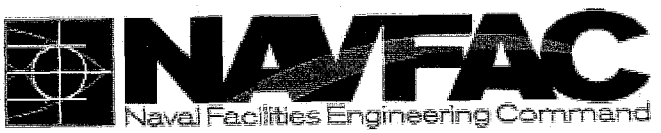
3/31/05-02474

Final

Work Plan and Sampling and Analysis Plan Soil Inorganics Background Investigation

Former Atlantic Fleet Weapons Training Facility Vieques, Puerto Rico



Prepared for

Department of the Navy

Atlantic Division

Naval Facilities Engineering Command

Contract No. N62470-02-D-3052
CTO-039

March 31, 2005

CH2MHILL

E032005005TPA

3/31/05-02474

Final

Work Plan and Sampling and Analysis Plan Soil Inorganics Background Investigation

Former Atlantic Fleet Weapons Training Facility Vieques, Puerto Rico

Prepared for

Department of the Navy

Atlantic Division
Naval Facilities Engineering Command

Contract No. N62470-02-D-3052
CTO-039

March 31, 2005

CH2MHILL

E032005051TPA

Contents

List of Appendixes

List of Figures

List of Tables

List of Acronyms

AFWTF	Atlantic Fleet Weapons Training Facility
AOC	Area of Concern
ASTM	American Society for Testing and Materials
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	constituent of concern
COPC	constituent of potential concern
CRQL	Contract Required Quantitation Limit
DOI	Department of the Interior
DQE	data quality evaluation
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
GIS	geographic information system
GPS	global positioning system
HSP	Health and Safety Plan
IDWP	Investigation-Derived Waste Plan
IR	Installation Restoration
LCS	laboratory confirmation sample
MDL	method detection limit
MS/MSD	matrix spike/matrix spike duplicate
NAD 83	North American Datum 1983
NAPR	U.S. Naval Activity Puerto Rico
NASD	Naval Ammunition Support Detachment
NAVFAC	Naval Facilities Engineering Command
NAVFACENGCOM	Naval Facilities Engineering Command
NFESC	Naval Facilities Engineering Support Command
NGVD	National Geodetic Vertical Datum
NSRR	U.S. Naval Station Roosevelt Roads
NTR	Navy Technical Representative
PAH	polycyclic aromatic hydrocarbon
PDF	probability density function
PI	photo identified
PMP	Project Management Plan
PPE	personal protective equipment
PREQB	Puerto Rico Environmental Quality Board
PWC	Public Works Center
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RFI	RCRA Facility Investigation
RL	reporting limit
SOP	standard operating procedure
SQL	standard quantitation limit
SVOC	semivolatile organic compound

SWMU	solid waste management unit
TDS	total dissolved solids
TM	technical memorandum
UTL	upper tolerance limit
VNWR	Vieques National Wildlife Refuge
VOC	volatile organic compound
WP	Work Plan
WRS	Wilcoxon rank sum

SECTION 1

Introduction

This Work Plan describes the work that will be completed for the background investigation for inorganics in soils at the former Atlantic Fleet Weapons Training Facility (AFWTF) Vieques, Puerto Rico. This Work Plan is prepared under the Naval Facilities Engineering Command (NAVFAC), Atlantic Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract N62470-02-D-3052, Contract Task Order 039. The technical approach is based on *Procedural Guidance for Statistically Analyzing Environmental Background Data* (NAVFACENGCOM, 1998). The purpose of this Work Plan is to define the procedures that will be used to establish background concentrations of soil inorganics that will be compared to site soil inorganics data to assess whether inorganics detected at a particular site (solid waste management unit [SWMU] or area of concern [AOC]) are attributable to releases from historical waste management activities or consistent with background levels.

The approach for this background investigation is consistent with the approach that was used for the background investigation work plan completed at the former Naval Ammunition Support Detachment (NASD) facility in western Vieques (CH2M HILL, 2000a). That investigation approach and report were reviewed and approved by the U.S. Environmental Protection Agency (EPA) Region 2, Puerto Rico Environmental Quality Board (PREQB) and Department of the Interior (DOI). In addition, comments from the community were solicited and addressed in the Background Investigation Report for the NASD facility (CH2M HILL, 2002).

The general background and physical setting of AFWTF is described in Section 1 of the Master Project Management Plan (PMP), prepared by CH2M HILL in June 2003 (CH2M HILL, 2003b). A regional location map of AFWTF is provided as Figure 1-1, and a map of Eastern Vieques is provided as Figure 1-2. Previous investigations at AFWTF have detected elevated levels of metals (with respect to regulatory screening criteria) in the soils at several installation restoration (IR) site locations. However, these investigations have not evaluated these constituent concentrations with respect to background conditions.

1.1 Purpose and Objectives

The purpose of the background sampling program is to provide sufficient data to establish representative background concentrations for inorganic constituents in soil that can be compared to site-specific data to assess whether the site-specific inorganics concentrations are indicative of contamination resulting from releases or consistent with background concentrations.

1.2 Site Visit

The selection of background sample locations is a very important step in the environmental restoration process. In order to obtain concurrence on background sample locations among

the technical stakeholders on this project, a site visit will be conducted during the technical review of this work plan to inspect the 29 proposed soil sample locations. Technical representatives from the Navy, EPA, DOI, and PREQB will be invited to attend the field site visit to concur upon the background soil sample locations.

E032005005TPA_183719.PP.WP

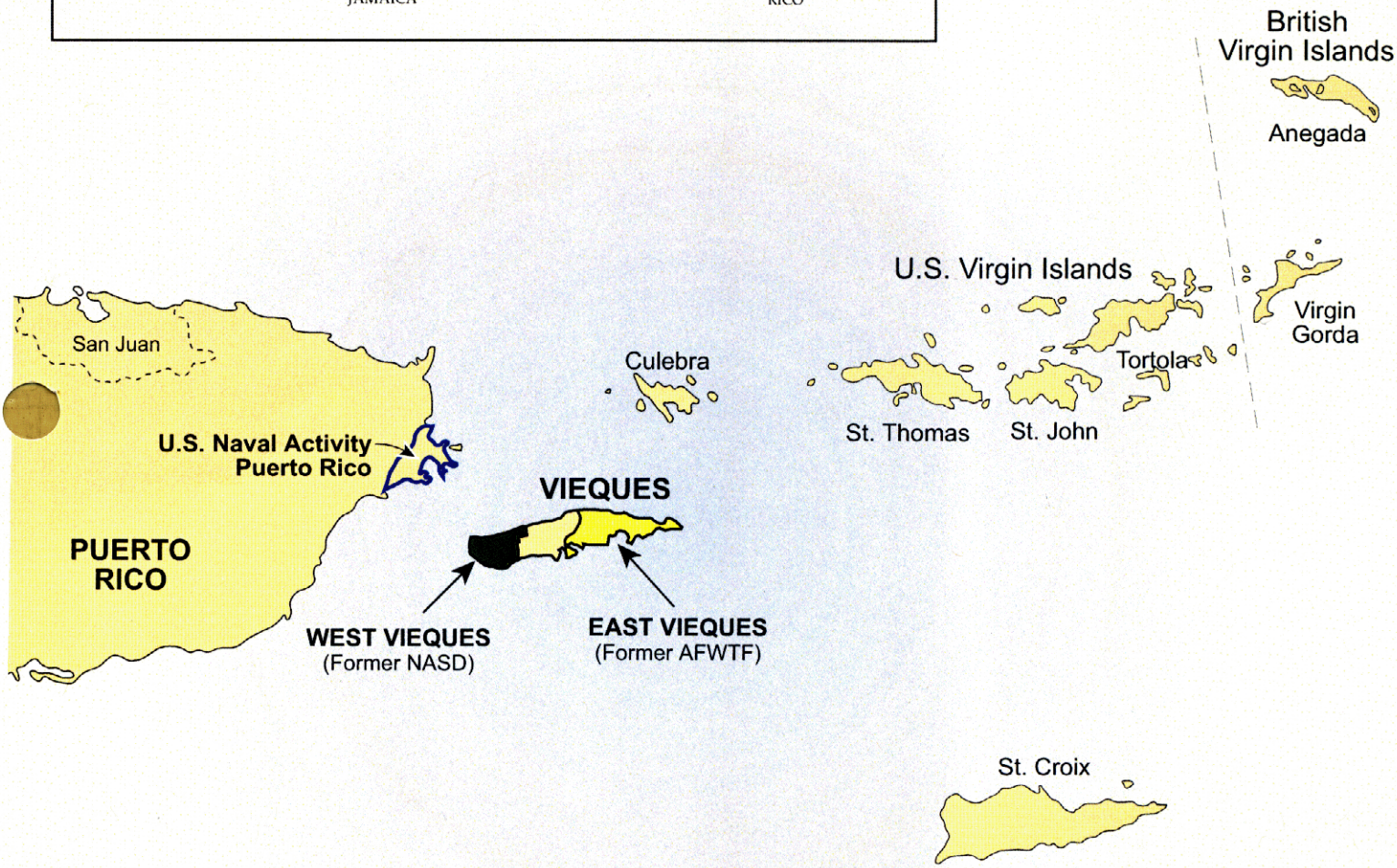
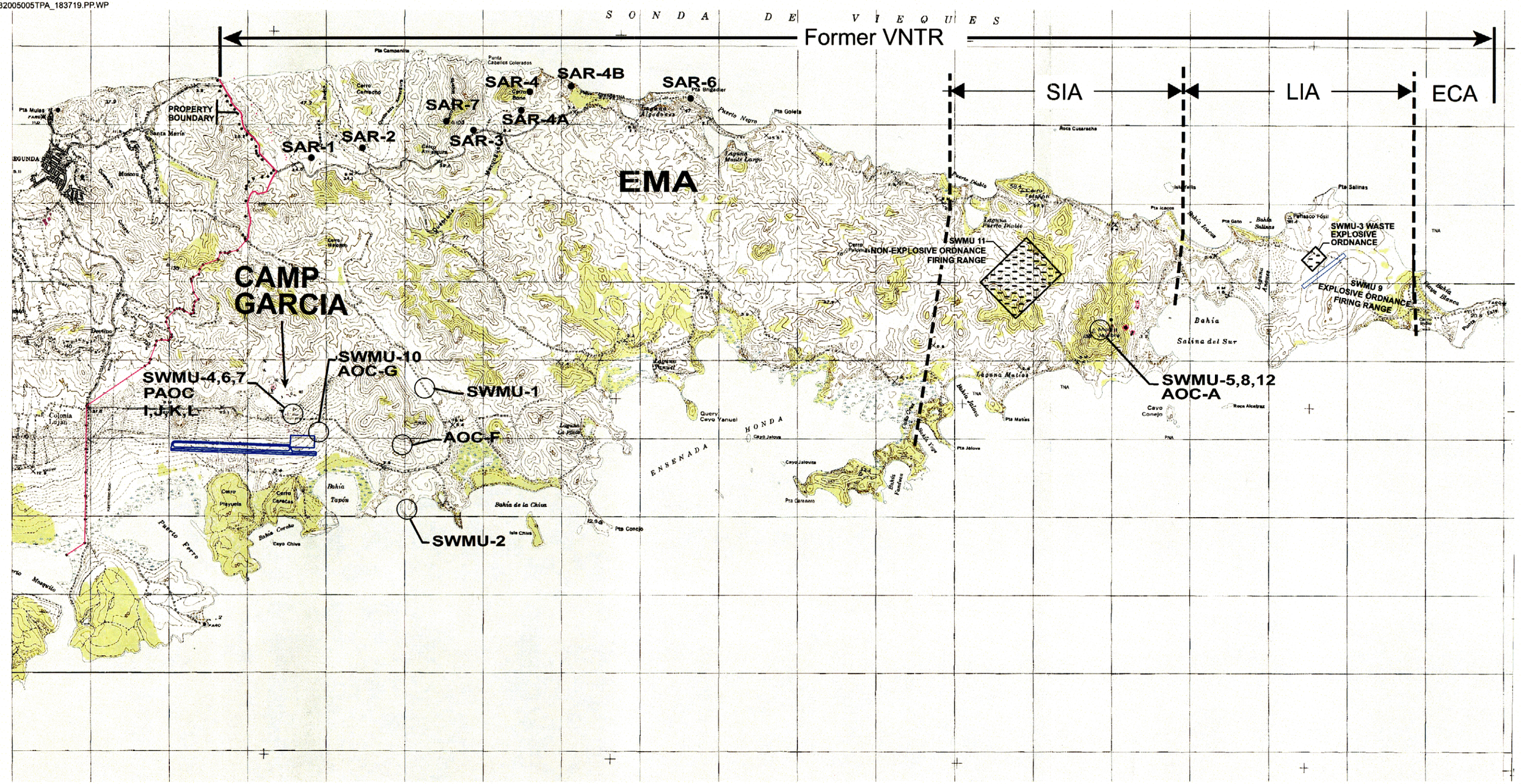


Figure 1-1
Regional Location Map
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico

E032005005TPA_183719.PP.WP



LEGEND
VNTR - Vieques Naval Training Range
EMA - Eastern Maneuver Area
SIA - Surface Impact Area
LIA - Live Impact Area
ECA - Eastern Conservation Area
SWMU - Solid Waste Management Unit
AOC - Area Of Concern
PAOC - Potential Area Of Concern
SAR - Small Arms Range
NOTE:
SWMU'S 3,9, and 11 are illustrated to provide the location relative to other SWMUs. These sites are excluded from the consent order.

FIGURE 1-2
Site Location Map
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico

CH2MHILL

SECTION 2

Sampling Rationale and Sampling Locations

This section presents the rationale and sampling locations for the background investigation at AFWTF. Several factors must be considered when potential background sampling areas are identified. The most important include geological features, upgradient sources of contamination, and potential anthropogenic influence on background areas. Anthropogenic influence could include emissions from automobiles and lawn maintenance. Potential sources of contamination that were avoided in selecting proposed locations for the background samples included the areas of impact resulting from ordnance fired from either marine artillery gun positions or small arms ranges. These areas of potential impact from live firing were mapped as a series of range fans during the Preliminary Range Assessment (CH2M HILL, 2003a). Background samples locations were not proposed within the range fan areas. In addition, known roadway and areas of mowing were avoided when identifying proposed background sample locations.

Background samples are to be collected within the same geologic conditions as the sites that are investigated to ensure constituent variations attributable to soil classification differences, if present, are taken into account.

The effects of potential upgradient sources were also evaluated in the sample location selection. If a potential background area may be affected by an upgradient but non-site-related constituent source, background samples may contain constituents that affect the background data. Site geology, the location of potentially contaminated sites, and aerial photographs were reviewed to support the selection of background sample locations, as discussed in Sections 2.1 and 2.2. The remainder of this section discusses the sample location selection rationale.

2.1 Geology and Soils

The geology at AFWTF is characterized by volcanic and plutonic bedrock overlain by alluvial unconsolidated sediments. The volcanic bedrock consists primarily of andesites of Cretaceous age (Baker, 1999). The plutonic bedrock consists largely of granodiorite and quartz-diorite that is exposed over a large percentage of the island. The alluvium consists of a mixture of sand, silt, and clay.

To ensure that sufficient background soil samples are collected within the same geologic zones as the IR sites, the generalized geology of Vieques Island map (Torres-Gonzalez, 1989) was reviewed to identify geologic zones. Based on these reviews, four general categories of geologic zones were identified in which the sites are located:

1. Qa - Alluvial deposits (sand, silt, and clay)
2. TI - Marine sedimentary rocks (report indicated variable limestones)

3. Kv - Sandstone, siltstone, conglomerate, lava, tuff, and *tuffaceous breccia*
4. KTd - Plutonic rock made up largely of granodiorite and quartz diorite

Figure 2-1 shows the extent of each geologic zone in relation to the IR sites. A review of IR site locations shows that SWMUs 4, 6, 7, and 10, and AOC G are located in geologic zones identified as KTd. SWMU 2 and AOC F are located in geologic zones identified as Kv. SMWU 1 is located in geologic zones Kv and Qa.

A similar sampling strategy was employed for the western Vieques (former NASD) Background Investigation. There, the results showed that soil inorganics data from the different soil types (Qa, Qs, and KTd) and different depths (surface and subsurface) were not statistically different and were therefore grouped together as one data set. Thus, while collecting sufficient background soil data from the soil horizon within each geologic zone will be done as a precautionary measure in case the data are statistically unique, the results may indicate that the inorganic levels in these different soil types are statistically similar. Where soil data for different horizons (both among different zones and from different depths) are statistically similar, the data will be combined to maximize statistical confidence. Where not statistically similar, the data sets will be kept separate.

Because the background soil data for western Vieques showed that the inorganics concentrations were statistically similar in the 0-to-6-inch and 4-to-6-foot intervals, the soil sample depths proposed for the eastern Vieques background study are also 0 to 6 inches and 4 to 6 feet.

2.2 Aerial Photograph Survey

An historical aerial photograph analysis conducted for AFWTF looked at aerial photographs dated 1936-37, 1959, 1962, 1964, 1967, 1970, 1985, and 1994. All of these photographs were evaluated for the Navy by a firm specializing in the analysis of aerial photography. The aerial photographic analysis was used to:

- Track the operational history of previously identified sites of known or potential contamination
- Track the history of site operations from pre-Navy occupation (pre-World War II) to present
- Identify anomalies (e.g., ground scars, cleared areas, debris piles, and possible disposal areas)

The locations of the background samples were selected away from all SWMUs, AOCs, and photo identified (PI) sites. The locations and descriptions of the PI sites are summarized in the Draft Final Environmental Baseline Survey for the Vieques Naval Training Facility (NAVFACENGCOM, 2003). The locations of the SWMUs, AOCs, and PI sites in relation to the proposed background samples are presented in Figure 2-1.

The locations of firing fans, illustrating potential impacted areas of ordnance fired from marine artillery and small arm ranges, are presented in the Final Draft Preliminary Range

Assessment Report (CH2M HILL, 2003a), and are shown on Figure 2-2. Background samples will not be collected within the fan areas.

2.3 Sample Locations and Analysis

The purpose of the background sampling program is to provide sufficient data to establish representative background concentration data for inorganics that occur throughout the former AFWTF, but that are not indicative of contaminants resulting from releases at a particular site. Here, "representative" means a sample set that is typical of the population being sampled.

With the selection of a background data set, choosing locations requires screening out areas of suspected release and identifying the physical characteristics of the chosen background locations relative to those of the investigative areas. It is important to emphasize that the background sample locations need to be chosen to be representative of the target population (i.e., background in this case), which does not require an indiscriminate form of randomness be applied to identifying the locations. Thus, background soil samples are proposed to be collected from areas away from former bombing areas, SWMUs, and AOCs, and in areas greater than 100 feet from roadways or mowed areas, similar to the sampling location approach implemented for West Vieques. Prior to sample collection, each sample location will be inspected in the field to ensure there are no visible signs of anthropogenic influence. Further, samples will not be collected in areas of obvious surface runoff. Technical representatives from EPA, PREQB, DOI, and the public will be invited to inspect the sample locations before the field program is initiated.

2.3.1 Soil Sampling Locations

Based on the criteria discussed above, twenty-nine background surface soil samples (0 to 6 inches bls) and co-located subsurface samples (4 to 6 feet bls) are proposed for this background study, as shown in Figures 2-1 and 2-2 and listed in Table 2-1. One contingency location is also shown for each of the four soil types (Qa, TI, Kv, and Ktd). The contingency locations will only be used if other locations are found to be unacceptable. All samples will be analyzed for TAL metals and additionally for thallium using SW-846 Method 7841, Atomic Absorption Furnace technique (GFAA). In addition, all samples will be analyzed for pH by method SW9045, TOC by method SW9060MOD, redox potential by SM2580 B, and cation exchange capacity by method 9081.

Familiarity with onsite geology is an important factor in selecting representative sites with similar geologic conditions. A qualified geologist will prepare geologic logs of all soil borings to be completed. Soil descriptions including soil name, Munsell color, moisture content, relative density or consistency, and mineralogy (if observable) will be recorded. The qualified geologist will also review logs of any previously installed borings to verify that the geologic units and soil types encountered are consistent with the units shown on the geologic map. The vegetation type at the proposed sample locations will be described in the field to ensure that the locations are generally similar in terms of plant species, composition, structure, etc. In addition, photographs will be taken of each sample location and surrounding area to provide another line of evidence that the area does not appear to be influenced by anthropogenic activities.

Eleven background surface soil samples were collected in 1999 along the western perimeter of AFWTF during the installation of the background monitoring wells. Three of the surface soil samples were collected in Kv deposits, six in KTd deposits, and two in Qa deposits. These samples were analyzed for Appendix IX metals. These data will be used to supplement the background investigation data. Table 2-1 lists all of the soil background samples, both existing and proposed; their locations are shown on Figure 2-1 and Figure 2-2.

TABLE 2-1
Background Soil Sample Locations

Soil Sample Name	Existing or New
Kv-1	Existing surface soil
Kv-2	Existing surface soil
Kv-3	Existing surface soil
Kv-4	New 0-6" and 4-6'
Kv-5	New 0-6" and 4-6'
Kv-6	New 0-6" and 4-6'
Kv-7	New 0-6" and 4-6'
Kv-8	New 0-6" and 4-6'
Kv-9	New 0-6" and 4-6'
Kv-10	New 0-6" and 4-6'
KTd –1	Existing surface soil
KTd-2	Existing surface soil
KTd-3	Existing surface soil
KTd-4	Existing surface soil
KTd-5	Existing surface soil
KTd-6	Existing surface soil
KTd-7	New 0-6" and 4-6'
KTd-8	New 0-6" and 4-6'
KTd-9	New 0-6" and 4-6'
KTd-10	New 0-6" and 4-6'
QA-1	Existing surface soil
QA-2	Existing surface soil
QA-3	New 0-6" and 4-6'
QA-4	New 0-6" and 4-6'
QA-5	New 0-6" and 4-6'
QA-6	New 0-6" and 4-6'
QA-7	New 0-6" and 4-6'
QA-8	New 0-6" and 4-6'
QA-9	New 0-6" and 4-6'
QA-10	New 0-6" and 4-6'
TI-1	New 0-6" and 4-6'
TI-2	New 0-6" and 4-6'
TI-3	New 0-6" and 4-6'
TI-4	New 0-6" and 4-6'
TI-5	New 0-6" and 4-6'
TI-6	New 0-6" and 4-6'
TI-7	New 0-6" and 4-6'
TI-8	New 0-6" and 4-6'
TI-9	New 0-6" and 4-6'
TI-10	New 0-6" and 4-6'
Total	**40 sample locations**
	11 existing locations
	29 new locations

2.4 Sample Size

Typically, the number of samples at a particular site is proposed to obtain an adequate understanding of the site data (mean, maximum, minimum, and distribution) and to obtain conservative upper confidence limits for the data set for comparison to decision-making limits.

Background soil samples will be collected for inorganics concentrations comparisons with site soil data. There is no specific number required for the sample size. However, it is generally understood that a larger number of samples provides a better statistical estimate of the representative concentration estimates of the background or the site conditions.

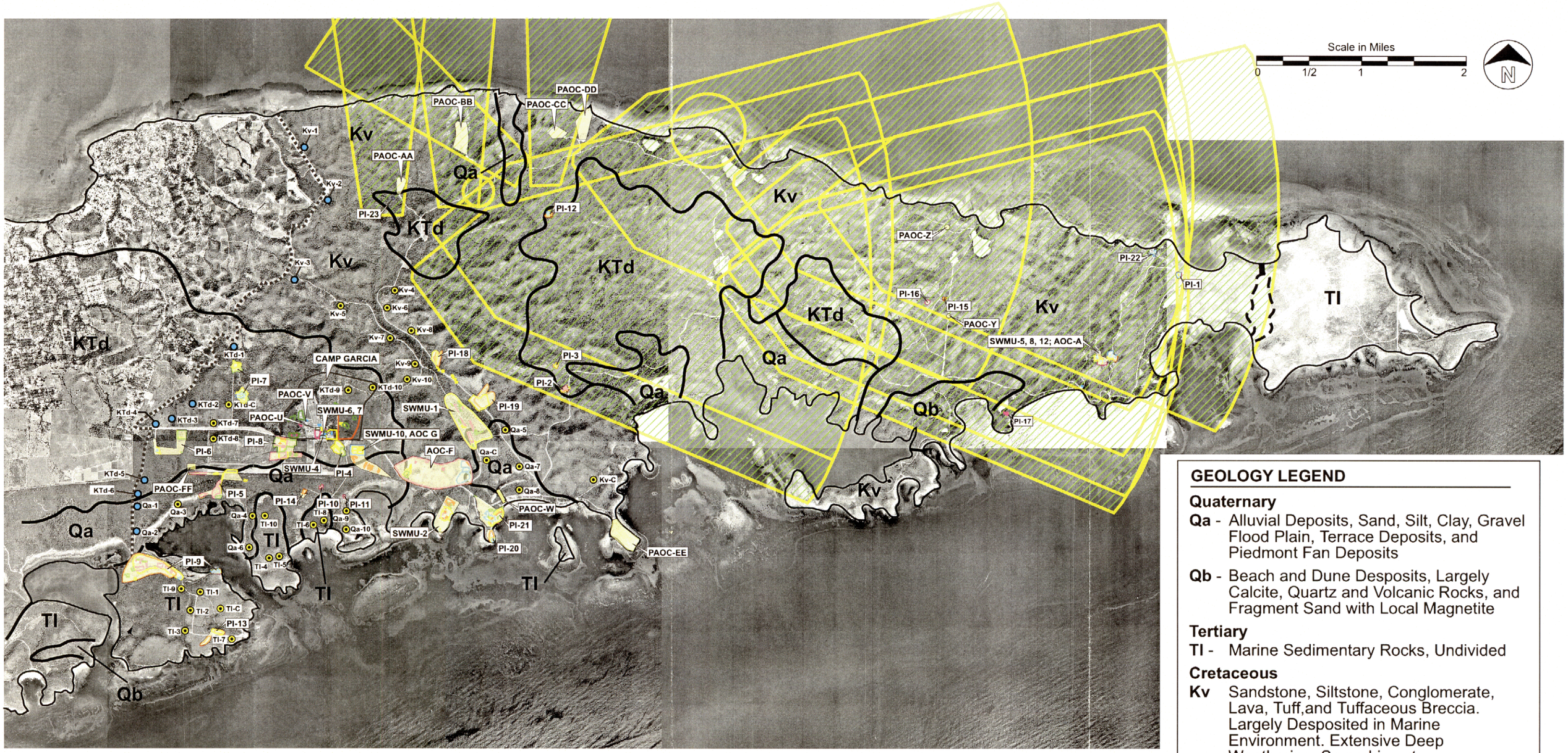
2.4.1 Soil Sample Size

The Max of N method to determine sample size is based on randomized collection of samples within defined areas of relatively homogeneous contamination. The number of samples within any homogeneous area is independent of the size of the area and has been based upon a nonparametric (distribution-free) statistical method which calculates the size of a sample (N) required to estimate a pre-specified tolerance interval of the sampled population with a pre-specified level of confidence (Conover, 1980). The following tabulates sample sizes to meet a range of pre-specified coverages and a range of pre-specified confidence levels.

Estimated Quantile	85% Confidence	90% Confidence	95% Confidence
50th [Median]	3	4	5
75th [Upper Quartile]	7	9	11
85th	12	15	19
90th	19	22	29
95th	37	45	59

A total of 40 surface soil (29 new and 11 existing) and 29 subsurface soil samples are proposed to be collected from background locations. The proposed minimum of 29 subsurface samples equates to a 95% confidence level for 90% of the sample population, assuming all new data are statistically similar and can be combined into one dataset for subsurface soil. A similar confidence level is anticipated for the 40 surface soil samples, again assuming the data are statistically similar and can be combined into one dataset.

If the surface and subsurface soil inorganics concentrations are statistically similar, the combined sample size will be 69 soil samples (29 surface soil, 29 subsurface soil, 11 existing surface soil). Because these combined samples are greater than 59, indicated for a 95% confidence level in 95% of the sample population, combining will likely result in confidence above the prescribed acceptable levels, as per EPA guidance (EPA, 2002b). The confidence limits associated with the samples will be calculated and reported in the background investigation results report.



Base imagery is comprised of 1994 1-meter USGS Digital Ortho-imagery quarter quadrangles (DOQQs).

Scale in Meters

1000 0 1000 2000

GEOLOGY LEGEND

Quaternary

Qa - Alluvial Deposits, Sand, Silt, Clay, Gravel Flood Plain, Terrace Deposits, and Piedmont Fan Deposits

Qb - Beach and Dune Desposits, Largely Calcite, Quartz and Volcanic Rocks, and Fragment Sand with Local Magnetite

Tertiary

TI - Marine Sedimentary Rocks, Undivided

Cretaceous

Kv Sandstone, Siltstone, Conglomerate, Lava, Tuff,and Tuffaceous Breccia. Largely Desposited in Marine Environment. Extensive Deep Weathering. Some Limestone.

KTd- Plutonic Rocks, Largely Grandiorite,and Quartz Diorite, Locally Deeply Weathered (from Torres-Gonzalez, 1989)

Aerial Photographic Analysis Findings

- SWMU, AOC, PI Sites
- 1994
- 1985
- 1970
- 1967
- 1964
- 1962
- 1959
- 1936-37

SYMBOL LEGEND

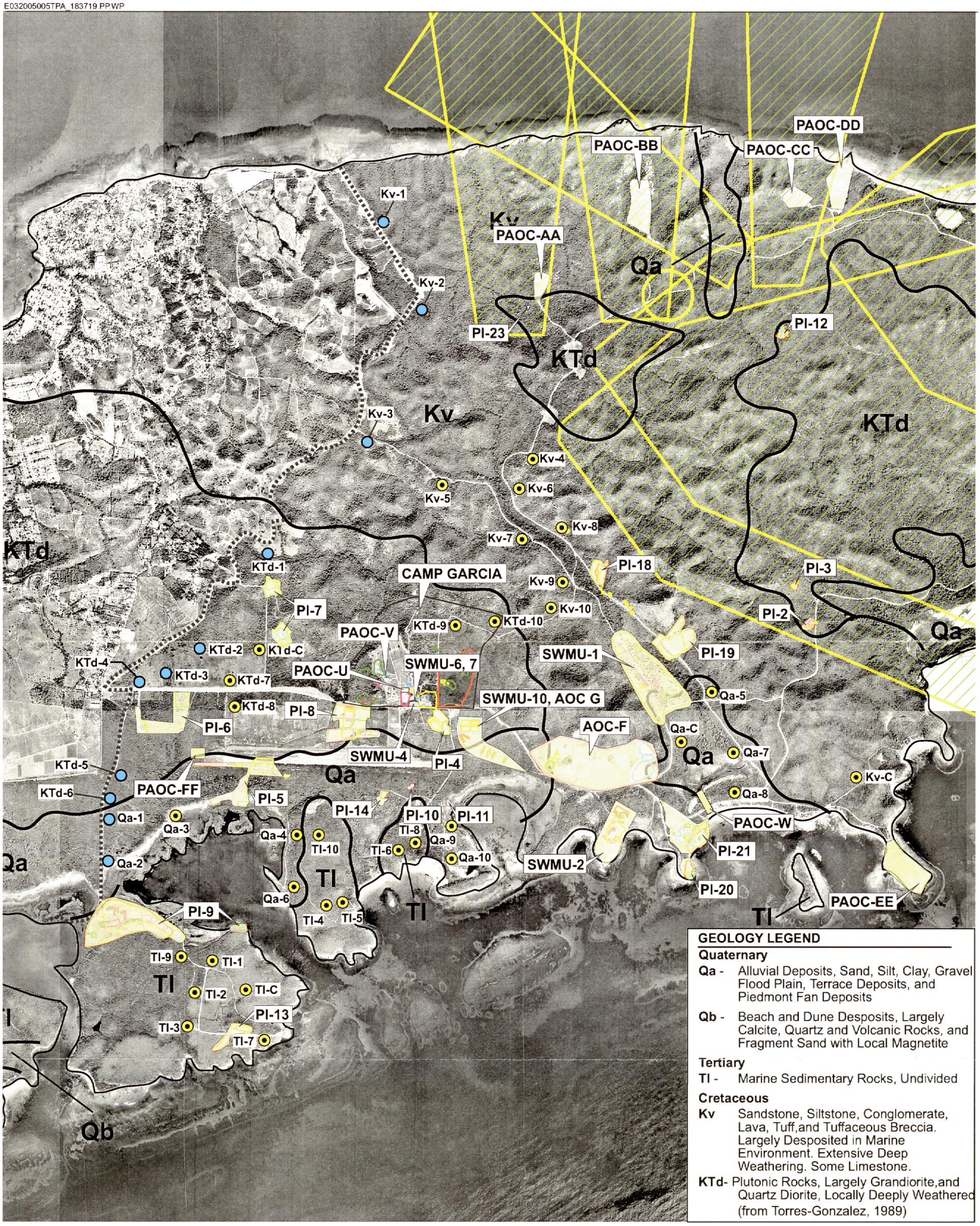
- Existing Surface Soil Sample
- Proposed Soil Sample

Note: Sample locations shown as Qa-C, TI-C, KTd-C, and Kv-C are contingency locations.

- Artillery Safetyfan
- AOC = Area of Concern
  PAOC = Potential Area of Concern
  PI = Photo Identified Site
  SWMU = Solid Waste Management Unit
- Western Perimeter Property Boundary

Figure 2-1
Existing and Proposed Backgrouind Sample Locations
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico

E032005005TPA_183719.PPWP



GEOLOGY LEGEND

Quaternary

Qa - Alluvial Deposits, Sand, Silt, Clay, Gravel Flood Plain, Terrace Deposits, and Piedmont Fan Deposits

Qb - Beach and Dune Desposits, Largely Calcite, Quartz and Volcanic Rocks, and Fragment Sand with Local Magnetite

Tertiary

TI - Marine Sedimentary Rocks, Undivided

Cretaceous

Kv Sandstone, Siltstone, Conglomerate, Lava, Tuff,and Tuffaceous Breccia. Largely Desposited in Marine Environment. Extensive Deep Weathering. Some Limestone.

KTd- Plutonic Rocks, Largely Grandiorite,and Quartz Diorite, Locally Deeply Weathered (from Torres-Gonzalez, 1989)

Base imagery is comprised of 1994 1-meter USGS Digital Ortho-imagery quarter quadrangles (DOQQs).

Aerial Photographic Analysis Findings

SWMU, AOC, PI Sites
- 1994
- 1985
- 1970
- 1967
- 1964
- 1962
- 1959
- 1936-37

SYMBOL LEGEND

- Existing Surface Soil Sample
- Proposed Soil Sample
- Artillery Safetyfan

AOC = Area of Concern
PAOC = Potential Area of Concern
PI = Photo Identified Site
SWMU = Solid Waste Management Unit

- Western Perimeter Property Boundary

Note: Sample locations shown as Qa-C, TI-C, KTd-C, and Kv-C are contingency locations.

Scale in Meters

1000 0 1000 2000

Scale in Miles

0 1/2 1 2

N

Figure 2-2
Existing and Proposed Backgrouind Sample Locations
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico

SECTION 3

Statistical Analysis

Determination of applicable statistical tests will be made once the background data have been collected, and the tests will be conducted in accordance with one or more of the following EPA and Navy guidance: *"Guidance for Comparing Background and Chemical Concentrations in Soil at CERCLA Sites,"* External Review Draft, EPA 540-R-01-003, September 2002 (EPA, 2002b); *"Role of Background in the CERCLA Cleanup Program"* OSWER 9285.6-07P, April 2002 (EPA, 2002a); *"Geostatistical Sampling and Evaluation Guidance for Soil and Solid Media,"* Review draft (EPA, 1996); and *The Guidance for Environmental Background Analysis, Volume I: Soil* (NAVFACENGCOM, April 2002). Using these guidance documents (as applicable), inorganics concentrations among the soil types will be statistically evaluated. Data sets (i.e., surface soil, subsurface soil, soil characteristics) will be combined where appropriate. Tests conducted, results, and conclusions will be presented and discussed in the background data analysis report.

3.1 Analyzing Data and Statistical Testing

The following subsections provide a brief overview of analytical methods for identifying data gaps, combining or pooling data sets, developing descriptive summary statistics, evaluating outliers, handling non-detect data, evaluating censored data, and conducting goodness-of-fit tests to determine data distribution.

3.1.1 Evaluation of Outliers

Data analysis and statistical testing may identify outliers in the background data set(s). Outliers are extreme high or low measurements that are sometimes referred to as "spurious" data because they are highly divergent from the main population of data. Outliers may arise from matrix interferences or errors in transcription, sampling technique, data coding, analytical methods, or instrument calibration. Alternatively, what may appear to be outliers may simply represent inherent variability in the regional background geochemistry. This will be particularly true for background areas in which the geochemistry is heterogeneous. When outliers are not identified and removed from data sets, they can disproportionately affect the statistical descriptors of the data sets. That is, the mean can be biased toward the direction of the outlier(s) and artificially increase data variability and standard deviation. Ultimately, outliers can lead to flawed statistical testing and erroneous conclusions about background conditions. Therefore, it is important to identify outliers in the background data set(s) before conducting further statistical analysis. Outliers will be identified by visually inspecting graphical representations of the data set(s). When potential outliers are identified, geographical association to the outlier data point will be checked to ensure that the variability is not the result of natural innate variability. It is important to emphasize that no datum will be discarded as an outlier based solely on the results of one of these statistical tests. The possibility always exists that the suspected outlier is an accurate measurement.

One of the graphical statistical methods for identifying outliers is through the use of Box Plots. Box plots, as well as additional statistical tests (as appropriate and in accordance with the aforementioned guidance), will be used to distinguish natural innate variability. Any methodology utilized will be documented with respect to rationale, applicability, and limitations.

A discussion of all outliers will be included in the Soil Background Investigation Report. For outliers that are found not to indicate natural innate variability (through statistical analysis per guidance), recommendations will be made regarding the need for additional evaluation of area(s) where samples containing the outlier data were collected.

3.1.2 Establishing Probability Density Functions With Goodness-of-Fit Tests

Probability Density Functions (PDFs) are used to graphically model the data distribution. Common PDFs used to model environmental data include normal, lognormal, and Weibull distributions. Determining the PDF that best fits a particular data set is important for selecting the statistical test best suited for the data set to provide optimal statistical performance. One of the most important characteristics of a data set is the underlying distribution of the data. For example, the Student's t-test may be quite useful for testing data that are distributed normally or lognormally. The Student's t-test may not be applicable, however, to determine differences between site and background populations if the underlying distributions are not normal. Hence, conducting a goodness-of-fit test to determine the best statistical test will be useful in determining whether site and background data sets are significantly different in distribution.

Two of the most important distributions for tests involving environmental data are the normal distribution and the lognormal distribution. Non-parametric tests will be used for data sets that do not follow either of these two PDFs.

3.1.3 Non-Detect Data Sets

The most common methods used to derive proxy values for non-detect data sets involve deletion and substitution techniques. EPA has developed general guidelines for these procedures based on the number of non-detected data in the data set. The analytical approaches include: (1) replace non-detects with one-half the standard quantitation limit (SQL) (not the contract required quantitation limit [CRQL]), (2) Cohen's Adjustment, Trimmed Mean, Winsorized Mean and standard deviation, and (3) the test for proportions.

Although choosing the most applicable approach is primarily based on the percentage of non-detects, professional judgment will also be applied. For example, in addition to percentage of non-detects, the number of data in the data set should be a factor in the decision.

3.1.4 Evaluating Censored Data

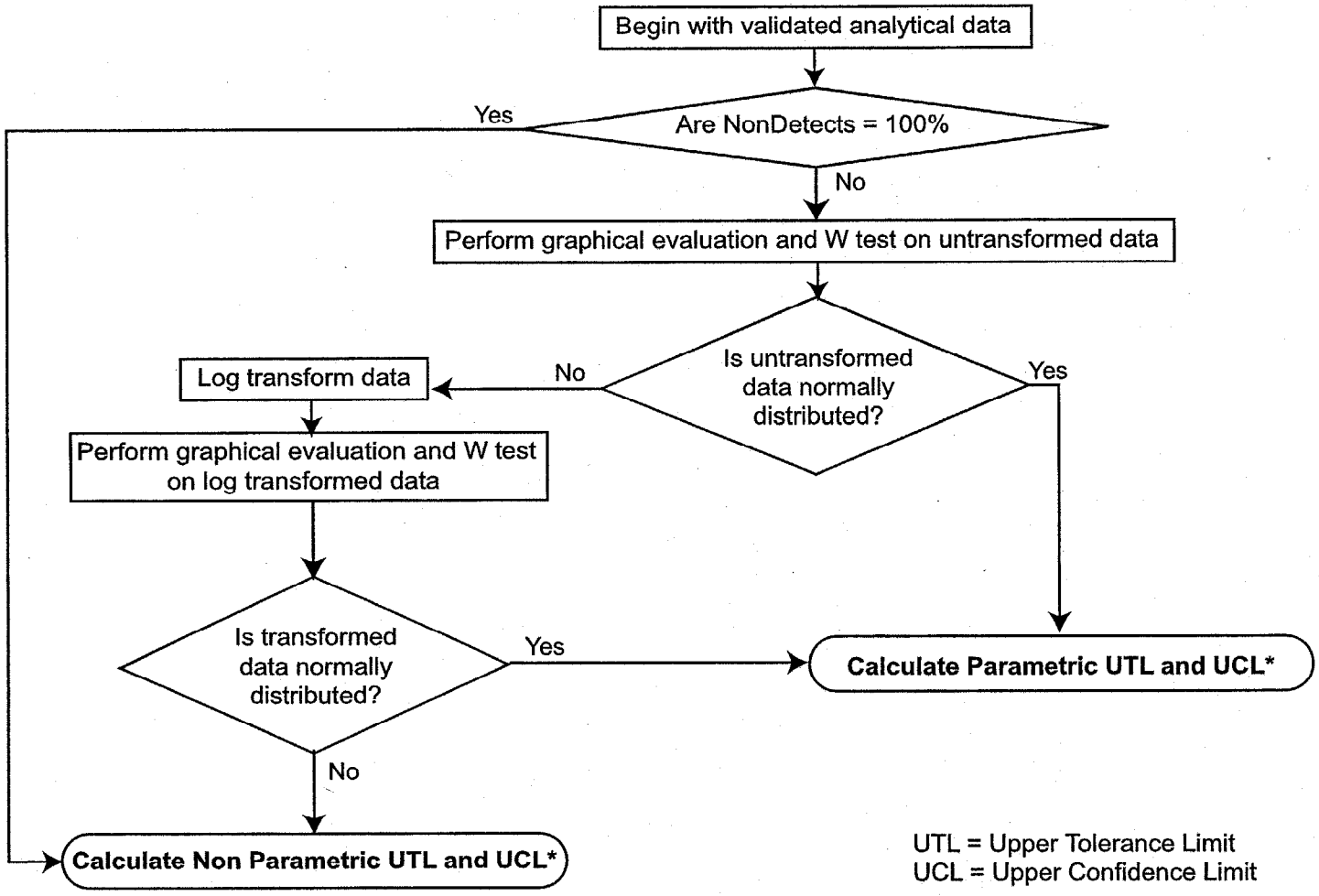
Selecting the appropriate statistical method requires matching the strengths and weaknesses of the statistical method with the data set under investigation. In other words, data should not be "force fitted" into an inappropriate test or inappropriately manipulated to fit the requirements of the statistical method. To conduct statistically robust background comparisons, matching the correct statistical method with a data set is a critical first step.

Figure 3-1 presents the decision-making flow chart that integrates data analysis and statistical testing.

The appropriate statistical test is selected based on how much information is available about the site and background PDFs, frequency of detection, and sample size of the data set. As shown in Figure 3-1, the Student's t-test is a parametric statistical test that may be used to detect differences in the background and site means when both background and site data sets follow a normal PDF, have a frequency of detection of 100 percent, and have equal variances. Many environmental data sets are lognormally distributed, which requires natural log-transformation of the data before computing statistical tests. A t-test, which is also a parametric test, may be used to detect differences in means when both data sets follow a normal distribution.

For data sets that follow a normal PDF but for which the frequency of detection is significantly less than 100 percent or for which the data set has multiple detection limits (for non-detect samples), non-parametric tests may be used because they are better able to handle the non-detects and are expected to provide greater statistical power.

Non-parametric statistical tests may also be used for data sets that do not follow a normal distribution. When there is a single detection limit (for non-detect samples), the Wilcoxon rank sum (WRS) test should be used. For non-normal data sets with multiple detection limits, the Gehan test should be used. For data sets that follow a lognormal distribution, either the non-parametric tests or the t-test computed on the natural logarithms of the data may be used.



UTL = Upper Tolerance Limit
UCL = Upper Confidence Limit

* if the calculated value is greater than the maximum detected value, use maximum value

Figure 3-1
Decision Flowchart for Background Point Estimate Value Calcuations
Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico

SECTION 4

Technical Approach and Investigation Procedures

This section details the technical approach developed to perform the sampling activities for the background investigation. The tasks to be implemented for the background investigation include: project planning and existing data review, field investigation, sample analysis and validation, statistical data evaluation, and preparation of a Background Investigation Report. To simplify the process of developing site-specific project plans, a Master Work Plan (WP), Master Field Sampling Plan (FSP), Master Quality Assurance Project Plan (QAPP), Master Investigation-Derived Waste Plan (IDWP), and Master Health and Safety Plan (HSP) were prepared for IR program activities to be performed at AFWTF. The Master Project Plans (CH2M HILL, 2003b) provide the details for sampling and analysis protocols to be followed and general types of activities to be accomplished for implementation of field activities at AFWTF. Preparation of site-specific plans is simplified through reference to the Master Plan documents.

4.1 Field Investigation

This task involves efforts related to fieldwork support, the field investigation, and surveying.

4.1.1 Fieldwork Support

Fieldwork support includes subcontractor procurement, mobilization, and utility clearance, as described in the following subsections.

4.1.1.1 Subcontractor Procurement

As part of the field mobilization to AFWTF, CH2M HILL will procure drilling services, vegetation clearance, analytical laboratory, and data validation services. If necessary, a surveying subcontractor will be procured to survey the locations of background samples where global positioning system (GPS) surveying is not possible. The subcontracted analytical laboratory will meet Naval Facilities Engineering Support Command (NFESC) Level D quality control. The laboratory will also be EPA-approved, and will meet the reporting limits specified in the QAPP (modified for thallium to have reporting limit below 0.52 mg/kg).

4.1.1.2 Mobilization/Demobilization

Mobilization includes procurement of necessary field equipment, and transport to the site. Equipment and supplies will be brought to the site when the CH2M HILL field team mobilizes for field activities.

Demobilization activities include time for IDW sampling and general site restoration prior to the return transport of field equipment and crew. IDW generated during field activities,

including equipment decontamination fluids, will be containerized in 55-gallon drums. The 55-gallon drums will be properly labeled and stored at a location designated by NAVFAC prior to disposal.

All IDW generated will be analyzed to determine whether it is hazardous or non-hazardous. The IDW will be disposed of in the appropriate manner dictated by the results of the analysis. It is anticipated that the IDW generated will be non-hazardous waste.

4.1.1.3 Utility Clearance

Utility clearances will be performed prior to the start of any subsurface investigation activities at the site. CH2M HILL will coordinate subsurface utility clearances with Public Works Center (PWC) at Naval Station Roosevelt Roads (NSRR), now referred to as U.S. Naval Activity Puerto Rico (NAPR). CH2M HILL will be responsible for ensuring that appropriate contacts have been made with PWC personnel and that clearances have been given for proposed subsurface sampling locations, including marking of utilities near the areas of proposed subsurface sampling locations, prior to the start of field operations.

4.1.2 Field Sampling Activities

This section describes the sampling activities to be conducted for the background study. The background investigation consists of the collection and analysis of:

- Fifty-eight soil samples, comprising 29 surface soil and 29 subsurface soil samples

Table 4-1 presents the number of background soil samples to be collected and methods of analysis. Quality Assurance/Quality Control (QA/QC) samples are also identified in the table, and are discussed in greater detail in subsequent subsections.

TABLE 4-1
Background Investigation Samples

Parameter	Method	No. of Samples	Equipment Rinseate Blanks	Field Blank	Field Duplicate	Matrix Spike	Matrix Spike Duplicate	Total Number of Samples
Soil Samples								
TAL Metals	ILM05.2	58	4	1	6	3	3	75
Thallium	SW-846, Method 7841	58	4	1	6	3	3	75
Cyanide	9012	58	4	1	6	3	3	75
pH	SW-846 SW9045 C	58	--	--	6	--	--	64
TOC	SW9060MOD	58	--	--	6	3	3	70
Redox Potential	SM2580 B	58	--	--	6	--	--	64
Cation Exchange Capacity	9081	58	--	--	6	3	3	70

Notes:
Thallium will be analyzed by SW-846 Method 7814, Atomic Absorption Furnace technique (GFAA)
Assumptions regarding rate of sample collection

Four days are required to collect soil samples
Equipment Rinseate blanks – one per day;
Field Blanks - one per sampling event
Field Duplicates – one per every ten samples
Matrix Spike/Matrix Spike Duplicates – one per 20 samples

Details regarding the required containers, preservatives, and holding times for soil samples are presented in Section 2 of the Master FSP. Table 4-2 summarizes sample containers, preservatives, and holding times to be used for the background investigation. Appendix A contains a checklist of procedures to be used during the field investigation.

TABLE 4-2
Required Containers, Preservatives, and Holding Times for Soil Background Investigation Samples

Parameter	Method	No. of Sample Containers	Sample Containers	Preservative	Holding Time	Volume of Sample Collected
Soil Samples						
TAL Metals	ILM05.2	1	2 oz. Glass jar with Teflon cap	Cool to 4°C	6 months, 28 days for Hg	Fill to shoulder
Thallium	SW 846, Method 7841	0	Included with TAL metals	--	6 months	--
Cyanide	9012	0	Included with pH	--	14 days	--
pH	SW 846 SW9045 C	1	2 oz. Glass jar with Teflon cap	Cool to 4°C	N/A	Fill to shoulder
TOC	SW9060MOD	1	2 oz. Glass jar with Teflon cap	Cool to 4°C	28 days	Fill to shoulder
Redox Potential	SM2580 B	1	2 oz. Glass jar with Teflon cap	Cool to 4°C	ASAP	Fill to shoulder
Cation Exchange Capacity	9081	1	4 oz. Glass jar with Teflon cap	Cool to 4°C	6 months	Fill to shoulder

Vegetation surveys will be included as a normal routine procedure prior to any land clearing or grading activities to assess for sensitive or listed flora and fauna. Field staff will survey the area, potentially assisted by Fish and Wildlife personnel, prior to any clearing to identify any threatened or endangered flora and fauna potentially present in the background areas. It is assumed that Fish and Wildlife will provide the field staff a listing (including pictures) of any threatened or endangered flora and fauna prior to vegetation clearing activities. If threatened or endangered flora or fauna are observed during the survey, Fish and Wildlife will be notified prior to vegetation clearing. During vegetation clearing, any incidents involving wildlife injury will be reported to the Vieques National Wildlife Refuge (VNWR) office within 24 hours of occurrence. Any specimens encountered will be kept in a container and handed over the VNWR personnel. Records will be kept of sightings that will provide additional information on indigenous fauna.

4.1.2.1 Soil Sampling Procedures

The background investigation involves the collection of co-located surface and subsurface soil samples. Surface soil samples will be collected using a stainless steel trowel or split spoon sampler and stainless steel mixing bowl. Surface soils will be collected from the surface to a depth of 6 inches bls. A stainless steel hand auger or split-spoon sampler will be employed for collecting the subsurface soil samples. Subsurface samples will be collected from a depth of 4 to 6 feet bls. A direct push drill rig or auger drill rig may be used to drive the split spoons for the surface and subsurface samples. The applicable Standard Operating Procedures (SOPs) for the collection of soil samples are located in the Master WP. Pertinent

information regarding the geology type and other surrounding features will be recorded on each boring log.

4.1.3 Sampling Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use. The applicable SOPs for the decontamination of personnel and equipment are presented in the Master WP.

4.1.4 Surveying

Sampling locations of each background soil sample will be horizontally located using a GPS following field activities. All survey data will be expressed as North American Datum 1983 (NAD 83) coordinates. In areas of high canopy, a 25-foot pole will be used to extend the GPS antenna. If GPS surveying is not possible due to interference, a licensed surveyor will be subcontracted to survey the sample locations.

4.1.5 Sample Designation

Samples collected during the background investigation will be assigned unique designations to allow the sampling information and analytical data to be entered into a Geographic Information System (GIS) data management system developed for AFWTF. The following subsections describe the sample designation specifications.

The sample locations will be identified in the field with a 2-foot long piece of ¼-inch diameter rebar hammered into the ground. The rebar will have a 2-foot long piece of 1-inch diameter PVC pipe placed over it. The PVC will be marked with the sample number using permanent markers. Additionally, colored flagging will be attached to the PVC pipe with the sample number identified.

4.1.5.1 Specifications for Field Location Data (Station Designation)

Field station data consist of information assigned to a physical location in the field where a sample is collected. For example, a soil boring that has been installed will require a name that will uniquely identify it with respect to other soil boring locations, or other types of sampling locations. The station name provides for a key in the database to which any samples collected from that location could be linked to form a relational database.

A listing of the location identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all field activities. Each station will be designated by an alphanumeric code that will identify the station location by facility, site type, site number, location type, and sequential location number. The scheme that will be used to identify field station data is documented in Section 3 of the Master FSP, and is summarized for the background investigation in Table 4-3.

TABLE 4-3
Field Station Scheme

First Segment	Second Segment	
Facility, Station Type, Site Number	**Station Type**	**Station Number, Qualifier**
AAANNN	**AA**	**NNNA**
Facility: CG = Camp Garcia, AFWTF, EMA Station Type: BG = Background Site Number: Qa = Alluvial deposits Tl = Marine Sedimentary Rock Deposits KTd = Plutonic Rock Deposits Kv = Sandstone, Siltstone, Conglomerate, Lava, Tuff, and Tuffaceous Breccia Deposits.	Station Type: SB = Subsurface Soil Sample Location SS = Surface Soil Sample Location Station Number: Sequential Station Number	

Notes:
"A" = alphabetic
"N" = numeric

4.1.5.2 Specifications for Analytical Data (Sample Designation)

Each analytical sample collected will be assigned a unique sample identifier. The scheme used as a guide for labeling analytical samples in the field is documented below. The format that will be used for electronic deliverables from the analytical laboratory and the data validator is also documented below.

4.1.5.3 Sample Identification Scheme

A standardized numbering system will be used to identify all samples collected during soil sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A listing of the sample identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities.

Sample identification for all samples collected during the investigations will use the following format:

Each sample will be designated by an alphanumeric code that will identify the facility, background, matrix sampled, and contain a sequential sample number. QA/QC samples will have a unique sample designation. Table 4-4 documents the general guide for sample identification.

TABLE 4-4
Sample Designation Scheme

First Segment	Second Segment		Third Segment
Facility, Station, and Site Number	Sample Type	Sample Location + Sample Qualifier	Additional Qualifiers (sample depth, sampling round, etc.)
AAANN	AA	NNNA or NNAA	ANN or NNNN

Facility:

CG = Camp Garcia, AFWTF, EMA

Station Type:

BK = Background

Site Number:

Qa = Alluvial deposits

TI = Marine Sedimentary Rock Deposits

KTd = Plutonic Rock Deposits

Kv = Sandstone, Siltstone, Conglomerate, Lava, Tuff, and Tuffaceous Breccia Deposits.

Sample Type:

SS = Surface Soil

SB = Subsurface Soil

EB = Equipment Blank

FB = Field Blank

FD = Field Duplicate

Sample Location:

1. Station Samples (NNA)

NNA – refers to sequential station number

NNA – letter qualifier for surface or subsurface sample.

2. QC Samples (NNN)

NNN – numbered sequentially for each type of blank (i.e., 1, 2, etc.) collected for that day's sampling

NNN – refers to month of sampling event

Sample Qualifiers:

P = duplicate sample

Additional Qualifiers:

1. Subsurface Sample (refers to depth of sample):

Enter depth of top of sample interval

2. QC Samples

NNNN - refers to day and year of sampling event

Notes:
"A" = alphabetic
"N" = numeric

4.1.5.4 Electronic Deliverable File Format

All analyses of soil will be conducted at a contracted laboratory that tabulates the results in an electronic format specified by CH2M HILL. The data validator will add data validation qualifiers to the table of analytical results. In addition to the hard copy data package deliverable, CH2M HILL will receive an electronic file from the data validator in a table format that will facilitate downloading into a database. Table 4-5 indicates the format that will be used for electronic deliverables.

TABLE 4-5
Analytical Data Electronic Deliverable

Analytical data must be delivered in a format compatible with Microsoft Access 2.0 or 7.0

Field Name	Field Type	Description
Sample_ID	A20	The CH2M HILL sample ID (taken from the Chain of Custody).
Sample_Analysis	A5	The analysis performed on the sample. Samples are classified into one or more of six groups: VOA, SVOA, INORG, PEST, WCHEM, and FMETAL (for filtered samples).
Date_Analyzed	D	The date the sample was analyzed.
Date_Received	D	The date the sample was received in the lab.
Date_Collected	D	The date the sample was collected.
Lab_Sample_ID	A15	The lab sample ID.
Dilution_Factor	N	The dilution factor used, if applicable.
SDG_Number	A6	The SDG number.
CAS_Number	A6-A2-A1	CAS Number of the compound being analyzed (Note that the CAS number must consist of three number segments of defined length, separated by dashes).
Chem_Name	A50	The compound being analyzed.
Ana_Value	N	The analytical result.
Std_Qual	A5	The lab qualifiers, if any (e.g., U, UJ, B).
DV_Qual	A5	The data validation qualifier (e.g., J, R).
Units	A10	The unit of the result (e.g., mg/kg).
Detect_Limit	N	The detection limit for the compound.
Method	A15	Analytical method used to analyze the sample fraction.

4.2 Sample Analysis and Validation

This task involves efforts related to the sample management and data validation. CH2M HILL will be responsible for tracking sample analysis and obtaining results from the laboratory. The analytical data generated during the background investigation field program will be validated by an independent data validation subcontractor according to EPA Region 2 guidance (EPA, 1994a).

4.2.1 Sample Analysis

All analyses of soil samples will be conducted at a contracted laboratory that fulfills all requirements of the Navy's QA/QC Program Manual and EPA's SW 846 methods, as specified in the scope of work (SOW) prepared by CH2M HILL. A signed certificate of

analysis will be provided with each laboratory data package, along with a certificate of compliance certifying that all work was performed in accordance with the SOW. All analyses will be performed following the most recent Navy guidance. Analyses will include the proper ratio of field QC samples recommended by NFESC guidance for the data quality objectives (DQOs).

This task includes checking the data from the laboratory and converting it into an electronic format that can be readily incorporated into the GIS Data Management system for AFWTF.

4.2.1.1 Field Quality Control Procedures

QC duplicate samples and blanks are used to provide a measure of the internal consistency of the samples and to provide an estimate of the components of variance and the bias in the analytical process. The Master QAPP provides details with regard to the number and frequency of field QC samples to be collected during the investigation.

4.2.1.2 Blanks

Blanks provide a measure of cross-contamination sources, decontamination efficiency, and other potential errors that can be introduced from sources other than the sample. American society for Testing and Materials (ASTM) Type II water will be used for blanks. Three types of blanks will be generated during sampling activities: field blanks, equipment rinseate blanks, and temperature blanks.

One field blank will be collected during the Background Investigation. If the sampling event extends beyond 1 week (5 working days) or for windy and dusty field conditions, additional field blanks will be collected, as appropriate. Field blanks are used to determine the chemical quality of water used for such procedures as decontamination and blank collection.

One equipment blank will be obtained for each day of sampling. Equipment blanks will give an indication of the efficiency of decontamination procedures.

One temperature blank will be included in each cooler.

4.2.1.3 Duplicates

Soil samples will be placed in a stainless steel bowl and thoroughly mixed before placement in appropriate sample containers. The samples will initially be stirred in a circular fashion in one direction until thoroughly mixed. The sample will be turned over in the bowl and subsequently stirred in a circular fashion in the opposite direction until thoroughly mixed. These procedures will ensure that all parts of the sample are mixed and that the sample is as homogeneous as possible before splitting the samples between original and duplicate and placing in the appropriate sample containers. Duplicate samples will be collected at the rate of 1 duplicate for every 10 field samples collected.

4.2.1.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD samples will be collected at a frequency of one MS/MSD for every 20 field samples collected. Analytical results of these samples indicate the impact of the matrix (water, soil, sediment) on extracting the analyte for analysis. MS/MSD samples give an

indication of the laboratory's analytical accuracy and precision within the sample matrix. Data validators will use these results to evaluate the accuracy of the analytical data.

4.2.2 Data Validation

Analytical results will be validated by CH2M HILL subcontractors approved by the Navy. Data validators will use EPA Region 2 guidance (EPA, 1994a).

The hardcopy data packages will be reviewed by the validation subcontractor using the process outlined in *Functional Guidelines for Evaluating Data* (EPA, 1994b). Areas of review include (when applicable to the method) holding time compliance, calibration verification, blank results, matrix spike precision and accuracy, method accuracy as demonstrated by laboratory confirmation samples (LCSs), field duplicate results, surrogate recoveries, internal standard performance, and interference checks. A data review worksheet will be completed for each data package. Any non-conformance will be documented. This data review and validation process is independent of the laboratory's checks and focuses on the usability of the data to support the project data interpretation and decision-making processes.

Qualified data will be appended with a qualifying flag, which consists of a single or double-letter abbreviation that reflects a problem with the data. The following flags will be used in the evaluation:

U - Undetected. Analyte was analyzed for but not detected above the method detection limit (MDL).

UJ - Detection limit estimated. Analyte was analyzed for, and qualified as not detected. The result is estimated.

J - Estimated. The analyte was present, but the reported value may not be accurate or precise. Numerical sample results that are greater than the MDL but less than the laboratory reporting limit (RL) are qualified with a "J," for estimated, as required by *Functional Guidelines for Evaluating Data* (EPA, 1994b).

R - Rejected. The data are unusable. (NOTE: Analyte/compound may or may not be present.)

4.3 Data Quality Evaluation

The data quality evaluation (DQE) is the quantitative and qualitative evaluation of overall trends in the project-specific database. The objective of the DQE process is to understand the effects of the overall analytical process on data usability to support project-specific DQOs. The DQE includes an analysis of the effect of the specific sample matrix on the overall analytical process.

The DQE deliverable is a DQE Technical Memorandum (TM) that can be used by the project team to readily understand project-specific data usability. Topics to be addressed in the DQE TM include the following:

- *Potential blank contamination* – the effect on the usability of data for compounds detected in both the field or laboratory blank samples and the corresponding field samples

- *Laboratory performance*—evaluation of the recovery for blank spike samples such as the LCS, calibration criteria, etc.
- *Potential matrix interferences*—evaluation of the accuracy and precision for surrogates, spiked field samples, and duplicate field sample results
- *Assessment of PARCCs*—comparison of data validation findings with PARCCs (precision, accuracy, representativeness, comparability, and completeness)

This task also includes the evaluation of validated laboratory data and field-generated data. The data evaluation will include incorporation of historical data from the previous investigations, tabulation of the data, and generation of figures and/or tables associated with data (e.g., sampling location maps). The DQE will be included in the Background Investigation Report.

4.4 Investigation Report

A Draft Background Investigation Report will be prepared for submittal to EPA, PREQB, and DOI for review. Based on the comments presented from the Draft Report, a Draft Final Report will be prepared for public review and comment, if deemed necessary. Following public review and comment, the Final Background Investigation Report will be prepared and submitted.

SECTION 5

Project Management and Staffing

The CH2M HILL Environmental Manager designated for the oversight of this project is Mr. Brett Doerr. Mr. Doerr will be supported by Mr. John Tomik, who serves as Activity Manager, and Mr. Mike Weatherby who serves as Task Manager for the Vieques project. Mr. Doerr will be responsible for such activities as technical support and oversight, budget and schedule review and tracking, preparation and review of invoices, personnel resources planning and allocation, and coordination with NAVFAC, NAPR, regulatory agencies, and subcontractors.

The background investigation field program (soil sampling) will be performed by qualified CH2M HILL staff members. CH2M HILL will notify NAVFAC and NAPR which CH2M HILL personnel will mobilize to the site prior to initiating field activities.

The Navy Technical Representative (NTR) is Mr. Chris Penny. Mr. Penny is the NAVFAC representative and provides technical direction on the project and coordinates funding and overall interaction with other agencies and interested parties. Mr. Penny can be contacted at the address and phone number listed below.

Mr. Chris Penny
Eastern Vieques Project Coordinator
Commander Atlantic Division-Naval Facilities
Engineering Command
Attn: Code EV23
6506 Hampton Blvd.
Norfolk, VA 23508-1278
Telephone (757) 322-4815

SECTION 6

Contractual Services

This section documents the anticipated subcontract services required for the completion of tasks documented in this work plan. The background investigation will require subcontract services from the following:

- Analytical Laboratory
- Data Validation
- Munitions and Explosives of Concern Avoidance (potentially)
- Drilling or direct push (potentially)
- Surveying (potentially)
- Vegetation Clearance

The names of the subcontractors will not be identified until the subcontracted procurements are bid. However, EPA will be provided the qualifications of the selected subcontractors to demonstrate that each meets requirements of the program.

SECTION 7

Project Schedule

Table 7-1 shows a breakdown on the schedule of anticipated deliverables and estimated intervals for governmental review based on the Consent Order. Appendix B includes the Navy's responses to technical review comments provided by EPA, PREQB, and DOI. Appendix C includes the Technical Memorandum entitled Background Investigation Work Plan for Eastern Vieques, dated October 28, 2004. Appendix D includes the Navy responses to comments from the EPA, PREQB, and DOI on the Technical Memorandum Background Investigation Work Plan for Eastern Vieques.

TABLE 7-1
Proposed Project Milestones

AFWTF Background Study	
Key Project Milestones	**Days Duration (from last date shown)**
Navy Submit Final Background Investigation Work Plan	April 1, 2005
Site Visit with Navy, EPA, PREQB, and DOI to concur on background sample locations	May 4, 2005
Agency approval of Final Work Plan (unless public comment extends work plan approval time or requires additional work plan modifications)	15
Procure Subcontractors/Mobilize	30
Conduct Field Investigation (including utility clearance, vegetation clearance, IDW management, surveying)	60
Laboratory Analyses	30
Data Validation/Management	30
Data Evaluation/Prepare Draft Background Investigation Report	60
Navy, EPA, DOI, and PREQB Review of Draft Background Investigation Report	90
Prepare Draft Final Background Report	75

SECTION 8

References

Baker. 1999. *Final Results of the Hydrogeologic Investigation, Vieques Island, Puerto Rico.* November

CH2M HILL. 2003a. *Final Draft Preliminary Range Assessment Report, Vieques Naval Training Range, Vieques Island, Puerto Rico.* April.

CH2M HILL. 2003b. *Master Work Plan for AFWTF.* June.

CH2M HILL. 2002. *Final Soil, Groundwater, Surface Water, and Sediment Background Investigation Report, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico.* October.

CH2M HILL. 2000a. *Final Work Plan and Sampling and Analysis Plan Soil, Groundwater, Surface Water, and Sediment Background Investigation, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico.* December.

CH2M HILL. 2000b. *Final Expanded Preliminary Assessment/Site Investigation, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico.* November.

Conover, W.J. 1980. *Practical Nonparametric Statistics.* John Wiley & Sons, Hoboken, N.J.

EPA. 2002a. *Role of Background in the CERCLA Cleanup Program.* Office of Solid Waste and Emergency Response and Office of Emergency Remedial Response, OSWER 9285.6-07P. April.

EPA. 2002b. *Guidance for Comparing Background and Chemical Concentrations in Soil at CERCLA Sites.* External Review Draft, EPA 540-R-01-003. September.

EPA. 1996. Geostatistical Sampling Evaluation Guidance for Soil and Solid Media, Review Draft. February.

EPA. 1994a. *Guidance for the Data Quality Objectives Process.* EPA QA/G-4. Office of Research and Development. EPA/600/R-96/055. September.

EPA. 1994b. *EPA's Functional Guidelines for Data Validation.*

NAVFACENGCOM. 2003. *Environmental Baseline Survey Vieques Naval Training Range, Vieques Island, Puerto Rico.* Draft Final.

NAVFACENGCOM. 2002. *The Guidance for Environmental Background Analysis, Volume I: Soil.* April.

NAVFACENGCOM. 1998. *Procedural Guidance for Statistically Analyzing Environmental Background Data.*

Torres-Gonzales. 1989. *Reconnaissance of the Ground Water Resources of Vieques Island, Puerto Rico.* U.S. Geological Survey Water Resource Investigations Report 86-4100.

Site-Specific Investigation-Derived Waste Plan Checklist

This checklist supplements the Master IDW Plan with site-specific information. Once completed for a specific project, it provides necessary IDW information for each investigation. It is to be taken into the field with the Master IDW Plan.

Site: AFWTF

1. IDW Media:
   - X Soil cuttings
   - ____ Well development or purge water
   - X Decontamination residual soil and wastewater
   - X Personal Protective Equipment (PPE) or disposable equipment
   - ____ Other _____

2. Expected Regulatory Status:
   - ____ Hazardous
   - ____ Solid Waste
   - X Unknown
   - X Other Waste management activities regulated by OSHA Hazwoper standard (1910.120)

3. Site Location: Decontamination fluids and PPE will be generated at all background drilling sites.

4. Nature of Contaminants Expected:
   - ____ Petroleum contamination
   - ____ Polyaromatic hydrocarbon
   - ____ Pesticides
   - ____ Herbicides
   - ____ PCBs
   - ____ Metals
   - X Other No contamination expected background locations to be sampled

5. Volume of IDW Expected:
   - X Drums - Maximum of two anticipated. One for decontamination fluids, and one for PPE and other disposable items.
   - ____ Cubic Yards
   - ____ Tons
   - 20 Gallons

6. Compositing Strategy for Sample Collection: Composite sampling will be performed on decontamination water collected.

7. IDW Storage

X As per Master IDW Plan _____ Other_____

8. Waste Disposal

X As per Master IDW Plan _____ Other_____

Site-Specific Field Sampling Plan Checklist

This checklist supplements the Master FSP with site-specific information. Once completed for a specific project, it provides necessary field sampling information for each investigation. It is to be taken into the field with the Master FSP.

Site: AFWTF

1. Tasks to be performed:

_____Geophysical surveys
_____Soil gas surveys
_____Surface water and sediment sampling
X_____Surface soil sampling
X_____Soil boring installation
X_____Subsurface soil sampling
_____Monitoring well installation and development
_____Monitoring well abandonment
_____Groundwater sampling
_____In-situ groundwater sampling
_____Aquifer testing
_____Hydrogeologic measurements
_____Biota sampling
_____Trenching
_____Land surveying
X_____Investigation derived waste sampling
X_____Decontamination
_____Other_____

2. Field measurements to be taken:

_____temperature
_____pH
_____dissolved oxygen
_____turbidity
_____specific conductance
X_____organic vapor monitoring
_____geophysical parameters (list):
_____electromagnetic induction
_____ground-penetrating radar
X_____surveying
_____magnetometry
X_____global positioning system
_____soil gas parameters (list):
_____combustible gases
_____water-level measurements
_____pumping rate
X_____other soil boring descriptions, photographs, general site description

3. Sampling program (nomenclature, etc.):

X_____As per Master FSP _____Other Investigation Work Plan

4. Map of boring and sampling locations (attach to checklist): See Work Plan.

5. Table of field samples to be collected: See Investigation Work Plan.

6. Applicable SOPs or references to specific pages in Master FSP: The following SOPs from the Master Work Plan are to be implemented.

- Shallow Soil Sampling
- Homogenization of Soil Samples

- Chain-of-Custody
- Packaging and Shipping Procedures
- Equipment Blank and Field Blank Preparation
- Decontamination of Personnel and Equipment
- Disposal of Waste Fluids and Soil
- Volatiles Monitoring with an OVA
- Soil Sampling

7. Site-specific procedures or updates to protocols established in the Master FSP:

Site-Specific Quality Assurance Project Plan Checklist

This checklist supplements the Master QAPP with site-specific information. Once completed for a specific project, it provides necessary quality assurance information for each investigation. It is to be taken into the field with the Master QAPP.

Site: AFWTF

1. List sampling tasks: groundwater and subsurface soil sampling, surface soil sampling, and monitoring well installations.

2. List data quality objectives: The objective of the Background Investigation is to determine the background concentrations of naturally occurring metals.

3. Organization:

NAVFAC Navy Technical Representative	Chris Penny/NAVFAC
PREQB Federal Facilities Project Manager	Yarissa Martinez/PREQB
CH2M HILL Activity Manager	John Tomik/CH2M HILL
Quality Control Senior Review	Mark Stinnett CH2M HILL
Technical Project Manager	Brett Doerr/ CH2M HILL
Field Team Leader	John Swenfurth/CH2M HILL

4. Table of samples with analyses to be performed and associated QC samples included in the SWMU Investigation Work Plan.

5. Analytical Quantitation Limits:

   X_____As per Master QAPP

   _____Other

6. QA/QC Acceptance Criteria (e.g., precision, accuracy)

   X_____As per Master QAPP _____Other (attached)

7. Data reduction, validation, and reporting:

   X_____As per Master QAPP _____Other (attached)

8. Internal QC Procedures (field and laboratory):

   X_____As per Master QAPP _____Other (attached)

9. Corrective Action:

   X_____As per Master QAPP _____Other (attached)

10. Other deviations from Master QAPP - None

Site-Specific Health and Safety Plan

This checklist must be used in conjunction with the Master HSP. This checklist is intended for use by CH2M HILL employees only. All CH2M HILL employees performing tasks under this checklist must read and sign both this checklist and the Master HSP and agree to abide by their provisions (see EMPLOYEE SIGNOFF attached to the checklist).

Site: AFWTF

Location(s): SWMU Location and Background Sampling Location Map and is included in the Work Plan.

This document shall be maintained onsite with the Master HSP. It will include as attachments from the Work Plan a site map and the site characterization and objectives for this site.

The procedures described in the Master HSP will be followed unless otherwise specified in this Site-Specific HSP.

1. HAZWOPER-Regulated Tasks

_____Test pit and excavation
X_____Soil boring installation
X_____Geoprobe boring
_____Geophysical surveys
X_____Hand augering
X_____Subsurface soil sampling
X_____Surface soil sampling
_____Soil gas surveys
_____Sediment sampling
_____Monitoring well/drive point installation
_____Monitoring well abandonment
_____Groundwater sampling
_____Aquifer testing
_____Hydrologic measurements
_____Surface water sampling
_____Biota sampling
X_____Investigation-derived waste (drum) sampling and disposal
_____Observation of loading of material for offsite disposal
_____Oversight of remediation and construction
_____Other_____

2. Hazards of Concern: (Check as many as are applicable. Refer to Section 3 of Master HSP for control measures):

X Heat stress
_____ Cold stress
_____ Buried utilities, drums, tanks
_____ Inadequate illumination
X Drilling
_____ Heavy equipment
_____ Working near water
_____ Flying debris
_____ Gas cylinders
X Noise
X Slip, trip, or fall hazards
X Back injury

_____ Confined space entry
_____ Trenches, excavations
_____ Protruding objects
X Vehicle traffic
_____ Ladders, scaffolds
_____ Fire
_____ Working on water
X Snakes or insects
X Poison ivy, oak, sumac
X Ticks
_____ Radiological
_____ Other_____

3. Contaminants of Concern (List if known. Refer to Table 3.8 of the Master HSP contaminant-specific information

_____ _____ _____

_____ _____

4. Personnel (List CH2M HILL field team members:

Field team leader(s) John Swenfurth

Site safety coordinator(s) John Swenfurth

Field team members To be determined

5. Contractors/Subcontractors

X Procedures as per Master HSP

X Other

Name: To be added _____ _____

Contact: To be added _____ _____

Telephone: To be added _____ _____

6. Level of PPE required: D
Refer to Table 5.1 of Master HSP, CH2M HILL SOPs HS-07 and HS-08, and Respiratory Protection, Section 2 of the Site Safety Notebook.

7. Air monitoring instruments to be used (refer to Master HSP for action levels):

X OVM 10.6 _____ FID

_____ CGI _____ Dust monitor

_____ O_2

8. Decontamination procedures:

_____ As per Section 7 of Master HSP

X Other As described in the SWMU Investigation Work Plan.

9. List any other deviations or variations from the Master HSP: None

10. Emergency Response (Check that all names and numbers are correct on page 47 of Master HSP and attach corrected page to this checklist)

11. Map to hospital (Highlight route to hospital from site and attach to this checklist)

12. Emergency Contacts (Check that all names and numbers are correct on page 49 of Master HSP and attach corrected page to this checklist)

13. Approval. This prepared site-specific checklist must be approved by John Longo/NJO or Laura Johnson/NJO or their authorized representative

    Name Title: Health and Safety Manager Date:

    (Signature will be included in the Final HSP)

14. Employee Signoff. All CH2M HILL employees working at the site must sign the attached Employee Signoff for the checklist as well as for the Master HSP.

_____ Site

HSP Checklist Employee Signoff

The employees listed below have been given a copy of both this health and safety plan checklist and the Master HSP, have read and understood them, and agree to abide by their provisions.

EMPLOYEE NAME	EMPLOYEE SIGNATURE AND DATE

May 11, 2004

Mr. Adolf Everett, P.E.
Chief
RCRA Program Branch
Environmental Protection Agency, Region 2
290 Broadway
New York, NY 10007-1866

Subject: Response to Comments on the Draft Work Plan and Sampling and Analysis Plan Soil and Groundwater Background Investigation, former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico

Dear Mr. Everett:

Attached are responses to comments from USEPA, PREQB, and USFWS on the above referenced document. The draft document has been revised to incorporate the comments and will be submitted as a "Draft Final" work plan for a 30-day public comment period.

Sincerely,

LANTDIV

Christopher T. Penny
RPM

c: Yarissa Martinez/PREQB
Felix Lopez/USFWS

Attachment A. – Response to EPA Comments

EPA/Superfund Comments on Draft Soil and Groundwater
Background Investigation Work Plan (Dec. 2003), AFWTF
Eastern Vieques, Puerto Rico

EPA COMMENT:

1. A more detailed presentation of the groundwater sampling locations is needed. This should include a table which summarizes the construction of existing wells and the type of material in which they are screened.

   The plan calls for 17 points to be used in the study. Of these it appears that 7 are in areas underlain by volcanic rock (Kv) - P-2, P-3, Kv-MW-1, KV-MW-2, NW-1, RCRA-1, and RCRA-2. In the cross sections provided, the existing wells are shown as emplaced in granodiorite, with no volcanic layer present. Stratigraphically, one would expect the volcanic units to be overlying the plutonic granodiorite, but this is not shown. The drilling logs of the existing wells should be consulted and provided (with contacts summarized in a table) to show what units are actually present. Note that even if KV is present, it is the screened interval which will dictate which rock type is represented by the sample.

   Of the remaining 10 wells, 8 appear to be in areas noted as underlain by granodiorite (Ktd). The remaining two are in alluvium (Qa), but appear to be screened in the KTd unit in the cross sections. From this, it appears that only the KTd and Kv units will be monitored for background. This point should be clarified. There should also be a justification for why the Qa unit does not merit attention. Is this thought to be a significant water bearing unit? Perhaps not, based on its horizontal extent?

***Response:** A table summarizing the well construction details and geologic units has been added to the draft final work plan as Table 2-1. The geologic contacts, if identified from the well logs are summarized in the table. In addition, the drilling logs of the existing wells are provided in Appendix B of the draft final work plan. The water bearing units in all wells, except for NW-8, occur either in the Kv or KTd units. All 12 of the sites listed in the consent order occur in the Kv or KTd units. Only well NW-8 is screened in the Qa unit.*

EPA COMMENT:

2. The text refers to 3 'newly installed' wells. It is not clear if these wells have already been installed or if they are being installed as part of the present work plan. There is no discussion of drilling activities. If these wells have already been installed, please refer to the work plan and report for their installation (of which I am not aware) and include construction and boring log information. EPA reserves the right to reject data from wells which were not installed as part of an approved work plan. If the wells have yet to be installed, then drilling techniques, target depths, etc. should be provided.

***Response:** The Navy proposes to install and sample three new wells (Kv-MW-1, Kv-MW-2, and KTd-MW-1) and sample one existing piezometer (P-2), as shown in the draft final work plan on Figure 2-5. The three proposed new wells are included in Table 2-1, with planned depths and screened intervals. In response to comments from PREQB requesting that piezometers with large sand pack intervals not be used as background wells, the Navy proposes to replace P-1 and P-3, originally proposed to be sampled in the draft work plan, with recently (February 2004) installed background wells SWMU-1 MW-1 and SWMU-10 MW-1. These two wells were sampled in February 2004 and their analytical data will be used in this background study.*

EPA COMMENT:

3. Similar to the groundwater samples, where possible, the actual borings that were drilled at previous soil sampling locations should be used to verify the composition of the uppermost bedrock unit underlying those samples. For the previous samples collected in Qa, the boring logs should indicate whether this in fact appeared to be alluvial material, as opposed to having resulted from weathering / soil development in place. Although the geology map provided does afford a good starting place, all data collected should be used to verify that it is correct and that samples are appropriately grouped together for statistical purposes.

***Response:** A qualified geologist will prepare geologic logs of all soil borings to be completed and will review logs of any previously installed borings to verify that the geologic units and soil types encountered are consistent with the units shown on the geologic map.*

EPA COMMENT:

4. Page 3-3 indicates that PAHs will be evaluated for their presence in background, but there is no PAH sampling planned as part of this effort. Please amend or clarify.

Response: The Navy will analyze 10% of the soil samples, closest to existing roadways, for PAH to check for their presence in background soils.

EPA COMMENT:

5. As noted in comments on previous documents, EPA Region 2 is implementing standard Electronic Data Deliverable (EDD) formats. These formats are more extensive than those noted in the work plan. The Navy and EPA should discuss a transition to the Regional EDD formats.

Response: Comment noted. The Navy's proposed EDD format needs to be maintained to be consistent with the existing Navy database for input into the Navy's Vieques database that has already been established. However, the Navy will initiate discussions with EPA to assess the requirements for conversion of the Navy database to EPA's format.

EPA COMMENT:

6. The document does not reference critical recent EPA guidance on comparing background data with data that characterize the site. Specifically, there is a September 2002 document, "Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (EPA-540-R-01-003, OSWER 9285.7-41)", available at http://www.epa.gov/superfund/programs/risk/background.pdf that should be incorporated into the work plan. Therefore, Chapter 3 of the work plan, Statistical Analysis, was not reviewed. The revised work plan will be reviewed to ensure that the recommendations in the guidance are appropriately included.

Response: An earlier version (June 2001) of the above referenced document is listed in the first paragraph of Section 3. The draft final work plan has been revised to reference the September 2002 guidance instead of June 2001.

EPA COMMENT:

7. As a general consideration, please note that any area which contains fill material shall not be included in a comparison with background concentrations.

Response: Comment noted. Should fill areas be encountered during drilling they will be noted and will be avoided during the selection of background soil sample locations.

EPA COMMENT:

8. The evaluation of thallium in soil and groundwater may require analytical methods that are more sensitive than the standard methods. The MCL for thallium is 2 µg/l, while the risk based concentrations are .26 µg/l and .55 mg/kg for groundwater and soil, respectively. In order to decrease the likelihood of reporting false positive thallium results, please ensure that analytical methods have appropriate reporting limits.

Response:

The method recommended in the draft work plan has been accepted by EPA and was used during the Phase I RFI investigation. The same method will be used in the background study.

Attachment B. – Response to PREQB Comments

Response to PREQB Comments from February 27, 2004 Letter

PREQB COMMENT:

1. New Comment. Page 2-2, Section 2.1, Paragraph 6 - The revised document states that inorganic levels within the various soil types found on Vieques Island were similar to those from earlier sampling. However, the previous background soil samples collected from the western portion of Vieques Island only included the Qa, Kv and KTd soil types. The Qb (beach and dune deposits) and TI (marine sedimentary rocks) soil types were not previously sampled. These soil types may contain different inorganic concentrations than the other soil types due to their different origins. There is no previously collected data for the Qb and TI soil types. If these two additional soil types are sampled, clarify how sample similarity will be assessed.

***Response:** If inorganic concentrations from Qb and TI soil types are statistically similar to the Qa, Kv, and KTd soil types, then they will be grouped together as one data set. If they are statistically different, then they will be grouped as separate data sets with separate UTL95 and UCL95 values.*

PREQB COMMENT:

2. Page 2-4, Section 2.3.2, Paragraph 4 - TRC's 2001 comment stated that samples should be analyzed for non-inorganic parameters to check that the areas sampled are not contaminated. Although the revised document includes analysis for organics such as pesticides, explosives, and perchlorate, the suite of organics does not included polyaromatic hydrocarbons (PAHs) as a proxy indication of general manmade impacts. As stated in the prior comments, the representativeness of background samples collected along a roadway (as discussed on Page 2-3, Section 2.3, paragraph 5) is questionable, and compounds like PAHs may be elevated near roadways and thus not truly indicative of background. Including PAHs in the suite of analysis could serve as a check on the area selected for background sampling. If PAHs are present at elevated concentrations, then it would indicate that the sample location was not far enough removed from the roadway (e.g., impacted by road runoff or exhaust deposition) or other source of contamination and is potentially unsuitable as a background location. The pesticide sampling added by the Navy will also assist in the determination of a suitable background location as these areas may have been impacted by crop, weed or mosquito control.

Response:. All roads on East Vieques are secondary dirt roads. There are no paved roads. All background samples are located at significant distance from the roads (50 to 100 feet away). The Navy will analyze 10% of the soil samples, closest to the roads, for PAHs to determine if there are impacts from runoff of road pavement material or air-borne deposition and runoff deposition from vehicle exhaust.

TRC also noted that photographs should be taken of each sample location to provide another line of evidence that the area is not impacted by contamination and that all photographs should be provided with the Background Investigation Report. The photograph(s) should show the sampling location and general surrounding area. Although interested parties are invited to participate in a pre-sampling tour of all proposed sampling locations (page 2-3), TRC still recommends photographing all sampling locations.

Response: Photographs will be taken of each sample location. This procedure has been added to the work plan.

PREQB COMMENT:

3. Page 4-9, Section 4.2.1, Paragraph 2 – TRC's 2001comment stated that analytical detection limits must be less than the EPA Region IX Preliminary Remediation Goals (PRGs) and ecological criteria. This comment was not addressed. The Background Investigation Report must provide a comparison of detection limits and analyte detections with PRGs and ecological criteria.

Response: Laboratory detection limits will be those presented in the Master Work Plan and approved by EPA. The purpose of the background sampling is to determine inorganic concentrations that are present in the background soil and groundwater, not to screen the data to PRGs and ecological criteria. The site laboratory data will be screened to PRGs and ecological criteria.

PREQB COMMENT:

4. New Comment. Page 1-1, Section 1.0, Paragraph 1 – This paragraph should also reference the following applicable documents and the work plan should demonstrate that relevant content has been incorporated into the technical approach:

- Role of Background in the CERCLA Cleanup Program, *OSWER 9285.6-01P, April 26, 2002*
- Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, *OSWER 9285.7-41, September 2002.*

These documents were developed by EPA to assist Superfund regional project managers (RPMs) and human health and ecological risk assessors during the remedial investigation process to evaluate background concentrations at Superfund sites. Since the Former Atlantic Fleet Weapons Training Facility may become a Superfund site, these documents are applicable and relevant.

Response: The April 2002 EPA document is referenced in Section 3. 1 of the work plan. The September 2002 EPA document is referenced in the draft final work plan.

PREQB COMMENT:

5. New Comment. Section 2 – General comment on sample collection. Data concerning surface soil physico-chemical properties and heterogeneity between background and impact area sample locations should be collected and compared. For example, sample locations should be roughly equivalent in terms of plant species composition, structure, and estimated canopy cover for reliable background/impact area comparisons. Different plant species can respond in different ways to the physico-chemical properties of soils (e.g., species compostion, structure, and canopy cover) and thus can be indicative of differences in the physico-chemical properties of soils and disturbance regimes on fine spatial scales. Also, data concerning soil properties and characteristics (e.g., Munsell hue, value and chroma) should also be collected to support comparisons with impact areas with no or limited vegetation. The data concerning surface soil physico-chemical properties and heterogeneity between background and impact area sample locations should be collected to assist in selecting sample locations and/or the interpretation of the resulting analytical data.

Response: The vegetation type will be described during the background sampling to assess if different plant species impact the soil composition. The soil samples will be described by a professional geologist in the field.

PREQB COMMENT:

6. New Comment. Page 2-1, Section 2.0 - This section should include a discussion of the appropriate numbers of samples (i.e., sample size) for background investigations. Section 3.5 of the "*Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites*" (September 2002) provides guidance on a statistical approach for selecting background sample size for soils.

Response:

There are several statistical methods that can be used to determine the confidence interval coverage for the given number of samples. The Max of N method to determine sample size is based on randomized collection of samples within defined areas of relatively homogeneous contamination. The number of samples within any homogeneous area is independent of the size of the area and has been based upon a nonparametric (distribution-free) statistical method which calculates the size of a sample (N) required to estimate a prespecified tolerance interval of the sampled population with a prespecified level of confidence (Practical Nonparametric Statistics, W.J. Conover. John Wiley, 1980). The following tabulates sample sizes to meet a range of prespecified coverages and a range of prespecified confidence levels.

Estimated Quantile	85% Confidence	90% Confidence	95% Confidence
50th [Median]	3	4	5
75th [Upper Quartile]	7	9	11
85th	12	15	19
90th	19	22	29
95th	37	45	59

A total of 29 surface soil and 29 subsurface soil samples are being proposed as part of the work plan, which results in a total of 66 soil samples to be collected from background locations. Since these samples are greater than 59 indicated for a 95% confidence level in 95% of the sample population, these are likely to result in acceptable confidence levels, as per EPA guidance. The confidence limits associated with the samples will be calculated and reported in the background investigation results report.

Sampling location selection and rationale is included in Section 2.0. A systematic sampling is not applicable for this background sampling effort as explained in the work plan.

PREQB COMMENT:

7. New Comment. Page 2-2, Section 2.1 – The report indicates that "bedrock in the AFWTF area is predominantly unweathered", however, Figure 2-5 indicates that for soil types Kv and KTd that deep weathering is a possible feature of these soils. Provide geologic borings or cite references to establish that the bedrock is predominantly unweathered in this area.

Response: There are areas in the AFWTF area where bedrock is exposed at the surface and is unweathered. At other areas, the soil profile is predominantly clay and silt, which is likely weathered remnants of the Kv and KTd bedrock. The AFWTF area has both unweathered bedrock outcrops and highly weathered soil profiles.

PREQB COMMENT:

8. New Comment. Page 2-4, Section 2.3.1 – The September 6, 2001 version of this work plan included collection of a groundwater sample from a water supply well. Clarify why this well is not proposed for sampling in the current document.

Response: The former water supply well is no longer in use and is not applicable to the background study. It was a 10-foot diameter dug well with a depth of 13 feet.

PREQB COMMENT:

9. Page 2-4, Section 2.3.1, Paragraph 1 – TRC's 2001 comments stated that piezometers should not be used to collect samples for groundwater quality since they are typically constructed for obtaining water level measurements and are not constructed for obtaining representative samples for water quality analysis. Information provided in Table 3-1 in Appendix A of the Current Conditions report suggests that the piezometers have been constructed in a manner that potentially biases chemical results to lower concentrations due to excessive screen or filter sand-pack length (e.g., over 100 feet in P-1). This comment was not addressed. Piezometers should be replaced with new or appropriately located existing monitoring wells.

Response: Due to the low hydraulic conductivity of the bedrock, very few water bearing fractures were present within the 100 foot interval of the borehole. As a result, this screened interval was selected to ensure that sufficient amount of representative groundwater could

be obtained However, piezometers P-1 and P-3 will be replaced with newly installed background wells SWMU-1 MW-1 and SWMU-10 MW-1. Piezometer P-2 has 18 feet of sandpack and will also be used as a background well.

PREQB COMMENT:

10. Page 2-7, Section 2.3.1, Paragraph 1 - TRC's 2001 comment requested a discussion of how representative samples are to be obtained from wells with screens longer than 10 feet. Page 30 of *The Practical Guide for Ground-Water Sampling* (Illinois State Water Supply, 1985) acknowledges sample dilution resulting from long well screens. EPA's *RCRA Ground-Water Monitoring: Draft Technical Guidance* (EPA, 1993) recommends that well screens be no more than 10 feet long (page 4-41, page 5-7, and page 6-40). According to Table 3-1 of the Current Conditions, 5 out of 11 wells and 6 out of 8 piezometers have excessive screen or filter pack lengths that could impart a low bias to chemical results. In wells NW-1, NW-4, NW-6, NW-7, P-1, P-2, P-3, P-5, and P-9, the extra filter pack above the height of the well screen creates a longer length to intercept the aquifer and results in a potential dilution. In wells NW-6 and P-8, screens are longer than 10 feet also potentially resulting in dilution. This comment was not addressed. These wells are not suitable for obtaining representative groundwater samples.

Response: The references above apply to sampling at contaminated site where wells are installed in uniform groundwater flow. Monitoring wells with 10 feet of screen and up to 25 feet of sand pack are appropriate to provide background data in a granodiorite formation where there are very few water bearing fractures over a 25 foot interval and produces very little water. The Navy will use wells NW-1, NW-4, and NW-7 as background wells.

PREQB COMMENT:

11. Page 2-10. Figure 2-4 - TRC's 2001 comment requested that Figure 2-4 be provided in E size for review of the PI sites versus background locations. This comment was not addressed.

Response: Figure 2-5 is provided as a larger scale of the background sampling area to easily view the PI sites and background locations. An E size drawing can be provided to TRC individually upon request, but it is not cost effective to add E size drawings for 25 copies.

PREQB COMMENT:

12. New Comment. Page 2-10. Figure 2-4 – The description of KTd soils is truncated

Response: Figure 2-4 has been modified to add "Weathered" to the description of KTd.

PREQB COMMENT:

13. New Comment. Page 3-1, Section 3.1.1 – If box plots and/or tests for outliers are proposed to distinguish "natural innate variability" from laboratory error then they should be specified in this section. Rosners test for detecting up to *k* outliers is one such test (Rosner, 1983), and is appropriate when the sample size is greater than 25 samples. Since the Rosners test assumes a normal or lognormal distribution, then the data will have to be subjected to a goodness-of-fit test and if non-normally distributed, transformed.

Response:

The text of the revised report has been edited to clarify that outlier analysis will be performed using box plots as a well as additional statistical tests. Box plots are useful for understanding the data distribution, in addition to identifying the extreme values. Box plots are proposed because they also present data in a graphical format that shows the data distribution, including upper and lower quartile of the data distribution, the median, and the outliers. We agree with the comment that there are several statistical methods for identification of outliers in addition to the extreme values identified by the box plots. Additional tests will be considered including the proposed Rosner's test for identification of outliers. However, if outliers are representative of natural variability, their representativeness of background conditions will be discussed in the report.

PREQB COMMENT:

14. New Comment. Page 3-2, Section 3.1.2 – It is the shape of the probability distribution that allows investigators to select the appropriate transformation to achieve a normal distribution. Parameters that influence the shape of the probability distribution include skewness and kurtosis. Goodness-of-fit tests are used to indicate whether the given data distribution departs significantly from normality. Examples of appropriate goodness-of-fit tests include the Shapiro-Wilk *W* test (Shapiro and Wilk, 1965), which is suitable for sample sizes less than 50; the Lilliefors test (Lilliefors, 1967; Lilliefors, 1969), which is suitable for sample sizes greater than 50; and the two-

sample Kolmogorov-Smirnov *D*-test (Chakravarti, Laha, and Roy, 1967), or D_{MAX}, which can be applied to data sets that contain more than ten samples. These tests are suitable for most of the sample sizes and distributions likely to be encountered in environmental data analysis, but the underlying limitations of the tests should be understood to guard against misapplication and to identify when other tests should be used.

Note that a suite of data transformations (and combinations of transformations) exist that are capable of converting even the most exotically distributed data sets to a normal distribution. Based upon the shape of the probability distribution histogram, it will become clear to the investigator whether to, for example, select an inverse transformation (1/x); $\log_{10}$; natural log (ln); square root; reflect; one of the trigonometric functions (e.g. arcsin); or some combination thereof e.g., $\log_{10}$ (1/x). Therefore, examination of the data's probability distribution using histograms or other suitable techniques is strongly recommended prior to selecting the appropriate data transformation or proceeding with non-parametric tests. For example, if the change in the relative distance between data points following transformation affects interpretation of results, then the raw, untransformed data should just be subjected to a non-parametric test.

Response:

Comment noted. Statistical evaluations will be conducted by a qualified and experienced statistician who is experienced in evaluating environmental data. Multiple test forms will be used, along with the recommended histogram presentations prior to determining the distribution for the data set. It will be conducted in accordance with the existing guidance and other references for the statistical evaluations.

PREQB COMMENT:

15. New Comment. Page 3-4 (Two-Sample Test) - Indicate that statistically significant results will be reported where $p<0.05$ α probability levels. Also, list a few descriptive statistics along with the test statistic (e.g., mean/median, standard deviation, standard error).

Response:

Tables with the statistical summaries will be included in the background investigation report for each sample matrix that would include number analyzed, number detected, concentration ranges such as minimum, and maximum. Also additional statistics such as

mean, median, geometric mean, standard deviation, and standard error will be included as suggested by the comment.

PREQB COMMENT:

16. New Comment. Page 3-4 (Geochemical Techniques/Correlations of Major Elements) – If a parametric correlation analysis will be used (e.g., Pearson product-moment correlation coefficient), indicate that the data will be transformed to achieve normality before using the test. A Pearson product-moment correlation matrix (Pearson, 1896) would be very useful if multiple interactions are to be investigated. If the data do not lend themselves to transformation (i.e., skewness and kurtosis are extremely high), a non-parametric Spearman Rank Order correlation coefficient (Gibbons, 1985) would be appropriate. A Spearman Rank Order correlation matrix can also be constructed when examining multiple interations. In both instances, use the t-statistic (t_s) to identify significant correlation coefficient (r) and indicate in the narrative that all significant correlation coefficient (r) will be reported where $p<0.05$ α probability levels.

Response:

Depending on the results of the analysis of the samples, correlations will be evaluated for the suitable sets of chemicals. Suggested statistical tests in this comment will be considered at that time.

PREQB COMMENT:

17. New Comment. Page 3-4 (Effects of Suspended Particulates) - In addition to using a correlation coefficient, an effective analysis of individual (or combined) effects of pH and turbidity on trace elements might include multivariate analyses such as Principal Components Analysis (PCA), or possibly non-metric multidimensional scaling (NMS). (Gauch 1982) NMS is especially desirable in that it can be used with non-normally distributed data (examines ranks of data sets). In this manner, data can be ordinated along two axes of concern (e.g., pH and turbidity) and the most important variable(s) can be identified.

Response:

Both pH and turbidity will be measured during the sampling of the groundwater. Correlation of pH and turbidity will also be evaluated as part of the data evaluation to understand the geochemistry of the groundwater.

PREQB COMMENT:

18. New Comment. Page 3-5, Figure 3-1 -

a. EPA-developed software programs like ProUCL (EPA, 2003) will not calculate a non-parametric upper confidence limit (UCL) for highly skewed data sets (σ >3.0). In those instances where the UCL cannot easily be determined for exotic distribution types (e.g. gamma), and a non-parametric method for calculating the UCL cannot be identified, the maximum sample value should be used rather than arbitrarily selecting a non-parametric UCL. Both the sample mean and the standard deviation should be reported along with the UCL value and the selected method for calculating the UCL.

b. Clarify why a non-parametric UCL would be calculated for a data set that follows a normal distribution following log transformation. This may be a typographic error, because parametric testing/calculation procedures are preferred when you have normally distributed data.

Response:

Often results from the various UCL95% calculation methods do result in selecting the maximum detected values, when the calculated value is greater than the site detected maximum concentration. The flowchart has been modified to add that final 'point estimate' value could be the maximum detected value.

A non-parametric UCL will not be estimated for normally distributed data.

PREQB COMMENT:

19. Page 4-1, Section 4.1.1.1 - TRC's 2001 comment stated that the qualifications of the laboratory must not only meet EPA Level D quality control, but also meet the QA requirements specified in the QAPP and the project-required reporting limits. In addition, the laboratory must be CLP-certified or EPA approved, as per Section X of the Consent Order. This comment was not addressed.

Response: The contracted laboratory for this project will meet the reporting limits in the QAPP and will be EPA approved and CLP certified.

PREQB COMMENT:

20. Page 4.2, Section 4.1.2.2, Paragraph 7 – TRC's 2001 comment stated that the submersible pump used for groundwater sampling must have a flow rate adjustable to less than 300 milliliters per minute (mL/min). Section V of Region II's March 16, 1998 Standard Operating Procedure (SOP) *Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling* (EPA, 1998) specifies that purging should be conducted at 200-500 mL/min. This SOP must be followed.

Response: Low flow sampling procedures will be adhered to. Purging and sampling will be conducted at flow rates of 200-500 mL/min.

PREQB COMMENT:

21. Page 4-3, Table 4-1 – TRC's 2001 comment requested revisions to Table 4-1 indicating that groundwater samples will be collected for total (unfiltered) metals analysis. Page 7-20 of EPA's *RCRA Ground-Water Monitoring Draft Technical Guidance* (EPA, 1993) discusses the inaccuracy of data from field-filtered samples. This comment was not addressed.

    In addition, the number of inorganic groundwater samples should be doubled to account for the collection of filtered and unfiltered samples at each location.

Response: Both filtered and unfiltered groundwater samples will be collected. As per EPA guidance, if the filtered metals concentrations are much lower than the unfiltered data, this indicates that the metals are related to suspended solids in the aquifer and are not representative of groundwater concentrations. EPA Region III has a policy to use field filtered groundwater samples for risk assessment if turbidity is high and cannot be lowered through well development. The number of samples for metals shown in Table 4-1 includes both filtered and non-filtered samples.

PREQB COMMENT:

22. New Comment. Page 4-3, Tables 4-1 and 4-2 - For soil and groundwater samples, the tables cite SW-846 methods 8081A and 8082 for the analysis of pesticides. SW-846

method 8081A is the correct method. If PCBs are also to be analyzed, then SW-846 method 8082 is appropriate and PCBs should also be listed on the tables; otherwise, the reference to SW-846 method 8082 should be eliminated.

Response: The method 8082 for PCBs has been eliminated from tables 4-1 and 4-2.

PREQB COMMENT:

23. New Comment. Page 4-3, Table 4-1 - The method reference for perchlorate analysis (314) should specify Revision 1 (November 1999).

Response: The perchlorate method has been revised to indicate Revision 1 (November 1999).

PREQB COMMENT:

24. New Comment. Page 4-4, Table 4-2 - There are no sample container, preservative, and holding time information entered for the perchlorate analysis of groundwater samples. These samples should be collected in a 1-liter polyethylene container, cooled to 4°C, and analyzed with 28 days of collection. This information must be added to Table 4-2.

Response: Sample container, preservation, and holding time information for perchlorate has been added to Table 4-2.

PREQB COMMENT:

25. New Comment. Page 4-5, Section 4.1.4 – Explain how sampling locations will be surveyed in areas where the forest canopy obstructs the GPS signal transmittal.

Response: In areas of high canopy, a 25 foot pole will be used to extend the GPS antenna.

PREQB COMMENT:

26. New Comment. Page 4-5, Section 4.1.5 – Sample locations should be identified with field markers such as wood or metal stakes in the event that resampling or reinspection of the area is required once the sampling has been completed.

Response: The sample locations will be identified with a 2-foot long piece of ¼-inch diameter rebar hammered into the ground. The rebar will have a 2-foot long piece of 1-inch diameter PVC pipe placed over it. The PVC will be marked with the sample number using permanent markers. Additionally, colored flagging will be attached to the PVC pipe with the sample number identified. This has been incorporated into the draft final work plan.

PREQB COMMENT:

27. Page 4-6, Table 4-4 - TRC's 2001 comment requested adding sample type designators for groundwater and surface water to Table 4-4. This comment was not addressed.

Response: Sample type GW=Groundwater has been added to Table 4-4.

PREQB COMMENT:

28. Page 4-9, Section 4.2 - TRC's 2001 comment requested clarification regarding the use of EPA National Functional Guidelines or Region II validation guidelines. There are various references to validation guidelines in this section. As per the Consent Order, Section X, Region II data validation guidelines must be used. Other validation guidelines may be used with prior EPA approval. It is unclear whether EPA approval has been given for use of other validation guidelines. References to both organic and inorganic validation guidelines are required since the metals data from the Baker (1999) investigation will also be validated. This comment was not addressed. The references should be as follows:

    For EPA National Functional Guidelines:

    - *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (October 1999)
    - *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (July 2002). Note that these guidelines have been updated since TRC's prior review of the September 2001 document.

    For Region II Guidelines (as per the Consent Order):

    - *CLP Organics Data Review and Preliminary Review* (March 2001)
    - *Evaluation of Metals Data for the Contract Laboratory Program* (January 1992)

Note that Region II has validation guidelines for SW-846 methods that may be more appropriate for this program. The guidelines listed above were in the Consent Order because the Consent Order assumed CLP methods would be used.

Response: All Navy data validation for Vieques Island analytical methods have been validated by EPA Region II guidance, utilizing Region II checklists by our subcontractors. Former Camp Garcia (East Vieques) is RCRA and has used Appendix IX lists by SW846 methods. Thus, references have been cited as EPA Region II DV guidance by SW846 methods until East Vieques becomes a NPL site.

PREQB COMMENT:

29. Page 4-9, Section 4.2.1, Paragraph 2 – TRC made a prior comment regarding the laboratory's submittal of a signed certificate of analysis with each data package. The certificate would state that all work was performed in accordance with the CLP SOW. However, as per the first sentence in this paragraph, all analyses are going to be performed using SW-846 methods. Therefore, this certificate would not be applicable to these analyses. The text should be edited. This comment was not addressed.

Response: Former Camp Garcia (East Vieques) is managed under RCRA and has used Appendix IX lists by SW846 methods, therefore CLP procedures will not be conducted.

PREQB COMMENT:

30. Page 4-10 to 4-11, Section 4.2.2 – TRC's 2001 stated that data validation results should be provided to the Puerto Rico Environmental Quality Board (EQB) with the Background Study Report. Validation methods and results should be confirmed. Validated data should be used to crosscheck the accuracy of data presented in the report. This comment was not addressed. This document should include a statement that this information will be provided to the EQB.

Response: The data validation report will be provided to EQB and a data quality evaluation section will be part of the background study report.

PREQB COMMENT:

31. Page 4-10, Section 4.2.2, Paragraph 5 – TRC previous comment stated that the "U" qualifier is not defined as "not detected above the method detection limit." The laboratory must report down to the quantitation limit (as defined by the lowest calibration standard and as required by SW-846 methods), and not the method detection limit, which is a statistically derived value and not representative of the accurate limit of quantitation. This comment was not addressed.

Response: Organic and general wet chemistry methods quantitate down to the lowest calibration standard and if not detected are reported as the reporting limit (RL) "U". Elemental methods (ICPES, GFAA, and CVAA) are quantitated down to the MDL and non-detects reported as the MDL "U". ICPES often uses a 2-point calibration to take advantage of the linear range of the method and not bias the calibration curve.

PREQB COMMENT:

32. New Comment. Page 8-1 - The listed data validation reference title is incorrect. This title is as follows: *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (July 2002). Based on Comment No. 26 above, this will need to be updated to the most recent revision (July 2002).

Response: For the RCRA work at East Vieques, EPA Region II Data Validation guidance is used with references to SW846 methods as required.

PREQB COMMENT:

33. Appendix A, Checklist for Field Sampling and Analysis Plan, Site-Specific Quality Assurance Project Plan Checklist – TRC's 2001 comment stated that the site-specific QAPP must demonstrate that the analytical quantitation limits will achieve the risk-based standards. In addition, the site-specific QAPP must provide more details on QA criteria, which were not specified in the Master QAPP (see Master QAPP comments). This comment was not addressed.

Response: The site-specific QAPPs provide methods, target lists, and risk based criteria as "desired limits". As the analytical work has to be competitive bid, the QAPP and lab scope of work (SOW) must be written prior to solicitation of bids. The lab SOW which goes out in the RFP requests each BOA lab solicited to note any variances or deviations to the

methods, targets, and desired limits of detection and reporting. These variances are supplied in the solicitation response.

Thus, some of the risk-based criteria for specific targets cannot be met by current analytical technologies and methodologies.

PREQB COMMENT:

34. Appendix A, Checklist for Field Sampling and Analysis Plan, Site-Specific Field Sampling Plan Checklist – The following comments were previously provided by TRC, but were not addressed in the new document.

    - Clarify why dissolved oxygen is not checked off as one of the field measurements to be taken. This parameter should be measured during groundwater sampling.
    - Clarify why oxidation-reduction potential is not included in the list of field measurements to be taken. This parameter should be measured during groundwater sampling and it is listed as one of the indicator parameters in Region II's SOP *Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling* (March 16, 1998).
    - The list of SOPs on the checklist did not always correspond to the titles of SOPs provided in Volume 2 of the Master Project Plans. The following discrepancies were noted:

      "Monitoring Well Installation" was entitled "General Guidance for Monitoring Well Installation" in Volume 2.

      "Field Rinse Blank Preparation" was entitled "Equipment Blank and Field Blank Preparation" in Volume 2.
    - An SOP listed on the checklist (Shallow Soil Sampling) was not provided in Volume 2 of the Master Project Plans.
    - Several SOPs were present in Volume 2 of the Master Project Plans and are applicable to this site-specific Work Plan. These SOPs should also be included on this checklist and are as follows:

      "Volatiles Monitoring with an OVA"

      "Field Measurement of pH"

"Field Measurement of pH and Eh"

"Field Measurement of Specific Conductance and Temperature"

"Field Measurement of Dissolved Oxygen"

"Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, and Temperature Using the Horiba® U-10"

"Preserving Non-VOC Aqueous Samples"

"Groundwater Sampling from Monitoring Wells"

"Soil Sampling"

"Field Filtering"

"Water-Level Measurements"

Region II's SOP *Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling* (March 16, 1998).

***Response:** Appendix A has been updated to include field measurements of dissolved oxygen and oxidation reduction potential. The titles of the SOPs in the checklist have been changed to correspond with the SOP titles in the Master Work Plan. The following SOPs have been added to the checklist: Volatiles Monitoring with an OVA, Field Measurement of pH, Field Measurement of pH and Eh, Field Measurement of Specific Conductance and Temperature, Field Measurement of Dissolved Oxygen, Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, and Temperature Using the Horiba® U-10, Preserving Non-VOC Aqueous Samples, Groundwater Sampling from Monitoring Wells, Soil Sampling, Field Filtering, and Water-Level Measurements, and Region II's SOP Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling (March 16, 1998).*

Attachment C. – Response to USFWS Comments

Response to Comments Received from the US FWS dated March 26, 2004 in regards to the Draft Soil and Groundwater Background Investigation Work Plan, Sampling and Analysis Plan, Former AFWTF, Vieques, December 2003

General Comments

It is recommended that all abbreviations and acronyms used in the document be included in the List of Acronyms and all literature cited in the text be included in Section 8, References. Also the use of both English and metric measurements in the same sections should be avoided.

The determination that a specific contaminant or substance is truly at background level should not be determined solely on the results from samples collected from the site itself. The document seems to imply that only ordnance related contaminants might be different than background. At Vieques, a site related contaminant may be present throughout the facility due to ubiquitous or frequently occurring activities, and may not be directly associated with a particular solid waste management unit (SWMU), area of concern (AOC) or photo identified site (PI). Pesticides, for example, may have been applied by the Navy throughout east Vieques and still persist in soil, sediment or groundwater. While it may not be possible to tie wide spread contaminants to a particular SWMU, AOC or PI site, they should still be considered contaminants of potential concern (COPC) or contaminants of concern.

This investigation as well as all future investigations should be designed with the pending National Priorities List (NPL) listing in mind.

Response:

Any abbreviations and acronyms accidentally omitted from the list of acronyms and any literature cited not included in Section 8, References, have been included in the appropriate sections of the draft final work plan.

The draft final work plan presents the importance of selecting appropriate locations for collecting background data in order to eliminate areas of potential contamination such as known SWMUs, AOCs, and PI sites. Background locations are areas where there was minimal past human activity. Ordnance related contamination in previously active training areas or range fans are implied to be different than background and these were considered unsuitable for background sample locations. Facility-wide contaminants are not anticipated based on a thorough review of historical aerials from 1936 through 1994 to determine past use of lands throughout the facility. This detailed review of the entire

facility has resulted in a careful screening of past Navy activities and these have been avoided during selection of background sampling locations. Pesticides, in general, have a tendency to be persistent in the environment, but wide-spread contamination above EPA action levels has not been documented in the hundreds of soil samples collected to date at locations throughout the facility that were likely used during past military activities. Any elevated concentration of COPCs detected during the facility-wide background study would be further investigated but the data set would not be used in determining background concentrations.

The pending NLP listing will change sampling protocols from RCRA to CERCLA. The current sampling protocols using Appendix IX lists under RCRA are more inclusive than CERCLA TAL and TCL sampling, therefore, when the site changes to CERCLA, the data will be applicable.

SPECIFIC COMMENTS

USFWS COMMENT:

1. Section 1, Introduction – Contaminants detected throughout the entire facility, such as pesticides, but not associated with a particular RCRA Facility Investigation (RFI) should not be classified as background without further investigating the distribution and magnitude of that constituent throughout the Atlantic Fleet Weapons Training Facility (AFWTF).

Response:

The purpose of the background study is to determine the distribution and magnitude of constituents such as metals and pesticides. Anthropogenic background chemicals such as pesticides may not be related to site activities. The purpose of the Phase I RFI is to determine if a release of hazardous chemicals has occurred as a result of site specific activities. If there are low level pesticides from basewide spraying for mosquito control, this activity may not be related to a specific hazardous waste site. However, if pesticides are found on a site above screening criteria, these constituents will be carried forward in a human health and ecological risk assessment as part of a Full RFI or No Further Action document, as appropriate.

USFWS COMMENT:

2. Section 1.1.1 - The Department of the Interior (DOI) should have representatives present during all field site visits to inspect the proposed soil sampling and monitoring well locations. Additionally, DOI should be allowed to comment on the Final Work Plan.

Response:

Presence of DOI representatives will be considered an integral part during the selection of the proposed soil sampling and monitoring well locations. Local knowledge of flora and fauna will be an important consideration in selecting these background locations. A site visit is planned to obtain regulator concurrence on the location of each background sample. The DOI will be presented with the opportunity to comment on the draft final work plan.

USFWS COMMENT:

3. Section 2.0 – The difference between wide spread anthropogenic impacts and those that are site specific should be clarified, as well as, the rational for classifying the former as background. The base wide activities mentioned in this section can be considered COPCs for further investigation and remediation.

Response:

See response to comment number 1.

USFWS COMMENT:

4. Section 2.1 – Other studies have indicated (ATSDR) there are several alluvial aquifers along the coast that are isolated and self contained. The configuration and location of these aquifers should be considered along with other geological, topographic, and cultural features when designing the groundwater investigation.

Response:

Geological, topographic, and cultural features are the main drivers in selecting appropriate background locations. All these factors, including site specific knowledge of aquifers collected during previous investigations, have been considered in detail to select background sampling locations. All of the 12 SWMUs and AOCs are located in either Kv or KTd geologic units. The background groundwater study is focused on these geologic units,

however, existing well NW-8 is screened in the shallow alluvial aquifer Qa, so data will be available from this geologic unit also.

USFWS COMMENT:

5. A qualified individual or soil scientist should field verify the soil type prior to sampling to assure that the soil series is consistent with the series indicated on the existing soil maps. Whenever possible, rock parent material should also be collected and analyzed separately.

Response:

The same qualified field team of professional geologists and scientists that has been collecting soil samples throughout the facility as part of the previous investigations will be collecting the background samples. Site familiarity with onsite geology will be an important factor in selecting representative sites with similar geologic conditions. Field confirmation will be performed of mapped soil series. There are no plans to collect rock samples at this time.

USFWS COMMENT:

6. The rational for sampling the soil from 0 to six inches then from 4 to 6 feet is not clear. There are no soil samples in the 6-inch to 4-foot vadose interval. Should we be sampling in this interval? If not, why not?

Response:

The 0 to 6-inch interval represents the biologically active zone where human and ecological exposure is likely to occur. All soil sampling to date has occurred at the 0 to 6 inch and 4 to 6 feet interval to sample typical subsurface exposure depths for construction activity. These sample depths have been used at the Former NASD (West Vieques) and have been approved by EPA and EQB.

USFWS COMMENT:

7. Section 2.3 – Specific field criteria used to certify that potential soil and ground water sampling locations are truly representative of current conditions and are not unduly influenced by excess human activity should be noted. We recommend moving these sampling locations as far away from existing roads and trails as possible.

Response:

Agreed. Sample locations will be moved as far away from roads and trails as practicable.

USFWS COMMENT:

8. Section 2.3.1 - The suitability of using the wells installed in 1999 for this current study need to be clarified. The data provided by these sampling wells need to meet the objectives of the current investigation. Conditions have changed since 1999, and at the very least, the existing wells should be resampled, rather than using existing data.

Response:

The wells installed in 1999 were located as far as possible from any previous Navy activity by placing these at the western perimeter of the AFWTF facility. No site activity has been reported or documented along the fence. There have been no changes in land use, topography, cultural, or geologic formations that would warrant additional sampling of the same aquifer sampled in 1999. Also, EPA has agreed to use the 1999 metals data.

USFWS COMMENT:

9. Ground water will be analyzed for metals, explosives, perchorlate and pesticides. There is no rational given as to why other contaminants such as PCBs, chlorinated solvents, petroleum hydrocarbons, are not being addressed as well.

Response:

The main purpose of the background study is to determine basewide metal concentrations.. Explosives and pesticides were added to the parameter list to confirm that the background sample locations are not impacted by other activities.

USFWS COMMENT:

10. We are concerned that the number and location of the existing wells (along the perimeter fence) and the proposed monitoring wells (3 new wells) will not yield sufficient information about the ground water level to conclude that no contaminant sources are present upgradient of the wells. Additional ground water monitoring wells should be installed in the northeast part of AFWTF between the existing property boundary and the proposed property boundary as shown in Fig.2-1.

Response:

All of the well locations have been carefully selected away from potential sources of contamination or human influence based on known directions of groundwater flow, surface water drainage patterns, and drainage divides. There are no known sources upgradient of any of the well locations that could affect groundwater constituents based on data record searches and from aerial reviews (1936 - 1994). The area suggested for additional groundwater monitoring located in between the existing and the proposed property boundaries is downgradient of wells MW -1 and RCRA-2 and groundwater conditions are represented by current monitoring activities at these two wells. Groundwater flow direction is clearly defined along the property boundary as shown in Figure 4-4 of the "Results of the Hydrogeologic Investigation, Vieques, Puerto Rico" (Baker, 1999).

USFWS COMMENT:

11. With the present sampling regime the statistical power may be insufficient to discern differences in inorganic chemical concentrations in groundwater.

Response:

The dataset for statistical analysis will consist of a total of sixteen groundwater samples. Based on the suggested statistical analyses that will be conducted, the pool size appears large enough to accomplish the goal and have a normal distribution among the wells. Additionally, all but one of the wells is screened in either KV or KTd geologic units. The groundwater data set will most likely be combined.

USFWS COMMENT:

12. Section 2.3.2 - It is not clear how non-impacted areas representative of underlying geologic and hydrologic conditions will be identified.

Response:

The soil sampling locations have been carefully evaluated by the same criteria as the groundwater well locations. All soil sample sites will be upgradient from any potential sources of contamination and will be kept separate from human influences to the greatest extent possible. Soil samples will be collected away from roads and away from known waste sites. The samples will be analyzed for explosives and pesticides to check for outside impacts. Also, 10% of the background soil samples will be analyzed for SVOCs.

USFWS COMMENT:

13. Why are pesticides not being analyzed in the vadose zone soil samples? Since pesticides can migrate to groundwater, they should be sampled in surface and subsurface soils samples.

Response:

If an area has pesticide contamination (other than low levels from routine applications), it can not be used as a background location. Surface soil samples will indicate if an area is impacted by pesticides. The deeper soil samples will not be analyzed for pesticides during the background study, but may be sampled at a later date, if required.

USFWS COMMENT:

14. Polycyclic Aromatic Hydrocarbons (PAH) are mentioned in the document, but are not specified in the suite of chemicals to be measured. If they are part of an analytical suite, they should be discussed. If not, there should be a discussion as to why PAHs are not being measured.

Response:

The reference to PAHs will be changed to SVOCs. Ten percent of the soil samples will be analyzed for SVOCs that include PAHs.

USFWS COMMENT:

15. Section 3.1.1 – In the event of an outlier it may be prudent to simply run the sample again rather than depend on statistical analysis. As stated in the section, the suspected outlier may be an accurate measurement and represent a hotspot. There needs to be further discussion about how to differentiate between outliers caused by analytical errors and those caused by actual hotspots.

Response:

Comment noted. The Quality Control (QC) check for the sampling and analysis includes collection of duplicate samples to check on the precision of the analysis, however, the QC is

conducted on only a percentage of the total samples. Field duplicate analyses measure both field and laboratory precision and can also be affected by the homogeneity of the samples. An evaluation and discussion of the detected outlier values will be included in the background investigation report.

USFWS COMMENT:

16. Section 3.2 - There is a distinction between background concentrations, benchmark concentrations, and risk-based concentrations. These should be discussed in the document. The benchmark concentrations used to identify the COPCs should be specified. The detection limits of the chemicals should be provided to ensure that they are sufficiently low to meet the objectives of the investigation.

Response:

The screening criteria used and their sources will be specified in the respective documents. No screening criteria will be included in the background investigation report itself.

USFWS COMMENT:

17. Section 4.0 - We recommend that the Master Work Plan and Master Field Sampling Plan be modified to include vegetation surveys prior to any land clearing for access trails, well pads, or access roads. Any wildlife injured or killed, especially reptiles, as part of these activities should be brought to the Vieques National Wildlife Refuge office. Adding these sampling efforts will add to our knowledge about the actual use of the area by native fauna which presently is not well documented.

Response:

Vegetation surveys will be included as a normal routine procedure prior to any land clearing or grading activities to assess for sensitive or listed flora and fauna. Any incidents involving wildlife injury will be reported to the Vieques National Wildlife Refuge (VNWR) office within 24 hours of occurrence. Any specimens encountered will be kept in a container and handed over the VNWR personnel. Records will be kept of sightings that will provide additional information on indigenous fauna. The Master Work Plan will be updated to add this standard operating procedure.

USFWS COMMENT:

18. Section 7 - The role of DOI in the project milestones should be incorporated.

Response:

DOI is a stakeholder in the project and has the role of landowner and also technical reviewer.

DRAFT TECHNICAL MEMORANDUM

Background Investigation Work Plan For Eastern Vieques

PREPARED FOR: CERCLA Technical Committee, Background Subcommittee

PREPARED BY: The Navy/ CH2MHILL

COPIES: C. Penny/NAVFAC J. Harlow/NAVFAC, T. Gordon/EPA, D. Rodriguez/EPA, Y. Martinez/PREQB, A. Crossland/EPA, M. Sivak/EPA, A. Everett/EPA, M. Pensak/EPA, D. Wehner/NOAA, F. Lopez/DOI, B. Doerr/CH2MHILL, V. Mylavarapu/CH2MHILL, J.Tomik/ CH2MHILL

DATE: October 28, 2004

Summary

Previous environmental investigations at the former Atlantic Fleet Weapons Training Facility (Facility) located on eastern Vieques, Puerto Rico have identified several sites as potential sources of environmental contamination. These sites were further investigated by collecting soil samples and analyzing the soil samples for the RCRA Appendix IX list of constituents. The investigations have detected inorganic concentrations in the surface and subsurface soils that exceed EPA Region IX Preliminary Remediation Goals (PRGs) which are utilized as initial screening criteria to assess if constituents detected at a site exceed the screening criteria protective of human and ecological receptors. The inorganic constituents that have been detected above PRGs have also been found to occur naturally in the soils of Vieques, as indicated in the Background Investigation For The Former NASD Facility (CH2MHILL, 2002). A Background Investigation Work Plan for eastern Vieques has been prepared by the Navy (CH2MHILL, 2004) and comments have been received from EPA, PR EQB, NOAA and DOI (EPA, 2004). A meeting was held in EPA Region 2 office on September 28, 2004 to discuss the comments from the agencies.

This memorandum addresses some of the key comments on the draft Work Plan and presents a technical approach for completing the background investigation on eastern Vieques. The main goal of the Background Investigation is to collect sufficient data to be able to differentiate whether the inorganic constituent concentrations detected in soils at the environmental sites on east Vieques are attributable to site-specific activities or are from Facility-wide background concentrations of inorganic constituents. The proposed background investigation will meet the following objectives:

1. Collect surface and subsurface soil samples within the areas of eastern Vieques not likely impacted from military activities and analyze the samples for inorganic constituents to determine the Facility-Wide background concentrations of inorganic constituents within the surface and subsurface soils.

2. Conduct a statistical analysis of the inorganic constituents to estimate the range of the inorganic constituents that occur within the background concentrations. The methods

used to establish the range of background levels will be based on the latest EPA Guidance (EPA 2002a, 2002b). Any levels exceeding this range will be assumed to be site related.

3. Compare the inorganic constituent concentrations detected at a site with the range of the inorganic background concentrations and PRGs to assess the nature and extent of inorganic contamination within the soils. This comparison will be used to: 1) determine if contamination is present at a site, and 2) delineate the extent of contamination to assess if additional investigations are needed.

4. If contamination is determined to be present at a site, a quantitative risk assessment will be conducted to assess the risks for the constituents that are detected above PRGs, including those constituents that are within the range of background concentrations. If unacceptable risk levels for inorganic constituents are identified in the quantitative risk assessment the inorganic constituents will be compared to the range of background concentrations to assess whether the risk is attributed to site related contamination or Facility-wide background levels. Following EPA and Navy Guidance (EPA 2002a, 2002b, Navy 1999) additional evaluations may include:

    - Graphical procedures such as box plots to determine if the site and background levels have similar distributions,
    - Comparison of the means of the site and background through Wilcoxon Ranksum test (WRS) and other EPA recommended procedures to determine if site inorganic levels are significantly different from background, and
    - Geochemical evaluations of constituents to assess if geochemical processes contribute to elevated inorganic concentrations.

Based on these evaluations, a risk management decision will be made to assess if any additional investigations or remedial actions are recommended for a site.

Media To Be Sampled

This Background Investigation will address only inorganic constituent concentrations in surface and subsurface soils, and will be conducted on a Facility-wide basis. Background data for other media (e.g. groundwater, surface water, or sediment) may be necessary and will be collected on a site-specific basis.

Some comments on the Work Plan requested that background surface water and sediment samples be collected. The need for collection of background surface water and sediment samples will be evaluated on a site-specific basis. Most of the identified environmental sites, where contamination has been detected, are generally not located in the close proximity to surface water bodies or sediment. As a result, no surface water or sediment samples have been collected to date at eastern Vieques. Should future sampling indicate there has been a release from the site and the contamination has migrated through the groundwater or soils to a surface water body, surface water and sediment sample locations will be proposed for regulatory consideration.

Groundwater Assessment

Although background groundwater data will not be collected as part of the Background Investigation, a brief description of background groundwater data collection is provided here.

Background inorganic constituent concentrations will be evaluated on a site-specific basis during the RFI or RI through the installation of site-specific upgradient well(s). During the RFI or RI a statistical comparison of upgradient versus downgradient groundwater conditions will be conducted. Should the downgradient well data show a statistically significant increase when compared to the upgradient data then the downgradient data will be considered to be site-related, unless there are other data that can demonstrate this is not the case, as discussed below.

By following the above protocol, the statistical analysis of upgradient versus downgradient groundwater quality may be skewed due to the greater number of downgradient wells than upgradient wells. Should the upgradient background levels be exceeded, and the exceedances be qualitatively assessed as non-site related (e.g. historical information suggests particular inorganics are not site-related), additional data may be evaluated to further assess whether the downgradient water quality data are representative of background conditions. Other data to be considered may include one or more of the following: 1) data collected from other wells at the Facility that have not been impacted by site activities, and are screened within the same water bearing formation; 2) the data from additional samples of the upgradient well(s); 3) data from the installation of additional upgradient well(s); 4) comparison of the filtered and unfiltered data of the upgradient and downgradient wells; and 5) identification of geochemical differences between the upgradient and downgradient wells. The appropriate evaluation will selected on a site-specific basis.

Depth Of Soil Sample Collection

At each of the proposed soil sample locations, surface soils will be collected at a depth of 0 to 6 inches and 4 to 6 feet. These depths are consistent with the depths of the site-specific soil samples collected during the Phase I RCRA Facility Investigation, which is appropriate for making comparisons between site-related and background concentrations. The Background Investigation for western Vieques determined there was no statistically significant difference between the inorganic constituent concentrations in the surface and subsurface soils. Therefore, the soils from the depth of 0 to 6 feet are assumed to have the same composition. As a result, the surface and subsurface soils data were combined to establish the background inorganic concentrations. Should the statistical analysis of the eastern Vieques provide the same conclusion, the surface and subsurface data will be combined for statistical analysis. However, should there be a statistically significant difference between the 0-to-6 inch and 4-to-6 foot samples, the two soil groups would remain separate and the need for collecting additional background soil samples will be re-evaluated.

Analytical Protocol

The inorganic analyses of the soil samples collected for the RFI were analyzed for RCRA Appendix IX inorganic constituents using SW-846 methods. This RCRA list of inorganic constituents is a more limited list than the CERCLA list of Target Analyte List (TAL)

inorganic constituents. With the pending designation of the Facility as a National Priority List (NPL) Site, it is anticipated that the environmental sites will be investigated under the CERCLA program. As a result, to meet the CERCLA Guidance the background soil samples will be analyzed for the CERCLA TAL inorganic constituents.

One of comments on the Work Plan recommended using a more sensitive analytical method for thallium because the previous detections of thallium, many of which were detected below the practical quantitation limit (PQL) , may have been false positives. A review of the more recent data from the RFI showed several thallium detections above the PQLs, indicating thallium is present in the soils on eastern Vieques and the existing analytical method is valid for detecting such concentrations. Another concern in use of a more sensitive analytical method for thallium is that a lower detection limit for thallium would be established for the background samples. As a result, a comparison of the RFI thallium results (with higher detection limits) would result in false exceedances of background levels. Based on this information, the analytical method for thallium proposed in the Work Plan is still proposed.

Results from the Phase I RFI indicated that pesticides are widespread throughout the Facility, indicative of Facility-wide pesticide application for pest-control, and should be considered as part of the Background Investigation. However, it is proposed that the Background Investigation covered by this Work Plan be limited to only those constituents that occur naturally within the soils. As a result, pesticides will be investigated separately on a Facility-wide basis to assess pesticides in the surface soils. Any further actions at a particular RFI or RI site (i.e., additional investigations, remedial actions) associated with elevated levels of pesticides, will be deferred until after the pesticide investigation has been completed. A Work Plan for the Facility-wide pesticide investigation will be prepared following the Background Investigation Work Plan.

Sample Locations

Some comments on the Work Plan requested that the background samples be collected at random locations throughout the Facility. However, there are limitations in collecting random samples. One limitation is that several areas within the facility may have been impacted by environmental sites and munitions response sites. Therefore, random sampling may result in elevated background concentrations based on impacts from potential contamination. Another limitation of random sampling locations is accessibility. Most of the undisturbed areas of the Facility are overgrown with dense scrub vegetation. It would be impractical, destructive, and cost-ineffective to collect background samples from some of these locations. Based on this information, it is proposed that the background samples be collected from random locations within the known undisturbed areas that are accessible (i.e., would not require extensive clearing).

Statistical Analyses

In accordance with EPA Guidance (EPA 2002a,2002b), the data distribution type for the soils analytical results will be determined. This will determine if the data are normal, lognormal, or non-normal in distribution using a theoretical distribution standard. An Upper Tolerance Limit 95% (UTL95%) and an Upper Confidence Limit of the mean at 95% (UCL95%) will be calculated according to the type of distribution identified.

Based on the site-specific inorganic constituent results and the risk assessment findings, further statistical tests will be conducted using the EPA guidance. An example of further statistical analysis includes comparison of site data with background data, using means of the data through WRS test and other EPA recommended tests (EPA 2002b). Additionally, site data will be compared with background data through graphical procedures, and geochemical evaluations (EPA 2002b and Navy 1999).

To assess if any of the soil samples have been potentially impacted by munitions sites or environmental contamination, statistical outlier tests will be conducted using the methods identified in the EPA Guidance (EPA 2002a,2002b). Results that show a value considered as an outlier will be eliminated from consideration as representative of background.

Use of Background data in RFIs and RIs

During the RI or RFI the site specific inorganic constituents data exceeding PRGs will be compared to the range of the inorganic background concentrations and PRGs to assess the nature and extent of inorganic contamination within the soils. This comparison will be used to: 1) determine if contamination is present at a site, and 2) delineate the extent of contamination to assess if additional investigations are needed. Any inorganic constituents detected in soils at levels exceeding the range of the background levels will be considered as site-related contamination. An evaluation will then be made to determine if the extent of contaminants detected has been adequately delineated or if additional site characterization is needed.

Once the nature and extent of the contamination has been defined the risk assessment will be completed for all constituents that exceed the PRGs, including those constituents that are within the range of background concentrations. Background data will not be used to screen out data to select constituents of potential concern (COPCs). Once the risk assessment is completed, any inorganic constituents contributing to unacceptable risks, or with HI values above acceptable criteria, will be compared to the background data. Based on this comparison, risk management decisions will then be made to assess if any further actions (i.e., additional investigations, additional statistical analyses, remedial actions, institutional controls) are recommended to protect human health or the environment.

Plan Of Action.

Following EPA, EQB, NOAA and DOI review of this memorandum, the Navy proposes a conference call be held to discuss the proposed approach for the Background Investigation. Once there is a consensus on the technical approach presented in this memorandum, a revised Background Investigation Work Plan for eastern Vieques will be prepared and submitted for all the agencies to review. Following regulatory approval of the Work Plan and completion of the Background Investigation, an assessment of the nature and extent of contamination for the sites investigated in the Phase I RFI will be completed and a Revised Draft RFI Report will be prepared. In addition, a Work Plan for a Phase II RFI at SWMU 1 will be prepared.

References

CH2MHILL, 2004 *Draft Final Work Plan and Sampling and Analysis Plan Soil and Groundwater Background Investigation Former Atlantic Fleet Weapons Training Facility Vieques, Puerto Rico.*

CH2M HILL. 2002. *Final Soil, Groundwater, Surface Water, and Sediment Background Investigation Report, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico.* October.

EPA. 2002a. *Role of Background in the CERCLA Cleanup Program.* Office of Solid Waste and Emergency Response and Office of Emergency Remedial Response, OSWER 9285.6-07P. April.

EPA. 2002b. *Guidance for Comparing Background and Chemical Concentrations in Soil at CERCLA Sites.* External Review Draft, EPA 540-R-01-003. September.

EPA. 2004. Letter from Mr. Adolph Everett of EPA with comments on *Draft Final Work Plan and Sampling and Analysis Plan Soil and Groundwater Background Investigation Former Atlantic Fleet Weapons Training Facility Vieques, Puerto Rico .*

Navy. 1999. *Handbook for Statistical Analysis of Environmental Background Data,* Prepared by: SWDIV and EFA West, of Naval Facilities Engineering Command, July.

Final - Response to Comments on Draft Background Investigation Work Plan For Eastern Vieques Technical Memorandum

This memorandum compiles the Navy's responses to all comments received on the *Draft Background Investigation Work Plan for Eastern Vieques* Technical Memorandum (Navy/CH2M HILL, October 28, 2004). For ease of review, each comment has been reproduced in **bold type**, followed by the Navy's response.

It is noted here that the *Draft Background Investigation Work Plan for Eastern Vieques* Technical Memorandum (Navy/CH2M HILL, October 28, 2004), hereafter referred to the "October 28 Tech Memo," was intended to clarify the background investigation approach, as discussed during the meeting held in EPA Region 2 office on September 28, 2004, and was not intended to replace the *Draft Final Work Plan and Sampling and Analysis Plan, Soil and Groundwater Background Investigation, Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico* (CH2M HILL, May 19, 2004), hereafter referred to as the Draft Final Work Plan. As such, based on discussions held during the March 8, 2005 Technical Subcommittee Meeting, the Draft Final Work Plan will be revised in accordance with the responses herein (including removal of groundwater as a media and organics as analytical parameters from the background investigation) and submitted as final, rather than re-submittal of a revised Technical Memorandum. The final work plan will be entitled *Final Work Plan and Sampling and Analysis Plan, Soil Background Investigation, Former Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico*, hereafter referred to as the Final Work Plan.

Environmental Protection Agency (EPA) Comments

1) **While the original intent of the Navy's background investigation proposal was to address the issue of whether or not exceedances of generic risk-based concentration (RBCs) values, such as the EPA Region IX "preliminary remediation goals" (PRGs), indicate a release of hazardous waste and/or hazardous constituents, is present at certain of the investigated SWMUs and AOCs, many commentors have recommended that the proposal be expanded to include a comprehensive screening of ambient background conditions in all environmental media, not just for soils and groundwater, as currently proposed. The Agency recommends that a separate proposal for establishing the ambient background conditions for media other than soil and groundwater be deferred until after the AFWTF facility is listed on the National Priorities List (NPL).**

   The Navy wishes to clarify that the October 28 Tech Memo pertains to only background soil. The Navy concurs that evaluation of background conditions for other media (e.g., groundwater, sediment, and surface water) be deferred until a later date, and evaluated on a site-specific and as-needed basis, as noted in the October 28 Tech Memo. The site-specific approach for background investigations for these other media will be incorporated, as necessary, into work plans developed for RFI/RI investigations at specific AOCs/SWMUs.

2) **Since the scope of the current work plan is focused on determining whether or not a release of hazardous wastes and/or hazardous constituents has occurred at certain of the investigated SWMUs and AOCs, and not on establishing ambient background conditions in all environmental media, it should be entitled "Supplemental RFI Investigation Work Plan", rather than Background Investigation Plan.**

The Navy wishes to clarify that the scope of work described in the October 28 Tech Memo does not include determination of whether there have been releases of hazardous waste/hazardous constituents at SWMUs/AOCs. Rather, its purpose is to establish a set of data that is representative of background soil inorganics data at the facility. As such, the Navy purports that it is appropriately entitled a background investigation, recognizing that the background soil data will be used to help differentiate site-related inorganic constituent levels from background inorganic constituent levels.

3) **Also, the revised work plan should make clear that if a release of hazardous waste or hazardous constituents exceeding generic RBCs and natural background concentrations is determined to exist at any of those SWMUs or AOCs based on the results of that "Supplemental RFI Investigation Work Plan", then additional work will be required at those SWMUs and AOCs. Pursuant to Section VI.B.7 of the Order, such work could include development of:**

A) **a "Full RFI Work Plan" to characterize: a) the potential pathways of contaminant migration; b) the source(s) of contamination; c) the degree and extent of contamination; and d) identify actual or potential human and/or ecological receptors and assess the risk to such receptors; and**

B) **implementation of site-specific risk evaluations to determine whether or not the indicated releases pose unacceptable risks to human health and/or the environment.**

The Navy wishes to note that the comment above is not consistent with Consolidated Comment #1 below, which defines a process for assessing potential risks associated with site constituent concentrations that is independent of background concentrations. For site-specific risk assessments, comparison to background inorganics concentrations will be conducted after the quantitative risk assessment is completed, and background inorganics data will not be considered when selecting constituents for quantitative risk assessment. Following quantitative risk assessment, the background soil inorganics comparison will be conducted in accordance with *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (EPA, September 2002)) and others, as applicable, cited in Section 3 of the Draft Final Work Plan, and included in the risk assessment discussions and recommendations. Where site-specific inorganics concentrations are found to represent an unacceptable level of potential risk, and are found to be statistically higher than background inorganics concentrations as defined by EPA (September 2002), additional characterization, controls, or corrective action will be proposed. See Figures 1 and 2 (attached) for the decision analysis regarding the use of site-specific and background data.

Consolidated Comments

1) **Any comparison of concentrations measured at specific solid waste management units (SWMUs) and areas of concern (AOCs) or other "sites" to background concentrations must be done independent of the human health risk assessment (HHRA). In the HHRA process, chemical concentrations are first screened against generic risk-based concentrations (RBCs). When there is an exceedance of the RBCs, the chemical is then carried into the quantitative risk assessment process. Comparison of concentrations at specific SWMUs/AOCs to background concentrations should be done after the HHRA, as part of risk management decisions, not before. The language in the workplan October 28 Technical Memorandum and the resultant work plan must be revised to more clearly state this process. (Also see comments number 8 and 14 below regarding the need to also evaluate whether or not unacceptable ecological impacts are posed).**

   With respect to the use of the background soil inorganics data as part of risk management decisions, the Navy concurs with the approach as described above. The use of site and background data, as part of the data flow process, is presented in Figures 1 and 2, attached to this memorandum.

2) **The background sampling as proposed is to develop a data set for inorganic constituents in surface and subsurface soils. As discussed above, if unacceptable human health risk is indicated at a SWMU or AOC due to measured inorganic constituents in the surface or subsurface soils, the entire background data set for those soils (surface and subsurface) should then be compared to the data set for soil samples collected at that SWMU/AOC. If no statistically significant difference is observed between the concentrations of naturally occurring inorganic constituents measured in the data set at the individual SWMUs/AOCs and the entire background data set, then no release of those inorganic constituents is indicated.**

   It is the Navy's understanding that Region II does not combine surface soil data and subsurface soil data for the residential exposure scenario; rather, this scenario utilizes only surface soil for estimating potential risk. Based on this understanding, only the background surface soil data would be used in this comparison, unless the background surface soil data and subsurface soil data are statistically comparable, in which case they would be combined to generate a comprehensive background soil dataset for both surface and subsurface soil.

   In addition to the above, combining surface and subsurface soil data can be done for the construction worker scenario, in which case the background surface and subsurface soil data would be combined for comparison.

3) **The Navy' rationale for not wishing to use a more sensitive method detection limit for thallium is that this will result in data that cannot be combined with existing SWMU/AOC data for thallium. In fact, due to some of the SWMU/AOC sample results for thallium exceeding the thallium risk-based concentration level, the Navy should now use a more sensitive analytical method to fully define the natural thallium background concentrations. If the thallium detection limits for the background samples also exceed the corresponding PRG concentration, any**

thallium background non-detect data may not be used to eliminate thallium as a constituent of concern at the SWMUs/AOCs. Whereas if the more sensitive detection levels are used in background and the data set confirms that the natural thallium background is above the PRG level, then at SWMUs/AOCs where non-detection of thallium were previously recorded using elevated detection levels, we can assume there are no thallium releases.

The methodology for thallium analysis proposed in the Draft Final Work Plan is SW-846 Method 6010B. This method is capable of achieving method detection limits (MDLs) that are below the adjusted PRG (i.e., 0.516 mg/kg), but may not be capable of achieving reporting limits (RLs) below the adjusted PRG. Although the MDL for all of the data analyzed as part of the RFI process has been below the adjusted PRG, the data collected in June 2000 were reported to the RL, which was above the adjusted PRG. All other RFI data were reported down to the MDL, which, as noted above, was below the adjusted PRG.

For the June 2000 data, it is recommended that the analytical laboratory revise the Form Is to report down to the MDL. This will either confirm non-detect data at the MDL (rather than the RL) or report detected concentrations that are below the adjusted PRG. In this way, all historic RFI data will be reported to MDLs that are below the adjusted PRG.

Based on the above information, it is proposed that future thallium analyses be accomplished using SW-846 Method 7814, Thallium, Atomic Absorption Furnace technique (GFAA). The GFAA analysis will be able to provide RLs that are consistently at or below the adjusted PRG. In addition, the original SW- 846 analytical method will be continue to be performed on the samples to ensure any statistical comparisons of site data to background data will utilize consistent analytical methodologies, if necessary.

4) **The October 28 Technical Memorandum should indicate the general areas where background samples are expected to be collected.**

As noted above, the intent of the October 28 Tech Memo was to clarify the background investigation approach, not to replace Draft Final Work Plan. Proposed background soil sample locations are presented in Figures 2-4 and 2-5 of the Draft Final Work Plan. Note that the proposed background groundwater sampling locations will be removed in the revised figures for the Final Work Plan. Further, actual sample locations will be concurred upon during a site visit with the agencies.

5) **Please clarify when the "further statistical tests" will be run on the soil data set, and how the results of the statistical tests will be utilized. Please also expand the discussion of the usage of geochemical evaluations.**

The use of statistical tests is the same as that described in Section 3 of the Draft Final Work Plan. As an initial evaluation, and as agreed upon for the background investigation on western Vieques, point-to-point comparisons will be made utilizing the 95% UTL value of the background concentrations. Determination of applicable statistical tests will be made once the background data have been collected, and the tests will be conducted in accordance with the EPA and Navy guidance cited in

Section 3 of the Draft Final Work Plan. *The Guidance for Environmental Background Analysis, Volume I: Soil* (Naval Facilities Engineering Command, April 2002) will be added to the guidance referenced.

Application of statistical testing in accordance with EPA and Navy guidance is warranted even if the datasets (background and site-specific) are not entirely random. It is common practice to utilize judgmental sampling for environmental investigations. This practice, by design, is intended to identify and differentiate contaminated areas from uncontaminated areas. Specifically, site-specific sampling points are generally targeted to areas of known or suspected contamination, rather than areas known or suspected to be uncontaminated. Thus, a dataset for a given environmental site is likely biased high with respect to distribution and concentrations of constituents. Again, this is a common practice because it provides for a conservative estimate of potential risks.

With the understanding of what bias may exist for a dataset, use of statistical methods for comparison with background is generally warranted. For example, for typical environmental datasets (i.e., biased toward contaminated areas), statistical comparison to background data is warranted because this dataset will likely contain higher concentrations of constituents than a random dataset from the same site. In this case, a conservative estimate (i.e., more protective) of whether site concentrations are within background is produced. For any statistical or other comparative test performed, the rationale for and applicability of its use, as well as any qualifications, will be presented with the results.

Comparative geochemical and geotechnical evaluations that may be utilized include elemental ratio comparisons between background and site-specific constituents, comparison of soil characterization and classification, and comparison of other geochemical parameters (e.g., redox, pH, cation exchange capacity, TOC). This information will be added to the revised Work Plan.

6) **The October 28 Technical Memorandum suggests that for groundwater, instead of establishing a regional background data set, site specific (i.e., SWMU/AOC specific) up gradient wells will be compared to downgradient wells using statistics. One a site-specific basis, only one or a few wells are installed to evaluate background groundwater quality for any given SWMU/AOC; therefore, it seems that the dataset will be limited. Please clarify what methods will be used to statistically analyze up gradient versus on-site groundwater quality. In addition to the guidance you cite, please also consult the EPA guidance *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities* (EPA/530-SW-89-026) to determine is usage of the statistical procedures discussed in that guidance are applicable here.**

As agreed to during the September 28, 2004 meeting at EPA Region 2, groundwater is to be eliminated from this background investigation.

7) **Eliminating detected constituents as potential constituents of concern (PCOCs) based only on knowledge of site activities is not appropriate. It is not uncommon for the use or release of contaminants to have occurred, yet there is no**

documentation that the contaminant was ever utilized in conjunction with past site activities.

The intent is not to eliminate constituents as COPCs solely by consideration of historical activities, and neither the October 28 Tech Memo nor the Draft Final Work Plan suggest this. However, historical activities are factors that may be considered when evaluating constituents identified and making risk management recommendations for the SWMUs.

8) **The Technical Memorandum and Background Work Plan must more clearly define what types of "quantitative risk assessment" will be conducted if contamination is found to be present at a SWMU/AOC site. Under both RCRA corrective action requirements and Superfund any final actions must evaluate whether or not there are unacceptable risks to both humans health and/or the environment.**

As noted above, the purpose of the background investigation is to establish a set of data that is representative of background soil inorganics data at the facility. No risk assessments will be conducted as part of the background investigation. Risk assessments will be/have been conducted for individual SWMUs/AOCs, as appropriate and in accordance with risk assessment protocol identified in their respective work plans.

9) **Some of the SWMs/AOCs being addressed under the RCRA Order are located along or in close proximity to drainage areas and/or the shoreline. As part of any final decision regarding the SWMUs/AOCs being addressed under the RCRA Order, the Navy should assess whether surface runoff pathways from those SWMUs/AOCs are present and if they represent potentially complete pathways for releases from the SWMUs/AOCs to impact to the coastal lagoons and mangrove swamp areas. As part of the revised Background Investigation Work Plan, the Navy should include an evaluation of whether surface runoff pathways from the SWMUs/AOCs being addressed under the RCRA Order are present and whether those represent potentially complete pathways for releases from the SWMUs/AOCs to impact to the coastal lagoons and mangrove swamp areas. If potentially complete runoff pathways are present, the revised Background Sampling Plan should include a discussion of whether sampling of sediment and surface water should be conducted, and a separate sampling plan for surface water and sediments needs to be developed that will indicate how surface water and sediments background sites will be determined, the proposed sampling and analytical methods, and the relevant screening criteria to be used. Also, the June 2004 *Draft Phase I RFI Final Report* (and possibly the February 2001 *Description of Current Conditions Report*) may need to be revised to indicate where surface runoff pathways from investigated SWMUs/AOCs represent potentially complete pathways for impacts to coastal lagoons and mangrove swamps.**

As noted in the response to EPA Comment #2, the purpose of the background investigation is to establish a set of data that is representative of background soil inorganics concentrations at the facility, not to make determinations of whether there have been releases of hazardous waste/hazardous constituents at SWMUs/AOCs. Separate investigations have been/will be conducted for individual SWMUs/AOCs

to evaluate whether site-specific releases have occurred. During these investigations, conceptual models are developed. If potential pathways are identified for release to surface water/sediment bodies, then sampling will be proposed in site-specific work plans to appropriately evaluate these pathways.

10) **Several commenters have expressed concern with the proposed background soil sampling data set being used to eliminate from further evaluation certain Potential Areas of Concern (PAOCs) or Photo Identified (PIs) sites, as is indicated in the June 2004 *Draft Phase I RFI Report*. While the October 28 technical Memorandum states that sediment and surface water sampling may be necessary and will be collected on a site specific basis, there seems to be no commitment to do so at the present time. In fact the October 28 Technical Memorandum states that most of the environmental sites are not located in close proximity to surface water or sediments. Please clarify if that statement is only made with regard to the 12 SWMU and AOCs required investigated under the RCRA Order, though that is clearly not the case for SWMU 2, the Fuels Off-loading site. In fact, many of the PAOC and PI sites identified since the RCRA Order took effect, as well as much of the live impact are (LIA), are adjacent to, or located in a wetland or water body. Although not part of the current Background Investigation proposal, as part of the future work, sediment sampling may be required for many of these sites.**

Please see response to Consolidated Comment #9. The Navy understands that surface water/sediment sampling may be appropriate at sites that are located adjacent to surface water bodies. Background and site-specific surface water and sediment sampling locations will be included, as appropriate, in work plans developed for those sites. The data collected during the soil background investigation will not be used to make these determinations.

11) **In addition, although not part of the current Background Investigation proposal, if coastal lagoon and mangrove swamp sediment and surface water samples are proposed for investigation, EPA recommends that in order to determine if impacts to coastal lagoon and mangrove swamp are SWMU/AOC related, upstream locations along the identified surface runoff pathways should also be considered for sampling.**

As noted in response to Consolidated Comments #9 and #10, site-specific sampling will be designed to adequately assess potential pathways identified in conceptual models for specific sites. If surface water/sediment are determined to represent a potential pathway, sediment/surface water sampling will be proposed, as appropriate.

12) **To be consistent with future CERCLA procedures, background soil and groundwater samples should undergo a full TCL and TAL analysis (as opposed to the Appendix IX list of 40 CFR § 264).**

The Navy concurs with this approach of analyzing data using CERCLA procedures. Given that this background investigation is for only inorganics in soils, all samples will be analyzed for TAL inorganics, which is what is stated in the October 28 Tech Memo. In addition, soil samples will be analyzed for thallium using SW-846 Method

7814, Thallium, Atomic Absorption Furnace technique (GFAA). The Draft Final Work Plan will be revised to reflect this.

13) **Although not part of the current Background Investigation proposal, if collected, sediment samples should undergo grain size and TOC evaluations, and for surface water samples, the hardness should be measured.**

If surface water/sediment sampling is deemed necessary for particular sites, the associated work plan(s) will propose the particular analytical protocol and associated rationale. If the parameters suggested above assist in evaluating potential releases, making background comparisons, and/or making risk management decisions, they will be included.

14) **Since the purpose of the National Wildlife Refuge System is for the conservation, management and restoration of fish and wildlife resources and their habitats, both the EPA Region 9 Preliminary Remediation Goals (PRG) for human health and appropriate Ecological Screening levels should be cited for all data comparison for data from the Vieques National Wildlife Refuge. The following is a list of recommended soil screening criteria, along with the source of the list, and the web address for accessing them:**

USEPA:

Ecological Soil Screening Level (Eco-SSL) Guidance and Documents
www.epa.gov/oerrpage/superfund/programs/risk/ecorisk/ecossl.htm

Oak Ridge National Laboratory:

R. Efroymson, M. Will, and G. Suter II. 1997. Toxicological Benchmarks for Contaminants of potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: Oak Ridge National Laboratory, Oak Ridge TN. ES/ER/TM-126/R2.
http://www.esd.ornl.gov/programs/ecorisk/benchmark_reports.html

R. Efroymson, M. Will, G. Suter II, and A. Wooten. 1997. Toxicological Benchmarks for Screening contaminants of Potential concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-85/R3
http://www.esd.ornl.gov/programs/ecorisk/benchmark_reports.html

Canada

Canadian Environmental Quality Guidelines, Environment Canada
www.ec.gc.ca/ceqg-rcqe/

The Netherlands:

T. Crommentuijn, M Polder, and E. van de Plasshe. 1997. Maximum Permissible Concentrations and Negligible Concentrations for Metals, Taking Background Concentrations into Account. Nat. Inst. Public Health and the Environ., Bilthoven, The Netherlands. RIVM Report 601501 001.

http://www.rivm.nl/bibliotheek/rapporten/601501001.html

As noted previously, the intent of this background study is not to make determinations of potential releases at specific sites. Comparisons to site-specific data and determinations of potential releases will be made in site-specific reports, during which appropriate risk-based criteria will be utilized. These criteria are/will be proposed in site-specific work plans.

15.) **In selecting the proposed background sample location, accessibility to a site should not be a selection criterion. Much of the dense scrub and vegetation may be mesquite or other such invasive exotic species, and the Fish & Wildlife Service (F&WS) may not be opposed to clearing those invasive exotic species for an access road and area for sample collection. However, prior to any such clearance, vegetation would need to be evaluated by a qualified individual prior to clearing. Given the current F&WS Refuge workload, the F&WS has indicated that the Navy consider contracting or hiring a site biologist for all future actions on Vieques.**

The purpose of the background sampling program is to provide sufficient data to establish representative background concentration data for inorganics that occur throughout the former Atlantic Fleet Weapons Training Facility, but that are not indicative of contaminants resulting from releases at a particular site. Here, "representative" means a sample set that is typical of the population being sampled.

With the selection of a background data set, choosing locations requires screening out areas of suspected release and identifying the physical characteristics of the chosen background locations relative to those of the investigative areas. It is important to emphasize that the background sample locations need to be chosen to be representative of the target population (i.e., background in this case), which does not require an indiscriminate form of randomness be applied to identifying the locations.

In identifying these representative locations, areas of potential environmental or munitions related contamination have been screened out. Within the remaining area, locations have been proposed that are outside known or suspected areas of influence by human activity, but are also economically accessible.

The validity of the background locations will be reinforced by invited review of the proposed sample locations by EPA, PREQB, and DOI prior to sample collection and by documentation of the geologic units and other physical characteristics of sample locations. All proposed background sample locations will be a minimum of 100 feet away from roads in undisturbed areas of vegetation and away from mowed and maintained areas to minimize the potential to detect constituent concentrations resulting from vehicular traffic along the roadways. Figures 2-4 and 2-5 of the Draft Final Work Plan will be revised, as necessary, to ensure meeting the criteria discussed in this response. Further, actual sample locations will be concurred upon during a site visit with the agencies.

16.) **If the selected background sampling areas that are currently accessible (i.e. easy to walk into), are suspect of recent anthropogenic disturbance and may not represent "natural" conditions. We recommend that a large suite of potential sample**

locations be identified, and then be visually screened to confirm there are no visual signs of anthropogenic impacts. The final sample locations can then be randomly selected from the suite of sites exhibiting no visual signs of anthropogenic impacts.

The Draft Final Work Plan discusses the approach to select background soil locations. As noted above, it states that the proposed locations will be a minimum of 100 feet away from roads in vegetation, and away from mowed and maintained areas to prevent detection of potential contamination resulting from vehicular traffic along the roadways. It also states that in order to obtain concurrence on background sample locations among the technical stakeholders, a site visit is proposed for the technical representatives from the Navy, EPA, DOI, and PREQB to inspect the 29 proposed soil sample locations. Figures 2-4 and 2-5 will be revised to include several contingency locations that may be used if visual inspection during the site visit identifies potential anthropogenic impacts at any of the proposed locations.

17.) **At the September 28, 2004 meeting is was generally accepted that the analysis of explosives, pesticides and/or most organic constituents in the background investigations was not appropriate since those parameters could not be considered to be natural occurring concentrations. However, measuring the concentrations of such parameters in the background samples could be useful in determining whether or not the soils at a background site are impacted waste or munitions related releases. If explosives, pesticides, and organic constituents are confirmed to <u>not</u> be present in a background sample, that would provide evidence that the background sample location has not impacted by releases, i.e., that it is representative of natural conditions.**

Considerable discussion has taken place with respect to the analytical protocol for background sampling. Until concurrence is reached regarding how non-inorganics data can be considered with respect to background, it is proposed that the background investigation be limited to inorganics, as agreed to during the September 2004 meeting. In addition, both the October 28 Tech Memo and the Draft Final Work Plan state that to assess if any of the soil samples have been potentially impacted by munitions sites or environmental contamination, statistical outlier tests will be conducted using the methods identified in EPA Guidance. Results that are statistically shown to be outliers will be eliminated from consideration as representative of background.

18.) **It is important to be able to relocate the background sampling locations after they had been sampled. The work plan should include a discussion of how the coordinates of the background sample locations will be determined (either be surveyed or GPS coordinates) and recorded.**

GPS surveying will be utilized to locate each background sampling point, unless vegetation obscures the satellite signal. In this case, a licensed surveyor will be contracted to survey those locations where GPS surveying is unsuccessful. The Draft Final Work Plan will be revised to reflect this information.

19.) **It is important to have procedures to adequately describe the background soil boring in terms of soil characteristics (i.e. color, grain type, soil horizon, presence**

of fill, evidence of contamination, odors). Also, it is important to have procedures to adequately describe the relationship between the soil sample locations and potential contaminant sources such as roads, buildings, drainage ditches, photo identified sites. The work plan should include a discussion of how both types of information will be gathered and recorded.

Standard Operating Procedures for describing soil characteristics are contained in Attachment 2 - Standard Operating Procedures, SOP Logging of Soil Borings – Page 4.5-1 through 4.5-6 of the *Final Master Work Plan, Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico* (CH2M HILL, June 12, 2003). These Standard Operating Procedures are referenced in Section 4.1.2.1 of the Draft Final Work Plan

Pertinent information such as the relationship between soil sample locations and potential contaminant sources such as roads, buildings, drainage ditches, photo identified sites are recorded on each boring log. This clarification will be added to Section 4.1.2.1 of the Draft Final Work Plan.

20.) **All background soil samples should be evaluated for Total Organic Carbon and pH. This data may be needed to assist in subsequent fate and transport assessments.**

As noted in the response to Comment #5, pH and TOC will be added to the background soil analytical protocol.

21.) **The work plan must include an acceptable QA/QC program to confirm the validity of the background analytical data.**

The Navy concurs with this comment. As stated in Section 4 of the Draft Final Work Plan, the approved Master Quality Assurance Project Plan, which is contained within the *Final Master Work Plan, Atlantic Fleet Weapons Training Facility, Vieques, Puerto Rico* (CH2M HILL, June 12, 2003), will be followed during the background study investigation.

22.) **The Statistical Analysis section of the Technical Memorandum indicates that background samples may inadvertently be collected from areas which have been impacted by past waste and/or munitions activities. If elevated concentrations in background samples are to be eliminated from the background data set if identified as outliers resulting from past waste and/or munitions activities, the Technical Memorandum and Background Work Plan should include a discussion of what actions would be triggers to assess if such outlier locations found in the background data set are the result of past waste or munitions-related releases.**

The Draft Final Work Plan will be revised to state that a discussion of outliers will be included in the background investigation report. The discussion will identify and discuss all outliers. For outliers that are found not to indicate natural innate variability (through statistical analysis per EPA guidance), recommendations will be made regarding the need for additional evaluation of area(s) where samples containing the outlier data were collected.