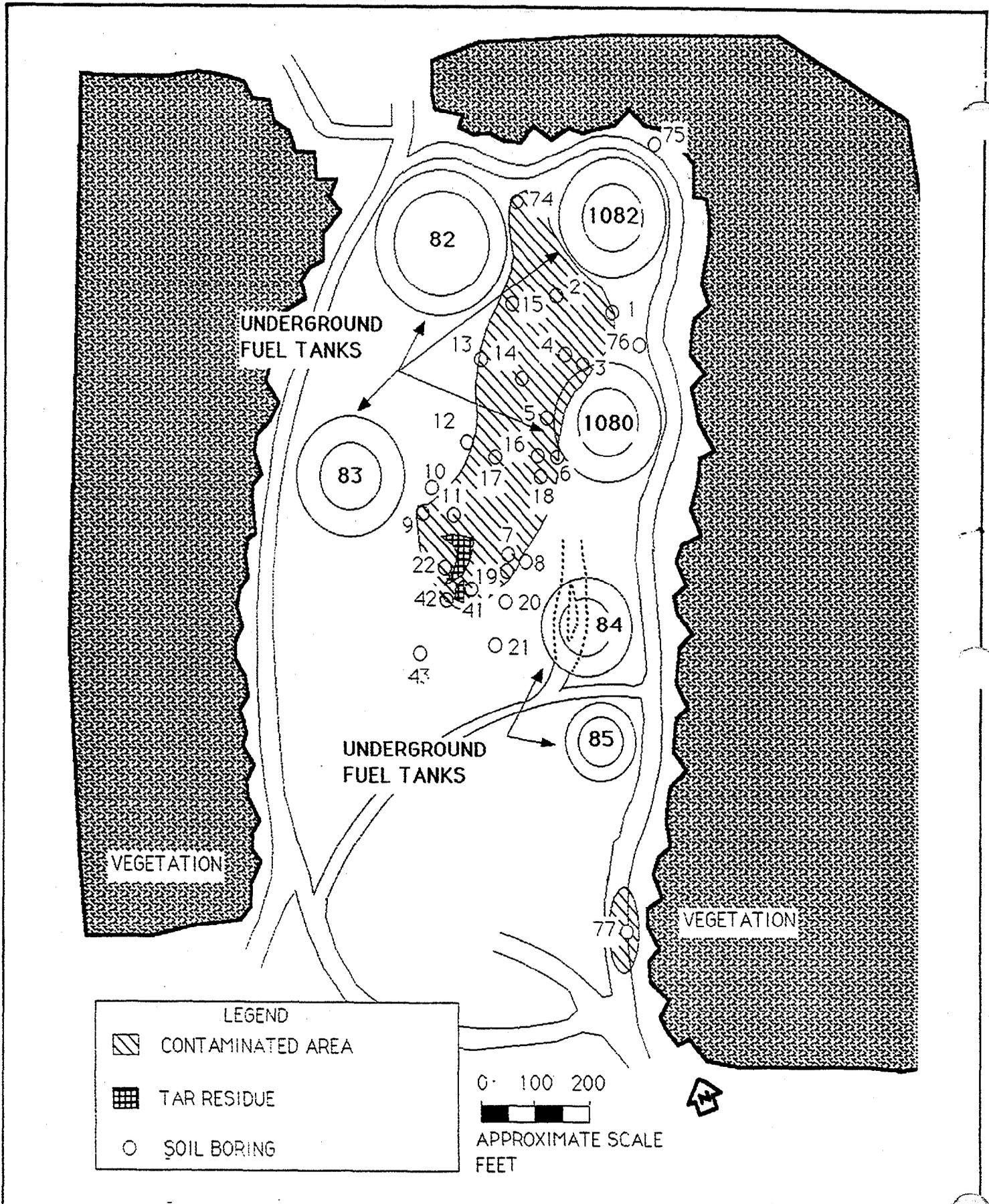


Figure 3-14  
 ROUND 2 SOIL BORING LOCATIONS  
 AND CONTAMINATION AT UPPER  
 SECTION OF SITE 12, TOW WAY  
 ROAD FUELS FARM



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presents the field observations for all 52 borings, and Table 3-18 presents the PID results.

As shown in Figure 3-14, the location of the detected fuel contamination in the upper section of Site 12 coincides with the low areas that form the drainage way for the tank farm. The contaminated area shown in Figure 3-14 is based on visual observation of contamination and/or PID readings exceeding 30 parts per million (ppm). The 30 ppm criterion for mapping the contamination was developed by a semi-quantitative analysis of all the PID readings for the site.

At soil boring 77, petroleum odors and a PID reading of 383 ppm were noted at a depth of 22 feet. As shown in Figure 3-14, this boring is separated from the other borings by a significant distance over which considerable changes in topography occur. Consequently, the contamination detected in this boring cannot justifiably be related to the other contaminated area shown in Figure 3-14.

Figure 3-15 shows the area where fuel contamination was detected in the lower section of Site 12. As with the upper section, all borings with visual contamination and/or maximum PID readings over 30 ppm were included in the contamination envelope.

### 3.11 TANKS 210 TO 217, SITE 13

During the Round 1 investigation of Site 13, eleven ground water monitor wells were installed, and samples of ground water, surface water, and sediment were collected for analysis. The sampling locations are shown in Figure 3-16, and these same sampling locations were resampled in the Round 2 investigation.

Table 3-17. NAVSTA Roosevelt Roads Confirmation Study, Soil Boring Field Observations at Site 12, Tow Way Road Fuels Farm (Page 1 of 7)

Soil Boring Number	Total Depth of Soil Boring (Ft BLS)	Depth of Vertical Contamination (Ft BLS)	Comments
1	20	0 - 10	0-6 ft. petroleum odor 4-6 ft. black dried petroleum at fractures 8-10 ft. black dried petroleum at fractures, no petroleum odor
2	14	0 - 14	4-10 ft. black dried petroleum at fractures, petroleum odor
3	20	6 - 20	4-6 ft. petroleum odor 6-8 ft. petroleum odor, black dried petroleum at fractures 8-12 ft. petroleum odor 12-20 ft. black dried petroleum at fractures
4	7	2 - 8	2-6 ft. petroleum odor
5	16	4 - 16	4-8 ft. black dried petroleum specks throughout, no apparent petroleum odor 8-10 ft. petroleum odor 10-16 ft. black dried petroleum at fractures
6	8	2 - 8	2-8 ft. petroleum odor
7	8	4 - 6	4-6 ft. petroleum odor
8	4	None	Clean
9	16	0 - 16	0-2 ft. possible black dried petroleum at fractures, no petroleum odor 2-4 ft. black dried petroleum specks throughout, petroleum odor 4-12 ft. petroleum odor 12-16 ft. black dried petroleum specks throughout, petroleum odor
10	8	None	Clean
11	17	4 - 16	4-6 ft. petroleum odor 6-14 ft. petroleum saturation, petroleum sheen 14-16 ft. petroleum odor
12	7	None	Clean

Table 3-17. NAVSTA Roosevelt Roads Confirmation Study, Soil Boring Field Observations at Site 12, Tow Way Road Fuels Farm (Page 2 of 7)

Soil Boring Number	Total Depth of Soil Boring (Ft BLS)	Depth of Vertical Contamination (Ft BLS)	Comments
13	20	2 - 20	2-4 ft. black dried petroleum at fractures, no petroleum odor 8-12 ft. black dried petroleum of fractures, no petroleum odor 14-16 ft. black dried petroleum at fractures, strong petroleum odor at fractures 18-20 ft. black dried petroleum specks, no petroleum odor
14	10	0 - 10	0-2 ft. petroleum odor 2-4 ft. black dried petroleum fractures, petroleum odor 4-6 ft. petroleum odor 6-8 ft. no petroleum odor 8-10 ft. black greasy petroleum on rock fragments, no petroleum odor
15	14	0 - 14	0-4 ft. petroleum odor 6-10 ft. black dried petroleum at fractures, petroleum odor 10-14 ft. black dried petroleum at fractures, no petroleum odor
16	18	0 - 18	0-4 ft. petroleum odor 4-18 ft. black dried petroleum at fractures, petroleum odor
17	12	0 - 8	0-2 ft. pesticide odor 2-4 ft. black dried petroleum at fractures, petroleum odor 6-8 ft. slight petroleum odor
18	12	2 - 6	2-6 ft. petroleum odor
19	10	4 - 8	4-6 ft. saturated with petroleum, petroleum odor 6-8 ft. black dried petroleum at fractures, no petroleum odor
20	14	None	Clean
21	6	2 - 4	2-4 ft. petroleum odor

Table 3-17. NAVSTA Roosevelt Roads Confirmation Study, Soil Boring Field Observations at Site 12, Tow Way Road Fuels Farm (Page 3 of 7)

Soil Boring Number	Total Depth of Soil Boring (Ft BLS)	Depth of Vertical Contamination (Ft BLS)	Comments
22	8	4 - 6	4-6 ft. soil discoloration, petroleum odor
23	4	None	Clean. Hit electric line at 4 ft. BLS. Hole abandoned
24	14	12 - 14	12-14 ft. sulfur odor
25	20	8 - 14	8-14 ft. free product, petroleum odor
26	20	0 - 20	0-4 ft. petroleum odor 18-20 ft. black dried petroleum staining at fractures, no petroleum odor
27	20	6 - 10	0-6 ft. strong petroleum odor
28	16	0 - 16	0-5 ft. petroleum odor 5-12 ft. no petroleum odor to possible petroleum odor 12-16 ft. black dried petroleum staining at fractures
29	20	6 - 18	6-10 ft. petroleum odor 16-18 ft. black dried petroleum staining at fractures
30	20	4 - 20	4-12 ft. petroleum odor 14-16 ft. no apparent petroleum odor 18-20 ft. no apparent petroleum odor
31	26	8 - 20	8-10 ft. no petroleum odor 10-20 ft. visible free product, petroleum odor
32	20	8 - 16	8-16 ft. visible free product, petroleum odor
33	20	4 - 16	4-6 ft. visible free product, petroleum odor
34	20	8 - 14	8-14 ft. turpentine-like odor

Table 3-17. NAVSTA Roosevelt Roads Confirmation Study, Soil Boring Field Observations at Site 12, Tow Way Road Fuels Farm (Page 4 of 7)

Soil Boring Number	Total Depth of Soil Boring (Ft BLS)	Depth of Vertical Contamination (Ft BLS)	Comments
35	22	8 - 18	8-10 ft. petroleum discoloration, petroleum odor 10-12 ft. petroleum sheen, petroleum odor 12-18 ft. slight petroleum odor
36	18	4 - 8	4-6 ft. petroleum discoloration, petroleum odor 6-8 ft. slight petroleum odor
37	18	8 - 12	8-10 ft. black discoloration, petroleum odor 10-12 ft. petroleum odor.
38	20	18 - 20	18-20 ft. sulfur odor
39	12	6 - 10	6-10 ft. petroleum odor
40	18	4 - 10	4-10 ft. petroleum odor
41	20	0 - 20	0-18 ft. petroleum odor 18-20 ft. no apparent petroleum odor, but high PID
42	13	0 - 13	0-2 ft. petroleum odor 2-6 ft. petroleum odor discoloration 6-8 ft. petroleum 10-12 ft. petroleum odor and discoloration
43	20	4 - 14	4-14 ft. non-visual contamination, no petroleum staining
44	14	0 - 14	8-10 ft. organic odor 10-12 ft. possible slight petroleum odor near bottom sample sulfur odor
45	24	6 - 10	6-10 ft. petroleum odor
46	24	4 - 16	4-6 ft. petroleum odor 6-12 ft. free product 14-16 ft. free product on outside of spoon, petroleum-odor

Table 3-17. NAVSTA Roosevelt Roads Confirmation Study, Soil Boring Field Observations at Site 12, Tow Way Road Fuels Farm (Page 5 of 7)

Soil Boring Number	Total Depth of Soil Boring (Ft BLS)	Depth of Vertical Contamination (Ft BLS)	Comments
47	18	6 - 12	6-12 ft. petroleum odor
48a	8	0 - 8	0-8 ft. non-visual contamination, no petroleum odor
48b	2	0 - 2	0-2 ft. non-visual contamination, no petroleum odor
48c	24	8 - 20	8-10 ft. free product strong petroleum odor 10-14 ft. petroleum film throughout samples, strong petroleum odor 14-18 ft. petroleum film on spoon
49	20	2 - 16	2-4 ft. petroleum odor 4-16 ft. free product in samples
50	20	0 - 6	0-6 ft. non-visual contamination, no petroleum odor
51	16	None	Clean
52	18	12 - 16	12-14 ft. strong sulfur odor
53	20	6 - 10	6-10 ft. petroleum odor 6-8 ft. approximate water table
54	20	None	Clean
55	20	16 - 20	16-20 ft. strong sulfur odor
56	20	2 - 20	2-4 ft. non-visual contamination 6-10 ft. petroleum odor 10-14 ft. petroleum odor, visible petroleum staining at fractures 14-16 ft. petroleum odor 18-20 ft. black streaks, possible petroleum staining

Table 3-17. NAVSTA Roosevelt Roads Confirmation Study, Soil Boring Field Observations at Site 12, Tow Way Road Fuels Farm (Page 6 of 7)

Soil Boring Number	Total Depth of Soil Boring (Ft BLS)	Depth of Vertical Contamination (Ft BLS)	Comments
57	20	4 - 18	4-6 ft. non-visual contamination, no petroleum odor 6-8 ft. possible petroleum odor 8-14 ft. strong petroleum odor 15-18 ft. sulfur odor
58	20	16 - 20	16-20 ft. sulfur odor
59	20	2 - 18	2-4 ft. slight petroleum odor, possible petroleum staining 6-8 ft. petroleum odor 8-10 ft. petroleum odor and sheen 10-14 petroleum odor 16-18 slight petroleum odor
60	20	14 - 16	14-16 ft. strong sulfur odor
61	14	6 - 14.1	6-8 ft. slight petroleum odor 8-12 ft. strong petroleum odor 12-14 ft. slight petroleum odor 14-14.1 ft. possible petroleum odor
62	20	8 - 16	8-10 ft. strong petroleum odor 10-12 ft. petroleum odor, sulfur odor 12-14 ft. slight petroleum odor 14-16 ft. non-visual contamination, no petroleum odor
63	20	10 - 16	13-15 ft. sulfur odor
64	20	0 - 18	0-8 ft. non-visual contamination, no petroleum odor 8-18 ft. sulfur odor
65	20	4 - 14	4-6 ft. non-visual contamination, no petroleum odor 6-8 ft. petroleum odor 8-10 ft. strong petroleum odor 10-12 ft. petroleum odor
66	20	2 - 18	2-8 ft. possible petroleum odor 8-12 ft. non-visual contamination 14-18 ft. sulfur odor

Table 3-17. NAVSTA Roosevelt Roads Confirmation Study, Soil Boring Field Observations at Site 12, Tow Way Road Fuels Farm (Page 7 of 7)

Soil Boring Number	Total Depth of Soil Boring (Ft BLS)	Depth of Vertical Contamination (Ft BLS)	Comments
67	20	12 - 14	12-14 ft. non-visual contamination, no petroleum odor
68	20	8 - 20	6-8 ft. approximate water level 8-10 ft. non-visual contaminant, no petroleum odor 18-20 ft non-visual contamination, no petroleum odor
69	20	12 - 14	12-14 ft. non visual contamination, no petroleum odor
70	20	14 - 20	14-16 ft. approximate water level 14-16 ft. non-visual contamination, no petroleum odor 16-18 ft. possible petroleum odor 18-20 ft. non-visual contamination, no apparent petroleum odor
71	20	0 - 4	0-4 ft. non-visual contamination, no petroleum odor
72	20	12 - 20	12-20 ft. sulfur odor 8-10 ft. approximate water table
73A	20	14 - 16	14-16 ft. possible petroleum odor, non-visual contamination
74	20	2 - 4	2-4 ft. black dry petroleum staining
75	20	None	Clean
76	14	None	Clean
77	26	8 - 26	8-10 ft. non-visual contamination 14-16 ft. non-visual contamination 16-18 ft. possible petroleum odor 18-26 ft. strong petroleum odor

Source: ESE, 1988

Table 3-18. NAVSTA Roosevelt Roads Confirmation Study, PID  
 Readings at Site 12, Tow Way Road Fuels Farm (Page  
 1 of 5)

Feet BLS	Soil Boring Number																
	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	SB-7	SB-8	SB-9	SB-10	SB-11	SB-12	SB-13	SB-14	SB-15	SB-16	SB-17
0																	
11	26.9	1.7	1.6	0.8	4.5	1.8	2.5	0.2	0.3	2.1	4.9	0.4	2.0	1.8	3.0	14.8	1.8
	106.3	1.7	1.1	6.4	2.9	1.6	2.4	0.2	0.3	3.2	4.3	0.9	-0.8	14.6	10.0	27.7	2.4
	17.5	0.9	1.2	9.3	2.2	2.9	6.8	-	-	2.4	9.2	2.2	-	12.6	1.4	32.6	1.6
	1.8	1.2	2.2	6.3	2.3	2.5	2.8		2.9	2.5	25.5	1.6	0.0	6.0	6.8	11.4	2.8
10	2.4	1.5	-		3.5	2.3			1.1		49.4		2.1	4.9	8.0	12.9	1.2
	2.2	1.5	-		4.2				3.8		11.0		2.3		6.7	8.8	1.0
	2.0	1.0	1.4						4.8		9.6		3.1		6.5	8.2	
	2.3		1.2						3.9		13.1		3.2			1.2	
	2.1		1.2						2.9		4.1		2.7			1.7	
20	2.8		1.6										3.4				

BLS = Below land surface  
 SB = Soil boring  
 - = No sample recovered or sample lost

Source: ESE, 1988

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Feet BLS	Soil Boring Number																	
	SB-18	SB-19	SB-20	SB-21	SB-22	SB-23	SB-24	SB-25	SB-26	SB-27	SB-28	SB-29	SB-30	SB-31	SB-32	SB-33	SB-34	
0	0.9	2.3	-1.8	2.1	7.3	1.9	2.0	13.3	10.6	-2.9	34.7	3.8	2.4	3.2	-2.1	1.1	2.9	
	12.1	-	-	2.5	1.0	2.1	1.9	10.6	33.0	-1.3	65.9	1.7	11.3	3.9	1.2	1.1	2.5	
	15.7	2.8	-	2.2	7.6	-	1.0	48.8	3.4	-1.8	114.6	9.3	6.9	2.8	5.7	6.8	0.7	
	2.8	2.6	2.4		4.0			-2.2	38.6	3.9	527.0	124.3	562.0	713.0	1.7	4.3	87.6	0.8
10	2.2	1.9	0.3					0.8	350.0	5.2	512.0	22.8	52.9	578.0	6.3	80.2	331.0	2.9
	2.4		-					2.0	72.0	54.9	0.8	22.9	0.4	94.4	72.4	45.8	10.8	6.5
			0.8					7.0	16.8	14.5	-1.0	10.8	0.7	0.7	115.0	-	-	2.1
									6.2	10.8	-1.2	9.5	1.4	15.1	40.3	37.5	6.8	1.9
									2.8	12.1	2.1		1.4	2.5	66.7	4.1	1.5	1.8
20									4.4	5.2	4.0		0.6	33.2	17.6	7.5	1.2	1.9
															3.6			
															1.5			
															3.6			

BLS = Below land surface  
 SB = Soil boring  
 - = No sample recovered or sample lost

Source: ESE, 1988

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Table 3-18. NAVSTA Roosevelt Roads Confirmation Study, PID  
 Readings at Site 12, Tow Way Road Fuels Farm (Page  
 3 of 5)

Feet BLS	Soil Boring Number																
	SB-35	SB-36	SB-37	SB-38	SB-39	SB-40	SB-41	SB-42	SB-43	SB-44	SB-45	SB-46	SB-47	SB-48	SB-49	SB-50	SB-51
0	2.2	2.9	1.3	4.4	8.9	4.2	38.2	27.8	4.0	5.0	4.3	1.5	2.8	6.3	8.2	32.7	4.2
11	3.5	2.9	-	7.7	9.4	6.1	59.4	13.9	4.1	6.7	6.7	3.2	3.7	4.5	4.4	5.5	4.9
	2.9	5.4	1.2	3.7	7.8	10.3	53.4	12.8	8.9	5.5	134.6	13.0	2.6	8.0	24.1	5.7	3.5
	3.2	21.0	2.0	2.9	131.5	45.3	58.4	9.8	6.8	4.8	341.0	5.5	8.7	5.7	69.4	4.1	2.3
10	8.1	-	2.5	2.8	43.2	12.0	16.5	-	4.7	6.1	9.6	97.1	17.2	22.2	12.0	1.1	4.7
	13.6	2.8	0.9	2.6	19.6	10.2	22.9	10.2	5.7	6.7	7.4	42.8	5.3	17.3	25.8	1.1	3.4
	2.2	2.7	1.1	7.9		16.3	12.6	10.4	6.8	7.3	4.7	10.3	7.3	8.7	15.4	4.6	3.2
	3.0	-	0.8	5.3		13.3	13.6		6.5	6.4	5.2	29.2	3.5	2.1	7.0	2.1	3.4
	2.6	3.2	0.5	14.5		13.8	10.8		0.7	8.2	4.1	23.4	3.8	1.8	4.5	2.7	1.7
20	3.8			8.1					1.7			15.4	5.2	48.0	4.0	3.9	
												4.0	5.4	-			
												3.8	4.0	-			
30																	

BLS = Below land surface

SB = Soil boring

- = No sample recovered or sample lost

Source: ESE, 1988

Tab 3-18. NAVSTA Roosevelt Roads Confirmation Study, PID Readings at Site 12, Tow Way Road Fuels Farm (Page 4 of 5)

Feet BLS	Soil Boring Number																
	SB-52	SB-53	SB-54	SB-55	SB-56	SB-57	SB-58	SB-59	SB-60	SB-61	SB-62	SB-63	SB-64	SB-65	SB-66	SB-67	SB-68
0	3.2	0.8	0.3	2.0	1.6	1.7	0.8	2.5	1.7	3.8	4.3	2.8	10.0	39.4	2.5	0.5	1.9
11	2.6	2.1	0.1	2.6	7.0	4.1	0.7	3.9	1.6	3.4	4.5	3.5	9.6	1.8	14.1	0.3	2.1
	1.1	58.4	0.2	2.3	4.4	17.6	0.7	3.0	1.2	3.6	3.5	4.3	7.5	6.9	11.1	0.3	3.2
	0.4	53.8	0.1	1.7	2.2	12.6	0.5	47.9	1.0	10.6	3.0	3.0	6.2	113.8	49.2	0.5	2.0
10	1.2	92.9	0.1	1.9	46.7	226.0	0.8	228.0	0.9	203.0	19.8	3.2	7.0	191.0	9.9	0.4	17.6
	5.7	18.8	0.1	3.4	211.0	160.0	0.8	227.0	1.2	180.0	15.1	10.4	32.1	231.0	7.7	0.5	2.5
	47.6	2.8	0.1	2.0	4.4	-	1.1	47.0	1.5	11.0	5.7	11.5	-	49.1	-	9.4	1.2
	8.3	3.2	-	2.3	2.9	20.6	0.9	-	30.9	6.5	6.3	103.0	-	3.0	3.0	0.9	3.1
	3.0	3.5	0.1	5.9	3.5	15.3	8.2	2.9	16.1	-	5.2	5.2	12.9	6.9	17.1	0.5	-
20	-	-	0.1	6.0	2.4	4.6	23.9	1.2	1.0	-	2.0	3.6	-	3.0	2.3	0.5	6.6

BLS = Below land surface

SB = Soil boring

- = No sample recovered or sample lost

Source: ESE, 1988

Table 3-18. NAVSTA Roosevelt Roads Confirmation Study, PID  
 Readings at Site 12, Tow Way Road Fuels Farm (Page  
 5 of 5)

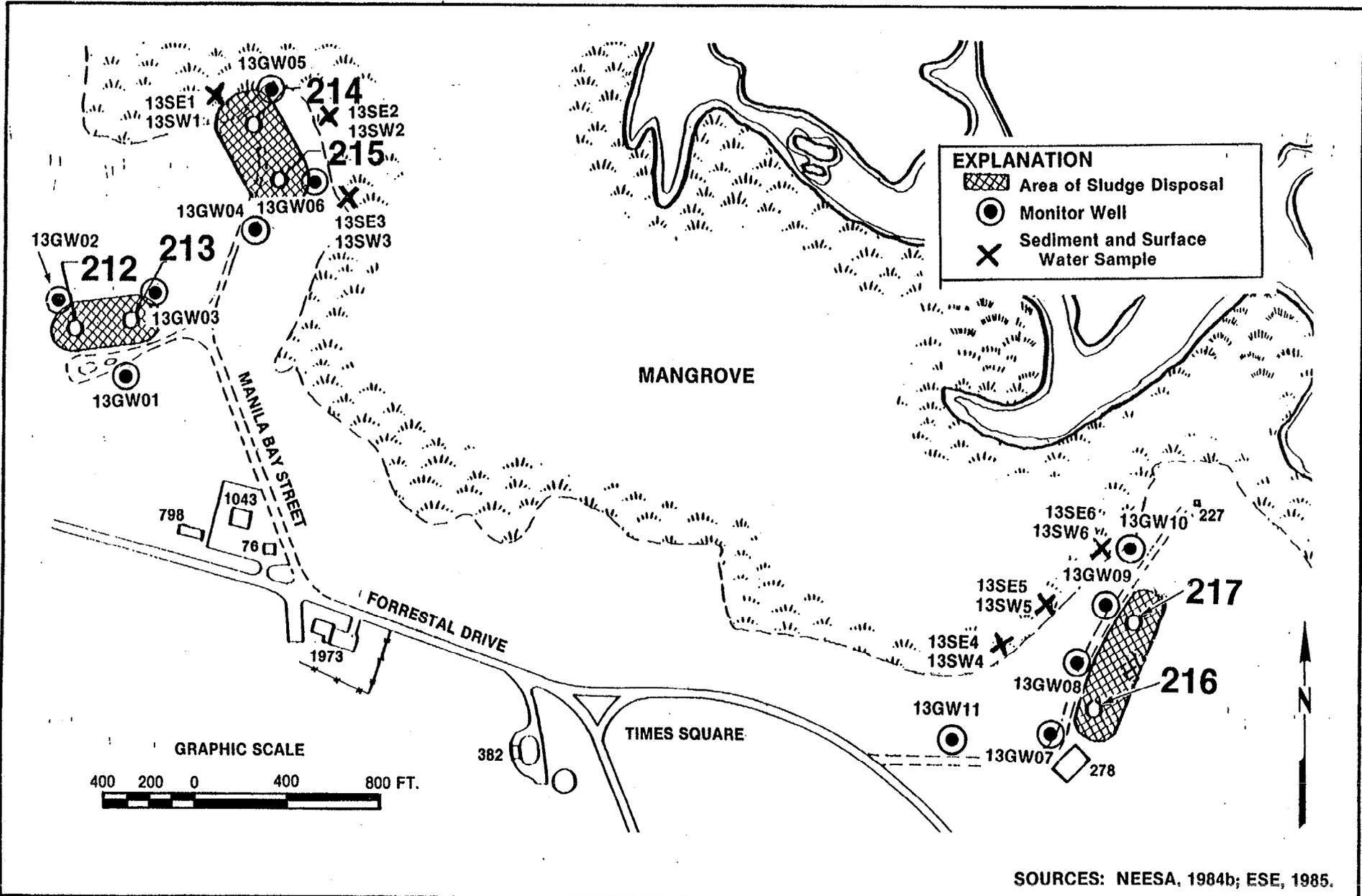
Feet BLS	Soil Boring Number								
	SB-69	SB-70	SB-71	SB-72	SB-73	SB-74	SB-75	SB-76	SB-77
0	1.8	0.4	6.0	0.4	1.9	-	3.5	1.0	2.9
11	1.3	0.7	6.0	0.5	1.2	0.5	2.5	1.2	15.3
	1.6	-	4.3	0.7	0.6	0.5	1.4	1.7	3.7
	1.2	0.6	-	0.6	-	0.3	1.1	2.0	2.4
10	2.1	0.6	-	0.5	1.0	-	1.0	1.7	23.0
	-	-	2.7	0.8	0.6	0.1	3.5	1.6	1.3
	7.5	0.8	2.7	0.9	-	0.5	0.4	1.2	3.3
	1.2	23.9	1.9	0.8	14.0	0.5	1.0	-	8.3
	1.1	29.9	1.1	0.7	-	0.3	-	-	11.3
20	0.8	34.1	2.5	0.7	-	1.1	4.1		182.0
									383.0
									134.6
									144.2
30									

BLS = Below land surface  
 SB = Soil boring  
 - = No sample recovered or sample lost

Source: ESE, 1988

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Figure 3-16  
ROUNDS 1 AND 2 SAMPLING  
LOCATIONS AT SITE 13,  
TANKS 210 TO 217



**CONFIRMATION STUDY  
U.S. NAVAL COMPLEX  
PUERTO RICO**

Sediment sample concentration data are presented in Table 3-19. As shown in Table 3-19, oil and grease, as well as lead, were detected in the sediments at Site 13 during both rounds of sampling. However, the oil and grease levels are not unusual considering the shipping activities in the vicinity of Site 13, and the lead levels are not significant.

Low levels of volatile organic compounds were detected in four of the six Round 2 sediment samples, but were not found in any Round 1 sediment samples.

Table 3-20 presents the concentration data for Site 13 surface water samples collected during both sampling rounds. Low levels of oil and grease were detected in two of the six Round 1 surface water samples, and low levels of lead were detected in all Round 2 surface water samples.

Table 3-21 presents the concentration data for the Round 1 and Round 2 ground water samples collected from Site 13. As shown in Table 3-21, significant levels of fuel-derived organic constituents were detected in monitor wells 13GW02, 13GW04, 13GW05, and 13GW09 during Round 1. However, during Round 2, significant levels of fuel-derived organic constituents were detected in monitor wells 13GW02 through 13GW05.

3.12 ENSENADA HONDA SHORELINE AND MANGROVES, SITE 14  
During the Round 1 investigation of Site 14, samples of surface water and sediment were collected for analysis. The sample locations are shown in Figure 3-17.

Table 3-22 presents the concentration data for the surface water and sediment samples. As shown in Table 3-22, some significant levels of oil and grease were detected in the sediment samples collected from Site 14, but the oil and grease concentrations detected in the surface water samples

Table 3-19. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Sediment Sampling Results, Site 13, Tanks 210 to 217

Constituent	Round 1 Concentrations												Round 2 Concentrations												Chemical Toxicity Parameters				
	Concentrations												Concentrations												Toxicity Data	AIC mg/kg/day	Designated levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
SEDIMENT																													
Sample Number:	13SE1	13SE2	13SE3	13SE4	13SE5	13SE6	13SE01	13SE02	13SE03	13SE04	13SE05	13SE06	13SE1	13SE2	13SE3	13SE4	13SE5	13SE6	13SE01	13SE02	13SE03	13SE04	13SE05	13SE06					
Oil & Grease (ug/kg, dry)	52300	6710	3280	1730	1830	10200	51800	2420	3490	179	202	144													NR	NR	NR	NR	NR
Benzene (ug/kg, dry)	--	--	--	--	--	--	--	--	--	2500	2400	--												Oral LD50 (rat) = 2800 mg/kg	NR	0.700	NR	NR	
Chlorobenzene (ug/kg, dry)	--	--	--	--	--	--	--	--	--	2100	2100	--												Oral LD50 (rat) = 2910 mg/kg	0.0270	3	NR	NR	
Methylene Chloride (ug/kg, dry)	--	--	--	--	--	--	--	4400	--	--	--	3200												Oral LD50 (rat) = 2136 mg/kg	NR	NR	NR	NR	
Toluene (ug/kg, dry)	--	--	--	--	--	--	--	--	--	3000	--	--												Oral LD50 (rat) = 5000 mg/kg	0.300	100	NR	NR	
Trichloroethene (ug/kg, dry)	--	--	--	--	--	--	--	--	--	2500	--	--												Oral LD50 (mus) = 2402 mg/kg	NR	NR	NR	NR	
Lead (mg/kg, dry)	400	42.3	--	7.79	--	--	189	13.8	4.67	5.15	9.16	10.9												Oral TDL0 (wmm) = 450 mg/kg/6Y	0.001400	500	1000	<10 - 700	

-- = Not Detected.  
 N/A = Not Analyzed  
 NR = Not Reported  
 wmm = Woman  
 mus = Mouse  
 LD50 = Lethal Dose Fifty  
 TDL0 = Toxic Dose Low

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.  
 Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

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Table 3-T20. NAVSTA Confirmation Study, Rounds One and Two  
 Surface Water Sampling Results, Site 13, Tanks 210  
 to 217

Constituent	Round 1 Concentrations		Round 2 Concentrations					Chemical Toxicity Parameters				
								Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)
SURFACE WATER												
Sample Number:	13SW5	13SW6	13SW01	13SW03	13SW04	13SW05	13SW06					
Oil & Grease (mg/L)	0.6	0.4	--	--	--	--	--	NR	NR	NR	NR	NR
Lead (ug/L)	--	--	18.7	7.0	26.1	32.6	37.6	Oral TDLo (wmn) = 450 mg/kg/6Y	0.001400	50	50	50

-- = Not Detected.  
 NR = Not Reported.  
 wmn = Woman  
 TDLo = Toxic Dose Low  
 AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

Source: ESE, 1988

Table 3-21. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Ground Water Sampling Results, Site 13, Tanks 210 to 217

Constituent	Round 1 Concentrations						Round 2 Concentrations						Chemical Toxicity Parameters					
	13GWI	13GW2	13GW3	13GW4	13GW5	13GW6	13GW01	13GW02	13GW03	13GW04	13GW05	13GW06	Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	ANQC (ug/L)	PRDOH MCL (ug/L)
<b>GROUND WATER</b>																		
Sample Number:	13GW1	13GW2	13GW3	13GW4	13GW5	13GW6	13GW01	13GW02	13GW03	13GW04	13GW05	13GW06						
Benzene (ug/L)	--	2000	0.21	--	350	--	--	1900	110	14	2100	--	Oral LD50 (rat) = 2800 ug/kg	NR	NR	NR	0.66	5.0
Bromodichloromethane (ug/L)	--	--	0.57	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 916 mg/kg	NR	NR	*100	NR	*100
Chlorobenzene (ug/L)	--	--	--	--	1.5	--	--	--	--	--	--	--	Oral LD50 (rat) = 2910 mg/kg	0.0270	NR	NR	(+, FCC) 50	NR
Chloroform (ug/L)	1.0	--	5.0	3.7	2.6	1.1	--	--	--	--	--	--	Oral LDLo (hmn) = 140 mg/kg	0.0100	NR	*100	0.19	*100
1,2-dichloroethane (ug/L)	--	90	--	170	--	--	--	--	--	150	--	--	Oral LD50 (rat) = 670 mg/kg	NR	NR	NR	0.94	10
Ethylbenzene (ug/L)	--	130	--	1.0	74	--	--	--	--	--	--	--	Oral LD50 (rat) = 3500 mg/kg	0.100	NR	NR	1400	NR
Toluene (ug/L)	--	34000	--	--	420	--	--	7500	--	--	38	--	Oral LD50 (rat) = 5000 mg/kg	0.300	NR	NR	14300	NR
Vinyl chloride (ug/L)	--	--	--	--	1.9	--	--	--	--	--	--	--	Oral LD50 (rat) = 5000 mg/kg	NR	NR	NR	2.0	10
Trichloroethene (ug/L)	--	--	--	--	--	--	--	1500	--	--	--	--	Oral LD50 (rat) = 500 mg/kg	NR	NR	NR	NR	NR
m-Xylene (ug/L)	--	290	--	--	220	--	--	--	--	--	21	--	Oral LD50 (rat) = 5000 mg/kg	0.0100	NR	NR	NR	NR
O-and/or P-Xylene (ug/L)	--	360	0.83	0.57	180	--	--	--	--	--	260	--	Oral LD50 (rat) = 5000 mg/kg	0.0100	NR	NR	NR	NR
1,2-Dibromoethane (EDB) (ug/L)	--	0.365	0.045	--	--	0.297	0.039	0.022	--	0.103	--	0.106	Oral LD50 (rat) = 108 mg/kg	NR	NR	NR	NR	NR
Lead (ug/L)	--	--	--	--	--	--	12.2	150	2.9	8.6	4.7	7.6	Oral TDLo (wmn) = 450 mg/kg/6Y	0.001400	50	50	50	50
Oil & Grease (ug/L)	0.7	5	0.6	3	2	0.5	0.3	57	--	12	4	--	NR	NR	NR	NR	NR	NR
<hr/>																		
Sample Number:	13GW7	13GW8	13GW9	13GW10	13GW11		13GW07	13GW09	13GW10									
Benzene (ug/L)	--	--	16	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 2800 ug/kg	NR	NR	NR	0.66	5.0
Bromodichloromethane (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 916 mg/kg	NR	NR	*100	NR	*100
Chlorobenzene (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 2910 mg/kg	0.0270	NR	NR	(+, FCC) 50	NR
Chloroform (ug/L)	--	--	--	0.42	--	--	--	--	--	--	--	--	Oral LDLo (hmn) = 140 mg/kg	0.0100	NR	*100	0.19	*100
1,2-dichloroethane (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 670 mg/kg	NR	NR	NR	0.94	10
Ethylbenzene (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 3500 mg/kg	0.100	NR	NR	1400	NR
Toluene (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 5000 mg/kg	0.300	NR	NR	14300	NR
Vinyl chloride (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 5000 mg/kg	NR	NR	NR	2.0	10
Trichloroethene (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 500 mg/kg	NR	NR	NR	NR	NR
m-Xylene (ug/L)	--	--	--	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 5000 mg/kg	0.0100	NR	NR	NR	NR
O-and/or P-Xylene (ug/L)	--	--	4.9	--	--	--	--	--	--	--	--	--	Oral LD50 (rat) = 5000 mg/kg	0.0100	NR	NR	NR	NR
1,2-Dibromoethane (EDB) (ug/L)	--	--	--	--	--	--	0.068	--	0.138	--	--	--	Oral LD50 (rat) = 108 mg/kg	NR	NR	NR	NR	NR
Lead (ug/L)	--	--	--	--	--	--	5.5	7.6	3.1	--	--	--	Oral TDLo (wmn) = 450 mg/kg/6Y	0.001400	50	50	50	50
Oil & Grease (ug/L)	0.3	0.4	0.2	0.4	0.2	--	--	--	--	--	--	--	NR	NR	NR	NR	NR	NR

-- = Not Detected.

N/A = Not Analyzed.

NR = Not Reported.

hmn = Human

wmn = Woman

LD50 = Lethal Dose Fifty

LDLo = Lethal Dose Low

TDLo = Toxic Dose Low

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

RCRA MCL = RCRA Maximum Concentration Limits.

MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards; (s) = National Secondary Drinking Water Standards.

ANQC = Ambient Water Quality Criteria is associated with 10-6 cancer risks; (FCC) Fresh Chronic Criteria; (+) Hardness Dependent - 100 mg/L used.

PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

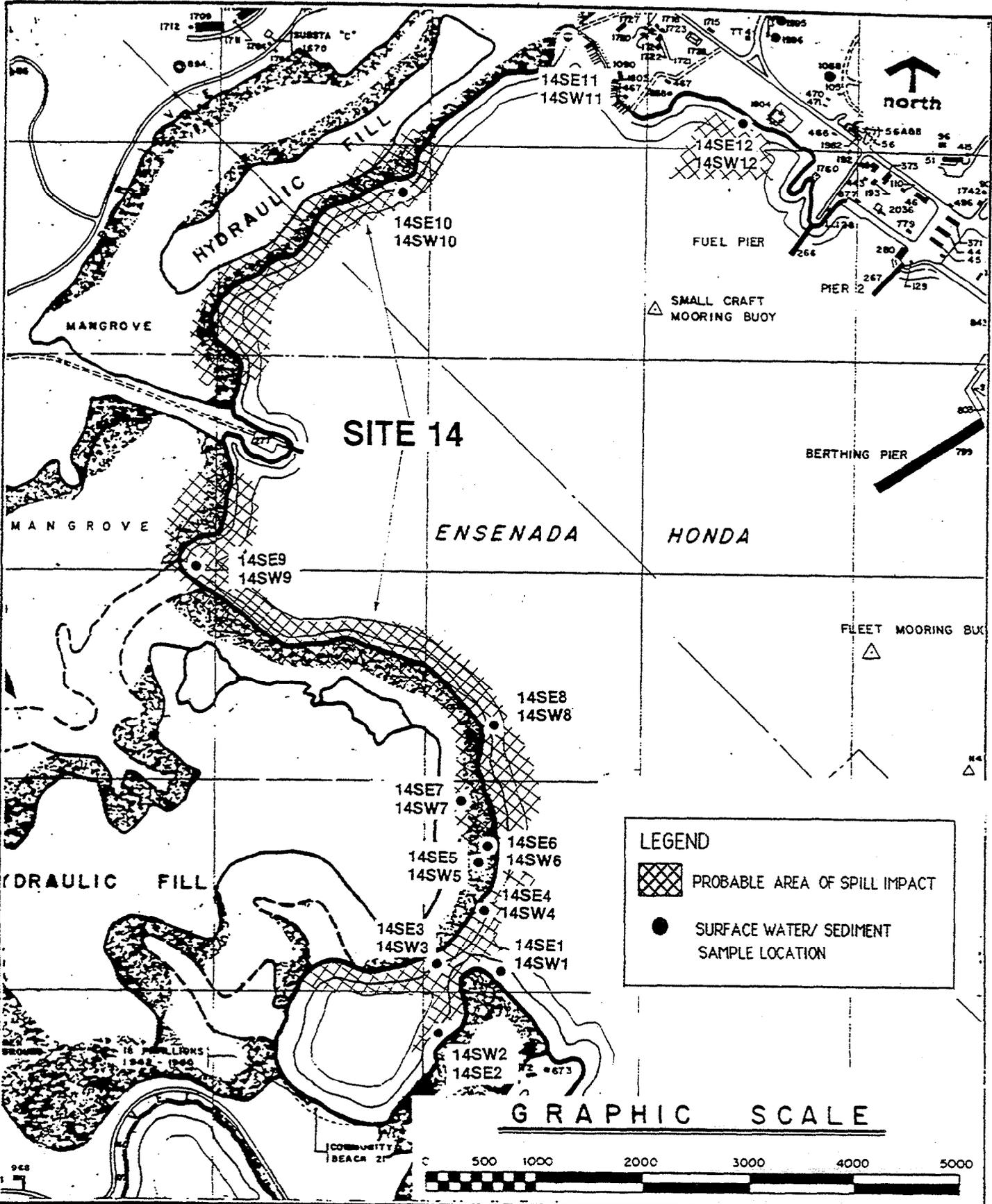


Figure 3-17  
 ROUND 1 SAMPLING LOCATIONS  
 AT SITE 14, ENSENADA HONDA  
 SHORELINE AND MANGROVES  
 SOURCES: NEE&A, 1984b; ESE, 1985.



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Table 3-2 NAVSTA Roosevelt Roads Confirmation Study, Round  
 One Surface Water and Sediment Sampling Results,  
 Site 14, Ensenada Honda Shoreline and Mangroves

Chemical Toxicity Parameters

Constituent	Round 1 Concentrations						Toxicity Data	AIC mg/kg/day in a Solid	Designated levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)	Element Concentration Ranges in Soils (ug/g)
	14SE1	14SE2	14SE3	14SE4	14SE5	14SE6					
<b>SEDIMENT</b>											
Sample Number:	14SE1	14SE2	14SE3	14SE4	14SE5	14SE6					
Methyl Ethyl Ketone (ug/g, dry)	0.008	--	--	--	--	--	Oral LD50 (rat) = 2737 mg/kg	0.0500	75	NR	NR
Oil & Grease (ug/g, dry)	112	119	250	219	656	147	NR	NR	NR	NR	NR
Sample Number:	14SE7	14SE8	14SE9	14SE10	14SE11	14SE12					
Methyl Ethyl Ketone (ug/g, dry)	--	--	--	--	--	--	Oral LD50 (rat) = 2737 mg/kg	0.0500	75	NR	NR
Oil & Grease (ug/g, dry)	806	225	2080	1670	1118	993	NR	NR	NR	NR	NR
<b>SURFACE WATER</b>											
Sample Number:	14SW4	14SW5	14SW6	14SW7	14SW8	14SW9					
Oil & Grease (mg/L)	0.8	2	0.7	0.5	0.3	0.6	NR	NR	NR	NR	NR
Sample Number:	14SW10	14SW11									
Oil & Grease (mg/L)	0.5	0.5					NR	NR	NR	NR	NR

-- = Not Detected.  
 V/A = Not Analyzed  
 NR = Not Reported  
 LD50 = Lethal Dose Fifty  
 AIC = Chronic Acceptable Intake for noncarcinogenic effects.  
 Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.  
 Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.  
 Element Concentration Ranges in Soil = Element Concentration Ranges in Soils and Surficial Materials of the Conterminous United States.

Source: ESE, 1988

did not indicate a substantial degree of contamination and are inherent to the shipping activities conducted in Ensenada Honda. Inspection of the mangroves indicated that the majority of damage resulting from past oil spillage occurred in the mangroves along the southwestern shore of Ensenada Honda, and signs of recovery were apparent in this area. Therefore, no additional monitoring was performed at Site 14 in the Round 2 investigation at NAVSTA Roosevelt Roads.

### 3.13 PEST CONTROL SHOP AND SURROUNDING AREA, SITE 18

During the Round 1 investigation of Site 18, soil samples were collected from the area adjacent to the former pest control shop (Building 258) and from the drainage ditches near Building 258. In addition, samples of surface water and sediment were collected from the drainage ditch south of the site. Figures 3-18 and 3-19 show the Round 1 sampling locations.

In the Round 2 investigation, three ground water monitor wells were installed and a sample of ground water was collected from each well for analysis. In addition, the two Round 1 surface water and sediment sampling locations (18 SW1/18 SE1 and 18 SW2/18 SE2) were resampled during Round 2, and four additional surface water and sediment sampling points located further downstream in the drainage ditch leading away from Site 18 were also sampled during Round 2. Figure 3-20 shows the Round 2 surface water and sediment sampling locations at Site 18, and Figure 3-21 shows the location of the monitor wells at Site 18.

Table 3-23 presents the Round 1 soil sampling results for Site 18. As shown in Table 3-23, the pesticides DDD,PP'; and DDE,PP' were detected in soil samples collected from the drainage ditches near Building 258. In addition, chlordane and several other pesticides were detected in the soil samples

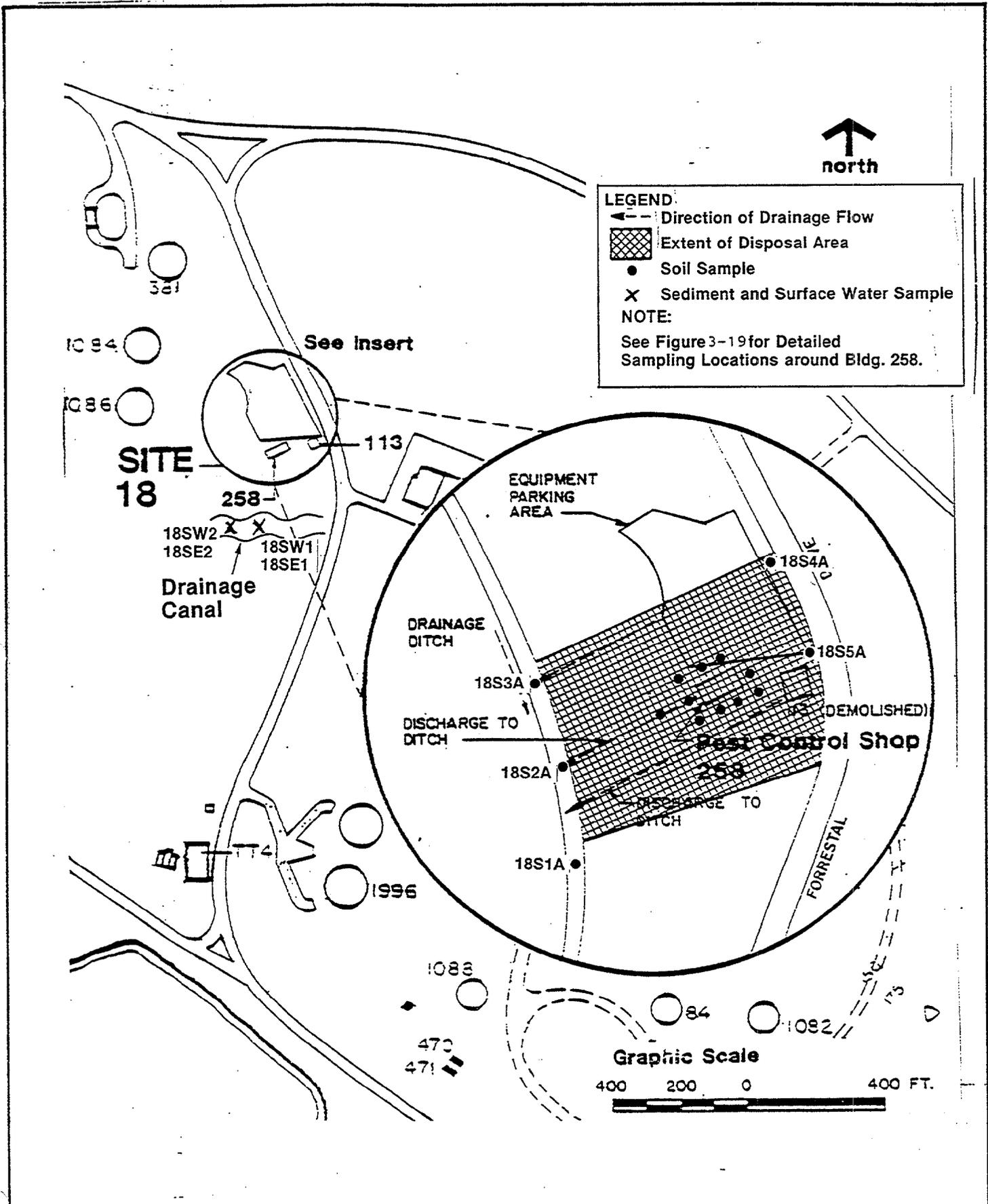
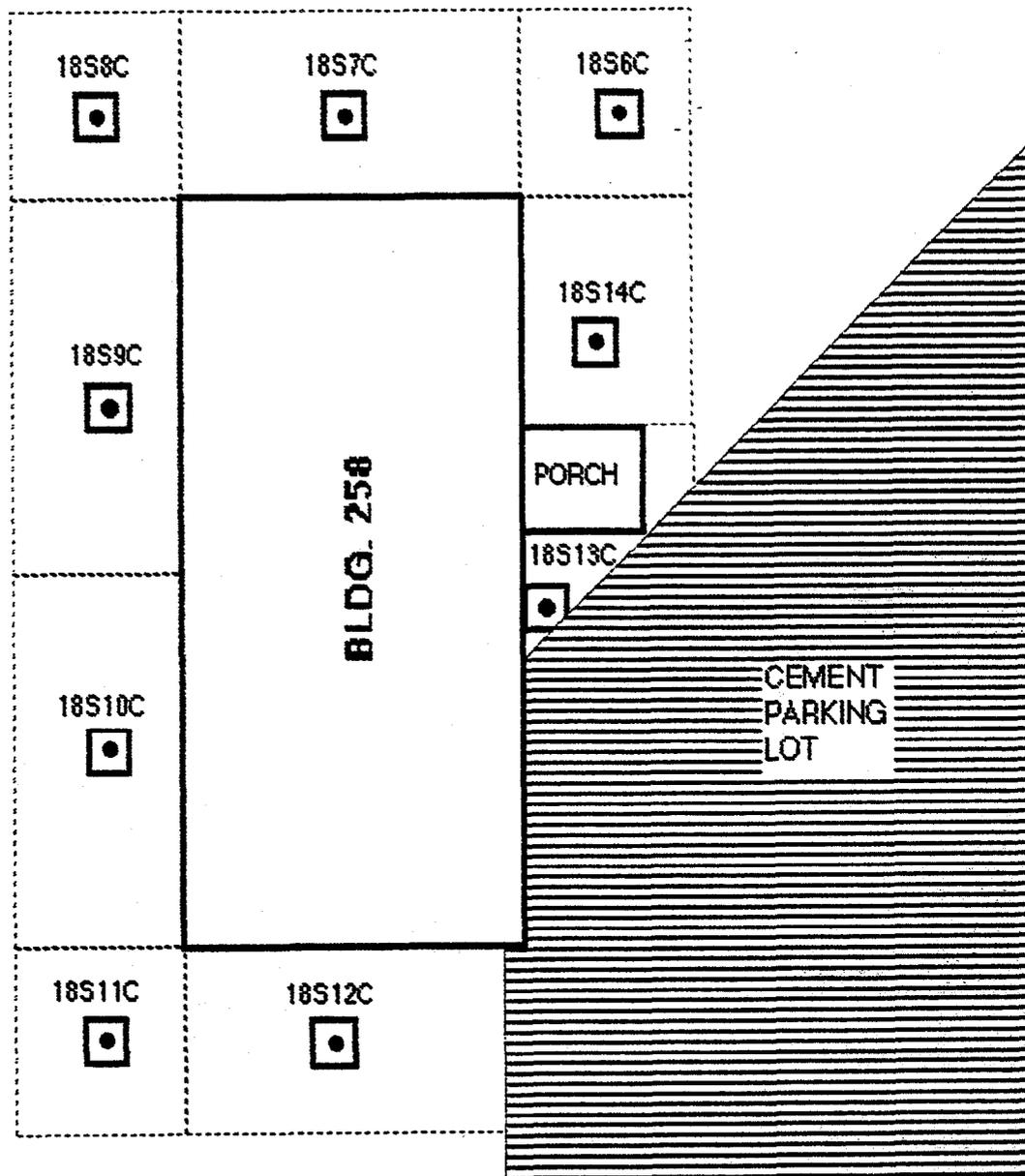


Figure 3-18  
 ROUND 1 SOIL, SURFACE WATER,  
 AND SEDIMENT SAMPLING LOCATIONS  
 AT SITE 18, PEST CONTROL SHOP  
 AND SURROUNDING AREA



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**LEGEND**

 Composite Sample Over Approximate Area

  
Approximate Scale  
1" = 20'

Figure 3-19  
ROUND 1 SOIL SAMPLING LOCATIONS  
AT SITE 18, PEST CONTROL SHOP  
AND SURROUNDING AREA



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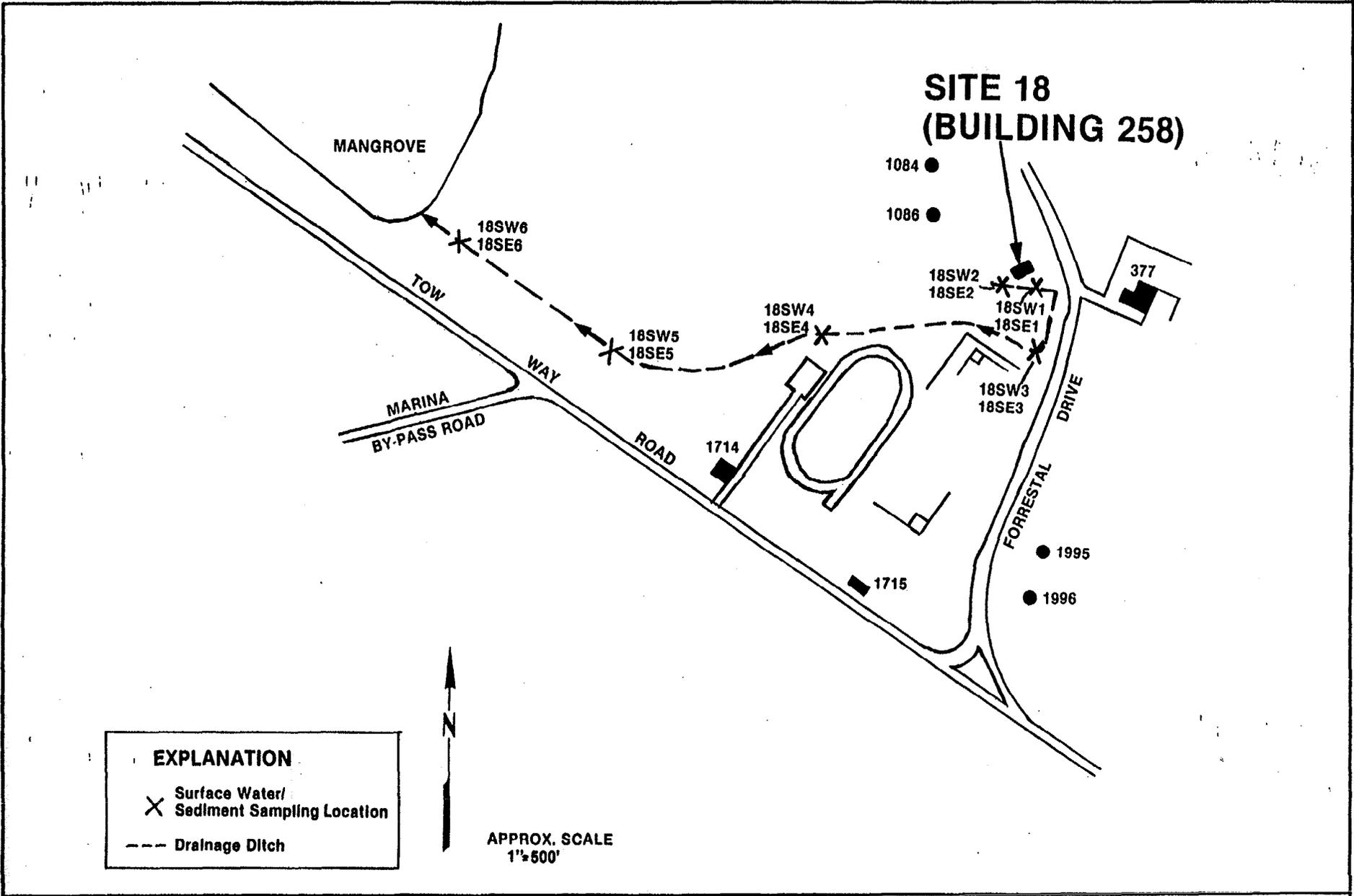


Figure 3-20  
 ROUND 2 SURFACE WATER AND SEDIMENT  
 SAMPLING LOCATIONS AT SITE 18, PEST  
 CONTROL SHOP AND SURROUNDING AREA



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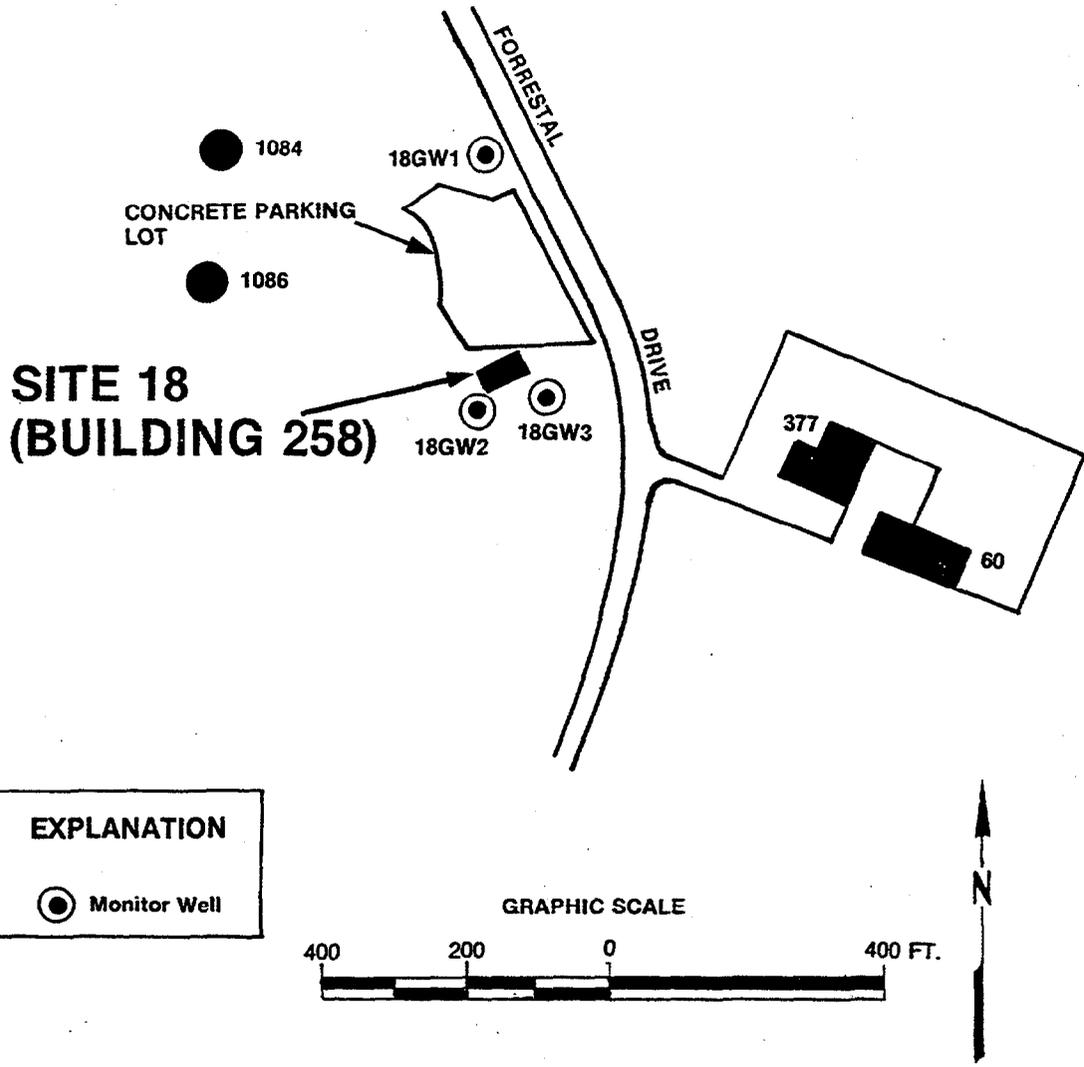


Figure 3-21  
ROUND 2 GROUND WATER SAMPLING  
LOCATIONS AT SITE 18, PEST CONTROL  
SHOP AND SURROUNDING AREA



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Table 3-23

NAVSTA Roosevelt Roads Confirmation Station, Round  
One Soil Sampling Results, Site 18, Pest Control  
Shop and Surrounding Area

## Chemical Toxicity Parameter

Constituent	Round 1 Concentrations						Toxicity Data	AIC mg/kg/day	Designated levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)
	18S1A	18S2A	18S3A	18S4A	18S5A	18S6C				
SOIL										
Sample Number:	18S1A	18S2A	18S3A	18S4A	18S5A	18S6C				
Aldrin (ug/g, dry)	--	--	--	--	--	--	Oral LD50 (rat) = 39 mg/kg	0.0000300	0.000074	1.4
Chlordane (ug/g, dry)	--	--	--	--	--	--	Oral LDLo (hmn) = 40 mg/kg	0.0000500	0.055	2.5
DDD, PP' (ug/g, dry)	--	--	6.65	17.3	55.3	1.84	Oral LD50 (rat) = 113 mg/kg	NR	NR	1.0
DDE, PP' (ug/g, dry)	--	--	2.23	--	--	2.10	Oral LD50 (rat) = 880 mg/kg	NR	NR	1.0
DDT, PP' (ug/g, dry)	--	--	--	--	--	--	UNK. LDLo (man) = 221 mg/kg	0.000500	0.000240	1.0
Endosulfan sulfate (ug/g, dry)	--	--	--	--	--	2.54	Oral LD50 (rat) = 18 mg/kg	0.0000500	74	NR
Endrin (ug/g, dry)	--	--	--	--	--	--	NR	NR	NR	NR
Heptachlor epoxide (ug/g, dry)	--	--	--	--	--	--	Oral LD50 (rat) = 47 mg/kg	0.0000300	0.0002	NR
Sample Number:	18S7C	18S8C	18S9C	18S10C	18S11C	18S12C				
Aldrin (ug/g, dry)	--	--	--	--	0.803	--	Oral LD50 (rat) = 39 mg/kg	0.0000300	0.000074	1.4
Chlordane (ug/g, dry)	--	--	--	--	57.4	38.3	Oral LDLo (hmn) = 40 mg/kg	0.0000500	0.055	2.5
DDD, PP' (ug/g, dry)	--	--	1.68	--	1.90	0.752	Oral LD50 (rat) = 113 mg/kg	NR	NR	1.0
DDE, PP' (ug/g, dry)	0.549	--	3.16	23.1	11.5	36.4	Oral LD50 (rat) = 880 mg/kg	NR	NR	1.0
DDT, PP' (ug/g, dry)	--	--	6.92	88.1	130	208	UNK. LDLo (man) = 221 mg/kg	0.000500	0.000240	1.0
Endosulfan sulfate (ug/g, dry)	2.16	--	--	--	--	--	Oral LD50 (rat) = 18 mg/kg	0.0000500	74	NR
Endrin (ug/g, dry)	--	--	--	--	--	--	NR	NR	NR	NR
Heptachlor epoxide (ug/g, dry)	--	--	--	--	--	--	Oral LD50 (rat) = 47 mg/kg	0.0000300	0.0002	NR
Sample Number:	18S13C	18S14C	18S15C							
Aldrin (ug/g, dry)	0.761	2.06	--				Oral LD50 (rat) = 39 mg/kg	0.0000300	0.000074	1.4
Chlordane (ug/g, dry)	142	181	--				Oral LDLo (hmn) = 40 mg/kg	0.0000500	0.055	2.5
DDD, PP' (ug/g, dry)	--	--	--				Oral LD50 (rat) = 113 mg/kg	NR	NR	1.0
DDE, PP' (ug/g, dry)	--	7.93	0.750				Oral LD50 (rat) = 880 mg/kg	NR	NR	1.0
DDT, PP' (ug/g, dry)	--	7.24	--				UNK. LDLo (man) = 221 mg/kg	0.000500	0.000240	1.0
Endosulfan sulfate (ug/g, dry)	--	--	--				Oral LD50 (rat) = 18 mg/kg	0.0000500	74	NR
Endrin (ug/g, dry)	--	13.2	--				NR	NR	NR	NR
Heptachlor epoxide (ug/g, dry)	--	0.993	--				Oral LD50 (rat) = 47 mg/kg	0.0000300	0.0002	NR

-- = Not Detected.

N/A = Not Analyzed

NR = Not Reported

LD50 = Lethal Dose Fifty

LDLo = Lethal Dose Low

UNK = Unknown

hmn = Human

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.

Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

collected from the area surrounding Building 258. The highest pesticide concentrations were found near the entrance to Building 258 on the northwest side of the building, and around the eastern corner of the building.

Table 3-24 presents the Round 1 and Round 2 sediment sampling results for Site 18. As shown in Table 3-24, chlordane and several other pesticides were detected in three sediment samples collected from the locations nearest Site 18 (18 SE1 - 18 SE3).

Table 3-25 presents the Round 1 and Round 2 surface water sampling results, as well as the Round 2 ground water sampling results for Site 18. As shown in Table 3-25, chlordane and DDE-PP' were detected in the surface water. All of the detected chlordane levels exceed the ambient water quality criterion for chlordane. The surface water concentration data also suggests downstream migration of chlordane.

With regard to the ground water sampling results, only a very low concentration of DDD,PP' (0.017 ug/L) was detected in monitor well 18GW02 located near the southern corner of Building 258. Pesticides were not detected in the other two monitor wells at Site 18.

Table 3-24. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Sediment Sampling Results, Site 18, Pest Control Shop and Surrounding Area

Constituent	Round 1 Concentrations			Round 2 Concentrations			Chemical Toxicity Parameter			
	18SE1	18SE2		18SE01	18SE02	18SE03	Toxicity Data	AIC mg/kg/day	Designated levels in a Solid (ug/g)	Threshold Limit Concentrations (ug/g)
SEDIMENT										
Sample Number:	18SE1	18SE2		18SE01	18SE02	18SE03				
Chlordane (ug/g, dry)	34.1	66.7		77.8	--	78.4	Oral LDLo (hmn) = 40 mg/kg	0.0000500	0.055	2.5
DDD, PP' (ug/g, dry)	--	--		--	75.6	--	Oral LD50 (rat) = 113 mg/kg	NR	NR	1.0
DDE, PP' (ug/g, dry)	1.37	2.63		310	82.0	79.8	Oral LD50 (rat) = 880 mg/kg	NR	NR	1.0
Endosulfan, A (ug/g, dry)	3.32	3.44		--	--	--	Oral LD50 (rat) = 18 mg/kg	0.0000500	74	NR
Endosulfan, B (ug/g, dry)	4.38	7.65		--	--	--	Oral LD50 (rat) = 18 mg/kg	0.0000500	74	NR

-- = Not Detected.

N/A = Not Analyzed

NR = Not Reported

hmn = Human

LD50 = Lethal Dose Fifty

LDLo = Lethal Dose Low

AIC = Chronic Acceptable Intake values for noncarcinogenic effects.

Designated Levels in a Solid = Designated levels in a solid to protect ground water at an average site in California.

Threshold Limit Concentrations = Hazardous Waste Total Threshold Limit Concentrations. Disposal of wastes exceeding these values is restricted in California.

Source: ESE, 1988

RR-00037-03.13-04/29/88

Table 3-25. NAVSTA Roosevelt Roads Confirmation Study, Rounds One and Two Surface Water and Ground Water Sampling Results, Site 18, Pest Control Shop and Surrounding Area

Constituent	Round 1 Concentrations		Round 2 Concentrations				Chemical Toxicity Parameters					
							Toxicity Data	AIC mg/kg/day	RCRA MCL (ug/L)	MCL (ug/L)	AWQC (ug/L)	PRDOH MCL (ug/L)
SURFACE WATER												
Sample Number:	18SW1	18SW2	18SW02	18SW03	18SW05	18GW02						
Chlordane (ug/L)	0.571	0.616	0.170	0.145	0.098	--	Oral LDLo (hmn) = 40 mg/kg	0.0000500	NR	NR	0.00046	NR
DDD,PP' (ug/L)	--	--	--	--	--	0.017	Oral LD50 (rat) = 113 mg/kg	NR	NR	NR	NR	NR
DDE,PP' (ug/L)	--	--	--	0.007	--	--	Oral LD50 (rat) = 880 mg/kg	NR	NR	NR	NR	NR

-- = Not Detected.  
 N/A = Not Analyzed.  
 NR = Not Reported.  
 LDLo = Lethal Dose Low  
 LD50 = Lethal Dose Fifty  
 hmn = Human  
 AIC = Chronic Acceptable Intake values for noncarcinogenic effects.  
 RCRA MCL = RCRA Maximum Concentration Limits.  
 MCL = Maximum Contaminant Levels of National Primary Drinking Water Standards.  
 AWQC = Ambient Water Quality Criteria is associated with 10<sup>-6</sup> cancer risks.  
 PRDOH MCL = Puerto Rico Department of Health Maximum Contaminant Levels for drinking water.

Source: ESE, 1988

RR-00037-03.13-04/29/88

3-74

#### 4.0 RECOMMENDATIONS

This section presents the recommendations for additional investigation of the sites at NAVSTA Roosevelt Roads and NAF Vieques. The recommendations are based on the evaluation of the environmental data generated by the Verification Step Round 1 and Round 2 investigations presented in Section 3.0. As described earlier, this data evaluation consists of comparing environmental sample concentrations with available standards and criteria.

However, recommendations are also based on a comparison of metals concentration data for ground water samples with that data for background ground water monitor wells. These wells include 12GW01 at Site 12, Tow Way Road Fuels Farm, and 10GW01 at Site 10, Building 25 Storage Area. This additional data evaluation was performed to account for the elevated metals levels that appear to naturally occur in the shallow ground water at NAVSTA Roosevelt Roads and NAF Vieques because of the volcanic nature of the subsurface strata. Table 4-1 presents the metals data for the ground water samples collected from background monitor wells 10GW01 and 12GW01.

The following paragraphs present the recommendations for each site at NAVSTA Roosevelt Roads and NAF Vieques.

##### 4.1 QUEBRADA DISPOSAL SITE, SITE 1

Metals were the only constituents of concern that were detected in the ground water samples collected from Site 1. Table 4-2 presents a comparison of the Site 1 ground water data to the background concentration ranges. As shown in Table 4-2, the metals levels detected in the ground water at Site 1 are generally representative of background levels. In addition, no elevated levels of any of the constituents of concern were detected in the soil and sediment samples

Table 4-1. Background Metals Concentrations in Shallow Ground Water

Metal	Concentration in Micrograms per Liter				Average
	Well 10GW01		Well 12GW01		
	Round 1	Round 2	Round 1	Round 2	
Antimony	<33.0	<21.0	NA	NA	<33.0
Arsenic	119	<10.0	NA	NA	64.5
Beryllium	17.3	< 1.0	NA	NA	9.2
Cadmium	29.6	< 2.4	NA	NA	16.0
Chromium (Hexavalent)	<20.0	<10.0	NA	NA	<10.0
Chromium (Total)	72.7	202	NA	NA	137
Copper	600	464	NA	NA	532
Lead	<21.0	<400	<21.0	6.1	<21.0
Mercury	0.309	< 0.2	NA	NA	0.254
Nickel	171	88.6	NA	NA	130
Silver	< 6.00	24.3	NA	NA	15.2
Selenium	324	154	NA	NA	239
Thallium	42.3	5.8	NA	NA	24
Zinc	733	541	NA	NA	637

Notes: NA = Not Analyzed

Table 4-2. Comparison of Site 1 Ground Water Metals Concentrations to Background Concentrations

<u>Constituent</u>	<u>Concentration Range Detected (ug/L)</u>	<u>Background Concentration Range (ug/L)</u>
Cadmium	6.0 - 13.0	<2.4 - 29.6
Chromium (Total)	173 - 512	72.7 - 202
Chromium (Hexavalent)	ND - 73.2	<10 - <20
Copper	121 - 629	464 - 600
Nickel	74.0 - 215	88.6 - 171
Zinc	113 - 400	541 - 733

Notes: ND = Not Detected.

*Table headers swapped*

collected at Site 1. Therefore, no additional investigation of Site 1 is recommended.

#### 4.2 MANGROVE DISPOSAL SITE, SITE 2

No elevated levels of any of the constituents of concern were detected in the soil, surface water, and sediment samples collected at Site 2. Therefore, no further investigation of Site 2 is recommended.

#### 4.3 IRFNA/MAF-4 DISPOSAL SITE, SITE 3

Total zinc was the only constituent detected in the ground water at Site 3. The detected level of 469 ug/L is below the National Secondary Drinking Water Standard of 5,000 ug/L. Therefore, no further investigation of Site 3 is recommended.

#### 4.4 ARMY CREMATOR DISPOSAL AREA, SITE 5

The concentration data for the sediment samples collected at Site 5 indicate that although several constituents of concern were detected, the levels detected were generally low and for isolated samples. Therefore, no further sampling and analysis of sediments at Site 5 are recommended.

The surface water concentration data indicate that several metals were detected at levels exceeding ambient water quality criteria. However, when the concentrations are evaluated relative to the background shallow ground water quality data presented in Table 4-1, the surface water concentrations are not significant. Therefore, no additional surface water monitoring is recommended for Site 5.

The ground water concentration data for Site 5 indicate that the only constituents of concern detected at significant levels are thallium and copper. However, significant thallium levels were only detected in the Round 1 investigation, and the elevated copper levels were found only in monitor well

5GW03. Because these data do not indicate persistent and widespread contamination, no additional investigation of Site 5 is recommended.

#### 4.5 LANGLEY DRIVE DISPOSAL SITE, SITE 6

The soil sampling data for Site 6 indicates the presence of elevated lead levels. However, the elevated lead levels appear to be restricted to two small areas near sample stations R6S10A and R6S11A. EP toxicity testing of two soil samples collected from these areas indicates that the samples are not classified as a hazardous waste. Therefore, no additional soil sampling and analysis are recommended for Site 6.

The only constituent of concern that was detected in the surface water samples collected at Site 6 in elevated concentrations (when compared to background shallow ground water quality data presented in Table 4-1) is lead. Although lead was not detected in any of the Round 2 surface water samples, the Round 1 concentrations were relatively high (>200 ppb) in all three samples. Therefore, resampling of the three surface water sampling stations at Site 6 for lead analysis is recommended.

The ground water sample collected from monitor well R6GW01, located upgradient of Site 6, had an elevated lead concentration of 121 ppb. In addition, low levels of organic compounds including pentachlorophenol and aldrin were detected. Therefore, resampling of monitor well R6GW01 for a Priority Pollutant scan (excluding asbestos, cyanide, and dioxin) is recommended. In addition, a focused environmental assessment of the area upgradient of monitor well R6GW01 is recommended to determine the presence of any potential sources of contamination.

#### 4.6 STATION LANDFILL, SITE 7

Soil sampling within the Drum Ditch disposal site within Site 7 indicated that none of the contaminants of concern were detected at significant levels. Only low levels of oil and grease were detected. Therefore, no additional investigation of the Drum Ditch is recommended.

Only very low and sporadic concentrations of organic compounds were detected in the ground water samples collected at Site 7. When compared to the background ground water quality data presented in Table 4-1, the metals concentrations for the Site 7 ground water samples are generally representative of background conditions. Some elevated levels of some metals were detected but only on a sporadic basis suggesting that a significant source of metals contamination does not exist at Site 7. Therefore, no additional ground water investigation is recommended for Site 7.

#### 4.7 DRONE WASHDOWN, SITE 8

The only constituent of concern that was detected in the sediment samples collected at Site 8 at elevated levels was oil and grease. However, because an elevated oil and grease level was detected at sample station 8SE1, which is upstream of the confluence with the drainage ditch from the drone washdown area, it is likely that oily waters are entering the drainage ditch from the hanger area (Building 200) upstream from station 8SE1.

The surface water concentration data indicates the sporadic presence of low levels of oil and grease and volatile organic compounds typically present in fuel and degreasing solvents. However, as with the sediment data, the surface water data indicates that the constituents of concern are emanating from the hanger area (Building 200). Because the constituent

levels detected are low, no additional monitoring is recommended for Site 8.

#### 4.8 PCB DISPOSAL, DRY DOCK AREA, SITE 9

Because no PCBs were detected in any of the surface water and sediment samples collected at Site 9, no additional sampling and analysis is recommended.

#### 4.9 BUILDING 25 STORAGE AREA, SITE 10

The ground water concentration data for Site 10 indicates that only very low levels of organic compounds were detected, and the metals concentrations detected were generally representative of background ground water quality as presented in Table 4-1. Some elevated levels of metals were detected but they were sporadic suggesting that a significant source of metals contamination does not exist at Site 10. Therefore, additional ground water monitoring is not recommended for Site 10.

#### 4.10 TOW WAY ROAD FUELS FARM, SITE 12

The concentration data for the surface water and sediment samples collected from Ensenada Honda directly offshore from Site 12 do not indicate the presence of any of the constituents of concern at levels beyond those inherent to bodies of water subject to shipping activities. Therefore, no additional sampling and analysis of surface water and sediment are recommended at Site 12.

The ground water concentration data for Site 12 shows elevated levels of benzene and toluene for samples collected from monitor well 12GW02. Although dark petroleum fuel resembling degraded diesel fuel was encountered in the installation and sampling of monitor well 12GW06, no constituents of concern, other than oil and grease, were detected in ground water

samples from this well. Oil and grease were not detected in monitor well 12GW06 in the Round 2 investigation.

As shown in Figure 4-1, fuel contamination was detected in the soil in the upper section of Site 12 in the drainage way between the tanks in the tank farm. Additional fuel contamination was found in the soil in the lower section of Site 12 as shown in Figure 4-2. As described in Section 3.0, the contamination was detected through field observations (visual and odor), as well as measurements with a PID. Because this approach was only semi-quantitative, further soil sampling and analysis are recommended at Site 12 to quantify the degree and determine the extent of soil contamination. sixteen soil borings are proposed (five in the upper section and eleven in the lower section) using the hollow stem auger technique to collect soil samples at 5-ft intervals to a depth of approximately 15 ft. Each sample will be analyzed for total petroleum hydrocarbons, benzene, toluene, xylene, and lead. Figures 4-1 and 4-2 show the proposed soil boring locations in the upper and lower sections of Site 12, respectively. As shown in Figure 4-2, the installation of two monitor wells (identified as 12GW07 and 12GW08) is recommended at two of the proposed soil boring locations. The objective of these two wells is to determine the lateral extent of the contamination detected in monitor well 12GW02. The sampling and analysis of monitor wells 12GW02 through 12GW08 for total petroleum hydrocarbons, benzene, toluene, xylene, and lead are recommended.

#### 4.11 TANKS 210 TO 217, SITE 13

No constituents of concern were detected in the surface water and sediment samples collected at Site 13 at significant levels. Therefore, no additional surface water and sediment sampling and analysis are recommended for Site 13.

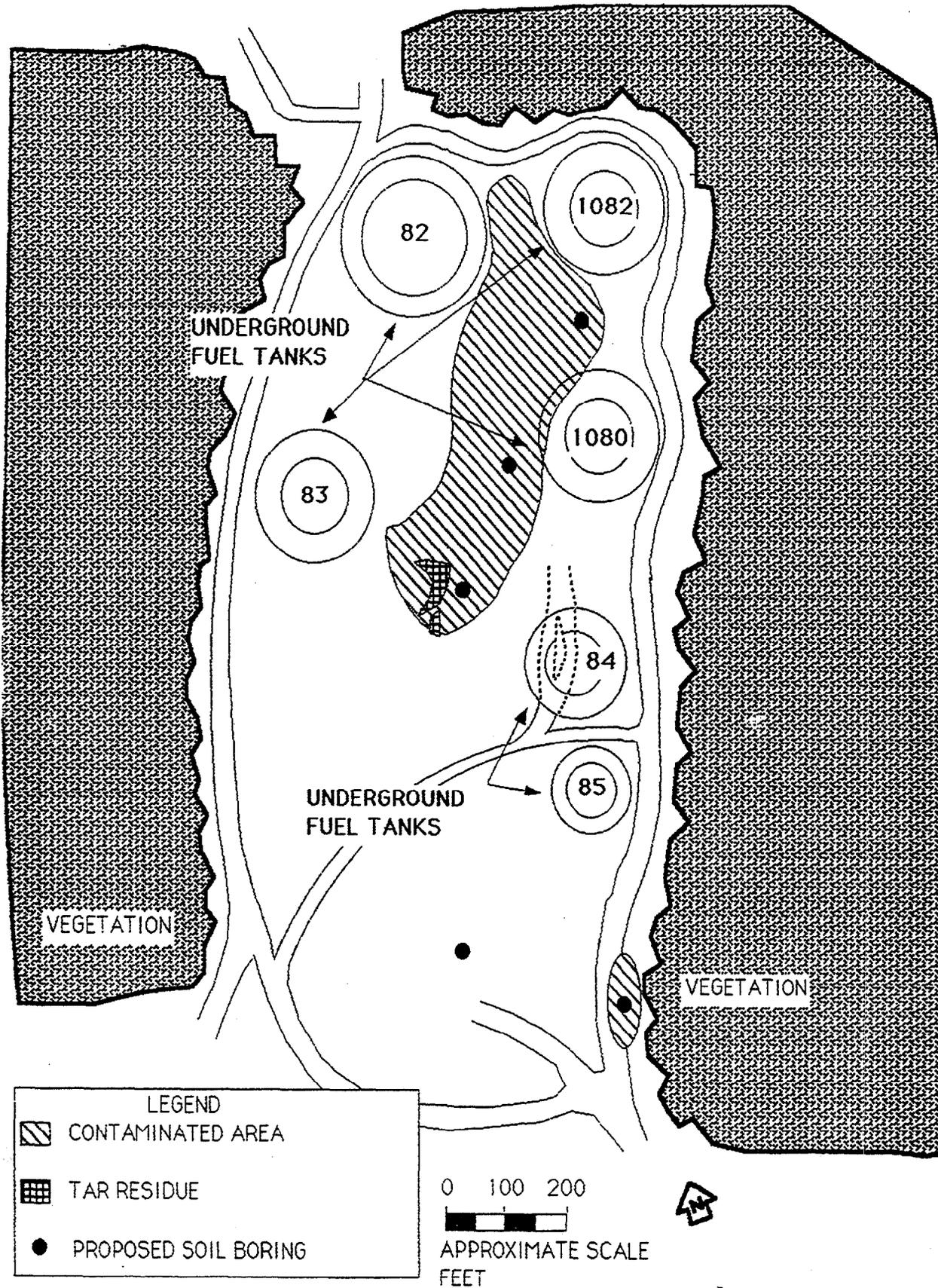


Figure 4-1  
 PROPOSED ROUND 3 SOIL BORING  
 LOCATIONS AT UPPER SECTION OF  
 SITE 12, TOW WAY ROAD FUELS FARM



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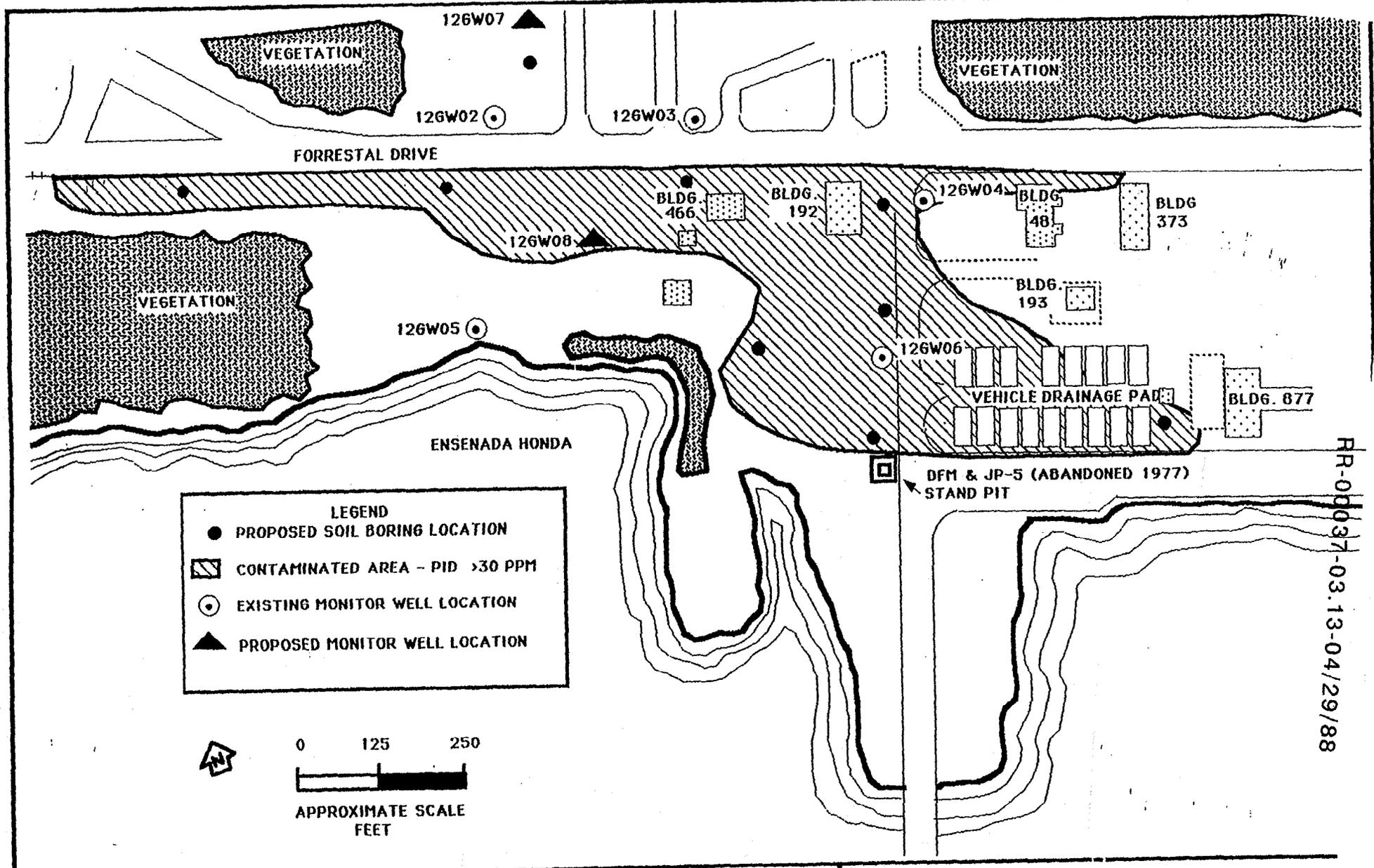


Figure 4-2  
 PROPOSED ROUND 3 SOIL BORING  
 LOCATIONS AT LOWER SECTION  
 OF SITE 12, TOW WAY ROAD  
 FUELS FARM



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Significant levels of fuel-derived constituents were detected in the ground water samples collected from wells 13GW02 through 13GW05 and 13GW09. In addition, low concentrations of 1,2-dibromoethane were detected in the samples from monitor well 13GW01, 13GW06, 13GW07, and 13GW10.

The samples from monitor well 13GW02 had the highest constituent concentrations, including a lead concentration of 150 ug/L.

To determine the extent of the fuel contamination detected at Site 13, sixteen soil borings and the installation of three monitor wells in the area of Tanks 212 through 217 are recommended. The soil borings will be drilled using the hollow stem auger technique with the collection of soil samples at 5-ft intervals to a depth of approximately 20 ft or to a depth at which ground water is encountered. The soil samples will be analyzed for total petroleum hydrocarbons, benzene, toluene, xylene, and lead. Ground water samples will be collected from existing monitor wells 13GW01-13GW06 and the three additional proposed wells and analyzed for the same constituents as for the soil samples.

In the area of Tanks 216 and 217, four soil borings are recommended to determine the degree and extent of fuel contamination in the area of monitor well 13GW09. Soil samples will be collected at 5-ft intervals to a depth of approximately 20 ft or to the depth at which ground water is encountered. The samples will be analyzed for the same constituents as for the soil samples collected in the area of Tanks 212-215.

Because of the high relief topography at Site 13, the exact location of the proposed soil borings and monitor wells will be determined during a pre-drilling site reconnaissance.

## 4.12 ENSENADA HONDA SHORELINE AND MANGROVES, SITE 14

Although elevated levels of oil and grease were detected in the sediment samples collected from Site 14, the mangroves which sustained damage from past oil spills in Ensenada Honda showed signs of recovery. No other constituents of concern were detected in samples of surface water and sediment collected from Site 14 in significant levels. Consequently, no additional monitoring is recommended for Site 14.

## 4.13 PEST CONTROL SHOP AND SURROUNDING AREA, SITE 18

Several pesticides, including chlordane, were detected in the surficial soils in the area adjacent to Building 258, the former pest control shop, at Site 18. Chlordane and other pesticides were also detected in the surface and sediment samples collected from the drainage ditch which conveys runoff from Site 18.

A low concentration of DDD,PP' (0.0017 ug/L) was detected in monitor well 18GW02, but no pesticides were detected in the other two monitor wells at Site 18.

A preliminary risk assessment of the pesticide contamination at Site 18 is recommended to determine if the levels of pesticide detected in the soils, surface water, sediment, and ground water pose a threat to human health and the environment. The results of this assessment will allow the determination of the need for further investigation of Site 18.

5.0 REFERENCES

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- U.S. Geological Survey (USGS). 1984. Element Concentrations in Soils And Other Surficial Materials of the Conterminous United States. Professional Paper 1270.

**ESE**

AN RSH COMPANY

**ENVIRONMENTAL SCIENCE  
AND ENGINEERING, INC.**

April 29, 1988  
ESE No. 87541-0600-1730

Commander  
Naval Facilities Engineering Command  
Atlantic Division  
Code 114: ATTN: Cherryl Barnett  
Norfolk, Virginia 23511-6287

RE: Round 2 Confirmation Study at NAVSTA Roosevelt Roads  
(Contract No. N62470-85-C-7972)

Dear Cherryl:

Enclosed is one copy of the report "Evaluation of Data from First and Second Rounds of Verification Sample Collection and Analysis for NAVSTA Roosevelt Roads" and the "Supplemental Appendix of Laboratory Data" for the NAVSTA Roosevelt Roads Confirmation Study.

The Remedial Action Alternatives Analysis Report for Site 16, Old Power Plant, Building 38 will be submitted to you next week.

Please do not hesitate to call me with any questions or comments concerning this report.

Sincerely,

*Russ Bowen*

Russell V. Bowen, P.E.  
Project Manager

RVB/mkw  
Enclosures