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CONTAMINATION ASSESSMENT/ REMEDIAL ACTIVITIES INVESTIGATION NORTH CHEVALIER DISPOSAL AREA (SITE 11) NAVAL AIR STATION PENSACOLA PENSACOLA, FLORIDA

INTERIM DATA REPORT VOLUME I

October 1991

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contamination exists in the east portion of Site 11. Detected contamination, other than radiation contamination, is clearly associated with past industrial waste disposal and burning and landfilling activities at Site 11. These sources of contamination, other than radiation contamination, are likely impacting the south arm of Bayou Grande.

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RECORD OF DOCUMENT CHANGES

Revisions to this document were made based on comments received from the U.S. Environmental Protection Agency, Florida Department of Environmental Regulation, Florida Department of Natural Resources, and National Oceanic and Atmospheric Administration. All revisions are in bold and enclosed in brackets to denote changes to the last version of this document.

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EXECUTIVE SUMMARY

As part of the U.S. Navy's Installation Restoration Program, Phase I of the Contamination Assessment/Remedial Activities Investigation vas conducted for the North Chevalier Disposal Area (Site 11), located on the Naval Air Station in Pensacola, Florida. This work vas performed by Ecology and Environment, Inc., (E & E) under contract to the U.S. Navy, Southern Division, Naval Facilities Engineering Command.

Site 11 occupies an approximately 18-acre area adjacent to an arm of Bayou Grande north of Chevalier Field. At the center of the site are two large, pre-fabricated buildings (buildings 3627 and 3628); Building 3445 is located on the southwestern corner of the site. The area around buildings 3627 and 3628 is paved with asphalt. A new paved road runs north-south through the site. Previous activities at Site 11 that may have resulted in potential source areas include landfilling and disposal and burning of industrial wastes in the central and northeast portions of the site and possibly aircraft salvage or maintenance in the southwest portion.

The purpose of the Phase I investigation vas to identify principal areas and primary contaminants of concern at the site and to provide recommendations for subsequent phases of investigation. The Phase I fieldwork included a site reconnaissance, habitat/biota survey, surface emissions survey and air particulate sampling, asbestos survey, radiation survey, geophysical survey, utilities survey, the collection and analysis of soil and groundwater samples, and a hydrologic assessment.

Soil and groundwater contamination are present on and in the vicinity of Site 11. The combined results of E & E's Phase I investigation and Geraghty and Hiller's (G & M's) 1984 and 1986 investigations indicate that Site 11 contamination is generally

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widespread. Metals (chromium, zinc, lead, copper, and arsenic), total recoverable petroleum hydrocarbons (TRPHs), volatile organic coupounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), urd phenols are the primary contaminants. Polychlorinated biphenyls (PCBs) are present below detection limits in one or more soil, groundwater, and sediment (Site 30) samples collected on or in the vicinity of Site 11. A potential source of radiation contamination exists in the east portion of Site 11 (approximately 50 feet east of Building 3628), where an elevated radiation reading of 40 to 45 µR/h was obtained during the radiation survey. However, the nature of the source material and the extent of the contamination are unknown.

Detected contamination, other than radiation contamination, is clearly associated vith past activities 8t Site 11 including industrial waste disposal and burning and landfilling. These sources of contamination, other than radiation contamination, are likely impacting the south arm of bayou Grande, as the results of Site 30 Phase I sediment and surface water sampling indicate.

Elevated levels of metals (including arsenic and lead), TRPHs, several VOCs, PAHs, and phenols were detected in on-site soil sample8 over a large area of the site. Metals contamination of unsaturated-tone soils is nearly ubiquitous at Site 11 south of buildings 3627 and 3628. The combined TRPH, PAH, and phenol contamination of soils in the unsaturated zone exists over the entire site, except in the extreme north portion and in the area of soil borings B007, B008, and B009. Soil contamination detected at Site 11 may be a result of past on-site activities, including industrial waste disposal and burning and landfilling. It is also apparent that Bayou Grande has been impacted by Site 11 soil contamination--sediment samples collected during the corresponding Phase I investigation of Site 30 exhibited elevated levels of metals, TRPHs, PAHs, and phenols.

Metals concentrations, exceeding either the respective Florida Primary Drinking Water Standards or Florida Groundwater Guidance Concentrations, *are* widespread in Site 11 groundvater samples; this widespread occurrence probably partially reflects that turbid temporary well groundwater samples were not filtered prior to acid preservation. However, the distribution of elevated total lead, chromium, zinc, and

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copper concentrations in Site 11 groundwater samples suggests that the central and south areas of the site, near buildings 3627 and 3628, and 3445, respectively, represent at least sources of metals contamination in the aquifer matrix sediments, if not also a source of actual groundwater contamination. Site 11 groundwater metals Contamination is clearly impacting Bayou Grande--surface water samples collected during the corresponding Phase I investigation of Site 30 exhibited arsenic, chromium, and zinc at levels exceeding Florida water quality standards.

Widespread TRPH contamination of groundwater in the central and south portions of the site, VOC contamination in the northeast and south portions of the site (and at different depths within the Sand-and-Gravel Aquifer), and PAH and phenol contamination in the northeast portion of the site are probably attributable to on-site sources. It is possible that some VOC, PAH, and phenol contamination in the extreme south and southeast portions of Site 11 may also represent potential off-site sources impacting Site 11 and Bayou Grande.

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1. INTRODUCTION

This Interim Data Report presents the findings of the Phase I investigation activities performed for the North Chevalier Disposal Area (Site 11), located at the Naval Air Station (NAS) in Pensacola, Escambia County, Florida. This report has been prepared by Ecology and Environment, Inc., (E & E) for the Southern Division, U.S. Navy, Naval Facilities Engineering Command, under Contract No. N62467-88-C-0200. The information presented in this report is based on information and file documents provided by the Navy and on information gathered during the Phase I fieldwork conducted on the site from October 1990 to February 1991. The investigation vas conducted in accordance vith the administrative documents prepared by E & E for this project, which include the [June 1990] Project Management Plan, [June 1990] Site Management Plan, [July 1990] Generic Quality Assurance Project Plan (GQAPP), [July 1990] General Health and Safety Plan, and [June 1990] Contamination Assessment/Remedial Activities Investigation Vork Plan--Group B with appended Site-Specific Health and Safety Plan and Site-Specific Quality Assurance Plan. [All references to these documents in this report apply only to the 1990 versions.]

Site 11 occupies an approximately 18-acre area adjacent to an arm of Bayou Grande north of Chevalier Field (see figures 1-1 and 1-2). At the center of the site are two large, pre-fabricated buildings (buildings 3627 and 3628); Building 3445 is located on the southwestern corner of the site. The area around buildings 3627 and 3628 is paved with asphalt. A new paved road runs north-south through the site. Previous activities at Site 11 that may have resulted in potential source areas include landfilling and disposal and burning of industrial wastes in the central and northeast portions of the site and possibly aircraft salvage or maintenance in the southwest portion.

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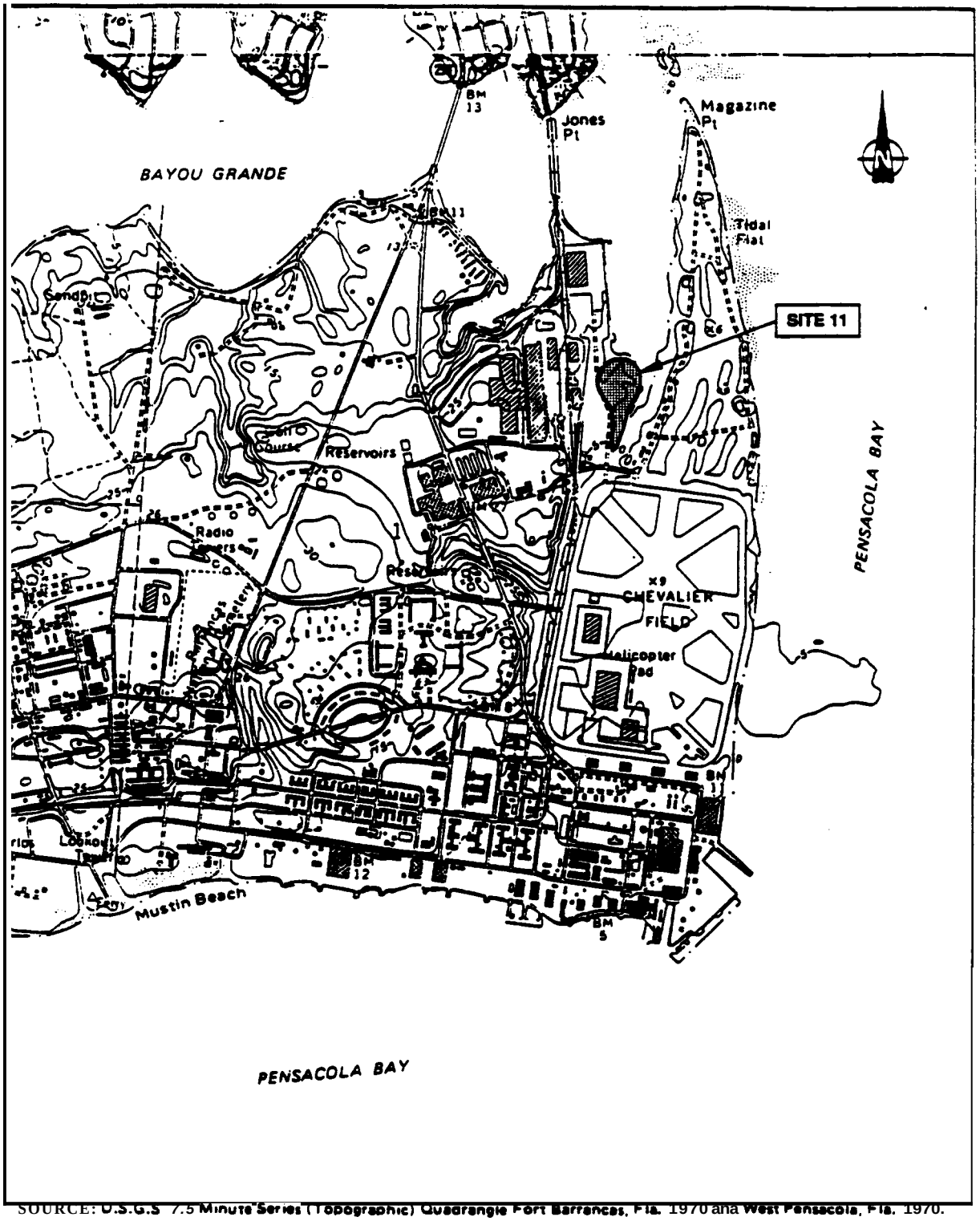
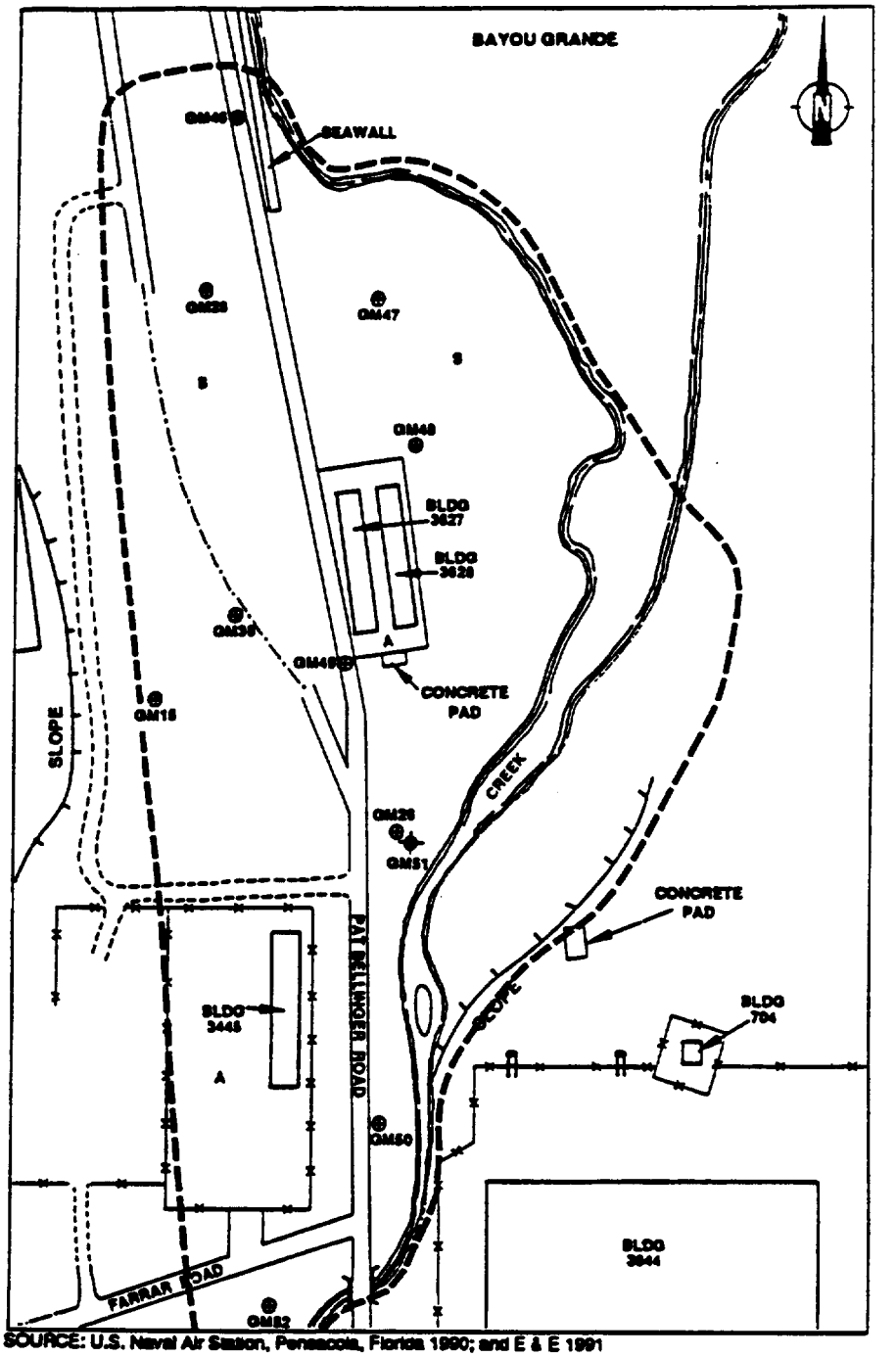


SOURCE: U.S.G.S 7.5 Minute Series (Topographic) Quadrangle Fort Barrancas, Fla. 1970 and West Pensacola, Fla. 1970. photorevised 1987.

SCALE

0 ½ 1 MILE

Figure 1-1 LOCATION MAP — NAS PENSACOLA SITE 11



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE 0 200 400 FEET

KEY:

	Unmaintained Road	A	Asphalt Paved Area		Fence
	Abandoned Road	S	Sand		Existing Permanent Shallow Monitoring Well
BLDG 3660	Building		Outfall Pipe		Existing Permanent Deep Monitoring Well
					Approximate Site Boundary

Figure 1-2 SITE VICINITY MAP — NAS PENSACOLA SITE 11

recommendations for subsequent phases of investigation. The Phase I fieldvork included a site reconnaissance, habitat/biota survey, surface emissions survey and air particulate sampling, asbestos survey, radiation survey, geophysical survey, utilities survey, and the collection and analysis of soil and groundvater samples. In addition, a hydrologic assessment performed at the site included the determination 'of groundvater and surface vater elevations, groundvater flow direction and hydraulic gradient, and surface vater flov rates. The recommendations for additional work at this site are presented vith this submittal under separate cover.

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2. INVESTIGATION METHODOLOGY

2.1 AERIAL PHOTOGRAPH AND EXISTING DATA ANALYSIS

Prior to the initiation of fieldwork, E & E personnel examined all available aerial photographs of NAS Pensacola for past and present conditions, features, and developments that might have had direct relevance to the fieldwork methodology. The aerial photograph analysis task involved assembling and stereoscopically analyzing historical photographic imagery and topographic maps available for the site area. Photographs were scaled to allow analysis of past and present surface conditions, drainage, and land use. The aerial photographs used in the analysis are listed in Table 2-1. The photographs were analyzed to obtain information regarding the evolution of site features that might have affected hydrologic conditions and to aid in the performance of such tasks as field reconnaissance and monitoring well placement.

2.2 SITE RECONNAISSANCE

A field reconnaissance survey was conducted on and around the site. Available aerial photographs and maps were used as guides in locating surface features. Visual inspections were made of surface conditions, vegetation, surface drainage patterns, areas of exposed site debris, and leachate seeps. These observations of surface conditions on the site were used to update the site map. During the reconnaissance survey, the field team identified areas which presented the most suitable conditions for the establishment of survey grid baselines. The use of a grid system as part of the Phase I field investigation is discussed in the following sections.

The reconnaissance survey team utilized radiation and air monitoring equipment during walkovers of site areas, in accordance with

Table 2-1

PHOTOGRAPHS AND MAPS USED IN THE AERIAL PHOTOGRAPH ANALYSIS
NAS PENSACOLA SITE 11

Source	Photograph/Map Number	Date	Scale
NAS Pensacola Public Works Department	1276833	2/5/90	1:2,400
	1276835	2/5/90	1:2,400
	1276836	5/22/86	1:2,400
	1276912		1:2,400
Florida Department of Transportation	FD-3886-12-03	10/26/89	1:24,000
	FD-3886-12-04	10/26/89	1:24,000
	FD-3618-12-03	11/21/86	1:24,000
	FD-3618-12-04	11/21/06	1:24,000
	FD-3109-12-03	9/22/03	1:24,000
	FD-3109-12-04	9/22/03	1:24,000
	FD-2684-12B-04	3/9/81	1:24,000
	FD-2684-12B-05	3/9/81	1:24,000
	FD-1888-11-03	4/28/76	1:24,000
	FD-1888-11-04	4/28/76	1:24,000
	FD-1331-11-03	5/4/73	1:24,000
	FD-1331-11-04	5/4/73	1:24,000
	FD-868-5-08	4/6/70	1:24,000
	FD-868-4-09	4/6/70	1:24,000
	FD-616-8-03	3/25/68	1:24,000
	FD-616-8-04	3/25/88	1:24,000
	FD-285-8-01	10/8/64	1:12,000
	FD-285-8-03	10/8/64	1:12,000
	PHS-7054-3-1	10/12/61	1:24,000
	PHS-7054-3-2	10/12/61	1:24,000
U.S. Department of Agriculture	CPF-1V-78	1/3/58	1:24,000
	CPF-4H-17	1/22/51	1:24,000
West Florida Regional Planning Council	FD-3618-12-03	11/21/86	1:4,800

14[NASP]UH6027:T0227/327/23

Source: Ecology and Environment, Inc., 1991.

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Section 6.1.1 of the GQAPP. Area "hot spots" were located, flagged, and identified on a site map for future reference. All findings of the physical reconnaissance were mapped in detail and recorded in the field logbook.

2.3 HABITAT/BIOTA SURVEY

A habitat/biota survey was conducted for the site, as well as an evaluation of applicable literature pertaining to NAS Pensacola. During the physical reconnaissance, an E & E biologist/ecologist determined the on-site terrestrial and aquatic habitats and the surrounding habitats that could be affected by off-site contaminant migration. During the walkover survey, rare, threatened, and endangered species and their potential habitats were identified, and general site conditions were evaluated regarding the site's ability to support viable populations of plants and animals.

2.4 ASBESTOS SURVEY

An asbestos survey was conducted on site during the habitat/biota survey. This survey consisted of [visually] locating and identifying suspect building materials [(i.e., insulation, shingles, tiles)] that could potentially contain asbestos. Samples were collected for analysis in areas where suspect materials were identified.

2.5 SURFACE EMISSIONS SURVEY AND PARTICULATE AIR SAMPLING

Following the establishment of the survey grid network (discussed in Section 2.7), a surface emissions survey was conducted using organic vapor analyzer (OVA) air monitoring equipment. The survey was conducted in accordance with Section 6.1.1 of the GOAPP. Measurements were made at each established grid point, and readings were recorded in the field logbook. In addition, preliminary air screening was conducted with a particulate monitor to determine if the site represents a source of particulates in the air. The air sampling was conducted in accordance with Section 6.1.[1] of the GOAPP.

26 RADIATION SURVEY

Polloving the establishment of the survey grid network (discussed in Section 2.7), a radiation survey vas conducted using a Bicron micro-R-meter. The survey vas conducted in accordance vith Section 6.3.[6] of the GQAPP. Measurements vere made at each established grid point, and readings vere recorded in the field logbook.

2.7 GEOPHYSICAL SURVEY

Metal detector, magnetometer, and electromagnetic terrain conductivity surveys were conducted 8t Site 11 and surrounding local areas. The metal detector *survey* vas conducted using a standard, portable metal detector/pipe locator; the magnetometer survey was conducted using a Geometrics G-856AX proton precession magnetometer, which measures the earth's total magnetic field near the surface in units of gammas. The electromagnetic terrain conductivity surveys were conducted using the EX-31 and EM-34 Geonics, Ltd., instruments. (The electromagnetic surveys are discussed in this report as the EM-31 and Bn-34 surveys.)

The EX-31 conductivity instrument measures the apparent terrain conductivity allowing quick screening for changes in conductivity potentially associated vith buried utilities or changes in soil conditions due to lithology, vater content, or leachate plumes, if present. The EM-31 has a fixed intercoil spacing of 12.1 feet which yields an effective exploration depth of approximately 19.7 feet. Operation of the En-31 in the horizontal dipole (shallov) mode yields an effective exploration depth of approximately 9.8 feet. Operation of the EM-34 in the horizontal dipole (shallov) made at intercoil spacings of 10 and 20 meters (32.8 and 65.6 feet, respectively) results in exploration depths of 24.6 feet and 49.2 feet.

The survey effort required the initial establishment of a grid system over the study area. To construct the grid, the site vas subdivided into two subsections (grids A and B) so that subgrid baselines could be established along existing roadways. Each subsection vas then gridded with spacings based on 100-foot centers. Baseline transects were established using a transit survey instrument and flagged at 50-foot intervals. Each grid system vas completed relative to an

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arbitrarily established origin point using a Brunton compass and tape measure. Grid points were flagged and numbered as follows:

Grid X, N (or S) n_1 + yy, E (or W) n_2 + zz,

where:

X = Grid letter;

n_1 = Distance in 100-foot increments north (N) or south (S) from the origin point;

n_2 = Distance in 100-foot increments east (E) or west (W) from the origin point;

yy = Additional distance in feet north or south from the nearest previously located 100-foot increment from the grid origin; and

zz = Additional distance in feet east or west from the nearest previously located 100-foot increment from the grid origin.

In the case of grid points located at even 100-foot increments from the origin, yy and zz = 00. Figure 2-1 shows the location of the two survey grids and origin points established on Site 11.

The geophysical survey was performed in accordance with field methodologies and data interpretation techniques discussed in Section 6.2.1 of the GQAPP, except during performance of the EM-34 surveys, readings were recorded at intercoil spacings of 10 and 20 meters, rather than the 10- , 20- , and 40-meter spacings specified in the GQAPP.

The EM-31 and magnetometer surveys vere conducted by obtaining measurements at 25-foot intervals with respect to the flagged locations. En-34 readings were obtained at each SO-foot interval grid point location. The geophysical data were used in conjunction with other background data to identify: the location and lateral extent of potential, buried debris and landfilling activities on site; and the potential location of subsurface contaminant plumes and leachate streams.

2.8 UTILITIES SURVEY

Prior to conducting any augering, boring, or drilling, E & E located all underground cables, pipes, utilities, and other subsurface

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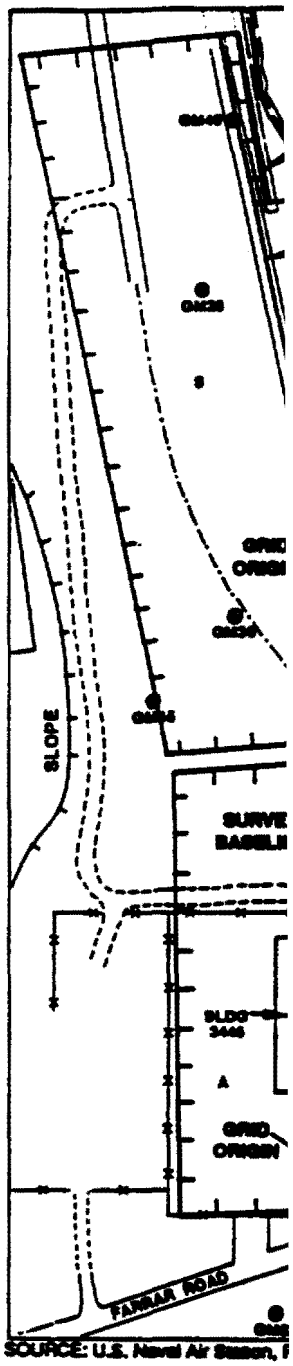

KEY:

	Unmaintained Road	A	Asphalt Paved Area		Existing Permanent Shallow Monitoring Well
	Abandoned Road	S	Sand		Existing Permanent Deep Monitoring Well
BLDG 684	Building		Outfall Pipe		Survey Grid Boundary
	Fence				

Figure 2-1 SURVEY GRID *MAP* — NAS PENSACOLA SITE 11

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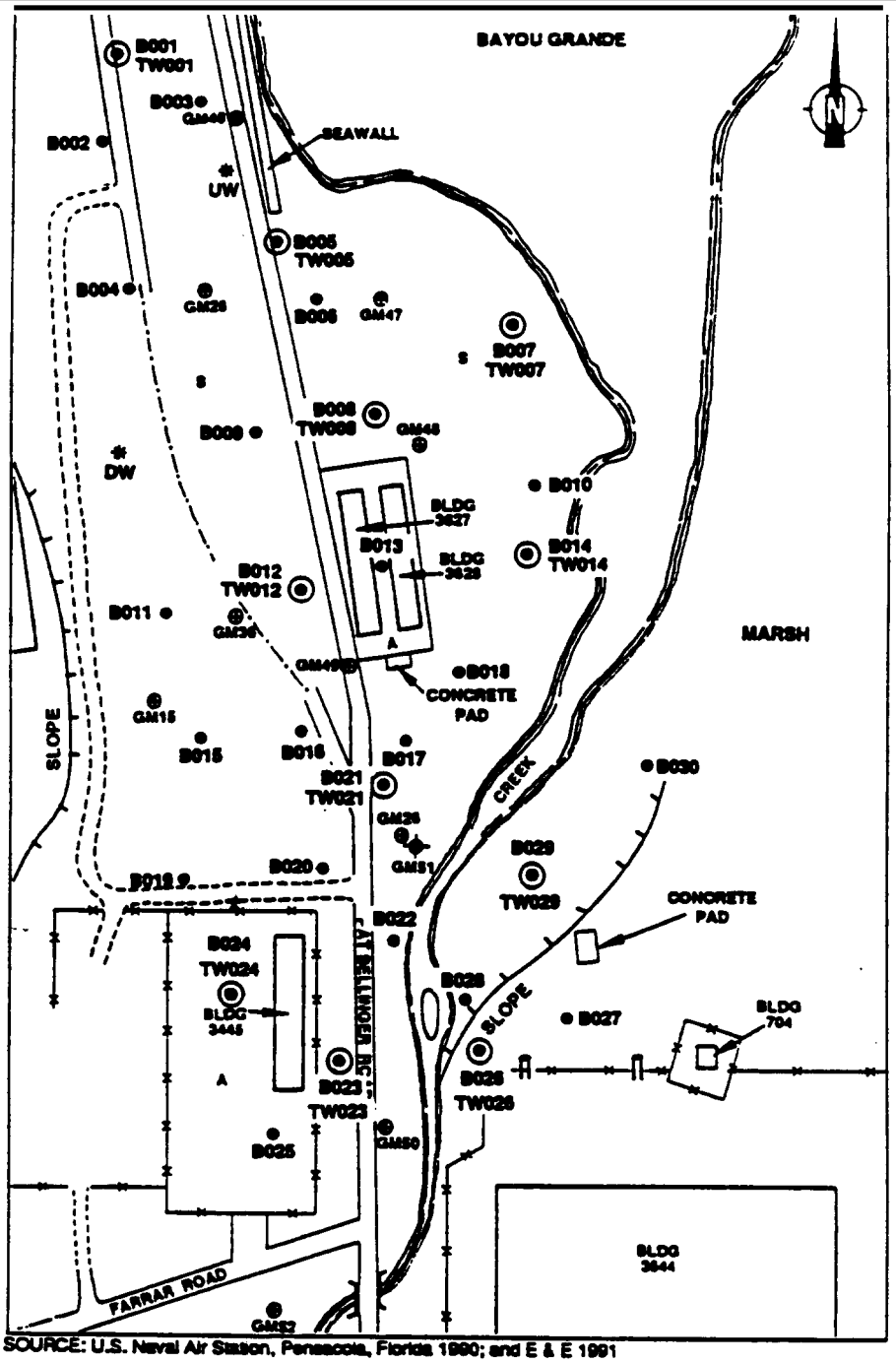
features that could potentially be damaged, create a safety hazard, or otherwise hinder fieldwork. The appropriate authorities (e.g., NAS Pensacola Public Works and Southern Bell) were contacted to identify the location of all underground utilities in the site area. In addition, E & E examined available maps and documents and conducted a metal detector survey to determine the presence of any other potentially hazardous subsurface features on site. The locations of all underground utilities and other obstructing features were marked with surveyor flags, fluorescent paint, or by other methods, as appropriate.

2.9 DATA ANALYSIS

Information obtained from the results of the above-described physical surveys was given primary consideration in the development of placement strategies for the Phase I soil borings and temporary monitoring wells. Prior to establishing the Phase I temporary monitoring well locations or other sampling points, the results of the aerial photograph analysis, site reconnaissance, surface emissions survey and air particulate sampling, radiation survey, geophysical survey, and utilities survey were evaluated to identify areas of potential surface or subsurface contamination, leachate seeps or streams, areas of stressed vegetation, and boundaries of landfilled areas. Some of the proposed Phase I soil boring and temporary monitoring well locations, shown on Figure 14-2 of the work plan, were revised as appropriate upon approval by Southern Division (see Figure 2-2).

2.10 SOIL BORINGS AND TEMPORARY MONITORING WELL INSTALLATION

Thirty soil borings were completed at Site 11 (see Figure 2-2). At each boring location, samples were collected by compositing soils over 5-foot depth intervals from land surface to the water table. Each 5-foot depth interval was assigned a letter designation as follows: A interval = surface to 5 feet below land surface (BLS); B interval = 5 to 10 feet BLS; C interval = 10 to 15 feet BLS; and so on to the water table. Samples were collected using either hand-operated bucket augers or solid-stem augers powered by a drill rig. Lithologic characteristics of the materials encountered in each borehole were recorded in the field



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE
0 200 400 FEET

KEY:

Unmaintained Road	A	Asphalt Paved Area	DW/UW	Downwind/Upwind
Abandoned Road	S	Sand	●	Soil Boring
BLDG 662 Building	⊕	Existing Permanent Shallow Monitoring Well	B005	Soil Boring Number
Fence	⊕	Existing Permanent Deep Monitoring Well	○	Temporary Monitoring Well
Outfall Pipe	*	Particulate Air Sampling Location	TW005	Temporary Monitoring Well Number

Figure 2-2 PARTICULATE AIR SAMPLING, SOIL BORING, AND TEMPORARY MONITORING WELL LOCATIONS — NAS PENSACOLA SITE 11

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logbook. All sampling, compositing, and lithologic logging activities were performed in accordance with Section 6.6 of the GOAPP. Equipment decontamination was performed in accordance with Section 6.10 of the GOAPP.

Temporary, stainless steel monitoring wells were installed in 11 of the 30 borings (see Figure 2-2). Each well was constructed with 5 feet of 0.01-inch slotted screen, and installed to a depth that allowed the well screen to bracket the water table. The wells were installed using either hand-operated bucket augers or solid-stem augers powered by a drill rig. Lithologic characteristics of materials encountered during installation of the wells were recorded in the field logbook. All equipment decontamination activities were performed in accordance with Section 6.10 of the GQAPP.

2.11 SOIL SAMPLING

Thirty-eight soil samples, plus two duplicate samples, were collected as described in Section 2.10 (see Figure 2-2). All soil samples were shipped to E & E's Analytical Services Center (ASC) in Buffalo, New York, and analyzed for the screening parameters listed in Table 2-2.

2.12 GROUNDWATER SAMPLING

2.12.1 Temporary Monitoring Wells

Eleven groundwater samples, plus one duplicate sample, were collected from the 11 temporary monitoring wells shown on Figure 2-2. Weather conditions; water levels; purge volumes; and groundwater pH, specific conductance, and temperature measurements were recorded in the field logbook prior to sampling. In addition, prior to purging, each well was checked for the presence of floating and/or sinking immiscible hydrocarbons using an MMC International oil-water probe. Each groundwater sample was collected immediately following well purging. All well purging and sampling activities were performed in accordance vith sections 6.8 and 6.11 of the GOAPP. Equipment decontamination was performed in accordance with Section 6.10 of the GQAPP. All groundwater

Table 2-2

SAMPLING AND ANALYTICAL SUMMARY
NAS PENSACOLA SITE 11

Medium	No. of Samples	Duplicates	Total	Analytical Suite[a,b]
Soil	30	2	40	A
Groundwater[d]	11	1	12	A

Medium	No. of Samples	Duplicates	Trip Blanks[f]	Field Blanks	Rinsate Blanks	Preservative Blanks[g]	Total	Analytical Suite[a,c]
Groundwater[e]	9	1	2	1	1	1	15	B

[NASP]UN6027:T0227/318/10

Key:

[a]Analytical suite designations are as follows:

A = Volatile organic compounds (VOCs) including chlorobenzene, polynuclear aromatic hydrocarbons (PAHs), phenols, pesticides and total polychlorinated biphenyls (PCBs), total recoverable petroleum hydrocarbons (TRPHs), and metals (total, unfiltered).

B = Target Compound List (TCL) VOCs plus xylene and ketones (EPA 8240), TCL base/neutral and acid extractable organic compounds (BNAs; EPA 8270), TCL pesticides and PCBs (EPA 8080), TRPHs (EPA 418.1), [Target Analyte List (TAL)] metals (total [i.e., unfiltered] and dissolved [i.e., millipore-filtered]) (EPA 6010/7060/7421/7471/7740/7841), cyanide (EPA 9010), gross alpha (EPA 900), total organic carbon (EPA 415.1), hardness (water only) (EPA 130.2), and alkalinity (water only) (EPA 310.1).

[b]Specific constituents encompassed by the various chemical groups included within analytical suite A are identified in tables 9-1 through 9-4 of the GQAPP.

[c]Specific constituents encompassed by the various chemical groups included within analytical suite B are identified in tables 9-5 through 9-13 of the GQAPP.

[d]Groundwater samples and analyses shown are for temporary monitoring wells only.

[e]Groundwater samples and analyses shown are for existing permanent monitoring wells only.

[f]Trip blanks analyzed for TCL VOCs only.

[g]Preservative blanks analyzed for TCL VOCs, TRPHs, dissolved [TAL] metals, and cyanide.

Source: Ecology and Environment, Inc., 1991.

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[Bold items enclosed in brackets denote changes to the last version of document]

samples collected from the temporary monitoring wells were sent to E & E's ASC and analyzed for the screening parameters listed in Table 2-2.

2.12.2 Existing Permanent Monitoring Wells

Nine groundwater samples, plus one duplicate sample, were collected from nine of the eleven existing permanent monitoring wells located on or in close proximity to the site (see Figure 1-2). Two wells, GM46 and GM50, had damaged casings and could not be sampled. Weather conditions; water levels; purge volumes; and groundwater pH, specific conductance, and temperature measurements were recorded in the field logbook prior to sampling. Each groundwater sample was collected immediately following well purging. All well purging and sampling activities were performed in accordance with sections 6.8 and 6.11 of the GQAPP. Equipment decontamination was performed in accordance with Section 6.10 of the GQAPP. All groundwater samples collected from the existing wells were sent to E & E's ASC and analyzed according to U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) protocol for the [Target Analyte List (TAL),] Target Compound List (TCL), and other parameters.

2.13 HYDROLOGIC ASSESSMENT

The hydrologic assessment of the site and surrounding areas included determination of water level elevations in both the existing permanent monitoring wells and the temporary monitoring wells.

Wellhead top-of-casing (TOC) elevations for the temporary monitoring wells were measured relative to the top of a driven reference stake located adjacent to each well using a spirit level and tape measure. Following groundwater sampling and removal of the temporary monitoring wells, the elevations of the driven reference stakes were surveyed using a transit with reference to a previously established elevation at permanent monitoring well GM47.

Wellhead TOC elevations and static water levels measured in each existing permanent well were referenced directly to the established benchmark. Static water levels in the permanent monitoring wells were measured on February 26, 1991, over a 2-hour period. These water levels

vere used to determine the shallow aquifer water table elevation, shallow groundwater flow direction, and horizontal hydraulic gradient in the site vicinity.

In conjunction vith the wellhead survey, the elevations of other nearby features (e.g., ponds, streams, and leachate seeps) vere established. A staff gauge was placed in the creek (south of Bayou Grande and northvest of Chevalier Field) south of the site and monitored over the course of the field investigation activities. A rain gauge station was established at the sue location (see Figure 2-2).

2.14 FIELD QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

All field tasks performed during the investigation vere documented in the field logbooks according to the procedures specified in Section 7.2 of the GQAPP.

2.14.1 Field QA/QC Samples

Field QA/QC samples vere prepared for all samples collected at the site during the Phase I investigation according to the procedures described in Section 6.12 of the GQAPP. Chain-of-custody was maintained for all samples collected, packaged, and shipped to B & E's ASC for analysis. Sample management was performed as specified in Section 7 of the GQAPP. The field QA/QC sampler collected and the corresponding analytical parameters are listed in Table 2-2.

2.14.2 Decontamination Procedures

All equipment vved during field activities was decontaminated in accordance vith Section 6.10 of the GQAPP.

2.15 INVESTIGATION-DERIVED VASTE MANAGEMENT

Excess soil material generated during soil boring and temporary monitoring well installation activities was temporarily contained adjacent to the well or boring and then backfilled into the borehole after the auger flights or temporary well casings had been removed following sample collection. Any soil material remaining after completion of borehole backfilling was placed in 55-gallon drums,

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sealed, labeled, and moved to a central area on the site. Each drum has a painted-on label listing the site number and the type of material contained in the drum.

All water generated during purging of the existing permanent monitoring wells was placed in 55-gallon drums, sealed, labeled, and moved to a central area on the site. Each drum has a painted-on label listing the site number and the type of material contained in the drum.

All water generated during development and purging of the temporary monitoring wells was temporarily contained adjacent to the well and then poured back into the well following collection of samples.

Potentially contaminated clothing and disposable materials, wastes generated during decontamination activities, and other potentially contaminated, investigation-derived materials were placed in 55-gallon drums, sealed, labeled "trash", and moved to a central area on the site. All drummed investigation-derived materials were subsequently picked up and disposed of by NAS Pensacola.

3. RESULTS

3.1 AERIAL PHOTOGRAPH AND EXISTING DATA ANALYSIS

The review of aerial photographs from 1951 to 1989 indicated that activities and surface features on and in the vicinity of Site 11 varied during this period. Three buildings and a road were constructed on site; activities in the southwest portion of the site appeared to change; areas of the site were cleared and landfilled; and vegetation increased in the east portion of the site.

Review of the January 22, 1951, aerial photograph indicated that no large buildings were present on site. Eowever, several small structures, possibly storage sheds, containers, or aircraft fuselages, occupied an area in the southwest corner of the site. A paved road extended from Chevalier Field to an area south of the site where it is apparent aircraft were parked and maintained.

Given the number of objects located in the area that is currently (1991) within the fenced perimeter of Building 3445 (see Figure 1-2) and the existence of an unpaved road, a great deal of activity probably occurred in the area of Building 3445. On the 1951 photograph, the east half of this area appeared partially paved and possibly fenced. A large darkened area (approximately 60 by 150 feet), possibly a result of burning of industrial wastes, was present west of the pavement.

The remainder of Site 11 was generally covered with low vegetation; however, two areas appeared to have been cleared by surface grading possibly in conjunction with landfilling. These two areas include an area in the northwest portion of the site that appeared to have a graded, relatively flat, sandy surface, and the northeast portion of the site that appeared to have a graded or filled sandy surface which sloped gently into the south arm of Bayou Grande.

[Bold items enclosed in brackets denote changes to the last version of document]

A small area void of vegetation in the east-central area of the site did not appear graded, rather it appeared to fan out from a point and follov subtle topographic changes toward Bayou Grande. Hovever, it is unknown whether this feature resulted from erosion, landfilling, or possible spillage of industrial vaste materials on site.

Reviev of the 1951 photograph also indicated that the site surface was relatively flat, vith some depressed *areas* in the central portion and a gentle slope eastward toward the arm of Bayou Grande or southeastward tovard the creek that discharges into Bayou Grande.

Reviev of the January 3, 1958, aerial photograph indicated that storage or maintenance activity vas continuing in the southvest portion of the site. Aircraft vere apparent on this photograph in the southvest portion of the site, and a greater number of various structures vere apparent in this area than in the 1951 photograph. The area that appeared darkened in the 1951 photograph was no longer evident. However, three circular, dark objects vere observed in the location of the formerly darkened area. The nature of these object8 could not be discerned. Cleared avv in the east portion of the site appeared revegetated; areas in the northvest and north-central portions of the site appeared cleared and graded.

Reviev of the October 12, 1961, and October 8, 1964, aerial photographs indicated increased vegetation in the east portion of the site, along the south arm of Bayou Grande, and the addition of small sheds and vehicles in the southvest portion of the site. No aircraft vere observed in the southvest portion of the site on these aerial photographs.

Reviev of the March 25, 1968, and April 6, 1970, aerial photographs indicated that aircraft vere again located in the southvest portion of the site. This area also appeared completely paved and fenced. The cleared, graded area in the north portion of the site had been extended south (1968) and then east (1970). Therefore, most of the northeast portion of the site was void of vegetation. Small areas in the northvest portion of the site vere still lacking vegetation; it is unknown if these areas vere stressed. In addition, aircraft vere no longer located at Chevalier Field, which is south of and adjacent to Site 11, and the area north of the site vas used as a marina.

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Review of the Hay 4, 1973, aerial photograph indicated that Building 3445 had been constructed in the southwest portion of the site. Vegetation increased in the central and east portions of the site. The northwest area appeared to have been cleared by additional surface grading.

Review of the March 9, 1981, aerial photograph indicated that the area around Building 3445 had been repaved and vehicles and other structures removed. Similar vehicles and structures were observed in the central area of the site along the east side of the on-site road. The surface on the west side of this road appeared to have been extensively cleared and graded.

Review of the September 22, 1983, aerial photograph indicated that vehicles had been returned to the paved area around Building 3445. Hany site surface features remained the same as on the previous photograph (1981), except for increased vegetation in the formerly cleared areas of the site and the placement of several storage containers, or bins, along the east side of the on-site road. The contents of these containers could not be discerned.

Review of the November 21, 1986, aerial photograph indicated that a large area had been cleared in the east-central area of the site and construction had started on buildings 3627 and 3628. The east portion of the site along Bayou Grande appeared to be heavily vegetated; whereas, the area on the west side of the site was sparsely vegetated with a few trees and low-lying vegetation.

Review of the October 26, 1989, aerial photograph indicated that construction of buildings 3627 and 3628 in the central area of the site had been completed and the area around the buildings had been paved. Pat Bellinger Road had also been Constructed connecting with the older on-site road. The surface around the road appeared to be slightly elevated due to the new road construction, and it appeared that surface runoff, at least on the central area of the site, was directed toward the west, away from Pat Bellinger Road.

Based on the review of the aerial photographs, many areas of Site 11, including the area around Building 3445 and the northeast-central

area of the site (where extensive surface filling, grading, and possibly landfilling have occurred), could represent potential sources of environmental contamination.

32 SITE RECONNAISSANCE

During the site reconnaissance, visual inspections were conducted around buildings 3445, 3627, and 3628, and across the site. The east portion of the site is thickly covered vith trees and undergrovth. Along the east boundary of the site is a Juncus marsh which surrounds the south arm of Bayou Grande (see Figure 1-2).

The vest portion of the site is open, vith generally light tan, medium- to fine-grained, sandy soil. Within the past year, the northwest portion of the site has been covered vith numerous rand piles approximately 4 to 8 feet in height, and a portion of the older road located in this area has been removed or covered vith sand.

Two outfalls from Building 3644, located off site and adjacent to the Site 11 area and which were not apparent in the 1989 reconnaissance photograph, had recently been installed southeaat of the rite. Runoff from these outfalls is directed northvard via a concrete pad. A concrete drain pad is also located south of the asphalt pavement around buildings 3627 and 3628. Drainage appears to flov southeast into the Juncus marsh.

The area around Building 3445 is entirely asphalt paved and fenced and is used for the storage of numerous old surplus vehicles. Drainage from this asphalt pavement appears to flov multidirectionally; at least one drain pad is located off the southeast corner of the pavement.

In the northeast portion of the site a trash layer has been exposed where the surface is eroding into the south arm of Bayou Grande. Trash piles containing metallic debris were observed in the heavily vegetated area on the east portion of the site. Similar debris was observed in the north-central portion of the site. Construction debris and vires were observed in the west-central portion of the site.

3.3 HABITAT/BIOTA SURVEY

Several habitat types are evident at Site 11. The area vest of Pat Bellinger Road appeared to have been vetland prior to filling activities

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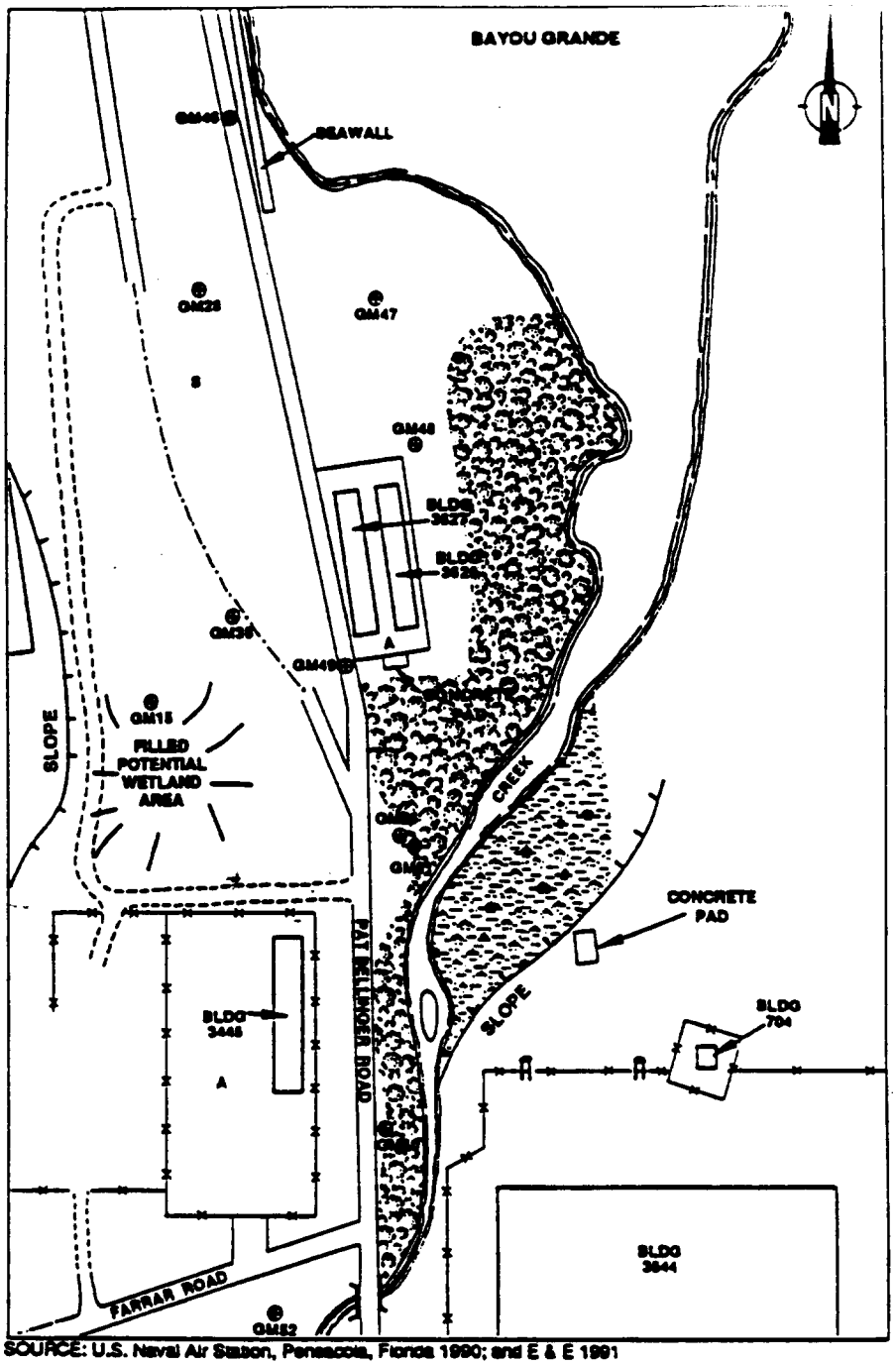
(see Figure 3-1). The existing dominant vegetation observed in this area include frog-fruit (Lippia nodiflora), rush fuirena (Fuirena scirpoidea), and purple mercardonia (Mercardonia acuminata), which are all wetland species. Scattered large willows are also present at this disturbed site, and smaller ones occur in the groundcover.

A forested wetland is present to the east of Pat Bellinger Road (see Figure 3-1). This area may be considered wetland under U.S. Army Corps of Engineers (COE) jurisdiction. Slash pine (Pinus elliottii) dominates the canopy of the northernmost portion of this area, with yaupon holly (Ilex vomitoria) and wax myrtle (Hyrica cerifera) in the subcanopy, and yaupon holly, inkberry (I. glabra), and sawgrass (Cladium jamaicense) in the groundcover. Moving southward, hardwoods begin to emerge as the dominant canopy flora, with laurel oak (O. laurifolia), black willow (Salix nigra), wax myrtle (H. cerifera), persimmon (Diospyros virginiana), and popcorn tree (Sapium sebiferum) in the canopy. The subcanopy is quite dense, with persimmon, yaupon holly, wax myrtle, and Carolina laurel cherry (Prunus caroliniana) as dominants. Groundcover species include Carolina laurel cherry, pepper vine (Ampelopsis arboreal, and muscadine (Vitis rotundifolia). This area is underlain by hydric soils, as identified from the Escambia County soil survey.

A marsh dominated by needlerush (Juncus romerianus), southern cattail (Typha domingensis), and goldenrod (Solidago sempervirens) is located at the boundary of Site 11 along the western side of the arm of Bayou Grande (see Figure 3-1). This wetland and the associated estuarine habitat are considered sensitive areas although the region has been historically disturbed.

Typical birds observed in the marshland (approximately 25 species) include herons, egrets, and teals (see Appendix A). Hardwood wetland areas provide habitat for approximately 10 identified species of birds, including yellow-bellied sapsucker, brown thrasher, and marsh wren.

Benthic coring in the marsh revealed no biota; hovever, wood, glass fragments, and other garbage were encountered. A trash layer, which included detritus from upland vegetation, was encountered 7 inches below the surface, and an oily sheen was observed in the seepage from the core boring.



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE
0 200 400 FEET

KEY:

Unmaintained Road		Outfall Pipe		Existing Permanent Deep Monitoring Well
Abandoned Road	A	Asphalt Paved Area		Emergent Marsh
Fence	S	Sand		Forested Wetland
		Existing Permanent Shallow Monitoring Well		

Figure 3-1 HABITAT/BIOTA MAP — NAS PENSACOLA SITE 11

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Live oysters were observed in the harbor area at the northeast perimeter .of the site. Hermit crabs and mussels were also observed around the Juncus in this area. No state or federally listed rare, threatened, or endangered species were identified on Site 11. In addition, no indication of stressed biota was observed.

3.4 ASBESTOS SURVEY

An asbestos survey of site wastes was conducted at Site 11 in conjunction with the habitat/biota survey. No materials containing asbestos were noted during the survey; however, one waste receptacle marked "for asbestos only" was observed with other waste receptacles in the southwest area of the site.

3.5 SURFACE EMISSIONS SURVEY AND PARTICULATE AIR MONITORING

An OVA was used to monitor surface emissions across the site. No measurements of organic vapors above background readings were observed during the surface emissions survey. Appendix B presents the results of the OVA surface emissions survey.

On November 14, 1990, a Mini-Ram particulate air monitoring device was used to determine if Site 11 represents a source of particulates in the air. During the test, the wind was blowing from the north-northeast at approximately 5 to 8 miles per hour (mph). The Mini-Ram was placed upwind at a location on Bellinger Road near permanent monitoring well GM-46 [(see Figure 2-2)). After 15 minutes, the time weighted average (TWA) of particulates was 0.04 milligrams per cubic meter (mg/m^3). The Mini-Ram was then placed directly downwind and approximately 400 feet southwest of the upwind station [(see Figure 2-2)]. After 15 minutes, the TVA was recorded as 0.06 mg/m^3. Based on these results (a difference in the two readings of 0.02 mg/m^3 during light winds), the central area of the site appears to be a potential source of low levels of particulates.

3.6 RADIATION SURVEY

A radiation survey was conducted at Site 11 [as described in Section 2.6 of this report.] Appendix B presents the results of the radiation survey. Background radiation levels [for gamma radiation at]

[Bold item enclosed in brackets denote changes to the last version of document]

NAS Pensacola are 2 to 3 microRoentgens per hour (µR/h). [Radiation levels ranged from background to 45 µR/h at Site 11.] Figure 3-2 shows that slightly-elevated, with respect to background, readings of 6 to 8 µR/h were observed along Pat Bellinger Road, the abandoned road in the northwest portion of the site, the unpaved road north of the Building 3445 compound, and in the area south of the concrete drainage pad from buildings 3627 and 3628. Localized readings of 10 µR/h and 15 µR/h were observed southeast of Building 3628 (see Figure 3-2). A localized reading of 40 µR/h was observed approximately 50 feet east of Building 3628 (see Figure 3-2). The readings of 6 to 8 µR/h along the roads do not indicate a significant radiation problem at Site 11. These levels, particularly along the older roads on the site, may be attributable to natural radioactivity of the [asphalt] road materials. It is unknown whether the readings obtained in the area south of buildings 3627 and 3628 or north of the Building 3445 complex are attributable to naturally radioactive materials. The isolated reading[s] of 40 µR/h [and 45 µR/h are] of some concern: [they] may represent a source of radiation contamination on Site 11.

3.7 GEOPHYSICAL SURVEY

The geophysical survey was conducted along a grid system (see Figure 2-1) in accordance with field methodologies discussed in Section 2.7 and also Section 6.2.1 of the GOAPP. Geophysical survey readings, grid coordinates, and field data are presented in appendices B, C, and D.

A metal detector survey was conducted at Site 11 to locate near-surface buried metal objects. All survey grid coordinates and metal detector survey data are presented in Appendix B. Metal was detected in several areas of the site as shown on Figure 3-3. Positive readings occurring in the vicinity of on-site buildings or near fencelines are primarily attributable to the metallic content of the buildings and fence, respectively. Many of the readings occurring in areas distant from Pat Bellinger Road and in the area east of Building 3628 appear to be attributable to surface and buried metal debris (see Figure 3-3).

The magnetometer survey was performed to locate buried metal objects possibly associated with past on-site activities. Figure 3-4

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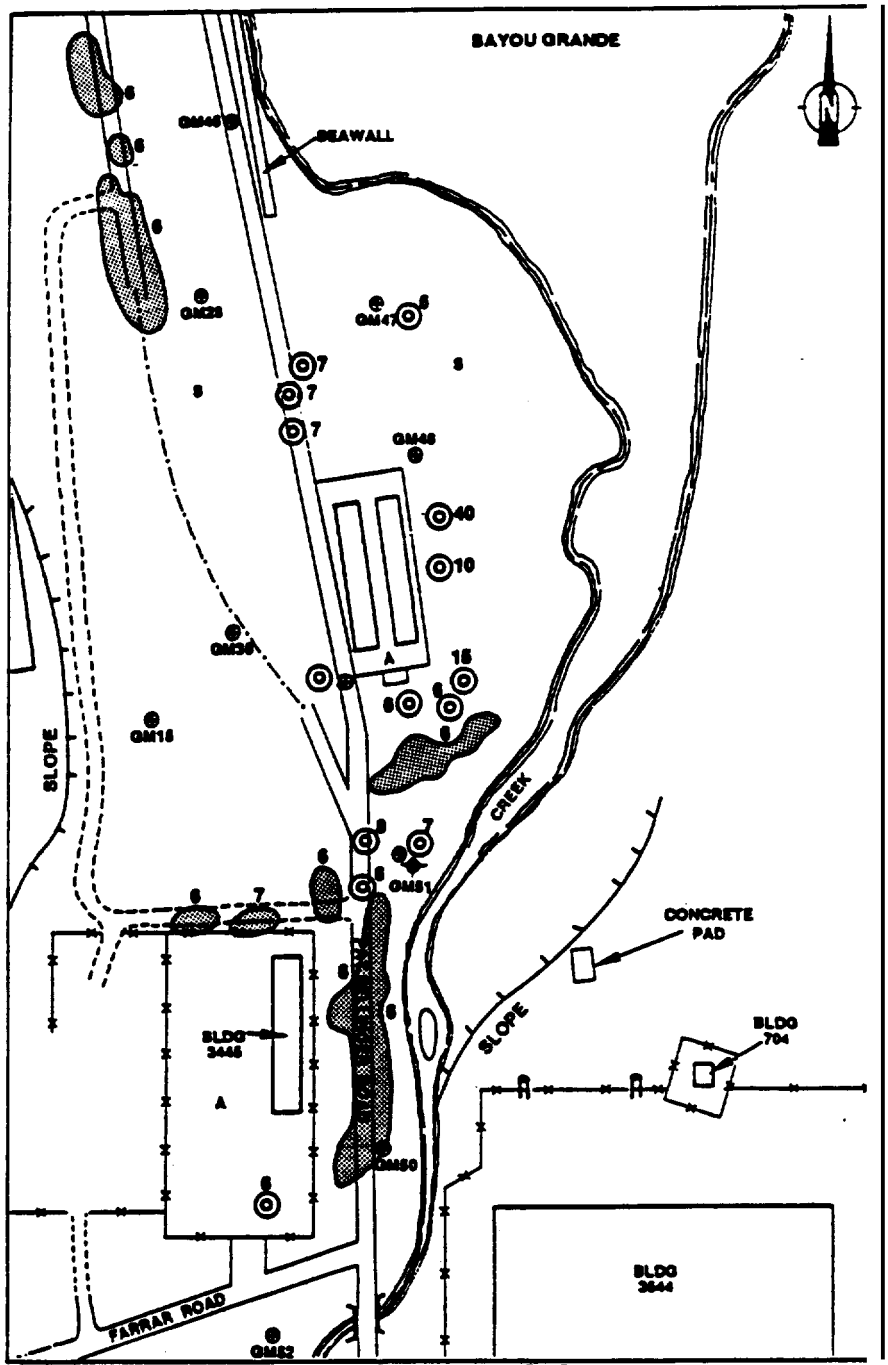


SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE
0 200 400 FEET

KEY:

- Unmaintained Road
- Abandoned Road
- BLDG 3445 — Building
- Fence
- Outfall Pipe
- A — Asphalt Paved Area
- S — Sand
- Existing Permanent Shallow Monitoring Well
- Existing Permanent Deep Monitoring Well
- 15 — Radiation Reading Above Background
- 6 — Area with Radiation Readings Above Background

Figure 3-2 RADIATION SURVEY MAP — NAS PENSACOLA SITE 11

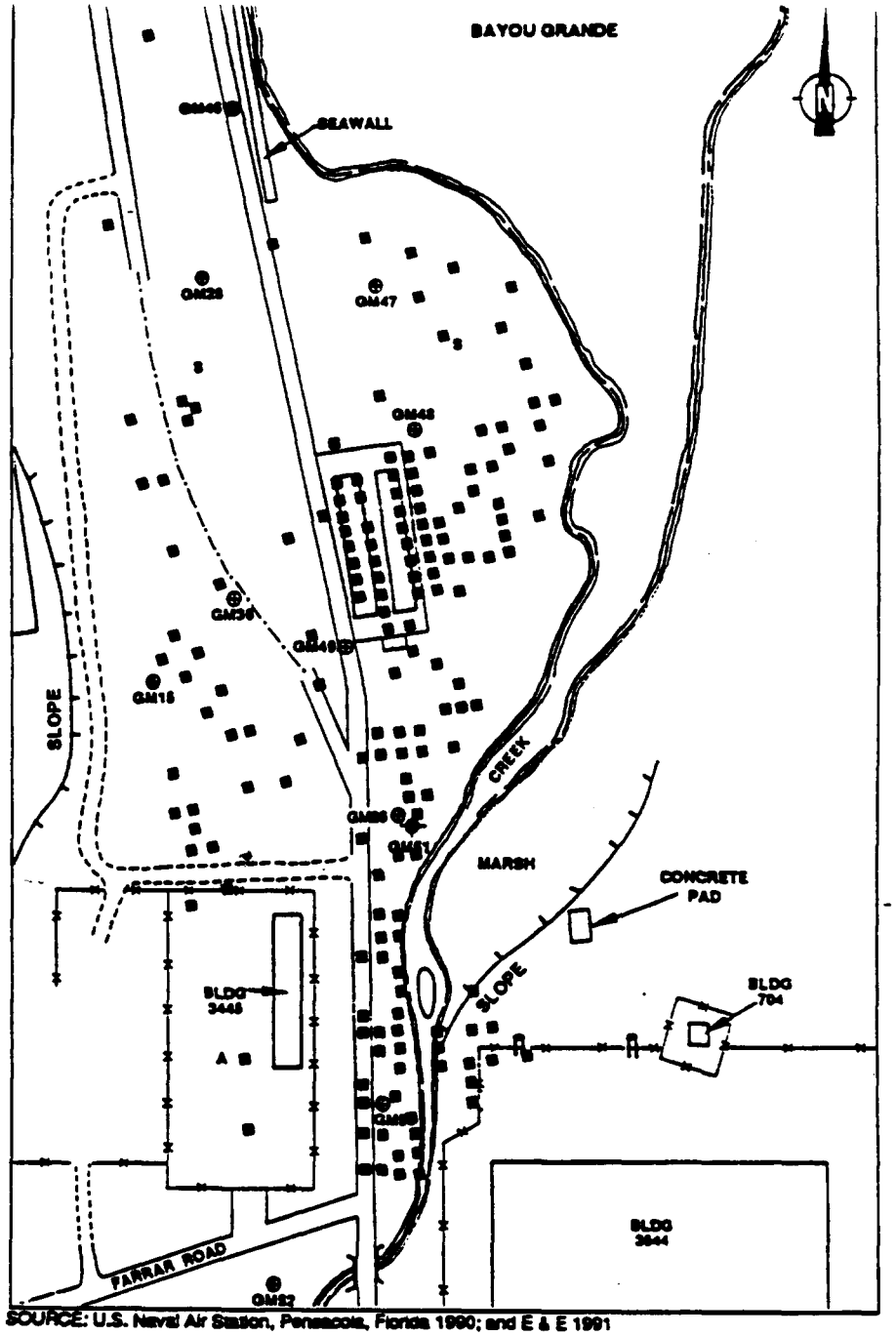
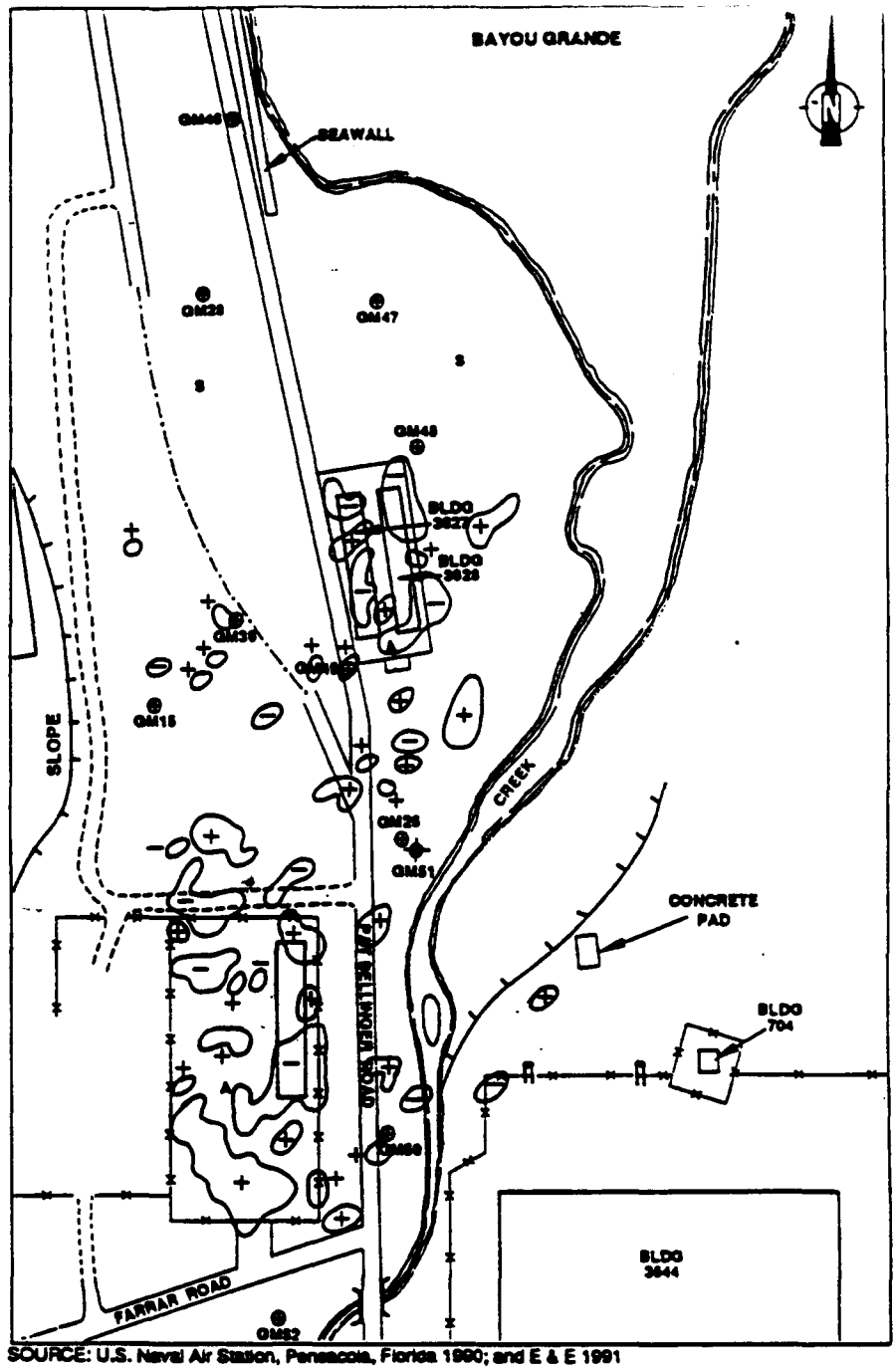


Figure 3-3 METAL DETECTOR SURVEY MAP— NAS PWSACOLA SITE 11



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE
0 200 400 FEET

KEY:

	Unmaintained Road		Outfall Pipe		Existing Permanent Deep Monitoring Well
	Abandoned Road	A	Asphalt Paved Area		Area of Total Magnetic Field greater than 520 gammas x 100
BLDG 694	Building	S	Sand		Area of Total Magnetic Field less than 470 gammas x 100
	Fence		Existing Permanent Shallow Monitoring Well		

Figure 3-4 MAGNETOMETER SURVEY MAP— NAS PENSACOLA **SITE 11**

shows the contoured total magnetic field values (in units of gammas x 100) across the site, including areas of positive magnetic anomalies greater than 52,000 gammas and areas of negative magnetic anomalies less than 47,000 gammas. (An undisturbed background reading on Site 11 is 50,000 gammas). Magnetometer values, grid coordinates, and field data are presented in Appendix D. Strong, extensive anomalies are observed on Site 11 in the areas of buildings 3627, 3628, and 3445. Eovever, several anomalies may be associated vith buried metallic objects east and vest of Building 3627, southeast of Building 3628, and north of Building 3644.

The En-31 survey vas performed by taking vertical dipole (deep) readings and horizontal dipole (shallov) readings at the survey grid points. All data, including field data, are presented in Appendix C. The results of the EM-31 vertical dipole survey are presented on Figure 3-5. Average conductivity values recorded vere 14 to 45 millimhos per meter (mmhos/m); however, the northeast portion of the site, tovard Bayou Grande, and the southvest portion exhibited conductivities greater than 100 mmhos/m. Within these areas vere very strong anomalies vith conductivities greater than 200 mmhos/m. These are presented as shaded areas on Figure 3-5. It is hypothesized that these areas of abnormal conductivity may represent the effects of salt vater intrusion from Bayou Grande vithin the Sand-and-Gravel Aquifer, combined vith buried metal and leachates from potentially landfilled areas observed in aerial photographs of Site 11.

The En-34 conductivity survey vas performed on Site 11 at horizontal dipoles (coils oriented vertically) at 10- and 20-meter intercoil spacings. Appendix D presents the results of the EM-34 survey. Results of the 20-meter spacing survey are presented on Figure 3-6. Similar to the En-31 survey readings, average EM-34 readings for Site 11 vere between 14 mmhos/m and 45 mmhos/m; in addition, areas of high conductivity greater than 100 mmhos/m are observed in the northeast portion of the site, tovard Bayou Grande, and in the southvest portion. Within these areas are very strong anomalies vith conductivities greater than 200 mmhos/m. These are presented as shaded areas on Figure 3-6. Similar to the results of the EM-31 survey, it is hypothesized that these areas of very high conductivity may represent the effects of salt

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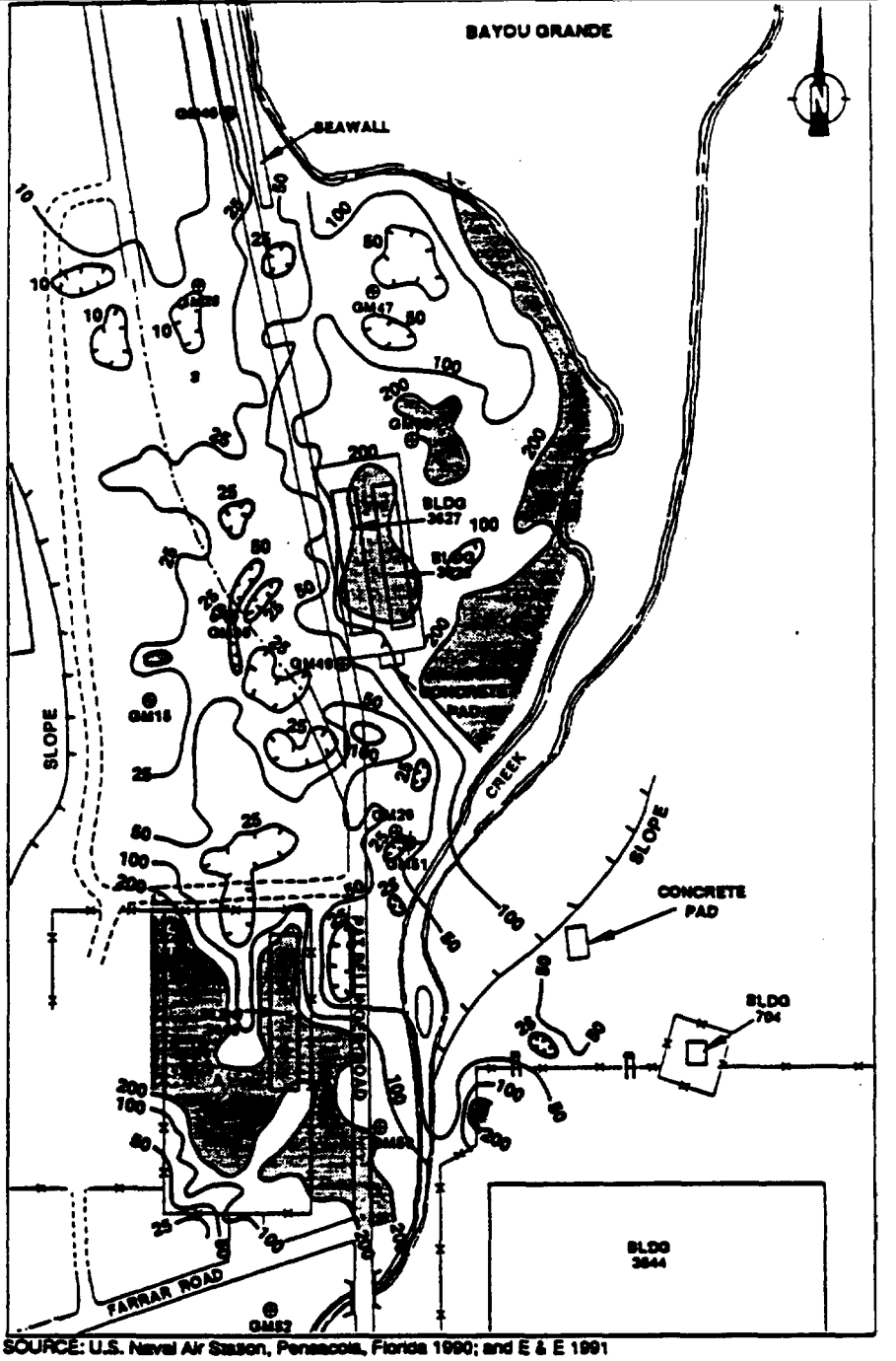


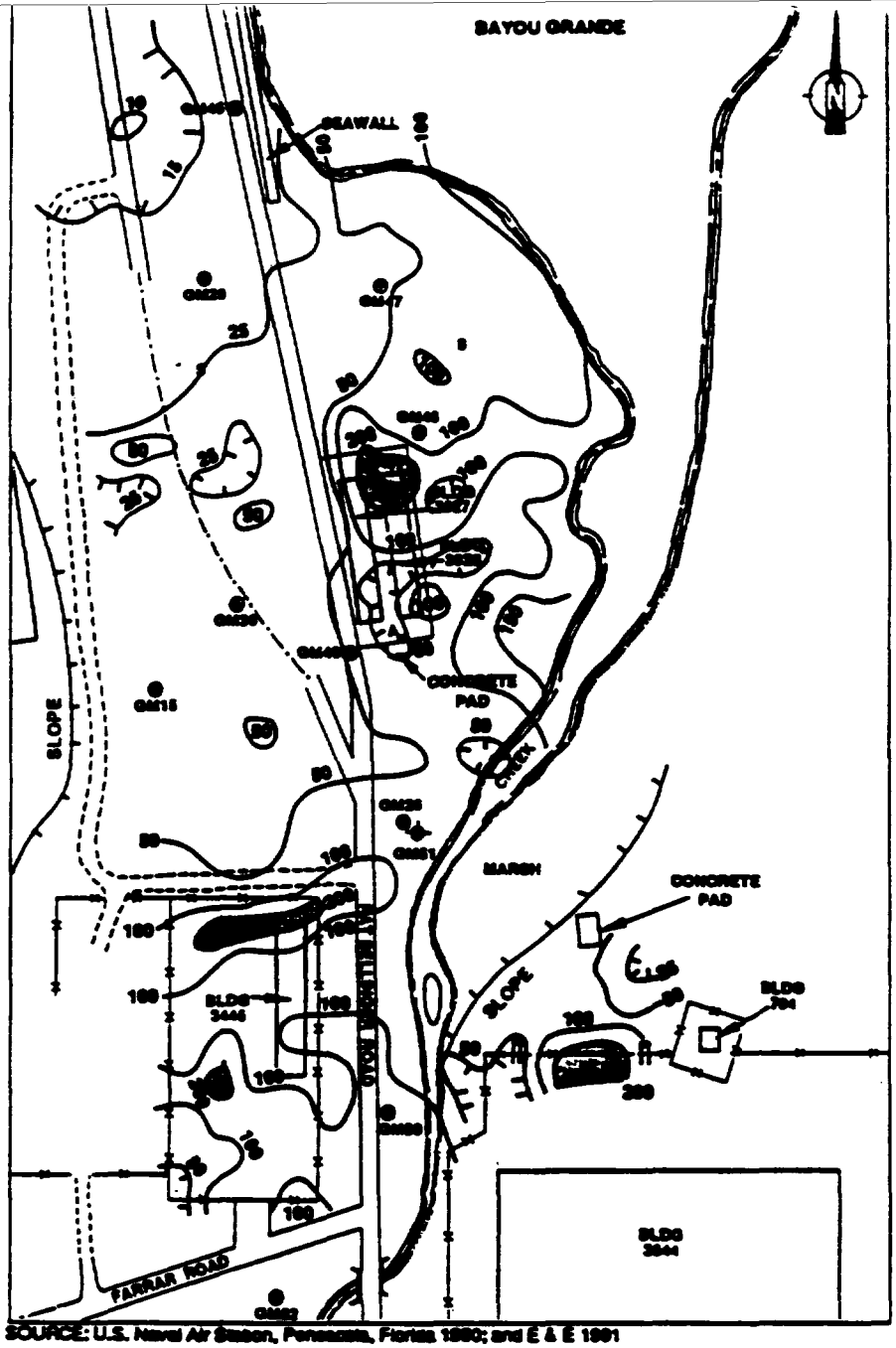
SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

KEY:

	Unmaintained Road		Outfall Pipe		Existing Permanent Deep Monitoring Well
	Abandoned Road	A	Asphalt Paved Area	50	Electromagnetic Conductivity Isopleth (millimhos/meter)
BLDG 692	Building	S	Sand		Area of Lower EM-31 Values
	Fence		Existing Permanent Shallow Monitoring Well		Area of Em-31 Values Greater than 200 millimhos/meter

Note: Effective exploration depth is 6 meters (19.7 feet)

Figure 3-5 EM-31 SURVEY MAP, VERTICAL DIPOLE — NAS PENSACOLA **SITE** 11



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE 0 200 400 FEET

KEY:

- Unmaintained Road
- Abandoned Road
- Building
- Fence
- Outfall Pipe
- A Asphalt Paved Area
- S Sand
- Existing Permanent Shallow Monitoring Well
- Existing Permanent Deep Monitoring Well
- Electromagnetic Conductivity Isopleth (millimhos/meter)
- Area of Lower EM-34 Values
- Area of Em-34 Values Greater than 200 millimhos/meter

NOTE: Effective exploration depth is 15 meters (49.2 feet)

Figure 3-6 EM-34 SURVEY MAP, 20 METER INTERCOIL SPACING HORIZONTAL DIPOLE NAS PENSACOLA SITE 11

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water intrusion, buried metal, and leachates from the potentially landfilled areas in the northeast and southwest portions of the site (see Figure 3-6).

3.8 HYDROLOGIC ASSESSMENT

3.8.1 Shallov Subsurface Lithology

Appendix E presents the lithologic logs for the 30 soil borings completed at Site 11. Based on information collected during completion of the borings, the shallow subsurface lithology beneath Site 11 can be generally characterized as a tan to light brown, fine- to medium-grained quartz sand that generally becomes a tan to white, medium-grained quartz sand at the water table. At several borings in the central and east portions of the site, a brown, silty, fine- to medium-grained quartz sand was encountered from 0 to 5 feet BLS. Eowever, at borings B012, B013, B020, and B023, a clayey red quartz sand was encountered from 0 to 5 feet BLS. At boring B025 a brown, fine- to medium-grained quartz sand mixed with shell fragments and pebbles was encountered, and at boring B024 a hard, dark brown, powdery, iron-like material (possibly an iron oxide) was encountered from 0.5 to 2 feet BLS.

At many borings in the southwest portion of the site (borings B015, B019, B020, B021, B023, and B024), petroleum-stained or saturated sands and even some metallic debris were encountered, and at many borings in the central and northeast portions of the site (borings B005, B006, B008, B009, B012, B013, B014, and B018), petroleum-stained or saturated sand was also encountered. A debris layer of metal, glass, wire, and other material fragments was encountered at borings B006, B008, and B013 over the 6- to 9-foot interval BLS.

[OVA readings taken in the open boreholes during drilling ranged from 0 to 1,000 ppm. Readings of 1,000 ppm were recorded in 12 of the 30 boreholes. The highest open-borehole OVA readings for the 30 boreholes are presented in Appendix E.]

3.8.2 Water Levels and Groundwater Flow

Table 3-1 presents the water level elevations measured in the temporary monitoring wells at Site 11. Table 3-2 presents the water level elevations measured in the permanent monitoring wells at Site 11.

Table 3-1

TEMPORARY MONITORING WELL CONSTRUCTION INFORMATION AND WATER LEVEL ELEVATIONS NAS PENSACOLA SITE 11

Well Number	Total Depth (BLS)	Depth to Water (BLS)	Depth to Water BTOC	TOC Elevation	Water Level Elevation	Date Measured
TW001	11 4	7 [illegible]8	11 18	[illegible]4.84	3 66	1/[illegible]/[illegible]1
TW005	8.64	6.66	8.02	11.33	3.31	1/17/91
TW007	3 40	[illegible].96	2 56	4 13	1[illegible]	[illegible]2[illegible]1
TW008	8.40	4.32	5.92	10.76	4.84	1/20/91
[illegible]2	8 22	3.72	8.52	14.04	5.52	[illegible]20/[illegible]1
TW014	3.44	1.17	2.73	4.76	2.03	1/20/91
TW021	6 70	2.21	5 51	8 12	2.61	1/[illegible]2/[illegible]1
TW02[illegible]	7.88	3 28	5 40	7 44	2 04	1/22/91
TW024	8.83	3.84	5.01	6.93	1.92	1/22/91
TW026	2.97	1.45	48	6 17	2.6[illegible]	1/22/[illegible]1
TW029	3.59	-0.04	1 37	-0 4[illegible]	-1.80	1/22/[illegible]1

[illegible]

Notes:

All depths are in feet.
All elevations are in feet referenced to mean sea level (MSL).
All wells were constructed of 2-inch diameter stainless steel with 5 [illegible]t of 0.01-inc[illegible] [illegible]n

Key:

BLS - Below land surface.
TOC - Top of casing.
BTOC - Below top of casing.

S[illegible]r[illegible] : E<ology a[illegible]d Environment, Inc., 1991.

[Bold items enclosed in brackets denote changes to the last version of document]

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Table 3-2

PERMANENT MONITORING WELL CONSTRUCTION INFORMATION AND WATER LEVEL ELEVATIONS NAS PENSACOLA SITE 11

Well Number	Total Depth (BLS)	Depth to Water (BLS)	Depth to Water BTOC	TOC Elevation	Water Level Elevation	Date Measured
GM15	11.5	3.30	4.50	7.60	3.10	2/26/91
GM26	11.5	2.13	3.06	4.53	1.47	2/26/91
GM28	20.0	5.98	8.21	10.83	2.61	2/26/91
GM36	20.0	2.84	5.20	7.76	2.56	2/26/91
GM46	15.0	7.35	7.81	10.16	2.35	2/26/91
GM47	15.0	3.37	5.90	7.73	1.83	2/26/91
GM48	15.0	4.49	6.86	8.77	1.91	2/26/91
GM49	15.0	7.49	7.95	10.11	2.16	2/26/91
GM50	15.0	1.72	4.17	5.65	1.48	2/26/91
GM51[a]	63.0	0.13	2.68	4.85	2.17	2/26/91
GM52	15.0	2.10	4.52	5.62	1.10	2/26/91

14[NASP]UH6027:T0227/317/22

Note:

All wells were constructed of 2-inch diameter PVC: shallow wells were constcuctod with 2.5 foot of 0.01-inch screen; deep wells were constructed with 5 foot of 0.01-inch screen.

Key:

[a]Deep well.

BLS = Below land surface.
TOC = Top of casing.
BTOC = Below top of casing.

Source: Ecology and Environment, fnc., 1991.

[Bold items enclosed in brackets denote changes to tho last version of document]

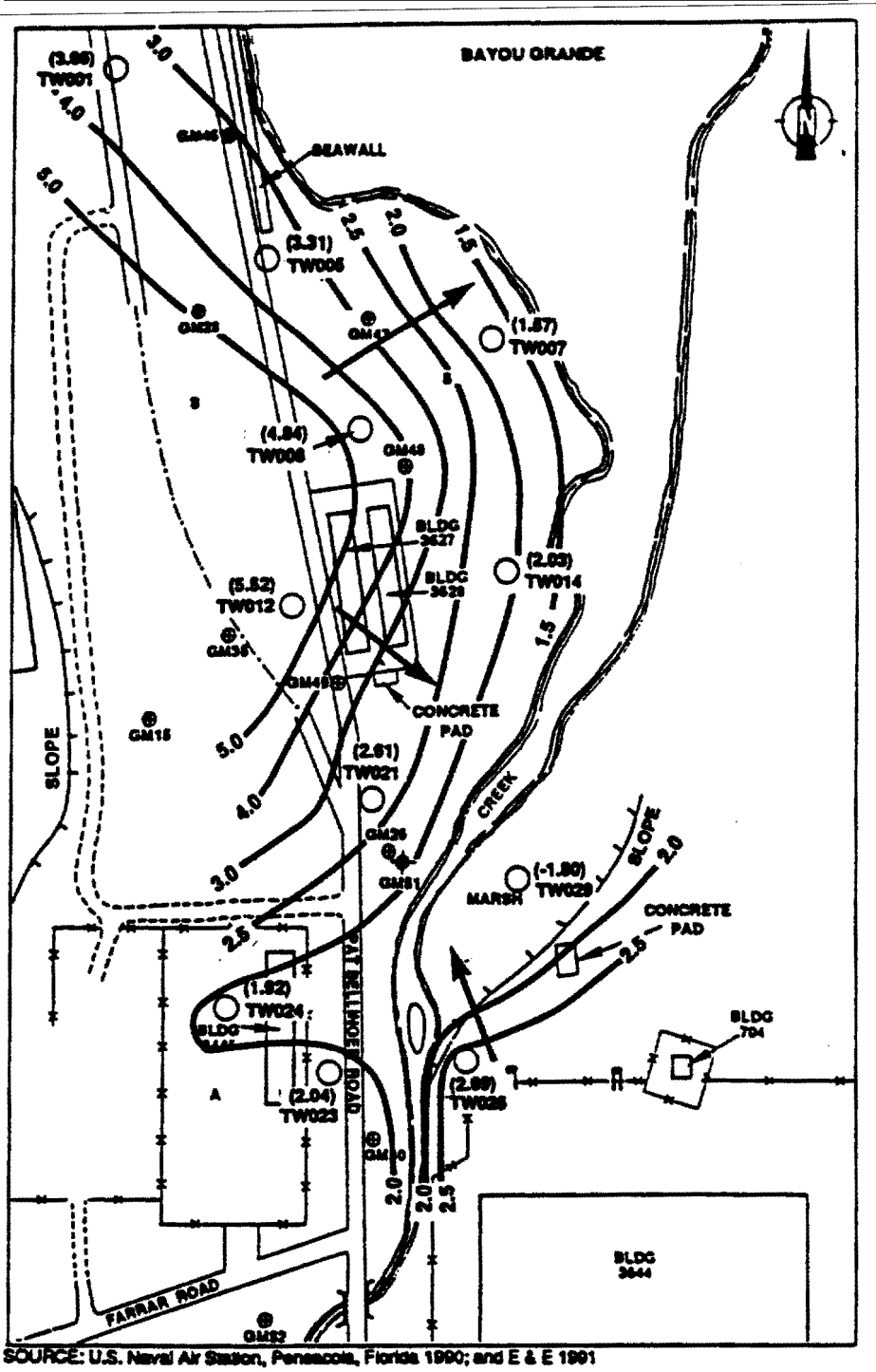
Based on the measurements obtained from water levels observed in the monitoring vells, the depth to the water table across the site ranges from 7.58 feet (in TW001) -0.04 feet BLS (in TW029).

Figure 3-7 illustrates the water level elevations and the groundwater flow direction in the upper portion of the surficial zone of the Sand-and-Gravel Aquifer at Site 11, based on the temporary monitoring well data. Based on these groundwater elevations, the direction of shallow groundwater flow is generally to the northeast, east, and southeast into the south arm of Bayou Crande. However, on the south one-third of the site, groundwater flov is north-northvast toward the south arm of Bayou Grande (see Figure 3-7). The horizontal hydraulic gradient is approximately 0.0125. The temporary monitoring well data presented on Figure 3-7 suggest that mounding of the water levels may occur in the area of temporary monitoring well TW012. The flov directions and horizontal hydraulic gradient may have been influenced during the sampling interval given the following: temporary monitoring well data were not all collected during one day, but over a period of five days (January 17 to 22, 1991; see Table 3-1) and *very* heavy rainfalls were recorded in the area on January 19, 1991.

Figure 3-8 illustrates the water level elevations and the groundwater flov direction based on the permanent monitoring well data collected in the upper portion of the surficial zone of the Sand-and-Gravel Aquifer at Site 11. Based on these groundwater elevations, the direction of shallow groundwater flov is eastward and the horizontal hydraulic gradient is approximately 0.004.

Permanent intermediate-depth monitoring well GM51 is located on Site 11 near well GM26. The water level elevation in GM51 is 0.13 feet BLS; whereas, the water level elevation in GM26 is 2.13 feet BLS (see Table 3-2). These data indicate that GM51 is screened within a deeper, possibly confined or semi-confined flow system. If this flow system is semi-confined, it indicates a lover permeability clay layer exists between the depths of the screened intervals where comparing GM26 and GM51. The water level elevations indicate an upward hydraulic gradient exists.

[Bold items enclosed in brackets denote changes to the last version of document]

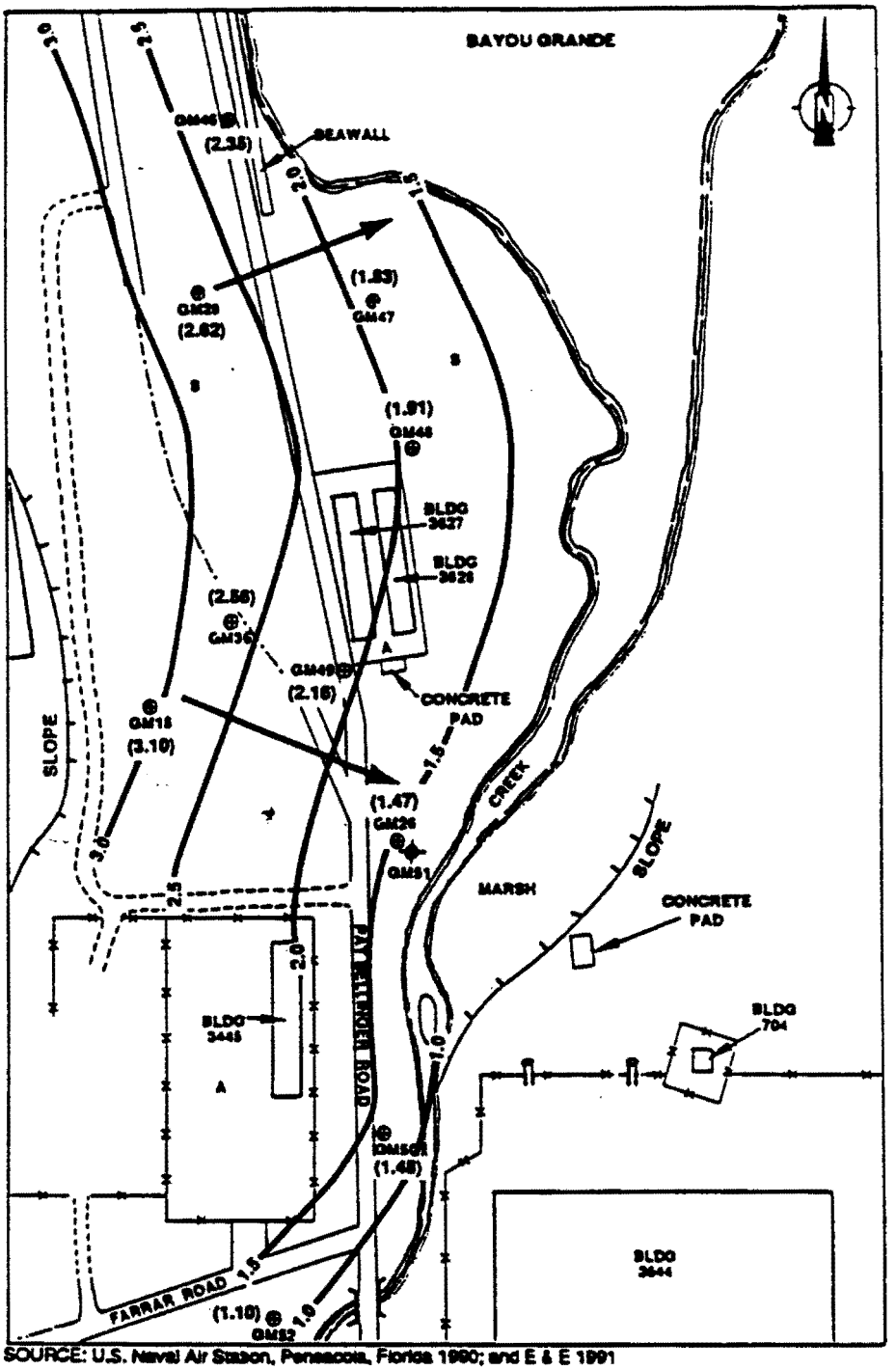


SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

KEY:

Unmaintained Road		Outfall Pipe		Existing Permanent Deep Monitoring Well	
Abandoned Road	A	Asphalt Paved Area		Temporary Monitoring Well	
BLDG 662	Building	S	Sand	(3.66)	Water Level Elevations (feet above MSL)
Fence			Existing Permanent Shallow Monitoring Well	5.0	Water Level Elevation Isopleth (feet above MSL)
					Groundwater Flow Direction

Figure 3-7 SURFICIAL ZONE WATER LEVEL ELEVATIONS, TEMPORARY MONITORING WELLS NAS PENSACOLA SITE 11



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE 0 200 400 FEET

KEY:

- Unmaintained Road
- Abandoned Road
- BLDG 662 Building
- Fence
- Outfall Pipe
- A Asphalt Paved Area
- S Sand
- Existing Permanent Shallow Monitoring Well
- Existing Permanent Deep Monitoring Well
- (2.35) Water Level Elevations (feet above MSL)
- 1.0 Water Level Elevation Isopleth (feet above MSL
- Groundwater Flow Direction

Figure 3-8 SURFICIAL ZONE WATER LEVEL ELEVATIONS, PERMANENT MONITORING WELLS NAS PENSACOLA SITE 11

3.9 CHEMICAL ANALYSES

[The following section presents the results of the laboratory analyses of the soil and groundwater samples. The specific analytical parameters and parameter groups are listed or referenced in Table 2-2.]

3.9.1 Soil

Table 3-3 summarizes the analytical screening results for soil samples collected at Site 11, and Figure 2-2 shows the soil boring locations. The complete analytical screening results for soil samples are presented in Appendix F.

Due to the depth to the water table across Site 11 (-0.04 feet to 7.58 feet BLS), soil samples were collected over the A and B intervals only at borings B001 through B005, B012, B013, and B015; at the other 22 borings, soil samples were collected only over the A interval. Soil sample numbers correspond to the number of the soil boring from which they were collected. Therefore, sample S002A was collected from boring B002A; sample S017A was collected from boring B017A; etc. However, because most of the soil samples were collected only over the A interval, parameter concentrations are generally discussed for soil borings rather than for soil samples. For discussion regarding borings B001 through B005, B012, B013, and B015, the A- and B-interval sample concentrations have been combined.

In general, one or more of the Site 11 soil samples exhibited elevated levels of metals, TRPHs, VOCs, PAHs, and/or phenols. A trace level of PCBs was detected in only one sample (S011A); however, the concentration was below the detection limit.

Metals

Figure 3-9 presents total metals concentrations (excluding lead) and lead concentrations detected in each soil boring across Site 11. [Figure 3-10 presents chromium and cadmium concentrations detected at each soil boring location across Site 11.] Chromium, zinc, and lead were detected in most of the soil samples. The concentrations detected in borings in the south portion of the site are elevated with respect to the concentrations detected in borings B001 through B004, formerly located in the north portion of the site. The highest chromium

Table 3-3

SUMMARY ANALYTICAL SCREENING RESULTS FOR SOIL SAMPLES
NAS PENSACOLA SITE 11
(All results in µg/kg, unless noted)

Parameter	[Detection Limit	Sample Number (Location and Depth Interval)							
		P11S001A (B001A)	P11S001B (B001B)	P11S002A (B002A)	P11S002B (B002B)	P11S003A (B003A)	P11S003B (B003B)	P11S004A (B004A)	P11S004B (B004B)
Arsenic (mg/kg)	6.9	—	—	7.6	—	—	—	—	7.0
Chromium (mg/kg)	1	2.0	—	2.8	—	2.7	1.8	2.0	1.3
Zinc (mg/kg)	a	2.6	—	4.5	—	—	—	9.8	—
Lead (mg/kg)	4	—	6.5	—	—	—	7.1	4.2	9.0
Cadmium (mg/kg)	0.5	—	—	—	—	—	—	—	—
Nickel (mg/kg)	4	—	—	—	—	—	—	—	—
Copper (mg/kg)	2.5	—	—	—	—	—	—	—	—
Silver (mg/kg)	1	—	—	—	—	—	—	—	—
TRPHs (mg/kg)	5	8.6	17	25	18	20	11	28,000	15,000
Benzene	1,000	—	—	—	—	—	—	—	—
Toluene	1,000	—	—	—	—	—	—	—	—
Total Xylenes	1,000	—	—	—	—	—	—	—	—
Methylene Chloride	1,000	2,000(B)	—	—	—	—	—	—	—
Total PAHs as Benzo-a-pyrene	1,000	—	—	—	—	—	—	16,000	8,900
Phenols as Trichlorophenol	a,000	—	—	—	—	—	—	150,000	6,500
Total PCBs	5,000]	—	—	—	—	—	—	—	—

14[NASP]UN6027:T0227/283/5

Key at end of table.

[Bold items enclosed in brackets denote changes to the last version of document]

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Table 3-3 (Cont.)

Parameter	[Detection Limit	Sample Number (Location and Depth Interval) P11S005A (B005A)	P11S005B (B005B)	P11S006A (B006A)	P11S007A (B007A)	P11S008A (B008A)	P11S009A (B009A)	P11S010A (B010A)	P11S011A (B011A)
Arsenic (mg/kg)	6.9	--	--	9.4	--	--	--	--	--
Chromium (mg/kg)	1	1.9	30	2.3	1.6	4.1	5.6	170	16
Zinc (mg/kg)	2	2.7	8.7	--	--	--	2.3	280	510
Lead (mg/kg)	4	4.7	13	--	--	--	6.8	270	510
Cadmium (mg/kg)	0.5	--	0.62	--	--	--	--	5.8	22
Nickel (mg/kg)	4	--	--	--	--	--	--	7.2	14
Copper (mg/kg)	2.5	--	--	--	--	--	--	100	340
Silver (mg/kg)	1	--	--	--	--	--	--	1.8	--
TRPHs (mg/kg)	5	21	550	19	11	54	19	56	250
Benzene	1.000	--	--	--	--	--	--	--	--
Toluene	1,000	--	--	--	--	--	--	--	--
Total Xylenes	1,000	--	--	--	--	--	--	--	--
Methylene Chloride	1,000	--	--	--	--	--	1,300(B)	--	--
total PAHs as Benzo-a-pyrene	1,000	--	2,ZOO	--	--	--	--	2,000	2,200
Phenols as Trichlorophenol	2,000	--	7,300	4,700	L)	--	--	(L)	10,000
total PCBs	5,000]	--	--	--	--	--	--	--	(L)

14[NASP]UH6027:T0227/283/5

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[Bold items enclosed in brackets denote changes to the last version of document]

Table 3-3 (Cont.)

Par a ntor	[Detection Limit	P11S012A (B012A)	P11S012B (B012B)	P11S013A (B013A)	P11S013AD[a] (B013A)	P111S013B (B013B)	P11S014A (B014A)	P11S015A (B015A)	P11S015B (B015B)
		Sample Number (Location and Depth Interval)							
Arsenic (mg/kg)	6.S	--	--	--	--	10	--	--	--
Chromium (mg/kg)	1	1.8	9.3	1.3	1.7	40	2.3	2.5	2.5
Zinc (mg/kg)	2	5.5	30	--	--	1,300	8.7	4.8	1.5
Lead (mg/kg)	4	8.7	--	7.3	--	510	11	--	11
Cadmium (mg/kg)	0.5	--	1.8	--	--	23	--	--	--
Nickel (mg/kg)	4	--	--	--	--	12	--	--	--
Copper (mg/kg)	2.5	--	7.7	--	--	270	--	--	3.7
Silver (mg/kg)	1	--	--	--	--	14	--	--	--
TRPHs (mg/kg)	5	66	21	--	--	12,000	15	3,600	3,600
Benzene	1,000	--	--	--	--	--	--	--	--
Toluene	1,888	--	--	--	--	--	--	--	--
Total Xylenes	1,000	--	--	--	--	1,300	--	--	--
Methylene Chloride	1,000	--	--	--	--	--	--	--	--
Total PAHs as Benzo-a-pyrene	1,000	--	4,300	--	--	27,000	2,400	3,500	43,000
Phenols as Trichlorophenol	2,000	--	13,000	--	--	11,000	--	13,000	15,000
Total PCBs	5,000]	--	--	--	--	--	--	--	--

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[Bold items enclosed in brackets denote changes to the last version of document]

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Table 3-3 (Cont.)

Parameter	[Detection Limit	Sample Number (Location and Depth Interval)							
		P11S016A (B016A)	P11S017A (B017A)	P1S018A (B018A)	P11S019A (B019A)	P11S019AD[b] (B019A)	P11S020A (B020A)	P11S021A (B021A)	P11S022A (B022A)
Arsonic (mg/kg)	6.9	--	--	--	8.3	--	13	--	--
Chromium (mg/kg)	1	10	17	18	16	16	6.8	36	110
Zinc (mg/kg)	2	70	120	520	630	520	180	1,000	85
Lead (mg/kg)	4	58	1,200	220	940	540	240	1,700	77
Cadmium (mg/kg)	0.5	2.6	8.5	14	21	19	8.0	64	4.8
Nickel (mg/kg)	4	--	10	6.8	7.3	7.6	9.3	110	--
Copper (mg/kg)	2.5	34	53	140	150	120	24	28,000	22
Silver (mg/kg)	1	--	3.8	9.0	--	--	--	--	--
TRPHs (mg/kg)	5	2,900	30	820	540	740	7,800	13.000	1,800
Benzene	1,000	--	--	--	--	--	1,400	--	--
Toluene	1,000	--	--	--	1,400	1,300	--	--	--
Total Xylenes	1,000	--	--	--	--	--	--	1,500	--
Methylene Chloride	1,000	--	--	--	--	--	--	--	--
Total PAHs as Benzo-a-pyrene	1,000	1,000	1,300	1,400	3,000	4,400	1,300	39,000	12,000
Phenols as Trichlorophenol	2,000	14,000	--	--	--	--	--	64,000	15,000
Total PCBs	5,000]	--	--	--	--	--	--	--	--

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[Bold items enclosed io brackets denote changes to the last version of document]

Table 3-3 (Cont.)

Parameter	[Detection Limit	Sample Number (Location and Depth Interval)							
		P11S023A (B023A)	P11S024A (B024A)	P11S025A (B025A)	P11S026A (B026A)	P11S027A (B027A)	P11S028A (B028A)	P11S029A (B029A)	P11S030A (B030A)
Arsenic (mg/kg)	6.9	--	7.0	--	--	14	11	--	11
Chromium (mg/kg	1	20	12	7.3	16	23	620	8.1	6.9
Zinc (mg/kg)	1	4S0	53	97	410	43	54	2.4	4.1
Lead (mg/kg)	4	1,500	60	210	180	91	160	4.4	8.9
Cadmium (mg/kg)	0.5	16	5.0	4.7	32	5.9	6.7	--	--
Nickel (mg/kg)	4	6.5	--	3.5	9.1	--	--	--	--
Copper (mg/kg)	2.5	84	19	19	88	4.7	13	--	--
Silver (mg/kg)	1	--	--	1.2	--	--	--	--	--
TRPHs (mg/kg)	5	41,000	46	5,400	6,100	140	1,800	--	210
Benzene	1,000	--	--	--	--	--	--	--	--
Toluene	1,000	--	--	--	--	1,200	--	--	1,200
Total Xylenes	1,000	1,600	--	--	--	--	--	--	--
Methylene Chloride	1,000	--	--	--	--	--	--	--	--
Total PAHs as Benzo-a-pyrene	1,000	3,200	8,800	4,700	280,000	1,500	9,600	1,200	1,400
Phenols as Trichlorophenol	1,000	,100,000	--	120,000	17,008	--	--	10,000	46,000
Total PCBs	5,000]	--	--	--	--	--	--	--	--

14[NASP]UU6027:T0227/283/9

Note: These results were reported on a wet-weight basis.

Key:

[a] Duplicate of sample P11S013A.
[b] Duplicate of sample P11S019A.

Dash (--) indicator compound not detected.

Qualifiers:
(B) = Compound also present in method blank.
(L) = Present below stated detection limit.

Source: Ecology and Environment, Inc., 1991.

[Bold items enclosed in brackets denote changes to tho last version ot document]

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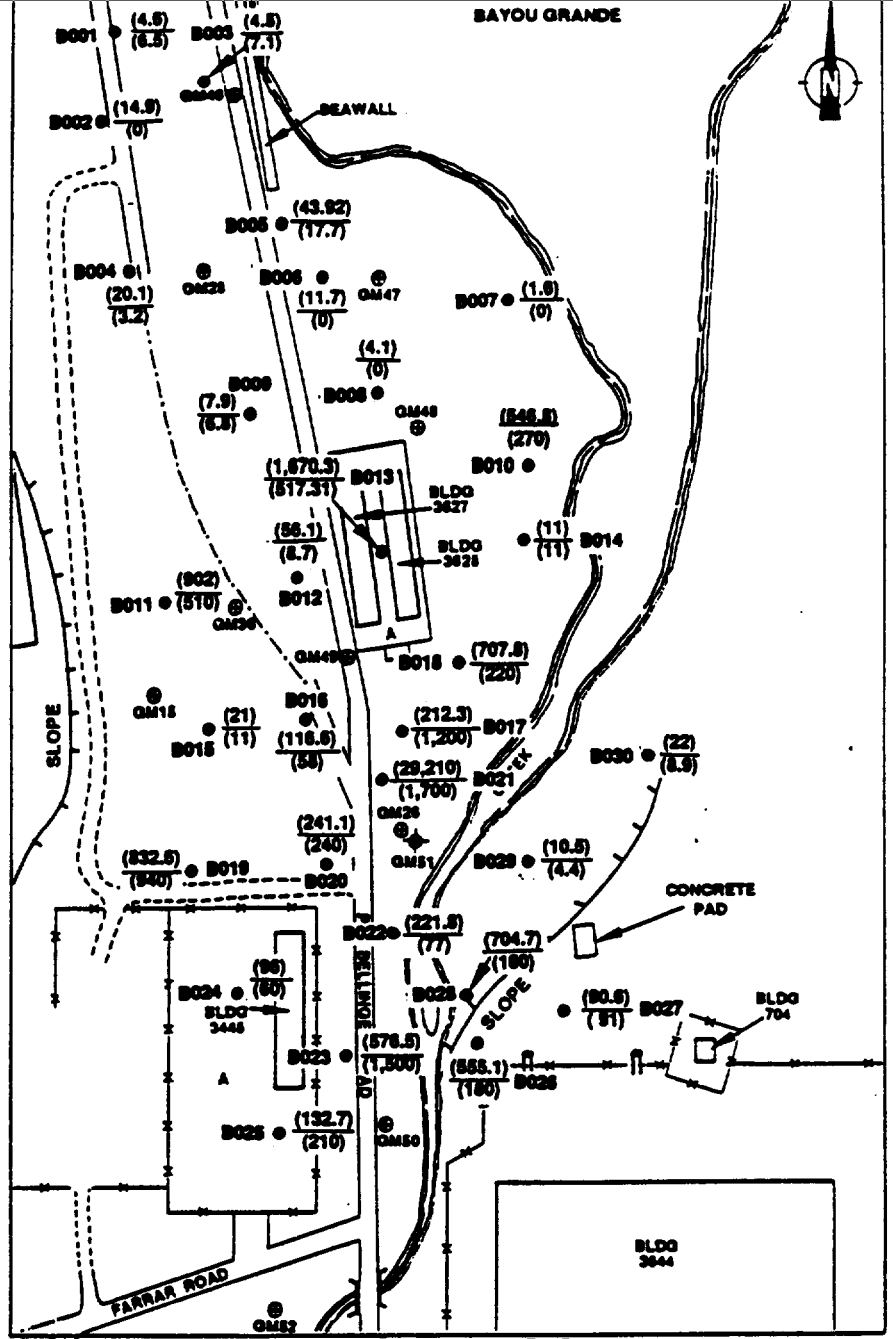


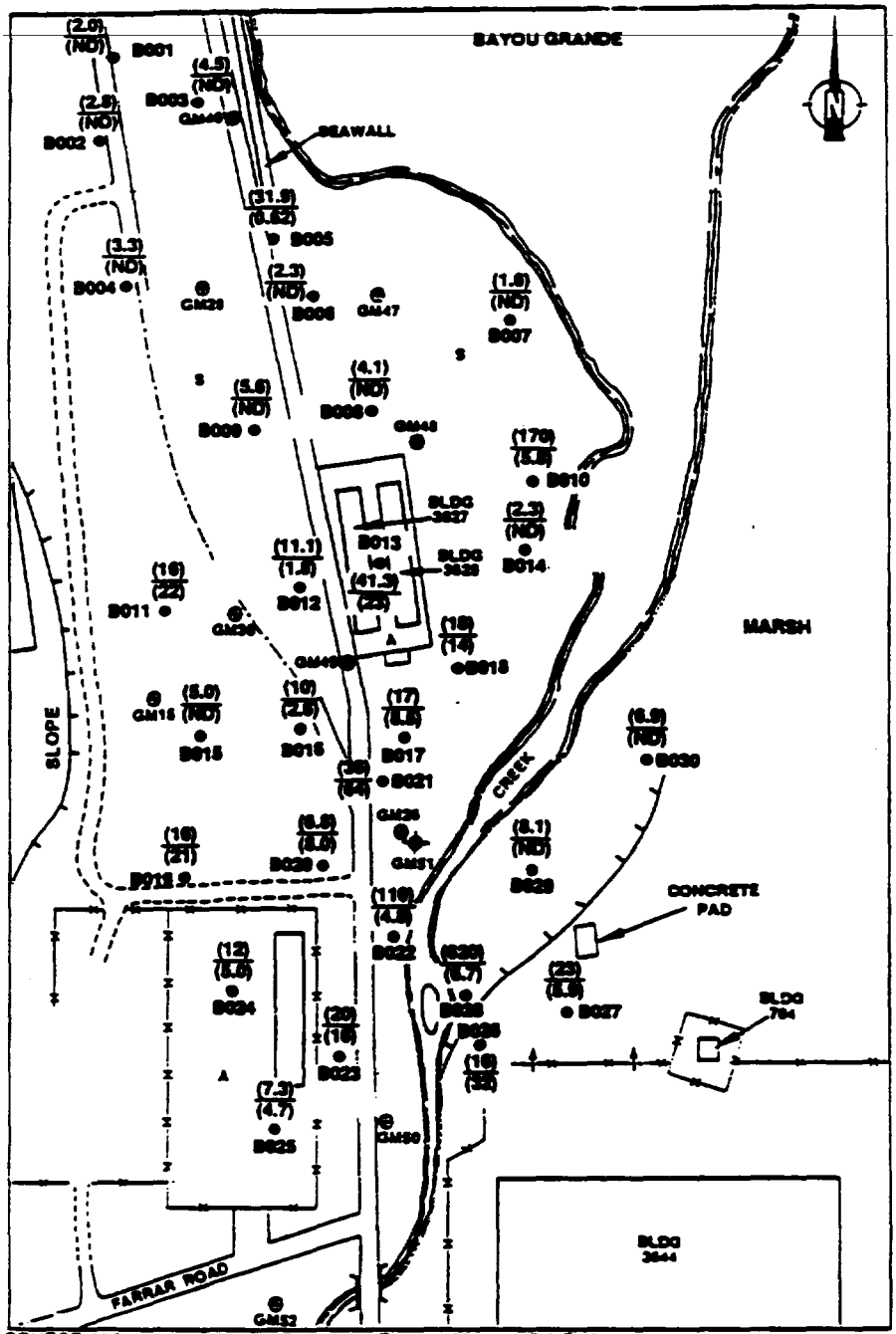
SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

KEY:

Unmaintained Road		Outfall Pipe		Existing Permanent Deep Monitoring Well	
Abandoned Road	A	Asphalt Paved Area		Soil Boring	
BLDG 662	S	Sand		(902)	Total Metals Concentration (Excluding Lead (mg/kg)
Fence		Existing Permanent Shallow Monitoring Well		(510)	Lead Concentration (mg/kg)

Note: The A- and B- interval concentrations have been combined at Borings B001 through B005, B012, B013 and B015.

Figure 3-9 TOTAL METALS CONCENTRATIONS (EXCLUDING LEAD) AND LEAD CONCENTRATIONS AT SOIL BORING LOCATIONS — NAS PENSACOLA SITE 11



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE 0 200 400 FEET

KEY:

Unmaintained Road	A	Asphalt Paved Area	●	Soil Boring
Abandoned Road	S	Sand	B006	Soil Boring Number
BLDG 662 Building	⊕	Existing Permanent Shallow Monitoring Well	(16)/(22)	Chromium Concentration (mg/kg) / Cadmium Concentration (mg/kg)
Fence	✦	Existing Permanent Deep Monitoring Well	(ND)	Not Detected
Outfall Pipe				

Note: The A and B interval concentrations have been combined at borings B001 through B005, B012, B013, and B015

Figure 3-10 CHROMIUM AND CADMIUM CONCENTRATIONS AT SOIL BORING LOCATIONS — NAS PENSACOLA SITE 11

concentration (620 mg/kg) was detected in boring B028, the highest zinc concentration (1,300 mg/kg) was detected in boring B013, and the highest lead concentration (1,700 mg/kg) was detected in boring B021. Additional lead concentrations were detected in the south and central areas of the site in borings B023 (1,500 mg/kg), B013 (510 mg/kg), B017 (1,200 mg/kg), and B019A and B019AD (940 mg/kg and 540 mg/kg, respectively).

Copper was detected in half the soil samples (19 of 38) at concentrations of 3.7 to 340 mg/kg; however, an extremely high concentration of 28,000 mg/kg was detected in boring B021.

Cadmium was detected in half the soil samples at concentrations of 0.62 to 64 mg/kg [(see Figure 3-10)], and nickel was detected in approximately one-third (12 of 38) of the samples, at concentrations of 3.5 to 110 mg/kg. The highest concentration for each metal (64 mg/kg and 110 mg/kg, respectively) was detected in boring B021. (Boring B021 exhibited the highest concentrations of lead, copper, cadmium, and nickel and the second highest zinc concentration.)

Arsenic was detected in approximately one-fourth (10 of 38) of the soil samples at relatively random locations in the north and south halves of the site; the highest concentration (14 mg/kg) was detected in boring B027. Silver was detected in five samples; three of these detections occur in the vicinity of buildings 3627 and 3628. The highest concentration (14 mg/kg) was detected in boring B013.

In general, total metals and lead concentrations in soil samples from the south two-thirds of the site are elevated with respect to total metals and lead concentrations in samples from the north one-third. The location of these elevated concentrations are east and west of Pat Bellinger Road, as well as east and west of the creek that discharges into Bayou Grande.

TRPHs

TRPE compounds were detected in all the soil borings at Site 11, except boring B029. The detected concentrations ranged from 11 mg/kg (in boring B007) to 41,000 mg/kg (in boring B023; see Table 3-3). The highest concentration of TRPHs (41,000 mg/kg) was detected in boring B023 (only the A interval of boring B023 was sampled); however, boring

B004 exhibited a slightly higher total TRPH concentration of *43,000* mg/kg for the combined A- and B-interval samples. Figure 3-[11] presents TRPE concentrations detected in each soil boring across Site 11. The highest TRPH concentrations occurred in borings along Pat Bellinger Road (borings B013, B020, B021, and B023) and in boring B004 near the abandoned road in the northwest portion of the site.

VOCs

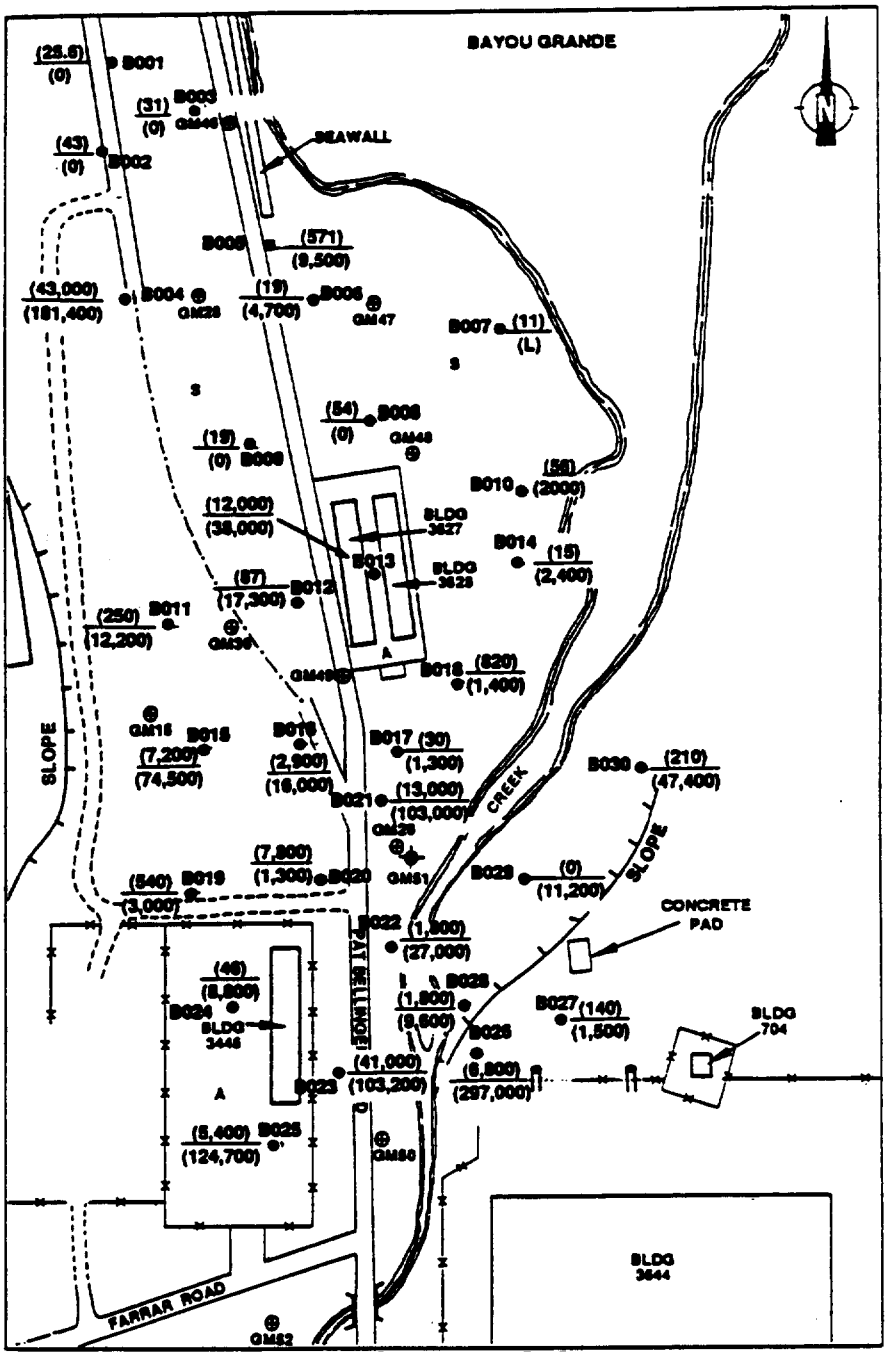
Toluene (four samples), total xylenes (three samples), and methylene chloride (tvo samples) were detected in nine of the 30 soil borings (see Table 3-3). Toluene was detected at 1,400 µg/kg in borings B019 and B020, and at 1,200 µg/kg in borings B027 and 8030. Total xylenes vere detected at 1,600 µg/kg in boring B023, 1,500 µg/kg in boring B021, and 1,300 µg/kg in boring B013. Methylene chloride was detected in two of the soil samples (from borings B001 and B009); the highest concentration was 2,000 µg/kg. This common laboratory solvent was also detected at similar levels in the associated laboratory method blanks (see Section 3.11.2); therefore, its presence in the soil samples can be attributed to laboratory-derived contamination.

PAHs

PAHs vere detected in approximately two-thirds (24 of 38) of the soil samples collected at Site 11 (see Table 3-3). Detected concentrations ranged from 1,000 µg/kg in boring B016 to 280,000 µg/kg in boring B026. Figure 3-(11) presents total PAH and phenol concentrations detected in each boring across Site 11. In general, elevated levels of PAHs were detected in an area which extends east from boring B004 to east of Pat Bellinger Road in the north portion of Site 11, and in the south two-thirds of the site (see Table 3-3 and Figure 3-[11]). It should be noted that PAHs were reported as benzo-a-pyrene for laboratory reporting purposes; however, PAHs other than benzo-a-pyrene may be present in the samples.

Phenols

Phenols were detected in half the soil samples (19 of 38) collec *ed* at Site 11 (see Table 3-3). The highest concentrations (150,000;



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE 0 200 400 FEET

KEY:

- Unmaintained Road
- Abandoned Road
- Fence
- Outfall Pipe
- A Asphalt Paved Area
- a Sand
- Existing Permanent Shallow Monitoring Well
- (L) Present Below Detection Limit
- Existing Permanent Deep Monitoring Well
- Soil Boring
- B005 Soil Boring Number
- (820) / (1,400) TRPH Concentration (mg/kg) / Total PAH and Phenol Concentration (ug/kg)

Note: The A and B interval concentrations have been combined at borings B001 through B005, B012, B013, and B015

Figure 3-11 TRPH AND TOTAL PAH AND PHENOL CONCENTRATIONS AT SOIL BORING LOCATIONS — NAS PENSACOLA SITE 11

120,000; and greater than 100,000 µg/kg) were detected in the A-interval samples from borings B004, B025, and 8023, respectively (see Table 3-3).

Similarly to PAHs, elevated levels of phenols vere detected in a limited area in the northvest portion of Site 11 and across the south tvo-thirds of the site (see Figure 3-Ill)). It should be noted that phenols vere reported as trichlorophenol for laboratory reporting purposes; however, phenols other than trichlorophenol may be present in the samples.

PCBs

PCBs were present only in the boring B011 sample at Site 11 at a trace level. The concentration of PCBs in this sample vas below the detection limit of 10 µg/kg.

3.9.2 Groundvater

Groundvater sample numbers correspond to the well number from which they were collected. Therefore, sample GW007 was collected from temporary vell TW007; GW023 was collected from temporary well TW023; etc. The same is true for the permanent monitoring vell samples: sample W021 was collected from permanent vell GM21; sample W052 vas collected from permanent vell GM52; etc.

Field Parameters

Table 3-4 lists the groundwater temperature, pH, and specific conductance values measured in the groundvater samples collected from the temporary monitoring vells (January 20 and 22, 1991) and the existing permanent monitoring wells (October 16 to 18, 1990). The field parameter measurements, other than specific conductance, for these vells are within the reported range of values for ambient groundwater in Escambia County (Clemens et al. 1989). The specific conductance values recorded in vells TW007, TW029, and GM51 exceed the upper limit of the reported specific conductance range. Floating or [sinking] immiscible hydrocarbons (free product) were detected by the oil-vatat interface probe during groundwater sampling of temporary monitoring wells TW012, TW021, TW023, and TW024. No measurements are given for the amount of free product as the thickness of free product detections were less than

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Table 3-4

GROUNDWATER FIELD PARAMETERS
NAS PENSACOLA SITE 11

Well Number	Temperature (°C)	pH (units)	Specific Conductance (umhos/cm)	Data Measured
TW001	21	6.6	64	1-20-91
TW005	20	5.8	89	1-20-91
TW007	17	6.3	3,000	1-20-91
TW008	18	5.7	390	1-20-91
TW012	22	5.2	330	1-20-91
TW014	20	6.6	460	1-20-91
TW021	21	7.7	390	1-22-91
TW023	19	7.1	580	1-22-91
TW024	20.5	6.8	360	1-22-91
TW026	19	7.8	235	1-22-91
TW029	17.5	7.1	6.400	1-22-91
GM15	25.0	6.77	223	10-18-90
GM26	25.3	6.81	223	10-17-90
OX28	24.1	5.84	—	10-16-90
GM36	24.1	6.76	277	10-18-90
GM47	23.8	5.09	—	10-16-90
GM48	24.6	7.13	615	10-17-90
GM49	24.6	6.38	188	10-17-90
GM51	23.2	7.44	9,460	10-17-90
GM52	25.1	5.83	117	10-18-90

14[NASP]UH6027:T0227/245/26

Key:

Dash (—) indicates data not collected.

Source: Ecology and Environment, Inc., 1991.

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the resolution measurement of the oil-water interface probe. Appendix E presents the temporary monitoring well information, including field parameter and groundwater elevation data.

Analytical Screening Parameters

Table 3-5 summarizes the analytical screening results for the groundvater samples collected from the 11 temporary walls installed on Site 11. Figure 2-2 shovs the temporary monitoring well locations at Site 11. The complete analytical screening results for the groundvater samples are presented in Appendix G.

The groundvater samples collected from all of the Site 11 temporary monitoring vells, except TW001, exhibited concentrations of five or more metals (see Table 3-5). However, as will be discussed in Section 3.10.4, the elevated metals concentrations detected may in part reflect acid preservative leaching/dissolution of aquifer matrix sediments entrained in these unfiltered samples, rather than actual groundvater contamination. VOCs, PAHs, and phenols were detected in one or more of the temporary well groundvater samples collected. Trace levels of PCBs were detected in three of the temporary well samples (GW007, GW008, and GW026).

Metals. Chromium, cadmium, and lead were present in all but tvo of the temporary monitoring vell groundvater samples (see Table 3-5) at concentrations exceeding the Florida Primary Drinking Water Standards (FPDWSs) of 50 micrograms per liter (µg/L), 10 µg/L, and 50 µg/L, respectively (Chapter 17-550, Florida Administrative Code [PAC]). [Figure 3-12 presents the chromium and cadmium concentrations detected in each Site 11 monitoring well groundwater sample.]

Silver vas detected in five samples, but only in two samples (GW005 and GW008) did the detected concentrations (180 µg/L and 140 µg/L, respectively) exceed the FPDWS of 50 µg/L. Arsenic vas present in only one sample (GW023); however, the detected concentration of 610 µg/L exceeds the PPDUS of 50 µg/L.

Zinc was detected in all the samples, but only in five samples (GW005, GW008, GW023, GW024, and GW026) did the detected concentrations exceed the Florida Secondary Drinking Water Standard (FSDWS) of 5,000

[Bold items enclosed in brackets denote changes to the last version of document]

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Table 3-5

SUMMARY ANALYTICAL SCREENING RESULTS FOR GROUNDWATER SAMPLES
(FROM TEMPORARY MONITORING WELLS)
NAS PENSACOLA SITE 11
(All results in µg/L, unless noted)

		Sample Number (Location)						
PAramotor	[Detection Limit	P11GW001 (TW001)	P11GW001D[a] (TW001)	P11GW005 (TW005)	P11GW007 (TW007)	P11GW008 (TW008)	P11GW012 (TW012)	[FPDWS/ FSDWS
Arsonic	69	--	--	--	--	--	--	SO
Chromium	10	160	140	1,100	760	2,600	77	SO
Zinc	20	69	56	22,000	390	20,000	1,500	5,000
Load	40	--	--	9,900	370	15,000	2,700	50
Cadmium	■	8.3	--	*800*	74	190	62	10
Nickel	40	--	--	210	43	370	90	
Copper	25	--	--	2,700	89	6,700	280	1,000
Silver	10	--	--	180	--	140	17	50
TRPHs (mg/L)	1	--	--	2.1	--	3.2	500	
Benzene	10	--	--	--	--	--	--	1
Toluene	10	--	--	--	--	--	--	
total Xylenes	10	--	--	--	--	--	12	
Trichloroethene	10	--	--	--	31	--	--	3]
Total PAHs as Benzo-a-pyrene	100	--	--	--	--	--	150	
Phenols as Trichlorophenol	100	--	--	--	520	--	220	
Total PCBs	10]	--	--	--	(L)	(L)	--	

14[NASP]UH6027:T0227/282/10

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[Bold items enclosed in brackets denote changes to tho last version of document]

Table 3-5 (Cont.)

Parameter	[Detection limit	Sample Number (Location) P11GW014 (TW014)	P11GW021 (TW021)	P11GW023 (TW023)	P11GW024 (TW024)	P11GW026 (TW026)	P11GW029 (TW029)	[FPDWS/ FSDWS
Arsenic	69	--	--	610	--	--	--	Sa
Chromium	10	96	29	1SO	31	1,000	560	Sa
Zinc	20	1,100	1,600	19.000	6,300	9,400	70	5,000
Load	40	590	1,900	22.000	1,300	9,900	160	Sa
cadmium	5	20	39	200	70	600	7.3	10
Nickel	40	--	--	*100*	31	140	--	
Copper	25	170	380	3,300	250	5,600	28	1,000
Silver	10	21		--	--	14	--	50
TRPHs (mg/L)	1	4.4	190	560	46	37	--	
Benzene	10	--	--	11	--	--	--	1
Toluene	10	--	--	11	--	--	--	
Total Xylenes	10	--	--	35	--	--	--	
Trichloroethene	10	--	--	--	--	--	--	3]
Total PAHs as Benzo-a-pyrene	100	L)	(L)	--	(L)	(L)	--	
Phenols as Trichlorophenol	100	340	--	--	--	--	--	
Total PCBs	10]	--	--	--	--	(L)	--	

14[NASP]UH6027:T0227/282/10

Key:

[FPDWS = Florida Primary Drinking Water Standard.
FSDWS = Florida Secondary Drinking Water Standard.]

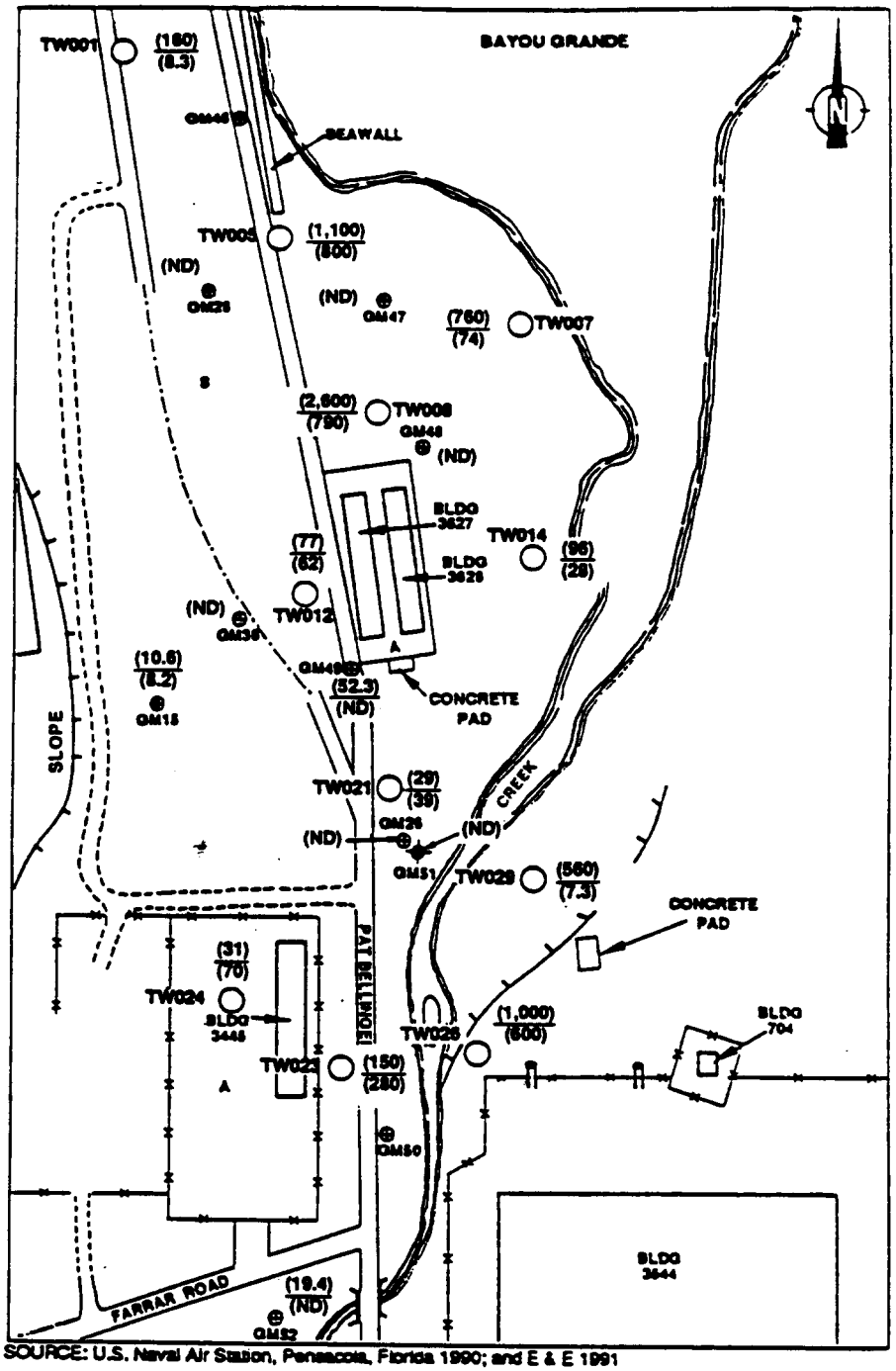
• Duplicate of sample P11GW001.

Dash (--) indicator compound not detected.

Qualifier:
(L) = Present below stated detection limit.

Source: Ecology and Environment, Inc., 1991.

[Bold items d in brackets denote changes to . version of document]



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

KEY:

Unmaintained Road		Outfall Pipe		Existing Permanent Deep Monitoring Well	
Abandoned Road	A	Asphalt Paved Area		Temporary Monitoring Well	
BLDG 692 Building	S	Sand	TW005	Temporary Monitoring Well Number	
Fence		Existing Permanent Shallow Monitoring Well	(160)/(8.3)	Chromium Concentration (mg/kg) / Cadmium Concentration (mg/kg)	
			(ND)	Not Detected	

Figure 3-12 CHROMIUM AND CADMIUM CONCENTRATIONS IN GROUNDWATER SAMPLES — NAS PENSACOLA SITE 11

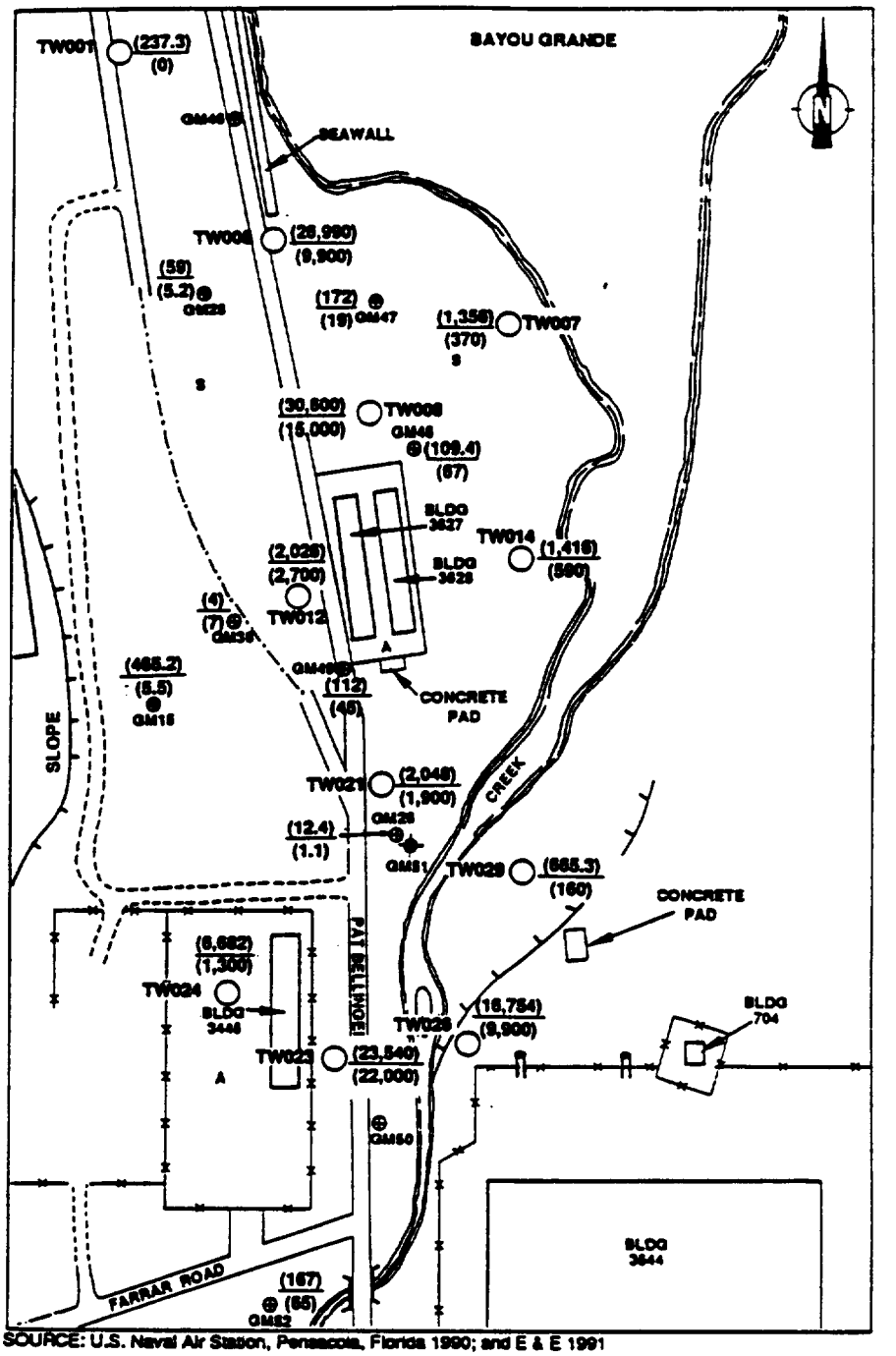
µg/L. Copper was detected in 10 of the samples, but only in four samples (GW005, GW008, GW023, and GW026) did the detected concentrations exceed the FSDWS of 1,000 µg/L. Nickel was detected in seven samples, but only in three samples (GW005, GW008, and GW023) did the detected concentrations exceed the Florida Groundwater Guidance Concentration (FGWGC) of 150 µg/L (FDER 1989).

For *each* metal detected at Site 11, the corresponding FPDVS, PSDWS, or FGWGC was exceeded in one or more samples. The highest concentrations of each metal detected vere in the samples GW005, GW008, or GW023 (see Table 3-5). Figure 3-[13] presents the total metals concentration (excluding lead) and the lead concentration in *each* monitoring well groundwater sample across Site 11. Figure 3-[13] also includes the corresponding screening-group metals concentration in each unfiltered sample collected from the existing permanent wells (see also Section 3.9.2.3). In general, the distribution of elevated groundwater total metals concentrations and the distribution of elevated groundwater lead concentrations correspond in tw areas: the north-central portion of the site and the south-central portion of the site.

TRPHs. TRPHs were detected in eight of the temporary monitoring well groundwater samples, and in five samples (GW012, GW021, GW023, GW024, and GW026) the detected concentrations exceed the potentially applicable FDER cleanup standard of 5 milligrams per liter (mg/L) (Chapter 17-770, FAC). Also, as mentioned previously, floating or immiscible hydrocarbons were observed in wells TW012, TW021, TW023, and TW024 during sampling. Figure 3-[14] presents the TRPH concentration in each temporary well groundwater sample across Site 11. The highest TRPH concentrations (500 mg/L, 190 mg/L, and 960 mg/L) were detected in groundwater samples collected from temporary monitoring wells TW012, TW021, and TW023, respectively, which were located in the central and south areas of the site, immediately east and west of Pat Bellinger Road.

VOCs. Groundwater samples GW007, GW012, and GW023 exhibited concentrations of one or more VOCs (see 'Cable 3-5). Benzene was detected in sample GW023 at 11 µg/L, which exceeds the FPDWS of 1 µg/L

[Bold items enclosed in brackets denote changes to the last version of document]



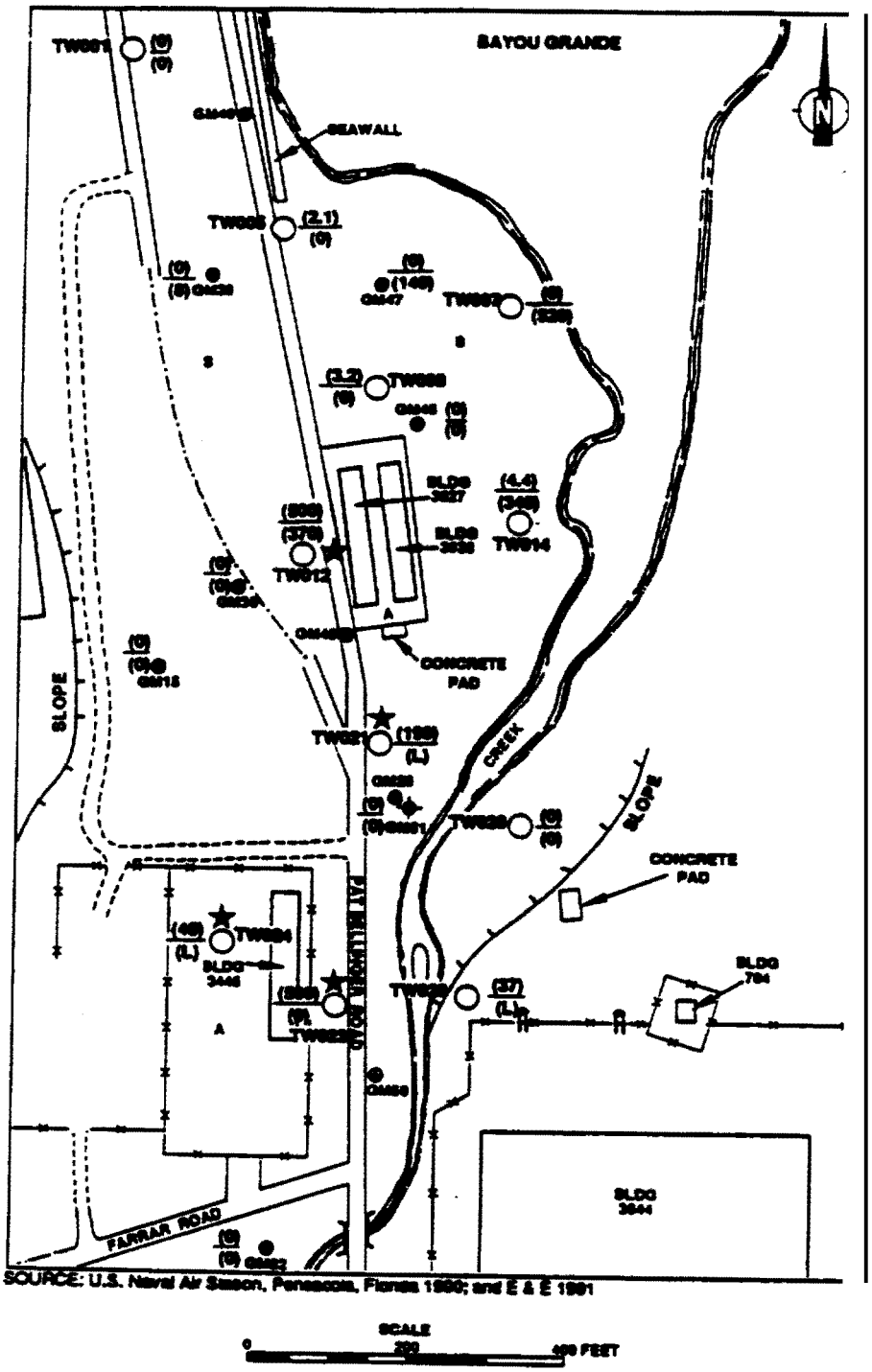
SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

SCALE
0 200 400 FEET

KEY:

Unmaintained Road		Outfall Pipe		Existing Permanent Deep Monitoring Well	
Abandoned Road	A	Asphalt Paved Area		Temporary Monitoring Well	
BLDG 692 Building	8	Sand	TW006	Temporary Monitoring Well Number	
Fence		Existing Permanent Shallow Monitoring Well	(172) / (19)	Total Metals Concentration (Excluding Lead) (mg/kg) / Lead Concentration (mg/kg)	

Figure 3-13 TOTAL METALS CONCENTRATIONS (EXCLUDING LEAD) AND LEAD CONCENTRATIONS IN GROUNDWATER SAMPLES NAS PENSACOLA SITE 11



SOURCE: U.S. Naval Air Station, Pensacola, Florida 1990; and E & E 1991

KEY:

- Unmaintained Road
- Abandoned Road
- Building
- Fence
- Outlet Pipe
- A Asphalt Paved Area
- S Sand
- Existing Permanent Shallow Monitoring Well
- Wells where free product was detected by oil-water interface probe.
- Existing Permanent Deep Monitoring Well
- Temporary Monitoring Well
- (600) / (376) TRPH Concentration (mg/L) / Total PAH and Phenol Concentration (ug/L)
- (L) Present Below Detection Limit

Figure 3-14 TRPH AND TOTAL PAH AND PHENOL CONCENTRATIONS IN SHALLOW GROUNDWATER SAMPLES — NAS PENSACOLA SITE 11

(Chapter 17-550, PAC). This sample also contained toluene at 11 µg/L and total xylenes at 35 µg/L, but these concentrations are below the respective FGWGCs of 24 µg/L and 50 µg/L (FDER 1989). Total xylenes were also detected at a low concentration (12 µg/L) in sample GW012. Trichloroethene was detected in sample GW007 at 31 µg/L, which exceeds the PPDWS of 3 µg/L (Chapter 17-550, FAC).

PAHs and Phenols. PAHs and/or phenols were detected in samples GW007, GW012, GW014, GW021, GW024, and GW026. PAHs were present below detection limits in samples GW014, GW021, GW024, and GW026 (see Table 3-5). Figure 3-**[14]** presents the total PAH and phenol concentration in each shallow groundwater sample from the temporary and permanent monitoring wells across Site 11. The highest total PAH and phenol concentrations were collected from temporary wells just east and west of buildings 3627 and 3628 and also in the northeast portion of the site, east of permanent monitoring well GM47.

PCBs. Trace levels of PCBs were present at concentrations below the detection limit of **10** µg/L in samples GW007, GW008, and GW026 (see Table 3-5).

[TAL/]TCL Parameters

Tables 3-6 and 3-7 summarize the analytical results for the groundwater samples collected from the permanent monitoring wells on Site 11. These samples were analyzed for the **[TAL/]TCL** parameter group, TRPHs, total alkalinity, total hardness, and total organic carbon. Figure 2-2 shows the existing permanent monitoring well locations at Site 11. The complete **[TAL/]TCL** analytical results for these groundwater samples are presented in Appendix H.

In general, a variety of metals were detected. Although a greater variety of metals and higher concentrations were detected in the unfiltered (total metals) samples than in the filtered (dissolved metals) samples (see Table 3-6). Hany VOCs and base/neutral and acid extractable compounds (BNAs) were also detected; however, some of these compounds were also present in the field, rinsate, or preservative blanks and associated laboratory method blanks (see Table 3-9 and

Table 3-6

SUMMARY [TAL] METALS ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
(FROM PERMANENT MONITORING WELLS)
NAS PENSACOLA SITE 11
(All results in µg/L, unless noted)

Parameter	[Detection Limit	Sample Number (Location) P11W015 (GM15)	P11W026 (GM26)	P11W028 (GM28)	[FPDWS/ PRDWS
Total Metals					
Aluminum	62	2,060	—	569	
Arsenic	1	—	3.6		50
Barium	10	2S.6	—	16	1,000
Cadmium	1	8.2	—		10
Calcium	500	32,700	33,900	5,830	
Chromium	10	10.6	—		W
Copper	15	412	—	—	1,000
Iron	19	812	1,890	1,710	300
Load	1	5.5	1.1	s.2	S0
Magnesium	500	2,970	1,750	1,720	
Manganese	2	36.9	S0.7	21.9	50
Mercury	0.2	—	—		2
Nickel	10	—	—	—	
Potassium	m	2,500	1.100	697	
Selenium	1	—	1.5		10
Sodium	500	8,630	4,910	4,290	160,000
Vanadium	10	—	—	—	
Zinc	4	34.8	8.8	59.6	5,000
Dissolved Metals					
Aluminum	62	194	—	70	
Arsonic	1	—	1.8	—	50
Barium	n	15.8	—	—	1,000
Cadmium	1	6.5	—	—	10
Calcium	500	34,100	33,600	5,490	
Iron	19	64	1,620	635	300
Load	1	—	—	—	S0
Magnesium	500	3,180	1,760	1,300	
Manganese	2	—	S0	1Y.1	S0
Mercury	0.2	—	—	0.53(W)	2
Potassium	m	2,530	1,770	648	
Selenium	1	—	1.7(W)	—	10
Sodium	500	9,880	5,000	4,650	160,000
Zinc	4]	13.6	6.7	11.4	5,000]

14[NASP]UN6027:T0227/329/25

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[Bold items enclosed in brackets denote changes to the last version of document]

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Table 3-6 (Cont.)

Parameter	[Detection Limit	Sample Number (Location) P11W036 (OM36)	P11W047 (GM47)	P11W04 (GM4)	[FPDWS/ FSDWS
Total Metals					
Aluminum	**62**	179	1,080	569	
Arsenic	1	--	11.6	1.4(W)	SO
Barium	10	11.6	42.3	172	1,000
Cadmium	1	--		--	10
Calcium	**500**	32,800	9,810	83,000	
Chromium	10	--	--	--	SO
Copper	15		--	--	1,000
Iron	19	183	6,100	2,010	300
Load	1	7	18.9	67.5.	SO
Magnesium	**500**	3,090	2,000	10,400	
Manganese	2	37.5	39.6	229	SO
Mercury	0.2	--	--	--	2
Nickel	**10**	--	--	--	
Potassium	**500**	5,470	569	6,700	
Selenium	1	--		--	10
Sodium	**500**	16,900	6,650	8,330	160,000
Vanadium	**10**	--	--	--	
Zinc	4	4	161	108	5,000
Dissolved Metals					
Aluminum	62	140	85	--	
Arsonic	1		14.8	--	SO
Barium	**70**	11.6	35	170	**1,000**
Cadmium	1	--	--	--	10
Calcium	**500**	33,500	9,690	90,500	
Iron	**19**	61	5,600	148	*300*
Load	1	1.4	3.7	--	SO
Magnesium	**500**	3,210	2,050	11,200	
Manganese	2	--	39.3	241	SO
Mercury	**0.2**	--	--	--	2
Potassium	**500**	5,730	789	7,660	
Selenium	1	--	--	--	10
Sodium	**500**	19,100	7,290	9,540	160,000
Zinc	**4]**	4	7.3	--	*5,000*

14[NASP]UH6027:T0227/329/25

Key at end of table.

[Bold items enclosed in brackets denote changes to the last version of document]

Table 3-6 (Cont.)

Parameter	[Detection Limit	Sample Number (Location) P11W049 (GM49)	P11W051 (GM51)	P11W052 (GM52)	[FPDWS/ FSDWS
Total Metals					
Aluminum	62	1,570	91	5,400	
Arsenic	1	—	—	39.5	H
Barium	10	—	69.6	34.8	1,000
Cadmium	1	—	—	—	10
Calcium	500	21,900	479,000	4.210	
Chromium	10	52.3	—	19.4	50
Copper	15	—	—	15.2	1,000
Iron	19	3,400	1,130	12,000	300
Load	1	45.5[a]		65.5[a]	50
Magnesium	500	1,900	78,500	1,000	
Manganese	2	101	341	34.4	50
Mercury	0.2	—	—	—	2
Nickel	15	25.1	—	—	
POtassium	500	961	12,600	813	
Selenium	1		—	—	10
Sodium	500	10,900	1,210,000	16,700	160,000
Vanadium	10	—	—	14.8	
Zinc	4	34.8	—	93.6	5,000
Dissolved Metals					
Aluminum	62	—	86	101	
Arsenic	1	—	—	14.9	W
Barium	10	—	69	10.2	1,000
Cadmium	1	—	—	—	10
calcium	500	22,000	454,000	3,790	
Iron	19	2,010	1,020	2,400	300
Load	1	1.2(W)	—	—	W
Magnesium	500	1,940	75,500	039	
Manganese	2	97.5	307	24.2	50
Mercury	0.2	—	—	—	2
Potassium	500	1,040	12,900	695	
Selenium	1	—	—		10
Sodium	500	9,030	1,230,000	17,100	160,000
Zinc	4]	6.0	—	10.1	5,000

14[NASP]UN6027:T0227/329/25

Key:

[FPDWS = Florida Primary Drinking Water Standard
FSDWS = Florida Secondary Drinking Water Standard
[a]The detection limit for this parameter increased by a factor of 10 in this sample.]
Dash (—) indicates compound not detected.

Qualifiers:
(N) = Spiked sample recovery not within control limits.
(W) = Post digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

Source: Ecology and Environment, Inc., 1991.

[Bold items enclosed in brackets denote changes to the last version of document]

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Table 3-7

SUMMARY TCL ANALYTICAL RESULTS
FOR GROUNDWATER SAMPLES
(FROM PERMANENT MONITORING WELLS)
NAS PENSACOLA SITE 11
(All results in µg/L, unless noted)

Parameter	[Detection Limit	Sample Number (Location) P11W015 (GM15)	P11W026 (GM26)	P11W028 (GM28)	[FPDWS/ PSDWS
Vinyl Chloride	10	--	--	--	1
Methylene Chloride	10	6(B[a])	6(B[a])	5(B[a])	
Acetone	10	15(B[a])	34(B[a])	44(B[a])	
Carbon Disulfide	5	--	--	--	
1,1-Dichloroethene	5	--	--	--	7
1,2-Dichloroethene (Total)	5	--	--	--	
Trichloroethene	5	--	--	--	3
Benzene	5	--	--	--	1
Tetrachloroethene	5	--	--	--	3]
Toluene	5	--	--	--	
Ethylbenzene	5	--	--	--	
Total Xylenes	5	--	--	--	
Naphthalone	10	--	--	--	
2-Methylnaphthalone	10	--	--	7(J)	
Acenaphthene	10	--	--	--	
Dibenzofuran	10	--	--	--	
Diethyl Phthalate	10	--	--	1(J)	
Fluorene	10	--	--	--	
Di-N-Butyl-Phthalate	10	4(J)	4(B[a],J)	3(B[a],J)	
Bis(2-Ethylhexyl)Phthalate	**10**	5(B[a],J)	10(B[a])	17(B[a])	
Tentatively Identified Compounds*					
Freon-113		13(B[a],J)	9(B[a],J)	14(B[a],J)	
Cyclohexanol		--	8(J)	--	
Hexane		17(B[a],J)	9(B[a],J)	6(B[a],J)	
2,2'-Oxybis-ethanol		--	170(B[a],J)	530(B[a],J)	
1,2-dichloro-1,1,2-trifluoro		--	--	--	
2-cyclohexen-1-one		9(J)	12(B[a],J)	9(B[a],J)	
Sulfur, mol.		--	--	--	
Butyl Benzene **Isomer**		--	--	--	
Butyl Phenol **Isomer**		--	--	--	
Dimethyl Benzene Isomer		--	--	--	
Dirthyl Indene Isomer		--	--	13(J)	
Dimethyl Naphthalene Isomer		--	--	8(J)	
Ethyl Dimethyl Benzene Isomer		--	--	12(J)	
Ethyl Methyl Benzene Isomer		--	--	--	
Methyl Indene Isomer		--	--	12(J)	
Methyl Naphthalene Isomer		--	--	--(J)	
Methyl Propyl Benzene **Isomer**		--	--	13(J)	
Tetramethyl Benzene Isomer		--	--	--	
Trimethyl Benzene **Isomer**		--	--	--	
Unkown Acid		--	--	(2) 31(J)	
Unknown Alcohol		--	--	--	
Unknown Hydrocarbon		(4) 44(J)	600(J)	(6) 1,448(J)	
Unknown Hydrocarbon		5.6(B[a],J)	17(B[a],J)	--	
Unknown Oxygenated Hydrocarbon		--	--	12(J)	
Unknown Compound		(3) 54(J)	--	(9) 158(J)	
Unknown Compound		--	(3) 34.6(B[a],J)	6.7(B[a],J)	
Total Alkalinity (mg/L as $CaCo_3$)	1	97	86	35	
Total Hardness (mg/L as $CaCo_3$)	1	100	94	26	
Total Organic Carbon (mg/L)	1]	5.3	22	12	

14[NASP]UH6027:T0227/328/21

Key at end of table.

[Bold items enclosed in brackets denote changes to tho last version of document]

Table 3-7 (Cont.)

Parameter	[Detection Limit	Sample Number (Location) P11W036 (GM36)	P15W047 (GM47)	P15W048 (GM48)	[PPDWR/ PSDWR
vinyl Chloride	10	—	—	—	1
Methylene Chloride	10	18(B[a])	5(B[a])	6(B[a])	
Acetone	10	17(B[a])	36(B[a])	40(B[a])	
Carbon Disulfide	5	—	2(J)	3(J)	
1,1-Dichloroethene	5	—	—	—	7
1,2-Dichloroethene [Total)	5	—	2(J)	—	
Trichloroethene	5	—	—	—	3
Benzene	5	—	5	—	1
Tetrachloroethene	5	—	—	—	3]
Toluene	5	—	7	—	
Ethylbenzene	5	—	24	—	
Total Xylenes	5	—	89	—	
Naphthalene	10	—	86	—	
2-Methylnaphthalene	10	—	56	—	
Acenaphthene	10	—	1(J)	—	
Dibenzofuran	10	—	1(J)	—	
Diethyl Phthalate	10	—	—	—	
Fluorene	10	—	2(J)	—	
Di-N-Butyl-Phthalate	10	1(J)	3(B[a],J)	10(B[a])	
Bis(2-Ethylhexyl)Phthalate	10	8(B[a],J)	11(B[a])	5(B[a],J)	
Tentatively Identified Compounds.					
Froom-113		13(B[a],J)	—	13(B[a],J)	
Cyclohexanol		—	—	—	
Hexane		13(B[a],J)	—	8(B[a],J)	
2,2'-Oxybis-ethanol		—	—	—	
1,2-dichloro-1,1,2-trifluoro		—	—	—	
2-cyclohexen-1-one		8(J)	—	—	
Sulfur, mol.		—	100(J)	—	
Butyl Benzene Isomer		—	37(J)	—	
Butyl Phenol Isomer		—	—	—	
Dimethyl Benzene Isomer		—	74(J)	—	
Dimethyl Indene Isomer		—	—	—	
Dimethyl Naphthalene Isomer		—	(2) 40(J)	—	
Ethyl Dimethyl Benzene Isomer		—	(3) 138(J)	—	
Ethyl Methyl Benzene Isomer		—	(4) 236(J)	—	
Methyl Indene Isomer		—	—	—	
Methyl Naphthalene Imowr		—	38(J)	29(J)	
Methyl Propyl Benzene Isomer		—	(3) 112(J)	—	
Tetramethyl Benzene Isomer		—	(2) 69(J)	—	
Trimethyl Benzene Isomer		—	(5) 783(J)	—	
Unkown Acid		—	—	—	
Unknown Alcohol		10(B[a],J)	—	—	
Unknown Hydrocarbon		54(J)(3)	1,208(J)	(2) 14(J)	
Unknown Hydrocarbon		—	—	—	
Unknown Oxygenated Hydrocarbon		—	16(J)	—	
Unknown Compound		(4) 31.1(J)	(3) 51(J)	(3) 73(J)	
Unknown Compound		—	—	(5) 54.6(B[a],J)	
Total Alkalinity (mg/L as $CaCo_3$)	1	58	45	300	
Total Hardness (mg/L as $CaCo_3$)	1	95	30	270	
Total Organic Carbon (mg/L)	1]	6.1	19	17	

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Table 3-7 (Cont.)

Parameter	(Detection Limit	Sample Number (Location) P11W049 (GM49)	P11W051 (GM51)	P11W052 (GM52)	[FPDWS/ FSDWS
Vinyl Chloride	10	—	—	310(E[a])	1
Methylene Chloride	10	4(B[a],J)	4(B[a],J)	20(B[a])	
Acetone	10	12(B[a])	9(B[a],J)	17(B[a])	
Carbon Disulfide	[illegible]	5	29	—	
1,1-Dichloroethene	5	—	—	11	7
1,2-Dichloroethene (Total)	5	—	—	1,300(E)	
Trichloroethene	5	—	—	100	3
Bonrono	5	—	—	—	1
Tetrachloroethene	5	—	5	5	31
Toluene	5	—	—	—	
Ethylbenzene	5	—	—	—	
Total Xylenes	5	—	—	—	
Naphthalene	10	—	—	—	
2-Methylnaphthalene	10	—	—	—	
Acenaphthene	10	—	—	—	
Dibenzofuran	10	—	—	—	
Diethyl Phthalate	10	—	—	—	
Fluorene	10	—	—	—	
Di-N-Butyl-Phthalate	10	3(B[a],J)	3(B[a],J)	3(J)	
Bis(2-Ethylhexyl)Phthalate	10	16(B[a])	16(B[a])	5(B[a],J)	
Tentatively Identified Compounds.					
Froon-113		—	—	14(B[a],J)	
Cyclohexanol		—	—	—	
Hexane		6(B[a],J)	6(B[a],J)	—	
2,2'-Oxybis-ethanol		660(B[a],J)	460(B[a],J)	—	
1,2-dichloro-1,1,2-trifluoro		—	—	70(J)	
2-cyclohexen-1-one		—	11(B[a],J)	—	
Sulfur, mol.		—	—	—	
Butyl Bonrono Isomor		—	—	—	
Butyl Phenol Isomor		—	—	22(J)	
Dimethyl Benzene Isomer		—	—	—	
Dimethyl Indene Isomor		—	—	—	
Dimethyl Naphthalene Isomer		—	—	—	
Ethyl Diwthyl Bonrono Isomer		—	—	—	
Ethyl Methyl Bonrono Isomer		—	—	—	
Methyl Indene Isomor		—	—	—	
Nothyl Naphthalene Isomor		—	—	—	
Nothyl Propyl Benzene Isomer		—	—	—	
Tetramethyl Bonrono Isomor		—	—	—	
Triwthyl Benzene Isomor		—	—	—	
Unkown Acid		15(J)	(2) 55(J)	—	
Unknown Alcohol		—	—	9(B[a],J)	
Unknown Hydrocbrbon		(4) 2,236(J)	10(J)	15(J)	
Unknown Hydrocarbon		27(B[a],J)	1 300(B[a],J)	—	
Unknown Oxygenated Hydrocarbon		—	—	—	
Unknown Compound		(9) 295(J)	(6 89(J)	(5) 97(J)	
Unknown Compound		(2) 39(B[a],J)	(2 34(B[a],J)	—	
Total Alkalinity (mg/L as $CaCo_3$)	1	66	87	20	
Total Hardness (mg/L as $CaCo_3$)	1	70	1,600	58	
Total Organic Carbon (mg/L)	1]	12	5.1	13	

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Key at end of table.

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Table 3-7 (cat.)

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Note: The number within parentheses preceding tho concentration is tho number of tentatively identified compounds [(TICs)] in this parameter group. The listed concentration represents tho sum of tho individual group-member concentrations.

Key:

[FPDWS = Florida Primary Drinking Water Standard
FSDWS = Florida Secondary Drinking Water Standard]
NA = Analyses not performed.
Dash (—) indicates compound not detected.
[*Values for the TICs are estimated. No detection limits were established for the TICs.]

Qualifiers:

(B^a) = Present in method blank.
(E^a) = Identifies compounds with concentrations exceeding calibration range of tho GC/MS instrument for the specific analysis.
(J) = [For non-TICs] estimated value; compound present below detection limit. [Also indicates that n c concentrations are estimated because no detection limits were established.]

Source: Ecology and Environment, Inc., 1991.

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Section 3.11.2). Cyanide, TRPHs, pesticides, and PCBs were not detected in any of the groundwater samples from the permanent monitoring wells.

Metals. Table 3-6 summarizes the analytical results for [TAL] metals in the permanent monitoring well groundwater samples. Figure 3-[13] presents total metals concentrations (all detected concentrations of screening metals only, excluding lead) and total lead concentrations in the temporary and permanent groundwater monitoring well samples collected across Site 11.

Only four metals (calcium, magnesium, potassium, and sodium) were detected at similarly high levels in both total and dissolved metals samples. Of these four metals, only sodium is regulated by an FPDVS (160,000 µg/L) [Chapter 17-550, FAC]. Sodium was detected only in sample W051 at total and dissolved concentrations of 1,270,000 µg/L and 1,230,000 µg/L, respectively, which exceed the FPDVS.

The total chromium concentration (52 µg/L) in sample W049 and the total lead concentrations (67 µg/L and 65 µg/L) in samples V048 and W052, respectively, exceed the respective FPDVSs of 50 µg/L (Chapter 17-550, FAC). Lead was also detected in six permanent monitoring well samples (W015, W026, W028, W036, W047, and W049) but at concentrations below the FPDVS of 50 µg/L (Chapter 17-550, FAC) [(see figures 3-12 and 3-13)].

Arsenic was detected in four permanent well samples (W026, W047, W048, and W052). Again, the highest total arsenic concentration (39 µg/L in sample W052) was below the FPDVS of 50 µg/L (Chapter 17-550, FAC).

Barium was detected in all the permanent monitoring well samples, except V026 and W049. Total barium concentrations ranged from 16 µg/L in sample W028 to 172 µg/L in sample W048; all barium concentrations are below the FPDVS of 1,000 µg/L (Chapter 17-550, FAC).

Cadmium in sample W015, mercury in sample W028, and selenium in sample W026 were detected at concentrations of 8.2 µg/L, 0.53 µg/L, and 1.5 µg/L, respectively, all below the respective FPDVSs of 10 µg/L, 2 µg/L, and 10 µg/L (Chapter 17-550, FAC).

Iron and manganese were detected in all the samples obtained from the permanent monitoring wells. Total iron concentrations detected

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ranged from 183 µg/L in sample W036 to 12,800 µg/L in sample W052, and all sample concentrations, except in W036, vere above the FSDWS of 300 µg/L (Chapter 17-550, PAC). Total manganese concentrations detected ranged from 23 µg/L in sample W028 to 341 µg/L in sample W051, and four of the sample concentrations (in W026, W048, W049, and W051) vere above the FSDWS of 50 µg/L (Chapter 17-550, PAC).

Zinc vas detected at total concentrations less than the PSDVS of 5,000 µg/L in samples W015, W026, W028, W036, W047, W048, W049, and W052, and copper vas detected at total concentrations less than the FSDWS of 1,000 µg/L in samples W015 and W052 (Chapter 17-550, PAC).

Nickel vas detected in only one sample (W049) at a concentration of 25 µg/L, which is belov the FGWGC of 150 µg/L (FDER 1989).

Total (unfiltered) metals concentrations in the permanent wells were generally higher than the respective dissolved (filtered) concentrations (see Table 3-6). Furthermore, it should be noted that the total metals concentrations in the temporary monitoring vell samples vere generally much higher than the total metals concentrations in the permanent monitoring vell samples (see tables 3-3 and 3-6). As will be discussed further in Section 3.10, the relationship between total metals concentrations in temporary well samples and total metals concentrations in permanent well samples, evaluated in combination vith the relationship between total metals and dissolved metals concentrations in permanent vell samples (discussed in the preceding paragraphs), supports the probability that total metals concentrations are being impacted by acid preservative leaching/dissolution of aquifer matrix sediments entrained in the groundvater samples.

VOCs. Table 3-7 summarizes the analytical results for the TCL parameters in the permanent monitoring vell groundvater samples. Methylene chloride and acetone vere detected in all of the permanent monitoring vell groundvater samples. Given that these compounds vere also detected in the associated laboratory method blanks, their presence in the groundwater samples can be attributed to laboratory-derived contamination.

Carbon disulfide vas detected in three samples (W047, W049, and W051) at concentrations of 2 µg/L, S µg/L, and 29 µg/L, respectively.

Benzene was detected in sample W047 at a concentration of 5 µg/L, which is above the FPDWS of 1 µg/L (Chapter 17-550, FAC). Ethylbenzene and total xylenes were also detected in sample W047 at concentrations of 24 µg/L and 89 µg/L, respectively, above the FGWGCs of 2 µg/L and 50 µg/L, respectively (FDER 1989). Toluene also was detected in sample W047 at 7 µg/L; however, this concentration is below the FGWGC of 24 µg/L (FDER 1989).

Sample W052 exhibited five VOCs; vinyl chloride (310 µg/L); 1,l-dichloroethene (11 µg/L); 1,2-dichloroethene (1,300 µg/L); trichloroethene (100 µg/L); and tetrachloroethene (5 µg/L) at concentrations exceeding the respective FPDWSs of 1 µg/L, 7 µg/L, and 3 µg/L (Chapter 17-550, FAC). In addition, tetrachloroethene was detected in sample W051 at a concentration of 5 µg/L, which exceeds the FPDWS of 3 µg/L (Chapter 17-550, FAC).

BNAs. Naphthalene was detected only in sample W047 at a concentration of 86 µg/L (see Table 3-7), which exceeds the FGWGC of 10 µg/L (FDER 1989). Sample W047 also exhibited 2-methylnaphthalene at a concentration of 56 µg/L, and trace levels of acenaphthene at 1 µg/L, dibenzofuran at 1 µg/L, and fluorene at 2 µg/L. 2-Methylnaphthalene and diethyl phthalate were also detected (7 µg/L and 1 µg/L, respectively) in sample W028. Di-n-butyl-phthalate and bis(2-ethylhexyl) phthalate were detected at trace levels in all the permanent well groundwater samples as well as in the associated laboratory method blanks; therefore, the presence of these compounds can be attributed to laboratory-derived contamination.

Tentatively Identified Compounds (TICs). A number of VOC and BNA TICs were detected in the permanent well groundwater samples (see Table 3-7). Seven of these 13 compounds, including Freon-113, hexane, 2,2'-Oxybis-ethanol, 2-cyclohexen-1-one, unknown alcohols, unknown hydrocarbons, and unknown compounds, were also detected in the associated laboratory method blanks; therefore, the presence of these compounds can be attributed to laboratory-derived contamination. In contrast, samples W028 and W047 contained numerous benzene, phenol,

indene, and naphthalene isomers; these isomers are not attributable to laboratory-derived contamination.

Remediation Parameters

The permanent well groundwater samples were also analyzed for total alkalinity, total hardness, and total organic carbon to support subsequent groundvater remediation design activities at Site 11, if required. Table 3-7 presents the analytical results for these remediation parameters.

[For comparitive purposes, regional (i.e., within southern Escambia County) values of these same parameters in the Sand-and-Gravel Aquifer are as follows: alkalinity (as mg/L of $CaCO_3$) values range from a.00 mg/L to 129.9 mg/L (Clemens et al. 1989); total hardness values range fra 1.00 mg/L to 326.00 mg/L, vith the majority being less than 50 mg/L (Johnson 1991); and total organic carbon value8 range fra 2.88 mg/L to 21.41 mg/L (Clemens et al. 1989).] With respect to the nine permanent monitoring wells sampled at Site 11, total alkalinity ran@ from 20 mg/L to 300 mg/L, total hardness ranged from 26 mg/L to 1,600 mg/L, and total organic carbon ranged from 5.1 mg/L to 22 mg/L. [The majority of the Site 11 groundvater samples exhibited values of alkalinity, hardness, and total organic carbon well within the reported ranges of regional values.]

3.10 CONTAMINATION DISTRIBUTION/SOURCE DISCUSSION

The tvo media, soil and groundvater, sampled at Site 11 exhibit elevated levels of the contaminant groups (metals, TRPHs, VOCs, PAHs, and phenols). Belov detection limit concentrations of PCBs also are present in the soil and groundvater. In some cases, the detected contamination is clearly associated with reported past activities at Site 11, including landfilling, disposal of Industrial vastes, and, possibly, aircraft salvage or maintenance.

Although none of the Site 11 media samples were analyzed for radioactive properties, the results of the radiation survey discussed in Section 3.6 indicate a potential source of radioactive contamination exists approximately 50 feet east of Building 3628 located in the

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east-central portion of Site 11 (see Figure 3-2). However, the nature of the source material(s) of the contamination are unknown.

In additfon, Site 11 contamination may be impacting the area around Bayou Grande. Surface water and sediment sampled along the south arm of Bayou Grande during the Corresponding Phase I investigation of Site 30 (discussed in sections 3.10.1 and 3.10.2) exhibited at least trace levels of one or more of the contaminant groups (metals, TRPHs, PAHs, phenols, and PCBs). However, results of sampling conducted in the southeast area of Site 11 indicate that Bayou Grande may also be impacted by sources other than Site 11, possibly located southeast of Site 11. In the following sections, each media sampled on Site 11 and the media sampled adjacent to Site 11 will be discussed separately regarding the nature, distribution, and potential source(s) of contamination.

3.10.1 Surface Water

Surface water sampling was conducted in Bayou Grande during the corresponding Phase I investigation of Site 30. The results indicate that surface water contamination is most likely attributable to leachate migration and/or surface water runoff from Site 11. Metals vere detected in all of the Site 30 surface water samples at concentrations exceeding the corresponding FDER Class III (recreational) surface water standards.

At Site 30, arsenic was detected in samples P30SW002 (71 µg/L) and P30SW004 (120 µg/L) at concentrations exceeding the FDER Class III surface water standard of 50 µg/L (Chapter 17-302, FAC). Chromium was detected in sample P30SW002 (52 µg/L) at a concentration exceeding the FDER Class III surface water standard of 50 µg/L, and zinc was detected in all samples adjacent to Site 11, P30SW002 (100 µg/L), P30SW003 (110 µg/L), and P30SW004 (110 µg/L), at Concentrations exceeding the FDER Class III surface water standard of 30 µg/L (Chapter 17-302, FAC). Each of these metals were detected at elevated concentrations in soil and groundwater samples at Site 11.

Possible sources of arsenic concentrations in the surface water of Bayou Grande may be soil and groundwater in the southwest portion of Site 11; arsenic was detected in soil samples from boring B024 and in

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groundwater samples from temporary well TW023 and permanent wells GM26 and GM52. Other sources of arsenic may be soil and groundvater in the north portion of Site 11 where arsenic vas detected in soil samples from borings B002, B004, B006, and B013 and in groundwater samples from permanent monitoring wells GM47 and GM48. The source of arsenic in soil and groundvater in the north portion of Site 11 may be associated with the previous landfilling activities in this area.

3.10.2 Sediment

The four Site 30 sediment samples (P30SD001, P30SD002, P30SD003, and P30SD004), collected in Bayou Grande in the vicinity of Site 11 during the corresponding Phase I investigation of Site 30, contained elevated levels of metals, TRPHs, PAHs, and phenols. PCBs vere also present belov detection limits in two of these samples.

Chromium, zinc, lead, cadmium, copper, and arsenic were the primary metals detected in these sediment samples. The highest total metals and the highest lead concentrations detected in samples P30SD002 and P30SD003 may be due to leachate migration from the central area of Site 11 and discharge to surface water via seeps, and/or possibly to surface runoff from Site 11. Correspondingly high levels of total metals and lead were detected in the soil borings in the central area of Site 11 (see Section 3.10.3). Arsenic in Site 11 soil and groundwater is possibly impacting Bayou Grande; arsenic was detected in surface vater and sediment samples collected from Bayou Grande during the corresponding Phase I investigation of Site 30 (see sections 3.10.1 and 3.10.2). Other sources of arsenic located east-southeast may be impacting Bayou Grande (arsenic was detected in borings 8027, 8028, and B030); however, the nature of this potential source is currently unknovn. Likewise, the high concentrations of TRPHs, PAHs, and phenols in sediment samples P30SD002, P30SD003, and P30SD004 may correspond to the high concentrations of these contaminants detected in soil borings in the central and south areas of Site 11.

Past disposal of industrial wastes, landfilling, and/or aircraft salvage or maintenance activities in the central and south areas of Site 11 are probably the sources of metal, TRPH, PAH, and phenol

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contamination in Site 11 sediments which are impacting the south arm of Bayou Grande.

Although trace levels of PCBs were detected in three of the four Site 30 sediment samples from Bayou Grande, only one Site 11 soil sample (from boring B011) and three Site 11 groundwater samples (GW007, GW008, and GW026) contained below detection limit concentrations of PCBs. At present, it is not evident if any on-site source of PCBs exists at Site 11 or whether such a source could impact Bayou Grande sediments . Thus, PCBs detected in Site 30 sediment samples may be attributable to another upstream source.

3.10.3 Soil

Concentrations of metals, TRPHs, VOCs, PAHs, and phenols were detected in many of the soil samples collected at Site 11. A below detection limit concentration of PCBs was present in one sample (S011A) from the western edge of Site 11. The impact of soil contamination in the northeast, central, and south areas of Site 11 on Bayou Grande sediment is apparent, as discussed in the preceding section (see Section 3.10.2).

Soil metals contamination is generally widespread in the south half of Site 11, and the concentrations are elevated with respect to the significantly lower metals concentrations detected in borings in the north portion of the site. Chromium, zinc, lead, and copper were the primary metals contaminants detected in soil. The highest metals concentrations were detected in borings located in the south and central areas of the site around buildings 3445, 3627, and 3628. Total lead concentrations also were generally highest in the south and central areas.

Total arsenic concentrations were elevated, with respect to other on-site soil samples, in samples collected in the north-central portion of the site (borings B002, B004, B006, and B013), in the central and southwest portions (borings B019, B020, and B024), and in the southeast portion (borings B027, B028, and B030).

Given that nearly all soil samples were composited over depth intervals of 0 to 5 feet BLS or to the depth of the water table, whichever was less, metals contamination of soil within the unsaturated

zone is widespread over the central and south portions of Site 11. The source of soil metals contamination in the south and central areas of Site 11 is probably past industrial waste disposal via landfilling and burning activities in the central and south portions of the site, and/or possible aircraft salvage or maintenance activities that may have occurred in the area west of boring B023. The source of metals contamination in the southeast portion of the site is not evident at this time.

The highest concentrations of TRPHs, PAHs, and phenols correspond well with the elevated metals concentrations observed in the central and south areas of the site. TRPH, PAH, and phenol concentrations in soil in the northvest portion of the site (at boring B004) and also in the south portion (around borings B021 and B023) probably resulted from past disposal and possible burning of industrial wastes in these areas. However, relatively high concentrations of TRPHs, PAHs, and phenols occur widely over the site except in the extreme north portion (near borings B001 and B002) and in a narrow area north of buildings 3627 and 3628 centered around borings B007, B008, and B009.

3.10.4 Groundvater

Concentrations of metals, TRPHs, VOCs, PAHs, and phenols were detected in many of the groundvater samples collected at Site 11. Belov detection level concentrations of PCBs were also detected in the groundwater samples (GW007, GW008, and GW026) collected from three of the temporary wells at Site 11.

All of the unfiltered (total metals) groundwater samples exhibited elevated concentrations of several metals. However, it is probable that these elevated total metals concentrations (exhibited by the unfiltered samples), at least in part reflect acid preservative leaching/dissolution of aquifer matrix sediments entrained in the samples, rather than actual groundvater contamination. Evidence that leaching/dissolution may be occurring is also provided by the Phase I analytical results for the metals groundwater samples collected from the existing permanent monitoring wells not only on Site 11, but also on sites 1 (Sanitary Landfill) and 15 (Pesticide Rinsate Disposal Area). The permanent monitoring well groundvater samples were much less turbid

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than temporary monitoring well samples, exhibited much lower total (unfiltered) metals concentrations than the proximate Phase I temporary monitoring well samples, and exhibited even lower dissolved (millipore-filtered) metals concentrations. In light of the permanent monitoring well groundwater sample results, groundwater metals Contamination may be widespread at Site 11 but not at the levels suggested by the analytical results for the temporary well groundwater samples.

Total metals and total (unfiltered) lead concentrations detected in temporary monitoring well groundwater samples do not necessarily correspond to the soil metals concentrations detected in the corresponding soil boring samples. For example, the two highest total metals concentrations and second and third highest lead concentrations were detected in groundwater samples GW005 and GW008; however, relatively low concentrations of total metals and lead were detected in the corresponding soil boring samples B005 (A- and B-intervals) and B008, composited from the unsaturated zone. The lack of correspondence indicates that in some areas of Site 11 superjacent soils of the unsaturated zone are not the direct source of shallow groundwater metals contamination, rather that the source of shallow groundwater metals contamination may be below the water table, within the saturated zone. However, this indication does not preclude that in some areas of Site 11 metals concentrations in unsaturated-zone soils may be an immediate source of metals contamination in groundwater, as is indicated at the former locations (in the central and south portions of the site, respectively) of wells TU021 and TW023 (see Figure 3-[13]). Elevated concentrations of metals were detected in both the soil and groundwater samples at the former locations of TW021 and TW023. In addition, soil metals concentrations at other locations within the central portion of the site (borings B013, B017, and B018) may indicate areas of metals concentrations in the shallow groundwater. Therefore, sources of shallow groundwater metals contamination are evident in the central and south portions of Site 11 possibly above and below the water table, and in the north-central portion of the site below the water table (see Figure 3-[13]). Industrial waste disposal via landfilling activities, possibly above, in contact with, or below the water table, are the

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likely source of metals contamination in groundvater via leaching of contaminated soils.

Arsenic was detected in groundvater samples obtained from vells TW023, GM26, GM47, GM48, and GM52. Soils in tvo areas may be sources of arsenic leachate to shallov groundvater at Site 11; these areas include the northvest and north-central portions of Site 11 around borings B002, B004, B006, and B013; and the southwest portion of Site 11 around brings B019, B020, and B024. Arsenic was detected in groundvater samples from permanent wells downgradient of the potential northwest and north-central source areas, and in groundwater samples from one temporary monitoring well and one permanent well downgradient of the potential southwest source area. These detections indicate a potential on-site source of arsenic to Site 11 groundwater; however, arsenic also was detected in the groundwater sample from temporary well P26TW002 at Site 26 (Supply Department Outside Storage) located hydraulically upgradient of Site 12.

The highest concentrations of TRPHs were detected in Site 11 groundwater samples from temporary wells in the central and south areas of the site along Pat Bellinger Road (see Figure 3-[14]). In addition, free product was detected in these temporary wells (see Figure 3-[14]), and petroleum-stained or saturated sands were encountered duringcompletion of the soil borings for these wells. Therefore, sources of TRPHs exist along Pat Bellinger Road in the central and south areas of the site, where soil borings have the highest concentrations of TRPHs. However, the widespread presence of TRPHs in soil borings at Site 11 (see Figure 3-[11]) indicates potentially larger source areas may exist.

The highest concentrations of VOCs were detected in groundwater samples obtained from permanent monitoring vells GM47, in the northeast area of the site, and GM52 in the southvest area of the site. Vinyl chloride, total xylenes, ethylbenzene, and benzene were detected in sample W047 at concentrations above the respective FPDWS or FGWGC. In addition, trichloroethene was detected in well TW007 (located near well GM47 but screened much more shallowly).

1,2-Dichloroethene; 1,1-dichloroethene; trichloroethene; and tetrachloroethene vere detected in sample W052, all at levels above the

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respective FPDWSs. Also sample WO51 from deep well GM51, located north of GM52, contained tetrachloroethene at a concentration above the FPDWS. The TRPH, PAH, and phenol concentrations in Site 11 soil borings located hydraulically upgradient or immediately adjacent to these wells (GM52 and GM51) indicate potential on-site sources of these chlorinated VOCs to the groundwater sampled from each well (see Figure 3-[11]). Given the distance of GH52 from Site 11, there may also be a potential, unknown, off-site contributor of VOCs to the groundwater in the area of well GM52.

Of particular interest is the detection of tetrachloroethene, a chlorinated solvent VOC that has a density greater than water, in the groundwater sample from GM51. Given this density property, it is possible that tetrachloroethene has "sunk" within the shallow groundwater of the Sand-and-Gravel Aquifer at Site 11 to the depth of the screened interval of GM51. However, as discussed previously, as a result of a probable low permeability, semi-confining, or confining clay layer, an upward gradient exists between the screened intervals of the deep permanent well GM51 and the shallow permanent well GM26, located adjacent to GM51. Therefore, the potential for downward migration of tetrachloroethene at Site 11 is diminished.

Three of the four VOC components of the benzene/toluene/ethylbenzene/total xylenes (BTEX) quadruplet were detected in Site 11 groundwater samples. Benzene, toluene (may not represent on-site contamination, see Section 3.11.2), and total xylenes were detected in well TWO23 and xylenes were detected in temporary well TWO12. As VOCs are more readily flushed through the soil column (i.e., VOCs have greater solubility/mobility) than TRPHs, PAHs, and phenols, the potential source of the VOCs may not be the immediately superjacent soils. Therefore, total xylenes detected in the groundwater sample from temporary well TWO23 may be attributable to the total xylenes detected in boring BO23; whereas, the toluene detected in the groundwater sample from temporary well TWO23 may be attributable to toluene detected in borings BO19 and BO20, as borings BO19 and BO20 are upgradient of boring BO23. A source of total xylenes in the groundwater sample from TWO12 is not readily apparent; however, TRPHs, PAHs, and phenols were detected in the upgradient soil boring BO11.

PAR and phenol concentrations vere detected in groundvater samples from wells TW012, TW014, TW007, and GM47, located in the central and northeast areas of the site: however, PAH and phenol concentrations vere detected in soil borings located in the northvest, central, and south areas of the site. Potential sources of PAHs and phenols detected in soil samples may be a result of past industrial waste disposal and landfilling activities near the locations of borings B004 (in the northvest portion), and B021 and B023 (in the south-central portion). However, leaching of PAHs and phenols to the groundwater in the immediate vicinity of B021 and B023 is not apparent. In contrast to this, PAHs and phenols vere detected in groundvater samples from TW012 and TU014 where soil samples from the corresponding borings (B012 and B014) also contained PAHs and phenols. Given both the above, it is apparent that on-site soils are sources of groundwater PAH and phenol concentrations, but leaching of these compounds from immediately superjacent soils may not be the principal mechanism for migration. Past industrial waste disposal activities may have included landfilling, hence burial of PAH and/or phenol sources directly in contact vith groundvater.

3.11 QA/QC

3.11.1 Field QA/QC

Analytical Screening Samples

Two soil field duplicate samples and one groundwater field duplicate sample vere collected for the Site 11 screening samples. The analytical results for the duplicate samples are presented in the summary screening results tables for soil and groundwater (tables 3-3 and 3-5, respectively). The results for the soil duplicate samples (S013AD and S019AD) and groundwater duplicate sample (GW001D) vere in agreement, vithin acceptable limits, with the results for the original samples.

[TAL/]TCL Samples

One field duplicate sample, tvo bottle trip blanks, one sampling equipment rinsate blank, one field blank, and one preservative blank vere collected for the nine Site 11 [TAL/]TCL groundvater samples. The

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analytical results for these QA/QC samples are presented in the summary results tables for the groundwater field QA/QC samples (tables 3-8 and 3-9).

The results for groundwater duplicate W052D were in agreement, within acceptable limits, with the results for the original sample. Methylene chloride, acetone, Freon-113, and hexane were detected in trip blanks TB01 and TB02 (which were only analyzed for VOCs), rinsate blank RB01, field blank FB01, and preservative blank PB01. Aluminum, copper, iron, magnesium, manganese, mercury, sodium, and/or zinc were the only metals detected in the blanks. **Bis(2-ethylhexyl)phthalate,** di-n-butyl-phthalate, and several TICs were also detected in one or more of the blanks. The detected contaminants in the various blanks are of little concern because they also occurred in the associated laboratory method blanks and, hence, can be attributed to laboratory-derived contamination, and the detected levels do not significantly impact interpretation of the field sample analytical results.

3.11.2 Laboratory QA/QC

Analytical Screening Samples

Methylene chloride is a common laboratory-derived contaminant (EPA 1988) and was present in several of the method blanks analyzed at the laboratory. Methylene chloride was present in the soil method blanks and in two soil samples collected at Site 11. In both cases, the methylene chloride concentrations found in these soil samples were only slightly above the detection limit for this compound and, therefore, can be attributed to laboratory-derived contamination.

Toluene was detected in a number of soil samples at concentrations between 1,200 **µg/kg** and 1,400 µg/kg, but was not detected in any of the associated laboratory method blanks. Given the relatively frequent occurrence, uniform detection level, and seemingly random distribution pattern of toluene in the soil samples, it is not believed that toluene represents an actual on-site contaminant. E & E's ASC analyst, after reviewing the relevant analytical raw data, suggests that these detections may represent false analytical positives associated with the

Table 3-8

SUMMARY [TAL] METALS ANALYTICAL RESULTS FOR GROUNDWATER
FIELD QA/QC SAMPLES
(FROM PERMANENT MONITORING WELLS)
NAS PENSACOLA SITE 11
(All results in µg/L, unless noted)

Parameter	[Detection Limit	Sample Number (Location/Type) P11W052 (GM52)	P11W052D[a] (GM52)	P11WTB01[b] (Trip Blank)	[P11WTB02[b] (Trip Blank)	[FPDWS/ PEDWS
Total Metals						
Aluminum	**62**	5,400	*7,290*	NA	NA	
Arsenic	1	39.5	31.7	NA	NA	**50**
Barium	**10**	34.8	38.6	NA	NA	**1,000**
Calcium	n o	4,270	4,060	NA	NA	
Chromium	10	19.4	13.2	NA	NA	**50**
Copper	15	**15.2**	15.5	NA	NA	**1,000**
Iron	**19**	12,800	13,100	NA	NA	**300**
Lead	**1**	65.1	58.0	NA	NA	**50**
Magnesium	**500**	1,000	1,100	NA	NA	
Manganese	2	34.4	31.8	NA	NA	**50**
Mercury	0.2	—	—	NA	NA	**2**
Potassium	**500**	813	634	NA	NA	
sodium	**500**	16,700	11,300	NA	NA	**160,000**
Vanadium	10	14.8	13.8	NA	NA	
Zinc	4	93.6	33.7	NA	NA	**5,000**
Dissolved Metals						
Aluminum	62	101	104	NA	ma	
Arsenic	1	14.9	17.3	NA	NA	**50**
Barium	10	10.2	14.2	NA	ma	**1,000**
calcium	[illegible]	3,790	3,570	NA		
Copper	15					
Iron	1	2,480	3,330	NA	NA	**300**
Magnesium	[illegible]	839	801	NA	NA	
Manganese	2	24.2	*20.9*	NA	NA	n
Potassium	**500**	**695**	581	NA	NA	
Sodium	**500**	17,100	17,000	NA	NA	**160,000**
Zinc	41	18.7	40.1	NA	NA]	**5,000]**

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Table 3-8 (Cont.)

Parameter	[Detection Limit	Sample Number (Location/Type) P11WTB01 (Field Blank)	P11WRB01[c] (Sampling Equipment Rinsate)	P11WPB01[d] (Preservative Blank)	[FPDWS/ FSDWS
Total Metals					
Aluminum	62	--	411	NA	
Arsenic	1	--	--	NA	SO
Barium	10	--	--	NA	1,000
Calcium	500	--	--	NA	
Chromium	10	--	--	NA	50
Copper	15	32	34	NA	1,000
Iron	19	412	93	NA	*300*
Lead	1	--	--	NA	SO
Magnesium	500	500	--	NA	
Manganese	2	--	4.5	NA	50
Mercury	0.2	--	0.21(N)	NA	2
Potassium	500	--	--	NA	
Sodium	500	539	544	NA	160,000
Vanadium	10	--	--	NA	
Zinc	4	--	72	NA	5,000
Dissolved Metals					
Aluminum	62	151	162	2,190	
Arsonic	1	--	--		SO
Barium	10	--	--		1,000
Calcium	500	--	--	--	
Copper	15	--	--	193	
Iron	1	59	65	884	*300*
Magnesium	500	--	--		
Manganese	2	--	--	13	50
Potassium	500	--	--	--	
Sodium	500	799	3,730	1,600	160,000
Zinc	4]	--	--	--	5,000]

14[NASP]UH6027:T0227/345/25

Key :

[FPDWS = Florida Primary Drinking Water Standard.
FSDWS = Florida Secondary Drinking Water Standard.]
NA = Analyses not performed.
Dash (--) indicates compound not detected.

[a]Duplicate of sample P11W052.
[b]Analyzed for VOCs only.
[c]Analyzed for total metals, dissolved metals, cyanide, VOCs, BHAs,
[d]pesticides, PCBs, TRPHs, and gross alpha radioactivity only.
Analyzed for dissolved metals, cyanide, VOCs, and TRPHs only.

Qualifier:
(N) = Spiked sample recovery not within control limits.

Source: Ecology and tnvironmont, Inc., 1991.

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Table 3-9

SUMMARY TCL ANALYTICAL RESULTS
FOR GROUNDWATER FIELD QA/QC SAMPLES
(FROM PERMANENT MONITORING WELLS)
NAS PENSACOLA SITE 11
(All results in µg/L, unless noted)

Parameter	[Detection Limit	Sample Number (Location/Type) P11SW052 (GM52)	P11W052D[a] (GM52)	P11WTB01[b] (Trip Blank)	P11WTB02[b] (Trip Blank)	[FPDWS/ PSDWS
Vinyl Chloride	10	310(E[a])	260(E[a])	—	—	1
Methylene Chloride	10	20(B[a])	6(B[a])	9(B[a])	10(B[a])	
Acetone	10	17(B[a])	19(B[a])	21(B[a])	18(B[a])	
1,1-Dichloroethene	5	11	9	—	—	7
1,2-Dichloroethene (Total)	5	1,300(E[a])	1,100(E[a])	—	—	
Trichloroethene	5	100	88	—	—	3
Tetrachloroethene	5	5	4(J)	—	—	3]
Di-N-Butyl-Phthalate	10	3(J)	12	NA	NA	
Bis(2-Ethylhexyl)Phthalate	10	5(B[a],J)	6(B[a],J)	NA	NA	
Tentatively Identified Compounds**						
Freon-113		14(B[a],J	16(B[a],J)	17(B[a],J)	8(B[a],J)	
Hexane		—	—	12(B[a],J)	16(B[a],J)	
2,2'-Oxybis-ethanol		—	—	—	—	
1,2-dichloro-1,1,2-trifluoro		70(J)	68(J)	—	—	
2-Cyclohexen-1-one		—	8(J)*	—	—	
Butyl Phenol Isomer		22(J)	22(J)	—	—	
Unknown acid		—	—	—	—	
Unknown alcohol		9(B[a],J)	11(B[a],J)	—	—	
Unknown hydrocarbon		15(J)*	—	6.6(J)	—	
Unknown hydrocarbon		—	—	—	—	
Unknown oxygenated hydrocarbon		—	—	—	—	
Unknown compound		(5) 97(J)	(5) 111(J)	5(J)	6(J)	
Unknown compound		—	—	—	—	
Total Alkalinity (mg/L as $CaCo_3$)	1	20	20	MA	NA	
Total Hardness (mg/L a $CaCo_3$)	1	58	18	MA	MA	
Total Organic Carbon (mg/L)	11	13	34	MA	NA	

14[NASP]UN6027:T0227/344/9

Key at end of table.

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Table 3-9 (Cont.)

Parameter	[Detection Limit	Sample Number (Location/Type) P11WTB01 (Field Blank)	P11WRB01[c] (Sampling Equipment Rinsate)	P11WPB01[d] (Preservative Blank)	[FPDWS/ FSDWS
Vinyl Chloride	10	--	--	--	1
Methylene Chloride	10	6(B[a])	16(B[a])	16(B[a])	
Acetone	10	12(B[a])	15(B[a])	12(B[a])	
1,1-Dichloroethene	5	--	--	--	7
1,2-Dichloroethene (Total)	5	--	--	--	
Trichloroethene	5	--	--	--	3
Tetrachloroethene	5	--	--	--	3]
Di-N-Butyl-Phthalate	10	5(B[a],J)	5(B[a],J)	NA	
Bis(2-Ethylhexyl)Phthalate	10	16(B[a])	15(B[a])	NA	
Tentatively Identified Compounds**					
Freon-113		--	12(B[a],J)	11(B[a],J)	
Hexane		7(B[a] J)	5(B[a],J)	7(B[a],J)	
2,2'-Oxybis-ethanol		490(B[a] J)	510(B[a],J)	--	
1,2-dichloro-1,1,2-trifluoro		--	--	--	
2-Cyclohexen-1-one		10(B[a],J)	8(B[a],J)	--	
Butyl Phenol Isomer		--	--	--	
Unknown acid		10(J)	(2) 26(J)		
Unknown alcohol		--	--	--	
Unknown hydrocarbon		(5) 1,991(J)	(4) 1,936(J)	--	
Unknown hydrocarbon		53(B[a],J)	38(B[a],J)	--	
Unknown oxygenated hydrocarbon		12(J)	--	--	
Unknown compound		(2) 14(J)	(5) 62(J)	(2) 18(J)	
Unknown coapound		(2) 49(B[a],J)	33(B[a],J)	--	
Total Alkalinity (mg/L as $CaCo_3$)	1	--	NA	NA	
Total Hardness (mg/L as $CaCo_3$)	1	3.9	NA	NA	
Total Organic Carbon (mg/L)	1]	--	NA	NA	

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Note: Tho number vithin parentheses preceding tho concontration is tho number of tentatively identified compounds [TICs)] in this parameter group. Tho listed concentration represents tho sum of tho individual group-member concontrationa.

Key:

[FPDWS = Florida Primary Drinking Water Standard.
FSDWS = Florida Secondary Drinking Water Standard.]
NA = Analyses not performed.
Dash (--) indicates coapound not detected.
*Duplicate analysis not within control limit..
[**Values for tho TICs are estimated. No detection limits were established for tho TICs.]

[a]Duplicate of sample P11W052.
[b]Analyzed for VOCs only.
[c]Analyzed for total metals, dissolved metals, cyanide, VOCs, BNAs, pesticides, PCBs, TRPHs, and gross alpha radioactivity only.
[d]Analyzed for dissolved metals, cyanide, VOCs, and TRPHs only.

Qualifiers:
(B[a]) = Present in method blank.
(E[a]) = Identifies compounds with concontrationa exceeding calibration range of tho GC/MS instrument for tho specific analysis.
(J) = [For non-TICs] estimated value; compound present below detection limit. [Also indicates that TIC concentrations are estimated because no detection limits were established.]
(N) = Spiked sample recovery not within control limits.
(W) = Post digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

Source: Ecology and Environment, Inc., 1991.

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measurement process/instrumentation. Such false positives are not uncommon, but are usually eliminated by performing second column confirmation analyses on samples that exhibit positive detections on the first column runs. The Phase I analytical screening samples were not subject to second column confirmation analysis.

[TAL/]TCL Samples

Hethylene chloride, acetone, **bis(2-ethylhexyl)phthalate,** di-n-butyl-phthalate, and several TICs (i.e., Freon-113, hexane, 2,2-Oxybis-ethanol, 2-cyclohexen-1-one, an unknown alcohol, an unknown hydrocarbon, and an unknown compound) vere detected both in one or more of the [TAL/]TCL groundwater samples and in the associated laboratory method blanks at comparable concentrations (see tables 3-7 and 3-9). Hence, the presence of these compounds is attributable to laboratory-derived contamination. Several additional laboratory QA/QC comments concerning the [TAL/]TCL sample analyses are presented at the end of tables 3-8 and 3-9.

4. CONCLUSIONS

Soil and groundwater Contamination are present on and in the vicinity of Site 11. The combined results of E & E's Phase I investigation and G&M's 1984 and 1986 investigations indicate that Site 11 contamination is generally widespread. Metals (chromium, zinc, lead, copper, and arsenic), TRPHs, VOCs, PAHs, and phenols are the primary contaminants. PCBs are present below detection limits in one or more soil, groundwater, and sediment (Site 30) samples collected on or in the vicinity of Site 11. A potential source of radiation contamination exists in the east portion of Site 11 (approximately 50 feet east of Building 3628), where an elevated radiation reading of 40 to 45 µR/h was obtained during the radiation survey. However, the nature of the source material and the extent of the contamination are unknown.

Detected contamination, other than radiation contamination, is clearly associated with past activities at Site 11, including industrial waste disposal and burning and landfilling. These sources of contamination, other than radiation contamination, are likely impacting the south arm of Bayou Grande, as the results of Site 30 Phase I sediment and surface water sampling indicate.

Elevated levels of metals (including arsenic and lead), TRPHs, several VOCs, PAHs, and phenols were detected in on-site soil samples over a large area of the site. Metals contamination of unsaturated-zone soils is nearly ubiquitous at Site 11 south of buildings 3627 and 3628. The combined TRPH, PAH, and phenol contamination of soils in the unsaturated zone exists over the entire site, except in the extreme north portion and in the area of soil borings B007, B008, and B009. Soil contamination detected at Site 11 may be a result of past on-site activities, including industrial waste disposal and burning and landfilling. It is also apparent that Bayou Grande has been impacted by

Site 11 soil contamination--sediment samples collected during the corresponding Phase I investigation of Site 30 exhibited elevated levels of metals, TRPHs, PAHs, and phenols.

Metals concentrations, exceeding either FPDWSs or FGWGCs, are widespread in Site 11 groundwater samples; this widespread occurrence probably partially reflects that turbid temporary well groundwater suples were not filtered prior to acid preservation. However, the distribution of elevated total lead, Chromium, zinc, and copper concentrations in Site 11 groundwater samples suggests that the central and south areas of the site, near buildings *3627* and *3628*, and 3445, respectively, represent at least sources of metals contamination in the aquifer matrix sediments, if not also a source of actual groundwater contamination. Site 11 groundwater metals contamination is clearly impacting Bayou Grande--surface water samples collected during the corresponding Phase I investigation of Site 30 exhibited arsenic, chromium, and zinc at levels exceeding Florida water quality standards.

Videspread TRPH contamination of groundwater in the central and south portions of the site, VOC contamination in the northeast and south portions of the site (and at different depths vithin the Sand-and-Gravel Aquifer), and PAH and phenol contamination in the northeast portion of the site are probably attributable to on-site sources. It is possible that some VOC, PAH, and phenol contamination in the extreme south and southeast portions of Site 11 may also represent potential off-site sources impacting Site 11 and Bayou Grande.

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Ecology and Environment, Inc. (E 6 E), 19[90]a, General Realth and Safety Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

_____, 19[90]b, Generic Project Management Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

_____, 19[90]c, Generic Quality Assurance and Project Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

_____, 19[90]d, Generic Site Management Plan, Contamination Assessments and Remedial Activities, Naval Air Station Pensacola, Pensacola, Florida.

_____, 1990, Contamination Assessment/Remedial Activities Investigation Work Plan--Group B, Naval Air Station Pensacola, Pensacola, Florida.

ERM-Southeast, Inc. (ERM), 1988, Draft Site Investigation Report NIRP Site 31 at Building 649, Naval Air Station Pensacola, Pensacola, Florida.

Flood and Associates, Inc, 1978, South Escambia and Santa Rosa Counties, 201 Facilities Plan, City of Pensacola, Escambia and Santa Rosa Counties, City of Gulf Breeze, Santa Rosa Island Authority, and Santa Rosa County Beach Administration.

Florida Department of Environmental Regulation, 1988, Unpublished Marine Sediment Data from Pensacola Bay Sediment Study, 1985 to 1987, Tallahassee, Florida.

Florida Natural Areas Inventory, 1988a, Special Plants and Animals List, Escambia County, Florida, Tallahassee, Florida.

_____, 1988b, Survey of Pensacola Naval Air Station and Outlying Bronson Field for Rare and Endangered Plants, Tallahassee, Florida.

Geraghty and Hiller, Inc. (G & H), 1984, Verification Study, Assessment of Potential Ground-water Pollution at Naval Air Station Pensacola, Pensacola, Florida.

_____, 1986, Characterization Study, Assessment of Potential Ground-water Pollution at Naval Air Station Pensacola, Pensacola, Florida.

_____, 1987a, Quarterly Report, Corrective Action Program, Wastewater Treatment Plant, Naval Air Station Pensacola, Pensacola, Florida.

_____, 1987b, Lithologic Logs, Naval Air Station Pensacola Wastewater Treatment Facility, Pensacola, Florida.

(Bold items enclosed in brackets denote changes to the last version of document]

_____, 1988, Semi-Annual Report, Corrective-Action and Compliance-Monitoring Programs, Surge Pond Operation Permit, Wastewater Treatment Facility, Naval Air Station Pensacola, Pensacola, Florida.

Greene, K. Michael, 1989, personal communication, Navy EIC.

Heil, D. C., 1989, personal communication, Florida Department of Natural Resources, Tallahassee, Florida.

Jacob, C. E. and E. E. Cooper Jr., 1940, Report on the Ground-water Resources of the Pensacola Area in Escambia County, Florida: U. S. Geological Survey, Open-file Report 400001.

[Johnson, T., 1991, personal communication, Northwest Florida Water Management District, Havana, Florida.]

Kennedy, L. R., 1982, Rainfall Summary for the Northwest Florida Water Management District: Water Resources Special Report 82-3.

Ketchen, B. G. and R. C. Staley, 1979, A Hydrographic Survey in Pensacola Bay, Florida State University, Department of Oceanography, Tallahassee, Florida.

Lohman, S. W., 1972, Ground-Water Eydraulics: U. S. Geological Survey Professional Paper 708, Washington, D.C.

Luckenbach, M. V., R. J. Diay, and L. C. Schaffner, 1988, Scientific Consultation and Analytical Services: Benthic Assessment Procedures, Project 5, Virginia Water Control Board, Gloucester Point, Virginia.

Harsh, O. T., 1966, Geology of Escambia and Santa Rosa Counties, Western Florida Panhandle: Florida Geological Survey, Bulletin 46, 140 p.

Musgrove, R. E., J. T. Barraclough, and O. T. Marsh, 1961, Interim Report on the Water Resources of Escambia and Santa Rosa Counties, Florida: Florida Geological Survey, Information Circular No. 30.

Husgrove, R. E., J. T. Barraclough, and R. G. Grantham, 1965, Water Resources of Escambia and Santa Rosa Counties, Florida: Florida Geological Survey, Report of Investigations No. 40.

_____, 1966, Water Resources Records of Escambia and Santa Rosa Counties, Florida: Florida Geological Survey, Information Circular No. 50.

Naval Energy and Environmental Support Activity (NEESA), 1983, Initial Assessment Study of Naval Air Station Pensacola, Pensacola, Florida, NEESA 13-015.

National Institute for Occupational Safety and Eealth Association, 1985, Occupational Safety and Eealth Guidance Manual for Hazardous Waste Site Activities.

[Bold items enclosed in brackets denote changes to the last version of document]

Northwest Florida Water Management District, 1981, Public Water Supply Systems in the Coastal Areas of Escambia, Santa Rosa, Bay, Okaloosa and Walton Counties: Northwest Florida Water Management District, Water Resources Special Report 81-3.

Pike, E., 1989, personal communication, NAS Pensacola Public Works Department.

Prickett, T. A., T. G. Naymik, and C. G. Lonnquist, 1981, A Random Valk Solute Transport Model for Selected Groundwater Quality Evaluations, Bulletin 654, Illinois State Water Survey, Champaign, Illinois.

Schropp, S. J., and E. L. Windom, 1988, A Guide to the Interpretation of Metals Concentrations in Estuarine Sediments, Florida Department of Environmental Regulation, Coastal Zone Management Section, Tallahassee, Florida.

SEGS, 1986, Florida Hydrogeologic Units: Southeastern Geological Society Ad Eoc Committee on Florida Hydrostrategraphic Unit Definition (SEGS), Florida Geologic Survey, Special Publication No. 28.

'Trapp, H., Jr., 1972, Availability of Ground Water for Public-Vater Supply in the Pensacola *Area*, Florida - Interim Report, June 1971: U. S. Geological Survey, Open-File Report FL72002.

_____, 1973, Availability of Ground Water for Public-Water Supply in Central and Southern Escambia County, Florida - Interim Report, July 1973: U. S. Geological Survey, Open-File Report FL72029.

_____, 1975, Hydrology of the Sand-and-Gravel Aquifer in Central and Southern Escambia County, Florida - Preliminary Report - November 1973: U. S. Geological Survey, Open-Fila Report FL74027.

_____, 1978, Preliminary Eydrologic Budget of the Sand-and-Gravel Aquifer under Unstressed Conditions, with a Section on Water Quality Monitoring, Pensacola, Florida:. U. S. Geological Survey, Water-Resources Investigations 77-96.

U.S. Environmental Protection Agency, 1984, Standard Operating Safety Guidelines.

_____, 1985, Guidance on Remedial Investigations under CERCLA, EPA, OSWER, HWERL, EPA report #540/6-85/002, NTIS ref #PB-85-268616, OSVER Directive 9355.0-06B, U.S. EPA, Cincinnati, Ohio.

_____, 1985, Guidance on Feasibility Studies under CERCLA, EPA, OSWER, OWPE, EPA report #540/G-85/003, NTIS ref #PB-85-238-590, OSWER Directive 9355.0-05c, U.S. EPA, Washington, D.C.

_____, 1987, Data Quality Objectives for Remedial Response Activities, OSWER Directive 9335.0-7B, U.S. EPA, Washington, D.C.

[Bold items enclosed in brackets denote changes to the last version of document]

1100426

_____, 1987, Compendium of Superfund Field Operations Methods, OSWER Directive 9355.0-14, EPA/540/P-87/00/a.

_____, 1988, CERCLA Compliance with Other Laws Manual, Draft, OSWER Directive 9234.1-01, U.S. EPA, Washington, D.C.

_____, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA Draft, OSWER Directive 9355.3-01 OERR # 68-01-7090 and 68-W8-0098, U.S. EPA, Washington, D.C.

U.S. Fish and Wildlife Service, 1987, Long Range Fish and Wildlife Section, Naval Air Station Pensacola and Outlying Field Bronson, Pensacola, Florida, U.S.F.W.S. Field Office, Panama City, Florida.

U.S. Geological Survey, 1970a, 7 1/2 Minute Topographic Map, Fort Barrancas, Florida, Quadrangle.

_____, 1970b, 7 1/2 Minute Topographic Map, West Pensacola, Florida Quadrangle, Photorevised 1987.

U.S. Navy, 1986, U.S. Navy Gulf Coast Strategic Homeporting Environmental Impact Statement, Appendix IV, Pensacola, Florida, Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina.

_____, 1987, General Development Map Nos. 1276829 to 1276839, U.S. Naval Air Station Pensacola, Pensacola, Florida, Southern Division Naval Facilities Engineering Command, Charleston, South Carolina.

Wagner, J. R., 1982, Hydrogeology of the Northwest Florida Water Management District: in Ground Water in Florida - Proceedings of the First Annual Symposium on Florida Hydrogeology: Northwest Florida Water Management District, Public Information Bulletin 82-2.

Wagner, J. R., 1989, Hydrogeologic Framework of the Northwest Florida Water Management District.

Wagner, J. R., T. W. Allen, L. A. Clemens, and J. B. Dalton, 1984, Ambient Ground Water Monitoring Program - Phase 1: Northwest Florida Water Management District, DER Contract Number WM65.

Walton, W.C., 1970, Ground Water Resource Evaluation: McGrav-Hill Book Co., New York.

Water and Air Research, Inc. (WAR), 1986, Report of Collection and Analyses of Sediment, Water, and Elutriate Samples for Navy Gulf Coast Strategic Homeporting Project, Pensacola, Florida.

[Bold items enclosed in brackets denote changes to the last version of document]

Wilkins, R. T., J. R. Wagner, and T. W. Allen, 1985, Hydrogeologic Data for the Sand-and-Gravel Aquifer in Southern Escambia County, Florida: - Northvest Florida Water Management District, Technical File Report 85-2.

Wolfe, S. E., J. A. Reidenauer, and D. B. Means, 1988, An Ecological Characterization of the Florida Panhandle, U.S. Fish and Wildlife Service Biological Report 88(12); Minerals Management Service OCS Study/MMS 88-0063.

[Bold items enclosed in brackets denote changes to the last version of document]

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6. FLORIDA PROFESSIONAL GEOLOGIST SEAL

I hereby affix my seal to the Interim Data Report for the North Chevalier Disposal Area (Site 11), located at the Naval Air Station in Pensacola, Escambia County, Florida, in accordance with Chapter 492 of the Florida Statutes and applicable rules and regulations developed pursuant thereto:

Name:	Greg J. Iiorner
License Number:	P.G. No. 1161
State:	Florida
Expiration Date:	July 31, 1992

Greg J. Horner

Greg J. Horner

October 13, 1991

Date

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