Section 3
MAPS

The maps on the following pages present the site location at MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and proposed Phase II sampling locations (where known). These maps are referenced in other sections of this FSP.

The proposed Phase II sampling locations presented on these maps are intended to illustrate the type of sampling strategy proposed for each unit. Other considerations (e.g., randomly selected starting points, underground utilities/pipelines, or overhead obstacles) could result in adjustments to sampling locations. The actual field sample locations will be accurately recorded by field personnel relative to surveyed coordinates, and if any sampling points require relocation, the reason for such changes will be described in the field notebook.

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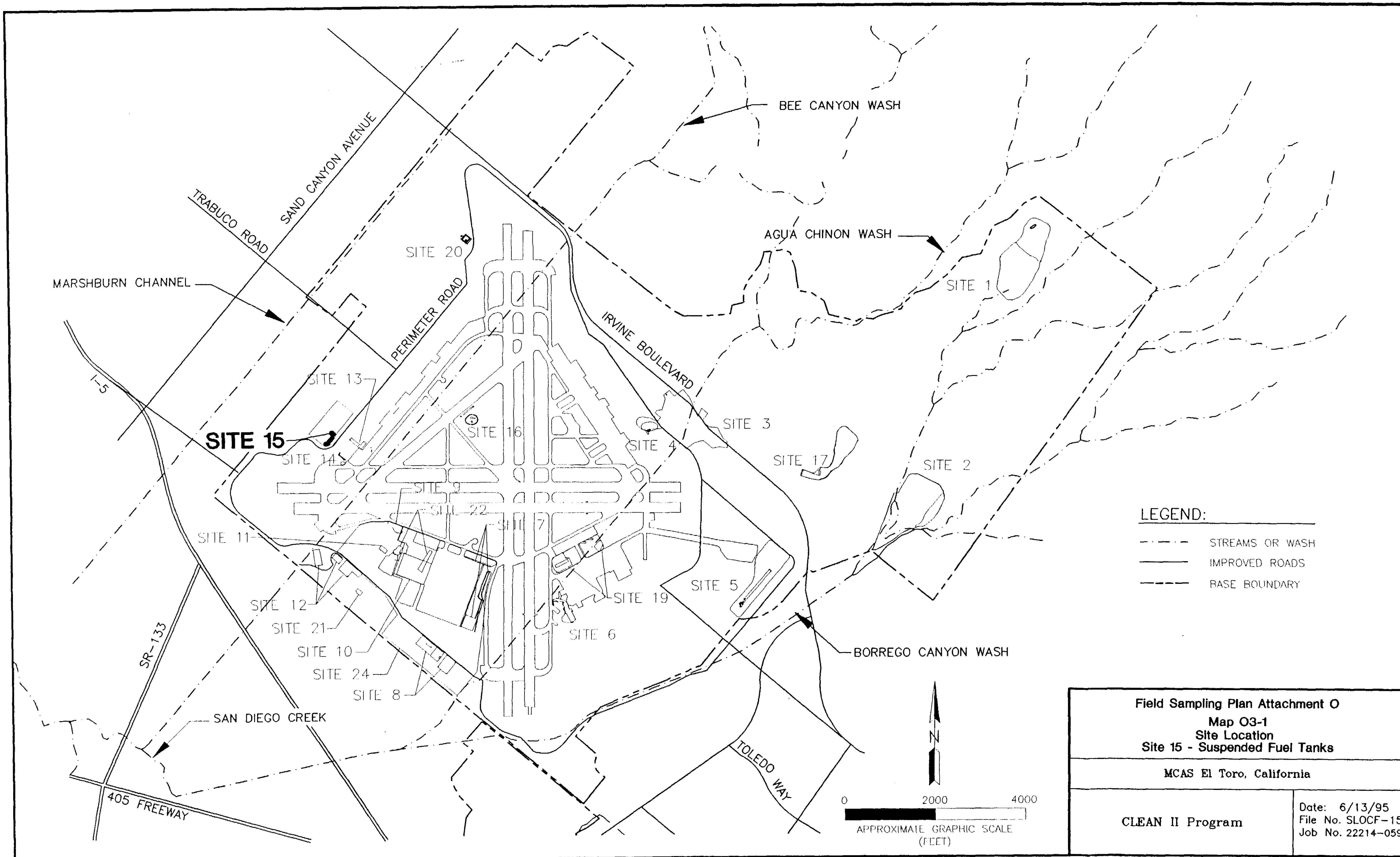

Field Sampling Plan Attachment O

Map O3-1
Site Location
Site 15 - Suspended Fuel Tanks

MCAS El Toro, California

CLEAN II Program

Date: 6/13/95
File No. SLOCF-15
Job No. 22214-059

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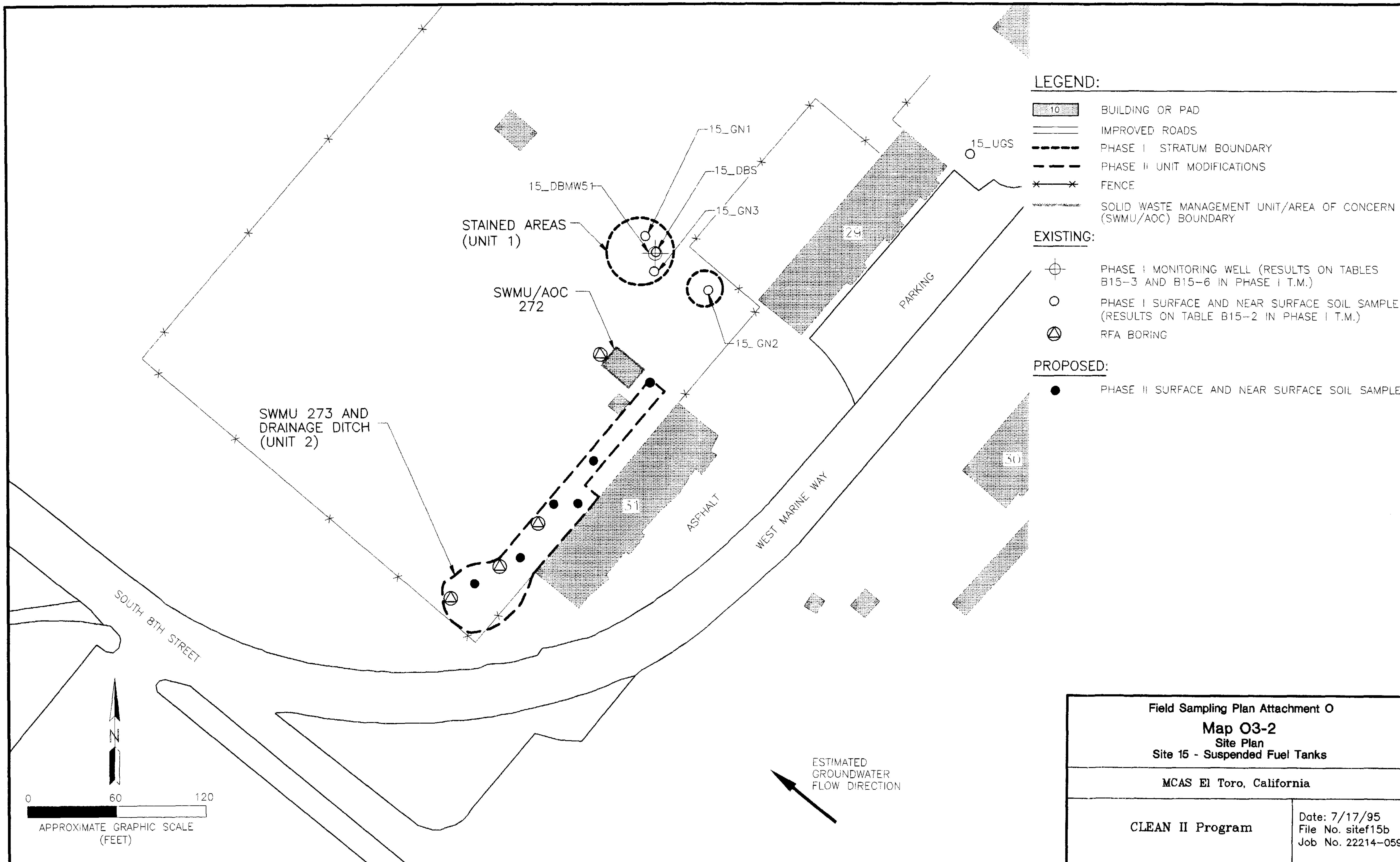

Field Sampling Plan Attachment O

Map O3-2
Site Plan
Site 15 - Suspended Fuel Tanks

MCAS El Toro, California

CLEAN II Program

Date: 7/17/95
File No. sitef15b
Job No. 22214-059

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

This section explains the rationale for the number of sampling programs, types of samples, locations of samples, and analytical parameters. The rationale for sampling is based on site conditions, previous investigations, and data quality objectives as presented in the appendices of the Phase II RI/FS Work Plan (BNI 1995a).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, types of samples, and locations are presented based on the smallest area of study. For some sites, the smallest area of study is a site unit; for other sites, the area of study may be the entire site. Selection of sampling programs, sample types, and locations is based on:

- site activities and history;
- types of media suspected or known to be impacted from previous investigations;
- objectives of site-specific RI/FS efforts; and
- site-specific initial surveys.

For the Phase II RI/FS investigation, Site 15 will be represented by two areas (units):

- Unit 1: Suspended Fuel Tanks (comprises the same area as Stratum 1 in the Phase I RI, which is the area beneath the two former elevated fuel tanks); and
- Unit 2: Drainage Area (has been created to include a drainage area that may have received surface drainage from the hazardous waste storage area behind Building 31 [solid waste management unit/area of concern (SWMU/AOC 273)]).

The units will be sampled using a tiered sampling approach, as discussed in the following sections. Previous site activities, Phase I RI sampling results, and regulatory comments were used to formulate the Phase II RI/FS sampling approach. During the Phase I RI, soil samples were collected from the stratum, and COPCs were identified and evaluated against PRGs. Phase II RI/FS sampling locations in all units have been positioned in locations to collect data to estimate or refine risk estimates for the units.

4.2 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk to human health or the environment. The Tier 1 sampling approach will consist of collecting shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed, such that, when the Phase I and II RI/FS data are evaluated together a risk can be estimated for the unit. An explanation of the proposed sampling designs for Tier 1 soil sampling can be found in Section 4 of the Phase II RI/FS Work Plan (BNI 1995a).

4.2.1 Unit 1: Suspended Fuel Tanks Area

Unit 1 has been approved for Early Action and is being addressed through the Non-Time Critical Removal Action process. An Engineering Evaluation/Cost Analysis has been prepared for this unit.

4.2.2 Unit 2: Drainage Area (SWMU/AOC 273)

Unit 2 (SWMU/AOC 273) is the area where surface drainage may have collected from hazardous waste storage behind Building 31.

4.2.2.1 SOIL SAMPLES

For the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at six areal systematic random sampling locations based on a grid spacing of 58 by 13 feet (Map O3-2).

4.3 TIER 2

The Tier 2 sampling program will also focus exclusively on shallow soil (0 to 10 feet) conditions. The primary objective of this program will be to refine the data on the extent of shallow soil contamination identified during the Tier 1 sampling. Tier 2 sample locations will be based on these sample results. The process by which the Tier 2 sample locations will be selected is detailed in Appendix O of the Phase II RI/FS Work Plan (BNI 1995a).

4.4 TIER 3

The objective of a Tier 3 soil sampling program is to estimate the extent of a contaminant plume in deeper subsurface soils. To accomplish this goal, a series of boreholes will be drilled and sampled. The location of Tier 3 boreholes is intended to minimize the number of boreholes required to define the lateral and vertical extent of the contaminant plume in deeper subsurface soils. Groundwater samples will be collected only when a contaminant plume in deeper subsurface soils has been traced (through a drilling and soil sampling program) downward to the water table. At such units/sites, the objectives of the sampling program must then be expanded to include a determination of whether groundwater has been adversely impacted as a result of the historic activities at the unit/site.

The process by which the locations for Tier 3 soil borings and monitoring wells will be selected is detailed in Appendix O of the Phase II RI/FS Work Plan (BNI 1995a).

Section 5
REQUEST FOR ANALYSES

Requests for analyses are based on:

- site activities and history,
- results of previous investigations, and
- objectives of site-specific RI/FS efforts.

The analytical methods referenced in this section are from the Phase II RI/FS Quality Assurance Project Plan (QAPP) (BNI 1995b). Section 6 in the QAPP specifies the number and/or frequency for collection of field duplicate and blank samples during the Phase II RI/FS field activities.

5.1 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk. The Tier 1 sampling approach will consist of collecting shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. Table O5-1 lists all soil samples and associated analyses for the Units in Site 15.

5.1.1 Unit 2: Drainage Area (SWMU/AOC 273)

The 18 Tier 1 soil samples that will be collected at Site 15, Unit 2, will be analyzed according to the methods listed below.

5.1.1.1 FIELD SCREENING

All soil samples will be field-screened for polychlorinated biphenyls (PCBs) and PAH with immunoassay test kits (U.S. EPA Method 4020 and 4035); and for total petroleum hydrocarbons (TPH)-diesel and -gasoline (U.S. EPA Method 8015M) and TAL metals (U.S. EPA Method 6000/7000) using an appropriately equipped mobile laboratory.

5.1.1.2 FIXED-BASE ANALYTICAL LABORATORIES

Four samples (three detects and one nondetect) will be submitted to the fixed-base laboratory to confirm field screening results. These fixed-based laboratory analyses are pesticides/PCBs (U.S. EPA Method 8080), PAH (U.S. EPA Method 8310), TPH-diesel and -gasoline (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under Naval Facilities Engineering Service Center (NFESC, formerly known as Naval Environmental and Energy Support Activity [NEESA]) Level D protocols.

5.2 TIER 2

A Tier 2 request for analysis, if necessary, will be contingent upon the Tier 1 sample results.

Table O5-1
Soil Sampling and Analysis

		PHASE II RI/FS SAMPLE NUMBERS			FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY				OFF-SITE LABORATORY[b]		
Tier	Unit/Name	No. of Locations	Samples/ Location	Total Samples	PAH[c,d]	VOCs[f,g]	TPH[h]- Gasoline and -Diesel[f]	Target Analyte List - Metals[f]	PCBs	TPH- Gasoline and -Diesel	Target Analyte List - Metals
Tier 1	Unit 2 Solid Waste Management Unit 273 and Drainage Ditch	6	3	18	X		X	X	X		
Tier 1 Subtotals				18	18		18	18	6		
Tier 2	Optional: Scope of Tier 2 would be to further define extent of shallow soil contamination; based on Tier 1 data, Phase I RI findings, and /or RCRA Facility Assessment data, with approval of Base Closure and Realignment (BRAC) Cleanup Team (BCT).										
Tier 3	Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data, Phase I RI findings, and/or RFA data, with approval of BCT.										

Notes:
- [a] four samples from Unit 2 will be sent to the off-site laboratory for confirmation analyses
- [b] these constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory
- [c] immunoassay analyses
- [d] PAH – polynuclear aromatic hydrocarbons
- [e] PCB – polychlorinated biphenyl
- [f] mobile laboratory analyses
- [g] VOC – volatile organic compound
- [h] TPH – total petroleum hydrocarbons

5.3 TIER 3

A Tier 3 request for analysis, if necessary, will be contingent upon the Tier 1 and Tier 2 sample results.

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Section 6
FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods referenced in this section are from Section 6 of the FSP and the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Standard Operating Procedures, which discuss specific field methods and procedures.

6.1 INITIAL SURVEYS

Before the collection of Phase II RI/FS soil samples, the site will be scaled, and sampling locations will be staked or paint-marked. Once a sampling point is marked, utility clearances will be made before collecting any sample that uses power equipment to reach the sample depth. Utility clearances may also be made at locations where samples are collected using a hand auger. Nonintrusive utility clearances will be completed by a subcontractor, using geophysical methodology in conjunction with site activities.

Each sampling point will be located by survey, using the California Plane Coordinate System, with northings and eastings determined to the nearest 0.1 foot. The surface elevation will be determined to the nearest 0.01 foot.

6.2 TIER 1

All samples in Tier 1 will be collected at the locations and depths described in Section 4.2. More information on soil sampling procedures is provided in Section 6 of the FSP.

6.2.1 Unit 2: Drainage Area (SWMU/AOC 273)

The 18 Tier 1 soil samples will be collected at Site 15, Unit 2, at depths of 0, 5, and 10 feet bgs in six borings as indicated below.

6.2.1.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer.

6.3 TIER 2

If Tier 2 soil sampling is conducted at Site 15, shallow soil samples will be collected as described above.

6.4 TIER 3

If Tier 3 sampling is conducted, deep soil samples (from 10 feet bgs to groundwater level) will be collected at 5-foot intervals, with a modified California split-spoon sampler equipped with stainless steel sleeves. The split-spoon sampler will be driven into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer. When drilling is required to depths of greater than 130 feet bgs, the hollow-stem auger drilling rig will be replaced by an air-rotary drilling rig. If groundwater sampling is necessary, sampling will follow procedures presented in Section 6 of the FSP.

Section 7
REFERENCES

Bechtel National, Inc. 1995a. *Final Work Plan, Phase II Remedial Investigation/Feasibility Study*. Marine Corps Air Station El Toro, California.

———. 1995b. *Final Quality Assurance Project Plan, Phase II Remedial Investigation/ Feasibility Study.* Marine Corps Air Station El Toro, California.

BNI. *See* Bechtel National, Inc.

Jacobs Engineering. *See* Jacobs Engineering Group, Inc.

Jacobs Engineering Group, Inc. 1993a. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study, Draft Work Plan*. Marine Corps Air Station El Toro, California.

———. 1993b. *Installation Restoration Program, Phase I Remedial Investigation Draft Technical Memorandum.* Marine Corps Air Station El Toro, California.

LUFT. *See* State of California Leaking Underground Fuel Tank Task Force.

State of California Leaking Underground Fuel Tank Task Force. 1989. *Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure.*

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Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Room 135
San Diego, California 92132-5187

Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN
ATTACHMENT P
OPERABLE UNIT 3 –
SITE 16 – CRASH CREW PIT NO. 2
MCAS EL TORO, CALIFORNIA

CTO-0059

Prepared by:

BECHTEL NATIONAL, INC.
401 West A St., Suite 1000
San Diego, California 92101

August 1995

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Section Page

TABLE OF CONTENTS (continued)

TABLE

ACRONYMS/ABBREVIATIONS

bgs	below ground surface
CLEAN	Comprehensive Long Term Environmental Action Navy
COPC	chemical of potential concern
FS	Feasibility Study
FSP	Field Sampling Plan
Irvine Subbasin	Irvine Groundwater Subbasin
LUFT	(California) Leaking Underground Fuel Tank (Field Manual)
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
PAH	polynuclear aromatic hydrocarbons
PRG	(U.S. EPA Region IX) Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SVOC	semivolatile organic compound
TAL	target analyte list
TFH	total fuel hydrocarbons
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound

ACRONYMS/ABBREVIATIONS (continued)

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Section 1
OBJECTIVES

This Field Sampling Plan (FSP) for the Site 16, Crash Crew Pit No. 2, outlines the field procedures and methodology to be used during the Remedial Investigation (RI)/Feasibility Study (FS) for this site. The purpose of this FSP is to enable field personnel unfamiliar with the site to gather the required samples and field data. It is also intended to assure that data collection will be comparable to and compatible with previous data collected at the site and with other sampling activities at other sites at the Marine Corps Air Station (MCAS) El Toro.

1.1 SAMPLING OBJECTIVES

The specific objectives for sampling at Site 16 are as follows:

- verify boundaries of waste disposal activities;
- characterize the nature and extent of contamination;
- estimate the vertical and horizontal extent of contamination; and
- characterize site-specific groundwater contamination, if soil contamination extends to groundwater.

1.2 DATA USAGE

To satisfy the RI/FS objectives for the Crash Crew Pit No. 2, the data to be collected, compiled, and analyzed will be used to perform the following:

- characterize subsurface soils;
- establish stratigraphic controls;
- establish geotechnical parameters;
- characterize groundwater conditions and quality (where soil contamination suggests);
- determine the types of contaminants in soil and/or groundwater;
- estimate the extent of contaminants in soil and/or groundwater;
- evaluate human health and ecological risks;
- evaluate the mass of contaminants;
- evaluate cleanup levels;
- characterize the feasible removal or remedial actions, if necessary; and
- evaluate remedial alternatives.

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Section 2
BACKGROUND

This section generally describes and discusses the results of previous investigations at Site 16. This section also provides a brief compilation of the data used to develop the site-specific FSP for Phase II RI/FS activities. Previous investigations and reports provide a more thorough discussion of site history, activities, and summaries of previous investigations.

2.1 SITE DESCRIPTION

Site 16 (Crash Pit Crew No. 2) is located near the center of the Station in the northwest corner between two runways (Map P3-1). The site is relatively flat, and surface drainage from the site appears to flow northwest into a drainage ditch that discharges into Bee Canyon Wash (Jacobs Engineering 1993a).

2.1.1 History

Site 16 was previously used to train firefighters from approximately 1972 until 1985. Contained on the site were three pits, one of which (the main pit) is still present. The main pit was used for larger training exercises. It was about 50 to 60 feet in diameter and 3 feet deep. During training, the pit was filled with water and covered with various mixtures of residual fuels and fluids (JP-5 fuel, leaded aviation gasoline, hydraulic fluid, and crankcase oil), and then the mixture was ignited. The main pit was connected by a buried drain pipe to a secondary pit approximately 40 feet away, which was roughly 12 by 35 feet, and 4 to 5 feet deep. The secondary pit stored residual liquids from the main pit. The third pit was smaller, about 10 feet by 3 feet, and was used for practicing with hand-held extinguishers. An estimated 275,000 gallons of residual fluids may have been placed in the three pits. Small quantities of napalm, white phosphorus, and magnesium phosphate were also reportedly burned (Jacobs Engineering 1993b).

2.1.2 Geology

The geology of Site 16 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993a). Holocene deposits consist of a matrix of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene, which are considered to be bedrock in the area. Based on a review of boring logs from the Phase I RI, subsurface lithology at Site 16 consists of lenses of clay, silt, sandy silt, silty sand and sand (Jacobs Engineering 1993b).

2.1.3 Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Subbasin (Irvine Subbasin). Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine-grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993b).

The Phase I RI results indicate the shallow, perched zone is not present at Site 16. The principal aquifer is present beneath Site 16 at a depth of about 180 feet below ground surface (bgs). The regional groundwater flow direction is to the northwest. The local hydraulic gradient has been influenced strongly by the pumping of irrigation wells located west of MCAS El Toro.

2.2 PHASE I REMEDIAL INVESTIGATION RESULTS

During the Phase I RI/FS in 1992-3, Site 16 (Map P3-2) was divided into three areas:

- Stratum 1 – Disturbed-Ground Area (including the two filled-in pits);
- Stratum 2 – Main Fire-Fighting Pit; and
- Stratum 3 – Drainage Channel.

The following site-specific activities were conducted:

- twenty-seven samples were collected from surface and near surface soil (0 to 4 feet bgs) from 11 locations;
- twenty-two samples were collected from subsurface (vadose zone) from five borings; and
- three groundwater monitoring wells (16_DBMW52, 16_UGMW33, and 16_DGMW81) were installed and sampled;
- soil samples were analyzed for target analyte list (TAL) metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total recoverable petroleum hydrocarbons (TRPH), total fuel hydrocarbons (TFH)-diesel and -gasoline, and dioxin and furans; and
- groundwater samples were analyzed for TAL metals, VOCs, SVOCs, pesticides and polychlorinated biphenyls (PCBs), herbicides, TRPH, TFH-diesel and -gasoline, and general chemistry.

United States Environmental Protection Agency (U.S. EPA) Region IX Preliminary Remediation Goals (PRGs) and ecological screening criteria were compared with corresponding shallow soil analytical results. The results are as follows:

- no chemicals of potential concern (COPCs) detected in shallow soil exceeded PRGs; and
- lead and zinc exceeded ecological screening criteria in shallow soil in Stratum 1.

Petroleum hydrocarbons detected in shallow soil were compared to California Leaking Underground Fuel Tank (LUFT) Field Manual (LUFT 1989) guidelines to evaluate their potential to migrate to the groundwater. Based on LUFT guidelines, petroleum hydrocarbons in the shallow soil at Site 16 may pose a threat to groundwater. TFH impacted soil is present to a depth of at least 53 feet bgs in boring 16_AB213 (Jacobs Engineering 1993a).

Groundwater samples were collected from the three groundwater monitoring wells constructed in the area of Site 16 and compared to applicable PRGs and maximum contaminant levels (MCLs). The results are as follows:

- antimony and nitrate in groundwater at the one downgradient well (16_DGMW81) and the on-site well (16_DBMW52) exceed PRGs;
- arsenic exceeds PRGs in UGMW33 (upgradient well);
- cadmium, nickel, and nitrate exceed primary MCLs in the on-site and downgradient wells;
- antimony and selenium exceed primary MCLs in all three wells;
- chloride, manganese, and sulfate exceed secondary MCLs in the on-site and downgradient wells; and
- Total dissolved solids exceed secondary MCLs in all three wells.

Although surface and subsurface soil samples indicated the presence of fuel petroleum hydrocarbons, various VOCs, and SVOCs in shallow soil in all three stratum, the results of groundwater sampling did not indicate the presence of these compounds in groundwater (Jacobs Engineering 1993a).

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Section 3
MAPS

The maps on the following pages present the site location at MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and proposed Phase II sampling location (where known). These maps are referenced in other sections of this FSP.

The proposed Phase II sampling locations presented on these maps are intended to illustrate the type of sampling strategy proposed for each unit. Other considerations (e.g., randomly selected starting points, underground utilities/pipelines, or overhead obstacles) could result in adjustments to sampling locations. The actual field sample locations will be accurately recorded by field personnel relative to surveyed coordinates, and if any sampling points require relocation, the reasons for such changes will be described in the field notebook.

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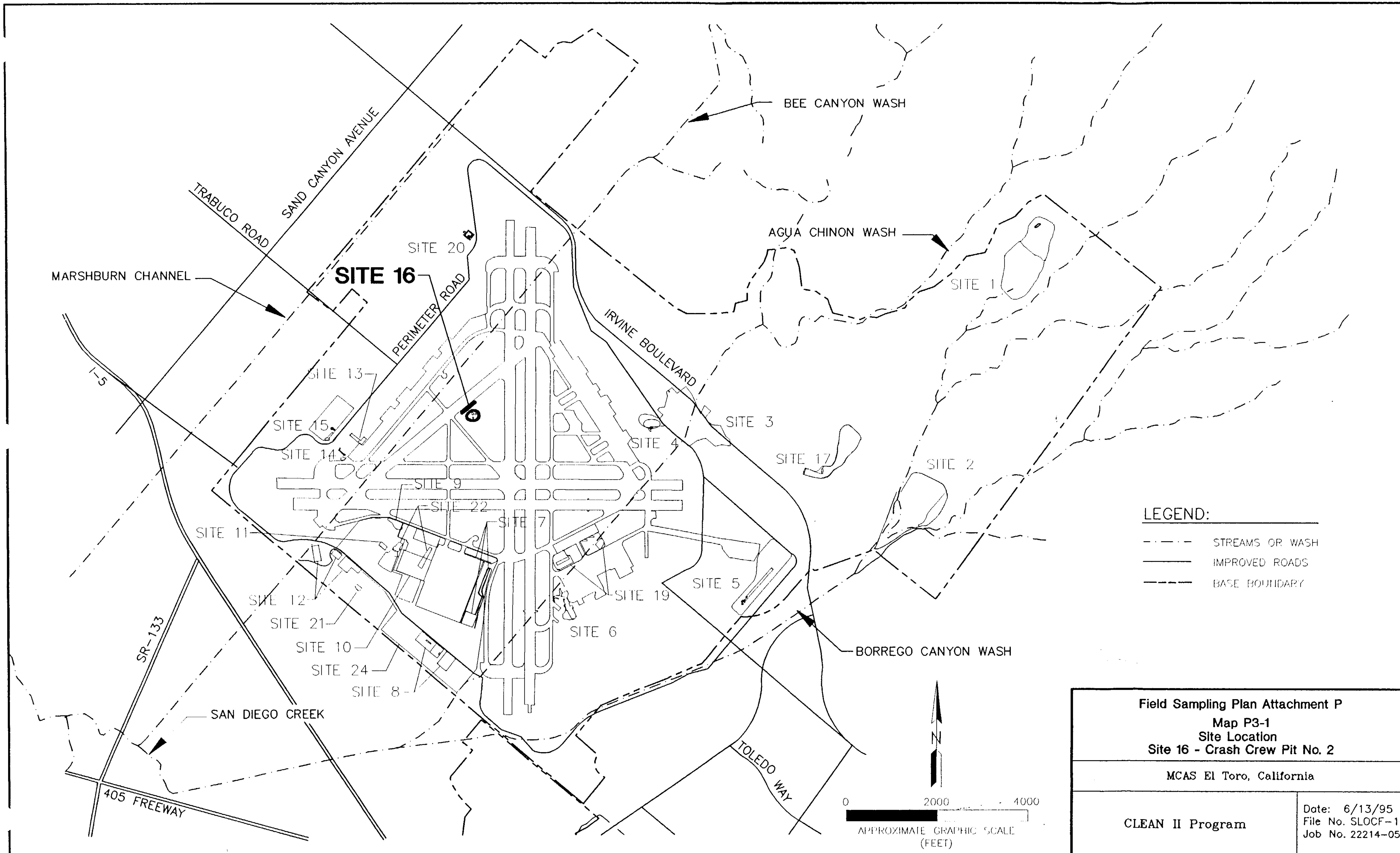
BEE CANYON WASH
AGUA CHINON WASH
SAND CANYON AVENUE
TRABUCO ROAD
MARSHBURN CHANNEL
SITE 16
SITE 20
PERIMETER ROAD
IRVINE BOULEVARD
SITE 1
SITE 13
SITE 15
SITE 14
SITE 3
SITE 4
SITE 17
SITE 2
SITE 9
SITE 22
SITE 7
SITE 11
I-5
SITE 12
SITE 21
SITE 10
SITE 24
SITE 8
SITE 19
SITE 5
SITE 6
SR-133
SAN DIEGO CREEK
405 FREEWAY
TOLEDO WAY
BORREGO CANYON WASH
LEGEND:
STREAMS OR WASH
IMPROVED ROADS
BASE BOUNDARY
N
0
2000
4000
APPROXIMATE GRAPHIC SCALE
(FEET)
Field Sampling Plan Attachment P
Map P3-1
Site Location
Site 16 - Crash Crew Pit No. 2
MCAS El Toro, California
CLEAN II Program
Date: 6/13/95
File No. SLOCF-16
Job No. 22214-059

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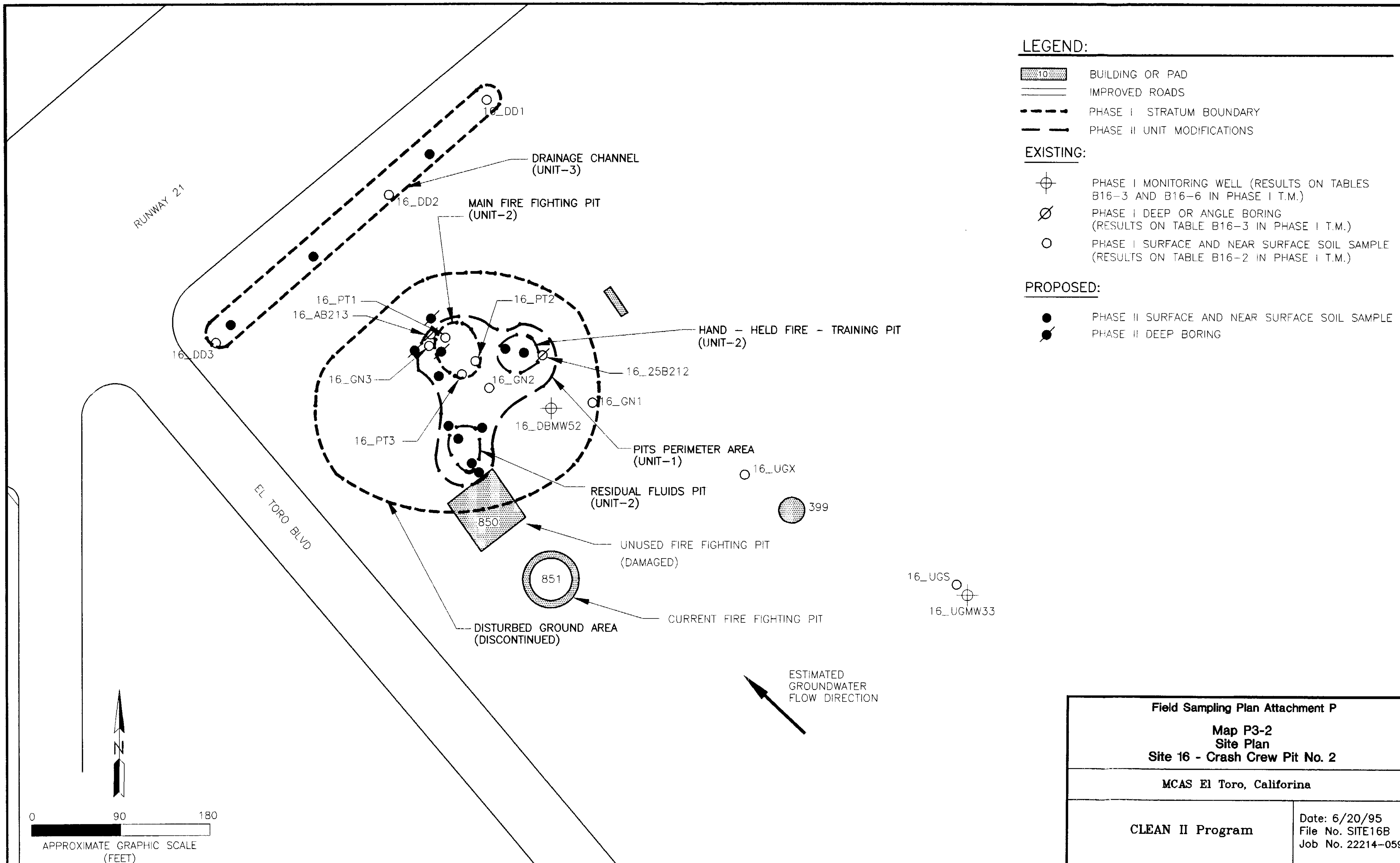

Field Sampling Plan Attachment P

Map P3-2
Site Plan
Site 16 - Crash Crew Pit No. 2

MCAS El Toro, California

CLEAN II Program

Date: 6/20/95
File No. SITE16B
Job No. 22214-059

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

This section explains the rationale for the number of sampling programs, types of samples, locations of samples, and analytical parameters. The rationale for sampling is based on site conditions, previous investigations, and data quality objectives as presented in the appendices of the Phase II RI/FS Work Plan (BNI 1995a).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, types of samples, and locations are presented based on the smallest area of study. For some sites, the smallest area of study is a site unit; for other sites, the area of study may be the entire site. Selection of sampling programs, sample types, and locations is based on the following:

- site activities and history;
- types of media suspected or known to be impacted from previous investigations;
- objectives of site-specific RI/FS efforts; and
- site-specific initial surveys.

Site 16 will be represented by three units for the Phase II Investigation:

- Unit 1 - Perimeter Area (this unit contains a portion of Phase I RI Site 16, Stratum 1; however, the area has been reduced to include just the immediate areas around the pits. Although Stratum 1 included a larger area [the disturbed ground area], it is thought that native soils were tilled here mainly to prevent potential grass fires during training activities);
- Unit 2 - Fire-Fighting Pits (which consists of the three fire-fighting pits); and
- Unit 3 - Drainage Channel (this unit has the same boundaries as Phase I RI Site 16, Stratum 3).

The units will be sampled using a tiered sampling approach as discussed in the following sections. Previous site activities, Phase I RI sampling results, and regulatory comments were used to formulate the Phase II sampling approach. During the Phase I RI, soil samples were collected from the strata, and COPCs were identified and evaluated against PRGs. Sampling locations in all units have been positioned in locations to refine risk estimates for the units.

4.2 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk to human health or the environment. The Tier 1 sampling approach will consist of the collection of shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed such that, when the Phase I and II RI/FS data are evaluated together, a risk can be estimated for the unit. An explanation of the proposed sampling designs for Tier 1 soil sampling can be found in Section 4 of the Phase II RI/FS Work Plan (BNI 1995a).

4.2.1 Unit 1: Perimeter Area

The Unit 1 boundaries of Site 16 consist of the perimeter area around the three fire-fighting pits.

4.2.1.1 SOIL SAMPLES

For the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs in the three stratified random sampling locations in Unit 1 (Map P3-2).

4.2.2 Unit 2: Fire-Fighting Pits

The Unit 2 boundaries of Site 16 consist of the area of the three fire-fighting pits.

4.2.2.1 SOIL SAMPLES

For the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs in the four stratified random sampling locations in Unit 2 (Map P3-2). Two of the boring locations will be in the residual fluids pit, and the other two will be located in the hand-held pit.

4.2.3 Unit 3: Drainage Channel

The Unit 3 boundaries of Site 16 consist of the drainage channel located west of the fire-fighting pits.

4.2.3.1 SOIL SAMPLES

For the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs in the three systematic random sampling locations on an axis in Unit 3 (Map P3-2).

4.3 TIER 2

The Tier 2 sampling program, like the Tier 1 sampling program described above, will focus exclusively on shallow soil (0 to 10 feet) conditions. The primary objective of this program will be to refine the data on the extent of shallow soil contamination identified during the Tier 1 sampling. Tier 2 sample locations will be based on these sample results. The process by which the Tier 2 sample locations will be selected is detailed in Appendix P of the Phase II RI/FS Work Plan (BNI 1995a).

4.4 TIER 3

The objective of a Tier 3 soil sampling program is to estimate the extent of a contaminant plume in deeper subsurface soils. To accomplish this goal, a series of boreholes will be drilled and sampled. Location of Tier 3 boreholes is intended to minimize the number of boreholes required to define the lateral and vertical extent of the contaminant plume in deeper subsurface soils. Groundwater samples will be collected only when a contaminant plume in deeper subsurface soils has been traced (through a drilling and soil sampling program) downward to the water table. At such units/sites, the objectives of the sampling program must then be expanded to include a determination of whether groundwater has been adversely impacted as a result of the historic activities at this unit/site.

Phase I RI soil sample results indicate that Tier 3 soil sampling will be necessary at this site. The process by which the locations for Tier 3 soil borings will be selected is detailed in Appendix P of the Phase II RI/FS Work Plan (BNI 1995a).

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Section 5
REQUEST FOR ANALYSES

Requests for analyses are based on:

- site activities and history,
- results of previous investigations, and
- objectives of site-specific RI/FS efforts.

The analytical methods referenced in this section are from the Phase II RI/FS Quality Assurance Project Plan (QAPP) (BNI 1995b). Section 6 in the QAPP specifies the number and/or frequency for collection of field duplicate and blank samples during the Phase II RI/FS field activities.

5.1 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk. The Tier 1 sampling approach will consist of the collection of shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. Table P5-1 lists all soil samples and associated analyses for the units in Site 16.

5.1.1 Unit 1: Perimeter Area

The nine Tier 1 soil samples that will be collected at Site 16, Unit 1, will be analyzed according to the methods listed below.

5.1.1.1 FIELD SCREENING

All soil samples will be field screened for polynuclear aromatic hydrocarbon (PAH) with immunoassay test kits (U.S. EPA Method 4035); for VOCs (U.S. EPA Method 8010); for benzene, toluene, ethylbenzene, and xylenes (BTEX) (U.S. EPA Method 8020); for total petroleum hydrocarbons (TPH)-diesel and -gasoline (U.S. EPA Method 8015M); and for TAL metals (U.S. EPA Method 6000/7000) using an appropriately equipped mobile laboratory.

5.1.1.2 FIXED-BASE ANALYTICAL LABORATORIES

All soil samples will be analyzed by a fixed-base laboratory for dioxins/dibenzofurans (U.S. EPA Method 8280) and phosphorus (U.S. EPA Method 365.2) under Naval Facilities Engineering Service Center (NFESC, formerly known as Naval Energy and Environmental Support Activity [NEESA]) Level D protocols. Three samples (two detects and one nondetect) will be submitted to the fixed-base laboratory to confirm field-screening results. The fixed-base laboratory analyses are PAHs (U.S. EPA Method 8310), VOCs (U.S. EPA Method 8010), BTEX (U.S. EPA Method 8240), TPH-diesel and -gasoline (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under NFESC Level D protocols.

Table P5-1
Soil Sampling and Analysis

		PHASE II RI/FS SAMPLE NUMBERS			FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY					OFF-SITE LABORATORY[b]		
Tier	**Unit/Name**	**No. Of Locations**	**Samples/ Location**	**Total Samples**	**PAH[c,d]**	**VOCs[e,f]**	**BTEX[e,g]**	**TPH[h]- Gasoline and -Diesel[e]**	**Target Analyte List - Metals[e]**	**Pesticides and PCBs**	**Herbicides**	**Others: Dioxins, Dibenzofurans, Total Phosphate**
Tier 1	Unit 1 Pits Perimeter Area	3	3	9	X	X	X	X	X			X
	Unit 2 Fire-Fighting Pits	4	3	12	X	X	X	X	X			X
	Unit 3 Drainage Channel	3	3	9	X			X	X			
Tier 1 Subtotals				30	30	21	21	30	30			21
Tier 2	Optional: Scope of Tier 2 would be to further define extent of shallow soil contamination; based on Tier 1 data and Phase I RI findings, with approval of Base Closure and Realignment (BRAC) Cleanup Team (BCT).											
Tier 3	Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data, combined with the Phase I RI findings, with approval of BCT.											

Notes:
- [a] three samples from Units 1 and 2 will be sent to the off-site laboratory for confirmation analyses
- [b] these constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory
- [c] immunoassay analyses
- [d] PAH – polynuclear aromatic hydrocarbons
- [e] mobile laboratory analyses
- [f] VOC – volatile organic compound
- [g] BTEX – benzene, toluene, ethylbenzene, and xylenes
- [h] TPH – total petroleum hydrocarbons

5.1.2 Unit 2: Fire-Fighting Pits

The 12 Tier 1 soil samples that will be collected at Site 16, Unit 2, will be analyzed according to the methods listed below.

5.1.2.1 FIELD SCREENING

All soil samples will be field screened for PAH with immunoassay test kits (U.S. EPA Method 4035), for VOCs (U.S. EPA Method 8010), for BTEX (U.S. EPA Method 8020), for TPH-diesel and -gasoline (U.S. EPA Method 8015M), and for TAL metals (U.S. EPA Method 6000/7000) using an appropriately equipped mobile laboratory.

5.1.2.2 FIXED-BASE ANALYTICAL LABORATORIES

All soil samples will be analyzed by a fixed-base laboratory for analysis of dioxins/dibenzofurans (U.S. EPA Method 8280) and phosphorous (U.S. EPA Method 365.2) under NFESC Level D protocols. Three samples (two detects and one nondetect) will be submitted to the fixed-base laboratory to confirm field-screening results. The fixed-base laboratory analyses are PAH (U.S. EPA Method 8310), VOCs (U.S. EPA Method 8010), BTEX (U.S. EPA Method 8240), TPH-diesel and -gasoline (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under NFESC Level D protocols.

5.1.3 Unit 3: Drainage Channel

The nine Tier 1 soil samples collected at Site 15, Unit 3, will be analyzed according to the methods listed below.

5.1.3.1 FIXED-BASE ANALYTICAL LABORATORIES

All samples will be submitted to the fixed-base laboratory for chemical analysis. The fixed-base laboratory analyses are PAH (U.S. EPA Method 8310), TPH-diesel and -gasoline (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under NFESC Level D protocols.

5.2 TIER 2

A Tier 2 request for analysis, if necessary, will be contingent upon the Tier 1 sample results.

5.3 TIER 3

A Tier 3 request for analysis, if necessary, will be contingent upon the Tier 1 and Tier 2 sample results.

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Section 6
FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods referenced in this section are from Section 6 of the FSP and the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Standard Operating Procedures, which discuss specific field methods and procedures.

6.1 INITIAL SURVEYS

Before the collection of Phase II RI/FS soil samples, the site will be scaled, and sampling locations will be staked or paint-marked. Once a sampling point is marked, utility clearances will be made before collecting any sample that uses power equipment to reach the sample depth. Utility clearances may also be made at locations where samples are being collected using a hand auger. Nonintrusive utility clearances will be completed by a subcontractor, using geophysical methodology in conjunction with site activities.

Each sampling point will be located by survey, using the California Plane Coordinate System, with northings and eastings determined to the nearest 0.1 foot. The surface elevation will be determined to the nearest 0.01 foot.

Excavation of test pits may be conducted at the site if delineation of each pit's area cannot be reliably defined on the basis of a surficial survey at the site. Two of the pits, formerly used for training of firefighters, have been backfilled, and their locations are no longer clearly defined/visible at the site. Two trenches, oriented at right angles to one another, would be excavated to an estimated depth of about 4 feet at each pit. The trenches would be excavated parallel to the longest dimension of each pit. These trenches would be used only to determine the lateral and vertical limits of the two pits, and to describe the soil profile associated with each pit. The trenches will remain open only on the day of excavation, and they will be backfilled with the excavated material once examination of the soil profile is completed.

6.2 TIER 1

All samples in Tier 1 will be collected at the locations and depths described in Section 4.2. More information on soil sampling procedures is provided in Section 6 of the FSP.

6.2.1 Unit 1: Perimeter Area

The nine Tier 1 soil samples will be collected at Site 16, Unit 1, at depths of 0, 5, and 10 feet bgs in three borings as indicated below.

6.2.1.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig with a 140-pound hammer. All soil sampling will be conducted as detailed in Section 6 of the FSP.

6.2.2 Unit 2: Fire-Fighting Pits

The 12 Tier 1 soil samples will be collected at Site 16, Unit 2, at depths of 0, 5, and 10 feet bgs in four borings as indicated below.

6.2.2.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig with a 140-pound hammer. All soil sampling will be conducted as detailed in Section 6 of the FSP.

6.2.3 Unit 3: Drainage Channel

The nine Tier 1 soil samples will be collected at Site 16, Unit 3, at depths of 0, 5, and 10 feet bgs in three borings as indicated below.

6.2.3.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig with a 140-pound hammer. All soil sampling will be conducted as detailed in Section 6 of the FSP.

6.3 TIER 2

If Tier 2 soil sampling is conducted at Site 16, shallow soil samples will be collected as described above.

6.4 TIER 3

Phase I RI soil sampling results indicate that Tier 3 sampling will be conducted at this site. Deep soil samples (from 10 feet bgs until groundwater level) will be collected at 5-foot intervals with a modified California split-spoon sampler equipped with stainless steel sleeves. The split-spoon sampler will be driven into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer. When drilling is required to depths of greater than 130 feet bgs, the hollow-stem auger drilling rig will be replaced by an air-rotary drilling rig. If groundwater sampling is necessary, sampling will follow procedures presented in Section 6 of the FSP.

Section 7
REFERENCES

Bechtel National, Inc. 1995a. *Final Work Plan, Phase II Remedial Investigation/Feasibility Study.* Marine Corps Air Station El Toro, California.

———. 1995b. *Final Quality Assurance Project Plan, Phase II Remedial Investigation/ Feasibility Study.* Marine Corps Air Station El Toro, California.

BNI. *See* Bechtel National, Inc.

Jacobs Engineering. *See* Jacobs Engineering Group, Inc.

Jacobs Engineering Group, Inc. 1993a. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study, Draft Work Plan.* Marine Corps Air Station El Toro, California.

———. 1993b. *Installation Restoration Program, Phase I Remedial Investigation Draft Technical Memorandum.* Marine Corps Air Station El Toro, California.

LUFT. *See* State of California Leaking Underground Fuel Tank Task Force.

State of California Leaking Underground Fuel Tank Task Force. 1989. *Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure.*

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Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Room 135
San Diego, California 92132-5187

Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN
ATTACHMENT Q
OPERABLE UNIT 2 – SITE 17 – COMMUNICATION STATION LANDFILL
MCAS EL TORO, CALIFORNIA

CTO-0059

Prepared by:

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August 1995

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TABLES

ACRONYMS/ABBREVIATIONS

Air SWAT	Air Solid Waste Assessment Test
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
COPC	chemical of potential concern
DQO	data quality objective
EM	electromagnetic
FID	flame ionization detector
FSP	Field Sampling Plan
GC	gas chromatograph
GC/MS	gas chromatography/mass spectroscopy
MCAS	Marine Corps Air Station
$MeCl_2$	dichloromethane
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mph	miles per hour
MSL	mean sea level
ND	not detected
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
$\%_V$	percent by volume
PCB	polychlorinated biphenyl
PID	photoionization detector
ppb_V	parts per billion by volume
ppm_V	parts per million by volume
PVC	polyvinyl chloride
PRG	(U.S. EPA Region IX) Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan

ACRONYMS/ABBREVIATIONS (continued)

RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RWQCB	(California) Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SCAQMD	South Coast Air Quality Management District
SVOC	semivolatile organic compound
TAL	target analyte list
TFH	total fuel hydrocarbons
TOC	total organic compound
TRPH	total recoverable petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound

ACRONYMS/ABBREVIATIONS (continued)

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Section 1
OBJECTIVES

This Field Sampling Plan (FSP) for the Site 17, Communication Station Landfill, outlines the field procedures and methodology applicable to this site. The FSP follows the United States Environmental Protection Agency (U.S. EPA) Region IX guidelines for preparing sample plans (U.S. EPA 1992). This FSP is written to aid field personnel unfamiliar with the site in gathering the required samples and field data. The purpose of this plan is to help assure that data collection activities will satisfy the field investigation design developed in the data quality objectives (DQOs).

The DQOs for this site were developed using the U.S. EPA seven-step DQO process. The field investigation is designed to determine if the site poses a human health or environmental risk and to provide data for selecting any necessary remedial alternative(s).

1.1 SAMPLING OBJECTIVES

The overall objective of this FSP is to direct collection of data sufficient to allow the presumptive remedy of capping as established by the U.S. EPA for municipal landfills at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites (U.S. EPA 1993). Site 17 can be classified as a municipal landfill because the wastes present are a large-volume, heterogeneous mixture of municipal waste (e.g., nontoxic household, construction, and landscaping debris) as well as industrial and hazardous wastes (including fuel hydrocarbons, solvents, pesticides, and metals). The Presumptive Remedy allows for unit closure after resolving hot spots issues and taking engineered or institutional steps to limit the release of contaminants to the environment.

Under the Presumptive Remedy approach, engineered designs are prepared to limit the release of contaminants to the atmosphere, surface water, and groundwater. The primary containment measures are:

- capping the landfill to limit direct contact with disposed waste, infiltration, and resulting contaminant leaching to groundwater, and to control surface water runoff and erosion;
- any necessary groundwater treatment to reduce the impact of released contaminants; and
- any necessary gas control and treatment to reduce uncontrolled atmospheric releases and the mass of subsurface volatile contaminants.

Also under the Presumptive Remedy, institutional controls are implemented to limit the exposure to landfilled waste. The most common institutional control is a deed restriction. Related Phase II data collection activities should thus include the delineation of landfill boundaries to allow the preparation of legal descriptions for the deed restrictions.

Additional input information supporting Presumptive Remedy decisions include the following:

- location, nature, and extent of potential hot spots;
- existence, areal extent, depth, nature, and condition of landfill cap; and
- delineation of landfilled wastes using historic, nonintrusive (e.g., electromagnetic [EM]), or intrusive (e.g., trenching) techniques.

1.2 DATA USAGE

To satisfy the objectives of this FSP, field data will be used for the following purposes.

- Surface geophysical and topographic surveys will be conducted to define the limits of landfilled waste and to record site elevations. The boundaries of landfilled waste and the resulting topographic map will support the landfill cap design, will define the area requiring institutional controls, and will assist in placing sample locations during the Phase II Remedial Investigation (RI).
- A soil gas survey will be performed to evaluate the potential presence of hot spots according to U.S. EPA Presumptive Remedy requirement. Hot spot data will be used to identify areas that may require further characterization. If the data indicate the presence of a hot spot that could threaten the integrity of the containment system, treatment or removal may be necessary.
- Air monitoring and sampling will be performed to reassess the migration of landfill gas into the atmosphere by verifying and supplementing existing emission data. The resulting data will be used to assess the effectiveness of the existing cap, evaluate whether additional control measures are necessary, and support the streamlined risk assessment.
- Groundwater monitoring well installation. The resulting data will be used to assess potential impacts to groundwater and to conduct subsequent compliance monitoring.

Section 2
BACKGROUND

This section presents a discussion on the general description and results of previous investigations at the Site 17. The purpose of this section is to provide a brief compilation of the data that were used to develop the site-specific FSP for Phase II RI/Feasibility Study (FS) activities. Previous investigations and reports provide a more thorough discussion of site history and activities.

2.1 SITE DESCRIPTION

Site 17 covers approximately 20 acres in a canyon west of the Magazine Road Landfill (Map Q3-1). The Communication Station Landfill is located in a small canyon and overflows out of the canyon mouth onto a flat, weed-covered field formerly used for agriculture. Steep foothills of the Santa Ana Mountains rise above the landfill. At its base, the landfill lies at an elevation of about 450 feet above mean sea level (MSL); at its upper end in the canyon, it lies at about 600 above feet MSL. The landfill itself is covered with sparse vegetation and varying amounts of fill. Refuse is visible at several locations. The former wash in the canyon has been largely obscured by refuse and dirt resulting from the excavation of an adjacent hill.

An area of stained soil was formerly visible at the base of the landfill. The stained area was created as vehicles were driven to the edge of the foot of the landfill, and unknown liquids were discharged onto the ground.

2.1.1 Site History

The landfill was actively used from 1981 to 1983 as a stationwide disposal facility. Aerial photographic evidence indicates landfilling activities were under way as early as 1970 and continued through 1986. Suspected waste types disposed of at the site included domestic waste and rubble, cooking grease, oils and fuels from sumps, and empty drums. Reportedly, any waste generated at Marine Corps Air Station (MCAS) El Toro may have been disposed at the landfill. An area of stained soil was formerly visible at the base of the landfill.

2.1.2 Geology

Subsurface soil samples collected during the Phase I RI reveal that the soil is predominantly silty sand, with fine-grained materials increasing toward the south. A semiconsolidated sandstone was encountered, beginning at a depth of about 70 feet below ground surface (bgs).

2.1.3 Hydrogeology

Subsurface soil samples collected during the Phase I RI reveal that the soil is predominantly silty sand, with fine-grained materials increasing toward the south. A semiconsolidated sandstone was encountered, beginning at a depth of about 70 feet bgs.

Groundwater lies at a depth of 200 feet bgs at Site 17. Although the groundwater flow direction has not been precisely defined, it has been estimated the flow direction is toward the northwest from the foot of the landfill, based on the regional hydraulic gradient. The potential for surface water runoff is expected to be slight, because of the small watershed area, permeable soils, and filling-in of the natural drainageway.

2.2 PHASE I REMEDIAL INVESTIGATION RESULTS

The activities conducted as part of its Phase I RI included:

- collecting of shallow soil samples from seven sampling locations;
- drilling and sampling one deep boring; and
- drilling, sampling, and installing one downgradient well (Well 17 DGMW82 is located within the site boundaries, so it is considered on-site for subsurface soil samples; however, it is considered downgradient for groundwater samples).

A summary of the Phase I RI analytical results is presented below (Jacobs Engineering 1993, Tables A17-1a through A17-1c). The summary includes minimum and maximum detected concentrations for each chemical listed. The minimum concentration is recorded as less than the detection limit if the chemical constituent was not detected. Metal concentrations are listed only if they exceeded U.S. EPA Region IX Preliminary Remediation Goals (PRGs) or ecological screening criteria (Jacobs Engineering 1993, Tables A3-a, A3-b, A17-a, and A17-b). Target analyte list (TAL) metals that were analyzed during the Phase I RI are beryllium, barium, arsenic, antimony, aluminum, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. The locations of Phase I RI investigations are shown on Map B3-2.

2.2.1 Shallow Soil

- metals: arsenic (1.5b to 4.4 milligrams per kilogram [mg/kg] [17_LF2 at 0 feet]), chromium (6 to 297 mg/kg [17_LF3 at 0 feet]), lead (1.4 to 361 mg/kg [17_SA1 at 0 feet]), zinc (16.3 to 260 mg/kg [17_SA1 at 0 feet]), and 20 other TAL metals;
- volatile organic compounds (VOCs): toluene (3J to 180 micrograms per kilogram [µg/kg] [17_SA2 at 4 feet]), acetone (< 10 to 86D µg/kg [17_SA2 at 4 feet]), methylene chloride (< 10 to 47D µg/kg [17_SA2 at 4 feet]);
- semivolatile organic compounds (SVOCs): benzo(a)anthracene (< 660 to 200J µg/kg [17_LF3 at 0 feet]); benzo(a)pyrene (< 660 to 390J µg/kg [17_LF3 at 0 feet]); benzo(g,h,i)perylene (< 660 to 160J µg/kg [17_LF3 at 0 feet]); chrysene (< 660 to 220J µg/kg [17_LF3 at 0 feet]); 2,4-dimethylphenol (< 660 to 6,000J µg/kg [17_SA1 at 0 feet]); fluoranthene (< 660 to 360J µg/kg [17_LF3 at 0 feet]); indeno(1,2,3-cd)pyrene (< 660 to 240J µg/kg [17_LF3 a t0 feet]); pyrene (< 660 to 320J µg/kg [17_LF3 at 0 feet]), 4-methylphenol (390J to 34,000 µg/kg [17_SA1 at 0]);

- petroleum hydrocarbons: total recoverable petroleum hydrocarbons (TRPH) (< 9 to 2,733 mg/kg [17_SA2 at 4 feet]), total fuel hydrocarbons (TFH)-gasoline (0.05 to 0.526 mg/kg [17_SA2 at 4 feet]), TFH-diesel (<12.5 to 1,010 mg/kg [17_SA1 at 0 feet]); and

- pesticides, polychlorinated biphenyls (PCBs), herbicides: alpha-chlordane (< 1.7 to 8.81J µg/kg [17_SA1 at 0 feet]), 4,4'-dichlorodiphenyldichloroethane (< 3.29 to 38.1J µg/kg [17_SA1 at 0 feet]), 4,4'-dichlorodiphenyldichloroethene (0.64J to 11.6J µg/kg [17_SA1 at 0 feet]), 4,4'-dichlorodiphenyltrichloroethane (< 3.29 to 135J µg/kg [17_LF3 at 0 feet]), delta-BHC (< 1.7 to 8.81J µg/kg [17_SA1 at 0 feet]), dieldrin (0.86J to 3.77J µg/kg [17_SA1 at 0 feet]), endosulfan sulfate (2.86J to 27.6 µg/kg [17_SA1 at 0 feet]), endrin ketone (< 3.29 to 8.66J µg/kg (17_SA1 at 0 feet)), heptachlor epoxide (< 1.7 to 2.91J µg/kg [17_SA1 at 2 feet]), gamma-chlordane (< 1.7 to 7.98J µg/kg [17_SA1 at 0 feet]), methoxychlor (< 1.7 to 7.56J µg/kg [17_SA2 at 4 feet]), and 2,4-DB (< 49.5 to 402J µg/kg [17_SA2 at 4 feet]).

2.2.2 Subsurface Soil

- metals: 21 of 23 TAL metals;

- VOCs: acetone (< 10 to 38 µg/kg [17_DGMW82 at 25 feet]), toluene (< 10 to 4J µg/kg [17_DBO53; 10 feet]), 2-butanone (< 10 to 16 µg/kg [17_DGMW82 at 25 feet]);

- petroleum hydrocarbons: TRPH (< 20 to 1,886 mg/kg [17_DBO53 at 10 feet]), TFH-gasoline (< 0.05 to 0.584 mg/kg [17_DBO53 at 10 feet]), TFH-diesel (< 13.6 to 106 mg/kg [17_DBO53 at 10 feet]); and

- pesticides, PCBs, herbicides: endrin ketone (< 3.4 to 2.9 µg/kg [17_DBO53 at 10 feet]), endosulfan sulfate (< 3.4 to 7.29 µg/kg [17_DBO53 at 10 feet]), dalapon (< 54.7 to 172 µg/kg [17_DBO53 at 10 feet]), dinoseb (< 25.6 to 38.8 µg/kg [17_DBO53 at 60 feet]), 2-methyl-4-chlorophenoxyproprionic acetic (< 25,600 to 70,300 µg/kg [17_DBO53 at 5 feet]), 2-methyl-4-chlorophenoxyproprionic acid (< 25,600 to 58,300 µg/kg [17_DBO53 at 40 feet]), 2,4-DB (< 51.2 to 200 µg/kg [17_DBO53 at 60 feet]), dichloroprop (< 102 to 171 µg/kg [17_DBO53 at 40 feet]).

2.2.3 Groundwater

- metals: arsenic (< 0.7 to 5.6B micrograms per liter [µg/L] [17_DGMW82]) and 12 other TAL metals; and

- VOCs: bromodichloromethane (< 1 to 7 µg/L [17_DGMW82]), chlorodibromomethane (< 1 to 6 µg/L [17_DGMW82]), and chloroform (< 1 to 7 µg/L [17_DGMW82]).

2.3 AIR SWAT

The following activities were conducted as part of the Air Solid Waste Assessment Test (Air SWAT) (Strata 1991):

- landfill gas sampling,
- ambient air sampling,
- integrated surface sampling, and
- landfill gas migration testing.

A summary of the Air SWAT analytical results is presented below. The Air SWAT report did not quantify compound detection limits. If the compound was not detected, it was reported as not detected (ND).

2.3.1 Landfill Gas

- VOCs: dichloromethane ($MeCl_2$) (ND to 820 parts per billion by volume [ppb_v]) (field blank 720 ppb_v); and
- other gases: oxygen (ND to 19 percent by volume [$\%_v$]), nitrogen (ND to 81 $\%_v$), and carbon dioxide (ND to 15 $\%_v$).

2.3.2 Ambient Air

- VOCs: $MeCl_2$ (ND to 4.3 ppb_v), 1,1,1-trichloroethane (0.51 to 6.4 ppb_v), tetrachloroethene (ND to 0.29 ppb_v).

2.3.3 Integrated Surface Sampling

- total organic compounds (TOCs) as methane (4.1 parts per million by volume [ppm_v]).

2.3.4 Landfill Gas Migration Sample Points

- TOC (ND to 13 ppm_v).

Section 3
MAPS

The maps on the following pages present the location of the site on MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and proposed Phase II sampling locations (where known). These maps are referenced in other sections of this FSP.

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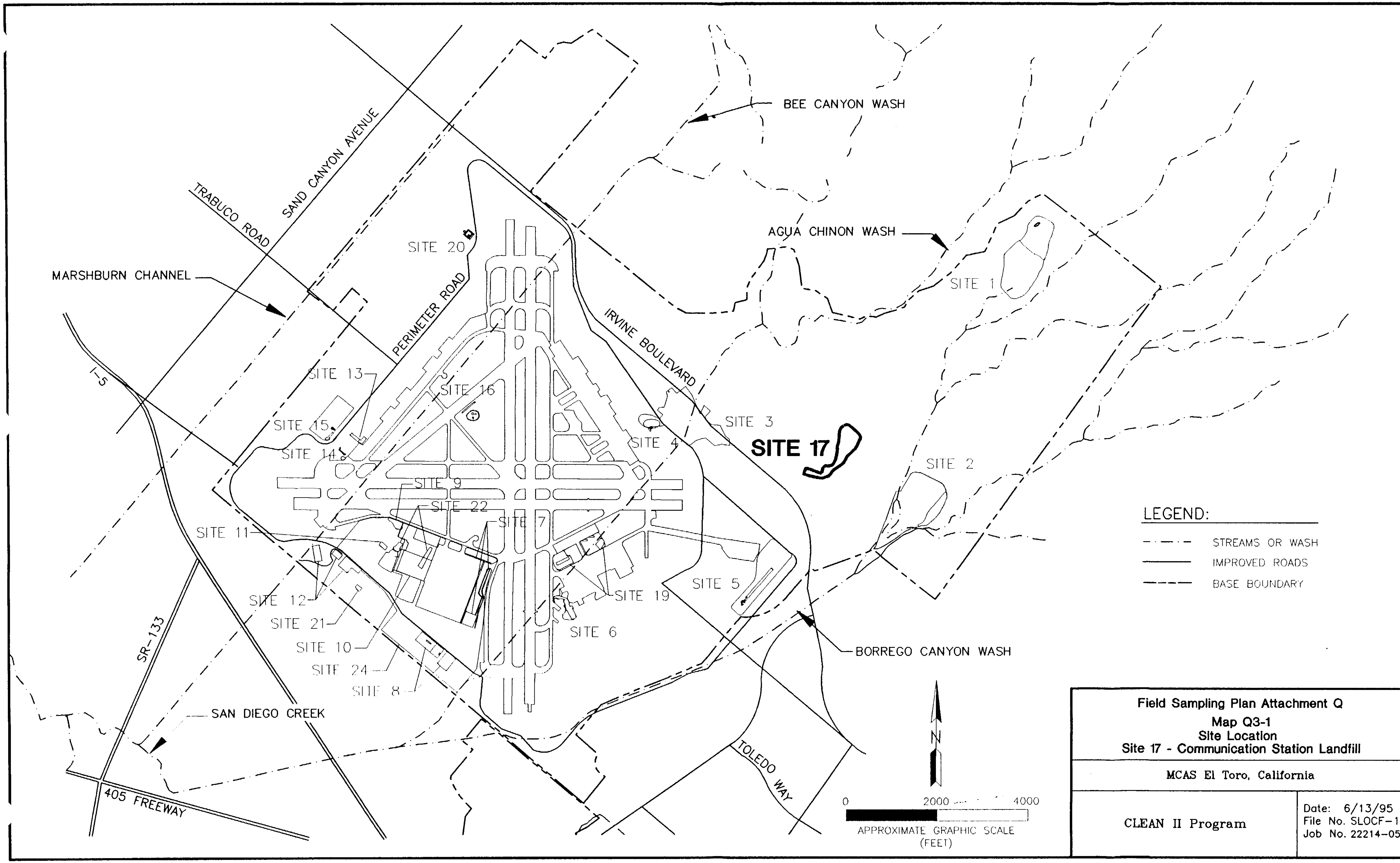

Field Sampling Plan Attachment Q
Map Q3-1
Site Location
Site 17 - Communication Station Landfill

MCAS El Toro, California

CLEAN II Program

Date: 6/13/95
File No. SLOCF-17
Job No. 22214-059

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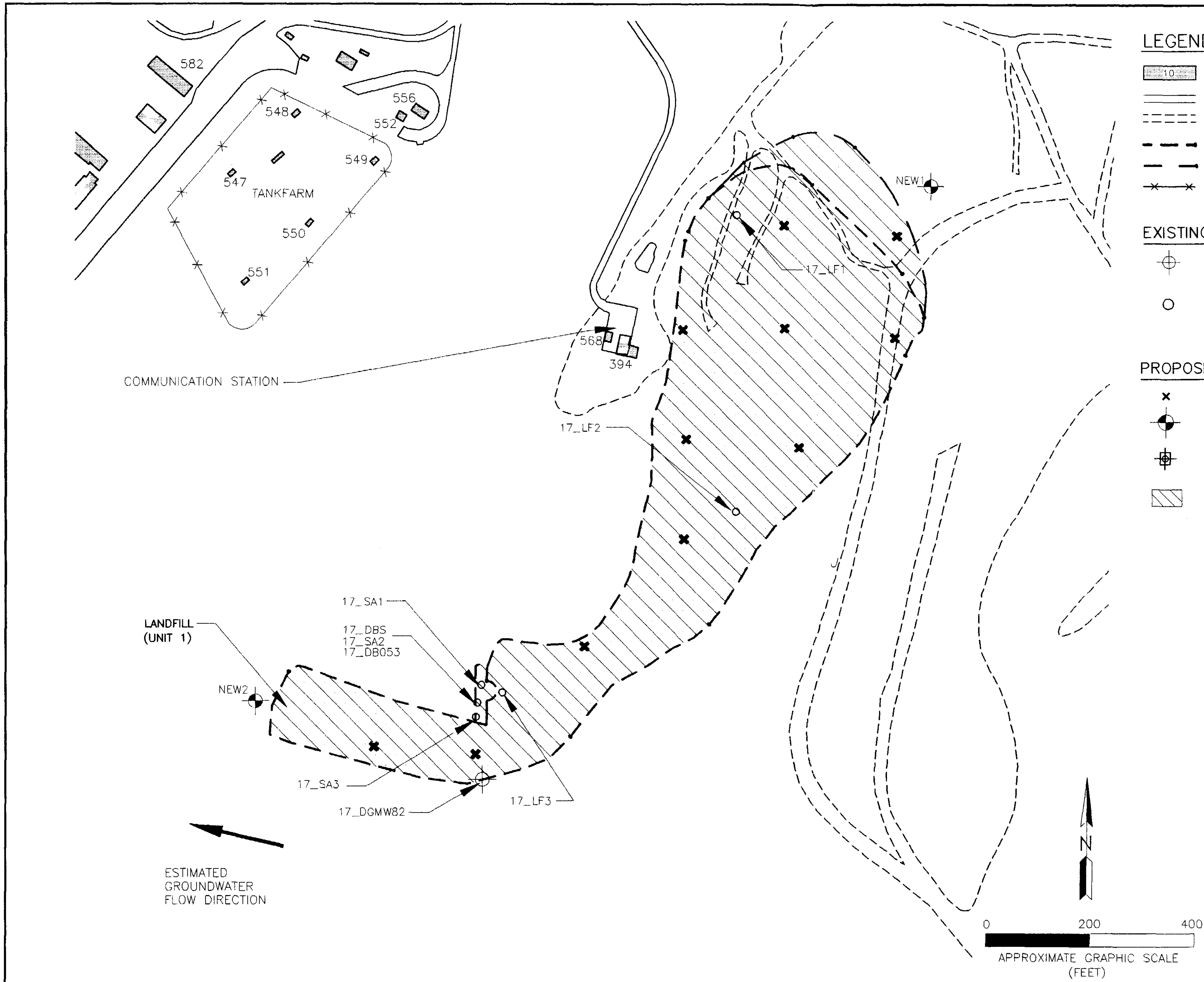

Field Sampling Plan Attachment Q Map Q3-2 Site Plan Site 17 - Communication Station Landfill	
MCAS El Toro, California	
CLEAN II Program	Date: 6/20/95 File No. sitef17b Job No. 22214-059

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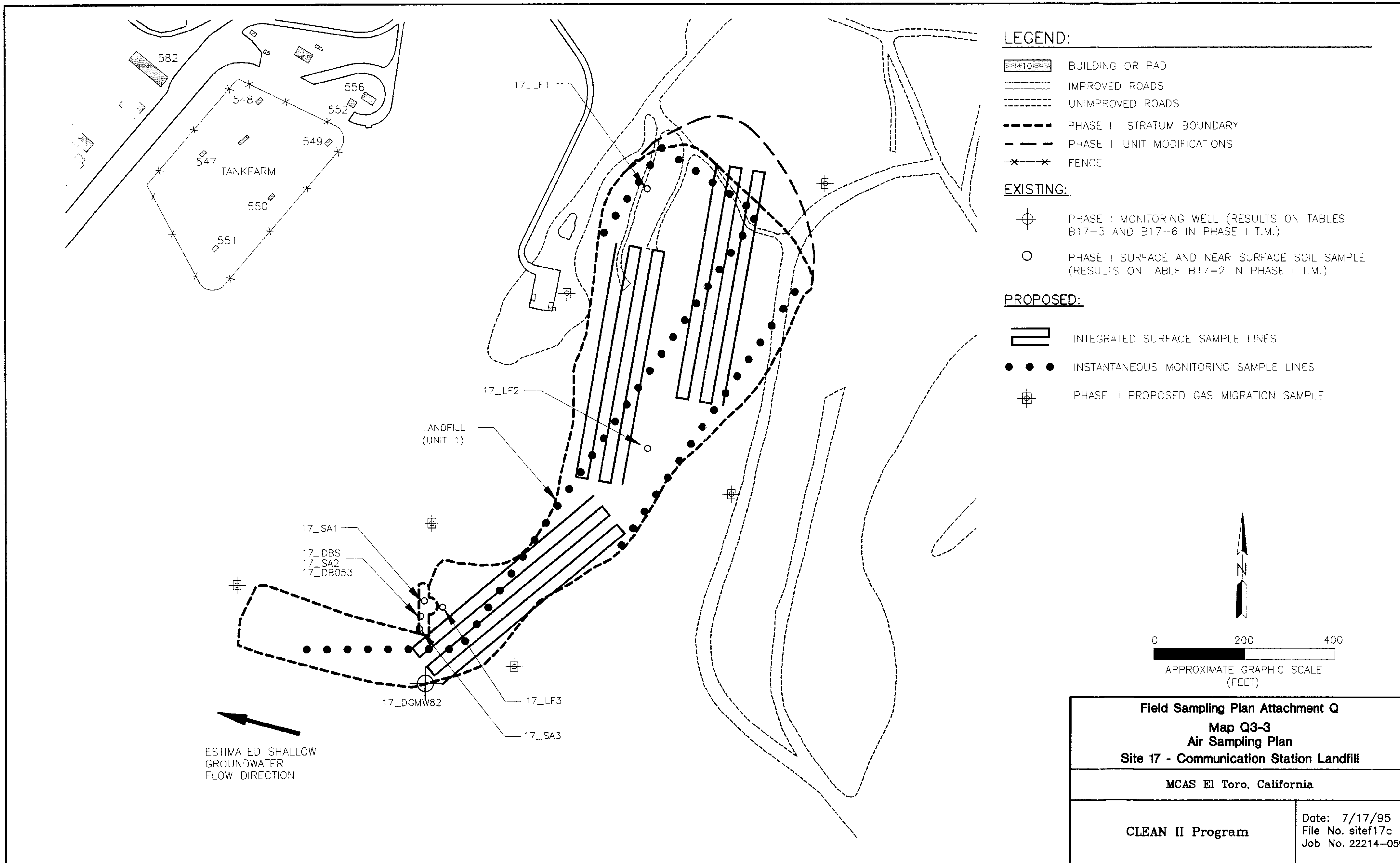

Field Sampling Plan Attachment Q

Map Q3-3
Air Sampling Plan
Site 17 - Communication Station Landfill

MCAS El Toro, California

CLEAN II Program

Date: 7/17/95
File No. sitef17c
Job No. 22214-059

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

The rationale for sampling at Site 17 is based on site conditions, previous investigations, and the DQOs as presented in Appendix Q of the Phase II Work Plan (BNI 1995a). The data collection activities at Site 17 are designed to be sufficient to allow application of the U.S. EPA Presumptive Remedy for municipal landfill sites (U.S. EPA 1993).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, sample types, and locations are presented on the basis of a site unit. Selection of specific sampling programs, sample types, and locations are based on:

- site history,
- types of media suspected or known to be impacted from previous investigations, and
- objectives of site-specific RI/FS efforts.

At Site 17, the following site unit has been defined: Unit 1, area occupied by the landfill.

The sampling program will be implemented by following a tiered approach. At the conclusion of each tier, collected data will be evaluated; based on the results of the evaluation, decisions will be made on whether or how to proceed with additional field activities outlined in subsequent tiers.

- Tier 1 sampling activities include assessing the need to collect additional samples to assess whether the site is a risk and includes nonintrusive investigations, limited intrusive sampling (e.g., soil gas surveys), and the sampling of existing systems (e.g., wells).
- Tier 2 activities include more extensive and intrusive investigations such as subsurface borings and sampling of soils, or the installation and sampling of wells.
- Tier 3 activities, if they occur, typically are remedial-design oriented such as soil vapor extraction or aquifer tests.

Because implementation of the Presumptive Remedy is the objective of the RI/FS, the following sections discuss specifics of several sampling methods and their relevance to this objective.

4.1.1 Surface Geophysical Survey

An EM surface geophysical survey will be conducted to better define the limits of landfilled waste. The area to be included in the survey is based on the Phase I RI (Jacobs Engineering 1993), employee interviews (Jacobs Engineering 1994), and aerial surveys (SAIC 1993). The boundaries of landfilled waste will be used to design a landfill cap and will define the area requiring institutional controls (including deed restrictions).

4.1.2 Soil Gas Survey

A soil gas survey will be performed to evaluate the potential presence of hot spots in accordance with the U.S. EPA Presumptive Remedy requirements (U.S. EPA 1993). The soil gas data will be used to identify potential hot spots. Hot spots may require further characterization, and treatment or removal if assessment of the data show the hot spot threatens the integrity of the landfill containment system. Soil gas samples will be collected and analyzed in a manner consistent with California Regional Water Quality Control Board (RWQCB) Los Angeles Region requirements for active soil gas investigations (RWQCB 1994)

4.1.3 Air Monitoring and Sampling

Air monitoring and sampling will be performed to reassess the migration of landfill gas into the atmosphere by verifying and supplementing existing emission data. The resulting data will be used to assess the effectiveness of the existing cap and evaluate whether additional control of landfill gas emission is necessary. Sample types and locations were selected using South Coast Air Quality Management District (SCAQMD) Rule 1150.1 guidelines (SCAQMD 1989).

4.1.4 Groundwater Monitoring and Sampling

Groundwater monitoring wells will be installed and sampled, and the resulting data will be used to assess if there are impacts to groundwater as well as compliance monitoring required for landfill closure (CCR 1991).

4.1.5 Vadose Zone Monitoring and Sampling

Soil sampling using angled borings will be performed to assess landfill impacts to vadose zone soils. Vadose zone monitoring equipment (i.e., soil vapor probe) will be installed in selected borings to assess the migration of landfill contaminants for vadose zone compliance monitoring. The soil samples collected during drilling will be analyzed for the chemicals of potential concern (COPCs) identified in the DQOs. For compliance monitoring, two vadose zone borings will be advanced under the landfill and equipped with vapor probes.

4.1.6 Ecological Samples

Samples of biota will be collected at Sites 2 and 17 to provide additional data to the proposed predictive model of the Phase II RI/FS ecological risk assessment (BNI 1995b). The purpose of the proposed biota is twofold:

- to provide a quantitative assessment of potential uptake of contaminants into the food chain, and
- to provide data which will be used to evaluate remedial alternatives.

4.2 TIER 1

Tier 1 sampling activities at Site 3 may include:

- land surveying,
- surface geophysical surveying,
- soil gas sampling, and
- air monitoring and sampling.

The application of these sampling activities are discussed for each unit of Site 3.

4.2.1 Unit 1: Landfill Area

The location of Unit 1 is shown on Map Q3-2. Unit 1 field investigations and data collection will focus on ascertaining information to supplement Phase I RI data and to facilitate cost-effective closure criteria set forth by California RWQCB. The Unit 1, Landfill Area, sampling program consists of two tiers.

The proposed scope for Tier 1 includes the following tasks:

- land surveying,
- surface geophysical surveying,
- soil gas sampling, and
- air sampling.

4.2.1.1 LAND SURVEYING

At the beginning and at the completion of the field investigation, Site 17 will be surveyed to establish horizontal and vertical controls. The initial field survey will establish proposed locations for the soil gas and geophysical survey, soil borings, and groundwater monitoring wells. In addition, the data will be used to generate a topographic map of the site. Topographic data will be used in the landfill cap design.

At the completion of the Phase II activities, a final survey will be conducted to identify sampling stations that were changed. The final survey will also establish well casing elevations and will locate landfilled waste boundaries as delineated by the surface geophysical survey and trenching data.

4.2.1.2 SURFACE GEOPHYSICAL SURVEYING

A previous surface geophysical survey was conducted using ground-penetrating radar during the Air SWAT investigation (Strata 1991). This geophysical survey was limited, leaving uncertainty regarding the boundaries of the landfill. Therefore, at the completion of the initial land survey, an EM survey will be conducted to better define landfilled waste boundaries.

The EM surface geophysical survey will be performed on a layout consisting of lines spaced at 50 feet. The area to be included in the surface geophysical survey are shown on Map Q3-2.

4.2.1.3 SOIL GAS SAMPLING

Soil gas samples will be collected from a 200-foot, on-center grid (Figure Q3-2). Samples will be collected from a depth of approximately 15 feet. Samples will be analyzed using an on-site mobile laboratory. Laboratory test results will be used to identify potential soil gas hot spots. Localized areas of containing potential hot spots will then be further characterized from a 25-foot, on-center grid.

To assess off-site migration of landfill gas, soil gas samples will be collected at a spacing of not less than 1,000 feet outside the fill areas and along the perimeter of the site from approximate depths of 10, 25, and 40 feet.

The soil gas and gas migration sample locations are shown on Map Q3-2.

4.2.1.4 AIR SAMPLING

The air sampling program consists of an instantaneous gas sampling survey, integrated surface gas sampling, flux chamber monitoring, ambient air sampling, and collection of local meteorological data. Meteorological data will be used to identify the optimum number and locations of the ambient air samples. Lateral migration of landfill gas will be evaluated by sampling at the perimeter of the landfill and outside the refuse boundaries as described in Section 4.2.1.3.

Instantaneous Gas Sampling

An instantaneous gas emissions survey will be performed over the landfill area. The instantaneous sampling survey consists of sampling grid lines where the concentration of the gas immediately above the surface of the landfill is monitored with a portable flame ionization detector (FID). Sample locations are shown on Map Q3-3.

Integrated Surface Samples

Three integrated surface samples will be collected to check that the average concentration of TOCs over a certain area (50,000 $feet^2$) does not exceed 50 ppm_V. Sample locations are shown on Map Q3-3.

Meteorological Data

Prior to and during ambient air sampling, mechanical weather stations will be installed at the perimeter of the landfill to measure wind speed and direction. The initial data will be reviewed to identify the optimum number and locations of the ambient air samples.

Ambient Air Sampling

Upwind and downwind ambient air samples will be collected at the perimeter of Site 17. The samples will be collected over a 24-hour period beginning between 10 and 11 a.m.

Flux Chamber Monitoring

The location and number of flux chamber samples will be determined in a manner consistent with the U.S. EPA Isolation Flux Chamber User's Guide (U.S. EPA 1986), and after a review of the surface emission and soil gas sampling results.

Landfill Gas Migration Samples

As described in Section 4.2.1.3, landfill gas migration samples will be collected during the soil gas investigation.

4.2.1.5 ECOLOGICAL SAMPLES

To assess this potential ecological risk and to provide data that will be useful for evaluation of remedial alternatives, soil invertebrates (e.g., earthworms or deer mice) will be collected from each site and a reference site near Site 17, which is not suspected of being contaminated. Up to 15 samples will be collected from the site and submitted for whole-body chemical analysis. Sampling location will be established by constructing a grid to provide 50 evenly spaced sampling points at each site. The 15 sampling locations will be randomly selected at each site. The types of biota and sampling procedures are presented in the Risk Assessment Plan (BNI 1995b).

4.3 TIER 2

4.3.1 Unit 1: Landfill Area

The scope of Tier 2 investigations depends on the findings of the Tier 1 investigation. At the completion of Tier 1, the data will be evaluated to focus the following Tier 2 tasks:

- trenching,
- subsurface sampling,
- groundwater monitoring well installation, and
- vadose zone sampling.

4.3.1.1 TRENCHING

The lateral extent of disposal activities will be confirmed by trenching across locations along the landfills perimeter where geophysical anomalies exist. To avoid contaminating the native soil, the backhoe will excavate the waste material from the perimeter of disposal areas toward the center of the disposal area.

4.3.1.2 SUBSURFACE SAMPLING

If potential hot spots are identified during Tier 1 sampling, hollow-stem auger borings may be collected. The number, location, and depth of these borings will depend on Tier 1 findings and field conditions. Information from these borings will help answer the following questions (U.S. EPA 1993):

1. Does evidence exists that indicates the presence and approximate location of localized waste?
2. Is the localized waste a "principal threat waste" such as a chlorinated solvent?
3. Is the localized waste in a discrete, accessible part of the landfill?
4. Is the localized waste significant enough of a threat, yet small enough in volume to be removed from the landfill in a cost-effective manner?

4.3.1.3 GROUNDWATER MONITORING WELL INSTALLATION

In addition to the existing monitoring well, a minimum of two new wells will be installed to complete a compliance monitoring system, define groundwater gradient, and assess the potential presence of groundwater contamination at the landfill perimeter. Compliance monitoring requires at least one upgradient monitoring well and two downgradient monitoring wells. Well numbers NEW1 and NEW2 will used for upgradient and downgradient water quality, respectively. The proposed locations of these wells are shown in Map Q3-2.

4.3.1.4 VADOSE ZONE SAMPLING

At least two slanted borings will be drilled and sampled adjacent to the main disposal area of Site 17. The borings will be cased, and a permanent sampling probe will be installed in the borings to collect leachate and/or gas that has percolated beneath the refuse into the vadose zone.

The final number and locations of these borings will depend on the results of the Tier 1 investigations.

Section 5
REQUEST FOR ANALYSES

Request for analyses is based on the analytical test rationale discussed in Section 4 of the FSP, which reflects the COPCs listed in the DQOs (BNI 1995a, Appendix Q). These were based on the results of Phase I RI activities.

The analytical methods discussed in this section comprise those presented in the Phase II Quality Assurance Project Plan (QAPP) for quality assurance procedures (BNI 1995c). The primary objective when requesting an analytical method is to provide data that are precise, accurate, representative, comparable, and complete. The data must meet the data quality objectives discussed in detail in the QAPP and must follow all the guidelines established under Naval Facilities Engineering Service Center (NFESC, formerly known as Naval Energy and Environmental Support Activity [NEESA]) Level D.

5.1 ANALYTICAL TESTING RATIONALE

The various analyses chosen are based on the COPCs and thus are site specific. During the Phase II RI, the NFESC Level D guidelines must be followed, and the analyses will be performed by an approved laboratory for Comprehensive Long-Term Environmental Action Navy (CLEAN) II. The parameters have been determined based on regulatory limits, health/risk calculations, and NFESC Level D analytical method limitations.

5.2 FIELD SCREENING

Field-screening analytical methods are cost-effective, have rapid turnaround time, and provide accurate data. Field-screening provides useful information during field investigations and remediation planning at contaminated sites. The data collected from the field-screening methods can minimize the number of nondetects submitted to a stationary laboratory for analysis, and can also be effectively used to estimate the nature and extent of contamination.

5.2.1 Metals (Title 26)

Landfills are typically sources of several types of metals. During the Phase I RI, several metals were identified in both soil and groundwater. For this reason, an on-site mobile laboratory will analyze select soil samples for Title 26 metals using inductively coupled argon plasma techniques.

5.2.2 Volatile Organics Compounds - PID and FID

VOCs at Site 17 include common solvents, dry cleaning fluids, and degreasing agents. They were commonly used at MCAS El Toro, and thus were likely disposed at the landfill. Additionally, VOCs were identified as COPCs in Site 17 soils and groundwater.

All soil samples collected will be field-screened with a photoionization detector (PID) and FID. All soil samples with PID and FID aboveground and 5 percent of the soil samples with nondetectable readings will be sent to the mobile laboratory. The on-site mobile laboratory will analyze the samples for VOCs using a gas chromatograph (GC) or gas chromatography/mass spectroscopy (GC/MS).

5.2.3 Nonhalogenated Volatiles - PID and FID

Fuel hydrocarbons (including gasoline and diesel fuel) were used extensively at MCAS El Toro and were probably disposed at the landfill. The Phase I investigation identified fuel hydrocarbons and TRPH at several locations at Site 17.

All soil samples collected will be field-screened with a PID and FID in the field. All soil samples with PID and FID aboveground and 5 percent of the soil samples with nondetectable readings will be sent to the mobile laboratory. The on-site mobile laboratory will analyze for nonhalogenated volatiles and fuel hydrocarbons using a portable GC or GC/MS.

5.2.4 Gross Alpha and Beta - Scintillometer

Dials painted with radioactive residue could have been disposed at the landfills. Gross alpha particle activity and gross beta particle activity were identified during Phase I field investigations as COPCs in groundwater.

All soil samples collected will be field-screened with the scintillometer.

5.2.5 TO-14 Volatile Organic Compounds - Soil Gas

Several VOCs have been identified at Site 17 in the soil gas, surface, and ambient air. This analysis will be performed on soil gas, surface, and ambient air samples.

All soil gas, surface, and ambient air samples collected will be analyzed in the on-site mobile laboratory using Method TO-14 for VOCs.

5.3 FIXED-BASE ANALYTICAL LABORATORY TESTS

As described in the QAPP (BNI 1995c), 20 percent of the soil samples analyzed by the mobile laboratory are required to be analyzed by a NFESC Level D laboratory for confirmation. Two-thirds of the 20 percent will include soil samples that contain detectable concentrations of VOCs, SVOCs, nonhalogenated volatiles, or concentrations of metals that exceed background. One-third of the 20 percent will include soil samples that contain nondetectable concentrations of the above constituents and soil samples that do not exceed background concentrations of metals. The analytical test methods for NFESC Level D confirmation analysis are described below.

5.3.1 Metals (Title 26 Metals) - U.S. EPA Methods 6010 and 200.7

Select soil samples analyzed by the mobile laboratory for Title 26 metals will be sent to the NFESC Level D laboratory for confirmation. All collected groundwater samples will be sent to the NFESC Level D laboratory for metals analysis.

5.3.2 Pesticides and PCBs - U.S. EPA Methods 8080 and 608

Although the pesticides identified during Phase I investigations are included in U.S. EPA Method 8270 (which is also being performed), the detection limits in the U.S. EPA Method 8080 are lower. To better define PRG limits, U.S. EPA Method 8080 will be performed.

Soil samples will be sent to the NFESC Level D laboratory for analysis of pesticides and PCBs using U.S. EPA Method 8080. All collected groundwater samples will be sent to the NFESC Level D laboratory for pesticides and PCBs using U.S. EPA Method 608.

5.3.3 Volatile Organic Compounds - U.S. EPA Methods 8240 and 624

Select soil samples analyzed in the mobile laboratory for VOCs will be sent to the NFESC Level D laboratory for confirmation. All collected groundwater samples will be sent to the NFESC Level D laboratory for confirmatory analyses of VOCs.

5.3.4 General Minerals/Chemistry

All groundwater samples will be sent to the NFESC Level D laboratory for analysis of general minerals and water chemistry. The analyses will include alkalinity (as $CaCO_3$), alkalinity with breakdown, total phosphates, ammonia-nitrogen, TKN, nitrate, calcium, sodium, potassium, magnesium, iron, sulfate, chloride, bicarbonate, nitrite, fluoride, turbidity, pH, TDS, and conductivity.

5.3.5 Gross Alpha and Beta - U.S. EPA Method 703

Of the soil samples collected and field screened for gross alpha/beta radioactivity, All of the samples with elevated radioactivity will be sent to the NFESC Level D laboratory for confirmation. All collected groundwater samples will be sent to the NFESC Level D laboratory for gross alpha/beta radioactivity analyses.

5.3.6 Total Organic Carbon - U.S. EPA Method 9060

Analysis for total organic carbon is being performed to characterize potential soil retardation factors. Retardation factors are helpful in understating contaminants fate and transport. For analysis, soil samples are retrieved from borings in the saturated zone. Only one sample (saturated soil) will be analyzed for TOCs in each well.

5.3.7 Semivolatile Organic Compounds - U.S. EPA Methods 8270 and 625

Select soil samples analyzed in the mobile laboratory for SVOCs, will be sent to the NFESC Level D laboratory for confirmation. All collected groundwater samples will be sent to the NFESC Level D laboratory for SVOC analyses.

5.3.8 Nonhalogenated Volatiles - U.S. EPA Method 8015M

Select soil samples analyzed in the mobile laboratory for nonhalogenated volatiles will be sent to the NFESC Level D laboratory for confirmation. All collected groundwater samples will be sent to the NFESC Level D laboratory for a nonhalogenated volatiles analyses.

5.3.9 Chlorinated Herbicides - U.S. EPA Methods 8150 and 615

Agricultural activities are common both on-Station and in the vicinity of the landfill; thus, it reasonable to expect several herbicides in the landfill. Typically, herbicides would be superficial because of their low tendency to migrate. However, because of the nature of a landfill, herbicides may have been landfilled and may occur deeper in the subsurface.

Select samples will be sent to the NFESC Level D laboratory for analysis of chlorinated herbicides. All groundwater samples collected will be sent to the NFESC Level D laboratory for chlorinated herbicide analyses.

5.4 SUMMARY OF TESTS

Tables Q5-1 through Q5-4 summarize the analytical tests planned for the Phase II RI.

Table Q5-1
Soil Sampling and Analysis – On-Site Mobile Laboratory

Tier	Unit/Name	No. of Locations	Samples/ Location[a]	Total Samples	ON-SITE MOBILE LABORATORY VOCs[b]	SVOCs[c]	TPH[d]	Metals	Gross Alpha & Beta[g]
Tier 1	Landfill Area[f]	2	5	10	10	10	10	10	10
Tier 2	Landfill Area	2	1	2	2	2	2	2	2
Total		4		12	12	12	12	12	12

Notes:
[a] a minimum of one soil sample from each slant boring drilled in the vadose zone and five samples from each groundwater monitoring well will be sent to the on-site mobile laboratory.
[b] VOC – volatile organic compound
[c] SVOC – semivolatile organic compound
[d] TPH – total petroleum hydrocarbons
[e] PCB – polychlorinated biphenyl
[g] field instrument

Table Q5-2
Soil Sampling and Analysis – Off-Site Laboratory

Tier	Unit/Name	No. of Locations	Samples[b] Location	Total Samples	OFF-SITE LABORATORY[a]							
					VOCs[c]	SVOCs[d]	TPH[e]	Pesticides/ PCBs[f]	Herbicides	Total Organic Carbon[g]	Metals	Gross Alpha & Beta
Tier 1	Landfill Area[f]	2	5	10	1	1	1	1	1	2	1	1
Tier 2	Landfill Area	2	1	2	1	1	1	1	1	0	1	1
Total		4		12	2	2	2	2	2	2	2	2

Notes:
- [a] a minimum of 10 percent of the total samples sent to the on-site mobile laboratory will be sent to an off-site laboratory for QA/QC.
- [b] a minimum of one soil sample from each slant boring drilled in the vadose zone and five soil samples from each groundwater monitoring well will be collected for analytical testing.
- [c] VOC – volatile organic compound
- [d] SVOC – semivolatile organic compound
- [e] TPH – total petroleum hydrocarbons
- [f] PCB – polychlorinated biphenyl

Table Q5-3
Soil Gas Sampling and Analysis

Tier	Unit/Name	No. of Locations	Samples/ Location[a]	Total Samples	ON-SITE MOBILE LABORATORY[b] TO-14 (Methane)	OFF-SITE LABORATORY[c] TO-14 (Methane)
Tier 1	Landfill Area	17[d] & TBD[e]	1 or 3	29	29	3
Tier 2	Landfill Area	2	1	2	2	2
Total		19		31	31	5

Notes:
[a] samples will be collected from 11 locations on the landfill at depths of 15 feet; samples will be collected from 6 locations outside the landfill boundary at depths of 10, 25, and 40 feet bgs
[b] all soil gas samples collected will be sent to the on-site mobile laboratory for analysis
[c] a minimum of 10 percent of the samples sent to the on-site mobile laboratory will be sent to an off-site laboratory for QA/QC
[d] additional soil gas samples may be collected to better define hot spots within the landfill
[e] TBD – to be determined

Table Q5-4
Groundwater Sampling and Analysis

Tier	Unit/Name	No. of Locations	Samples/ Location	Total Samples	OFF-SITE LABORATORY								ON-SITE MOBILE LABORATORY
					VOCs[a]	SVOCs[b]	TPH[c]	Pesticides/ PCBs[d]	Herbicides	General Chemistry	Metals	Gross Alpha & Beta	VOCs
Tier 1	Landfill Area	NA[e]											
Tier 2	Landfill Area	2	1	2	2	2	2	2	2	2	2	2	2
Total		2		2	2	2	2	2	2	2	2	2	2

Notes:
[a] VOC – volatile organic compound
[b] SVOC – semivolatile organic compound
[c] TPH – total petroleum hydrocarbons
[d] PCB – polychlorinated biphenyl
[e] N/A – not applicable

Section 6
FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods discussed in this section are based on CLEAN II Program Standard Operating Procedures.

6.1 LAND SURVEY

An initial land survey will establish proposed locations for the soil gas and geophysical survey, soil borings, and groundwater monitoring wells. Each control point to be surveyed will be marked on the ground and on the draft field maps. Each point will be identified by the station identification on the map and on a flag attached to the rebar marking the sampling location.

Each sampling point will be surveyed and located to the nearest 0.1 foot, using the California Plane Coordinate System with northings and eastings. The precision of the vertical measurements will be within 0.01 feet. A surface contour map will be generated with 2-foot contour intervals.

At the completion of the Phase II activities, a final survey will be conducted to identify sampling stations that were changed. The final vertical controls will be resurveyed to the accuracy of 0.01 feet. The final survey will also establish well casing elevations, and identify landfilled waste boundaries as delineated by the surface geophysical survey and trenching data. Further land surveying details are discussed in Section 6 of the FSP.

6.2 SURFACE GEOPHYSICAL SURVEY

At the completion of the initial land survey, a surface geophysical survey will be conducted to define landfilled waste boundaries. Both electromagnetic induction profiling and time-domain electromagnetic surveys will be performed. Survey lines will be spaced at approximately 50-foot intervals that cross the suspected boundaries of fill areas. The area to be surveyed includes the suspected limits of waste disposal at the landfill. Operational procedures for surface geophysical surveys are described in Section 6 of the FSP.

6.3 TRENCHES

The rationale for limited trenching is to confirm the presence of past disposal activities at locations where surface geophysics indicate the presence of anomalies. The lateral extent of disposal activities will be confirmed by trenching across the perimeter of anomalous areas using a backhoe. To avoid contaminating the native soil, the backhoe will excavate the waste material from the perimeter of disposal areas toward the center of the disposal area.

Excavation will continue until the lateral extent of wastes are visibly determined, or the depth of approximately 10 feet bgs is reached, whichever comes first.

6.4 SOIL GAS

Soil gas samples will be collected using a cone penetrometer test rig. Soil gas samples will be collected according to "Requirements for Active Soil Gas Investigation," produced by the California RWQCB, Los Angeles Region (RWQCB 1994). Guidelines that will not be followed are related to the recommended distance between sample points. A 200-foot initial grid pattern is planned for Site 17 with a secondary 25-foot grid to characterize hot spots. Soil gas sampling procedures are described in detail in FSP Section 6.

6.5 SOIL SAMPLES

Surface and near-surface soil samples will be collected with a hand trowel or hand auger. Part of the soil sample will be directly transferred to the sample jar and placed into the cooler. Samples being analyzed for VOCs will have a portion of the sample placed in a plastic bag for field determination of organic vapor in the headspace.

Soil samples will also be collected from angled soil borings and monitoring well borings. Each boring will be hand augered to a depth of 5 feet (or refusal) to reduce the potential of drilling through subsurface utilities. A CLEAN II Team geologist will be present for drilling, soil logging and sampling, field screening, and final abandonment or completion of a monitoring or vadose well. All borings will be logged according to the Unified Soils Classification System. Soil samples will be collected at minimum 5-foot intervals by driving a modified California soil sampler. Sample intervals may be reduced at the discretion of the field geologist. Soil sampling procedures are outlined in the following FSP sections:

- Section 6.9, geophysics;
- Section 6.2, utility clearance;
- Section 6.12, decontamination;
- Section 6.3, surface samples;
- Section 6.3, hollow-stem auger borings;
- Section 6.3, hand auger borings;
- Section 5.2, field screening; and
- Section 6.14, sample handling, packaging, and shipping.

6.6 AIR SAMPLING

Air sampling will be performed to satisfy SCAQMD Rule 1150.2 requirements for the control of gaseous emissions from inactive landfills. The surface emission sampling program will be implemented to evaluate the landfill gas surface emissions and the potential for off-site migration. The sampling program consists of an instantaneous gas sampling survey, integrated surface gas sampling, flux chamber monitoring, ambient air sampling, and collection of local meteorological data. Lateral migration of landfill gas will be evaluated by sampling at the perimeter of the landfill and outside the refuse boundaries, as described in Section 4.2.1.4.

6.6.1 Instantaneous Gas Sampling

During the instantaneous sampling survey, the concentration of the gas immediately above the surface of the landfill is monitored with a portable FID. The FID is held no more than 3 inches above the landfill surface. Areas above which the instantaneous organic vapor analyzer reading exceed 50 ppm_V will be identified per SCAQMD Rule 1150.2.

6.6.2 Integrated Surface Samples

To collect integrated surface samples, Site 17 will be divided into several grids, each 50,000-square-feet in size. One integrated surface sample will be collected at 2 to 3 inches above the surface from each 50,000-foot^2 grid area. Surface samples will be collected using a portable self-contained sampling unit equipped with a collection probe and a pump. Continuous samples are collected in 10-liter Tedlar™ bags at a pump flow rate of 333 cubic centimeters per minute taken while walking through 2,600 linear feet in 25 minutes. The integrated surface sample contained in the Tedlar™ bag will be monitored with a portable FID. If the FID reading exceeds 500 ppm_V, the sample will be submitted to the laboratory for analysis. Surface monitoring and sampling will be performed when landfill is dry (a minimum of 72 hours after rainfall). Surface sampling will be terminated when the average wind speed exceeds 5 miles per hour (mph) (determined on a 10-minute average) or the instantaneous wind speed exceeds 10 mph.

6.6.3 Flux Chamber Monitoring

Although not required by SCAQMD Rule 1150.2, landfill gas emissions will be collected from an isolated soil surface area using an emission isolation flux chamber, for risk assessment purposes. Gaseous emissions are sampled by placing the flux chamber over the area to be sampled and working it into the surface to a depth of approximately 1 inch. Sweep air is injected at a flow rate of 5 liter per minute. After 24 minutes, samples are collected. To prevent cross-contamination before and between sampling, the chamber will be purged with ultra-high-purity air (less than 0.1 ppm_V total hydrocarbons) and followed with running a method blank until exit concentrations are less than 10 ppm_V or less than 10 percent of expected concentrations, whichever is smaller. Gas emission samples will not be collected using the flux chamber during or after a rain. Gas emission samples will be collected after a minimum of 72 hours after rainfall. Details of monitoring and sampling procedures are provided in the FSP Section 6. The location and number of flux chamber samples will be determined after the review of the surface emission and soil gas sampling results.

6.6.4 Ambient Air Sampling

Ambient air sampling will be performed at the perimeter of Site 17 to assess potential concentrations of landfill gas migrating off-site. Several continuous recorders will be installed and operated at the perimeter of the landfill to measure wind speed and direction throughout the sampling period. These data will be reviewed to identify the optimum number and locations of the ambient air samples. The mechanical weather stations will be installed approximately 12 feet above the ground, and more than 60 feet away from obstacles such as trees and buildings. Three ambient air samplers will be installed at the perimeter of Site 17 at downwind and upwind locations. Samples will be collected in a 10-liter Tedlar™ bag over a 24-hour period beginning, between 10 and 11 a.m.

6.7 GROUNDWATER SAMPLES

Before collecting groundwater samples, depth to water level will be measured in the existing wells. Before sampling, each monitoring well will be purged. After the level of groundwater has recovered to at least 90 percent of the prepurged level, groundwater samples will be collected. The water samples will be analyzed for VOCs in the on-site mobile laboratory.

Groundwater wells drilled and installed at Site 17 will follow well-development procedures. All new wells will be developed before groundwater sampling. Groundwater sampling procedures are outlined in the following FSP sections:

- Section 6.9, geophysics;
- Section 6.2, utility clearance;
- Section 6.12, decontamination;
- Section 6.4, field measurement of water quality parameters;
- Section 6.4, groundwater sampling to evaluate water quality;
- Section 6.4, field filtration of groundwater samples; and
- Section 6.14, sample handling, packaging, and shipping.

6.7.1 Monitoring Well Construction

To maintain a consistent groundwater quality data collection effort, Phase II monitoring wells will be constructed similar to those installed during the Phase I RI. The wells will be constructed with flush-threaded, 4-inch-diameter, Schedule 40, polyvinyl chloride (PVC) blank casing, screened over the lower 40 feet. Flush-threaded, 4-inch diameter, stainless steel, wire-wrapped screen will be used. The screen slot size (0.010-inch or 0.020-inch) will be determined at the time of drilling. Sand filter pack will be selected such that at least 90 percent of the filter pack is retained by the well screen. Centralizers will be used at the top, bottom, and center of the well screen.

Wells over 200 feet in depth will be constructed using 5-inch-diameter, flush-threaded, Schedule 80 PVC blank casing and screened over the lower 40 feet. Flush-threaded, 5-inch-diameter, stainless steel, wire-wrapped well screen will be used. Sand filter pack will be selected such that at least 90 percent of the filter pack is retained by the well screen. Centralizers will be used at the top, bottom, and center of the well screen. The wells will be constructed by suspending the casing in the boring. Well construction procedures are described in the following sections of the FSP:

- Section 6.4, monitoring well construction; and
- Section 6.4, surface completion of monitoring wells.

6.7.2 Well Development and Groundwater Sampling

The well materials will be allowed to set at least 48 hours before development. Each monitoring well will be developed using a surge-and-pump method until the discharged water is relatively free of fine suspended sediment. After each well volume is removed, samples of the discharged water will be collected and analyzed in the field for conductivity, temperature, pH, and turbidity. Well development will be complete when conductivity, temperature, and pH measurements vary less than 10 percent, and the discharged water is relatively free of fine suspended sediment. The field measurements will be recorded on the well-development log.

Groundwater samples will be collected after waiting at least 7 days after development. Groundwater sampling and development procedures are described in FSP Section 6.

6.8 LEACHATE SAMPLING

At least two slanted borings will be drilled and sampled adjacent to the main disposal area of the Site 3. Borings will be drilled at an angle of 30 degrees from vertical to obtain lateral penetration of approximately 50 feet bgs. Soil samples will be collected at 5-foot intervals and will be monitored for VOCs.

After the boring is cased, a probe assembly will be installed 1 foot into the vadose zone at the bottom of the casing. After applying a vacuum to the sample container with a hand pump, the needle assembly will be lowered into the drive rod, connected to the filter tip, and a leachate sample will be collected.

Different size sample container vials are available to collect 35-, 70-, and 500-milliliter samples. The pressure inside the sample vials can be monitored by an electronic pressure transducer.

An unsaturated soil moisture sampling system (lysimeter) will be used to collect a soil moisture sample from angled soil borings to assess the potential infiltration of landfill leachate in the vadose zone. The angled soil borings will be drilled such that at termination, the borings will be located beneath the refuse. A lysimeter probe assembly will be lowered through the hollow-stem augers and inserted approximately 1 to 2 feet into the soil. A vacuum will be applied to the lysimeter using a hand pump or equivalent vacuum device. A soil moisture sample will be collected.

6.9 ECOLOGICAL SAMPLING

Up to 15 samples will be collected from the site and submitted for whole-body chemical analysis. Sampling location will be established by constructing a grid to provide 50 evenly spaced sampling points at each site. The 15 sampling locations will be randomly selected at each site. The types of biota and sampling procedures are presented in the Risk Assessment Plan (BNI 1995b).

Biota samples will be placed in clean glass jars and submitted for analyses of pesticides by U.S. EPA Method 8080, semivolatile organics by U.S. EPA Method 8270, and metals by U.S. EPA Method Series 6000/7000. Approximately 60 grams wet weight of tissues are required from each sample to conduct these analyses.

The following information will be recorded in the field logbook:

- date and time of sample collection,
- general meteorological data,
- location of sample,
- vegetation,
- equipment used,
- sample number,
- dimensions of soil excavation,
- number of individuals from each location,
- deviations from sampling plan,
- sampler name, and
- sampling method.

Before chemical analyses, the sample will be homogenized to obtain a uniform tissue sample. Homogenization will occur at the analytical laboratory, so no chemical preservative will be needed during shipping; however, the samples will be shipped in a chilled cooler.

Section 7
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Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Room 135
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Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN ATTACHMENT R OPERABLE UNIT 3 – SITE 19 – AIRCRAFT EXPEDITIONARY REFUELING SITE MCAS EL TORO, CALIFORNIA

CTO-0059

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August 1995

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ACRONYMS/ABBREVIATIONS

ACER	Aircraft Expeditionary Refueling
bgs	below ground surface
CLEAN	Comprehensive Long-Term Environmental Action Navy
COPC	chemical of potential concern
EE/CA	Engineering Evaluation/Cost Analysis
FS	Feasibility Study
FSP	Field Sampling Plan
Irvine Subbasin	Irvine Groundwater Subbasin
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PRG	(U.S. EPA Region IX) Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facilities Assessment
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SVOC	semivolatile organic compound
TAL	target analyte list
TFH	total fuel hydrocarbons
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound

ACRONYMS/ABBREVIATIONS (continued)

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Section 1
OBJECTIVES

This Field Sampling Plan (FSP) for Site 19, the Aircraft Expeditionary Refueling (ACER) Site, outlines the field procedures and methodology to be used during the Remedial Investigation (RI)/Feasibility Study (FS) for this site. The purpose of this FSP is to enable field personnel unfamiliar with the site to gather the required samples and field data. It is also intended to assure that data collection will be comparable to and compatible with previous data collected at the site and with other sampling activities at other sites at the Marine Corps Air Station (MCAS), El Toro.

1.1 SAMPLING OBJECTIVES

The specific objectives for sampling at Site 19 are as follows:

- verify boundaries of waste disposal activities;
- characterize the nature and extent of contamination;
- estimate the vertical and horizontal extent of contamination; and
- characterize site-specific groundwater contamination, if soil contamination extends to groundwater.

1.2 DATA USAGE

To satisfy the RI/FS objectives for the ACER Site, the data to be collected, compiled, and analyzed will be used to perform the following:

- characterize subsurface soils;
- establish stratigraphic controls;
- establish geotechnical parameters;
- characterize groundwater conditions and quality (where soil contamination suggests);
- determine the types of contaminants in soil and/or groundwater;
- estimate the extent of contaminants in soil and/or groundwater;
- evaluate human health and ecological risks;
- evaluate the mass of contaminants;
- evaluate cleanup levels;
- characterize the feasible removal or remedial actions, if necessary; and
- evaluate remedial alternatives.

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Section 2
BACKGROUND

This section generally describes and discusses the results of previous investigations at Site 19. This section also provides a brief compilation of the data used to develop the site-specific FSP for Phase II RI/FS activities. Previous investigations and reports provide a more thorough discussion of site history, activities, and summaries of previous investigations.

2.1 SITE DESCRIPTION

The ACER Site is surrounded by a concrete apron and taxiway located in the southeast region of MCAS El Toro, southwest of Buildings 404 and 415 (Map R3-1). The terrain in the immediate vicinity of the site is relatively level at an elevation of about 330 feet above mean sea level. Aqua Chinon Wash, which is mainly culverted at MCAS El Toro, lies exposed along the northwest side of Stratum 1 (Jacobs Engineering 1993a).

2.1.1 History

Site 19 was operated as a fuel storage area between 1964 and 1987. The site contained six 20,000-gallon JP-5 fuel bladder revetments surrounded by 4-foot-high berms. Minor spills and leaks reported occurred throughout the operational period of the facility. In addition, an estimated 15,000 gallons of JP-5 were spilled after a bladder rupture. An investigation after the rupture found elevated levels of petroleum hydrocarbons in soil in the area. The fuel bladders were removed in 1986, and the soil was excavated to approximately 15 feet below ground surface (bgs) over a 30-foot^2 area. A 300- by 60-foot area has been excavated to a depth of 2 feet. The excavated area has not been refilled, and it is partly vegetated (Jacobs Engineering 1993a).

2.1.2 Geology

The geology of Site 19 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993b). Holocene deposits consist of a matrix of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene, which are considered to be bedrock in the area.

Based on a review of Phase I RI boring logs, the subsurface lithology at Site 19 consists of interbedded silty sand to well-graded sand. Boring logs indicate 10- to 40-foot layers of fine-grained silts and clays, interbedded with sand from 10 feet to more than 60 feet thick, with occasional gravel lenses. Finer-grained sediments appear to be more prominent in the southeast at about 80 feet bgs.

2.1.3 Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Subbasin (Irvine Subbasin). Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine-grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993b).

The Phase I RI results indicate the shallow, perched zone is not present at Site 19. The principal aquifer is present beneath Site 19 at a depth of about 150 feet bgs. The regional groundwater flow direction is to the northwest. The local hydraulic gradient has been influenced strongly by the pumping of irrigation wells located west of MCAS El Toro.

2.2 PHASE I REMEDIAL INVESTIGATION RESULTS

During the Phase I RI, Site 19 was represented by three strata (Map R3-2):

- Stratum 1 – Northwest Stained Area;
- Stratum 2 – Excavated Area; and
- Stratum 3 – Stained Area Around Excavation.

The following site-specific activities were conducted:

- twenty-four shallow soil samples (0 to 10 feet bgs) were collected from 10 locations: 3 samples each from Strata 2 and 3, and 4 samples from Stratum 1;
- soil samples were collected from three 25-foot borings and two 60-foot angle borings;
- four monitoring wells (19_DBMW54, 19_UGMW35, 19_DGMW85, and 19_DGMW86) were drilled, installed, and sampled (subsurface soil and groundwater);
- soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total fuel hydrocarbons (TFH)-diesel and -gasoline, total recoverable petroleum hydrocarbons (TRPH), and target analyte list (TAL) metals; and
- groundwater samples were analyzed for general chemistry, VOCs, SVOCs, pesticides/polychlorinated biphenyls (PCBs), TFH, TRPH, and TAL metals.

In addition, United States Environmental Protection Agency (U.S. EPA) Region IX Preliminary Remediation Goals (PRGs) and ecological screening criteria for shallow soil at the site were compared with corresponding analytical sampling results. The results of the soil investigation indicated that:

- benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene exceed PRGs in Stratum 1;

- benzo(a)pyrene, and cobalt exceed ecological screening criteria in Stratum 1; and
- no chemicals of potential concern (COPCs) detected in shallow soil in Strata 2 or 3 exceed PRGs or ecological screening criteria.

The groundwater samples that were collected from the four groundwater monitoring wells (19_UGMW35, 19_DBMW54, 19_DGMW85, and 19_DGMW86) constructed near Site 19 indicated that no site-related contaminants were identified in these wells. The results of the groundwater analytical results indicate that:

- selenium was detected in concentrations above primary maximum contaminant levels (MCLs) in the groundwater in all wells;
- nitrate/nitrite was detected in concentrations above primary MCLs in the groundwater in the on-site and downgradient wells;
- aluminum was detected in concentrations above secondary MCLs in the groundwater in the on-site well;
- manganese was detected in concentrations above secondary MCLs in the groundwater in the upgradient and downgradient wells; and
- total dissolved solids in all wells exceeded secondary MCLs.

Site 19 does not appear to be a source of the regional VOC contamination (Jacobs Engineering 1993a).

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Section 3
MAPS

The maps on the following pages present the site location at MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and proposed Phase II sampling locations (where known). These maps are referenced in other sections of this FSP.

The proposed Phase II sampling locations presented on these maps are intended to illustrate the type of sampling strategy proposed for each unit. Other considerations (e.g., randomly selected starting points, underground utilities/pipelines, or overhead obstacles) could result in adjustments to sampling locations. The actual field sample locations will be accurately recorded by field personnel relative to surveyed coordinates, and if any sampling points require relocation, the reasons for such changes will be described in the field notebook.

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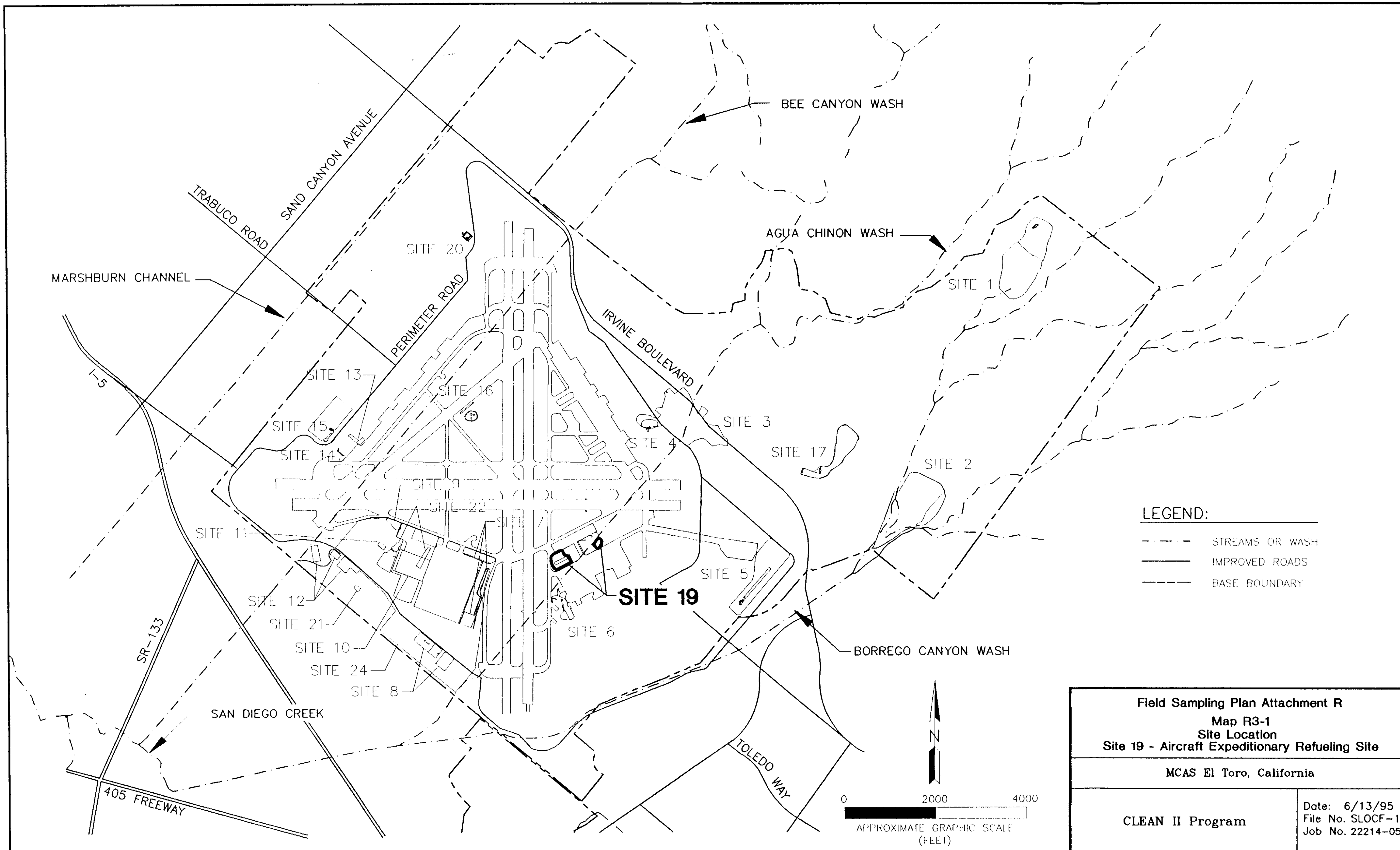

Field Sampling Plan Attachment R

Map R3-1
Site Location
Site 19 - Aircraft Expeditionary Refueling Site

MCAS El Toro, California

CLEAN II Program

Date: 6/13/95
File No. SLOCF-19
Job No. 22214-059

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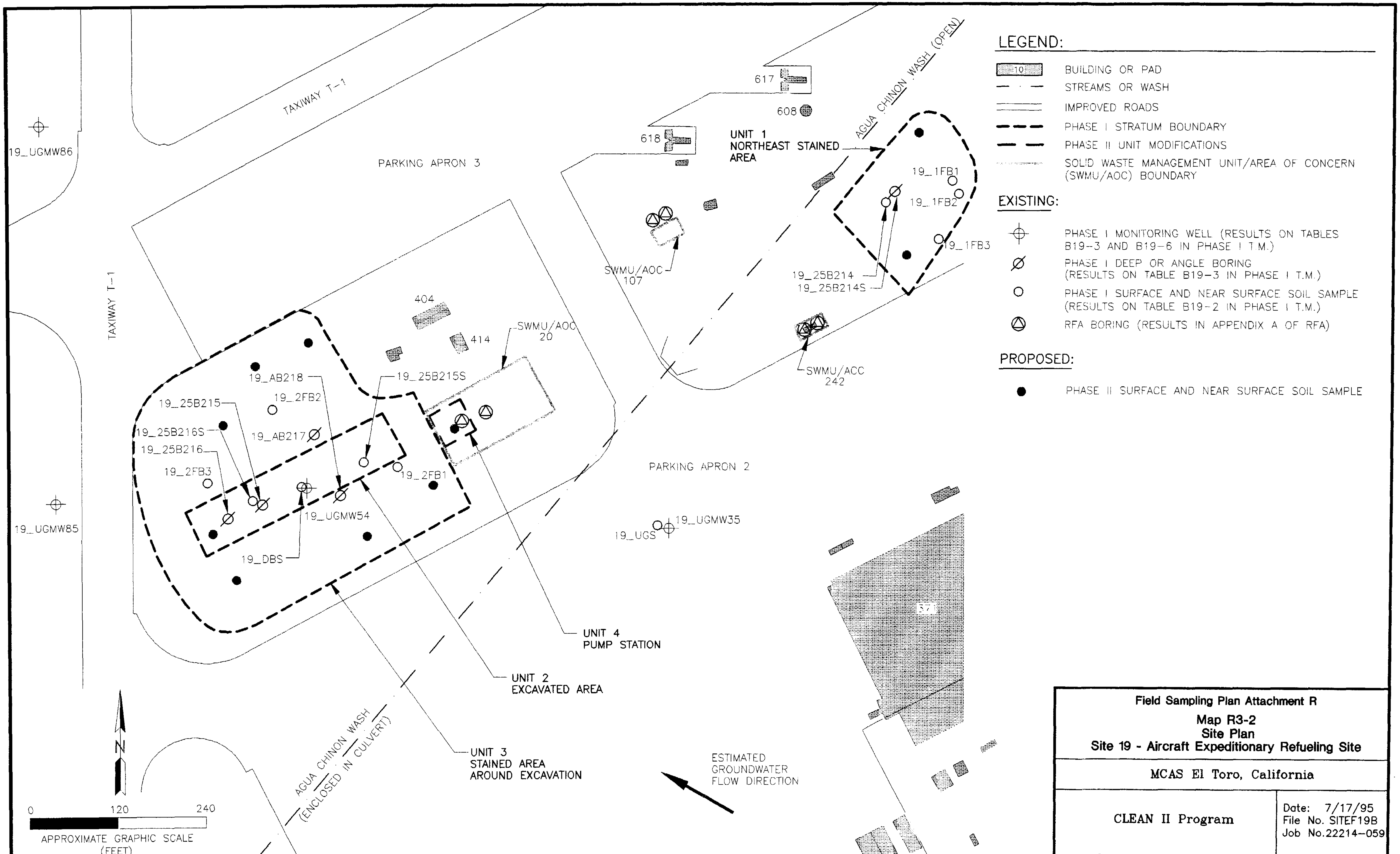
LEGEND:
BUILDING OR PAD
STREAMS OR WASH
IMPROVED ROADS
PHASE I STRATUM BOUNDARY
PHASE II UNIT MODIFICATIONS
SOLID WASTE MANAGEMENT UNIT/AREA OF CONCERN (SWMU/AOC) BOUNDARY
EXISTING:
PHASE I MONITORING WELL (RESULTS ON TABLES B19-3 AND B19-6 IN PHASE I T.M.)
PHASE I DEEP OR ANGLE BORING (RESULTS ON TABLE B19-3 IN PHASE I T.M.)
PHASE I SURFACE AND NEAR SURFACE SOIL SAMPLE (RESULTS ON TABLE B19-2 IN PHASE I T.M.)
RFA BORING (RESULTS IN APPENDIX A OF RFA)
PROPOSED:
PHASE II SURFACE AND NEAR SURFACE SOIL SAMPLE
TAXIWAY T-1
TAXIWAY T-1
19_UGMW86
19_UGMW85
PARKING APRON 3
PARKING APRON 2
617
608
618
UNIT 1 NORTHEAST STAINED AREA
AGUA CHINON WASH (OPEN)
19_1FB1
19_1FB2
19_1FB3
19_25B214
19_25B214S
SWMU/AOC 107
SWMU/ACC 242
404
414
SWMU/AOC 20
19_AB218
19_25B215S
19_2FB2
19_25B215
19_25B216S
19_AB217
19_25B216
19_2FB3
19_2FB1
19_UGMW54
19_DBS
19_UGS
19_UGMW35
UNIT 4 PUMP STATION
UNIT 2 EXCAVATED AREA
UNIT 3 STAINED AREA AROUND EXCAVATION
AGUA CHINON WASH (ENCLOSED IN CULVERT)
ESTIMATED GROUNDWATER FLOW DIRECTION
N
0
120
240
APPROXIMATE GRAPHIC SCALE (FEET)
Field Sampling Plan Attachment R
Map R3-2
Site Plan
Site 19 - Aircraft Expeditionary Refueling Site
MCAS El Toro, California
CLEAN II Program
Date: 7/17/95
File No. SITEF19B
Job No.22214-059

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

This section explains the rationale for the number of sampling programs, types of samples, locations of samples, and analytical parameters. The rationale for sampling is based on site conditions, previous investigations, and data quality objectives as presented in the appendices of the Phase II RI/FS Work Plan (BNI 1995a).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, types of samples, and locations are presented based on the smallest area of study. For some sites, the smallest area of study is a site unit; for other sites, the area of study may be the entire site. Selection of sampling programs, sample types, and locations is based on the following:

- site activities and history;
- types of media suspected or known to be impacted from previous investigations;
- objectives of site-specific RI/FS efforts; and
- site-specific initial surveys.

The Site 19 will be represented by four units for the Phase II RI/FS.

- Unit 1 - Northeast Stained Area (an area that contained 2 fuel bladder revetments adjacent to Aqua Chinon Channel 500 feet north of Building 371). This unit has the same boundaries as Phase I RI Site 19 Stratum 1.
- Unit 2 - Excavated Area (an area northwest of Unit 1 where a JP-5 fuel spill took place). This unit has the same boundaries as Phase I RI, Site 19, Stratum 2.
- Unit 3 - Stained Area Around Excavation (the stained area surrounding Unit 2). This unit has the same boundaries as Phase I RI, Site 19, Stratum 3.
- Unit 4 - Pump Station (an unpaved area located northeast of Unit 2 and 3). This unit was investigated as solid waste management unit/area of concern 20 during the Resource Conservation and Recovery Act (RCRA) Facilities Assessment (RFA).

The units will be sampled using a tiered sampling approach as discussed in the following sections. Previous site activities, Phase I RI sampling results, and regulatory comments were used to formulate the Phase II RI/FS sampling approach. During the Phase I RI, soil samples were collected from each stratum, and COPCs were identified and evaluated against PRGs. Sampling locations in all units have been positioned in locations to refine risk estimates for the units or to confirm RFA results.

4.2 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk to human health or the environment. The Tier 1 sampling approach will consist of collecting shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed such that, when the Phase I and II RI/FS data are evaluated together, a risk level can be estimated for the unit. An explanation of the proposed sampling designs for Tier 1 soil sampling can be found in Section 4 the Phase II RI/FS Work Plan (BNI 1995a).

4.2.1 Unit 1: Northeast Stained Area

Unit 1 has been approved for Early Action and is being addressed through the Non-Time-Critical Removal Action process. An Engineering Evaluation/Cost Analysis (EE/CA) will be prepared for this unit.

4.2.2 Unit 2: Excavated Area

Unit 2 has been approved for Early Action and is being addressed through the Non-Time-Critical Removal Action process. An EE/CA has been prepared for this unit.

4.2.3 Unit 3: Stained Area Around Excavation

The Unit 3 boundaries of Site 19 consist of the stained area surrounding Unit 2.

4.2.3.1 SOIL SAMPLES

In the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at six areal systematic random sampling locations based on a grid spacing of 152 by 162 feet (Map R3-2).

4.2.4 Unit 4: Pump Station

The Unit 4 boundaries of Site 19 consist of an unpaved area (fenced enclosure) located northeast of Units 2 and 3.

4.2.4.1 SOIL SAMPLES

In the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at the one judgmental sampling location (Map R3-2).

4.3 TIER 2

The Tier 2 sampling program will also focus exclusively on shallow soil (0 to 10 feet) conditions. The primary objective of this program will be to refine the data on the extent of shallow soil contamination identified during the Tier 1 sampling. Tier 2 sample locations will be based on these sample results. The process by which the Tier 2 sample locations will be selected is detailed in Appendix R of the Phase II RI/FS Work Plan (BNI 1995a).

4.4 TIER 3

The objective of a Tier 3 soil sampling program is to estimate the extent of a contaminant plume in deeper subsurface soils. To accomplish this goal, a series of boreholes will be drilled and sampled. Location of Tier 3 boreholes is intended to minimize the number of boreholes required to define the lateral and vertical extent of the contaminant plume in deeper subsurface soils. Groundwater samples will be collected only when a contaminant plume in deeper subsurface soils has been traced (through a drilling and soil sampling program) downward to the water table. At such units/sites, the objectives of the sampling program must then be expanded to include a determination of whether groundwater has been adversely impacted as a result of the historic activities at this unit/site.

Phase I RI soil sample results indicate that Tier 3 soil sampling will be necessary at this site. The process by which the locations for Tier 3 soil borings and monitoring wells will be selected is detailed in Appendix R of the Phase II RI/FS Work Plan (BNI 1995a).

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Section 5
REQUEST FOR ANALYSES

Requests for analyses are based on:

- site activities and history,
- results of previous investigations, and
- objectives of site-specific RI/FS efforts.

The analytical methods referenced in this section are from the Phase II RI/FS Quality Assurance Project Plan (QAPP) (BNI 1995b). Section 6 in the QAPP specifies the number and/or frequency for collection of field duplicate and blank samples during the Phase II RI/FS field activities.

5.1 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk. The Tier 1 sampling approach will consist of the collection of shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. Table R5-1 lists all soil samples and associated analyses for the Units in Site 19.

5.1.1 Unit 3: Stained Area Around Excavation

The 18 Tier 1 soil samples that will be collected at Site 19, Unit 3, will be analyzed according to the methods listed below.

5.1.1.1 FIELD SCREENING

All soil samples will be field-screened for polynuclear aromatic hydrocarbons (PAH) with immunoassay test kits (U.S. EPA Method 4035) and for total petroleum hydrocarbons (TPH)-diesel and -gasoline (U.S. EPA Method 8015M) using an appropriately equipped mobile laboratory.

5.1.1.2 FIXED-BASE ANALYTICAL LABORATORIES

Five samples (four detects and one nondetect) will be submitted to the fixed-base laboratory to confirm field screening results. The fixed-base laboratory analyses are PAH (U.S. EPA Method 8310) and TPH-diesel and -gasoline (U.S. EPA Method 8015M) under Naval Facilities Engineering Service Center (NFESC, formerly known as Naval Energy and Environmental Support Activity [NEESA]) Level D protocols.

5.1.2 Unit 4: Pump Station

The three Tier 1 soil samples that will be collected at Site 19, Unit 4, will be analyzed according to the methods listed below.

Table R5-1
Soil Sampling and Analysis

Tier	Unit/Name	PHASE II RI/FS SAMPLE NUMBERS			FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY					OFF-SITE LABORATORY[b]	
		No. of Locations	Samples/ Location	Total Samples	PAH[c,d]	PCBs[c,e]	VOCs[f,g]	TPH[h]-Gasoline and -Diesel[f]	Target Analyte List - Metals[f]	Pesticides and PCBs	Herbicides
Tier 1	Unit 1 NE Stained Area	2	3	6	X			X	X		
	Unit 2 Excavated Area	1	3	3	X			X			
	Unit 3 Stained Area Around Excavation	6	3	18	X			X			
	Unit 4 Pump Station	1 judge	3	3	X			X			
Tier 1 Subtotals				30	30			30	6		
Tier 2	Optional: Scope of Tier 2 would be to further define extent of shallow soil contamination; based on Tier 1 data, Phase I RI findings, and/or RCRA Facility Assessment (RFA) data, with approval of Base Closure and Realignment (BRAC) Cleanup Team (BCT).										
Tier 3	Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data, Phase I RI findings, and/or RFA data, with approval of BCT.										

Notes:
[a] at a minimum, 10 percent of detects and 5 percent of nondetects will be sent to the off-site laboratory for confirmation analyses
[b] these constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory
[c] immunoassay analyses
[d] PAH – polynuclear aromatic hydrocarbons
[e] PCB – polychlorinated biphenyl
[f] mobile laboratory analyses
[g] VOC – volatile organic compound
[h] TPH – total petroleum hydrocarbons

5.1.2.1 FIXED-BASE ANALYTICAL LABORATORIES

All samples will be submitted to the fixed-base laboratory for chemical analyses. The fixed-base laboratory analyses are PAH (U.S. EPA Method 8310) and TPH-diesel and -gasoline (U.S. EPA Method 8015M) under NFESC Level D protocols.

5.2 TIER 2

A Tier 2 request for analysis, if necessary, will be contingent upon the Tier 1 sample results.

5.3 TIER 3

A Tier 3 request for analysis, if necessary, will be contingent upon the Tier 1 and Tier 2 sample results.

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Section 6

FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods referenced in this section are from Section 6 of the FSP and the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Standard Operating Procedures, which discuss specific field methods and procedures.

6.1 INITIAL SURVEYS

Before the collection of Phase II RI/FS soil samples, the site will be scaled, and sampling locations will be staked or paint-marked. Once a sampling point is marked, utility clearances will be made before collecting any sample that uses power equipment to reach the sample depth. Utility clearances may also be made at locations where samples are being collected using a hand auger. Nonintrusive utility clearances will be completed by a subcontractor, using geophysical methodology in conjunction with site activities.

Each sampling point will be located by survey, using the California Plane Coordinate System, with northings and eastings determined to the nearest 0.1 foot. The surface elevation will be determined to the nearest 0.01 foot.

6.2 TIER 1

All samples in Unit 1 will be collected at the locations and depths described in Section 4.2. More information on soil sampling procedures is provided in Section 6 of the FSP.

6.2.1 Unit 3: Stained Area Around the Excavation

The 18 Tier 1 soil samples will be collected at Site 19, Unit 3, at depths of 0, 5, and 10 feet bgs in six borings as indicated below.

6.2.1.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer.

6.2.2 Unit 4: Pump Station

The three Tier 1 soil samples will be collected at Site 19 Unit 4, at depths of 0, 5, and 10 feet bgs in one boring as indicated below.

6.2.2.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer.

6.3 TIER 2

If Tier 2 soil sampling is conducted at Site 19, shallow soil samples will be collected as described above.

6.4 TIER 3

Phase I RI soil sampling results indicate that Tier 3 sampling will be conducted at this site. Deep soil samples (from 10 feet bgs to groundwater level) will be collected at 5-foot intervals with a modified California split-spoon sampler equipped with stainless steel sleeves. The split-spoon sampler will be driven into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer. When drilling is required to depths of greater than 130 feet bgs, the hollow-stem auger drilling rig will be replaced by an air-rotary drilling rig. If groundwater sampling is necessary, sampling will follow procedures presented in Section 6 of the FSP.

Section 7
REFERENCES

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Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN
ATTACHMENT S
OPERABLE UNIT 3 –
SITE 20 – HOBBY SHOP
MCAS EL TORO, CALIFORNIA

CTO-0059

Prepared by:

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ACRONYMS/ABBREVIATIONS

bgs	below ground surface
CLEAN	Comprehensive Long-Term Environmental Action Navy
COPC	chemical of potential concern
EE/CA	Engineering Evaluation/Cost Analysis
FS	Feasibility Study
FSP	Field Sampling Plan
Irvine Subbasin	Irvine Groundwater Subbasin
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PRG	(U.S. EPA Region IX) Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facilities Assessment
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SVOC	semivolatile organic compound
SWMU/AOC	solid waste management unit/area of concern
TAL	target analyte list
TFH	total fuel hydrocarbons
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

ACRONYMS/ABBREVIATIONS (continued)

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Section 1
OBJECTIVES

This Field Sampling Plan (FSP) for Site 20, the Hobby Shop, outlines the field procedures and methodology to be used during the Remedial Investigation (RI)/Feasibility Study (FS) for this site. The purpose of this FSP is to enable field personnel unfamiliar with the site to gather the required samples and field data. It is also intended to assure that data collection will be comparable to and compatible with previous data collected at the site and with other sampling activities at other sites at the Marine Corps Air Station (MCAS) El Toro.

1.1 SAMPLING OBJECTIVES

The specific objectives for sampling at Site 20 are as follows:

- verify boundaries of waste disposal activities;
- characterize the nature and extent of contamination;
- estimate the vertical and horizontal extent of contamination; and
- characterize site-specific groundwater contamination, if soil contamination extends to groundwater.

1.2 DATA USAGE

To satisfy RI/FS objectives for the Hobby Shop site, the data to be collected, compiled, and analyzed will be used to perform the following:

- characterize subsurface soils;
- establish stratigraphic controls;
- establish geotechnical parameters;
- characterize groundwater conditions and quality (where soil contamination suggests);
- determine the types of contaminants in soil and/or groundwater;
- estimate the extent of contaminants in soil and/or groundwater;
- evaluate human health and ecological risks;
- evaluate the mass of contaminants;
- evaluate cleanup levels;
- characterize the feasible removal or remedial actions, if necessary; and
- evaluate remedial alternatives.

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Section 2
BACKGROUND

This section presents a discussion on the general description and the results of previous investigations at Site 20. This section also provides a brief compilation of the data used to develop the site-specific FSP for Phase II RI/FS activities. Previous investigations and reports provide a more thorough discussion of site history, activities, and summaries of previous investigations.

2.1 SITE DESCRIPTION

The Hobby Shop, used as an automobile service and repair facility for military personnel, is located in the northwest quadrant of MCAS El Toro near the intersection of North Ninth Street and West Marine Way (Map S3-1). The site consists of the U-shaped Building 626, its interior courtyard and entry driveway, a section of drainage ditch that fronts the building along North Ninth Street, a drainage ditch along the southeast side of the building, and a small area adjacent to the northwest side of Building 626 (Map S3-2). The southeast wing of Building 626 is an enclosed structure; the northeast site and northwest wings are segmented into covered vehicle service bays (Jacobs Engineering 1993a). In addition to the main structure, the site includes a 600-gallon waste oil tank (located roughly 10 feet beyond the exterior wall of the northwest wing), two oil/water separators, and three 50-gallon solvent-filled parts-cleaning tanks (Jacobs Engineering 1993a).

2.1.1 History

Site 20 has operated continuously since 1967 as an auto shop. Waste oils containing metals, fuels, and solvents are common wastes that have been produced. These fluids were temporarily stored in an underground storage tank (UST), oil/waste separators, and solvent tanks at the site.

Used automobile engine and transmission oils have been routinely drained into the 600-gallon waste oil tank via a pipe that extends through the northwest wing wall to the inlet for the waste oil tank. The ground surface above the UST, extending back to the building wall, is heavily stained with oil. Water from the oil/water separator drains directly into the drainage ditch that fronts the site along North Ninth Street. The oil is periodically removed by a private contractor (Jacobs Engineering 1993b). It has been reported that the sides of this drainage ditch were stained black (Jacobs Engineering 1993a), but no staining was observed in the ditch during September and October 1994 site inspections. Furthermore, profuse vegetative growth in the ditch exhibited no signs of stress that might suggest the presence of soil contamination.

Sludge from the three 50-gallon solvent tanks is periodically emptied into the oil/water separators while the waste solvent is transferred to drums. Prior to 1976, kerosene was reportedly used to wash down the paved courtyard area. The wash runoff drained into a catch basin located in the entry driveway. Liquids collected in the catch basin were routed into three oil/water separators prior to 1995. In April 1995, two of the three oil/water separators were removed and replaced by one new oil/water separator in the same location adjacent to the entry driveway. Since 1976, a biodegradable soap has been used to clean the courtyard and front entry areas. The waste oil tank, a vehicle wash rack in one of the service bays, and the storage area for the spent solvent drums were designated as solid waste management units/areas of concern (SWMUs/AOCs) 156 through 158, as part of the Resource Conservation and Recovery Act (RCRA) Facilities Assessment (RFA) conducted at MCAS El Toro (Jacobs Engineering 1993a).

2.1.2 Geology

The geology of Site 20 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993b). Holocene deposits consist of a matrix of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene, which are considered to be bedrock in the area.

Based on a review of Phase I RI boring logs, the subsurface lithology at Site 20 consists of interstratified lenses of clay, silt, sandy silt, silty sand, and fine- to medium-grained sands. Silt and sandy silt are present to a depth of between approximately 20 and 30 feet beneath the site. Below that interval, interstratified sand and silt are present to between approximately 40 and 50 feet depth. Below approximately 50 feet, the soils consist primarily of sand, with occasional lenticular clay or silt strata ranging from about 2 to 20 feet thick.

2.1.3 Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Subbasin (Irvine Subbasin). Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine-grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993b).

The Phase I RI results indicate the shallow, perched zone is not present at Site 19. The principal aquifer is present beneath Site 19 at approximately 150 feet below ground surface (bgs). The regional groundwater flow direction is to the northwest. The local hydraulic gradient in the area of the site has been influenced strongly by the pumping of irrigation wells located west of MCAS El Toro.

2.2 PHASE I REMEDIAL INVESTIGATION RESULTS

For the Phase I RI, Site 20 was represented by four strata:

- Stratum 1 - East Drainage Ditch (unlined ditch on southeast side of Building 626);
- Stratum 2 - South Drainage Ditch (unlined ditch along North Ninth Street);
- Stratum 3 - Stained Area (soil area above the UST on the northwest side of Building 626); and
- Stratum 4 - Courtyard (interior courtyard of Building 626).

Stratum 1, a shallow linear depression covering approximately 1,070 feet^2, may have formed due to soil erosion resulting from rainfall runoff from the roof of Building 626. Stratum 2, a linear ditch about 2 feet deep paralleling North Ninth Street, covers approximately 1,430 feet^2. Stratum 3 a flat and bare soil area, is characterized by oily, discolored surficial soil that covers approximately 1,420 feet^2. Stratum 4, the paved courtyard of the U-shaped Hobby Shop, covers approximately 19,260 feet^2 (Map S3-2).

The following site-specific activities were conducted:

- thirty-five shallow soil samples (0 to 4 feet bgs) were collected from 12 locations, three each from Strata 1, 2, 3, and 4;
- thirteen subsurface soil samples were collected from 3 locations;
- three borings were drilled and completed as monitoring wells (20_UGMW36, 20_DBMW55, 20_DGMW88) and sampled;
- all soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total fuel hydrocarbons (TFH)-diesel and -gasoline, total recoverable petroleum hydrocarbons (TRPH), and target analyte list (TAL) metals;
- soil samples from borings 20_DD4, 20_DD5, 20_DD6, 20_GN1, 20_GN2, and 20_GN3 were also analyzed for pesticides/polychlorinated biphenyls (PCBs); and
- groundwater samples were analyzed for general chemistry, VOCs, SVOCs, pesticides/PCBs, TRPH, TFH, and TAL metals.

United States Environmental Protection Agency (U.S. EPA) Region IX Preliminary Remediation Goals (PRGs) and ecological screening criteria for shallow soil at the site were compared with corresponding analytical sampling results. The results of the soil investigation indicate that:

- no chemicals of potential concern (COPCs) exceed PRGs or ecological screening criteria in Stratum 1;
- bis(2-ethylhexyl) phthalate exceed PRGs; and 4,4'-DDE, lead, and zinc exceed ecological screening criteria in Stratum 2;
- benzo(a)pyrene and lead exceed PRGs; and benzo(a)pyrene, lead, mercury, and zinc exceed ecological screening criteria in Stratum 3; and
- cobalt and lead exceed ecological screening criteria.

The groundwater samples were collected from the three groundwater monitoring wells constructed near Site 20 and compared to PRGs and maximum contaminant levels (MCLs). No site related contaminants were identified in these wells. The results are as follows:

- antimony, arsenic, and nitrate in groundwater exceed human health PRGs;
- antimony, nitrate, and selenium exceeded primary MCLs; and
- chloride, manganese, sulfate, and total dissolved solids exceed secondary MCLs.

Section 3
MAPS

The maps on the following pages present the site location at MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and proposed Phase II sampling locations (where known). These maps are referenced in other sections of this FSP.

The proposed Phase II sampling locations presented on these maps are intended to illustrate the type of sampling strategy proposed for each unit. Other considerations (e.g., randomly selected starting points, underground utilities/pipelines, or overhead obstacles) could result in adjustments to sampling locations. The actual field sample locations will be accurately recorded by field personnel relative to surveyed coordinates, and if any sampling points require relocation, the reasons for changes will be described in the field notebook.

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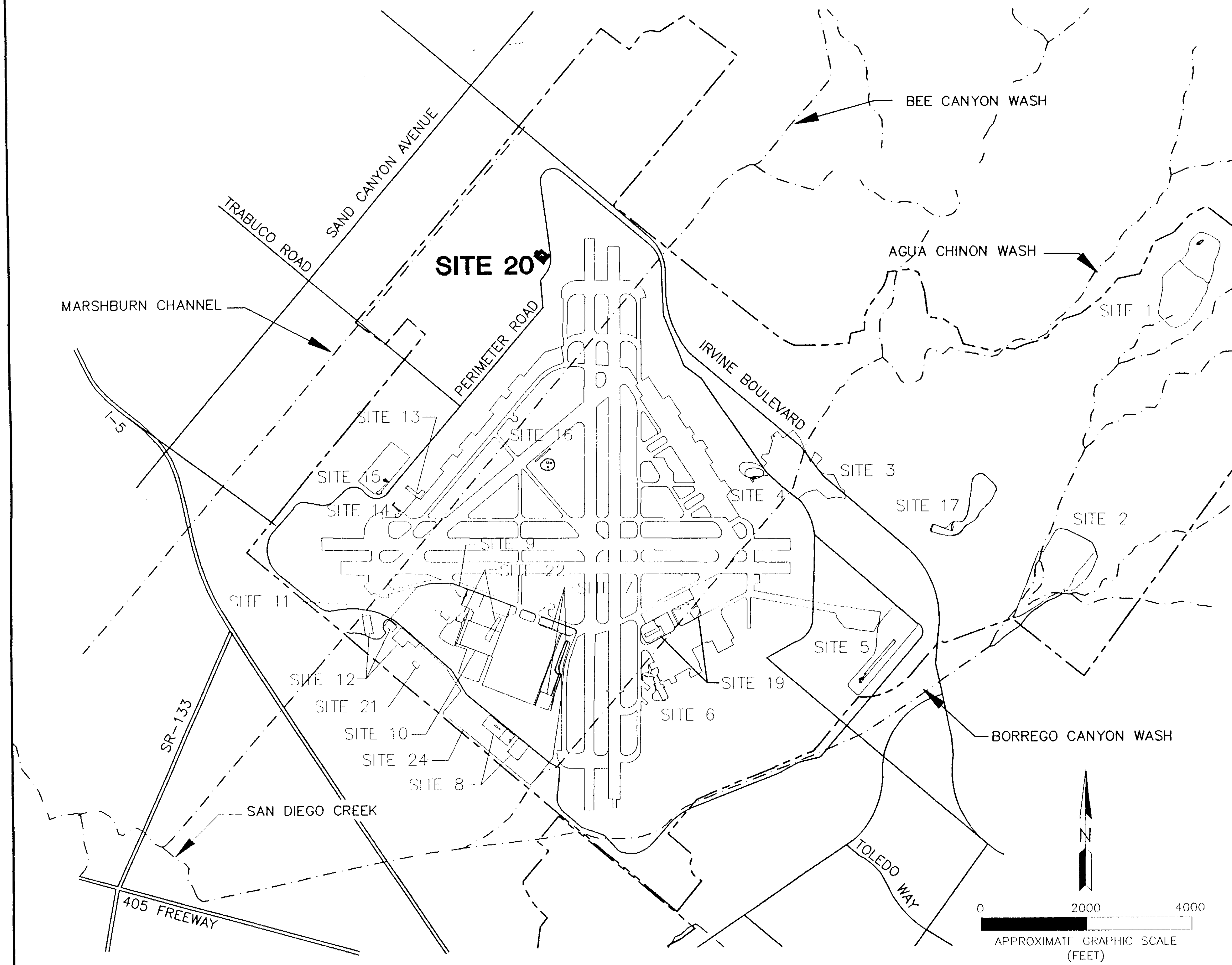

Field Sampling Plan Attachment S Map S3-1 Site Location Site 20 - Hobby Shop	
MCAS El Toro, California	
CLEAN II Program	Date: 6/13/95 File No. SLOCF-20 Job No 22214-059

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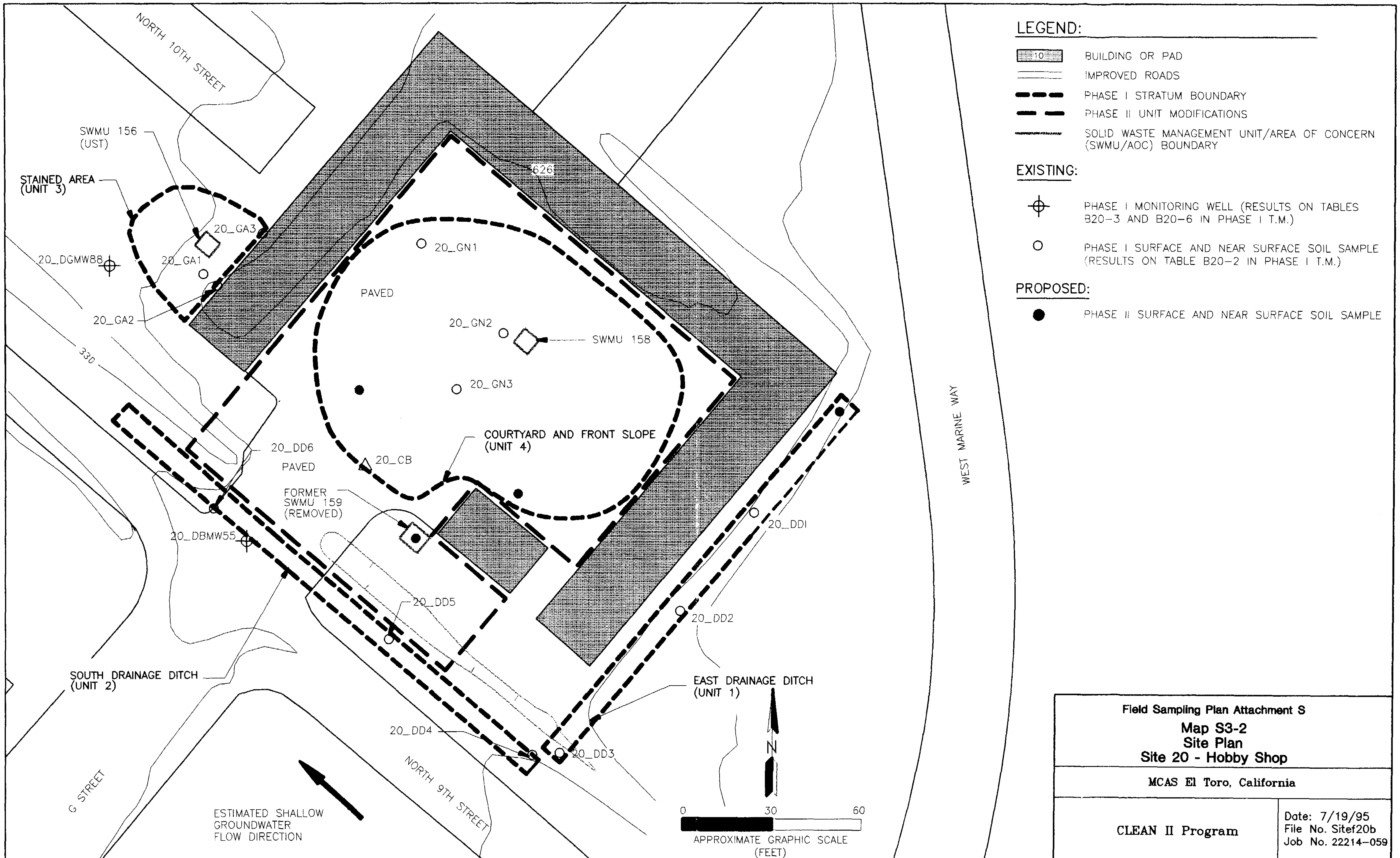

Field Sampling Plan Attachment S

Map S3-2
Site Plan
Site 20 - Hobby Shop

MCAS El Toro, California

CLEAN II Program

Date: 7/19/95
File No. Sitef20b
Job No. 22214-059

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

This section explains the rationale for the number of sampling programs, types of samples, locations of samples, and analytical parameters. The rationale for sampling is based on site conditions, previous investigations, and data quality objectives as presented in the appendices of the Phase II RI/FS Work Plan (BNI 1995a).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, types of samples, and locations are presented based on the smallest area of study. For some sites, the smallest area of study is a site unit, and for other sites, the area of study may be the entire site. Selection of sampling programs, sample types, and locations is based on:

- site activities and history;
- types of media suspected or known to be impacted from previous investigations;
- objectives of site-specific RI/FS efforts; and
- site-specific initial surveys.

Site 20 will be represented by four units for the Phase II RI/FS investigation;

- Unit 1 - East Drainage Ditch (unlined ditch on southeast side of Building 626; has the same boundaries as Phase I RI, Site 19, Stratum 1);
- Unit 2 - South Drainage Ditch (unlined ditch along North Ninth Street; has the same boundaries as Phase I RI, Site 19, Stratum 2);
- Unit 3 - Stained Area (soil area above UST on northwest side of Building 626; has the same boundaries as Phase I RI, Site 19, Stratum 3); and
- Unit 4 - Courtyard and Front Slope (interior courtyard of Building 626 and its entry driveway. This unit includes the area covered by Phase I RI, Site 19, Stratum 4, except the area has been expanded to include the courtyard area and the entry drive).

Also located within the expanded boundaries of Unit 4 are SWMUs/AOCs 157 and 158. These areas are a vehicle wash rack and a drum storage area, respectively. An additional SWMU/AOC was identified in the RFA within Site 20 boundaries. SWMU/AOC 156, a 600-gallon waste oil UST, is located beneath Unit 3. The vehicle wash rack (SWMU/AOC 157) and the drum storage area (SWMU/AOC 158) will be investigated as part of Unit 4. The UST (SWMU/AOC 156) will be evaluated separately as part of a basewide UST project. These SWMU/AOCs were identified in the RFA (Jacobs Engineering 1993c).

The units will be sampled using a tiered sampling approach, as discussed in the following sections. The tiered approach is intended to minimize the level of effort necessary to fully characterize the site and determine the extent of contamination that may have occurred as a result of the activities which have taken place at Site 20. Previous and current site activities, Phase I RI sampling results, and regulatory comments were used to formulate the Phase II RI/FS sampling approach developed for each of the four units at Site 20. During the Phase I RI, soil samples were collected from each strata, and COPCs were identified and evaluated against PRGs. Sampling locations in all units have been positioned in locations to refine risk estimates for the units.

4.2 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk to human health or the environment. The Tier 1 sampling approach will consist of collecting shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed, such that when the Phase I and II RI/FS data are evaluated together, a risk can be estimated for the unit. An explanation of the proposed sampling designs for Tier 1 soil sampling can be found in Section 4 of the Phase II RI/FS Work Plan (BNI 1995a).

4.2.1 Unit 1: East Drainage Ditch

The Unit 1 boundary at Site 20 is approximately the limit of the shallow drainage swale adjacent to the southeast side of Building 626. This unit has boundaries identical to the Phase I RI, Site 20, Stratum 1. This unit had initially been recommended for No Further Investigation; however, the U.S. EPA has requested one additional location be sampled to confirm the Phase I RI results.

4.2.1.1 SOIL SAMPLES

In the Phase II RI/FS, Tier 1 soil samples will be collected at 0 and 2 feet bgs at one judgmental-sample location (Map S3-2).

4.2.2 Unit 2: South Drainage Ditch

The Unit 2 boundaries at Site 20 are the lateral limits of the drainage ditch situated along North Ninth Street in front of the Hobby Shop. Unit 2 is presently being evaluated for Early Action through the Non-Time-Critical Removal Action process. An Engineering Evaluation/Cost Analysis (EE/CA) has been prepared for this unit.

4.2.3 Unit 3: Stained Area

The Unit 3 boundary at Site 20 is approximately the outer limit of the oil-stained surficial soil surrounding the fill pipe for the waste oil UST (SWMU/AOC 156) just beyond the northwest wall of the Hobby Shop. Unit 3 is presently being evaluated for Early Action through the Non-Time-Critical Removal Action process. An EE/CA has been prepared for this unit.

4.2.4 Unit 4: Courtyard and Front Slope

The Unit 4 boundary at Site 20 consists of the paved or concrete covered areas at this site.

4.2.4.1 SOIL SAMPLES

In the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 2, 5, and 10 feet bgs at three stratified random-sampling locations (Map S3-2).

4.3 TIER 2

The Tier 2 sampling program will also focus exclusively on shallow soil (0 to 10 feet) conditions. The primary objective of this program will be to refine the data on the extent of shallow soil contamination identified during the Tier 1 sampling. Tier 2 sample locations will be based on these sample results. The process by which the Tier 2 sample locations will be selected is detailed in Appendix S of the Phase II RI/FS Work Plan (BNI 1995a).

4.4 TIER 3

The objective of a Tier 3 soil sampling program is to estimate the extent of a contaminant plume in deeper subsurface soils. To accomplish this goal, the drilling and sampling of a series of boreholes will be required. The location of Tier 3 boreholes is intended to minimize the number of boreholes required to define the lateral and vertical extent of the contaminant plume in deeper subsurface soils. Groundwater samples will be collected only when a contaminant plume in deeper subsurface soils has been traced (through a drilling and soil sampling program) downward to the water table. At such units/sites, the objectives of the sampling program must then be expanded to include a determination of whether groundwater has been adversely impacted as a result of the historic activities at this unit/site.

The process by which the locations for Tier 3 soil borings and monitoring wells will be selected is detailed in Appendix S of the Phase II RI/FS Work Plan (BNI 1995a).

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Section 5
REQUEST FOR ANALYSES

Requests for analyses are based on:

- site activities and history;
- results of previous investigations; and
- objectives of site-specific RI/FS efforts.

The analytical methods referenced in this section are from the Phase II RI/FS Quality Assurance Project Plan (QAPP) (BNI 1995b). Section 6 in the QAPP specifies the number and/or frequency for collection of field duplicate and blank samples during the Phase II RI/FS field activities.

5.1 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk. The Tier 1 sampling approach will consist of the collection of shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. Table S5-1 lists all soil samples and associated analyses for the Units in Site 20.

5.1.1 Unit 1: East Drainage Ditch

The two Tier 1 soil samples that will be collected at Site 20, Unit 1, will be analyzed according to the methods listed below.

5.1.1.1 FIXED-BASE LABORATORY ANALYTICAL LABORATORIES

All soil samples will be analyzed by a fixed-base laboratory for pesticides/PCBs (U.S. EPA Method 8080), SVOCs (U.S. EPA Method 8270), VOCs (U.S. EPA Method 8010), TFH-diesel and -gasoline (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under Naval Facilities Engineering Service Center (NFESC; formerly known as Naval Energy and Environmental Support Activity [NEESA]) Level D protocols.

5.1.2 Unit 4: Courtyard and Front Slope

The twelve Tier 1 soil samples that will be collected at Site 20, Unit 4, will be analyzed according to the methods listed below.

5.1.2.1 FIELD SCREENING

All soil samples will be field-screened for PCBs and polynuclear aromatic hydrocarbons (PAH) with immunoassay test kits (U.S. EPA Methods 4020 and 4035), and for VOCs (U.S. EPA Method 8010), total petroleum hydrocarbons (TPH)-diesel and -gasoline (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) using an appropriately equipped mobile laboratory.

Table S5-1
Soil Sampling and Analysis

Tier	Unit/Name	PHASE II RI/FS SAMPLE NUMBERS			FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY					OFF-SITE LABORATORY[b]				
		No. of Locations	Samples/ Location	Total Samples	PAH[c,d]	PCBs[c,e]	VOCs[f,g]	TPH[h] Gas and Diesel[f]	Target Analyte List - Metals[f]	Pesticides and PCBs	SVOCs	VOCs	TFH	TAL Metals
Tier 1	Unit 1 East Drainage Ditch	1	2	2						X	X	X	X	X
	Unit 4 Courtyard and Front Slope	3	4	12	X		X	X	X	X				
Tier 1 Subtotals				14	12		12	12	12	14	2	2	2	2
Tier 2	Optional: Scope of Tier 2 would be to further define extent of shallow soil contamination; based on Tier 1 data and Phase I RI findings, with approval of Base Closure Team.													
Tier 3	Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data, combined with the Phase I RI findings, with approval of BCT.													

Notes:
[a] three samples from Unit 4 will be sent to the off-site laboratory for confirmation analyses
[b] these constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory
[c] immunoassay analyses
[d] PAH – polynuclear aromatic hydrocarbons
[e] PCB – polychlorinated biphenyl
[f] mobile laboratory analyses
[g] VOC – volatile organic compound
[h] TPH – total petroleum hydrocarbons

5.1.2.2 FIXED-BASE ANALYTICAL LABORATORIES

Three samples (two detects and one nondetect) will be submitted to the fixed-base laboratory to confirm field-screening results. The fixed-based laboratory analyses will include pesticides/PCBs (U.S. EPA Method 8080), PAH (U.S. EPA Method 8310), VOCs (U.S. EPA Method 8010), and TPH-diesel and -gasoline (U.S. EPA Method 8105M) under NFESC Level D protocols.

5.2 TIER 2

A Tier 2 request for analysis, if necessary, will be contingent upon the Tier 1 sample results.

5.3 TIER 3

A Tier 3 request for analysis, if necessary, will be contingent upon the Tier 1 and Tier 2 sample results.

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Section 6
FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods referenced in this section are from Section 6 of the FSP and the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Standard Operating Procedures, which discuss specific field methods and procedures.

6.1 INITIAL SURVEYS

Before the collection of Phase II RI/FS soil samples, the site will be scaled and sampling locations will be staked or paint-marked. Once a sampling point is marked, utility clearances will be made before collecting any sample that uses power equipment to reach the sample depth. Utility clearances may also be made at locations where samples are being collected using a hand auger. Nonintrusive utility clearances will be completed by a subcontractor, using geophysical methodology in conjunction with site activities.

Each sampling point will be located by survey, using the California Plane Coordinate System, with northings and eastings determined to the nearest 0.1 foot. The surface elevation will be determined to the nearest 0.01 foot.

6.2 TIER 1

All samples in Unit 1 will be collected at the locations and depths described in Section 4.2. More information on soil sampling procedures is provided in Section 6 of the FSP.

6.2.1 Unit 1: East Drainage Ditch

The two Tier 1 soil samples will be collected at Site 20, Unit 1, at depths of 0 and 2 feet bgs in one boring as indicated below.

6.2.1.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer, or using hand auger and hand drive-sampler equipment.

6.2.2 Unit 4: Courtyard and Front Slope

The twelve Tier 1 soil samples will be collected at Site 20, Unit 4, at depths of 0, 2, 5, and 10 feet bgs in three borings as indicated below.

6.2.2.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer.

6.3 TIER 2

If Tier 2 soil sampling is conducted at Site 20, shallow soil samples will be collected as described above.

6.4 TIER 3

If Tier 3 sampling is conducted, deep soil samples (from 10 feet bgs to groundwater level) will be collected at 5-foot intervals, with a modified California split-spoon sampler equipped with stainless steel sleeves. The split-spoon sampler will be driven into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer. When drilling is required to depths of greater than 130 feet bgs, the hollow-stem auger drilling rig will be replaced by an air-rotary drilling rig. If groundwater sampling is necessary, sampling will follow procedures presented in Section 6 of the FSP.

Section 7
REFERENCES

Bechtel National, Inc. 1995a. *Final Work Plan, Phase II Remedial Investigation/Feasibility Study*. Marine Corps Air Station El Toro, California.

———. 1995b. *Final Quality Assurance Project Plan, Phase II Remedial Investigation/ Feasibility Study*. Marine Corps Air Station El Toro, California.

BNI. *See* Bechtel National, Inc.

Jacobs Engineering. *See* Jacobs Engineering Group, Inc.

Jacobs Engineering Group, Inc. 1993a. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study, Draft Work Plan*. Marine Corps Air Station El Toro, California.

———. 1993b *Installation Restoration Program, Phase I Remedial Investigation Draft Technical Memorandum*. Marine Corps Air Station El Toro, California.

———. 1993c. *Installation Restoration Program, Final Resource Conservation and Recovery Act (RCRA) Facility Assessment Report*. Marine Corps Air Station El Toro, California.

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Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Room 135
San Diego, California 92132-5187

Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN ATTACHMENT T OPERABLE UNIT 3 – SITE 21 – MATERIALS MANAGEMENT GROUP MCAS EL TORO, CALIFORNIA

CTO-0059

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August 1995

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FSP	Field Sampling Plan
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NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
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PCB	polychlorinated biphenyl
PRG	(U.S. EPA Region IX) Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
TAL	target analyte list
TFH	total fuel hydrocarbons
TPH	total petroleum hydrocarbons
U.S. EPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

ACRONYMS/ABBREVIATIONS (continued)

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Section 1
OBJECTIVES

This Field Sampling Plan (FSP) for Site 21, the Materials Management Group, outlines the field procedures and methodology to be used during the Remedial Investigation (RI)/Feasibility Study (FS) for this site. The purpose of this FSP is to enable field personnel unfamiliar with the site to gather the required samples and field data. It is also intended to assure that data collection will be comparable to and compatible with previous data collected at the site and with other sampling activities at other sites at the Marine Corps Air Station (MCAS) El Toro.

1.1 SAMPLING OBJECTIVES

The specific objectives for sampling at Site 21 are as follows:

- verify boundaries of waste disposal activities;
- characterize the nature and extent of contamination;
- estimate the vertical and horizontal extent of contamination; and
- characterize site-specific groundwater contamination, if soil contamination extends to groundwater.

1.2 DATA USAGE

To satisfy the RI/FS objectives for Site 21, the data to be collected, compiled, and analyzed will be used to perform the following:

- characterize subsurface soils;
- establish stratigraphic controls;
- establish geotechnical parameters;
- characterize groundwater conditions and quality (where soil contamination suggests);
- determine the types of contaminants in soil and/or groundwater;
- estimate the extent of contaminants in soil and/or groundwater;
- evaluate human health and ecological risks;
- evaluate the mass of contaminants;
- evaluate cleanup levels;
- characterize the feasible removal or remedial actions, if necessary; and
- evaluate remedial alternatives.

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Section 2
BACKGROUND

This section generally describes and discusses the results of previous investigations at Site 21. This section also provides a brief compilation of the data used to develop the site-specific FSP for Phase II RI/FS activities. Previous investigations and reports provide a more thorough discussion of site history, activities, and summaries of previous investigations.

2.1 SITE DESCRIPTION

The Materials Management Group, Building 320, is located on the southwest portion of MCAS El Toro (Map T3-1). The site consists of an outside area northwest of the building used to store drums of chemicals and to temporarily store drums of chemicals with expired shelf lives. The storage area is a fenced enclosure, mostly unpaved and covered with dirt and gravel, with small areas of concrete. A catch basin is located outside the southwest corner of the fenced enclosure (Jacobs Engineering 1993a).

2.1.1 History

Site 21, a supply distribution center for MCAS El Toro and other marine facilities, has been used for the storage of drums since approximately 1946. No documented leaks or spills have occurred at the site; however, contaminants may have leaked from drums during the life of the storage area. The catch basin located northwest of the fenced enclosure may have been the receiving area for off-site runoff (Jacobs Engineering 1993a).

2.1.2 Geology

The geology of Site 21 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993b). Holocene deposits consist of a matrix of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene, which are considered to be bedrock in the area.

Based on a review of Phase I RI boring logs, the subsurface lithology at Site 21 consists of discontinuous layers of sandy lean clay, lean silt, sandy silt, silty sand, and poorly graded sand (Jacobs Engineering 1993b).

2.1.3 Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Subbasin (Irvine Subbasin). Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine-grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the

Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993b).

The Phase I RI results indicate that the shallow, perched zone is not present at Site 21. The principal aquifer is present beneath Site 21 at a depth of about 95 feet below ground surface (bgs). The regional groundwater flow direction is to the northwest. The local hydraulic gradient has been influenced strongly by the pumping of irrigation wells located west of MCAS El Toro.

2.2 PHASE I REMEDIAL INVESTIGATION RESULTS

During the Phase I RI, Site 21 was represented by one stratum, an area that included the outside drum storage area and the catch basin located on the southwest corner of the site (Map T3-2). During the Phase I RI, the following site-specific activities were conducted:

- nine shallow samples (0 to 10 feet bgs) were collected from four locations;
- one sediment sample was collected from the catch basin near the site;
- twelve subsurface (vadose zone) samples were collected from three borings;
- three groundwater monitoring wells (21_DBMW56, 21_UGMW37, and 21_DGMW90) were installed and sampled in the area of the site;
- soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds, herbicides, pesticides/polychlorinated biphenyls (PCBs), total fuel hydrocarbons (TFH)-diesel and -gasoline, total recoverable hydrocarbons, and target analyte list (TAL) metals; and
- groundwater samples were analyzed for general chemistry, VOCs, TFH-diesel and -gasoline, TAL metals, and gross alpha and gross beta.

Concentrations of chemicals of potential concern (COPCs) detected in shallow soil at Site 21 during Phase I RI were compared to United States Environmental Protection Agency (U.S. EPA) Region IX Preliminary Remediation Goals (PRGs) and ecological screening criteria. No COPCs detected in shallow soil in Site 21, Stratum 1, exceeded PRGs or ecological screening criteria.

Groundwater samples were collected from the three groundwater monitoring wells constructed in the area of Site 21. Concentrations of COPCs were compared to applicable human health PRGs and maximum contaminant levels (MCLs). The results are as follows:

- methyl chloride, tetrachloroethene, and trichloroethene, exceed PRGs and MCLs in the upgradient well (21_UGMW37);
- methyl chloride exceed PRG in the on-site well (21_DBMW56);
- antimony exceed MCL in the downgradient well (21_DGMW90);

- nickel exceed MCL in the on-site well (21_DBMW56) and the downgradient well (21_DGMW90); and
- nitrate and selenium exceed MCLs in all three wells.

The contaminants detected in groundwater wells at Site 21 appear to be related to the regional groundwater VOC contamination, not to the activities believed to have occurred at Site 21 (Jacobs Engineering 1993a).

The analytical results of the soil samples indicated the presence of petroleum hydrocarbons. Based on the California Leaking Underground Fuel Tank (LUFT) Field Manual guidelines (LUFT 1989), petroleum hydrocarbons in the shallow soil and vadose zone soils at Site 21 do not appear to pose a threat to groundwater quality (Jacobs Engineering 1993a). Trace levels of TFH as gasoline are present to depths of at least 80 feet bgs in the area of wells 21_DBMW56 and 21_DGMW90. Although surface and vadose soil samples contained trace levels of petroleum hydrocarbons, the analytical results of groundwater samples did not indicate the presence of these compounds.

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Section 3
MAPS

The maps on the following pages present the site location at MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and proposed Phase II sampling locations (where known). These maps are referenced in other sections of this FSP.

The proposed Phase II sampling locations presented on these maps are intended to illustrate the type of sampling strategy proposed for each unit. Other considerations (e.g., randomly selected starting points, underground utilities/pipelines, or overhead obstacles) could result in adjustments to sampling locations. The actual field sample locations will be accurately recorded by field personnel relative to surveyed coordinates, and if any sampling points require relocation, the reasons for such changes will be described in the field notebook.

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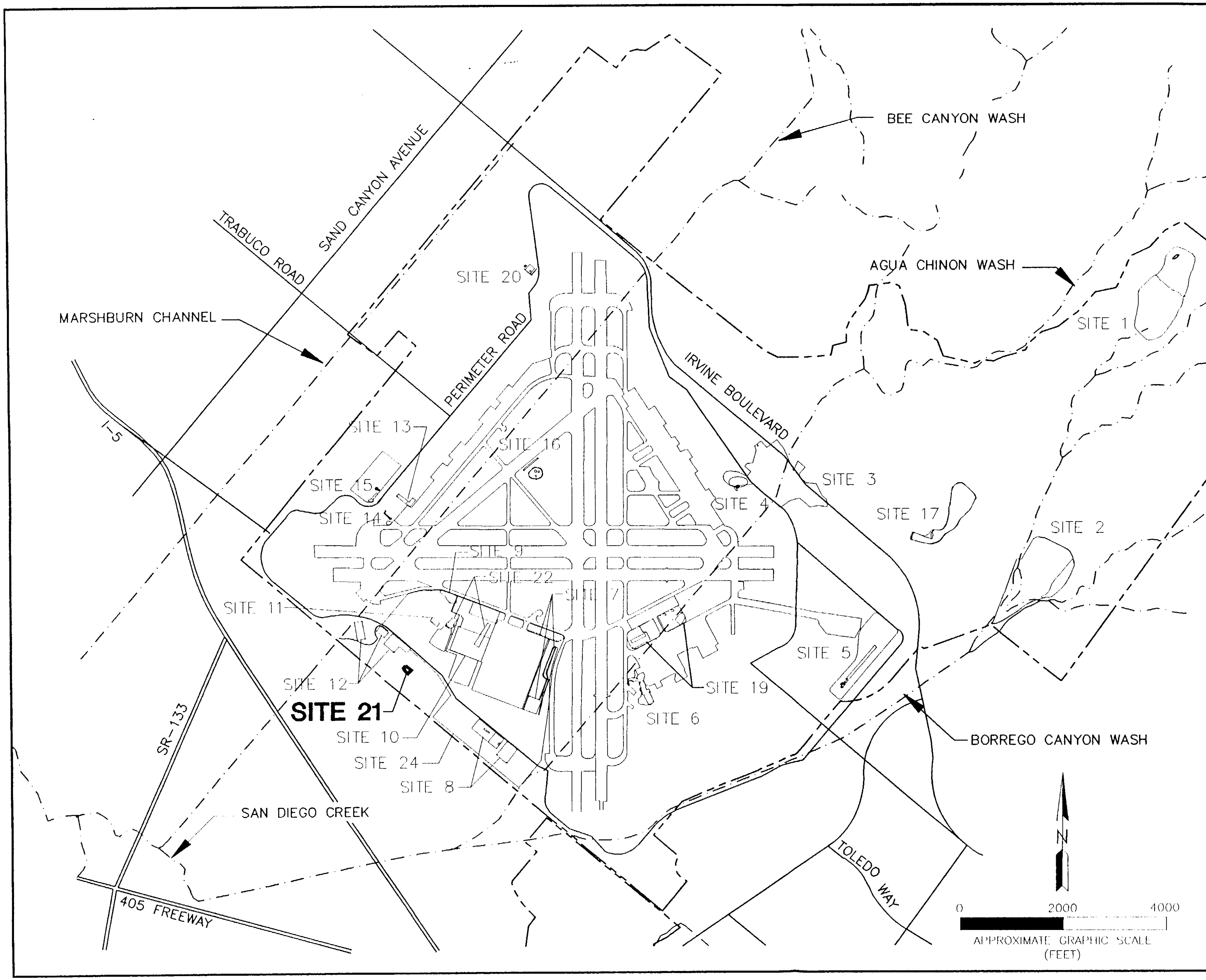

Field Sampling Plan Attachment T

Map T3-1
Site Location
Site 21 - Materials Management Group-Building 320

MCAS El Toro, California

CLEAN II Program

Date: 6/13/95
File No. SLOCF-21
Job No. 22214-059

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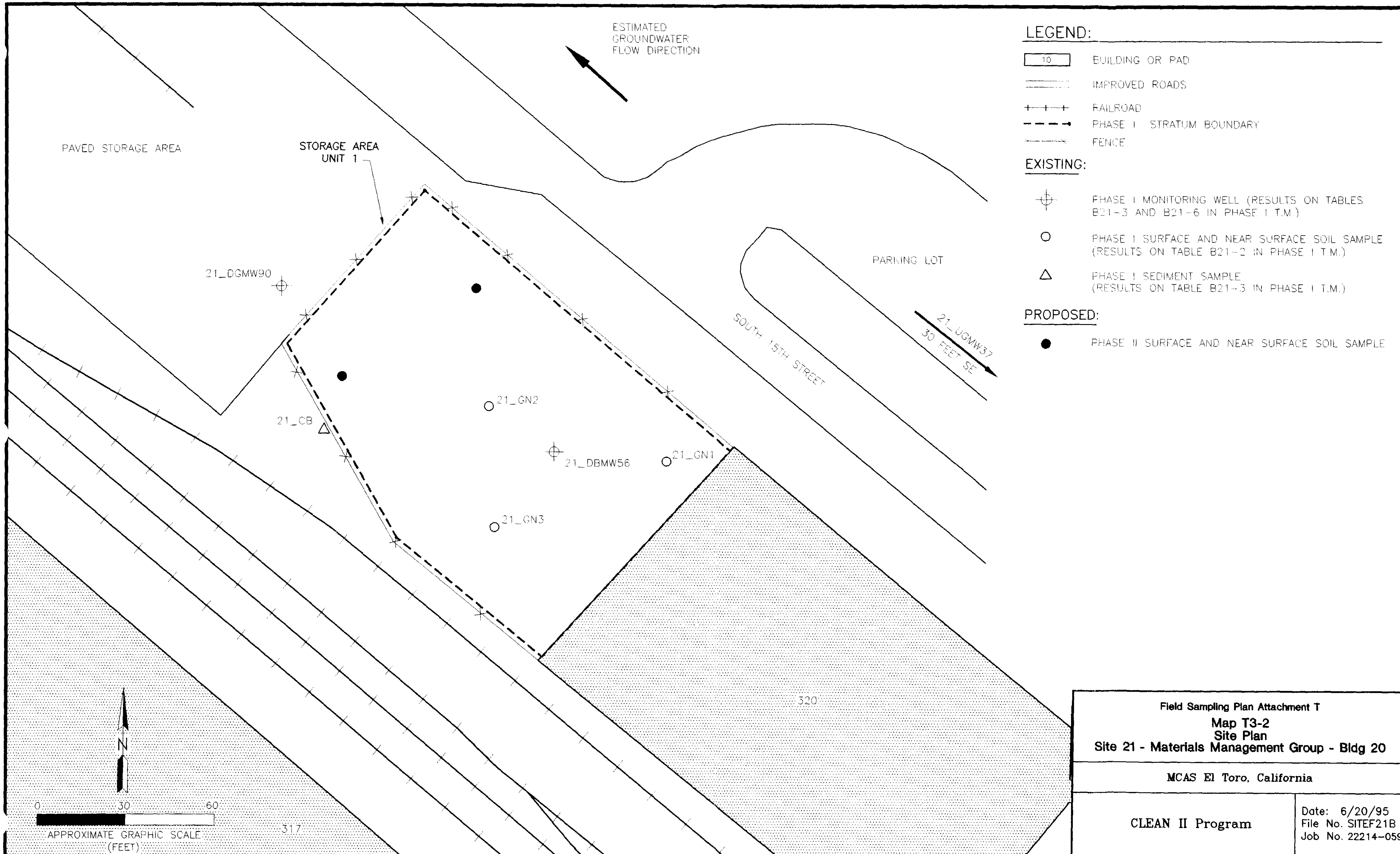
ESTIMATED GROUNDWATER FLOW DIRECTION
PAVED STORAGE AREA
STORAGE AREA UNIT 1
21_DGMW90
21_CB
21_GN2
21_DBMW56
21_GN1
21_GN3
SOUTH 15TH STREET
PARKING LOT
21_UGMW37 30 FEET SE
320
317
0
30
60
APPROXIMATE GRAPHIC SCALE (FEET)
N
LEGEND:
10
BUILDING OR PAD
IMPROVED ROADS
RAILROAD
PHASE I STRATUM BOUNDARY
FENCE
EXISTING:
PHASE I MONITORING WELL (RESULTS ON TABLES B21-3 AND B21-6 IN PHASE I T.M.)
PHASE I SURFACE AND NEAR SURFACE SOIL SAMPLE (RESULTS ON TABLE B21-2 IN PHASE I T.M.)
PHASE I SEDIMENT SAMPLE (RESULTS ON TABLE B21-3 IN PHASE I T.M.)
PROPOSED:
PHASE II SURFACE AND NEAR SURFACE SOIL SAMPLE
Field Sampling Plan Attachment T
Map T3-2
Site Plan
Site 21 - Materials Management Group - Bldg 20
MCAS El Toro, California
CLEAN II Program
Date: 6/20/95
File No. SITEF21B
Job No. 22214-059

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

This section explains the rationale for the number of sampling programs, types of samples, locations of samples, and analytical parameters. The rationale for sampling is based on site conditions, previous investigations, and data quality objectives as presented in the appendices of the Phase II RI/FS Work Plan (BNI 1995a).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, types of samples, and locations are presented based on the smallest area of study. For some sites, the smallest area of study is a site unit; for other sites, the area of study may be the entire site. Selection of sampling programs, sample types, and locations is based on:

- site activities and history;
- types of media suspected or known to be impacted from previous investigations;
- objectives of site-specific RI/FS efforts; and
- site-specific initial surveys.

The site will be represented by one area (unit) for the Phase II RI/FS. Unit 1 is the same area as Stratum 1 (Storage Area) from the Phase I RI. Unit 1 will be sampled using a tiered sampling approach. Previous site activities, Phase I RI sampling results, and regulatory comments were used to formulate the Phase II RI/FS sampling approach. During the Phase I RI, soil samples were collected from the stratum, and COPCs were identified and evaluated against PRGs. Sampling locations in Unit 1 have been positioned in random locations to refine risk estimates for the unit.

4.2 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk to human health or the environment. The Tier 1 sampling approach will consist of collecting shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed such that, when the Phase I and II RI/FS data are evaluated together, a risk can be estimated for the unit. An explanation of the proposed sampling designs for Tier 1 soil sampling can be found in Section 4 of the Phase II RI/FS Work Plan (BNI 1995a).

4.2.1 Unit 1: Storage Area

The Unit 1 boundaries of Site 21 consist of the storage area located west of Building 320.

4.2.1.1 SOIL SAMPLES

In the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at two stratified random sampling locations (Map T3-2).

4.3 TIER 2

The Tier 2 sampling program, will also focus exclusively on shallow soil (0 to 10 feet) conditions. The primary objective of this program will be to refine the data on the extent of shallow soil contamination identified during the Tier 1 sampling. Tier 2 sample locations will be based on these sample results. The process by which the Tier 2 sample locations will be selected is detailed in Appendix T of the Phase II RI/FS Work Plan (BNI 1995a).

4.4 TIER 3

The objective of a Tier 3 soil sampling program is to estimate the extent of a contaminant plume in deeper subsurface soils. To accomplish this goal, a series of boreholes will be drilled and sampled. The location of Tier 3 boreholes is intended to minimize the number of boreholes required to define the lateral and vertical extent of the contaminant plume in deeper subsurface soils. Groundwater samples will be collected only when a contaminant plume in deeper subsurface soils has been traced (through a drilling and soil sampling program) downward to the water table. At such units/sites, the objectives of the sampling program must then be expanded to include a determination of whether groundwater has been adversely impacted as a result of the historic activities at the unit/site.

The process by which the locations for Tier 3 soil borings and monitoring wells will be selected is detailed in Appendix T of the Phase II RI/FS Work Plan (BNI 1995a).

Section 5
REQUEST FOR ANALYSES

Requests for analyses are based on:

- site activities and history,
- results of previous investigations, and
- objectives of site-specific RI/FS efforts.

The analytical methods referenced in this section are from the Phase II RI/FS Quality Assurance Project Plan (QAPP) (BNI 1995b). Section 6 in the QAPP specifies the number and/or frequency for collection of field duplicate and blank samples during the Phase II RI/FS field activities.

5.1 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk. The Tier 1 sampling approach will consist of the collection of shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. Table T5-1 lists all soil samples and associated analyses for the Units in Site 21.

5.1.1 Unit 1: Storage Area

The six Tier 1 soil samples that will be collected at Site 21 Unit 1, will be analyzed according to the methods listed below.

5.1.1.1 FIELD SCREENING

All soil samples will be field-screened for polynuclear aromatic hydrocarbons (PAH) with immunoassay test kits (U.S. EPA Method 4035), and for VOCs (U.S. EPA Method 8010), and total petroleum hydrocarbons (TPH)-diesel and -gasoline (U.S. EPA Method 8015M) using an appropriately equipped mobile laboratory.

5.1.1.2 FIXED-BASE ANALYTICAL LABORATORIES

All soil samples will be analyzed using a fixed-base laboratory for pesticides/PCBs (U.S. EPA Method 8080) and herbicides (U.S. EPA Method 8150) under Naval Facilities Engineering Service Center (NFESC, formerly known as Naval Energy and Environmental Support Activity [NEESA]) Level D protocols. Three samples (two detects and one nondetect) will be submitted to the fixed-base laboratory to confirm field screening results. The fixed-based laboratory analyses will include PAH (U.S. EPA Method 8310), VOCs (U.S. EPA Method 8010), and TPH-diesel and -gasoline (U.S. EPA Method 8015M) under NFESC Level D protocols.

Table T5-1
Soil Sampling and Analysis

		PHASE II RI/FS SAMPLE NUMBERS			FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY					OFF-SITE LABORATORY[b]		
Tier	Unit/Name	No. of Locations	Samples/ Location	Total Samples	PAH[c]	PCBs[c]	VOCs[c]	TPH[d] Gasoline and Diesel[e]	Target Analyte List - Metals[e]	Pesticides and PCBs[f]	Herbicides	Others
Tier 1	Unit 1 Storage Area	2	3	6	X		X	X		X	X	
Tier 1 Subtotals				6	6		6	6		6	6	
Tier 2	Optional: Scope of Tier 2 would be to further define extent of shallow soil contamination; based on Tier 1 data and Phase I RI findings, with approval of BCT.											
Tier 3	Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data, combined with the Phase I RI findings, with approval of BCT.											

Notes:
[a] at a minimum, 10 percent of detects and 5 percent of nondetects go to the off-site laboratory for confirmation analyses
[b] these constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory
[c] immunoassay analyses
[d] TPH – total petroleum hydrocarbons
[e] mobile laboratory analyses
[f] PCB – polychlorinated biphenyl

5.2 TIER 2

A Tier 2 request for analysis, if necessary, will be contingent upon the Tier 1 sample results.

5.3 TIER 3

A Tier 3 request for analysis, if necessary, will be contingent upon the Tier 1 and Tier 2 sample results.

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Section 6
FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods referenced in this section are from Section 6 of the FSP and the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Program Standard Operating Procedures, which discuss specific field methods and procedures.

6.1 INITIAL SURVEYS

Before the collection of Phase II RI/FS soil samples, the site will be scaled, and sampling locations will be staked or paint-marked. Once a sampling point is marked, utility clearances will be made before collecting any sample that uses power equipment to reach the sample depth. Utility clearances may also be made at locations where samples are being collected using a hand auger. Nonintrusive utility clearances will be completed by a subcontractor, using geophysical methodology in conjunction with site activities.

Each sampling point will be located by survey, using the California Plane Coordinate System, with northings and eastings determined to the nearest 0.1 foot. The surface elevation will be determined to the nearest 0.01 foot.

6.2 TIER 1

All samples in Unit 1 will be collected at the locations and depths described in Section 4.2. More information on soil sampling procedures is provided in Section 6 of the FSP.

6.2.1 Unit 1: Storage Area

The six Tier 1 soil samples will be collected at Site 21, Unit 1 at 0, 5, 10 feet bgs in the two borings as indicated below.

6.2.1.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig equipped with 140-pound hammer.

6.3 TIER 2

If Tier 2 soil sampling is conducted at Site 21, shallow soil samples will be collected as described above.

6.4 TIER 3

If Tier 3 sampling is conducted, deep soil samples (from 10 feet bgs until groundwater level) will be collected at 5-foot intervals, with a modified California split-spoon sampler equipped with stainless steel sleeves. The split-spoon sampler will be driven into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer. When drilling is required to depths of greater than 130 feet bgs, the hollow-stem auger drilling rig will be replaced by an air-rotary drilling rig. If groundwater sampling is necessary, sampling will follow procedures presented in Section 6 of the FSP.

Section 7
REFERENCES

Bechtel National, Inc. 1995a. *Final Work Plan, Phase II Remedial Investigation/Feasibility Study.* Marine Corps Air Station El Toro, California.

Bechtel National, Inc. 1995b. *Final Quality Assurance Project Plan, Phase II Remedial Investigation/Feasibility Study.* Marine Corps Air Station El Toro, California.

BNI. *See* Bechtel National, Inc.

Jacobs Engineering. *See* Jacobs Engineering Group, Inc.

Jacobs Engineering Group, Inc. 1993a. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study, Draft Work Plan.* Marine Corps Air Station El Toro, California.

———. 1993b. *Installation Restoration Program, Phase I Remedial Investigation Draft Technical Memorandum.* Marine Corps Air Station El Toro, California.

LUFT. *See* State of California Leaking Underground Fuel Tank Task Force.

State of California Leaking Underground Fuel Tank Task Force. 1989. *Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure.*

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Southwest Division
Naval Facilities Engineering Command
Contracts Department
1220 Pacific Highway, Room 135
San Diego, California 92132-5187

Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN
ATTACHMENT U
OPERABLE UNIT 3 –
SITE 22 – TACTICAL AIR FUEL DISPENSING SYSTEM
MCAS EL TORO, CALIFORNIA

CTO-0059

Prepared by:

BECHTEL NATIONAL, INC.
401 West A St., Suite 1000
San Diego, California 92101

August 1995

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TABLE

ACRONYMS/ABBREVIATIONS

bgs	below ground surface
CLEAN	Comprehensive Long-Term Environmental Action Navy
COPC	chemical of potential concern
FBR	fuel bladder revetment
FS	Feasibility Study
FSP	Field Sampling Plan
Irvine Subbasin	Irvine Groundwater Subbasin
LUFT	(California) Leaking Underground Fuel Tank (Field Manual)
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
PAH	polynuclear aromatic hydrocarbons
PRG	(U.S. EPA Region IX) Preliminary Remediation Goal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SVOC	semivolatile organic compound
TAFDS	Tactical Air Fuel Dispensing System
TAL	target analyte list
TFH	total fuel hydrocarbons
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound

ACRONYMS/ABBREVIATIONS (continued)

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Section 1
OBJECTIVES

This Field Sampling Plan (FSP) for Site 22, the Tactical Air Fuel Dispensing System (TAFDS), outlines the field procedures and methodology to be used during the Remedial Investigation (RI)/ Feasibility Study (FS) for this site. The purpose of this FSP is to enable field personnel unfamiliar with the site to gather the required samples and field data. It is also intended to assure that data collection will be comparable to and compatible with previous data collected at the site and with other sampling activities at other sites at the Marine Corps Air Station (MCAS) El Toro.

1.1 SAMPLING OBJECTIVES

The specific objectives for sampling at the Site 22 are as follows:

- verify boundaries of waste disposal activities;
- characterize the nature and extent of contamination;
- estimate the vertical and horizontal extent of contamination; and
- characterize site-specific groundwater contamination, if soil contamination extends to groundwater.

1.2 DATA USAGE

To satisfy the RI/FS objectives for the TAFDS, the data to be collected, compiled, and analyzed will be used to perform the following:

- characterize subsurface soils;
- establish stratigraphic controls;
- establish geotechnical parameters;
- characterize groundwater conditions and quality (where soil contamination suggests);
- determine the types of contaminants in soil and/or groundwater;
- estimate the extent of contaminants in soil and/or groundwater;
- evaluate human health and ecological risks;
- evaluate the mass of contaminants;
- evaluate cleanup levels;
- characterize the feasible removal or remedial actions, if necessary; and
- evaluate remedial alternatives.

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Section 2
BACKGROUND

This section generally describes the results of previous investigations at Site 22. This section also provides a brief compilation of the data used to develop the site-specific FSP for Phase II RI/FS activities. Previous investigations and reports provide a more thorough discussion of site history, activities, and summaries of previous investigations.

2.1 SITE DESCRIPTION

Site 22 is located in the southwestern quadrant of MCAS El Toro (Map U3-1) at an elevation of approximately 280 feet above mean sea level (Jacobs Engineering 1993a). The TAFDS, originally located in the eastern portion of the Petroleum Disposal Area (Site 10), was first observed in 1952 aerial photographs. In 1971, it was relocated to an area immediately west of Site 10, and east of Building 369.

2.1.1 History

Heavy staining was observed at both TAFDS locations. Several fuel bladder revetments (FBRs), each containing a fuel bladder, were located at this site. Numerous stained areas surrounded these FBRs. Reportedly, the Western Area has a history of petroleum-based fuel spillages and leaks that occurred during routine operations. During a particular spill in the early 1980s, an unknown quantity of fuel was spilled and was followed by soil cleanup (Jacobs Engineering 1993a).

2.1.2 Geology

The geology of Site 22 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993b). Holocene deposits consist of a matrix of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene, which are considered to be bedrock in the area.

Based on a review of Phase I RI boring logs, the subsurface lithology at Site 22 consists of layered sequences of sands, silts, and clays (i.e., sandy clay, silty sand). Well-defined permeable units, such as well-sorted sands, are infrequent (Jacobs Engineering 1993b).

2.1.3 Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Subbasin (Irvine Subbasin). Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine-grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the

Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993b).

The Phase I RI results indicate the shallow, perched zone is not present at Site 22. The principal aquifer is the main water-producing zone for the Irvine area. Groundwater is present beneath Site 22 at approximately 120 feet below ground surface (bgs). The regional groundwater flow direction is to the northwest. The local hydraulic gradient has been influenced strongly by the pumping of irrigation wells located west of MCAS El Toro.

2.2 PHASE I REMEDIAL INVESTIGATION RESULTS

During the Phase I RI (Jacobs Engineering 1993b), the TAFDS was divided into two strata (Map U3-2):

- Stratum 1 – Western Fuel Dispensing Area (the western and more recent fuel dispensing area); and
- Stratum 2 – Eastern Fuel Dispensing Area (the eastern and older fuel dispensing area).

The following site-specific activities were conducted:

- surface and shallow soil samples from were collected from seven sampling locations;
- one deep boring was drilled, completed as a monitoring well (22_DBMW47), and sampled (subsurface soil and groundwater);
- one 25-foot boring was drilled and sampled in Stratum 2;
- soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), total fuel hydrocarbons (TFH)-gasoline and -diesel, total recoverable petroleum hydrocarbons, and target analyte list (TAL) metals; and
- groundwater samples were analyzed for general chemistry, VOCs, SVOCs, pesticides/PCBs, TFH-gasoline and -diesel, TAL metals, and gross alpha and gross beta.

Concentrations of chemicals of potential concern (COPCs) detected in shallow soil at Site 22 during Phase I RI were compared to United States Environmental Protection Agency (U.S. EPA) Region IX Preliminary Remediation Goals (PRGs) and ecological screening criteria. The results are as follows:

- benzo(a)pyrene exceed PRGs; and benzo(a)pyrene and lead exceed ecological screening criteria in Stratum 1; and
- no COPCs detected in shallow soil in Stratum 2 exceed PRGs or ecological criteria.

Concentrations COPCs detected in groundwater samples collected from the on-site well (22_DBMW47) were compared to PRGs and maximum contaminant levels (MCLs). The results are as follows:

- carbon tetrachloride, tetrachloroethene, trichloroethene exceed PRGs; and
- antimony, selenium, sulfate, nitrate-N, and TDS exceed MCLs.

Petroleum hydrocarbons detected in shallow soil samples were also compared to California Leaking Underground Fuel Tank (LUFT) Field Manual guidelines (LUFT 1989) to evaluate their potential to migrate to the groundwater. Based on LUFT guidelines, petroleum hydrocarbons in shallow soil do not appear to pose a threat to groundwater. No COPCs detected in subsurface soil were judged to have the potential to reach the groundwater (Jacobs Engineering 1993a).

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Section 3
MAPS

The maps on the following pages present the site location at MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and proposed Phase II sampling locations (where known). These maps are referenced in other sections of this FSP.

The proposed Phase II sampling locations presented on these maps are intended to illustrate the type of sampling strategy proposed for each unit. Other considerations (e.g., randomly selected starting points, underground utilities/pipelines, or overhead obstacles) could result in adjustments to sampling locations. The actual field samples will be accurately recorded by field personnel relative to surveyed coordinates, and if any sampling points require relocation, the reasons for such changes will be described in the field notebook.

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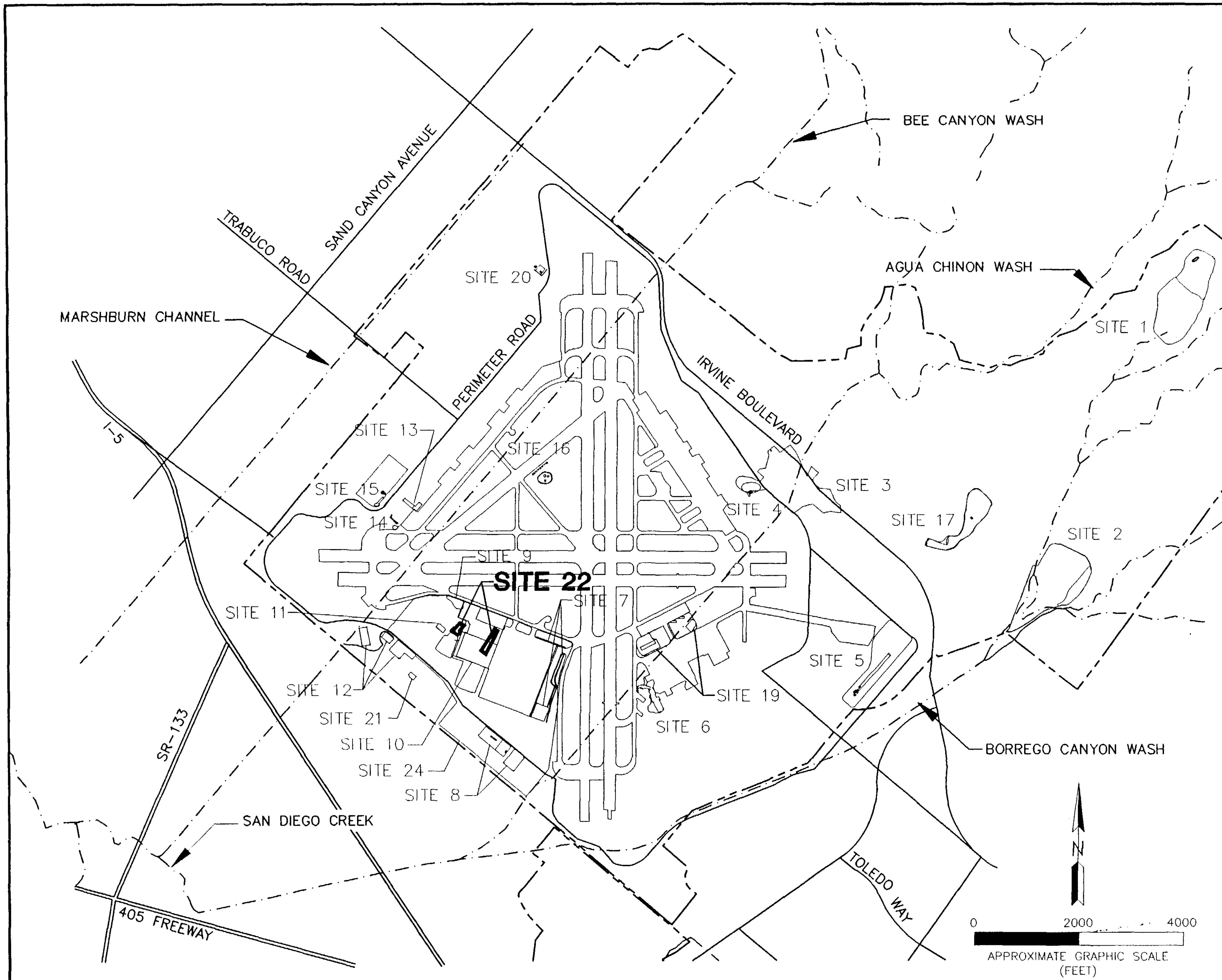

Field Sampling Plan Attachment U

Map U3-1
Site Location
Site 22 - Tactical Air Fuel Dispensing System

MCAS El Toro, California

CLEAN II Program

Date: 6/13/95
File No. SLOCF-22
Job No. 22214-059

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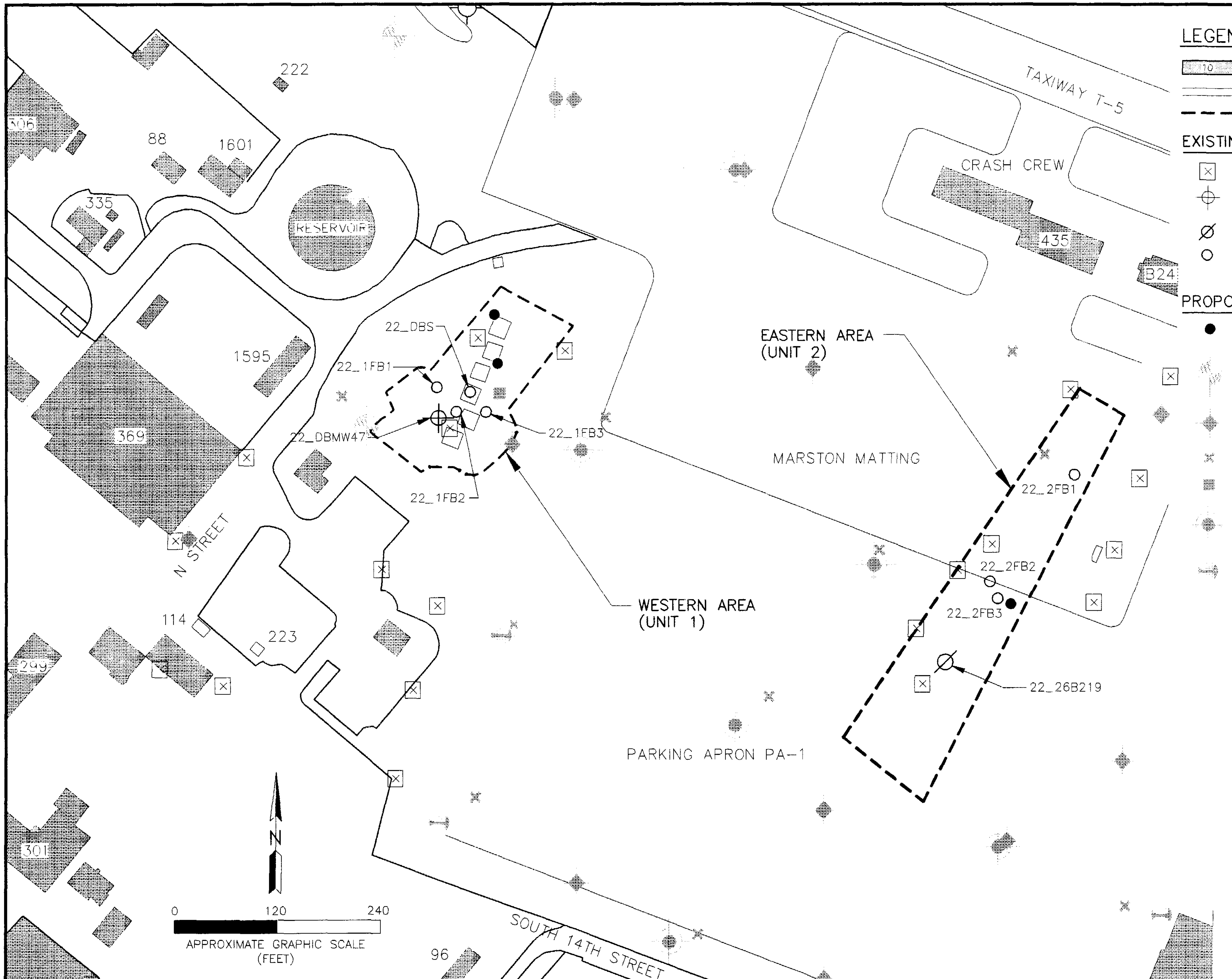

Field Sampling Plan Attachment U

Map U3-2
Site Plan
Site 22 - Tactical Air Fuel Dispensing System

MCAS El Toro, California

CLEAN II Program

Date: 7/17/95
File No. SITEF22B
Job No. 22214-059

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

This section explains the rationale for the number of sampling programs, types of samples, locations of samples, and analytical parameters. The rationale for sampling is based on site conditions, previous investigations, and data quality objectives as presented in the appendices of the Phase II RI/FS Work Plan (BNI 1995a).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, types of samples, and locations are presented based on the smallest area of study. For some sites, the smallest area of study is a site unit; for other sites, the area of study may be the entire site. Selection of sampling programs, sample types, and locations is based on:

- site activities and history;
- types of media suspected or known to be impacted from previous investigations;
- objectives of site-specific RI/FS efforts; and
- site-specific initial surveys.

The TAFDS was originally located south of Building 435 within the eastern portion of the Petroleum Disposal Area (Site 10). In 1971, it was relocated to an area immediately west of Site 10 and east of Building 369. Several FBRs were located at the TAFDS. Numerous stained areas were observed around these FBRs. The two TAFDS locations had a long history of petroleum fuel spillages and leaks during routine operations. Suspected contaminants at these locations include VOCs, SVOCs, and other petroleum products.

Units 1 and 2 will be sampled using a tiered sampling approach, as discussed in the following sections. The tiered approach is intended to minimize the level of effort necessary to fully characterize the site and determine the extent of contamination that may have occurred as a result of the site activities. Previous site activities, Phase I RI sampling results, and regulatory comments were used to formulate the Phase II RI/FS sampling approach developed for Unit 1 at Site 22. During the Phase I RI, soil samples were collected from each strata, and COPCs were identified and evaluated against PRGs. Sampling locations in Unit 1 have been positioned in random locations to refine risk estimates for the unit.

4.2 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk to human health or the environment. The Tier 1 sampling approach will consist of the collection of shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed such that, when the Phase I and II RI/FS data are evaluated together, a risk can be estimated for the unit. An explanation of the proposed sampling designs for Tier 1 soil sampling can be found in Section 4 of the Phase II RI/FS Work Plan (BNI 1995a).

4.2.1 Unit 1: West TAFDS Area

Unit 1 is the west location of the TAFDS which lies immediately west of the Petroleum Disposal Area (Site 10) and east of Building 369.

4.2.1.1 SOIL SAMPLES

In the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at two stratified random sampling locations (Map U3-2).

4.2.2 Unit 2: East TAFDS Area

Unit 2 is the east location of the TAFDS which lies in the east side of the Petroleum Disposal Area (Site 10). This unit had initially been proposed for No Further Investigation; however, the U.S. EPA has requested one additional sample location be sampled to confirm Phase I RI results.

4.2.2.1 SOIL SAMPLES

For the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs in one judgmental sampling location (Map U3-2).

4.3 TIER 2

The Tier 2 sampling program will also focus exclusively on shallow soil (0 to 10 feet) conditions. The primary objective of this program will be to refine the data on the extent of shallow soil contamination identified during the Tier 1 sampling. Tier 2 sample locations will be based on these sample results. The process by which the Tier 2 sample locations will be selected is detailed in Appendix U of the Phase II RI/FS Work Plan (BNI 1995a).

4.4 TIER 3

The objective of a Tier 3 soil sampling program is to estimate the extent of a contaminant plume in deeper subsurface soils. To accomplish this goal, a series of boreholes will be drilled and sampled. The location of Tier 3 boreholes is intended to minimize the number of boreholes required to define the lateral and vertical extent of the contaminant plume in deeper subsurface soils. Groundwater samples will be collected only when a contaminant plume in deeper subsurface soils has been traced (through a drilling and soil sampling program) downward to the water table. At such units/sites, the objectives of the sampling program must then be expanded to include a determination of whether groundwater has been adversely impacted as a result of the historic activities at this unit/site.

The process by which the locations for Tier 3 soil borings and monitoring wells will be selected is detailed in Appendix U of the Phase II RI/FS Work Plan (BNI 1995a).

Section 5
REQUEST FOR ANALYSES

Requests for analyses are based on:

- site activities and history;
- results of previous investigations; and
- objectives of site-specific RI/FS efforts.

The analytical methods referenced in this section are from the Phase II RI/FS Quality Assurance Project Plan (QAPP) (BNI 1995b). Section 6 in the QAPP specifies the number and/or frequency for collection of field duplicate and blank samples during the Phase II RI/FS field activities.

5.1 TIER 1

The purpose of the Tier 1 sampling plan will be to estimate whether the unit poses a risk. The Tier 1 sampling approach will consist of the collection of shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. Table U5-1 lists all soil samples and associated analyses for the Site 22, Unit 1.

5.1.1 Unit 1: West TAFDS Area

The six Tier 1 soil samples that will be collected at Site 22 Unit 1, will be analyzed according to the methods listed below.

5.1.1.1 FIELD SCREENING

All soil samples will be field-screened for polynuclear aromatic hydrocarbons (PAH) with immunoassay test kits (U.S. EPA Method 4035) and for total petroleum hydrocarbons (TPH)-gasoline and -diesel (U.S. EPA Method 8105M) using an appropriately equipped mobile laboratory.

5.1.1.2 FIXED-BASE ANALYTICAL LABORATORIES

A minimum of 10 percent of the total number of positives and a minimum of 5 percent of the nondetects will be submitted to the fixed-base laboratory to confirm field screening results. The fixed-based laboratory analyses are PAHs (U.S. EPA Method 8310) and TFH-gasoline and -diesel (U.S. EPA Method 8105M) under Naval Facilities Engineering Service Center (NFESC, formerly known as Naval Energy and Environmental Support Activity [NEESA]) Level D protocols.

5.1.2 Unit 2: East TAFDS Area

The three Tier 1 soil samples will be collected at Site 22, Unit 2, and will be analyzed according to the methods listed below.

Table U5-1
Soil Sampling and Analysis

Tier	Unit/Name	PHASE II RI/FS SAMPLE NUMBERS			FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY					OFF-SITE LABORATORY[b]	
		No. of Locations	Samples/ Location	Total Samples	PAH[c,d]	PCBs[c,e]	VOCs[f,g]	TPH[h] Gasoline and Diesel[e]	Target Analyte List - Metals[f]	SVOCs	TPH-Gasoline and Diesel
Tier 1	Unit 1 Western Area	2	3	6	X			X			
Tier 1	Unit 2 Eastern Area	1	3	3						X	X
Tier 1 Subtotals				9	6			6		3	3
Tier 2	Optional: Scope of Tier 2 would be to further define extent of shallow soil contamination; based on Tier 1 data and Phase I RI findings, and soil gas survey results, with approval of BCT										
Tier 3	Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data, Phase I RI findings, and soil gas survey results, with approval of BCT										

Notes:
[a] three samples from Unit 1 will go to the off-site laboratory for confirmation analyses
[b] these constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory
[c] immunoassay analyses
[d] PAH – polynuclear aromatic hydrocarbons
[e] PCB – polychlorinated biphenyl
[f] mobile laboratory analyses
[g] VOC – volatile organic compound
[h] TPH – total petroleum hydrocarbons

5.1.2.1 FIXED-BASE LABORATORY ANALYTICAL LABORATORIES

All soil samples will be analyzed by a fixed-base laboratory for SVOCs (U.S. EPA Method 8270) and TFH-gasoline and -diesel (U.S. EPA Method 8015M) under NFESC Level D protocols.

5.2 TIER 2

A Tier 2 request for analysis, if necessary, will be contingent upon the Tier 1 sample results.

5.3 TIER 3

A Tier 3 request for analysis, if necessary, will be contingent upon the Tier 1 and Tier 2 sample results.

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Section 6
FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods referenced in this section are from Section 6 of the FSP and the Comprehensive Long-Term Environmental Action Navy Comprehensive Long-Term Action Navy (CLEAN) II Program Standard Operating Procedures, which discuss specific field methods and procedures.

6.1 INITIAL SURVEYS

Before the collection of Phase II RI/FS soil samples, the site will be scaled and sampling locations will be staked or paint-marked. Once a sampling point is marked, utility clearances will be made before collecting any sample that uses power equipment to reach the sample depth. Utility clearances may also be made at locations where samples are being collected using a hand auger. Nonintrusive utility clearances will be completed by a subcontractor, using geophysical methodology in conjunction with site activities.

Each sampling point will be located by survey, using the California Plane Coordinate System, with northings and eastings determined to the nearest 0.1 foot. The surface elevation will be determined to the nearest 0.01 foot.

6.2 TIER 1

All samples in Unit 1 will be collected at the locations and depths described in Section 4.2. More information on soil sampling procedures is provided in Section 6 of the FSP.

6.2.1 Unit 1: West TAFDS Area

The six Tier 1 soil samples will be collected at Site 22, Unit 1, at depths of 0, 5, and 10 feet bgs in two borings as indicated below.

6.2.1.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer.

6.2.2 Unit 2: East TAFDS Area

The three Tier 1 soil samples will be collected at Site 22, Unit 1, at depths of 0, 5, and 10 feet bgs in the boring as indicated below.

6.2.2.1 SOIL SAMPLES

All soil samples will be collected with a modified California split-spoon sampler fitted with stainless steel sleeves. The sampler will be advanced into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer.

6.3 TIER 2

If Tier 2 soil sampling is conducted at Site 22, shallow soil samples will be collected as described above.

6.4 TIER 3

If Tier 3 sampling is conducted, deep soil samples (from 10 feet bgs until groundwater level) will be collected at 5-foot intervals, with a modified California split-spoon sampler equipped with stainless steel sleeves. The split-spoon sampler will be driven into the ground by a hollow-stem auger drilling rig equipped with a 140-pound hammer. When drilling is required to depths of greater than 130 feet bgs, the hollow-stem auger drilling rig will be replaced by an air-rotary drilling rig. If groundwater sampling is necessary, sampling will follow procedures presented in Section 6 of the FSP.

Section 7
REFERENCES

Bechtel National, Inc. 1995a. *Final Work Plan, Phase II Remedial Investigation/Feasibility Study.* Marine Corps Air Station El Toro, California.

Bechtel National, Inc. 1995b. *Final Quality Assurance Project Plan, Phase II Remedial Investigation/Feasibility Study.* Marine Corps Air Station El Toro, California.

BNI. *See* Bechtel National, Inc.

Jacobs Engineering. *See* Jacobs Engineering Group, Inc.

Jacobs Engineering Group, Inc. 1993a. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study, Draft Work Plan.* Marine Corps Air Station El Toro, California.

———. 1993b. *Installation Restoration Program, Phase I Remedial Investigation Draft Technical Memorandum.* Marine Corps Air Station El Toro, California.

LUFT. *See* State of California Leaking Underground Fuel Tank Task Force.

State of California Leaking Underground Fuel Tank Task Force. 1989. *Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure.*

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Naval Facilities Engineering Command
Contracts Department
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Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN
ATTACHMENT V
SITE 23 – SEWER LINES
MCAS EL TORO, CALIFORNIA

CTO-0059

Prepared by:

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August 1995

Attachment V
SITE 23 – SEWER LINES

Site 23 – Sewer Lines consist of buried iron piping that transported plating wastes from the metal plating shops in Buildings 295, 296, and 297 to the former industrial wastewater treatment plant (part of SWMU 90) located at Installation Restoration Program Site 12 – The Sludge Beds/ Drying Beds. The industrial wastewater treatment plant and the associated sewer lines operated for less than one year in 1945. The sewer lines were investigated during the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) conducted at Marine Corps Air Station (MCAS) El Toro in 1992 and summarized in the Jacobs Engineering July 1993 report, Installation Restoration Program, Final RCRA Facility Assessment Report, MCAS El Toro, California (Jacobs Engineering 1993)*.

Based on the RFA results, the site was recommended for No Further Response Action Planned. Due to the RFA recommendation, no additional investigation of the site under the Phase II Remedial Investigation/Feasibility Study will be conducted.

* Jacobs Engineering Group, Inc. 1993. Installation Restoration Program, Final Resource Conservation and Recovery Act (RCRA) Facility Assessment Report. Marine Corps Air Station El Toro, California.

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Contract No. N68711-92-D-4670

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN ATTACHMENT W OPERABLE UNIT 2 – SITE 24 – VOC SOURCE AREA MCAS EL TORO, CALIFORNIA

CTO-0059

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August 1995

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ACRONYMS/ABBREVIATIONS

BCT	BRAC Cleanup Team
bgs	below ground surface
BRAC	Base Realignment and Closure
CLEAN	Comprehensive Long-Term Environmental Action Navy
CME	Central Mining Equipment
COPC	chemical of potential concern
CPT	cone penetrometer test
DCE	dichloroethene
DRMO	Defense Reutilization and Marketing Office
FID	flame ionization detector
FS	Feasibility Study
FSP	Field Sampling Plan
GC	gas chromatograph
GC/MS	gas chromatography/mass spectroscopy
IAFS	Interim-Action Feasibility Study
Irvine Subbasin	Irvine Groundwater Subbasin
JMM	James M. Montgomery Engineers, Inc.
MCAS	Marine Corps Air Station
µg/L	micrograms per liter
MSL	mean sea level
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
OCWD	Orange County Water District
PCE	tetrachloroethene
PID	photoionization detector
PSI	Perimeter Study Investigation
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment

ACRONYMS/ABBREVIATIONS (continued)

RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RWQCB	(California) Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SIPOA	Site Inspection Plan of Action
SOP	Standard Operating Procedure
SVE	soil vapor extraction
SWMUs/AOCs	Solid Waste Management Units/Areas of Concern
TCE	trichloroethene
TFH	total fuel hydrocarbons
TIC	The Irvine Company
TPH	total petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

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Section 1
OBJECTIVES

This Field Sampling Plan (FSP) for the Volatile Organic Compound (VOC) Source Area (Site 24) outlines the field procedures and methodology applicable to completing the Remedial Investigation (RI)/Feasibility Study (FS) for this site. The purpose of this FSP is to enable field personnel unfamiliar with the site to gather the required samples and field data. It is also intended to assure that data collection will be comparable to and compatible with previous data collected at the site and with other sampling activities at other sites at the Marine Corps Air Station (MCAS) El Toro.

1.1 SAMPLING OBJECTIVES

The specific objectives for this FSP at Site 24 are as follows:

- characterize the nature and extent of VOC contamination,
- characterize VOC migration in the vadose zone,
- characterize VOC migration in groundwater,
- characterize soil parameters to support the FS and pilot testing, and
- evaluate feasible removal or remedial actions.

The first step in identifying and characterizing the VOC Source Area is to recognize that the groundwater plume hot spot beneath Site 9 and the soil gas hot spot near Buildings 296 and 297 are separated by approximately 1,500 to 2,000 feet. It is assumed that the elevated VOC concentrations in the shallow soil gas represent the general point of VOC entry into the soil. One objective of the Phase II RI is to identify and characterize the VOC source in the soil and soil gas, and to connect these plumes with the groundwater plume. This will result in a delineation of the horizontal and vertical extent of VOC contamination in the vadose zone and an understanding of the VOC migration pathway to groundwater. These data are key in supporting the FS and in identifying areas for soil vapor extraction pilot tests.

To accomplish these goals, the stratigraphy beneath the site will be characterized to assess potential migration pathways. Stratigraphic data will include lithologic, and cone penetrometer test (CPT) logging. The soil gas plume previously identified in the 5- to 30-foot depth range will be further investigated. Both the horizontal and vertical extent of VOCs in the vadose zone will be defined. Stratigraphic data will be used to assist in identifying soil gas and soil sampling locations.

The horizontal and vertical extent of the groundwater plume beneath the site will also be delineated. Adequate data will be collected to support the FS. The United States Environmental Protection Agency (U.S. EPA) presumptive remedies for VOC source areas will be evaluated.

1.2 DATA USAGE

To satisfy the objectives of the RI/FS for the VOC Source Area, the data to be collected, compiled, and analyzed will be used to do the following:

- characterize subsurface soils with regard to VOC fate and transport,
- assess potential stratigraphic controls on VOC migration,
- determine geotechnical soil parameters to support the FS and pilot testing,
- evaluate groundwater conditions and quality,
- determine types of contaminants in soil, soil gas, and groundwater,
- determine extent of contaminants in soil, soil gas, and groundwater,
- assess human health and ecological risks,
- estimate mass of contaminants,
- evaluate promising remedial options through pilot testing, and
- evaluate cleanup goals.

Section 2
BACKGROUND

This section provides a site description, including site geology and hydrogeology and the results of previous investigations at the VOC Source Area. The purpose of this section is to provide a brief compilation of the data that were used to develop the site-specific FSP for Phase II RI/FS activities. Previous investigations and reports provide a more thorough discussion of site history, activities, and summaries of previous investigations.

2.1 SITE DESCRIPTION

Site 24 comprises approximately 200 acres in the southwestern quadrant above the Station. The site slopes to the west from an elevation of approximately 320 feet above mean sea level (MSL) at the intersection of the east-west and north-south runways to approximately 240 feet MSL near the end of the east-west runway. The site location is shown on Map W3-1. Site 24 encompasses existing IR Sites 7, 8, 9, 10, 11, 12, and 22 and several solid waste management units and areas of concern (SWMUs/AOCs) investigated by the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) where VOCs were detected (discussed later in this section).

The current boundaries of Site 24 have been drawn to include potential sources of regional VOC contamination in groundwater based on Phase I RI data, RFA data, soil gas survey data, aerial photograph interpretation, discussions with regulatory agencies, and employee interviews at MCAS El Toro. Existing RI/FS sites that lie within Site 24 boundaries are being investigated separately. The investigation at Site 24 will only consider the potential contributions of these sites to the regional groundwater problem. Site 24 and its boundaries are shown on Map W3-2.

2.1.1 Geology

MCAS El Toro is located within the Tustin Plain at the southeastern end of the Los Angeles Basin. The Los Angeles Basin is characterized by a northwest-trending, doubly plunging synclinal trough that has accumulated approximately 30,000 feet or more of detrital sediments since the Miocene Epoch. There are several faults on flank of the Los Angeles Basin syncline. Of these faults, only the Newport-Inglewood is considered active. There are no known active, historic, or inactive faults located within the boundaries of Site 24.

2.1.1.1 QUATERNARY GEOLOGY

Most of the surface and near-surface materials encountered on Site 24 are of Holocene Age and consist of a matrix of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are alluvial fan deposits derived from the Santa Ana Mountains to the east. The Holocene alluvial materials conformably overlie Pleistocene Age sediments, which are predominantly composed of interbedded, fine-grained, lagoonal and near-shore marine deposits. Pleistocene Age sediments could not be differentiated from Holocene Age sediments in Phase I soil borings.

2.1.1.2 TERTIARY GEOLOGY

Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene Age. These units are considered to be bedrock in the area and are present at a depth of approximately 370 to 400 feet beneath Site 24.

2.1.1.3 SITE STRATIGRAPHY

Stratigraphic interpretations based on Phase I boring log data indicate that relatively thick (20 to 40 feet) heterogeneous geologic units can be correlated across Site 24. These near-surface units (to about 200 feet below ground surface [bgs]) appear to generally thicken and dip toward the alluvial basin at approximately two degrees. The attitude of the stratigraphy encountered and correlated in the soil borings is consistent with an alluvial setting.

Three layers from ground surface to approximately 200 feet bgs appear to be correlated across the site. Layers I and III are sand-rich but interbedded with clay and silt. Layer II contains more clay and silt with some sandy interbeds. These stratigraphic units may control subsurface migration of liquids or vapor beneath Site 24. A map illustrating the top of Layer II is included as Map W3-3. Cross sections illustrating the inferred stratigraphy are included as Maps W3-4, W3-5, and W3-6.

2.1.2 Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Subbasin (Irvine Subbasin). Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sand and fine-grained gravel contained within a complex assemblage of sandy clay and sandy silt. Three general aquifer systems have been identified near the Station: a shallow groundwater unit, an intermediate horizon, and a principal aquifer.

The shallow groundwater unit is unconfined with an interpreted thickness of 100 feet. It is encountered approximately 120 feet beneath Site 24. Beneath this unit is an approximately 90-foot thick, relatively finer-grained unit called the intermediate horizon. The principal aquifer extends from the base of the intermediate horizon to the top of semiconsolidated marine sediments below.

Aquifer tests in monitoring wells installed on and near MCAS El Toro generated hydraulic conductivity values ranging from 0.2 to 65 feet per day, with an average of approximately 30 feet per day. The tests also indicate the presence of hydraulic barriers or compartmentalization within the aquifer. The principal aquifer is unconfined in near-surface conditions and becomes increasingly confined with depth. Specific yields range from 0.2 to 0.036.

The groundwater flow beneath Site 24 is to the northwest with a hydraulic gradient that ranges from 0.0024 to 0.008. The magnitude of the hydraulic gradient and the flow direction are strongly influenced by large pumping depressions located off-Station to the west. These depressions have created vertical gradients that have been documented in multiple completion wells installed near deep pumping wells (Jacobs Engineering 1994a).

A review of data from on-site multiport monitoring wells 18_BGMW03 suggests that vertical migration of VOCs has not occurred. Groundwater samples collected from the water table completion (screened 124 to 164 feet bgs) contained trichloroethene (TCE) concentrations ranging from 210 to 370 micrograms per liter (µg/L) (Jacobs Engineering 1994b). TCE has not been detected in the next deeper screened interval (222 to 242 feet bgs) in three rounds of groundwater sampling (Jacobs Engineering 1994b). TCE was detected in the July 1993 sampling event in the next two lower completions (280 to 300 and 370 to 390 feet bgs) at an estimated value of 0.8 µg/L. It is not clear if the estimated value reflects groundwater conditions or represents a sampling or analytical artifact. The possibility of the vertical migration of VOCs in the groundwater hot spot will be assessed during the Phase II RI.

A detailed description of the hydrogeology of MCAS El Toro is described in Section 2 of the Phase II RI Work Plan (BNI 1995a).

2.2 PREVIOUS INVESTIGATIONS AND RESULTS

This section describes the findings of previous investigations, surveys, and interviews completed for Site 24. For more detailed descriptions, refer to the referenced documents.

2.2.1 Interviews

Employee interviews were conducted by the Navy to obtain a better understanding of current and historical operations at the Station, especially operations concerning waste disposal practices. Highlights of the employee interviews that concern Site 24 included the following observations (Jacobs Engineering 1994c):

- aircraft refurbishing operations that involved the use of solvents occurred in Buildings 295, 296, 297, 324, and 359;
- liquid wastes were dumped into the industrial waste lines or on the ground surface around these buildings;
- liquid wastes from Buildings 295 and 296 were commonly disposed into storm drains that eventually emptied into Bee Canyon Wash;
- liquid wastes dumped near Building 296 may have drained to a drainage ditch to the east that eventually led to Agua Chinon Wash;
- a drainage ditch (that would receive airplane wash water) was formerly located adjacent to the northwest edge of the original tarmac;
- liquid wastes were spread over unpaved areas of the flightline for dust suppression;
- drummed liquid waste was occasionally transferred from the point of origin to Building 324; storage of approximately 50 to 100 drums occurred on three sides of the building;

- a former laundromat was located in Building 307, and a leaking underground storage tank is located northeast of the building (SWMU/AOC 145);
- some metal plating operations occurred in Building 309; and
- dark, oily soil was observed in the Defense Reutilization and Marketing Office (DRMO) storage yard; some contaminated soil has been excavated and transported to Site 2.

2.2.2 Aerial Photographs

Site 24 encompasses the potential source area of VOC groundwater contamination identified during the RFA and Phase I RI. Because the site has not been discussed in earlier documents, the following section will not describe the U.S. EPA photographs separately from the Science Applications International Corporation (SAIC) photographs, but will describe all findings from both surveys in chronological order (SAIC 1993).

Entries preceded by "1" are not thought to be potential sources because there is no historic evidence of solvent use in these areas. Entries preceded by "2" are located in areas that will be investigated further during the Phase II RI.

1946

- (1) Two vertical tanks near the northeast corner of Building 306 (also noted in 1952 and 1955).
- (1) Two impoundments on the southwest side of Building 306.
- (1) Liquid flowing southwesterly from the southwest side of Building 302 along M Street.
- (1) Open storage area at the current location of Building 360, south of the DRMO Storage Yard.
- (2) Open storage area with possible drums near South Marine Way and P Street, northwest of Building 313 (similar area in 1970).

1952

- (1) A pile of dark material and a trench at the northwestern edge of the site (features not visible after 1952).
- (1) One impoundment and two vertical tanks east of the Former Wastewater Treatment Plant, across M Street.
- (2) A possible stain northwest of Building 320.
- (2) Numerous stains scattered in the western portion of the site.
- (2) A stain extending along a road west of Building 297 and three additional stains between the southeastern end of the long stain and the old aircraft apron.

1964

- (1) Stains north of Building 325, west of R Street, and north of South Marine Way.
- (2) Open storage area with probable stains and probable drums 500 feet southeast of the southeastern corner of the aircraft parking apron.
- (2) Three stained areas on the westerly side of Building 324 near South 14th and Q Streets.
- (2) Stained areas east of Building 312 and east of Building 309 with probable liquid flowing southeast from near Building 312.
- (2) Stains throughout the open area south of Site 10.
- (2) Stains east of Building 369 (also visible in 1965).
- (2) Stains in the graded area in the southeast corner of the site, west of Agua Chinon Wash (now a motorpool).

1965

- (2) Liquid or stain flow in the southwestern corner of the open area south of Site 10 (also visible in 1970 and 1992).
- (2) Stains along the eastern side of Building 297 and at the south corners of Building 296.

1967

- (2) Open storage area with probable drums south of Site 10.

1968

- (1) Probable wet soil near the northwest corner of Building 320.
- (2) Stains in the cleared area east of R Street and north of South Marine Way.

1970

- (1) Horizontal tank surrounded by berm at east side of Agua Chinon Wash (no longer visible in 1980 photograph).
- (1) Three vertical tanks in an open storage area between the railroad tracks south of Site 12.
- (2) Seven probable drums with stains nearby in an open storage area south of Tank 175.
- (2) A pool of possible liquid and a stain approximately 150 feet west of Tank 175, and a pile of medium-toned material east of Tank 175.
- (2) Numerous probable drums, stains, and liquid or stain flow in the open area 330 to 450 feet southwest of Tank 175.
- (2) Dark stained areas east of Building 297 (larger than in 1965).

- (2) Stained areas north and at the southeastern corner of Building 296.
- (2) Additional stains in the graded area between Site 8 and Agua Chinon Wash (now used as open storage at motorpool).
- (2) Open storage area northwest of Building 313 with drums, 14 vertical tanks, and a possible stain (same location, but different extent than in 1946).
- (2) Flow of liquid along the east side of P Street and the north side of South Marine Way.

1971

- (2) Open storage area with probable drums about 800 feet southeast of Building 296.

1973

- (2) Open storage areas southeast of Building 296, across the drainage.

1975

- (1) Open storage area with possible drums about 400 feet east of Building 672 (no photo available).
- (2) Probable wet soil and liquid near the southeast side of Building 360, south of the DRMO Storage Yard (no photo available).

1976

- (1) Northerly flowing liquid on the southeast side of Building 320 (no photo available).
- (2) Liquids and wet soil on the east side of Building 96 (U.S. EPA noted channelized drainage in 1970).

1977

- (1) Liquid flowing westerly from vicinity of Building 1589, about 200 feet northeast of Building 368, Department of Public Works (no photo available).

1979

- (1) Open storage area about 400 feet east of Building 295.
- (1) Open storage area southeast of Site 7, expanded to runway.
- (1) Stains between Buildings 320 and 323.
- (1) Possible drums between Building 323 and the railroad tracks.
- (2) Vertical tank immediately north of Building 445, south of Building 296.

1980

- (1) Possible liquid flowing south across parking area east of R Street and north of South Marine Way (also visible in 1991).
- (1) Two areas of liquid and/or stain flow, south from Buildings 301 and 302.
- (2) A pool of possible liquid west of Tank 175, in the approximate area where possible liquid was observed in 1970.
- (2) Staining in the motorpool area west of Building 297.
- (2) Stains at the east side of Building 297; at the north, east, and southwest corners of Building 296; and at the southeast corner of Building 295.

1984

- (1) Probable stains or wet soil southeast of Building 305, near South Marine Way and O Street.
- (1) Probable stains or wet soil southwest of Building 305, near South 15th Street and O Streets.

1986

- (1) Stains south of Site 22 and southeast of Building 369.
- (1) A large stained area in the motorpool north of Building 388, west of Building 297.
- (1) Numerous stains and liquid on the aircraft parking apron.
- (2) A berm east of Agua Chinon Wash, south of the one noted in 1970.

1988

- (1) Possible liquid at the southerly corner of Building 369.
- (2) Liquid flowing southwesterly from the northwest corner of Building 307, near South 14th and K Streets.

1991

- (1) Open storage area with approximately 18 possible drums and two stains south, southeast, and southwest of Tank 175.
- (1) A pool of liquid southeast of Building 369.
- (1) Additional stains in the motorpool north of Building 388 and west of Building 297.
- (1) Stains at the northern side of Building 297.
- (2 Stains and flowing liquid in the open storage area between the railroad tracks south of Site 12.
- (2) A pool of possible liquid in the bermed area of Agua Chinon Wash.

1992

- (2) Probable liquids about 100 feet north of Building 386, near N Street and N Place (no photo available).
- (2) Liquid flowing southwesterly from Buildings 388 and 655, across the parking areas, and apparently into a drainage ditch similar to 1965 and 1970 (no photo available).

2.2.3 Pre-RCRA Facility Inspection Investigations

In June and July of 1985, the Orange County Water District (OCWD) discovered TCE in agricultural wells owned by The Irvine Company (TIC). TCE was found in wells TIC 47 (screened at 268 to 1,107 feet bgs) and TIC 35 (screened at 263 to 1,503 feet bgs), which are located downgradient 3,500 feet and 8,500 feet, respectively, from the Station. The OCWD initiated an off-site investigation to determine the source and extent of the TCE contamination. After analyzing samples from a network of monitoring wells and soil vapor probes, and after reviewing the results of independent investigations conducted by Cannon, Inc., and Wilma Pacific, Inc., the OCWD concluded that MCAS El Toro was the source of contamination.

A Site Inspection Plan of Action (SIPOA) was released in August 1988, and it included a recommendation to investigate 19 sites (JMM 1988). One site (Site 18) was intended to address the off-Station groundwater contamination.

In July 1987, the California Regional Water Quality Control Board (RWQCB), Santa Ana Region, issued Cleanup and Abatement Order 87-97 that required a supplement be added to the SIPOA addressing off-Station contamination. In response to the Cleanup and Abatement Order, a Perimeter Study Investigation (PSI) was conducted to assess VOC contamination along the southwestern boundary of the (JMM 1989). The PSI report concluded that VOCs were present in the shallow groundwater (approximately 100 feet deep) near the Station boundary. TCE, tetrachloroethene (PCE) chloroform, and carbon tetrachloride were detected in groundwater samples.

Soon after the PSI report was released, an interim groundwater pump-and-treat system using activated carbon was installed at the southwestern Station boundary. The system was capable of pumping and treating approximately 10 to 30 gallons per minute from three extraction wells. Effluent water was used to irrigate the golf course. The system influent TCE and PCE concentrations ranged from 10 to 160 μg/L, and 25 to 100 μg/L, respectively. The system began operating in June 1989. In April 1993, the RWQCB, Santa Ana Region, rescinded the Cleanup and Abatement Order. The treatment system was shut down in September 1993.

2.2.4 RCRA Facility Inspection

An RFA was conducted to evaluate whether an additional 140 sites at MCAS El Toro should be included under the RI/FS program (Jacobs Engineering 1993a). Of the sites investigated within the VOC source area, eight had detections of TCE or PCE in soil samples. The eight sites included SWMUs/AOCs 76, 95, 110, 145, 198, 229, 250, and 283. The highest concentration was detected in SWMU/AOC 198 (16 μg/L of PCE).

2.2.5 Phase I Remedial Investigation

Results of the Phase I RI/FS, were reported in May 1993. The results from operable unit 1 indicated that the TCE groundwater plume hot spot was beneath Site 9, and the plume extended approximately three miles downgradient from the MCAS El Toro property boundary. In addition, PCE, 1,2-dichloroethene (DCE), 1,1-DCE, and carbon tetrachloride were detected in groundwater beneath Site 24. Despite extensive soil sampling, relatively little soil contamination was found that could be considered the source of the impacted groundwater (Jacobs Engineering 1993b).

2.2.6 Soil Gas Survey

A soil gas survey was conducted in June 1994 to help locate the VOC source (Jacobs Engineering 1994d). Soil gas samples were collected from depths between 5 and 30 feet bgs. The highest concentrations of soil gas were found around Buildings 296, 297, and 324. This area was referred to as the Main Soil Gas Source Area. Twelve other possible shallow VOC source areas were also identified. Soil gas concentrations were observed to generally increase with depth, indicating a need to further characterize the soil gas plume at greater depths. The soil gas survey report recommended that 14 of the 18 VOC source areas receive further investigation to evaluate the extent of VOCs in the soil or soil gas. The U.S. EPA and/or the California Environmental Protection Agency Department of Toxic Substances Control recommended further investigation for all 18 areas.

2.2.7 Chemicals of Potential Concern

Chemicals of potential concern (COPCs) for Site 24 include all VOCs detected at Site 24 during the RFA, the Phase I RI, the soil gas survey, and groundwater sampling events. The COPCs (as determined by those studies) for Site 24 are listed below:

benzene	1,2-dichloroethene	toluene
2-butanone	ethylbenzene	1,1,1-trichloroethane
carbon disulfide	Freon 113	1,1,2-trichloroethane
carbon tetrachloride	2-hexanone	trichloroethylene
chloroform	methyl chloride	vinyl chloride
1,1-dichloroethane	methylene chloride	xylenes
1,1-dichloroethene	tetrachloroethene	
1,2-dichloroethane	total fuel hydrocarbons (TFH)-gasoline	

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Section 3
MAPS

The maps on the following pages present the location of the site on MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and the proposed Phase II sampling locations, where known. These maps are referenced in other sections of this FSP Attachment.

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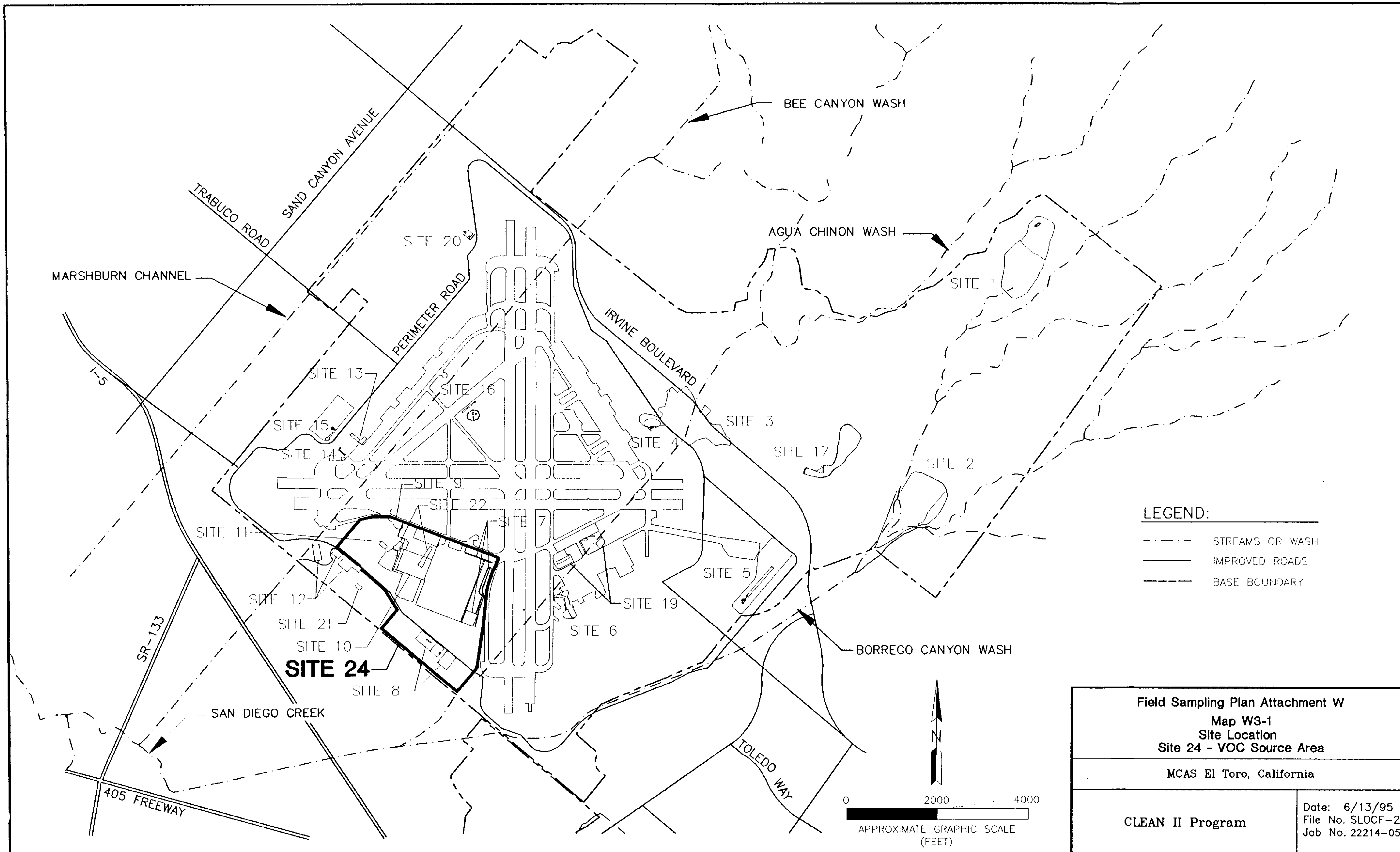

Field Sampling Plan Attachment W

Map W3-1
Site Location
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program

Date: 6/13/95
File No. SLOCF-24
Job No. 22214-059

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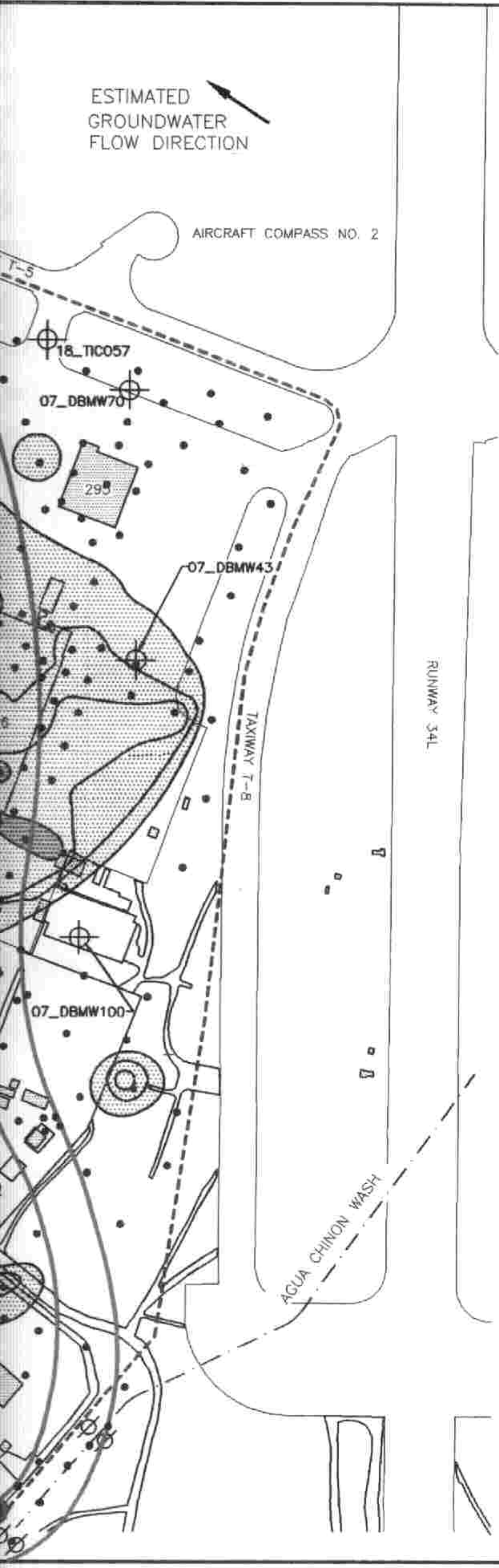
BEE CANYON WASH
AW-5
09_DGMW75
AW-4
RESERVOIR
09_DGMW45
AW-2
RESERVOIR
SOUTH 14TH STREET
SOUTH 12TH STREET
TAXIWAY T-31
CRASH CRE
435
B24
307
529
L STREET
21_DBMW48
12_UGMW31
306
370
304
301
302
369
1595
22_DGMW47
PARKING APRON PA-1
300
AW-3
1589
368
299
386
07_ DGMW71
18_BGMW03E
18_BGMW03B
18_BGMW03A
18_BGMW03C
PLANT ROAD
298
10_DGMW77
AW-6
655
21_DGMW90
21_DGMW37
18_TIC060
21_DBMW56
320
317
388
297
07_DGMW91
18_PS5
SOUTH 15TH STREET
07_DGMW72
333
SOUTH 4TH STREET
318
355
312
309
18_PS8
359
BASE BOUNDARY
Q STREET
313
324
631
18_W3380
08_DGMW74
18_PS7
08_DGMW73
360
18_PS3
N
18_BGMW05C
18_BGMW05B
18_BGMW05A
18_RW2
18_PS4
18_BGMW05D
18_BGMW05E
18_W3386
0
450
900
APPROXIMATE GRAPHIC SCALE
(FEET)
500
50
5
0.5



LEGEND:

- 10 BUILDING OR PAD
- STREAMS OR WASH
- IMPROVED ROADS
- RAILROAD
- PHASE II UNIT BOUNDARY
- —500— CONCENTRATIONS OF TCE IN GROUNDWATER (μg/L) (FROM SAMPLES COLLECTED JULY 1992 TO JANUARY 1993 RESULTS IN TABLE C-1 PHASE I T.M.)

SOIL GAS CONCENTRATIONS:

(RESULTS IN DRAFT SOIL GAS SURVEY T.M , TABLE C-1)

- 1.0 TO 5.0 ug/L TCE
- 5.0 TO 50.0 ug/L TCE
- 50.0 TO 500.0 ug/L TCE
- GREATER THAN 500.0 ug/L TCE

EXISTING:

- SOIL GAS SURVEY POINT
- PHASE I MONITORING WELL
- PHASE I DEEP ANGLE BORING
- AW-6 ABANDONED WATER WELLS

Field Sampling Plan Attachment W

Figure W3-2
Site Plan
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program	Date: 7/25/95 File No. sitef24h Job No. 22214-059

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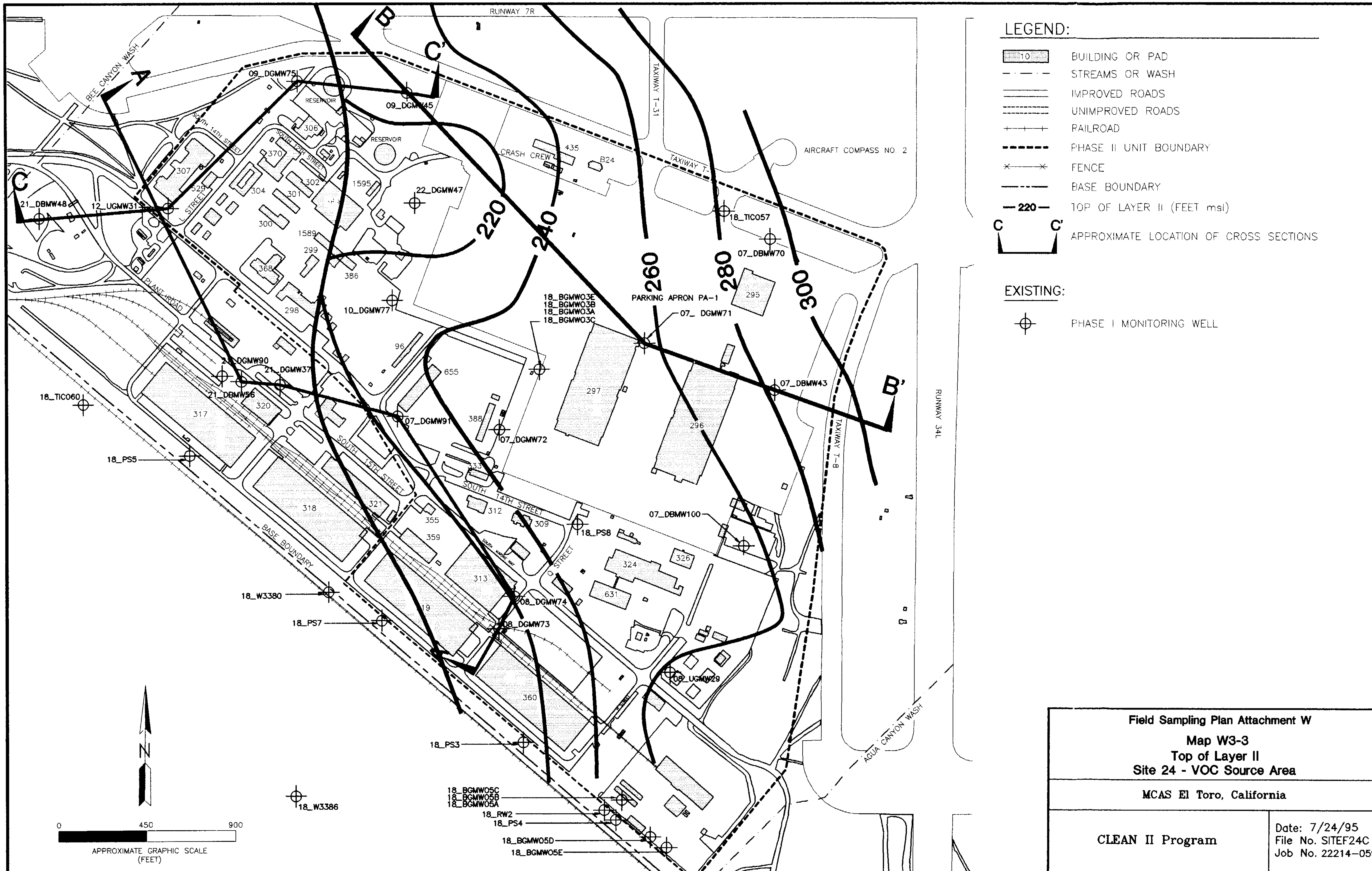

Field Sampling Plan Attachment W

Map W3-3
Top of Layer II
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program

Date: 7/24/95
File No. SITEF24C
Job No. 22214-059

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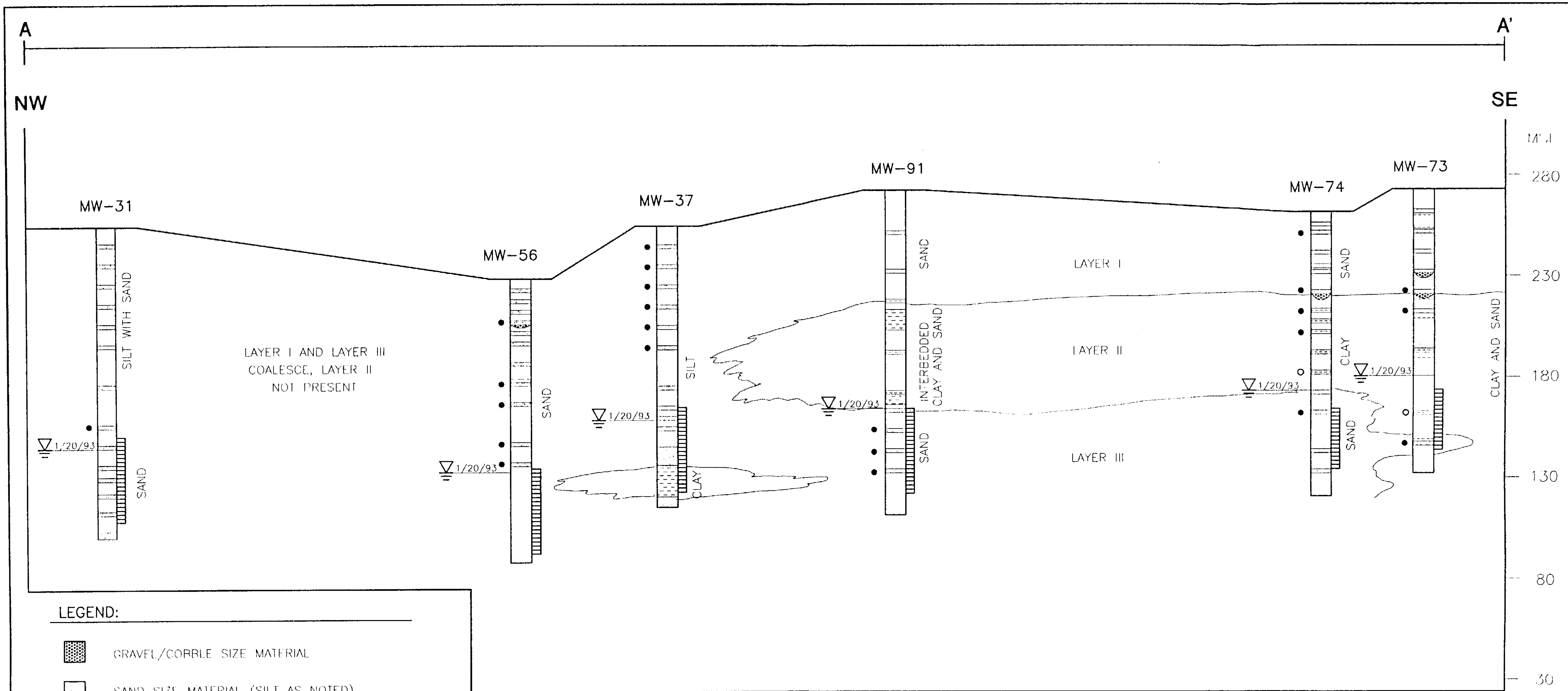

LEGEND:

- GRAVEL/COBBLE SIZE MATERIAL
- SAND SIZE MATERIAL (SILT AS NOTED)
- CLAY SIZE MATERIAL
- GROUNDWATER ELEVATION AND DATE MEASURED
- • > 1ppm ON FID/PID
- o > 5ppm ON FID/PID
- WELL SCREEN

0 50 100
APPROXIMATE VERTICAL SCALE
(FEET)

0 250 500
APPROXIMATE HORIZONTAL SCALE
(FEET)

Field Sampling Plan Attachment W

Map W3-4
Geologic Cross Section A-A'
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program

Date: 03/15/95
File No. SITEF24A
Job No. 22214-059

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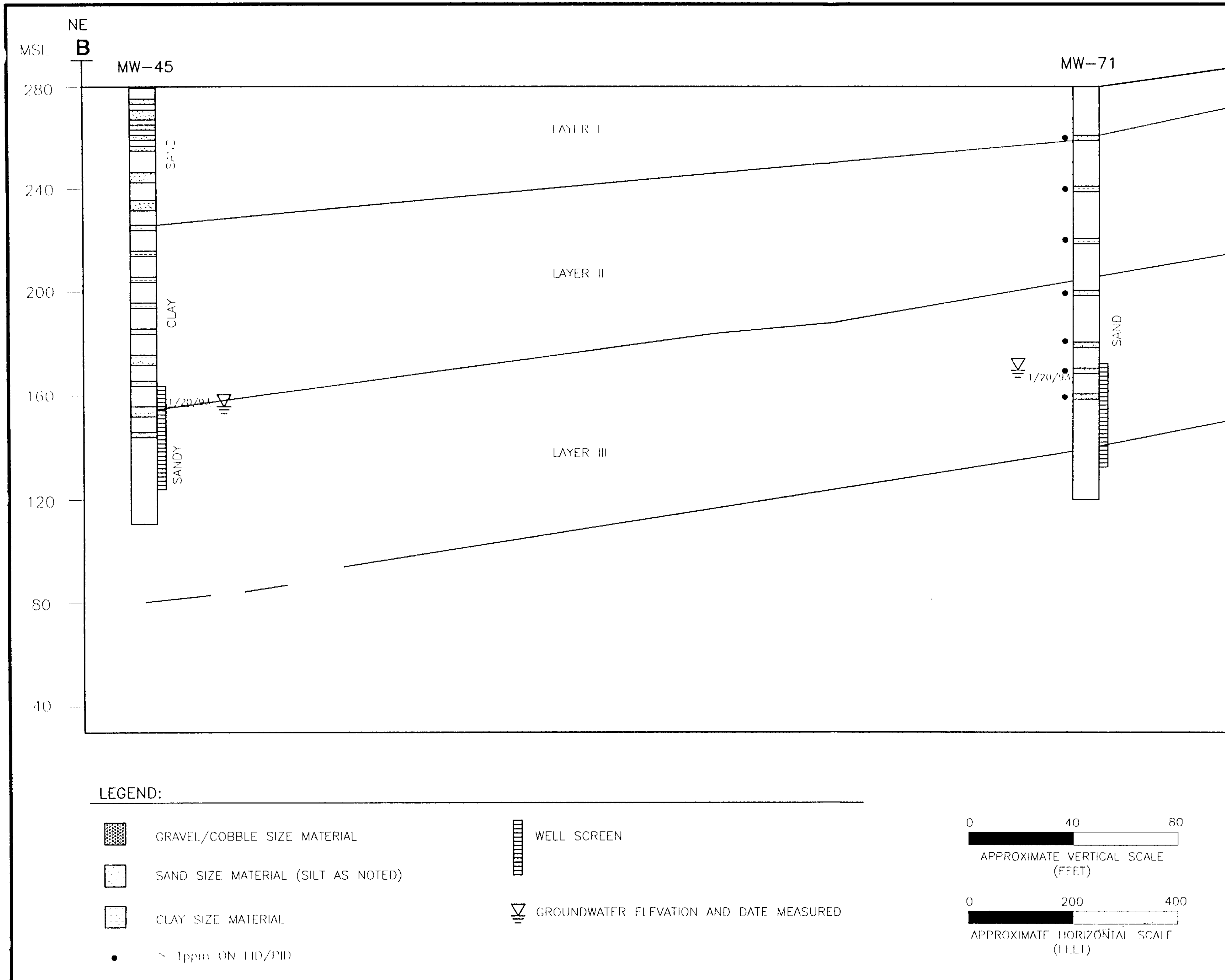

Field Sampling Plan Attachment W

Map W3-5
Geologic Cross Section B-B'
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program

Date: 03/15/95
File No. SITEF24B
Job No. 22214-059

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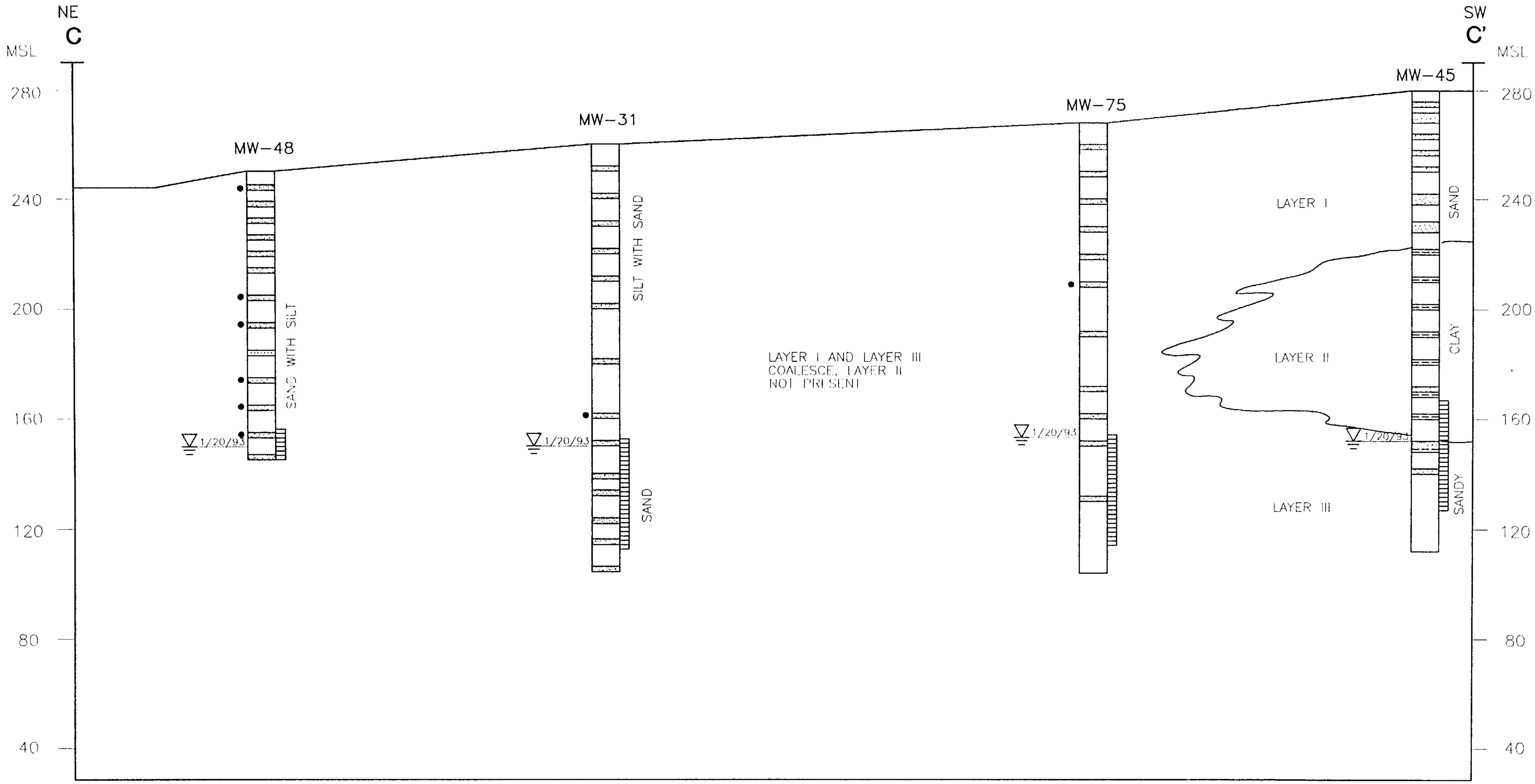

LEGEND:

- GRAVEL/COBBLE SIZE MATERIAL
- SAND SIZE MATERIAL (SILT AS NOTED)
- CLAY SIZE MATERIAL
- • > 1ppm ON FID/PID
- WELL SCREEN
- GROUNDWATER ELEVATION AND DATE MEASURED

0 40 80
APPROXIMATE VERTICAL SCALE (FEET)

0 200 400
APPROXIMATE HORIZONTAL SCALE (FEET)

Field Sampling Plan Attachment W

Map W3-6
Geologic Cross Section C-C'
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program

Date: 03/15/95
File No. SITEF24D
Job No. 22214-059

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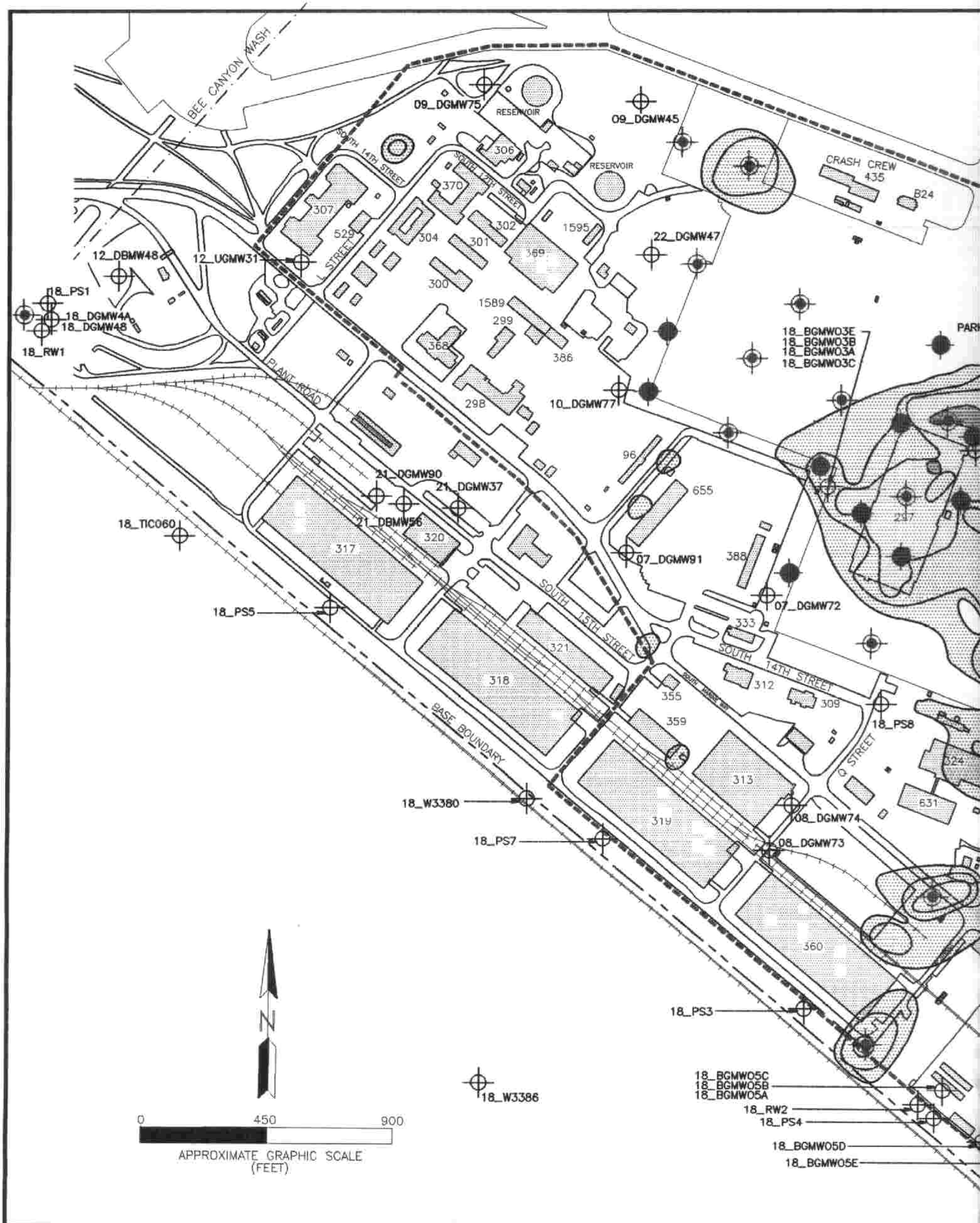

BEE CANYON WASH
09_DGMW75
RESERVOIR
09_DGMW45
RESERVOIR
306
CRASH CREW
435
B24
SOUTH 14TH STREET
SOUTH 12TH STREET
370
307
529
302
1595
22_DGMW47
304
301
369
12_DBMW48
12_UGMW31
L STREET
300
18_PS1
18_DGMW4A
18_DGMW48
18_RW1
1589
299
386
368
18_BGMW03E
18_BGMW03B
18_BGMW03A
18_BGMW03C
PLANT ROAD
298
10_DGMW77
96
21_DGMW90
21_DGMW37
21_DBMW56
655
18_TIC060
320
317
07_DGMW91
388
18_PS5
07_DGMW72
SOUTH 15TH STREET
333
321
318
SOUTH 14TH STREET
312
355
309
18_PS8
BASE BOUNDARY
359
Q STREET
313
18_W3380
08_DGMW74
631
319
18_PS7
08_DGMW73
360
N
18_PS3
18_BGMW05C
18_BGMW05B
18_BGMW05A
18_RW2
18_PS4
18_W3386
18_BGMW05D
18_BGMW05E
0
450
900
APPROXIMATE GRAPHIC SCALE
(FEET)

LEGEND:

- BUILDING OR PAD
- STREAMS OR WASH
- IMPROVED ROADS
- UNIMPROVED ROADS
- RAILROAD
- PHASE II UNIT BOUNDARY
- FENCE
- BASE BOUNDARY

SOIL GAS CONCENTRATIONS:

(RESULTS IN DRAFT SOIL GAS SURVEY T.M., TABLE C-1)

- 1.0 TO 5.0 ug/L TCE
- 5.0 TO 50.0 ug/L TCE
- 50.0 TO 500.0 ug/L TCE
- GREATER THAN 500.0 ug/L TCE

EXISTING:

- PHASE I MONITORING WELL
- PHASE I DEEP ANGLE BORING

PROPOSED:

- PROPOSED LOCATION OF HOLLOW STEM AUGER BORINGS (MINIMUM 5-FOOT DRIVE SAMPLES)
- PROPOSED LOCATION OF HOLLOW STEM AUGER BORINGS (CONTINUOUS SAMPLES)

Field Sampling Plan Attachment W

Map W3-7
Soil Boring Locations
Site 24 - VOC Source Area

MCAS. El Toro, California

CLEAN II Program

Date: 7/25/95
File No. SiteF24E
Job No. 22214-059

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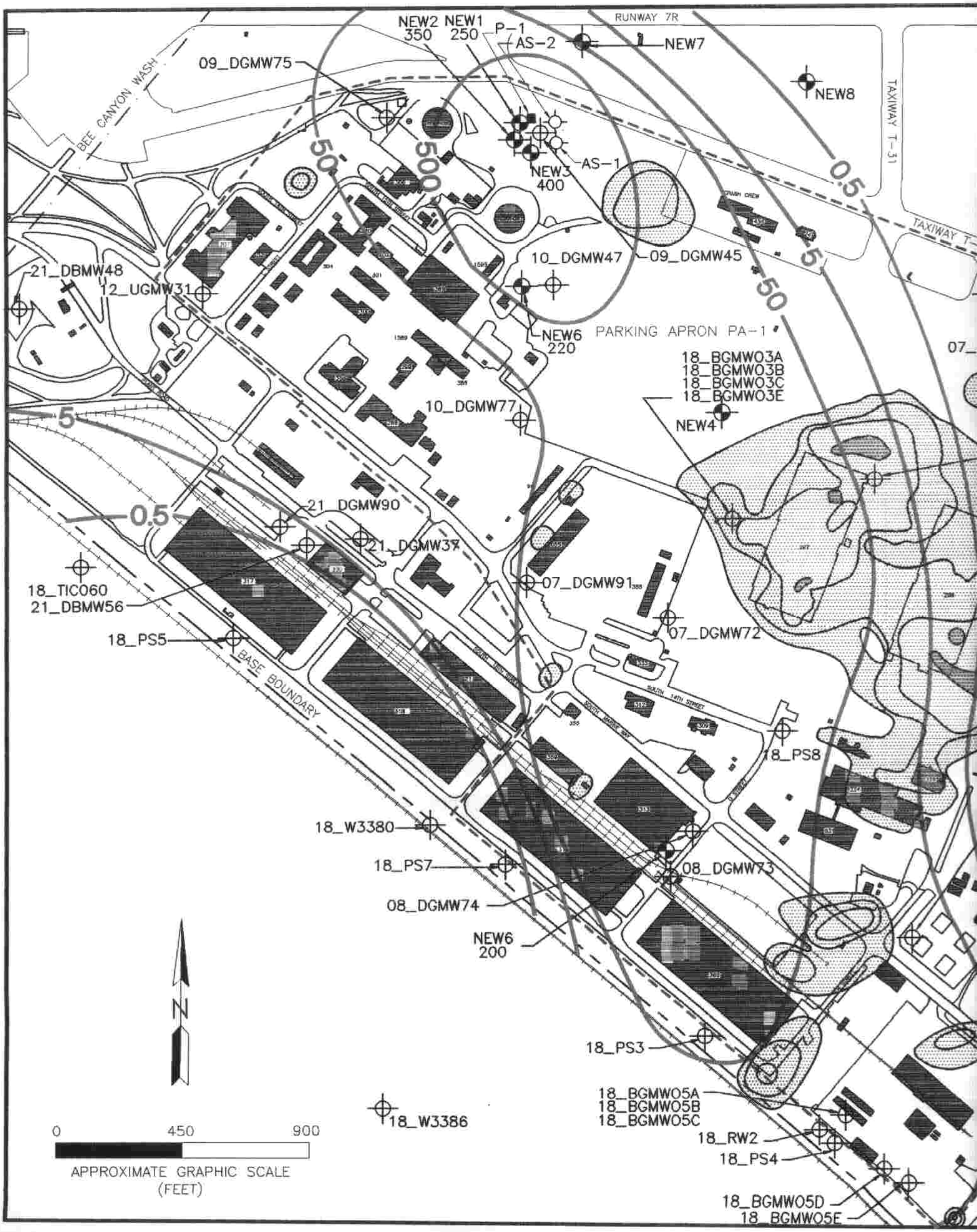
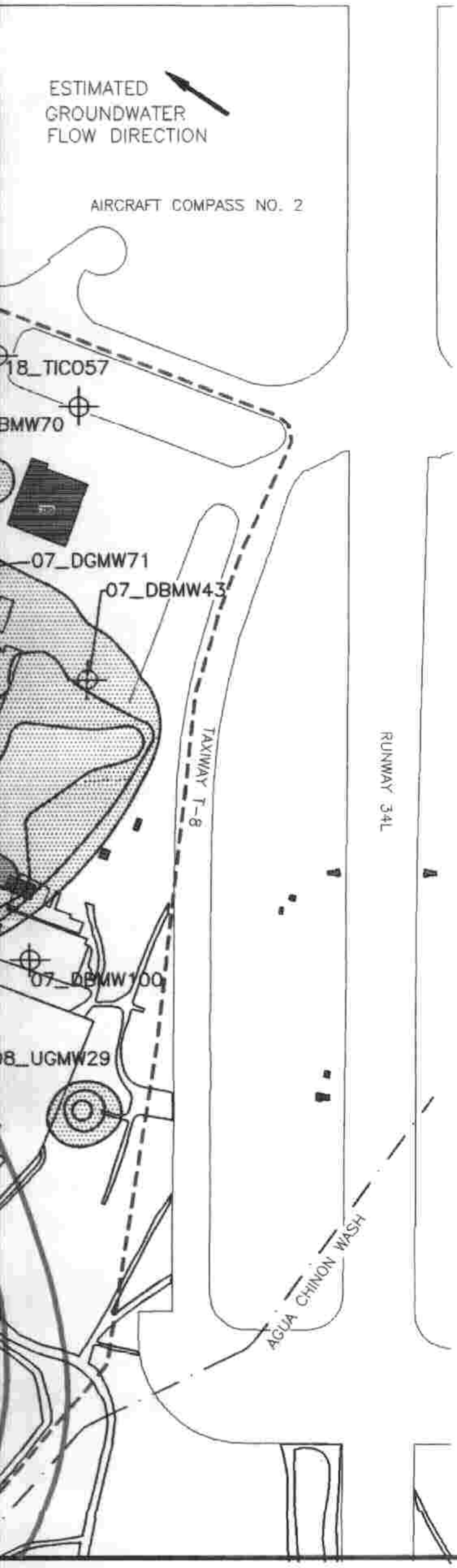

RUNWAY 7R
NEW2 NEW1
350 250
P-1
AS-2
NEW7
09_DGMW75
NEW8
TAXIWAY T-31
BEE CANYON WASH
50
500
NEW3
400
AS-1
0.5
TAXIWAY T
10_DGMW47
09_DGMW45
5
50
21_DBMW48
12_UGMW31
NEW6
220
PARKING APRON PA-1
18_BGMW03A
18_BGMW03B
18_BGMW03C
18_BGMW03E
NEW4
10_DGMW77
5
0.5
21 DGMW90
21_DGMW37
18_TIC060
21_DBMW56
07_DGMW91
07_DGMW72
18_PS5
BASE BOUNDARY
SOUTH 14TH STREET
18_PS8
18_W3380
18_PS7
08_DGMW73
08_DGMW74
NEW6
200
N
18_PS3
18_BGMW05A
18_BGMW05B
18_BGMW05C
0 450 900
APPROXIMATE GRAPHIC SCALE
(FEET)
18_W3386
18_RW2
18_PS4
18_BGMW05D
18_BGMW05E



LEGEND:

- BUILDING OR PAD
- STREAMS OR WASH
- IMPROVED ROADS
- UNIMPROVED ROADS
- RAILROAD
- PHASE II UNIT BOUNDARY
- FENCE
- BASE BOUNDARY
- —500— CONCENTRATION OF TCE IN GROUNDWATER (μg/L) (FROM SAMPLES COLLECTED JULY 1992 TO JANUARY 1993 RESULTS IN TABLE C-1 PHASE I T.M.)

SOIL GAS CONCENTRATIONS:

(RESULTS IN DRAFT SOIL GAS SURVEY T.M , TABLE C-1)

- 1.0 TO 5.0 ug/L TCE
- 5.0 TO 50.0 ug/L TCE
- 50.0 TO 500.0 ug/L TCE
- GREATER THAN 500.0 ug/L TCE

EXISTING:

- PHASE I MONITORING WELL

PROPOSED:

- PHASE II PIEZOMETER
- PHASE II MONITORING WELL (IF NUMBER PRESENT NEXT TO WELL NUMBER, IT INDICATES TOTAL DEPTH OF WELL)
- PHASE II AIR SPARGING WELLS

Field Sampling Plan Attachment W
Monitoring Well, Piezometer and Air Sparging Boring Locations
Map W3-8
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program	Date: 7/25/95 File No. SITEF24I Job No. 22214-059

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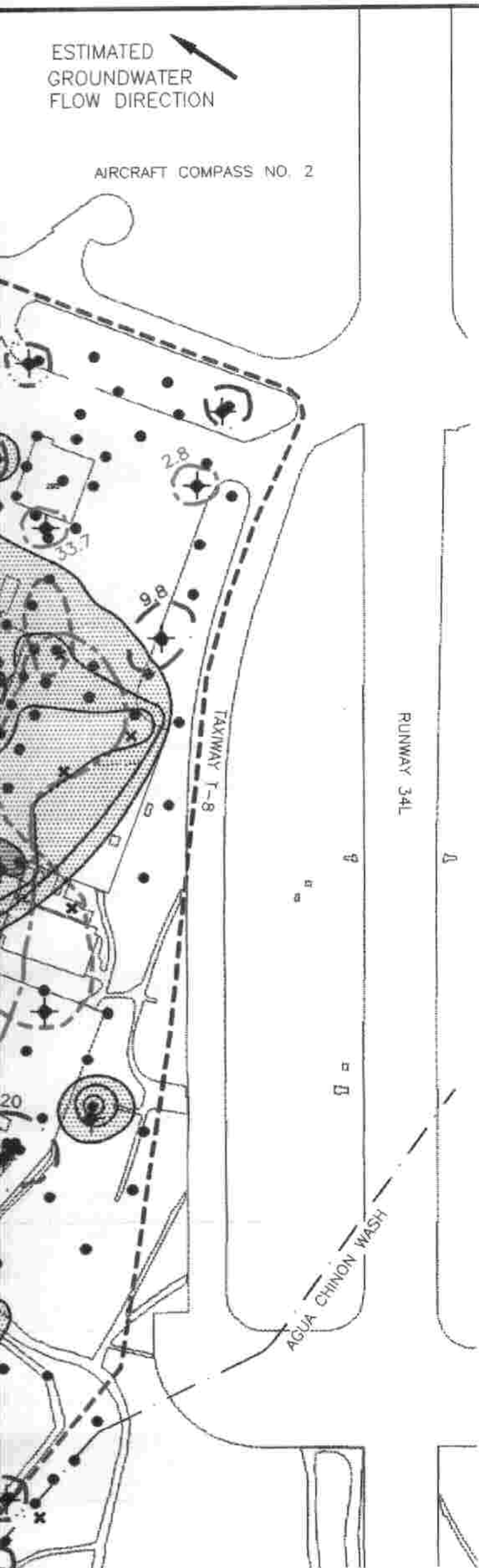
BEE CANYON WASH
TAXIWAY T-31
PARKING APRON PA-1
BASE BOUNDARY
0
450
900
APPROXIMATE GRAPHIC SCALE
(FEET)
N



LEGEND:

- BUILDING OR PAD
- STREAMS OR WASH
- IMPROVED ROADS
- UNIMPROVED ROADS
- RAILROAD
- PHASE II UNIT BOUNDARY
- FENCE
- BASE BOUNDARY

SOIL GAS CONCENTRATIONS:

(RESULTS IN DRAFT SOIL GAS SURVEY T.M., TABLE C-1)

- 1.0 TO 5.0 ug/L TCE
- 5.0 TO 50.0 ug/L TCE
- 50.0 TO 500.0 ug/L TCE
- GREATER THAN 500.0 ug/L TCE

SOIL GAS EXTENT:

- FREON 113 WITH MAXIMUM CONCENTRATION IN μg/L
- 1,1-DCE WITH MAXIMUM CONCENTRATION IN μg/L
- 1,2-DCE WITH MAXIMUM CONCENTRATION IN μg/L
- PCE WITH MAXIMUM CONCENTRATION IN μg/L
- CARBON TETRACHLORIDE WITH MAXIMUM CONCENTRATION IN μg/L
- 1.3 MAXIMUM SOIL GAS CONCENTRATION (μg/L) WITHIN CONTOUR

EXISTING SOIL GAS SAMPLE LOCATION:

- SOIL GAS SAMPLE LOCATION

EXISTING:

- SOIL GAS SAMPLE LOCATION

PROPOSED:

- TIER 1 CPT LITHOLOGIC AND SOIL GAS SAMPLING LOCATION
- TIER 1 CPT LITHOLOGIC SAMPLING LOCATION
- TIER 1 SOIL GAS SAMPLING LOCATION

Field Sampling Plan Attachment W
Soil Gas Sampling Locations and Lithologic (CPT) Sampling Points
Map W3-9
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program	Date: 7/25/95 File No. SITEF24F Job No. 22214-059

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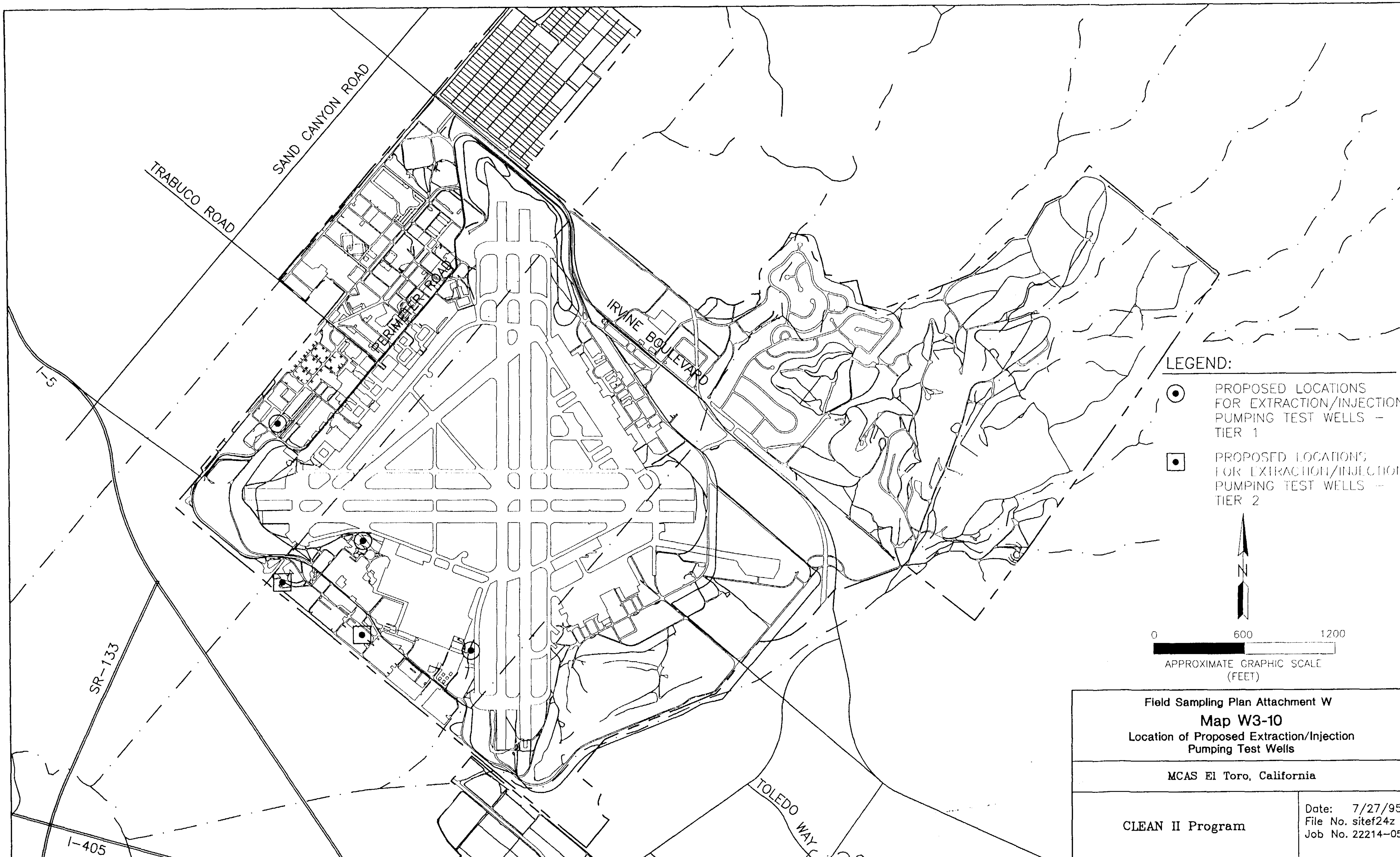

Field Sampling Plan Attachment W

Map W3-10

Location of Proposed Extraction/Injection Pumping Test Wells

MCAS El Toro, California

CLEAN II Program

Date: 7/27/95
File No. sitef24z
Job No. 22214-059

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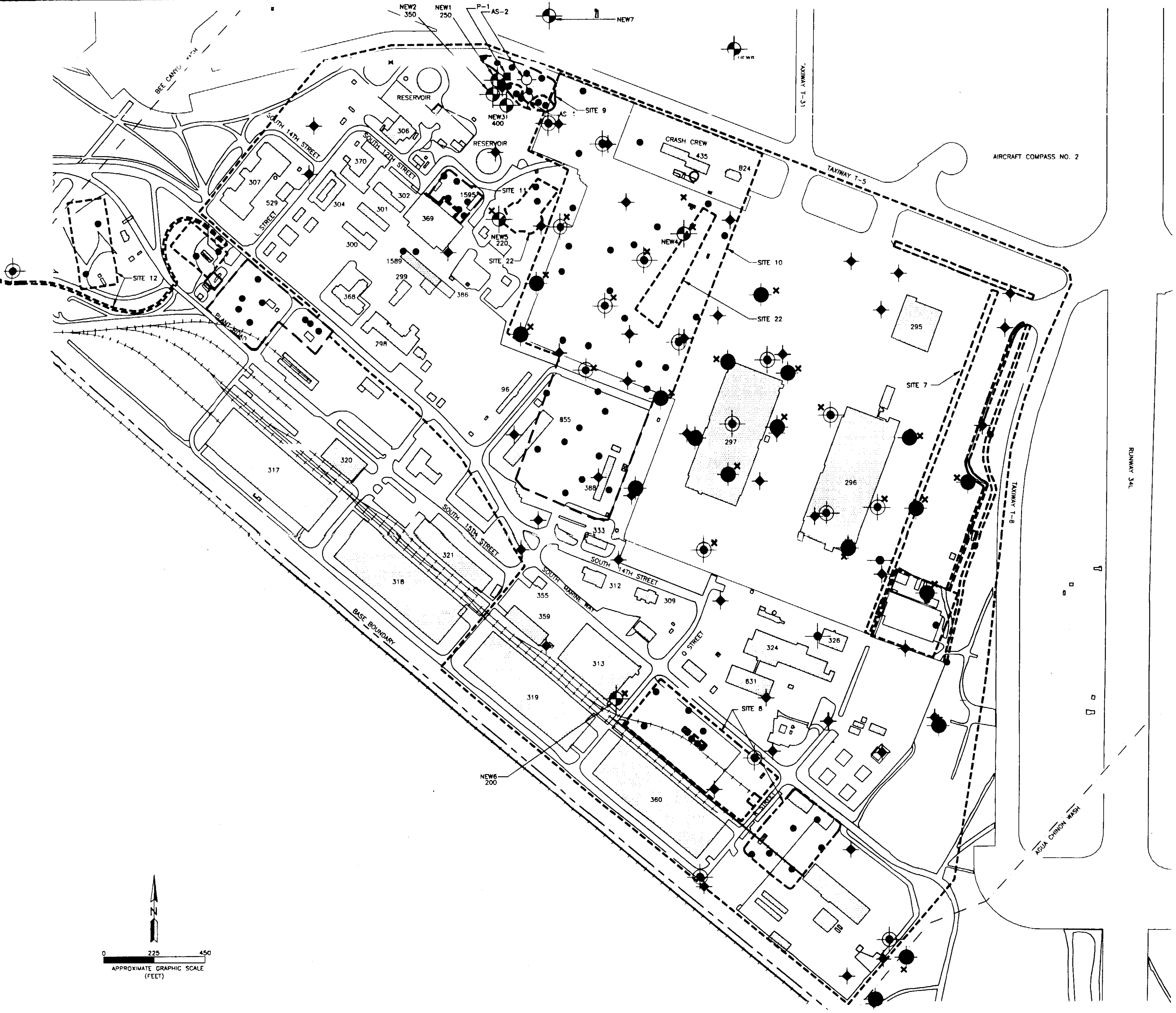

LEGEND:

- BUILDING OR PAD
- STREAMS OR WASH
- IMPROVED ROADS
- RAILROAD
- PHASE II SITE 24 BOUNDARY
- PHASE II OU-3 SITE BOUNDARIES
- FENCE
- BASE BOUNDARY

EXISTING:

- PHASE I MONITORING WELL LOCATION

PROPOSED:

- TIER 1 CPT LITHOLOGIC SAMPLING LOCATION
- PHASE II MONITORING WELL LOCATION WITH APPROXIMATE DEPTH IN FEET
- TIER I CPT LITHOLOGIC AND SOIL GAS SAMPLING LOCATION
- LOCATION OF PHASE II PIEZOMETER
- HOLLOW STEM AUGER BORING/LOCATION (CONTINUOUS SAMPLES)
- HOLLOW STEM AUGER BORINGS/LOCATION (MINIMUM 5-FOOT DRIVE SAMPLES)
- AS-2 PHASE II AIR SPARGING WELLS
- PHASE II SURFACE AND NEAR SURFACE SOIL SAMPLE (OU-3 SITES 7, 8, 9, 10, 11, 12, AND 22)

W3-83

Field Sampling Plan Attachment W

Map W3-11
Summary of Phase II RI Sampling Locations
Site 24 - VOC Source Area

MCAS El Toro, California

CLEAN II Program

Date: 7/26/95
File No. site24os
Job No. 22214 ...

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

This section explains the rationale for the sampling program, including number of samples, types of samples, locations of samples, and analytical parameters. The rationale for sampling is based on site conditions, previous investigations, and data quality objectives as presented in the Appendix W of the Phase II Work Plan (BNI 1995a).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, types of samples, and locations are presented on the basis of the smallest area of study. The Site 24 sampling program sample types and locations are based on:

- the types of media suspected or known to be impacted from previous investigations;
- the site history and activities, especially those related to chlorinated solvent use or disposal;
- the need to further characterize the nature and extent of VOCs in the vadose zone and groundwater to support the Phase II FS; and
- the need to characterize site stratigraphy to identify potential horizontal migration pathways and to support the Phase II FS and proposed remedial pilot testing.

Soil, soil gas, and groundwater samples will be analyzed during the Phase II RI. Tables W4-1, W4-2, and W4-3 summarize the number, type, and location of the proposed samples. Refer to the maps in Section 3 for specific sample locations.

4.2 UNIT 1

Site 24 will be investigated as one unit. This approach is considered the most efficient way to demonstrate the interrelationship between the VOC source in the vadose zone with VOC-impacted groundwater. The approach will assess the effect of site stratigraphy and lithology on VOC fate and transport.

The Phase II RI fieldwork will be divided into two tiers. The first tier will focus on assessing the horizontal and vertical extent of groundwater contamination, completing an initial assessment of the vertical extent of VOCs in soil and soil gas, and refining knowledge of site stratigraphy, CPT data, and continuously cored soil borings. The second tier of fieldwork will be used to expand existing data and further characterize the nature and extent of VOC contamination in soil, soil gas, and groundwater, as needed. Data necessary to support the FS will be collected during both phases.

4.2.1 Soil Samples

Thirty-three hollow-stem auger borings drilled to groundwater will be used to define site stratigraphy and to assess the nature and extent of VOC contamination in the soil (Map W3-7). Approximately one-half of the borings will be sampled continuously using the

Table W4-1
Soil Gas Sampling and Analysis

Tier	Unit/Name	No. of Locations	Samples/ Location	Total Samples	ON-SITE MOBILE LABORATORY		
					VOC[a] (with Freon 113)	TPH[b] Gasoline[c]	BTEX[c,d]
Tier 1	VOC Source Area	55	4	220	220	11	11
Subtotals				220	220	11	11
Tier 2	To be decided after analysis of Tier 1 data.						
Tier 3	Not Applicable						

Notes:
[a] VOC – volatile organic compound
[b] TPH – total petroleum hydrocarbons
[c] analyzed when BTEX and TPH-gasoline were encountered during the Phase I RI; total number is approximate
[d] BTEX – benzene, toluene, ethylbenzene, and xylenes

Table W4-2
Soil Sampling and Analysis

Tier	Unit/Name	No. of Locations	Samples/ Location	Total Samples[b]	ON-SITE MOBILE LABORATORY[a]		
					VOC[c] (with Freon 113)	TPH[d]-Gasoline[d]	BTEX[e]
Tier 1	VOC Source Area	33	6	198	198	11	11
Subtotals				198	198	11	11
Tier 2	Not Applicable						
Tier 3	Not Applicable						

Notes:
[a] thirteen samples with detectable concentrations and seven of nondetects will be submitted to the fixed-base laboratory for confirmation
[b] all samples will be field-screened using a portable photoionization detector, flame ionization detector, and/or portable gas chromatograph; it is estimated that 25 percent of all samples will be submitted to the on-site mobile laboratory for analyses
[c] VOC – volatile organic compound
[d] TPH – total petroleum hydrocarbons
[e] analyzed when BTEX and TPH-gasoline were encountered during the Phase I RI; total number is approximate

Table W4-3
Groundwater Sampling and Analysis

Tier	Unit/Name	No. of Locations	Samples/ Location	Total Samples	OFF-SITE LABORATORY VOCs[a]	SVOCs[b]	Metals	General Chemistry	ON-SITE MOBILE LABORATORY VOCs
Tier 1	VOC Source Area								10
	New 1	1	4	4	1	1	1	1	
	New 2	1	1	1	1	1	1	1	
	New 3	1	1	1	1	1	1	1	
	New 4	1	1	1	1	1	1	1	
	New 5	1	1	1	1	1	1	1	
	New 6	1	1	1	1	1	1	1	
	New 7	1	4	4	1	1	1	1	10
	New 8	1	4	4	1	1	1	1	10
	AS-1	1	3	3	–	–	–	3	3
	AS-2	1	3	3	–	–	–	3	3
Sparging Pilot Test	09_DBMW45	1	6	6	0	0	0	2	6
Subtotals				29	8	8	8	16	42
Tier 2	Not Applicable								
Tier 3	Not Applicable								

Notes:
[a] VOC – volatile organic compound
[b] SVOC – semivolatile organic compound

Central Mining Equipment (CME) 5-foot core barrel to develop a complete stratigraphic profile beneath the site. The remaining borings will be sampled at minimum 5-foot intervals, or closer, at the discretion of the field geologist. A thorough understanding of the site stratigraphy is necessary to determine the migration pathway of VOCs through the vadose zone to groundwater. For efficiency, soil samples may also be collected during the soil gas investigation using the CPT rig.

If elevated VOC concentrations are encountered, the hollow-stem auger borings will be converted to soil vapor extraction (SVE) wells or piezometers. Installing SVE wells and piezometers during the soil investigation phase will expedite the implementation of the SVE pilot testing and the subsequent FS.

Soil sample analytical results will be used to estimate the volume and distribution of impacted soil, the type and concentrations of VOCs present in the soil, and the physical parameters of the soil. These data will be used to identify areas for SVE pilot testing and to assist in selecting a remedial alternative.

Shallow-soil quality near potential sources, such as degreasers and storm drain catch basins, may be assessed using backhoe test pits and hand auger borings. Backhoe test pits may also be needed to locate the abandoned water supply wells.

A mobile laboratory will be at the site during all drilling and soil sampling. The total number of soil samples to be analyzed is estimated to be approximately 200. This estimate is based on analyzing approximately 25 percent of the samples collected. The number of analyzed samples may be changed based on field screening with the photoionization detector (PID), flame ionization detector (FID), and/or portable gas chromatograph (GC), and on the evaluation of sample data as the investigation progresses.

4.2.2 Groundwater Samples

The air-rotary/casing-driver drilling method is the preferred method to facilitate the construction of deep groundwater monitoring wells. This method will reduce the potential of cross-contamination from the water table to deeper zones in the aquifer. However, air-rotary drilling in fine-grained sediments, such as those beneath Site 24, may face the loss of drilling return due to clogging of lines with the silt and clay. If the borings cannot be advanced using an air-rotary drill rig, the only other alternative for drilling the deep wells is using a mud-rotary drill rig. Every attempt will be made to drill the deep wells using the air-rotary/casing-driver method; a mud-rotary will be the final option. Water table monitoring wells and air sparging wells will be drilled using the hollow-stem auger drilling method.

A minimum of three and a maximum of five deep monitoring wells are proposed to complete the vertical characterization of VOC contamination in groundwater near the groundwater hot spot. The highest concentrations of VOCs in groundwater have been obtained from well 09_DBMW45. This area is considered to have the greatest potential for deeper groundwater contamination. Because the presence of VOCs in groundwater beneath the well screen of 09_DBMW45 would modify the investigation of the VOC Source Area, drilling the deep well will receive priority scheduling when fieldwork begins.

To evaluate potential VOC concentrations at depth, up to three air-rotary borings are proposed for drilling to 250, 350, and 400 feet bgs near well 09_DBMW45. The 250-foot-deep well will be drilled, developed, and sampled before drilling is initiated on the proposed deeper well. If laboratory analytical data indicate the presence of VOCs in groundwater, the deeper well will be drilled. If no VOCs are detected, it will be assumed that the vertical extent of groundwater contamination has been defined, and the deeper wells will not be drilled. Two deep monitoring wells are proposed to delineate the vertical extent of VOCs in the groundwater plume hot spot near 22_DBMW47 and 08_DGMW74. These proposed wells are labeled New 1, 2, 3, 6, and 7. The proposed deep well locations are shown on Map W3-8.

An alternate and less expensive sampling method for vertical characterization is to use the CPT rig direct-push groundwater sampler. This method has not been tested at MCAS El Toro, but has been successfully used at other locations in southern California to depths of 260 feet bgs. If the CPT is capable of advancing the direct-push groundwater sampler, it will be used to collect groundwater samples and to identify the vertical extent of VOC-impacted groundwater. A hollow-stem auger pilot hole may be used to facilitate CPT direct-push groundwater sampling, if necessary. Groundwater samples will be collected at 20-foot intervals beginning at the water table. A well would then be installed to monitor the vertical extent of VOC-impacted groundwater.

Three groundwater monitoring wells will be drilled to complete the horizontal characterization of VOCs in groundwater and the spatial relationship of groundwater contamination to the source. These wells are labeled New 4, 7, and 8. Proposed water table well locations are also shown on Map W3-7.

The current stratigraphic interpretation indicates favorable conditions exist for extending and possibly connecting the main soil gas (TCE) plume in the Building 296/297 area to the TCE groundwater plume beneath Site 24. Groundwater quality data combined with soil and soil gas analytical data may prove or disprove this relationship.

4.2.3 Soil Gas

Additional soil gas samples are proposed between the groundwater plume and the soil gas hot spot to characterize the VOC migration pathway to groundwater. The proposed soil gas samples will build on the previous soil gas survey by sampling from deeper zones in identified hot spots, investigating areas that had one sample detection, and sampling new areas that historically received aircraft wash water runoff. Stratigraphic data from the geophysical borings will be used to assist in the selection of soil gas sampling depths. Soil gas samples will be collected above soil layers with relatively low permeability where VOCs have the potential to be transported or to accumulate. Lithologic data from the CPT rig will be used to fine-tune sampling depths based upon permeability/conductivity and stratigraphy.

Previous soil gas sampling at Site 24 was conducted in the 5- to 30-foot range, with limited coverage from 20 to 30 feet (27 samples). The VOC soil gas contamination has been shown to increase with depth in the highest concentration plume areas, indicating that the vertical extent of the soil gas plume has not been adequately delineated. A CPT rig will be used to extend the soil gas investigation to the water table. Soil gas samples will be collected from depths not attainable with the CPT rig by utilizing the hollow-stem borings as pilot holes. The rationale for these samples is to complete the vertical profile of VOC distribution in the unsaturated zone. Locations of the proposed hollow-stem borings are shown on Map W3-7. Soil gas sampling will also include collecting and analyzing soil gas samples from equivalent depths at five locations investigated during the Phase I soil gas survey. The Phase I and Phase II data will be compared to evaluate potential differences. Soil gas and CPT sample locations are shown on Map W3-9.

4.2.4 Pilot Testing

This section describes the rationale for conducting pilot tests to evaluate appropriate remedial technologies. SVE, air sparging, and aquifer pumping tests will be performed. SVE is a presumptive remedy for sites with VOCs in soils (U.S. EPA 1993).

Two air-sparging wells are proposed for the area near well 09_DBMW45. The sparging wells will be used to assess the feasibility of air sparging to remediate VOCs in groundwater beneath the site. The air-sparging wells will be located in the areas of highest VOC concentrations in groundwater to demonstrate the ability of this technology to remove dissolved VOCs from the groundwater. Soil samples will be collected and analyzed for geotechnical parameters to aid in the implementation of the pilot tests. Each air-sparging boring will contain an air-sparging well (screened below the water table) and an SVE well (screened above the water table) to collect sparging vapor. Air-sparging well locations are shown on Map W3-8.

Before conducting the air-sparging pilot tests, the vertical characterization of groundwater will be completed in the area of well 09_DBMW45. Vertical characterization is necessary to assess the potential presence of free-phase TCE. If free-phase TCE is present in the aquifer, the sparging tests will not be performed, thereby preventing further mobilization of the dissolved TCE. Vertical characterization of VOCs in groundwater is described in Section 4.2.2.

SVE wells will be installed in areas with the highest VOC concentrations in soil and soil gas. The pilot tests will be conducted to evaluate the efficiency of using SVE to remove VOCs from the vadose zone.

Aquifer pumping and injection tests will be performed on new test wells shown on Map 3-10. These test locations were chosen in a cooperative effort with Comprehensive Long-Term Environmental Action Navy (CLEAN) I staff to support the OU-1 Interim-Action Feasibility Study (IAFS). Aquifer pumping tests produce large volumes of water. This water will be handled as described in the final Investigation-Derived Waste Management Plan for Phase II activities at MCAS El Toro (BNI 1995b).

Section 5
REQUEST FOR ANALYSES

Requests for analyses are based on:

- site activities and history,
- results of previous investigations,
- objectives of site-specific RI/FS efforts,
- specific COPCs, and
- required detection limits.

The analytical methods referenced in this section are described in the Phase II Quality Assurance Project Plan (QAPP) for quality assurance procedures (BNI 1995c). The primary objective when specifying an analytical method is to achieve data that are precise, accurate, representative, complete, and comparable. The data must meet the data quality objectives discussed in detail in the QAPP and must follow all the guidelines established under Naval Facilities Engineering Service Center (NFESC, formerly Naval Energy and Environmental Support Activity [NEESA]) Level D (NEESA 1988).

5.1 ANALYTICAL TESTING RATIONALE

The types of analyses chosen are based on the COPCs and are site-specific. During the Phase II RI/FS, the NFESC Level D guidelines must be followed. The analyses will be performed by an approved laboratory for the CLEAN II Program. The parameters have been determined based on regulatory limits, health/risk calculations, and U.S. EPA Contract Laboratory Program analytical method limitations.

5.2 FIELD SCREENING

Field-screening methods are cost-effective, have rapid turnaround time, and provide accurate data. Field screening provides useful information during field investigations and remediation planning at contaminated sites. The data collected from the field-screening methods can minimize the number of nondetects submitted to a stationary laboratory for analysis and can also effectively determine the nature and extent of contamination.

Each soil sample collected will be field-screened for organic headspace vapors using a portable FID and PID. In addition, a portable GC may be used to measure headspace concentrations of VOCs. Headspace concentration data will be used as an aid in determining the need for laboratory analyses, and to provide supplementary guidance for health and safety practices. The FID and PID headspace measurements will be obtained by placing a portion of the soil sample in a sealable plastic bag and allowing it to equilibrate for approximately 15 minutes. The FID and PID measurements will be taken by inserting the probe tip into the sealed bag and recording the stabilized reading. The portable GC measurements will be obtained by placing a small soil sample (10 to 20 grams) in a preweighed vial filled approximately halfway with water. After shaking the vial to disaggregate the soil sample, the vial will be placed in a constant-temperature water bath. Measurements will be obtained by direct injection of headspace vapor into the GC (U.S. EPA Method 3810). Specific procedures for obtaining field screening measurements are described in CLEAN II Standard Operating Procedure (SOP) 3.

5.3 MOBILE LABORATORY ANALYSES

A mobile laboratory will be used to provide real-time analytical results for groundwater, soil, and soil gas samples.

5.3.1 Volatile Organic Compounds - GC or GC/MS

All soil samples collected will be screened with a portable PID, FID, and/or a portable GC. Samples will be sent to the on-site mobile laboratory based on the need to define the nature and extent of VOC-impacted soil. Approximately 25 percent of the soil samples and all groundwater samples collected will be analyzed by the mobile laboratory. The on-site mobile laboratory will analyze the samples for VOCs using a portable GC or gas chromatography/mass spectroscopy (GC/MS).

5.4 FIXED-BASE ANALYTICAL LABORATORY TESTS

As described in the QAPP, a percentage of samples are required to be analyzed by a NFESC Level D laboratory for confirmation. The analytical test methods for NFESC Level D confirmation are listed below. During a meeting on 06 June 1995, the Base Realignment and Closure (BRAC) Cleanup Team (BCT) agreed that 20 of the soil samples collected at Site 24 will be sent to the Level D laboratory for confirmation (BNI 1995d). Approximately two-thirds of the confirmation samples will be selected from detects and one-third from nondetects.

5.4.1 Volatile Organic Compounds - U.S. EPA Method 8010/8240

Of the soil samples collected and analyzed in the mobile laboratory for VOCs, 20 will be selected for confirmation. Thirteen of the samples with detectable concentrations and seven with nondetectable concentrations will be sent to the NFESC Level D laboratory for confirmation. All groundwater samples will be sent to the NFESC Level D laboratory for confirmatory analyses of VOCs.

5.4.2 Semivolatile Organics - U.S. EPA Method 8270

All groundwater samples collected from monitoring wells 1 through 8 will be sent to the NFESC Level D laboratory for semivolatile organic compound analyses.

5.4.3 Metals (Title 26 Metals) - U.S. EPA Method 6010

All groundwater samples taken from monitoring wells 1 through 8 will be sent to the NFESC Level D laboratory for metals analysis.

5.4.4 General Minerals/Chemistry

Although the general minerals/chemistry analysis provides information necessary for remedial design, samples analyzed for the constituents and parameters included in this method may yield higher than acceptable results due to natural geologic processes. Several constituents and parameters included in this analysis were identified as COPCs during the Phase I investigations.

All collected groundwater samples will be sent to the NFESC Level D laboratory for general minerals/chemistry analysis.

5.5 SUMMARY OF TESTS

Site 24 analytical parameters are summarized by sampling media in Tables W4-1, W4-2, and W4-3.

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Section 6
FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods referenced in this section are referenced to Section 6 of the FSP and in CLEAN II SOPs that discuss specific field methods and procedures.

6.1 INITIAL SURVEYS

Initial surveys include land survey for horizontal and vertical position of sampling points and a geophysical survey to identify subsurface utilities.

6.1.1 Land Survey

Sample locations will be surveyed by a professional land surveyor to the nearest 0.01 foot (horizontal) and to the nearest 0.01 foot (vertical).

6.1.2 Geophysics

Once the stake or paint mark is set to locate a boring, MCAS El Toro utility maps will be checked for subsurface utilities. Geophysical methods (through a subcontractor) will be used to help identify locations of underground utilities that may cause a hazard during drilling.

6.2 SOIL SAMPLES

A CLEAN II Program geologist will be present for drilling, soil logging and sampling, field screening, geophysical logging, and final abandonment of any borings. Each boring will be hand-augered to a depth of 5 feet bgs to reduce the potential of drilling through subsurface utilities. These borings are shown on Maps W3-7, W3-8, and W3-9.

Mud-rotary borings will be continuously cored using a 10-foot Christiansen 94-millimeter core barrel. A minimum of two soil samples will be collected per core barrel and screened using a portable PID, FID, and/or portable GC. This interval may be reduced at the discretion of the field geologist. These samples will not be submitted to the mobile laboratory.

Approximately one-half of the hollow-stem auger borings will be sampled by driving a modified California soil sampler in front of the auger assembly. Soil sampling procedures using the modified California sampler are described in CLEAN SOP 4. Drive samples will be collected at a minimum of 5-foot intervals using stainless steel sleeves. Sample intervals may be reduced at the discretion of the field geologist. Drive samples in the air-rotary borings will be identical to those in the hollow-stem auger borings.

Approximately fifty percent of the hollow-stem auger borings will be continuously cored using a CME 5-foot core barrel advanced (without rotation) in front of the lead auger. At least one sample per core barrel will be analyzed in the field with the portable FID, PID, and/or portable GC. Soil sampling procedures using the CME continuous system are described in SOP 4.

Headspace measurements will be performed as described in CLEAN II SOP 3. Headspace concentration data will be evaluated and a decision will be made whether to perform mobile laboratory analyses. Approximately 25 percent of the soil samples collected from the hollow-stem auger borings will be submitted to the mobile laboratory (Table W4-2).

Each borehole will be logged by a CLEAN II Program geologist according to the Unified Soils Classification System. Soil classification is described in CLEAN II SOP 3.

After reaching total depth, the hollow-stem borings will have a soil gas piezometer or SVE well installed (SOP 5) or will be abandoned per CLEAN II SOP 13.

Test pits, trenches, and hand auger borings may be used to assess near-surface soil conditions near degreasers, storm drain piping, and other suspected VOC source areas, as necessary. Test pits may be required to locate abandoned water supply wells. Up to 20 soil samples will be collected and analyzed for VOCs. The location of test pits, trenches, and hand auger borings have not been defined but will be based upon results obtained from this and previous investigations.

6.3 GROUNDWATER SAMPLES

Groundwater samples will be collected from all new monitoring and air sparging wells. Groundwater samples from the new monitoring wells will be analyzed for the same parameters as nearby surrounding wells (Table W4-3). These wells are shown on Map 3-9.

6.3.1 Monitoring and Pumping/Injection Well Construction

To maintain a consistent groundwater quality data collection effort, Phase II monitoring wells will be constructed similar to those installed during the Phase I RI/FS. The wells will be constructed with flush-threaded, 4-inch-diameter, schedule 40, polyvinyl chloride (PVC) blank casing and screened over the lower 40 feet. Flush-threaded, 4-inch-diameter, stainless steel, wire-wrapped screen will be used. The selection of the screen slot size (0.010-inch or 0.020-inch) will be determined based on grain-size distribution analysis of sample(s) collected in the saturated zone. Sand filter pack will be selected, such that at least 90 percent of the filter pack is retained by the well screen. Centralizers will be used at 20-foot intervals.

Wells over 200 feet in depth will be constructed using 5-inch-diameter, schedule 80 PVC blank casing and screened over the lower 20 feet. Flush-threaded, 5-inch-diameter, stainless steel screen will be used. Filter pack sand and screen slot size will be selected, and centralizers will be used as described above.

Pumping/injection wells will be constructed using 6-inch-diameter, schedule 80 PVC blank casing with screen over the lower 100 feet. Flush-threaded, 6-inch-diameter stainless steel screen will be used. Filter pack sand and screen slot size will be selected, and centralizers will be used as described above.

The wells will be constructed by suspending the casing in the boring. The sand filter pack, bentonite seal, cement/bentonite grout, and concrete sanitary seal will be constructed as described in Section 6 of the FSP, as applicable. Each well will be equipped with a locking cap and lock.

6.3.2 Well Development and Groundwater Sampling

The well seal materials will be allowed to set for approximately 48 hours before development. Each monitoring well will be developed using a surge-and-pump method until the discharged water is relatively free of fine suspended sediment. Up to 10 well volumes will be removed. After each well volume is removed, samples of the discharged water will collected and analyzed in the field for groundwater conductivity, temperature, and pH. Well development will be complete when conductivity, temperature, and pH measurements vary less than 10 percent between well volumes, and the discharged water is relatively free of fine suspended sediment. Turbidity measurements will also be collected. These data will be recorded on the well development log. Well development will be performed as described in Section 6 of the FSP.

Groundwater samples will be collected after waiting a minimum of 7 days after development. Groundwater sampling procedures are described in Section 6 of the FSP.

6.3.3 Wastewater Samples

Monitoring well purge water and decontamination wash water will be treated with the on-site activated-carbon treatment system. Approximately 20 wastewater samples will be collected to evaluate the treatment system performance.

6.4 SOIL GAS

The soil gas survey will be conducted in two tiers. Tier 1 will be used to define the vertical extent of VOCs in soil gas at specific locations identified during the Phase I RI (Map W3-9). Tier 1 sampling will also include collecting and analyzing soil gas samples at five Phase I locations as described in Section 4.2.3 of this attachment. Tier 2 sampling will be used to define the horizontal extent of VOCs after evaluating the Tier 1 data. Soil gas samples will be collected by advancing a soil gas sample probe with the CPT rig. At MCAS Tustin, the CPT rig has been proven effective to at least 90 feet bgs (the maximum depth attempted); at other locations in southern California, depths of 260 feet bgs have been attained.

A mobile laboratory will analyze soil gas samples for VOCs by U.S. EPA Method 8010 (modified to include Freon 113). Because total petroleum hydrocarbons (TPH)-gasoline and benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected at several locations during the Phase I RI soil gas survey, soil gas samples collected in those areas will also be analyzed for TPH-gasoline and BTEX by U.S. EPA Methods 8015/8020 (Table W4-1). Soil gas sampling and analyses will follow guidelines developed by the RWQCB, Los Angeles Region (RWQCB 1994).

6.4.1 Tier 1

Tier 1 samples will be collected at 50 locations to assess the vertical extent of VOCs along the perimeter of the main soil gas plume, within areas of highest soil gas concentrations in the main soil gas plume, and near the center of each discrete soil gas plume identified during the Phase I RI. The Tier 1 CPT (inferred lithologic analyses) and soil gas sample locations will coincide to identify permeable zones before collecting soil gas samples. To assess the vertical extent of VOCs in soil gas, up to four soil gas samples will be collected at the approximate depths of 50, 75, 95, and 115 feet bgs. If four depth intervals are sampled, the Tier 1 effort represents 200 soil gas samples to be analyzed. However, if two consecutive soil gas samples do not contain detectable concentrations of VOCs, the vertical extent will be considered defined, and deeper samples will not be collected. Tier 1 soil gas sample locations are shown on Map W3-9.

6.4.2 Tier 2

Tier 2 samples will be used to define the horizontal extent of VOCs in soil gas after analyzing vertical extent data collected during Tier 1 sampling. Tier 2 sample locations will be dependent on Tier 1 results.

6.4.2.1 CONE PENETROMETER TESTING (75 POINTS)

Seventy-five cone penetrometer test points for inferred lithologic analyses will be completed on the site. These will be used to further define the intermediate depth stratigraphy. Soil gas sampling will be aided by allowing samples to be taken in the most permeable zones identified with CPT data. CPT points are shown on Map W3-9.

6.5 PILOT TESTING

SVE, air-sparging, and aquifer pumping pilot tests will be performed to support the feasibility study. SVE pilot tests will be used to evaluate the efficiency of removing VOCs from subsurface soil using vapor extraction.

The air-sparging pilot tests will be used to evaluate the efficiency of removing VOCs from groundwater using clean air injection into the saturated zone. Two air-sparging borings will be drilled and tested near monitoring well 09_DBMW45.

Aquifer pumping and injection tests will be conducted to evaluate the efficiency of using pumping and injection to contain VOC-impacted groundwater.

6.5.1 Soil Vapor Extraction

SVE pilot tests will be conducted in areas where elevated concentrations of VOCs are present in the soil and soil gas. A portable vacuum blower and generator will be used to conduct the pilot test. The vacuum blower will be connected to the SVE well using PVC piping. Sampling ports will be installed in the PVC piping between the SVE well and the vacuum blower to measure vacuum pressure, air flow, and VOC concentrations.

Vacuum pressure will be measured with a standard pressure gauge, chosen to cover the range of pressures expected given the size of the vacuum blower and the anticipated soil permeability. Air flow will be measured with a pilot tube and a portable anemometer. VOC concentrations will be measured in the field with a portable PID, FID, and/or portable GC. SVE sampling techniques and information that will be recorded in the field logbook are described in Section 6 of the FSP.

The information obtained from the pilot test that will be used in the FS includes the following:

- effective radius of influence,
- preferential flow paths, if any,
- optimum SVE well spacing,
- extraction air-flow rate versus applied vacuum,
- VOC concentrations in the extracted air,
- VOC mass removal rate,
- air emission treatment requirements, and
- expected time of cleanup.

6.5.2 Air-Sparging Pilot Testing

An air-sparging pilot test is proposed for the area near monitoring well 09_DBMW45 (Map W3-8). This is the highest known area of VOC contamination at MCAS El Toro. The pilot test area was chosen to demonstrate the effectiveness of air sparging in treating the groundwater hot spot.

The sparging wells will be drilled in the upgradient direction approximately 20 feet from well 09_DBMW45. The well is proximate to well 09_DBMW45 so that it can be used as a monitoring point for measurements of air-sparging bubble flux.

Bubble flux can be used to measure active partitioning in groundwater. Bubble flux is measured by lowering a conduit into the monitoring well near the air-sparging wells. An inverted funnel is attached to the bottom of the conduit to capture the air-sparging bubbles. The conduit is raised and lowered in the monitoring well, where bubbles (under hydrostatic pressure) are captured at the various depths. A rotameter-type flowmeter will be used to measure bubble flux. Measurements will be recorded at 1-foot increments in the monitoring well. Air-sparging sampling techniques and information that will be recorded in the field logbook are described in Section 6 in the FSP.

The air-sparging pilot test will be conducted using a portable generator and blower. The sparging blower will be connected to the air-sparging wells using PVC piping.

SVE measurements will be performed concurrently as described in Section 6. Soil gas VOC concentrations will be measured before and after sparging to assess the contribution of sparging gas to the recovered vapor.

6.5.3 Aquifer Pumping/Injection Tests

Aquifer pumping and injection tests will be conducted to evaluate the efficiency of using pumping and injection to contain VOC-impacted groundwater. The tests will be conducted in the areas shown on Map W3-10. Remedial alternatives described in the IAFS include shallow extraction and injection wells screened over the upper 100 feet in the Site 24 area (Jacobs Engineering 1994e). Four of the six alternatives include groundwater injection wells. The IAFS has assumed that the shallow extraction and injection wells will be able to sustain pumping and injection rates of 40 gallons per minute; this rate will be evaluated during the Phase II RI. Because these tests require a cooperative planning effort between the CLEAN I and CLEAN II Programs, a formal presentation to the BCT will be provided before pilot testing.

Existing monitoring wells in the test areas generally have only 30 to 40 feet of screened interval beneath the water table. This is not considered adequate for evaluation of the IAFS remedial alternative that utilize groundwater pumping and injection wells. New extraction/injection test wells will be drilled and constructed in the areas shown on Map W3-10. Three of the five wells will be installed and tested as part of the Tier 1 program. Based on conversations with the CLEAN I staff, 24-hour aquifer tests will satisfy the data needs of the IAFS. The drilling and test results will be presented to the BCT, and a decision will be reached regarding additional testing before proceeding with the two Tier 2 wells shown on Map W3-10.

Pumping test equipment, test protocol, and the information to be recorded in the field logbook are described in Section 6 of the FSP.

6.6 SUMMARY OF PHASE II REMEDIAL INVESTIGATION SAMPLING LOCATIONS

Phase II RI sampling locations are summarized on Map W3-11.

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COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN II

FIELD SAMPLING PLAN ATTACHMENT X OPERABLE UNIT 2 – SITE 25 – MAJOR DRAINAGES MCAS EL TORO, CALIFORNIA

CTO-0059

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ACRONYMS/ABBREVIATIONS

BCT	BRAC Cleanup Team
bgs	below ground surface
BRAC	Base Realignment and Closure Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
COPC	chemical of potential concern
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorotriphenyldichloroethane
DQO	data quality objective
FID	flame ionization detector
FSP	Field Sampling Plan
GC	gas chromatograph
GC/MS	gas chromatography/mass spectroscopy
LUFT	(California) Leaking Underground Fuel Tank (Field Manual)
MCAS	Marine Corps Air Station
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photoionization detector
PRG	(U.S. EPA Region IX) Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
SOP	Standard Operating Procedure
SVE	soil vapor extraction
SVOC	semivolatile organic compound

ACRONYMS/ABBREVIATIONS (continued)

TAL	target analyte list
TCE	trichloroethene
TDS	total dissolved solids
TFH	total fuel hydrocarbons
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
USCS	Unified Soils Classification System
U.S. EPA	United States Environmental Protection Agency
VOA	volatile organics analyte
VOC	volatile organic compound

ACRONYMS/ABBREVIATIONS (continued)

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Section 1
OBJECTIVES

This Field Sampling Plan (FSP) for Site 25, Major Drainages, outlines the field procedures and methodology applicable to completing the Phase II Remedial Investigation (RI)/Feasibility Study (FS) for this site. The purpose of this FSP is to enable field personnel unfamiliar with the site to gather required samples and field data. It is also intended to assure that data collection will be comparable and compatible with previous data collected at the site and with other sampling activities at other sites at Marine Corps Air Station (MCAS) El Toro.

1.1 SAMPLING OBJECTIVES

The specific objectives for this FSP at Site 25 are as follows:

- characterize the nature and extent of subsurface soil contamination identified near Bee Canyon and Agua Chinon Washes during the Phase I RI;
- characterize potential risk to groundwater from the contaminated subsurface soil;
- characterize physical soil parameters to support the FS and pilot testing;
- characterize sediment contaminant levels in Marshburn Channel to support the ecological risk assessment;
- characterize surface water contaminant levels in all drainages to support the human health and ecological risk assessments; and
- evaluate feasible removal or remedial actions, as necessary.

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Section 2
BACKGROUND

This section presents a site description and results of previous investigations at Site 25, the Major Drainages. The purpose of this section is to provide a brief compilation of the data that were used to develop the site-specific FSP for the Phase II RI/FS activities. Previous reports, which are referenced below, provide a more thorough discussion of site history, activities, and summaries of previous investigations.

2.1 SITE DESCRIPTION

Site 25 consists of four main drainage channels that flow through or adjacent to MCAS El Toro and portions of San Diego Creek. The channels are Agua Chinon Wash, Bee Canyon Wash, Borrego Canyon Wash, and Marshburn Channel. Three of these drainage channels are continuous with natural washes that originate in the Santa Ana Mountains (Agua Chinon, Bee Canyon, and Borrego Canyon). Surface drainage from the hills and irrigated farmland combines with runoff generated from extensive paved surfaces on the Station. The MCAS El Toro storm sewer system discharges to the drainage channels, which then flow into San Diego Creek. San Diego Creek discharges into Upper Newport Bay, about 7 miles downstream from its intersection with Marshburn Channel. The channels are mostly lined and/or culverted through the Station. A figure illustrating the locations of the major drainages is included as Map X3-1.

Agua Chinon Wash traverses the east-central portion of MCAS El Toro. It enters the Station near Site 3 at the northeast property line in a culvert. The wash is culverted all the way across the Station, except for a short reach adjacent to Site 19. It emerges from the culvert about 100 yards from the southwestern boundary. This area was formerly unlined. It is currently under construction for realignment and installation of a concrete liner. Agua Chinon Wash is culverted again at the Station boundary and remains culverted almost to San Diego Creek.

Bee Canyon Wash traverses the west-central portion of MCAS El Toro. As with Agua Chinon Wash, it enters a culvert at the Station boundary and remains culverted across MCAS El Toro, reemerging for about 100 yards at the southwestern boundary. The wash then reenters a culvert and remains culverted for the remainder of the way to San Diego Creek.

Borrego Canyon Wash enters MCAS El Toro near Site 2 and runs adjacent to the eastern boundary. About midway, it is lined with concrete, although historically the concrete has been cracked in many places. It departs the Station about 100 yards east of Aqua Chinon Wash, where it enters a culvert and remains culverted for the remainder of the way to San Diego Creek. Extensive portions of the concrete-lined channel are currently being repaired and repaved.

Marshburn Channel runs adjacent to the western boundary of MCAS El Toro. It is lined with concrete, generally in good repair, and remains open all the way to San Diego Creek.

San Diego Creek, which receives surface flow from the preceding drainages, lies southwest of MCAS El Toro and flows through commercial and agricultural areas.

Approximately five miles downstream of the Station, the creek runs through a recreational area that includes hiking and bicycle paths. San Diego Creek flows into Upper Newport Bay. Recreational uses of the bay include swimming and fishing. The bay is also an ecological preserve used by migratory birds.

2.1.1 History

The major drainages are thought to be potential receptors of contaminants that originate from a variety of sources and historical disposal practices. These sources include surface water runoff from MCAS El Toro, surface water runoff from areas upstream of MCAS El Toro, and waste fluids introduced directly into the drainages or indirectly via the storm drain systems.

The Phase I RI (Jacobs Engineering 1993a) concluded that the unlined portions of Marshburn Channel, Bee Canyon Wash, Agua Chinon Wash, and Borrego Canyon Wash are locations in which contaminated water may have infiltrated through the vadose zone to groundwater. Culverting and lining of the drainages have limited the infiltration areas, but cracks and joints in the concrete channels or culverts are potential pathways to groundwater.

2.1.2 Geology

MCAS El Toro is located within the Tustin Plain at the southeastern end of the Los Angeles Basin. The Los Angeles Basin is characterized by a northwest-trending, doubly plunging, synclinal trough. The depression of the Los Angeles Basin began in middle Miocene time and is thought to be greater than 30,000 feet deep. There are several faults on the flank of the Los Angeles Basin syncline. Of these faults, only the Newport-Inglewood is considered active. There are no known active faults on Site 25. An unclassified fault on Site 2 intersects Borrego Canyon Wash.

2.1.2.1 QUATERNARY GEOLOGY

The majority of materials encountered on MCAS El Toro are of Holocene Age and consist of a matrix of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are alluvial fan deposits derived from the Santa Ana Mountains to the east. The Holocene alluvial materials conformably overlie Pleistocene Age sediments predominantly composed of interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene Age sediments could not be differentiated from Holocene Age sediments in Phase I soil borings.

2.1.2.2 TERTIARY GEOLOGY

Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene Age. This is considered to be bedrock in the area (Jacobs Engineering 1993a).

2.1.3 Hydrogeology

The groundwater investigation has been incorporated into Site 24. For more details on site-specific and regional hydrogeology refer to the Appendix W of the Phase II RI/FS Work Plan (BNI 1995a) and Section 1.3.9 of the Phase I Technical Memorandum (Jacobs Engineering 1993a), respectively.

2.2 PREVIOUS INVESTIGATIONS AND RESULTS

This section discusses the results of previous investigations completed for Site 25. For more detailed descriptions, refer to the referenced documents.

2.2.1 Interviews

Employee interviews were conducted by the Navy to obtain a better understanding of current and historical operations at the Station, especially operations concerning waste disposal practices (Jacobs Engineering 1994a). A summary of these interviews can be found in Appendix W of the Phase II Work Plan.

2.2.2 Aerial Photographs

Findings from both United States Environmental Protection Agency (U.S. EPA) and Science Applications International Corporation aerial photographs are summarized in Appendix W of the Phase II Work Plan (BNI 1995a).

2.2.3 RCRA Facility Inspection

A Resource Conservation and Recovery Act (RCRA) Facility Assessment was conducted by the Navy to evaluate whether an additional 140 sites at MCAS El Toro should be included under the RI/FS program (Jacobs Engineering 1993b). The four wash areas were represented by separate solid waste management unit/areas of concern. Although additional sampling was recommended for each site, only Agua Chinon and Bee Canyon Washes were suggested for inclusion into the RI/FS.

2.2.4 Phase I Remedial Investigation

In the Phase I RI, the drainage channels were included in Site 18 because the drainages were considered to be potential sources of volatile organic compounds (VOCs). Because Site 18 has been redefined for the Phase II RI to include only groundwater sampling, sampling of soil, sediment, and surface water at the major drainages constitute Site 25, a separate site.

The Phase I RI concluded that surface water and sediments are unlikely to contribute significantly to groundwater contamination. Contaminated soil detected beneath the unlined portions of Agua Chignon and Bee Canyon Washes was believed to have a greater potential than surface sediments for contributing to groundwater contamination.

Surface water may be important in contaminant transport. For example, dichlorodiphenyldichloroethene (DDE) was found at higher concentrations upstream of the Station, indicating that those contaminants may be coming from upstream. Agricultural activities, particularly upstream of Marshburn Channel and Bee Canyon Wash monitoring stations (18 MCI and 18 BEI, respectively), are potentially a source of the pesticides. Agricultural activities occurring on the Station are also potential sources of herbicides and pesticides.

U.S. EPA Region IX Preliminary Remediation Goals (PRGs) and ecological screening criteria were compared with corresponding surface water, sediment, and shallow and subsurface soil analytical results from the Phase I RI (Jacobs Engineering 1993a, pages A25-9 to A25-11). A summary of the results from these comparisons are discussed by media below.

2.2.4.1 SURFACE WATER

Ecological screening criteria for surface water are referenced from the Clean Water Act Ambient Water Quality Criteria for Protection of Freshwater Aquatic Life. Acute water quality criteria were used for comparisons in washes due to intermittent flow. Chronic water quality criteria were used for comparisons in San Diego Creek because of constant flow (Jacobs Engineering 1993a, Table A25-3c). In most cases, total metal concentrations are responsible for exceeding the ecological criteria in surface water. The surface water findings from the Phase I RI are summarized below:

- no chemicals of potential concern (COPCs) were detected during the Phase I RI that exceed PRGs;
- the cumulative cancer risk from COPCs exceeded 10^{-6} in Bee Canyon and Borrego Canyon Washes and San Diego Creek;
- aluminum and copper exceeded ecological screening in all of the drainages;
- cadmium exceeded ecological screening criteria in Borrego Canyon and Bee Canyon Washes and San Diego Creek;
- zinc exceeded the ecological screening criteria in Bee Canyon and Borrego Canyon Washes, Marshburn Channel, and San Diego Creek;
- 4,4'-dichlorotriphenyldichloroethane (DDT) exceeded ecological screening criteria in Agua Chinon Wash and Marshburn Channel;
- cyanide exceeded ecological screening criteria for Marshburn Channel;
- beryllium, lead, mercury, and silver exceeded ecological screening criteria in San Diego Creek; and
- gamma-chlordane exceeded ecological screening criteria in San Diego Creek and the upstream sample from Bee Canyon Wash.

2.2.4.2 SEDIMENT

Ecological screening criteria for wet wash sediment were derived using ambient water quality criteria and an equilibrium partitioning approach for nonpolar organic compounds. This approach is consistent with that used by the U.S. EPA in the development of sediment quality criteria (Jacobs Engineering 1993a). The basic assumption is that exposure occurs primarily from the dissolved fraction of the chemical. Deposits in dry washes do not represent aquatic environments, and using sediment criteria derived from ambient water quality criteria is not appropriate. These dry deposits are more appropriately evaluated assuming terrestrial exposure criteria. Therefore, terrestrial criteria were used (Jacobs Engineering 1993a). The sediment findings from the Phase I RI are summarized below:

- no COPCs were detected in shallow soil or sediment during the Phase I RI that exceeded PRGs;
- no COPCs exceeded ecological screening criteria in Agua Chinon Wash, Borrego Canyon Wash, and San Diego Creek;
- 4,4'-DDE exceeded ecological screening criteria in upstream and downstream sediment in Marshburn Channel, and mercury exceeded criteria in the downstream sediment; and
- 4,4'-DDE exceeded ecological screening criteria in upstream sediment in Bee Canyon Wash.

2.2.4.3 SUBSURFACE SOIL

Total fuel hydrocarbons (TFH) constituents were detected in subsurface soil at concentrations of 131,000 milligrams per kilogram (mg/kg) of TFH-gasoline at Station 18 ACA B223 and 2,270 mg/kg of TFH-diesel at Station 18 ACA B224. These soil borings were drilled beneath Agua Chinon and Bee Canyon Washes, respectively. Soil beneath both washes exceed California Leaking Underground Fuel Tank (LUFT) Field Manual guidelines (LUFT 1989) for TFH-gasoline and -diesel in subsurface soil.

2.2.5 Soil Gas Survey

The primary objective of the Phase I RI soil gas survey was to locate potential shallow subsurface source(s) of VOC groundwater contamination. Soil gas samples were collected from 27 locations near Agua Chinon and Bee Canyon Washes at depths between 5 and 30 feet below ground surface (bgs). Analytes consisted of trichloroethene (TCE), tetrachloroethene (PCE), 1,2- dichloroethene (DCE), 1,1-DCE, Freon-113, vinyl chloride, carbon tetrachloride, TFH-gasoline, benzene, toluene, ethylbenzene, and xylenes. The results are summarized below (Jacobs Engineering 1994b, Table C-1):

2.2.5.1 AGUA CHINON WASH

- TFH was detected at two locations with a maximum concentration of 434 micrograms per liter (µg/L);
- toluene and xylenes were detected at two locations with maximum concentrations of 6.1 and 8 µg/L, respectively; and
- TCE (53.1 µg/L), PCE (1.6 µg/L), and 1,1-DCE (4.6 µg/L) were detected in one sample each. Cis-1,2-DCE and trans-1,2-DCE were detected in 2 samples with maximum concentrations of 1.1 and 3.4 µg/L, respectively.

2.2.5.2 BEE CANYON WASH

- TFH was detected at two locations with a maximum concentration of 160 µg/L;
- toluene was detected at two locations, and xylenes at one location with maximum concentrations of 7.9 and 2.2 µg/L, respectively;
- 1,1-DCE was detected at two locations with a maximum concentration of 2.9 µg/L; and
- 1,2-DCE was detected at one location with a concentration of 1 µg/L.

2.2.6 Chemicals of Potential Concern

COPCs for Site 25 include all chemicals detected in the Phase I RI for each media (Jacobs Engineering 1993a, pages A25-4 to A25-8). A complete list of all COPCs by site appears in Table 3-1 of the Phase II RI Work Plan (BNI 1995a). The target analyte list (TAL) metals analyzed during the Phase I RI are beryllium, barium, arsenic, antimony, aluminum, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

2.2.6.1 SURFACE WATER

The following are considered COPCs for surface water runoff:

<u>Agua Chinon Wash</u>

- general chemistry: bicarbonate, chloride, nitrate/nitrite as N, sulfate, and total dissolved solids (TDS);
- metals: 22 of 23 TAL metals, excluding mercury;
- VOCs: methyl chloride, and 2-butanone;
- semivolatile organic compounds (SVOCs): 2-methylnaphthalene, benzyl butyl phthalate, bis(2-ethylhexyl) phthalate, and 4-nitrophenol;
- pesticides and polychlorinated biphenyls (PCBs) 4,4' -DDT and beta-BHC; and
- fuel and petroleum hydrocarbons: TFH-diesel.

Bee Canyon Wash

- general chemistry: cyanide, bicarbonate, chloride, nitrate/nitrite as N, sulfate, and TDS;
- metals: 19 of 23 TAL metals, excluding mercury, selenium, silver, and thallium;
- VOCs: methyl chloride and carbon tetrachloride;
- SVOCs: bis(2-ethylhexyl) phthalate and 4-nitrophenol;
- pesticides/PCBs: gamma-chlordane; and
- fuel and petroleum hydrocarbons: TFH-diesel.

Borrego Canyon Wash

- general chemistry: bicarbonate, chloride, nitrate/nitrite as N, sulfate, and TDS;
- metals: 19 of 23 TAL metals, excluding antimony, mercury, silver, and thallium; and
- VOCs: methyl chloride.

Marshburn Channel

- general chemistry: cyanide, bicarbonate, chloride, nitrate/nitrite as N, sulfate, and TDS;
- metals: 21 of 23 TAL metals, excluding selenium and silver;
- VOCs: methyl chloride, and toluene; and
- pesticides and PCBs: 4,4'-DDE, gamma-chlordane, delta-BHC, 4,4'-DDT endosulfan sulfate.

San Diego Creek

- general chemistry: cyanide, bicarbonate, chloride, nitrate/nitrite as N, sulfate, and TDS;
- metals: 23 of 23 TAL metals;
- VOCs: methyl chloride; and
- SVOCs: benzyl butyl phthalate.

2.2.6.2 SEDIMENT

The following are considered COPCs for sediment:

Agua Chinon

- metals: 18 of 23 TAL metals, excluding silver, beryllium, antimony, thallium, and selenium;
- herbicides: 2,4-DB;

- VOCs: methylene chloride; and
- fuel and petroleum hydrocarbons: TFH-gasoline.

Bee Canyon

- metals: 22 of 23 TAL metals, excluding antimony;
- VOCs: methylene chloride;
- SVOCs: bis(2-ethylhexyl) phthalate;
- pesticides and PCBs: 4,4'-DDE and 4,4'-DDT; and
- herbicides: dichloroprop.

Borrego Canyon

- metals: 15 of 23 TAL metals, excluding silver, beryllium, cadmium, sodium, nickel, antimony, selenium, and thallium.

Marshburn Channel

- metals: 20 of 23 TAL metals, excluding silver, beryllium, and antimony;
- VOCs: methylene chloride;
- herbicides: dichloroprop, 2,4,5-trichlorophenoxyproprionic acid (Silvex), and 2,4-DB;
- pesticides and PCBs: endosulfan sulfate, delta-BHC, 4,4'-DDE, and 4,4'-DDT; and
- fuel and petroleum hydrocarbons: TFH-gasoline.

San Diego Creek

- metals: 22 of 23 TAL metals, excluding beryllium;
- pesticides and PCBs: 4,4'-DDT;
- herbicides: dichloroprop, and dalaphon;
- SVOCs: 4-methylphenol; and
- fuel and petroleum hydrocarbons: total recoverable petroleum hydrocarbons (TRPH), and TFH-gasoline.

2.2.6.3 SHALLOW SOILS

The following are considered COPCs for shallow soil:

Agua Chinon Wash

- metals: 20 of 23 TAL metals, excluding silver, mercury, and antimony;
- pesticides and PCBs: endosulfan sulfate; and
- fuel and petroleum hydrocarbons: TFH-gasoline.

Bee Canyon

- metals: 21 of 23 TAL metals, excluding beryllium and selenium;
- VOCs: toluene; and
- fuel and petroleum hydrocarbons: TRPH.

Borrego Canyon

- metals: 19 of 23 TAL metals, excluding silver, mercury, antimony, and selenium.

Marshburn Channel

- metals: 19 of 23 TAL metals, excluding silver, mercury, antimony, and selenium;
- pesticides and PCBs: 4,4'-dichlorodiphenyldichloroethane (DDD), 4,4'-DDE, 4,4'-DDT, endrin ketone, endrin, endosulfan sulfate; and
- fuel and petroleum hydrocarbons: TFH-diesel.

2.2.6.4 SUBSURFACE SOIL

The following are considered COPCs for subsurface soil:

Agua Chinon Wash

- metals: 21 of 23 TAL metals, excluding silver and antimony;
- VOCs: methylene chloride;
- SVOCs: benzyl butyl phthalate, bis(2-ethylhexyl) phthalate;
- pesticides and PCBs: 4,4'-DDD; and
- fuel and petroleum hydrocarbons: TFH-gasoline, TFH-diesel, and TRPH.

Bee Canyon Wash

- metals: 20 of 23 TAL metals, excluding beryllium, selenium, and antimony;
- SVOCs: 2-methylnaphthalene, dibenzofuran, naphthalene, phenanthrene;
- pesticides and PCBs: alpha-chlordane, gamma-chlordane, Aroclor 1260, and 4,4'-DDD; and
- fuel and petroleum hydrocarbons: TFH-gasoline, TFH-diesel, and TRPH.

Borrego Canyon Wash

- metals: 20 of 23 TAL metals, excluding mercury, antimony, and selenium;
- pesticides and PCBs: 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT; and
- fuel and petroleum hydrocarbons: TRPH.

Marshburn Channel

- metals: 20 of 23 TAL metals, excluding silver, mercury, and antimony;
- pesticides and PCBs: 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT; and
- fuel and petroleum hydrocarbons: TRPH.

Section 3
MAPS

The maps on the following pages present the location of the site on MCAS El Toro, site boundaries, site units, physical features of the site, previous sampling locations, and proposed Phase II sampling locations, where known. These maps are referenced in other sections of this FSP.

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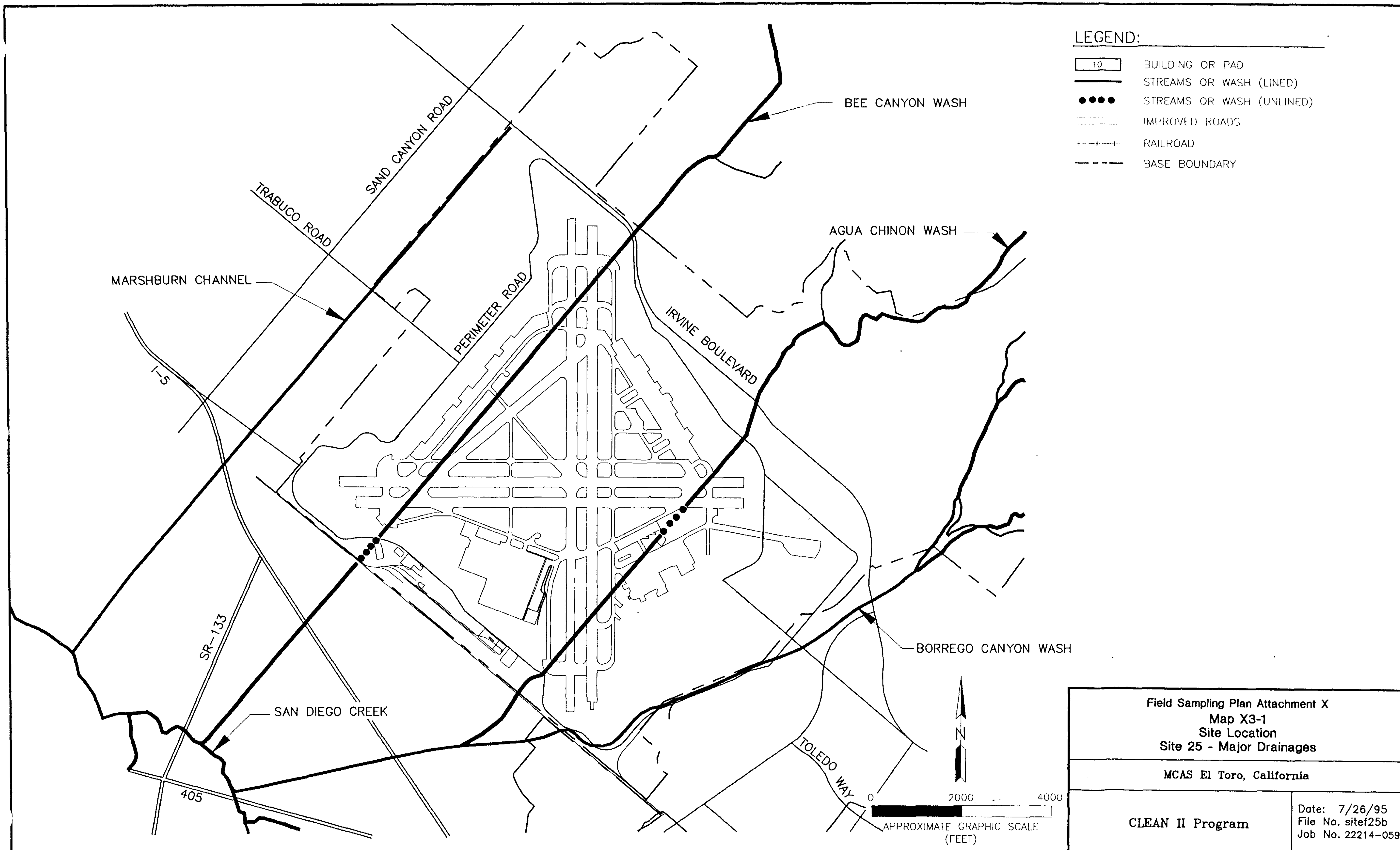

Field Sampling Plan Attachment X
Map X3-1
Site Location
Site 25 - Major Drainages

MCAS El Toro, California

CLEAN II Program

Date: 7/26/95
File No. sitef25b
Job No. 22214-059

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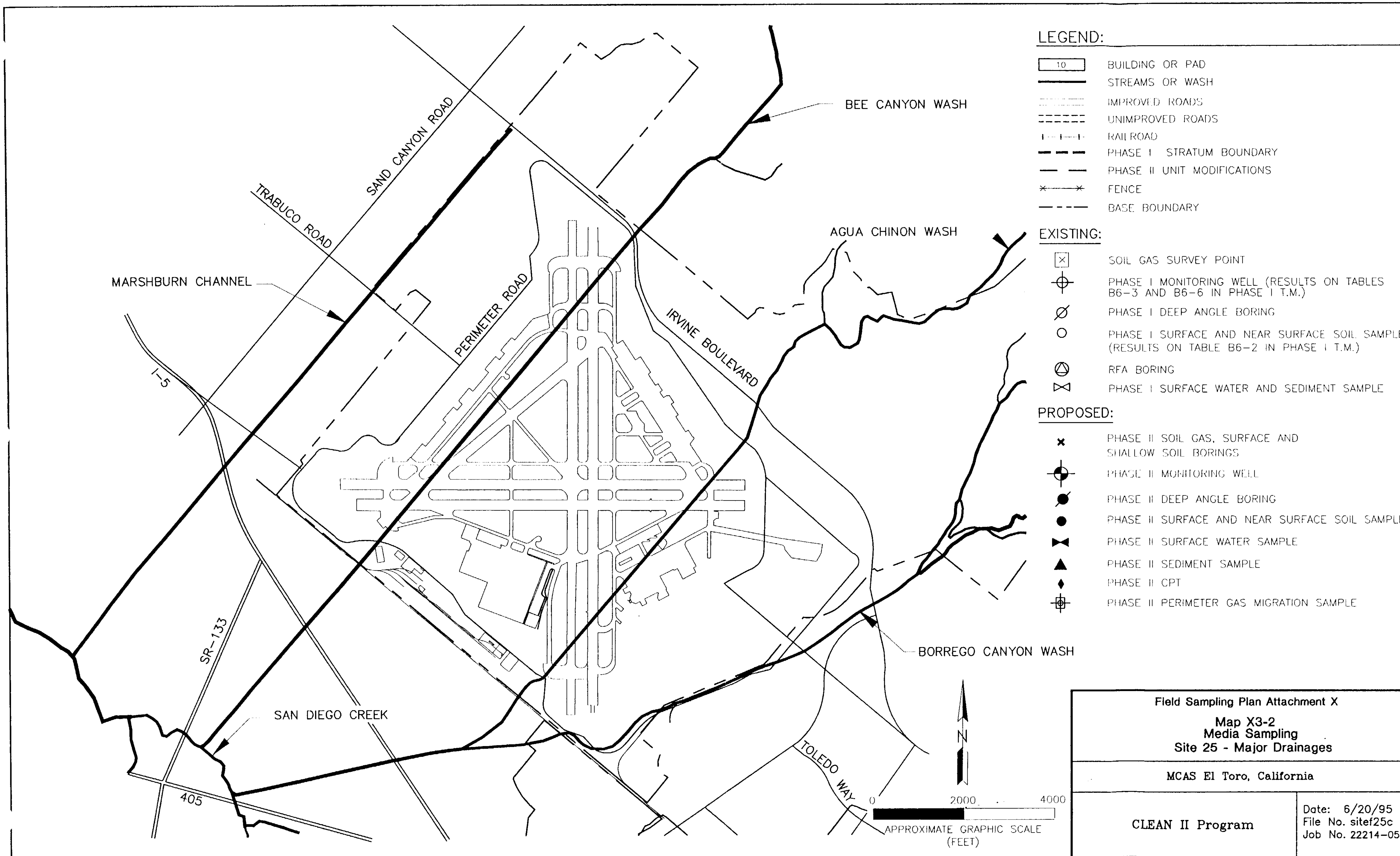

LEGEND:
10
BUILDING OR PAD
STREAMS OR WASH
IMPROVED ROADS
UNIMPROVED ROADS
RAILROAD
PHASE I STRATUM BOUNDARY
PHASE II UNIT MODIFICATIONS
FENCE
BASE BOUNDARY
EXISTING:
SOIL GAS SURVEY POINT
PHASE I MONITORING WELL (RESULTS ON TABLES B6-3 AND B6-6 IN PHASE I T.M.)
PHASE I DEEP ANGLE BORING
PHASE I SURFACE AND NEAR SURFACE SOIL SAMPLE (RESULTS ON TABLE B6-2 IN PHASE I T.M.)
RFA BORING
PHASE I SURFACE WATER AND SEDIMENT SAMPLE
PROPOSED:
PHASE II SOIL GAS, SURFACE AND SHALLOW SOIL BORINGS
PHASE II MONITORING WELL
PHASE II DEEP ANGLE BORING
PHASE II SURFACE AND NEAR SURFACE SOIL SAMPLE
PHASE II SURFACE WATER SAMPLE
PHASE II SEDIMENT SAMPLE
PHASE II CPT
PHASE II PERIMETER GAS MIGRATION SAMPLE
BEE CANYON WASH
AGUA CHINON WASH
SAND CANYON ROAD
TRABUCO ROAD
MARSHBURN CHANNEL
PERIMETER ROAD
IRVINE BOULEVARD
I-5
SR-133
SAN DIEGO CREEK
405
BORREGO CANYON WASH
TOLEDO WAY
N
0
2000
4000
APPROXIMATE GRAPHIC SCALE
(FEET)
Field Sampling Plan Attachment X
Map X3-2
Media Sampling
Site 25 - Major Drainages
MCAS El Toro, California
CLEAN II Program
Date: 6/20/95
File No. sitef25c
Job No. 22214-059

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Section 4
RATIONALE FOR SAMPLING LOCATIONS

This section explains the rationale for the number of sampling programs, types of sample, locations, and analytical parameters. The rationale for sampling is based on site conditions, results of previous investigations, and data quality objectives (DQOs) as presented in the appendices of the Phase II Work Plan (BNI 1995a).

4.1 SAMPLING PROGRAMS, SAMPLE TYPES, AND LOCATIONS

Sampling programs, types of samples, and sampling locations are presented by medium and chemical are based on:

- site activities and history;
- results of DQO analysis;
- types of media suspected or known to be impacted based on results from previous investigations;
- objectives of site-specific RI/FS efforts; and
- site-specific initial surveys.

Surface water, sediment, and shallow and subsurface soil sampling and analysis for the Phase II RI are summarized in Tables X4-1, X4-2, and X4-3.

4.1.1 Surface Water Samples

A wide range of analyses both upstream and downstream of the Station will allow continued evaluation of non-point-source contributions by MCAS El Toro to surface water contamination. Analysis of total and dissolved metals, cyanide, and pesticides will assist the human health and ecological risk assessments. General chemistry data will be used to calculate risk levels for hardness-dependent metals. Metal, herbicide, and pesticide analyses at upstream and downstream sampling locations will also assist in establishing background concentration levels in surface water and sediment.

One round of surface water samples will be collected during the first rainfall that produces runoff during the Phase II investigation. The Phase II RI will use the same sampling stations that were used in the Phase I RI. An additional upstream station in Borrego Canyon Wash will be included. The sample locations are shown on Map X3-2.

4.1.2 Sediment Samples

Two samples will be collected to confirm mercury and pesticide levels associated with ecological risk in Marshburn Channel sediment. One sediment sample will be taken at the upstream and downstream Phase I sample stations in the Marshburn channel. Like the Phase I RI sampling, Phase II sediment samples will be collected at 0 and 2 feet bgs. These sample locations are shown on Map X3-2.

Table X4-1
Surface Water Sampling and Analysis

					OFF-SITE LABORATORY						
Tier	Unit/Name	No. of Locations	Samples/ Location	Total Samples	SVOC[a]	Pesticides and PCBs[b]	Herbicides	TPH[c]-Diesel	Total and Dissolved Metals	General Chemistry	Cyanide
Tier 1	Unit 1 Agua Chinon Wash	2	1 upstream 1 downstream	2	X	X	X	X	X	X	X
	Unit 2 Bee Canyon Wash	2	1 upstream 1 downstream	2	X	X	X	X	X	X	X
	Unit 3 Borrego Canyon Wash	2	1 upstream 1 downstream	2	X	X	X	X	X	X	X
	Unit 4 Marshburn Channel	2	1 upstream 1 downstream	2	X	X	X	X	X	X	X
	Unit 5 San Diego Creek	4	4 downstream	4	X	X	X	X	X	X	X
Subtotals				12	12	12	12	12	12	12	12
Tier 2	Not Applicable										
Tier 3	Not Applicable										

Notes:
[a] SVOC – semivolatile organic compound
[b] PCB – polychlorinated biphenyl
[c] TPH – total petroleum hydrocarbons

Table X4-2
Sediment Sampling and Analysis

Tier	Unit/Name	No. of Locations	Samples/ Location	Total	OFF-SITE LABORATORY: Pesticides	OFF-SITE LABORATORY: Metals (including mercury)
Tier 1	Unit 4 Marshburn Channel	2	1 upstream 1 downstream	2	2	2
Subtotals				2	2	2
Tier 2	Not Applicable					
Tier 3	Not Applicable					

Table X4-3
Soil Sampling and Analysis

Tier	Unit/Name	No. of Locations	Samples/ Location	Total Samples	ON-SITE MOBILE LABORATORY[a]: SVOC[b]	TPH[c]-Gasoline	TPH-Diesel	BTEX[d]
Tier 1	Unit 1 Agua Chinon Wash	3	6	18	18	18	18	18
	Unit 2 Bee Canyon Wash	1	6	6	6	6	6	6
Subtotals				24[e]	24	24	24	24
Tier 2	Not Applicable							
Tier 3	Not Applicable							

Notes:
- [a] Six soil samples will be sent to the off-site laboratory for confirmation. Two-thirds of confirmations will be detections and one-third will be nondetects.
- [b] SVOC – semivolatile organic compound
- [c] TPH – total petroleum hydrocarbons
- [d] BTEX – benzene, toluene, ethylbenzene, and xylenes
- [e] all samples will be field-screened using a photoionization detector and flame ionization detector; it is estimated that 25 percent of all samples will go to the on-site mobile laboratory for analysis

4.1.3 Subsurface Soil Samples

Four hollow-stem auger borings will be drilled to groundwater (approximately 120 feet), or to the vertical extent of impacted soil to assess the nature and extent of previously identified soil contamination. Three deep borings will be located in the Agua Chinon Wash area, and one will be placed in the Bee Canyon Wash area. Boring locations are shown on Map X3-2.

Soil samples taken from the hollow-stem auger borings will be used to estimate the volume and distribution of petroleum-impacted soil identified during the Phase I RI, the type and concentrations of contaminants present in the soil, and the physical parameters of the soil. These data will be used to support the Phase II FS.

If elevated VOC concentrations are encountered in subsurface soils, the borings will be converted to soil vapor extraction (SVE) wells or piezometers. Installation of SVE wells and piezometers during the soil investigation phase will facilitate SVE pilot testing and the evaluation of environmental alternatives in the subsequent FS.

Section 5
REQUEST FOR ANALYSES

Requests for analyses are based on:

- site activities and history,
- results of previous investigations,
- objectives of site-specific RI/FS efforts,
- COPCs, and
- required detection limits.

The analytical methods referenced in this section are referenced to the Phase II Quality Assurance Project Plan (QAPP) for quality assurance procedures (BNI 1995b). The primary objective when specifying an analytical method, is to achieve data that are precise, accurate, representative, complete, and comparable. The data must meet the DQOs discussed in detail in the QAPP and must follow all the guidelines established under Naval Facilities Engineering Service Center (NFESC, formerly Naval Energy and Environmental Support Activity [NEESA]) Level D (NEESA 1988).

5.1 ANALYTICAL TESTING RATIONALE

The types of analyses chosen are based on the COPCs and are site-specific. During the Phase II RI/FS, the NEESA Level D guidelines must be followed. The analyses will be performed by an approved laboratory for the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Program. The parameters have been determined based on regulatory limits, health/risk calculations, and U.S. EPA Contract Laboratory Program analytical method limitations.

5.2 FIELD SCREENING

Field-screening methods are cost-effective, have rapid turnaround time, and provide accurate data. Field screening provides useful information during field investigations and remediation planning at contaminated sites. The data collected from the field-screening methods can minimize the number of nondetects submitted to a stationary laboratory for analysis and can also effectively determine the nature and extent of contamination.

Each soil sample collected will initially be field-screened for organic headspace vapors using a portable flame ionization detector (FID), photoionization detector (PID), and/or a portable gas chromatograph (GC). Headspace concentration data will be used as an aid in determining the need for further analytical work and to provide supplementary guidance for health and safety practices. The FID and PID headspace measurements will be obtained by placing a portion of the soil sample in a sealable plastic bag and allowing it to equilibrate for approximately 15 minutes. The FID and PID measurement will be taken by inserting the probe tip into the sealed bag and recording the stabilized reading. The portable GC measurements will be obtained by placing a small soil sample (10 to 20 grams) in a preweighed vial filled approximately halfway with water. After shaking the vial to disaggregate the soil sample, the vial will be placed in a constant-temperature water bath. Measurements will be obtained by direct injection of headspace vapor into the GC (U.S. EPA Method 3810). Specific procedures for obtaining field screening measurements are described in CLEAN II Standard Operating Procedure (SOP) 3.

5.3 MOBILE LABORATORY ANALYSES

A mobile laboratory will be used to provide real-time analytical results for groundwater, soil, and soil gas samples.

5.3.1 Volatile Organic Compounds – GC or GC/MS

All soil samples collected will be field-screened with a portable PID, FID, and/or GC. Six of the soil samples will be sent to the on-site mobile laboratory. The on-site mobile laboratory will analyze the samples for VOCs using a GC or gas chromatography/mass spectroscopy (GC/MS).

5.3.2 Fuel Hydrocarbons – GC

The Phase I RI identified high levels of fuel hydrocarbons beneath Agua Chinon and Bee Canyon Washes. All soil samples collected will be field-screened with a PID. Six of the soil samples will be sent to the on-site mobile laboratory. The on-site mobile laboratory will test for nonhalogenated volatiles and petroleum hydrocarbons as gasoline and diesel with a GC.

5.3.3 Semivolatile Organics – GC/MS

Several fuel and oil products, as well as burned by products, are included in the GC/MS analysis. Several SVOCs have been identified as COPCs in soil samples during Phase I investigations.

All soil samples collected will be field screened with a PID or an FID in the field. Six samples with detectable concentrations of TPH-diesel will be sent to the on-site mobile laboratory. The on-site mobile laboratory will test for SVOCs with GC/MS.

5.4 FIXED-BASE ANALYTICAL LABORATORY TESTS

During a meeting on 6 June 1995, the Base Realignment and Closure (BRAC) Cleanup Team (BCT) agreed that six soil samples will be collected from Site 25 and will be analyzed by a NFESC-approved laboratory for confirmation (BNI 1995c). Two-thirds of the confirmation samples will be selected from detections and one-third from nondetects. The analytical tests methods for NFESC confirmation analyses are described below. Surface waters and sediment will be submitted directly to the fixed-base laboratory.

5.4.1 Metals (Title 26 Metals) – U.S. EPA Method 6010

All surface water and sediment samples collected will be sent to the NFESC laboratory for analyses.

5.4.2 Pesticides and Polychlorinated Biphenyls – U.S. EPA Method 8080

All surface water and sediment samples collected will be sent to the NFESC laboratory for analyses.

5.4.3 Volatile Organic Compounds – U.S. EPA Methods 8010/8240

Of the soil samples collected and analyzed in the mobile laboratory for VOCs, six will be sent to the off-site laboratory for confirmation. Four of the samples with detectable concentrations and two with nondetectable concentrations will be sent to the NFESC laboratory for confirmation.

5.4.4 Semivolatile Organic Compounds – U.S. EPA Method 8270

Of the soil samples collected and analyzed in the mobile laboratory for SVOCs, six will be sent to the off-site laboratory for confirmation. Four of the samples with detectable concentrations and two with nondetectable concentrations will be sent to the NFESC laboratory for confirmation. All collected surface water samples will be sent to the NFESC laboratory for confirmatory analyses of SVOCs.

5.4.5 Fuel Hydrocarbons – U.S. EPA Method 8015

Of the soil samples collected and analyzed in the mobile laboratory for fuel hydrocarbons, six will be sent to the off-site laboratory for confirmation sampling. Four of the samples with detectable concentrations and two with nondetectable concentrations will be sent to the NFESC laboratory for confirmation. All collected surface water samples will be sent to the NFESC laboratory for confirmatory analyses of fuel hydrocarbons.

5.4.6 Chlorinated Herbicides – U.S. EPA Method 8150

All surface water samples collected will be sent to the NFESC laboratory for chlorinated herbicides analyses.

5.4.7 General Minerals/Chemistry

Although the general minerals/chemistry analysis provides information necessary for remedial design and the ecological risk assessment, samples analyzed for the constituents and parameters included in this method may yield higher than acceptable results due to natural processes. Several constituents and parameters included in this analysis were identified as COPCs during the Phase I investigations.

All collected surface water samples will be sent to the NFESC laboratory for general minerals/chemistry analysis. Surface water will also be analyzed for cyanide.

5.5 SUMMARY OF TESTS

Site 25 sampling and analysis is summarized by sampling media in Tables X4-1, X4-2, and X4-3.

Section 6
FIELD METHODS AND PROCEDURES

This section presents site-specific field methods that will be used to collect samples and other field data. The field methods referenced in this section are referenced to Sections 5 and 6 of the FSP and the CLEAN II SOPs that discuss specific field methods and procedures.

6.1 SURFACE WATER SAMPLES

Surface-water sampling will occur only after a rain, when there is stream flow. Sample locations for the Phase II RI will be the same as for the Phase I RI (Map X3-2). Sampling will occur during the first storm event, if possible. Because this flow is short-lived, surface-water sampling must be preplanned, and other work may stop during the period of sampling. Depending on the number of stations, more than one team may be assembled. Members of each team will be assigned prior to the need for sampling. Dedicated supplies will be stored at the field administration office and will not be used for other sampling efforts.

Suites of sample bottles will be preassembled. No preservatives will be used for metals until samples have been filtered (if metals samples cannot be field-filtered, any existing preservative will be thoroughly rinsed from the sample container before it is filled). Samples for metals analysis may be field-filtered or marked for filtration in the laboratory. The metals sample bottle will be marked to indicate whether sample has been filtered.

To avoid introduction of downstream contaminants during sampling, surface water sampling will progress from the farthest downstream sampling point to the farthest upstream sampling point. For stream flows less than 2 feet deep, a sample dipper will be used to collect surface water samples. For larger flows, a multivertical, depth-integrated sampler will be used. The sample dipper or depth-integrated sampler will be submerged as close as possible to the center of the flow; however, safety is a more important consideration than exact sample location. A Teflon™ churn splitter will be used to subsample composite samples obtained with the depth-integrated sampler. The water in the collection container will be used to fill the sampling bottles.

The procedure for surface water sampling will be as follows: select the appropriate bottles as per Section 6 of the FSP, and confirm that a Teflon™ liner is present in the cap, if required. Submerge the vial with the mouth of the container upstream, and fill slowly and continuously with a minimum entry turbulence. Record pH, conductance, and temperature information in the logbook and complete the chain-of-custody form. A photograph of the sample location should be taken, if possible. If a photograph is not possible, a sketch or description of the sampling location should be made in the field logbook.

Following collection of the water-quality sample, the surface water flow velocity and volumetric flow rate at the sampling point will be estimated. Velocity is normally the highest in the center of the flow and in the deeper parts of the channel.

A float will be dropped at the upper end of a predetermined distance. The number of seconds required for the float to travel the distance will be noted. This procedure will be conducted three times with the float placed in the middle and near each of the two banks. The velocity will be calculated for each float by dividing the distance by the time (feet per second). The value will then be averaged.

The width of the cross section will be measured or estimated visually. The depth of water at three or more points along the cross section will be determined by measurement or estimation.

The cross-sectional area will be calculated by averaging the water depths and multiplying that value times the width of the channel (square feet). The volume of flow will be determined by multiplying the velocity by the cross-sectional area by 70 percent to obtain flow in cubic feet per second. (Note: Average surface water velocity is typically 70 percent of the surface velocity.)

6.2 SEDIMENT SAMPLES

Sediment samples will be collected at upstream and downstream locations in Marshburn Channel (Map X3-2). Sediment sampling includes the collection of samples up to 6 inches bgs. Special care must be taken in areas where samples will be collected so the staking and setup operations do not contribute to contamination. Prior to use, the trowel and other sampling equipment must be decontaminated (FSP Section 6), and if transported, wrapped in plastic while en route to sampling locations.

If necessary, surface debris, grass, and vegetation will be cleared from the sampling location using a decontaminated shovel. Spray paint or any other marking materials will be removed prior to sampling.

Depending on the soil integrity, either a hand trowel or a hand auger will be used to collect the sample. Part of the collected sample will be directly transferred to the sample jar and placed into the sample cooler. The other part of the sample will be placed in a plastic bag for field determination of vapor in the headspace.

The surface indentation that is left from the sampling event will be leveled off to the surrounding material prior to leaving the site so it is not a safety hazard. A marked stake will be left at the site for the surveyors (FSP Section 6).

The sample label and chain-of-custody record will be completed (FSP Section 6). In addition, information on the site and sample identification number, location and depth, soil classification under Unified Soils Classification System (USCS), field organic vapor value, and any deviation from described sampling procedures will be noted in the field logbook.

6.3 SUBSURFACE SOIL SAMPLES

Hollow-stem auger drilling will be used to collect soil samples near Bee Canyon and Agua Chinon Washes (Map X3-2). On the Station, hollow-stem auger drilling has been used for borings to a depth of 180 feet.

Utility clearance must be obtained as described in FSP Section 6. All equipment will be steam-cleaned (FSP Section 6) prior to moving to the drilling location. The orientation of the drilling rig and supporting equipment shall be determined jointly by the drilling subcontractor and the health and safety coordinator. Plastic sheeting will be laid over the area of work in the exclusion zone, and the drilling rig will be set on the plastic sheeting. Unless otherwise indicated by the Site Manager, an initial hole will be hand augered to a depth of 5 feet.

Soil samples will be collected at minimum 5-foot intervals. A modified California split-spoon sampler will be decontaminated (FSP Section 6) and fitted with decontaminated stainless-steel or brass sleeves. Four to six sleeves will be used. The sampler will be lowered to the bottom of the hole and driven into undisturbed soil with the hammer.

The number of blows per 6-inch depth will be recorded for each sampling run. The sampler will be retrieved and opened and the sampling sleeves will be numbered from the top. If there is sloughed material in the hole, or if the sample does not appear to be representative of undisturbed samples, all sleeves of material will be discarded and a second sampling assembly will be used to repeat the process.

Soil from the lower sleeve will be described using the USCS as detailed in SOP 3 and FSP Section 6. The soil will be emptied into a plastic bag and field-screened for VOCs, as described in FSP Section 5. The next lowest (second from the bottom) sleeve will be marked for laboratory analyses (FSP Section 5). The third sample from the bottom may be used for confirmation analyses.

Soil samples that are taken for laboratory analysis will have Teflon™ sheeting placed over each end of the sleeve and a plastic cap placed over the Teflon™. The caps will be fastened and wrapped with silicon tape around the sleeve. Sealed sleeves will be put in a sealed plastic bag and placed in the sample cooler.

The sample label and chain-of-custody record will be completed (FSP Section 6). Information on the boring log and in the field logbook will include sample number, chain-of-custody identification number, site identification and location, depth, USCS soil classification, field organic vapor values, and any modification of the above procedures.

After total depth is reached and the final sample is collected, the boring will be backfilled (FSP Section 6), or a SVE well will be constructed (FSP Section 6). After the above operations are completed, the drilling rig and ancillary equipment will be removed and decontaminated following the procedures described in FSP Section 6. Drilling waste will be disposed as described in FSP Section 6.

Subsurface soil sampling is described in FSP Section 6 and in CLEAN II SOP 4.

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Section 7
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