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WORK PLAN FOR GROUNDWATER SAMPLING AT STUDY AREAS 2, 3 AND 52, OPERABLE UNIT 3 (OU 3) AND BUILDING 2273 NTC ORLANDO FL

6/1/2002

TETRA TECH

Rev. 5
06/21/02

Work Plan
for
Groundwater Sampling

Naval Training Center
Orlando, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0024

June 2002

07.04.02.0004
00654

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0602-A087

June 21, 2002

Commander, Southern Division
Naval Facilities Engineering Command
ATTN: Ms. Barbara Nwokike, Code ES333
P.O. Box 190010
2155 Eagle Drive
North Charleston, SC 29419-9010

Reference: CLEAN Contract No. N62467-94-D-0888
Contract Task Order No. 0024

Subject: Work Plans for Groundwater Sampling
Former Naval Training Center, Orlando, Florida

Dear Ms. Nwokike:

Enclosed are the following work plan revisions in hardcopy and CD formats:

- *Work Plan for Groundwater Sampling,* June 2002, Revision 5. This plan covers sampling at SA 2, SA 52, OU 3, and Building 2273.
- *Work Plan for Well Installation and Groundwater Sampling,* Operable Unit 2, June 2002, Revision 2.

A second copy of this transmittal has been mailed to your attention at Southern Division's Orlando office.

The text of the two work plans was changed to address USEPA comments in two letters dated April 2, 2002, from Greg Fraley, and to comply with the new Florida Standard Operating Procedures, issued January 1, 2002.

Please contact me at (865) 220-4730 if you have any questions regarding the plan.

Sincerely,

Steven B. McCoy, P.E.
Task Order Manager

SBM:ckf

Enclosures

c: Ms. Barbara Nwokike, Southern Division (Orlando Office) (hardcopy and CD)
Mr. Wayne Hansel, Southern Division (hardcopy and CD)
Mr. David Grabka, FDEP (hardcopy and CD)
Mr. Gregory Fraley, USEPA Region 4 (hardcopy and CD)
Mr. Michael Campbell, Tetra Tech NUS (hardcopy)
Ms. Debbie Wroblewski, Tetra Tech NUS (cover letter only)
Mr. Mark Perry, Tetra Tech NUS (unbound hardcopy)
Mr. Skip Barton, Tetra Tech NUS (hardcopy)
Mr. Steve Tsangaris, CH2M Hill (CD)
Mr. Mark Salvetti, Harding ESE (CD)
Mr. J.E. Bentkowski, Gannett Fleming (hardcopy and CD)
File/db

WORK PLAN
FOR
GROUNDWATER SAMPLING

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

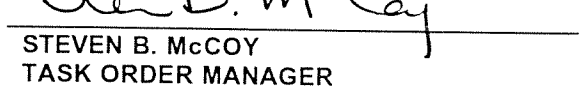
Submitted by:

Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NO. N62467-94-D-0888
CONTRACT TASK ORDER 0024

JUNE 2002

PREPARED UNDER THE SUPERVISION OF:



STEVEN B. McCOY
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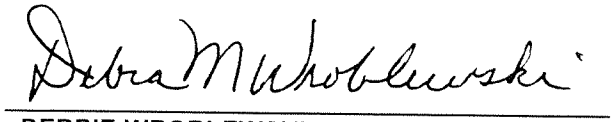
OAK RIDGE, TENNESSEE

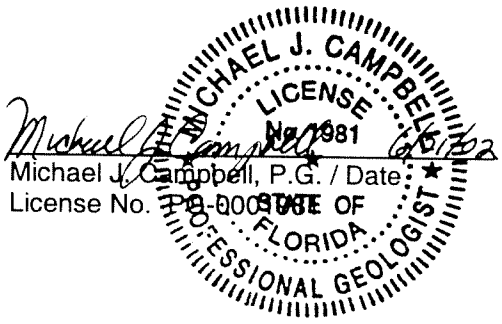
APPROVED FOR SUBMITTAL BY:



DEBBIE WROBLEWSKI
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

PROFESSIONAL GEOLOGIST CERTIFICATION

I hereby certify that this document, *Work Plan for Groundwater Sampling, Naval Training Center, Orlando, Florida,* was prepared under my direct supervision in accordance with acceptable standards of geological practice.



Michael J. Campbell, P.G. / Date
License No. PG-0001981

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FIGURES

ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
bgs	below ground surface
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylenes
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
DO	dissolved oxygen
DOC	dissolved organic carbon
DQO	Data Quality Objective
FDEP	Florida Department of Environmental Protection
GCTL	Groundwater Cleanup Target Level
HLA	Harding Lawson Associates
IDW	investigation-derived waste
IRA	Interim Removal Action
LNAPL	light nonaqueous phase liquid
MCL	Maximum Contaminant Level
MS	matrix spike
MSD	matrix spike duplicate
NA	natural attenuation
NFESC	Naval Facilities Engineering Service Center
NTC	Naval Training Center
NTU	Nephelometric Turbidity Unit
OAFB	Orlando Air Force Base
OPT	Orlando Partnering Team
ORP	oxidation reduction potential
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCE	tetrachloroethene or perchloroethylene
PE	polyethylene
PID	photoionization detector
POP	Project Operations Plan
PP	polypropylene
QA	quality assurance
QC	quality control
SA	Study Area
SOP	Standard Operating Procedure
SS	stainless steel
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List

TOC	top of casing
TRPH	total recoverable petroleum hydrocarbon
USAF	U. S. Air Force
USEPA	U. S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

1.0 INTRODUCTION

1.1 PURPOSE

The Naval Training Center (NTC) located in Orlando, Florida, consists of four areas (the Main Base, Area C, Herndon Annex, and McCoy Annex) as shown in Figure 1-1. The NTC ceased operations in April 1999 as proscribed by the Defense Base Realignment and Closure (BRAC) Act of 1990. As part of the closure process, the Navy initiated a program to identify and remediate environmental contamination at NTC. To ensure that all consultants planned and executed their field activities in a manner consistent with Southern Division, Naval Facilities Engineering Command, and regulatory requirements, the *Project Operations Plan for Site Investigations and Remedial Investigations* [POP] (ABB-ES, 1997) was prepared and implemented.

In the environmental program, certain Study Areas (SAs) and Operable Units (OUs) may require periodic sampling of groundwater until contaminant concentrations decrease below specified levels. This document presents the technical approach for performing the sampling with general requirements and procedures specified in the body of the plan. Site-specific information (site background, wells to be sampled, well construction details, sampling frequency, etc.) is provided in the Appendices. Unless otherwise specified herein, all work will be performed in accordance with the requirements and guidance of the POP.

1.2 HEALTH AND SAFETY

Health and safety aspects of Tetra Tech NUS' work at NTC, Orlando are controlled in accordance with the *Health and Safety Plan for Performing Investigative Work and Data Sampling* (Tetra Tech NUS, Inc., 2002).

1.3 PROJECT GUIDANCE

The investigation methods and procedures used to complete the scope of work proposed in this work plan will follow the POP (ABB-ES, 1997). Where appropriate, methods and procedures specified in the POP will be superceded by the more recently published guidance documents listed below:

- Florida Department of Environmental Protection, *DEP Standard Operating Procedures for Laboratory Operations and Sample Collection Activities, DEP QA-001/01*, January 2002.
- U.S. Environmental Protection Agency, Region 4, *Environmental Investigations, Standard Operating Procedures and Quality Assurance Manual*, November 2001.

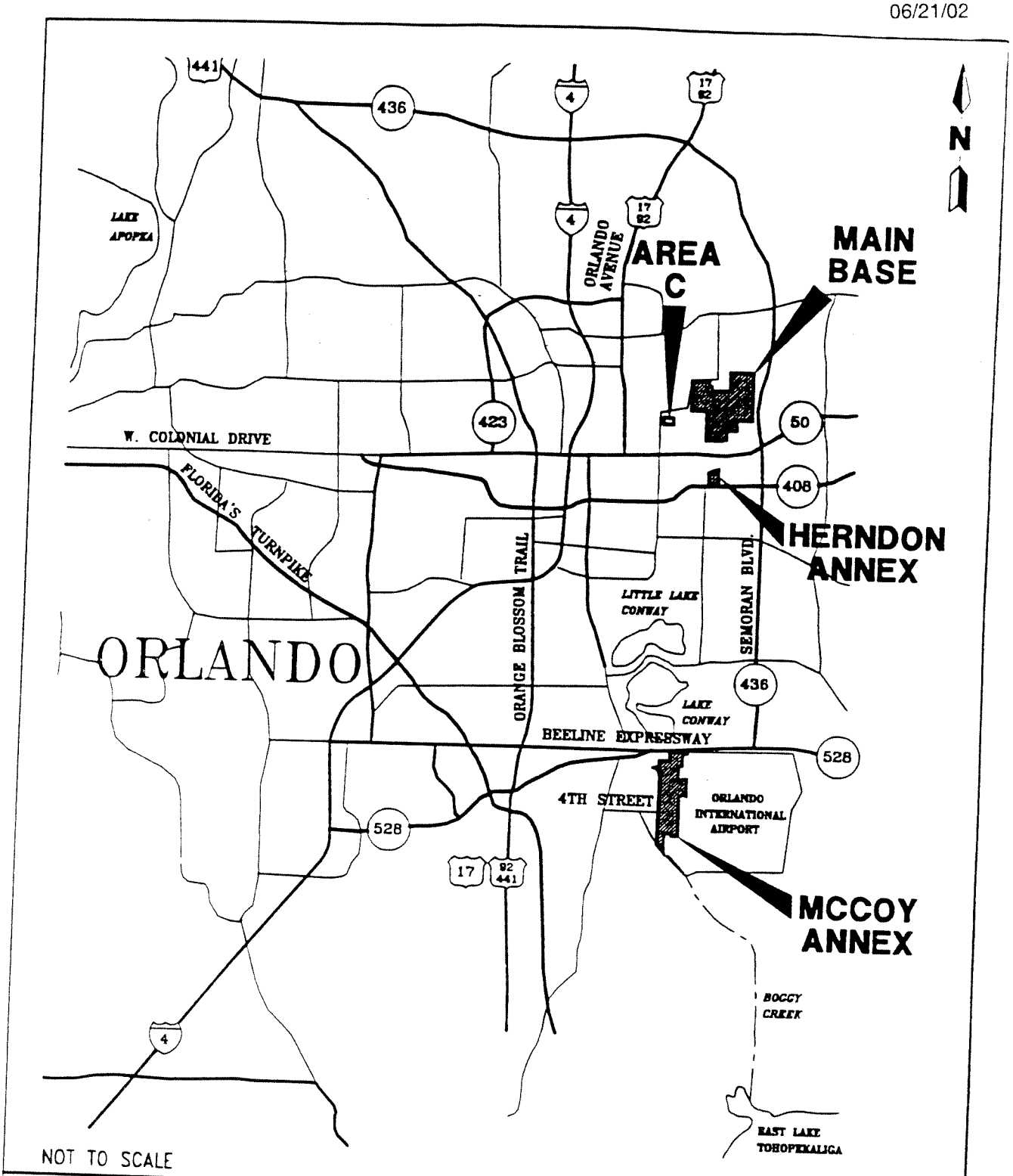

FIGURE 1-1
LOCATION OF NAVAL TRAINING CENTER, ORLANDO

SOURCE: HLA, 1999

WORK PLAN FOR GROUNDWATER SAMPLING

NAVAL TRAINING CENTER ORLANDO, FLORIDA

2.0 PURGING AND SAMPLING

Quarterly sampling will be conducted for one year. After one year, the Orlando Partnering Team (OPT) will evaluate the data and may change the sampling frequency if appropriate.

2.1 WATER LEVEL MEASUREMENTS

Prior to groundwater sampling a comprehensive synoptic round of water levels will be collected at each site. Well caps will be removed at least one half-hour before the first round of water levels are measured. A photoionization detector (PID) will be used to screen for volatile organic compounds (VOCs) immediately after well cap removal. A second round of water levels will be collected approximately one half-hour after the initial round. If the difference in water levels is greater than 0.05 foot, measurements will continue to be made every half-hour until the water level stabilizes, or for a maximum of four consecutive measurements.

2.2 TUBING REQUIREMENTS

The monitoring wells at NTC will be purged and sampled using micro-flow techniques to minimize the volume of groundwater that must be containerized, managed, and disposed. In-line flow-through cells and portable field meters will be used for real-time parameter monitoring during purging. Typically, tubing will be used with peristaltic pumps or small diameter, variable-speed submersible pumps (e.g., Grundfos Rediflo 2) to withdraw water from the well. All tubing will be new and dedicated to one sample location. The tubing will be pre-cut to the appropriate length at an off-site location in a clean, controlled environment. The tubing will be transported to the site in new, untreated plastic bags. If the tubing is not certified clean by the supplier/vendor, then an equipment rinsate blank will be collected for each batch of tubing and submitted for analytes of interest analysis. Tubing will disposed after each use.

Polyethylene (PE), polypropylene (PP), Teflon®, or Teflon-lined tubing can be used to purge and to collect samples for volatile and extractable organics, metals, and all other water chemistry analyses. These tubing types may also be used in the peristaltic pump head if flexible-wall varieties are available. The exceptions listed below must be followed:

Flexible, medical-grade silicon tubing may be used in a peristaltic pump head only for the collection of samples for metals and non-metallic inorganics [e.g., ions and dissolved organic carbon (DOC)] analyses.

VOC samples may not be collected using a pump of any type.

If PE, PP, Teflon®, or Teflon-lined tubing is not used in the peristaltic pump head, then samples for extractable organic analyses must be collected using a vacuum trap method (see FDEP SOP FS 2221 and Figure FS 2200-1). All equipment that contacts the groundwater before the sample container must be constructed of Teflon, PE, PP, stainless steel (SS), or glass, including the interior of the container cap and all fittings. (Rubber cannot be used).

2.3 PURGING PROCEDURES

Prior to the initiation of purging, the following tasks will be completed:

- All down-hole equipment will be properly decontaminated.
- An equipment blank will be collected for each lot of new tubing (if it is not certified clean) used during the purging/sampling event.
- Purge/sample tubing will be precut at an off-site clean location, bagged, and transported to the sample location.
- New, clean, plastic sheeting will be placed on the ground surface around the well head to help prevent contamination of the well or sampling equipment.
- The water level in the well will be measured and recorded.
- If undocumented, the total well depth will be measured and recorded.
- The well volume will be calculated and recorded.
- The combined volume of the tubing, pump, and flow-through cell (if used) will be calculated and recorded.

The steps listed below are to be followed for the purging procedure.

1. The discharge tubing will be lowered into the well as slowly as possible to minimize disturbance to the water in the well.
2. The end of the tubing will be positioned at the midpoint of the saturated screen length. The end of the tubing will be kept at least 2 feet above the bottom of the well to minimize mobilization of any particulates present (where practical).
3. The water level will be measured and recorded before starting the pump.

4. Purging will begin with the pump at the lowest setting and will slowly increase until discharge occurs.

5. The water level will be checked again and the pump speed adjusted to balance the pump rate with the well yield to prevent drawdown. Drawdown should be less than 0.3 foot unless site conditions warrant a change. The water level and pumping rate will be monitored, adjusted (if needed), and recorded every 3 to 5 minutes (or as appropriate) during purging.

   Note: Adjustments are best made during the first 15 minutes of pumping to minimize purging time. During pump start-up, drawdown in excess of 0.3 foot may occur, but then the well may recover as pump rate adjustments are made. Unless site conditions warrant a change, purging will proceed at a rate of approximately 100 mL/min. Note that during the early phase of purging, emphasis will be placed on minimizing and stabilizing pumping stress and recording those adjustments.

6. After water level stabilization: for submerged well screens purge one combined volume of the tubing/pump/flow cell prior to recording field parameters; for partially submerged well screens purge one well volume prior to recording field parameters. Subsequently, field parameters will be monitored and recorded every 3 to 5 minutes (or longer if appropriate) until stabilization.

7. Purging will be considered complete when three consecutive measurements meet all criteria in the following table.

Parameter	Unit	Limit
Temperature	Degrees Celsius (°C)	± 0.2 °C
Specific Conductance	Micro-siemens/centimeter (µs/cm)	± 5%
pH	Standard Unit (SU)	± 0.2
Dissolved Oxygen (DO)	Milligrams per liter (mg/L)	≤ 20% of saturation at field temp. (FDEP Table FS2200-2)[a]
Turbidity	Nephelometric Turbidity Unit (NTU)	≤ 20 NTU[b]

[a] Alternatively (when DO is > 20% of saturation), if DO ≤ 2 mg/L, then ± 0.2 mg/L; if DO > 2 mg/L, then ± 10%

[b] Alternatively (when turbidity is > 20 NTUs), if turbidity ≤ 50 NTUs, then ± 5 NTUs; if turbidity > 50 NTUs, then ± 10%

8. If any of the purging completion criteria in the above table are not met, but have become asymptotic for 60 minutes, consult with project leader to determine when/if sample should be collected.

9. For a well with a submerged well screen, purge at least three volumes of the combined tubing/pump/flow cell volume prior to sample collection.

2.4 MONITORING WELL SAMPLING PROCEDURES

When purging is complete, sample collection will be conducted using the same tubing and peristaltic pump that was used to purge the well. The flow-through cell will be disconnected and sample bottles will be filled. The following tasks will be performed when collecting groundwater samples from all wells.

- Fresh gloves will be worn for each sample collected.
- A fresh, clean plastic sheet will be placed on the ground around the well head.
- All samples will be immediately preserved as necessary according to the analytical method requirements.
- Sample containers will be immediately labeled and placed on wet ice in a cooler that has been thoroughly washed prior to use; a clean, untreated plastic bag will be used to line the cooler.
- The sample log form will be completed, and the event will be recorded in the field logbook.

Sample collection procedures vary with the target analyte group; analyte-specific instructions follow.

Target Compound List (TCL) VOCs

Sampling will be conducted using the same tubing and peristaltic pump that was used to purge the well. When purging is complete, the samples will be collected using the tube evacuation method (ABB-ES, 1997), as follows:

- Fresh gloves will be donned by the sampler.
- The peristaltic pump will be stopped, the tubing will be disconnected prior to the pump head, and a gloved finger will be placed over the end of the tubing to trap the water.
- The tubing will be gently lifted out of the well ensuring that the open, bottom end of the tubing does not become contaminated outside the well.
- The water trapped in the tubing will be released and allowed to slowly flow into the clean, preserved sample container provided by the laboratory.

Extractable Organics [Semivolatile Organic Compounds (SVOCs), Polynuclear Aromatic Hydrocarbons (PAHs), Herbicides, And Pesticides]

Sampling will be conducted when purging is complete using the same tubing and peristaltic pump used during purging. If flexible-wall PE, PP, Teflon®, or Teflon®-lined tubing is used in the pump head, the samples will be collected as follows:

- Fresh gloves will be donned by the sampler.
- The sample containers will be filled directly from the pump discharge tubing.

If Silicone® or silastic tubing is used in the pump head, the samples will be collected using the vacuum trap method (FDEP, 2002), as follows:

- Fresh gloves will be donned by the sampler.
- The peristaltic pump will be stopped and a 1-liter amber glass sample bottle equipped with a Teflon® transfer assembly will be connected to the inflow tubing, between the well and the pump.
- When sufficient vacuum is generated in the bottle, the bottle will fill.
- A new transfer assembly will be used at each well.

Dissolved Metals and DOC

Sampling will be conducted using the same tubing and peristaltic pump that was used to purge the well. The samples will be collected as follows:

- Fresh gloves will be donned by the sampler.
- The samples will be filtered using a new, disposable 45-µm, in-line filter. The filter will be attached to the pump discharge line and the sample container filled directly from the filtered discharge.

Target Analyte List (TAL) Metals and IONS

Sampling will be conducted using the same tubing and peristaltic pump that was used to purge the well. The samples will be collected as follows:

- Fresh gloves will be donned by the sampler.
- The sample container will be filled directly from the pump discharge tubing.

Samples for TCL VOCs will be collected using the tube evacuation method (ABB-ES, 1997). SVOC, PAH, pesticide, and herbicide samples will be collected using the vacuum jug assembly method (ABB-ES, 1997). Samples for TAL metals will be collected from the pump discharge tubing.

2.4.1 Sample Numbering

The monitoring well samples will be numbered as follows:

NTC02*TWWWRR*

where: NTC = Naval Training Center
02 = two-digit SA designation (02); for OUs the designation will be "U" plus the OU number (e.g., U3 for OU3)
T = sample type ("G" for groundwater, "D" for duplicate)
WWW = well location and screen depth designation (e.g., 17C)
RR = sampling round number (e.g., 10)

For example, the groundwater sample collected from well OLD-02-17C at SA 2 during sampling round 10 will be designated NTC02G17C10. Note for samples collected at Building 2273 the first five sample digits are N2273 (e.g., in lieu of NTC02). Samples for field duplicates will be identified with a "blind" number (e.g., NTC02D1000). The corresponding environmental sample will be noted in the field logbook. The Task Order Manager will identify the appropriate round number.

2.4.2 Quality Control (QC) Samples

QC samples will be collected at the frequencies listed below.

- One field duplicate per 10 environmental samples.
- One trip blank per cooler containing samples for VOC analysis.
- One matrix spike/matrix spike duplicate (MS/MSD) per 20 environmental samples.
- One equipment blank per lot of new, disposable tubing.

"MS/MSD" will be added to the sample number on the labels and the chain of custody. New sample numbers will not be created for these samples. MS/MSD samples will be collected in the field by the Field Operations Leader and will require 3X sample volume for each set (1X for environmental sample, 1X for MS sample, and 1X for MSD sample).

If any nondisposable sampling equipment is used and decontaminated, the additional QC samples listed below will be collected.

- One rinsate blank per 10 environmental samples.
- One field blank from each water source used for decontamination.

2.4.3 Sample Shipping

Environmental samples (and associated QC samples) will be shipped via overnight courier on a daily basis to the subcontract fixed-base laboratory. The shipping address and contact information will be provided in the Field Instruction to be prepared for each field event. A label identifying the contents as "environmental samples" will be affixed to each cooler prior to reception by the courier.

3.0 DECONTAMINATION

Decontamination of any nondedicated sampling equipment used will be performed in accordance with procedures specified in FDEP SOP 001-02 (January 2002) unless otherwise specified herein. Cleaning will be performed under controlled conditions (i.e., cleaning on site is not recommended, but may follow criteria specified in the FDEP SOPs). Because dedicated PE, PP, Teflon®, or Teflon-lined tubing will be used for purging and sampling the wells, little or no routine decontamination is anticipated.

If redevelopment is required for problematic monitoring wells, or if deep or large capacity wells are purged and sampled, centrifugal pumps may be used downhole. The pump body and internal mechanisms, including seals and connections, must comply with FDEP SOPs (January 2002) Tables FS 1000-1, 1000-2, and 1000-3 (i.e., must be Teflon and/or SS construction). All downhole pumps used for development, purging, or sampling will be decontaminated using the following steps:

1. Rinse pump in hot tap water.
2. Soak pump in hot, sudsy water solution (Liqui-Nox or equivalent).
3. Scrub exterior to remove particulate matter or surface film.
4. Rinse thoroughly with hot tap water.
5. Rinse with isopropanol.
6. Rinse with analyte-free water.
7. Allow to completely air dry; wrap in aluminum foil and seal until used.

Note: Ambient temperature water may be substituted for hot water if unavailable.

All other sampling tools and miscellaneous sampling equipment will be decontaminated using the following steps:

1. Wash with potable water and Alconox.
2. Rinse thoroughly with potable water.
3. Rinse with deionized water or analyte-free water.
4. Rinse with isopropanol.
5. Rinse with analyte-free water and air dry.
6. Wrap with aluminum foil.

Note: The isoproponal rinse may be omitted for delicate equipment such as meter bodies, probes, or cables. If plastic sampling equipment is to be cleaned, substitute appropriate acid solution for isopropanol (see FDEP SOP FC1001).

4.0 DATA QUALITY

4.1 DATA QUALITY OBJECTIVES (DQOs)

DQOs are qualitative or quantitative statements developed by the data user to specify the quality of data needed from a particular data activity to support specific decisions. The DQOs are the starting point in the design of an investigation. The DQO development process matches sampling and analytical capabilities to the data targeted for specific uses and ensures that the quality of the data satisfies project requirements.

The DQOs for laboratory analyses [other than for natural attenuation (NA) parameters] will be characterized by rigorous quality assurance (QA)/QC protocols and documentation, providing technically defensible analytical data. The intended uses of the data are to monitor the concentrations of contaminants and (if applicable) to evaluate the progress of NA of contaminants in groundwater.

Field test kits will be used to generate screening-level data for the evaluation of NA processes that may be occurring in the aquifer. Analyses for dissolved oxygen, carbon dioxide, ferrous iron, and sulfides will typically be conducted in the field using one of several commercially available test kits. The results from the field test kits are semi-quantitative and are not considered definitive. These data are not used for defining plumes or for risk assessment. The field test kit data are supportive in nature and are used to demonstrate trends and spatial variation of the geochemical environment in the area of the plume. Field test kit data, in conjunction with laboratory analyses of the COCs and other biodegradation by-products (e.g., biogenic gases) across the plume area, will be used to support characterization of NA in the aquifer.

The hydrogeologic and analytical data collected will be used to evaluate groundwater migration, flow gradients, and geochemistry to determine if exposure potential from contaminant plumes exists and to predict if contaminant migration will occur in the future. NA parameters are collected to estimate the potential for natural processes such as biodegradation to reduce contaminant concentrations in groundwater.

4.2 DATA VALIDATION

The approach to providing reliable data that meet the DQOs will include QA/QC requirements for each of the VOC and inorganic analytical data types generated during the field investigation. The QA/QC efforts for laboratory analyses will include collection and submittal of QC samples and the assessment and validation of data from the subcontract laboratory.

Data quality indicators include the precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters. These parameters will be used within the data validation process to evaluate data quality. The data will be validated in accordance with the U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) guidelines for inorganic and organic data review (USEPA, 1994 and 1999) and the Naval Facilities Engineering Service Center (NFESC) guidelines contained in *Navy Installation Restoration Chemical Data Quality Manual* (NFESC, 1999).

Limited data validation will be performed on all laboratory data and will evaluate data completeness, holding time compliance, calibration compliance, laboratory blank contamination, and detection limits. This type of validation will be performed primarily to eliminate false positives and false negatives. No validation will be performed for field test kit data.

5.0 INVESTIGATION-DERIVED WASTE (IDW) MANAGEMENT

Soil cuttings from monitoring well installation will be temporarily stored in a roll-off bin or drums. Drilling mud from monitoring well installation will be stored in Department of Transportation-approved 55-gallon steel drums or disposed of in a manner approved by the base contact. Decontamination fluids, well development water, and purge water will be temporarily stored in a poly tank or drums. Fluids will be sampled, analyzed, and disposed of by a licensed waste hauler following completion of monitoring well sampling at the site. Each drum will be clearly marked with the following information or as otherwise directed by the base contact:

- Company name (Tetra Tech NUS).
- Base contact (Barbara Nwokike) and phone number (843-820-5566 or 407-895-6714).
- Identification number (TtNUS-SSS-XXX), where SSS is the site identifier (e.g., SA 2 or OU 3) and XXX is the well number (e.g., 13C).
- Material contained in the drum (e.g., soil cuttings or purge water).
- Date the IDW was produced.
- Site.

Miscellaneous sampling material (e.g., gloves, tubing, and plastic) will be disposed of in approved dumpsters located in Area C near Building 1056 on Seabee Street.

6.0 LOGBOOKS AND FORMS

The site logbook is a hard-bound, with pre-printed pages, controlled-distribution record book in which all major on-site activities are documented. The following information will be recorded in the site logbook in real time on a daily basis:

- Study Area, Operable Unit, or tank site.
- All field personnel present.
- Arrival/departure of site visitors.
- Arrival/departure of major equipment.
- Start/completion of borehole/monitoring well installation or sampling event.
- Weather conditions.
- Health and safety issues including daily safety meetings.
- Problems encountered.
- Deviations from standard operating procedures and documentation explaining rationale.
- Record of pertinent phone calls.
- Sampling information including sample number, date and time of collection, analyses to be performed, and the chain-of-custody number.
- Documentation of decontamination activities.
- Documentation of sample storage and shipping information, including all sample numbers and the shipper's airbill number used for each shipment.
- IDW information (location where IDW originated, material in the drums, date produced, and location where drums were left).
- Signature and date at the completion of daily entries.

All pertinent information gathered during the monitoring well installation and sampling activities -- including installation, development, water level surveys, purging, and sampling -- will be written in detail on boring logs, well construction logs, water level survey logs, and purging/sampling logs. In addition to

the general entries placed into the logbook, detailed entries will be made on the sampling forms and will include (at a minimum) those items listed below:

Groundwater

- Date of purging/sampling.
- Personnel performing the purging/sampling.
- PID reading at top of casing (TOC).
- Groundwater elevation measurements (depths below TOC) prior to placing the tubing in the well and again prior to pump startup.
- Time, water level, and flow rate during purging (at 3- to 5-minute intervals, or as appropriate).
- Time and values of field parameters during purging (at 3- to 5-minute intervals after drawdown stabilization, or as appropriate).
- Estimated volume of purge water, time, sample number, and all analytical parameters during sampling.
- Duplicate sample number.

Soil

- Date/time of sample.
- PID reading of soil sample.
- Sample number, depth interval, color, description of soil sample, and analysis to be performed.
- Duplicate sample number.
- Approximate soil sample recovery, if less then 100 percent.

7.0 CONTACTS

The following personnel are approved contacts for their respective project areas.

Project Area	Responsible Personnel	Phone Number
Base Contact	Barbara Nwokike	843-820-5566 or 407-895-6714
Task Order Management	Steven McCoy	865-220-4730
Technical Issues	Michael Campbell or Allan Jenkins	865-220-4714 or -4724
Health & Safety	Matt Soltis	412-921-8912
Procurement	Sandy D'Alessandris	412-921-8435
Laboratory Services	(a)	(a)
Analytical Issues	Joe Samchuck	412-921-8510
Drilling Contractor	(a)	(a)

(a) To be provided in the Field Instruction for each field event.

REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1997. *Project Operations Plan for Site Investigations and Remedial Investigations.* Naval Training Center, Orlando, Florida, August.

FDEP (Florida Department of Environmental Protection), 2002. *FDEP Standard Operating Procedures for Laboratory Operations and Sample Collection Activities*, January.

NFESC (Naval Facilities Engineering Service Center), 1999. *Navy Installation Restoration Chemical Data Quality Manual*, September.

Tetra Tech NUS, Inc., 2002. *Health and Safety Plan for Performing Investigative Work and Data Sampling*, June.

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USEPA, 2001. *Environmental Investigations, Standard Operating Procedures and Quality Assurance Manual* including 1997 revisions. Region 4. November.

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APPENDIX A

STUDY AREA 2
HERNDON ANNEX

STUDY AREA 2

HERNDON ANNEX

1.0 INTRODUCTION

1.1 SITE DESCRIPTION

Study Area (SA) 2 is located at Herndon Annex, approximately one and one-half miles south of the Main Base of NTC (see Figure 1-1). The history of Herndon Annex dates to the construction of the original Orlando Municipal Airport, prior to 1940. The construction of Orlando Army Air Base began on this site in August 1940, and it was officially opened on December 1, 1940.

In 1947, the U.S. Air Force (USAF) assumed command of the facilities at Orlando Army Air Base, and the facility became known as Orlando Air Force Base (OAFB). The annex property was used for civilian and military aviation at various times from 1940 to 1968. Herndon Annex was also used on an occasional basis in the 1950s and early 1960s by the USAF as a sanitary landfill site. The Navy acquired the site in 1968 and maintained a supply warehouse there.

1.2 BACKGROUND

Groundwater screening at Herndon Annex was completed in five phases between July 1994 and December 1998. Direct push surveys included cone penetrometer testing at 36 locations to depths of up to 80 feet below ground surface (bgs), and the collection of 156 water and soil samples at 50 locations to depths from 13.5 to 64 feet bgs. Benzene was detected at concentrations exceeding the Florida Groundwater Cleanup Target Level (GCTL) of 1 μg/L at 30 locations in 59 samples at depths ranging from 3 feet bgs (in the deep drainage ditch between Herndon Annex and the Azalea Park neighborhood) to 61 feet bgs. The average depth for benzene detections exceeding the GCTL was 44 feet bgs.

Twenty-one monitoring wells were installed during site screening. Construction data for the monitoring wells are presented in Table A-1. Figures A-1 and A-2 show the groundwater elevation contours for the shallow and deep portions of the surficial aquifer, respectively. Figure A-3 presents the exceedances of the current Florida Department of Environmental Protection (FDEP, 1999) GCTLs in soil and groundwater samples from the monitoring wells.

TABLE A-1

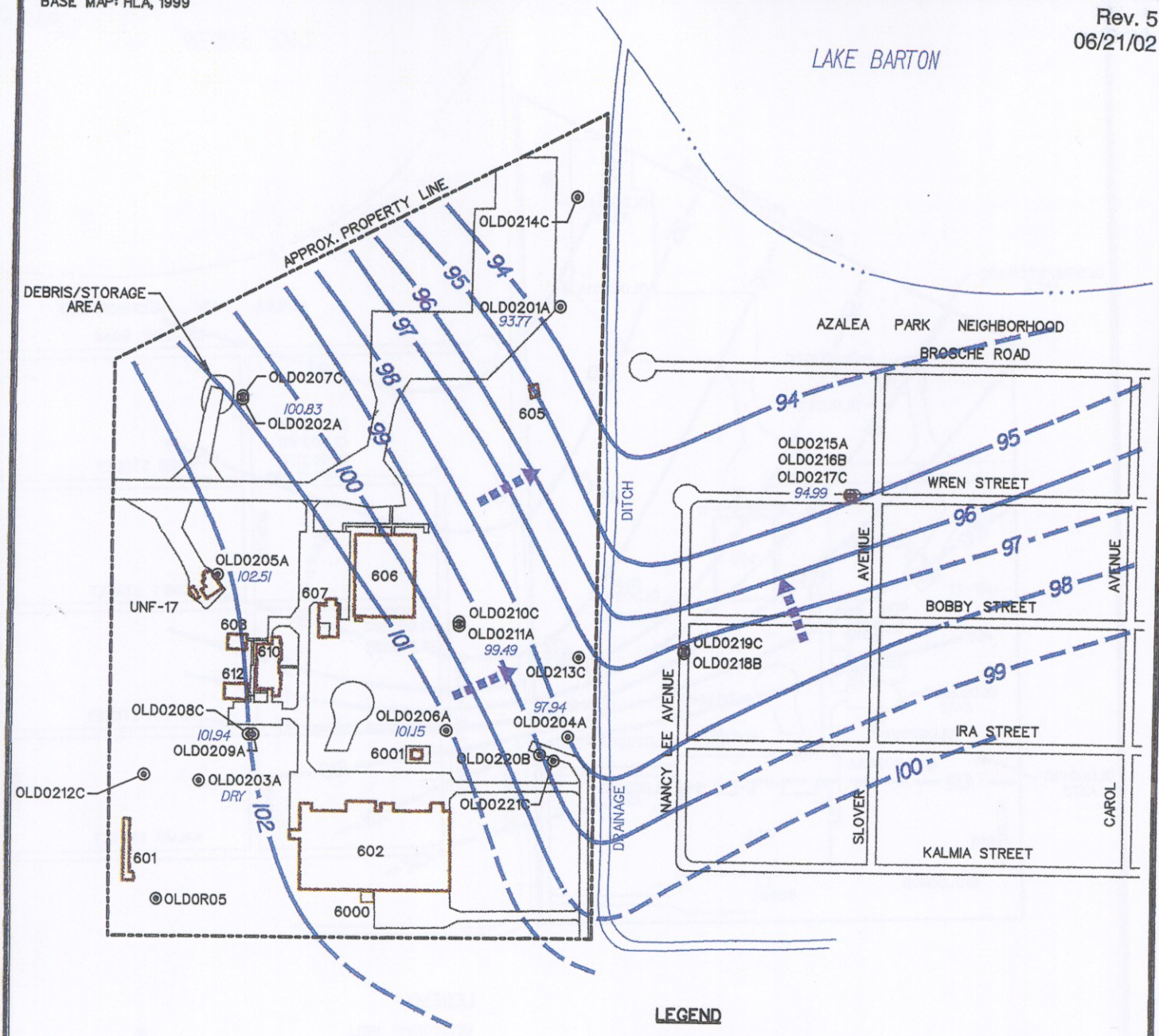
WELL CONSTRUCTION DATA
STUDY AREA 2

HERNDON ANNEX
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

Well Number	Date Installed	Well Type	Boring Depth (ft bls)	Boring Diameter (in.)	Well Depth (ft bls)	Top of Casing Elevation (ft)	Well Casing			Screen			Bentonite Seal Interval (ft)	Sand Pack Interval (ft)
							Diameter (in.)	Length (ft)	Interval (ft)	Diameter (in.)	Length (ft)	Interval (ft)		
OLD-02-01A	09/02/94	II	17.5	6.25	16.9	104.70	2.0	7.0	0 - 7	2.0	10.0	7 - 17	3 - 4	4 - 17.5
OLD-02-02A	09/06/94	II	13.5	6.25	13.1	111.27	2.0	3.0	0 - 3	2.0	10.0	3 - 13	1.5 - 2	2 - 13.5
OLD-02-03A	09/06/94	II	13.5	6.25	13.0	117.45	2.0	3.0	0 - 3	2.0	10.0	3 - 13	1.5 - 2	2 - 13.5
OLD-02-04A	09/06/94	II	15.5	6.25	15.1	110.63	2.0	5.0	0 - 5	2.0	10.0	5 - 15	1.5 - 2	2 - 15.5
OLD-02-05A	09/06/94	II	13.5	6.25	12.1	112.89	2.0	3.0	0 - 3	2.0	10.0	3 - 13	1.5 - 2	2 - 13.5
OLD-02-06A	09/07/94	II	13.5	6.25	12.8	109.17	2.0	3.0	0 - 3	2.0	10.0	3 - 13	1.5 - 2	2 - 13.5
OLD-02-07C	02/12/94	II	64.0	6.25	64.0	111.52	2.0	57.0	0 - 57	2.0	5.0	57-62	54 - 55	55 - 64
OLD-02-08C	02/12/95	II	66.0	6.25	66.0	112.31	2.0	60.0	0 - 60	2.0	5.0	60-65	56 - 57	57 - 66
OLD-02-09A	02/22/95	II	16.0	6.25	15.3	112.34	2.0	5.0	0 - 5	2.0	10.0	5 - 15	1.5 - 2	2 - 16
OLD-02-10C	02/23/95	II	58.0	6.25	56.3	106.90	2.0	52.0	0 - 52	2.0	5.0	52 - 57	48 - 49	49 - 58
OLD-02-11A	02/22/95	II	16.0	6.25	12.8	107.14	2.0	5.0	0 - 5	2.0	10.0	5 - 15	1.5 - 2	2 - 16
OLD-02-12C	08/12/97	II	66.0	6.25	58.0	116.04	2.0	53.0	0 - 53	2.0	5.0	53 - 58	49 - 50	50 - 58
OLD-02-13C	08/15/97	II	54.0	6.25	49.1	104.72	2.0	44.0	0 - 44	2.0	5.0	44 - 49	40 - 41	41 - 49
OLD-02-14C	08/14/97	II	50.0	6.25	45.8	102.74	2.0	41.0	0 - 41	2.0	5.0	41 - 46	37 - 38	38 - 47
OLD-02-15A	12/01/97	II	15.5	6.25	14.5	100.05	2.0	10.0	0 - 10	2.0	5.0	10 - 15	2 - 4	4 - 15.5
OLD-02-16B	12/03/97	II	33.5	6.25	32.3	99.97	2.0	28.0	0 - 28	2.0	5.0	28 - 33	23 - 26	26 - 33.5
OLD-02-17C	12/02/97	II	56.0	6.25	49.1	99.82	2.0	45.0	0 - 45	2.0	5.0	45 - 50	40 - 43	43 - 50.25
OLD-02-18B	12/05/97	II	34.5	6.25	33.4	102.17	2.0	29.0	0 - 29	2.0	5.0	29 - 34	24 - 27	27 - 34.5
OLD-02-19C	12/04/97	II	58.0	6.25	51.9	102.32	2.0	49.0	0 - 49	2.0	5.0	49 - 54	44 - 47	47 - 54.5
OLD-02-20B	10/26/98	II	41.0	6.25	41.3	108.26	2.0	36.0	0 - 36	2.0	5.0	36 - 41	31 - 32	32 - 41
OLD-02-21C	10/26/98	II	61.0	6.25	60.4	108.56	2.0	50.0	0 - 50	2.0	5.0	56 - 61	51 - 56	56 - 61

BASE MAP: HLA, 1999

Rev. 5
06/21/02



LEGEND

MONITORING WELL ⊙

GROUNDWATER ELEVATION [1] 99.49

POTENTIOMETRIC SURFACE ISOCON [1] (DASHED WHERE APPROX.)

GROUNDWATER FLOW DIRECTION (APPROX.) ▪▪▪▪▶

1 - ELEVATION IN FEET ABOVE MEAN SEA LEVEL

-N-

400 0 400

SCALE IN FEET

FIGURE A-1

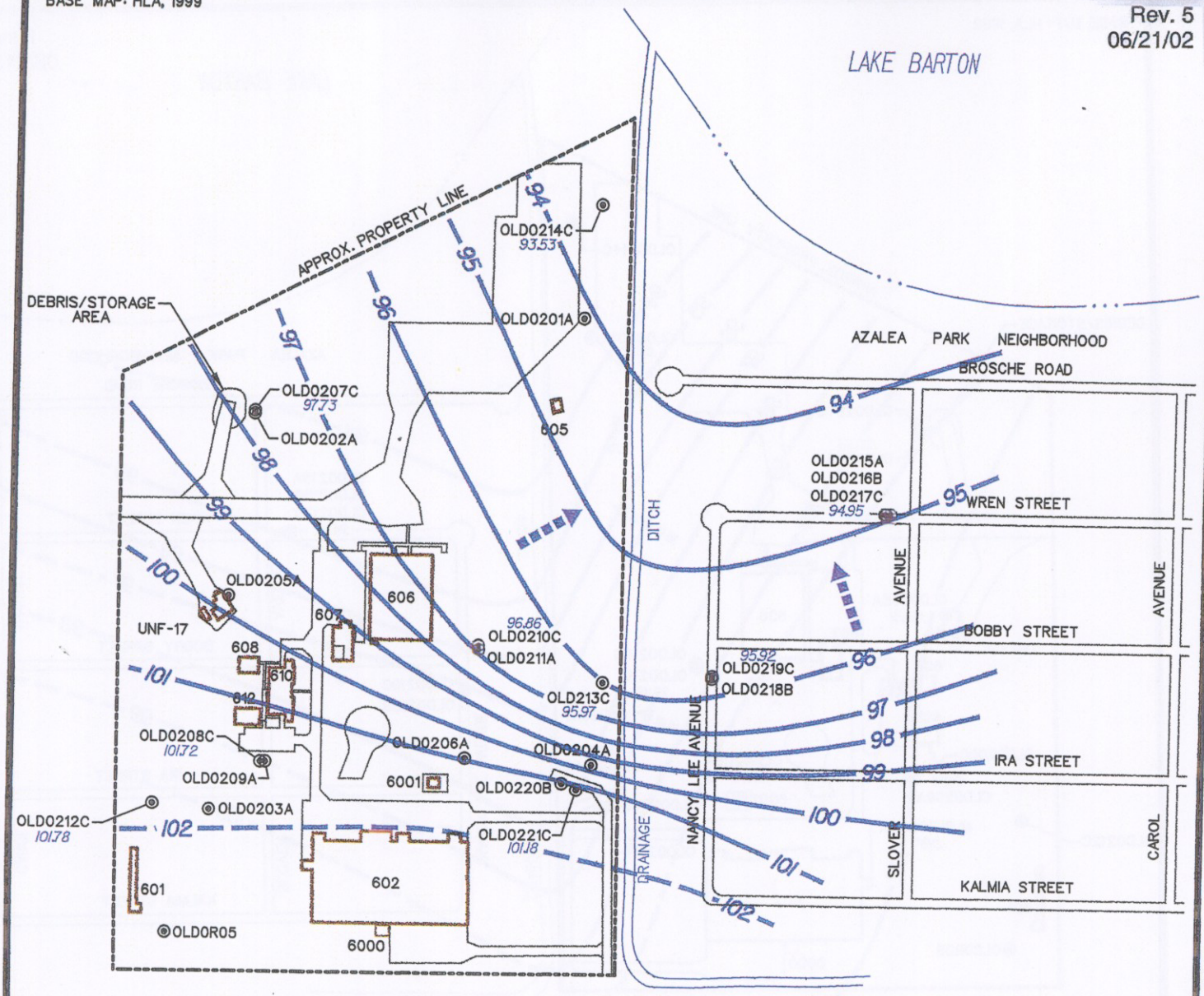
SHALLOW ZONE WATER TABLE ELEVATION MAP - JULY 13, 1999
WORKPLAN FOR GROUNDWATER SAMPLING
STUDY AREA 2 - HERNDON ANNEX

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

n8-5x11v.dgn

BASE MAP: HLA, 1999

Rev. 5
06/21/02



LEGEND

MONITORING WELL ◉

GROUNDWATER ELEVATION[1] 94.95

POTENTIOMETRIC SURFACE ISOCON[1] (DASHED WHERE APPROX.) ———

GROUNDWATER FLOW DIRECTION (APPROX.) ▪▪▪▪▶

1 - ELEVATION IN FEET ABOVE MEAN SEA LEVEL

N

400 0 400

SCALE IN FEET

FIGURE A-2

DEEP ZONE POTENTIOMETRIC SURFACE MAP - JULY 13, 1999
WORKPLAN FOR GROUNDWATER SAMPLING
STUDY AREA 2 - HERNDON ANNEX

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

n8-5x11v.dgn

4707995

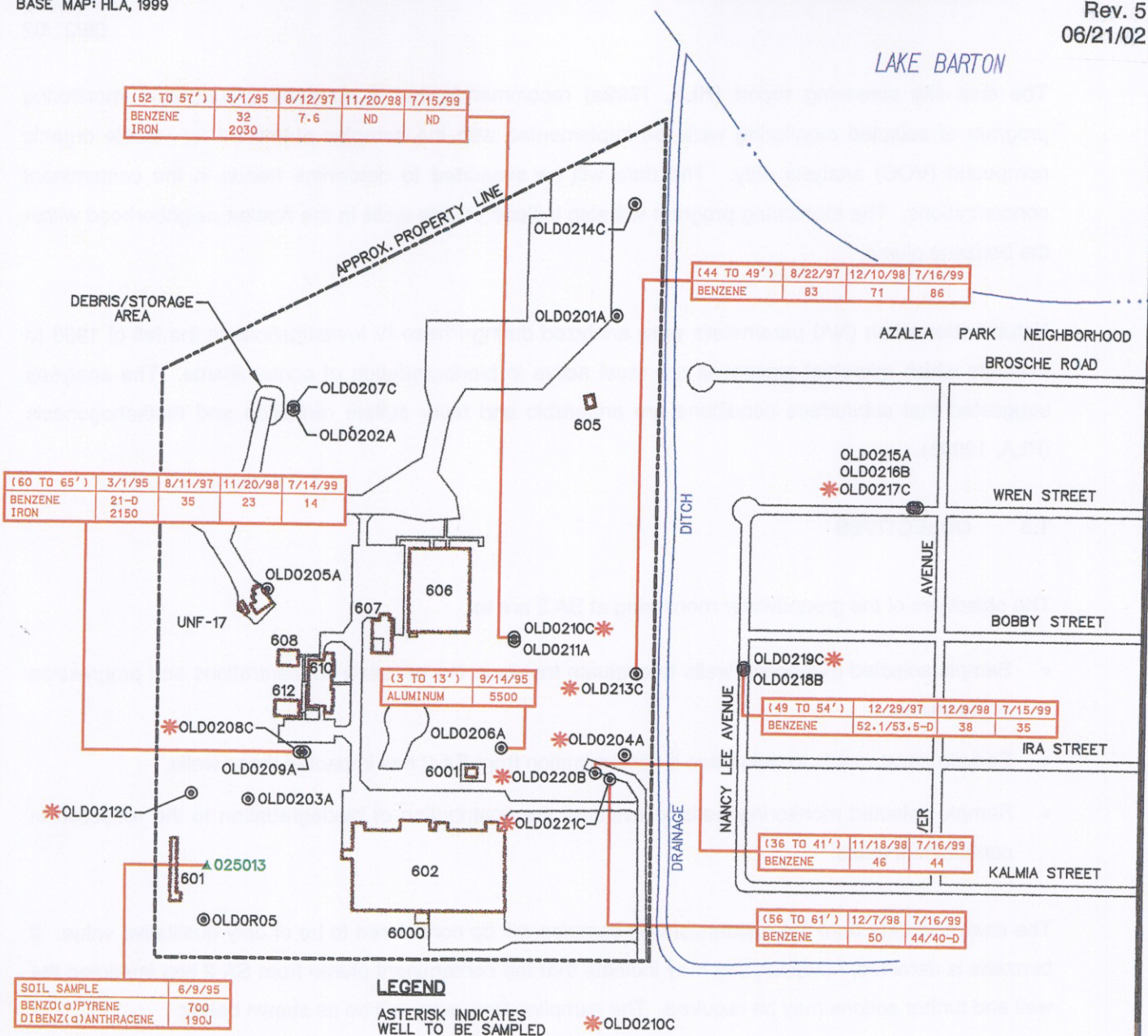
A-4

CAD FILE NO./DATE: 74570017.dgn/11-5-99

CTO 0024

BASE MAP: HLA, 1999

Rev. 5
06/21/02



(52 TO 57')	3/1/95	8/12/97	11/20/98	7/15/99
BENZENE	32	7.6	ND	ND
IRON	2030			

(44 TO 49')	8/22/97	12/10/98	7/16/99
BENZENE	83	71	86

(60 TO 65')	3/1/95	8/11/97	11/20/98	7/14/99
BENZENE	21-D	35	23	14
IRON	2150			

(3 TO 13')	9/14/95
ALUMINUM	5500

(49 TO 54')	12/29/97	12/9/98	7/15/99
BENZENE	52.1/53.5-D	38	35

(36 TO 41')	11/18/98	7/16/99
BENZENE	46	44

(56 TO 61')	12/7/98	7/16/99
BENZENE	50	44/40-D

SOIL SAMPLE	6/9/95
BENZO(a)PYRENE	700
DIBENZ(a)ANTHRACENE	190J

LEGEND

ASTERISK INDICATES WELL TO BE SAMPLED — *OLD0210C

MONITORING WELL — ◎

SURFACE SOIL SAMPLE — △

SAMPLE DEPTH — SAMPLE COLLECTION DATE

(56 TO 61')	12/7/98	7/16/99
BENZENE	50	44/40-D

ANALYTE — ANALYTE CONCENTRATION [1,2]

NOT DETECTED — ND

DUPLICATE — D

ESTIMATED VALUE — J

1-GROUNDWATER CONCENTRATIONS IN MICROGRAMS PER LITER (ug/L)
2-SOIL CONCENTRATIONS IN MICROGRAMS PER KILOGRAM (ug/Kg)

NOTE:
DATA ARE SHOWN FOR LOCATIONS WITH PAST OR CURRENT EXCEEDANCES.

-N-

400 0 400
SCALE IN FEET

FIGURE A-3

GROUNDWATER CONCENTRATIONS JULY 1999 WORKPLAN FOR GROUNDWATER SAMPLING STUDY AREA 2 - HERNDON ANNEX

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

n8-5x11v.dgn

The final site screening report (HLA, 1999a) recommends that a quarterly groundwater monitoring program of selected monitoring wells be implemented with the samples submitted for volatile organic compound (VOC) analysis only. The data will be evaluated to determine trends in the contaminant concentrations. The monitoring program will also include private wells in the Azalea neighborhood within the benzene plume.

Natural attenuation (NA) parameters were analyzed during Phase IV investigations in the fall of 1998 to evaluate which microbial processes are most active in biodegradation of contaminants. The analyses suggested that subsurface conditions are anaerobic and favor sulfate reduction and methanogenesis (HLA, 1999b).

1.3 OBJECTIVES

The objectives of the groundwater monitoring at SA 2 are to:

- Sample selected monitoring wells to evaluate trends in the benzene concentrations and progression of the plume.
- Sample private wells to determine if contamination from SA 2 has impacted these wells.
- Sample selected monitoring wells to evaluate the contribution of biodegradation to the reduction in contaminant mass.

The analytical data from the residential well samples will be considered to be of only qualitative value. If benzene is detected, however, this may indicate that the contaminant plume from SA 2 has impacted the well and further actions may be required. The sampling frequency will be as shown below:

Sample Type	Sampling Frequency
Environmental	Quarterly
NA Parameters	Annually

Note: The sampling frequency is subject to change by the Orlando Partnering Team.

2.0 WELL LIST AND ANALYTICAL PARAMETERS

The wells to be sampled, analytical parameters, rationale for sampling, contaminant of concern, and cleanup criterion are listed below. Well locations are shown in Figure A-3. The list of wells to be sampled will be evaluated periodically by the Orlando Partnering Team and is subject to revision. Samples (other

than for NA parameters) are to be collected and analyzed in accordance with U.S. Environmental Protection Agency (USEPA) Level IV Data Quality Objectives (DQOs). NA analyses will be performed in accordance with Level II DQOs.

Well Number*	Analytical Parameters[(a)]	Rationale
OLD-02-04A	TCL VOCs (Method 8260)	Downgradient well (monitor for discharge to the drainage ditch)
OLD-02-08C	TCL VOCs (Method 8260)	Historical positive detections
OLD-02-12C	TCL VOCs (Method 8260)	Positive field screening detection
OLD-02-13C	TCL VOCs (Method 8260)	Historical positive detections
OLD-02-17C	TCL VOCs (Method 8260)	Downgradient well
OLD-02-19C	TCL VOCs (Method 8260)	Historical positive detections
OLD-02-20B	TCL VOCs (Method 8260)	Historical positive detections
OLD-02-21C	TCL VOCs (Method 8260)	Historical positive detections
OLD-02-38C	TCL VOCs (Method 8260)	Replacement for destroyed well OLD-02-10C

(a) Bottle requirements will be provided in the Field Instruction for each sampling event.

*Note: Well OLD-02-14C has been dropped from the sampling program based upon the July 1999 results.

Contaminant of Concern	Cleanup Criterion
Benzene	1 μg/L (GCTL)

Five wells [OLD-02-10C (destroyed and subsequently replaced by OLD-02-38C), OLD-02-12C, OLD-02-13C, OLD-02-17C, and OLD-02-19C] to be sampled annually for NA parameters were selected during the Orlando Partnering Team meeting on October 18-19, 1999. The rationale for the selection of wells is shown in the following table.

Well Number	Rationale
OLD-02-12C	Clean deep well upgradient not affected by plume; background.
OLD-02-13C	Deep well at center of plume at most contaminated portion of aquifer.
OLD-02-17C	Clean deep well downgradient from dissolved contaminant plume
OLD-02-19C	Intermediate well at leading edge of plume, downgradient from source area, in the dissolved contaminant plume.
OLD-02-38C	Clean deep well, crossgradient of plume.

The NA parameters to be analyzed for are indicated in Table A-2.

TABLE A-2

**NATURAL ATTENUATION PARAMETERS AND METHODS FOR GROUNDWATER SAMPLING
STUDY AREA 2, HERNDON ANNEX
NAVAL TRAINING CENTER, ORLANDO, FLORIDA**

ANALYTICAL PARAMETER	METHOD	GUIDANCE
Alkalinity	Laboratory	USEPA Method E310.1
Biogenic gases: H_2, DO, CO_2, N_2, Ethene, Ethane, Methane	Field gas extraction; laboratory analysis of fixed gases and light hydrocarbons	Extraction and analysis using MICROSEEPS propriety methodology
Anions: NO_2, NO_3, Cl, SO_4	Laboratory	USEPA 300 series; 48-hour hold time for nitrate and nitrite
Carbon dioxide	Field Test Kit	HACH kit CA-DT; to confirm biogenic gas results
Dissolved Organic Carbon (DOC)	Laboratory	SW-846 Method 9060; sample from one or more clean, upgradient well(s)
Dissolved Oxygen (DO)	Field Meter and Field Test Kit	Previous data show D.O. <1 mg/L; will verify with CHEMetrics field kits K-7501 (<1 mg/L) and K7512 (>1 mg/L); to confirm biogenic gas results
$Iron^{+2}$ (ferrous)	Field Test Kit	Filter in the field if NTU >20 HACH kit IR-18C
Iron and Manganese	Laboratory	SW-846 Method 6010B
pH, conductivity, ORP, temperature, turbidity	Field Flow-through Cell	Recorded during well purging
Sulfate	Laboratory	USEPA Method 8051
Sulfide	Field Test Kits for Hydrogen Sulfide and Total Sulfide	HACH kits HS-C and HS-WR

The final site screening report (HLA, 1999a) recommends that a quarterly groundwater monitoring program of selected monitoring wells be implemented with the samples submitted for volatile organic compound (VOC) analysis only. The data

3.0 SAMPLING PROCEDURES

Monitoring Wells - Monitoring wells will be sampled as described in Section 2.0 of the Work Plan.

Residential Wells - Potentially affected residential wells with in-place plumbing will be sampled following the FDEP Standard Operating Procedures (FDEP, 2002) which are included as Attachment 1 to this appendix.

4.0 REFERENCES

FDEP (Florida Department of Environmental Protection), 2002. *DEP Standard Operating Procedures for Laboratory Operations and Sample Collection Activities*, DEP-QA-001/01, Tallahassee, FL.

FDEP, 1999. *Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C.*, CEHT/TR-99-01, May.

HLA (Harding Lawson Associates), 1999a. *Base Realignment and Closure Environmental Site Screening Report, Study Area 2, Herndon Annex*, Naval Training Center, Orlando, Florida, Unit Identification Code N65928, Contract No. N62467-89-D-0317/107, July.

HLA (Harding Lawson Associates), 1999b. Draft *Natural Attenuation Monitoring Work Plan. Study Area 2. Herndon Annex*, Naval Training Center, Orlando, Florida. Unit Identification Code N65920, Contract No. N62467-89-D-0317/107, September.

ATTACHMENT 1

FDEP SOPs
for
RESIDENTIAL WELL SAMPLING

SOURCE: DEP - SOP- 001/01, Revision Date: January 1, 2002.

FS 2214. Wells With Plumbing (permanently installed pumps or production wells)

Wells with in-place plumbing are commonly found at municipal water treatment plants, industrial water supplies, private residences, etc.

1. Remove all hoses, aerators and filters (if possible).
2. Open the spigot and purge sufficient volume to flush the spigot and lines and until the purging completion criteria in FS 2212, section 3 (SEE BELOW) have been met.
3. Reduce the flow rate to approximately 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples.

FS 2223. Wells With In-Place Plumbing

If a storage tank is present, locate a cold water spigot, valve or other sampling point close to the well head between the pump and the storage tank. If there is no sampling location between the pump and the storage tank, locate the spigot, valve or other sampling point closest to the tank. Remove all screens or aerators and reduce the flow rate to no more than 500 mL/minute. Collect the samples directly into the appropriate containers.

FS 2212. Well Purging Techniques

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. Equipment selection must comply with construction and configuration requirements specified in Table FS 2200-1 and the discussions in FS 2201.

3. PURGING COMPLETION: Purging is considered complete if any one of the following three (3) criteria are satisfied:

3.1. Three (3) consecutive measurements in which the three (3) parameters listed below are within the stated limits, Dissolved Oxygen is no greater than 20 percent of saturation at the field measured temperature, and Turbidity is no greater than 20 Nephelometric Turbidity Units (NTUs).

- Temperature: ± 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading

Document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.2. If it is impossible to get Dissolved Oxygen at or below 20 percent of saturation at the field measured temperature, or Turbidity at or below 20 NTUs, then three (3) consecutive measurements of Temperature, pH, Specific Conductance and the parameter(s) Dissolved Oxygen and/or Turbidity that does not meet the requirements in section 3.1 above must be within the limits listed below:

- Temperature: + 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading
- Dissolved Oxygen: ± 0.2 mg/L or 10%, whichever is greater
- Turbidity: ± 5 NTUs or 10%, whichever is greater

Additionally, document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of conditions at the site that may cause the Dissolved Oxygen to be high and/or Dissolved Oxygen measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that may cause the Turbidity to be high and any procedures that will be used to minimize Turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the Department determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first two (2) items are required to be submitted in future reports. However, if the Department cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first two (2) items, a description of the conditions at the site that may have caused the affected parameter(s) to be high is required to be submitted in future reports.

3.3. If after five (5) well volumes, three (3) consecutive measurements of the field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen, and Turbidity are not within the limits stated in section 3.2 above, check the instrument condition and

calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. It is at the discretion of the project leader whether or not to collect a sample or to continue purging.

Further, the report in which the data are submitted must include the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of conditions at the site that may cause the Dissolved Oxygen to be high and/or Dissolved Oxygen measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that may cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the FDEP determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first two (2) items are required to be submitted in future reports. However, if the FDEP cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first two (2) items, a description of the conditions at the site that may have caused the affected parameter(s) to be high is required to be submitted in future reports.

3.4. One fully dry purge (not recommended). This criterion applies only if purging was attempted per FS 2212, FS 2213, and section 3.4.1 below, and if it is impossible to balance the pumping rate with the rate of recharge at very low pumping rates (< 100 mL/minute).

3.4.1. If wells have previously and consistently purged dry, when purged according to FS 2212 and FS 2213, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

3.4.1.1. Place the pump or tubing intake within the well screened interval.

3.4.1.2. Use very small diameter Teflon, Polyethylene or PP tubing and the smallest possible pump chamber volume to minimize the total volume of water pumped from the well and to reduce drawdown.

3.4.1.3. Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.

3.4.1.4. Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.

3.4.1.5. Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).

3.4.1.6. Measure pH, Specific Conductance, Temperature, Dissolved Oxygen and Turbidity and begin to collect the samples (see FS 2222)..

APPENDIX B

STUDY AREA 52
McCOY ANNEX

STUDY AREA 52

McCOY ANNEX, NTC, ORLANDO

1.0 INTRODUCTION

1.1 SITE DESCRIPTION

Study Area (SA) 52 is located in the west-central part of the McCoy Annex (Figure B-1). The site screening investigation of this Study Area (HLA, 1999) focused on the area in the vicinity of Building 7261 (Figure B-2). Available drawings indicate that Building 7261 was built between 1956 and 1962 and was demolished in the early 1980s. It was 1,616 square feet in size and was constructed with a concrete foundation, concrete floor, and wood walls. At various times, Building 7261 was used for mixing pesticides, covered storage, and as a maintenance shop.

1.2 BACKGROUND

Site screening investigations, completed in May 1996, confirmed that soil and groundwater contained pesticides above screening levels (HLA, 1999). An Interim Removal Action (IRA) (soil removal) was completed in September 1997 with 1,300 tons of soil excavated and the excavated area backfilled with clean soil. Three monitoring wells were installed after the IRA. Well OLD-52-13, located in the area of the most contaminated soil, contained dieldrin above the Groundwater Cleanup Target Level (GCTL) (FDEP, 1999). The Orlando Partnering Team (OPT) recommended groundwater restrictions and quarterly groundwater monitoring. The most recent sampling (September 9, 1998) indicated that the dieldrin concentration in OLD-52-13 remains above the Florida GCTL (0.08 μg/L vs. GCTL 0.005 μg/L) (Figure B-2). The Final Report, recommending continued groundwater monitoring and institutional controls, was approved by the Florida Department of Environmental Protection (FDEP) in May 1999 (HLA, 1999).

1.3 OBJECTIVES

The objective of this groundwater monitoring only event at SA 52 is to:

- Sample the appropriate monitoring wells until the concentrations of dieldrin in groundwater fall below the FDEP GCTL in two consecutive events.

Figure B-1

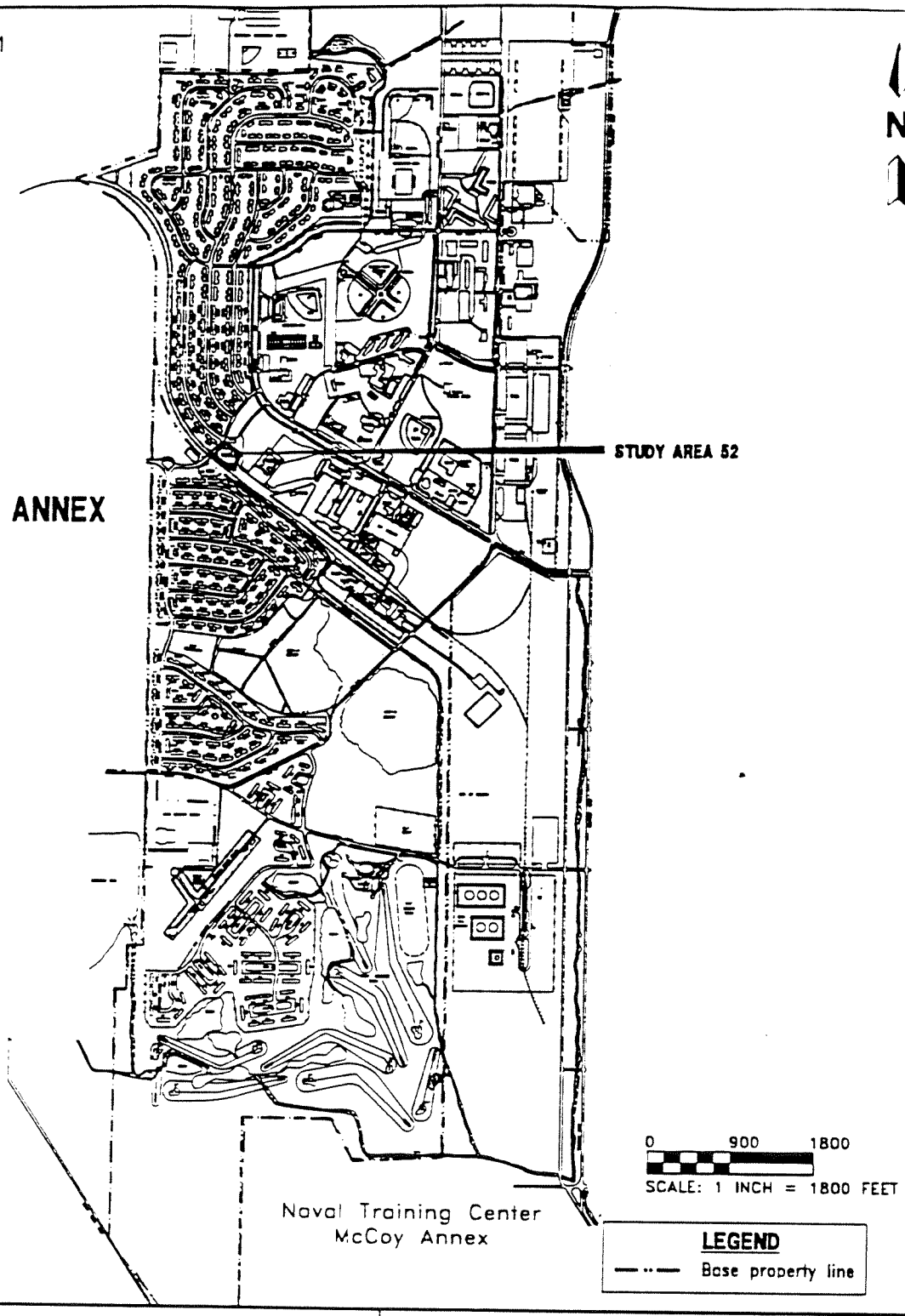


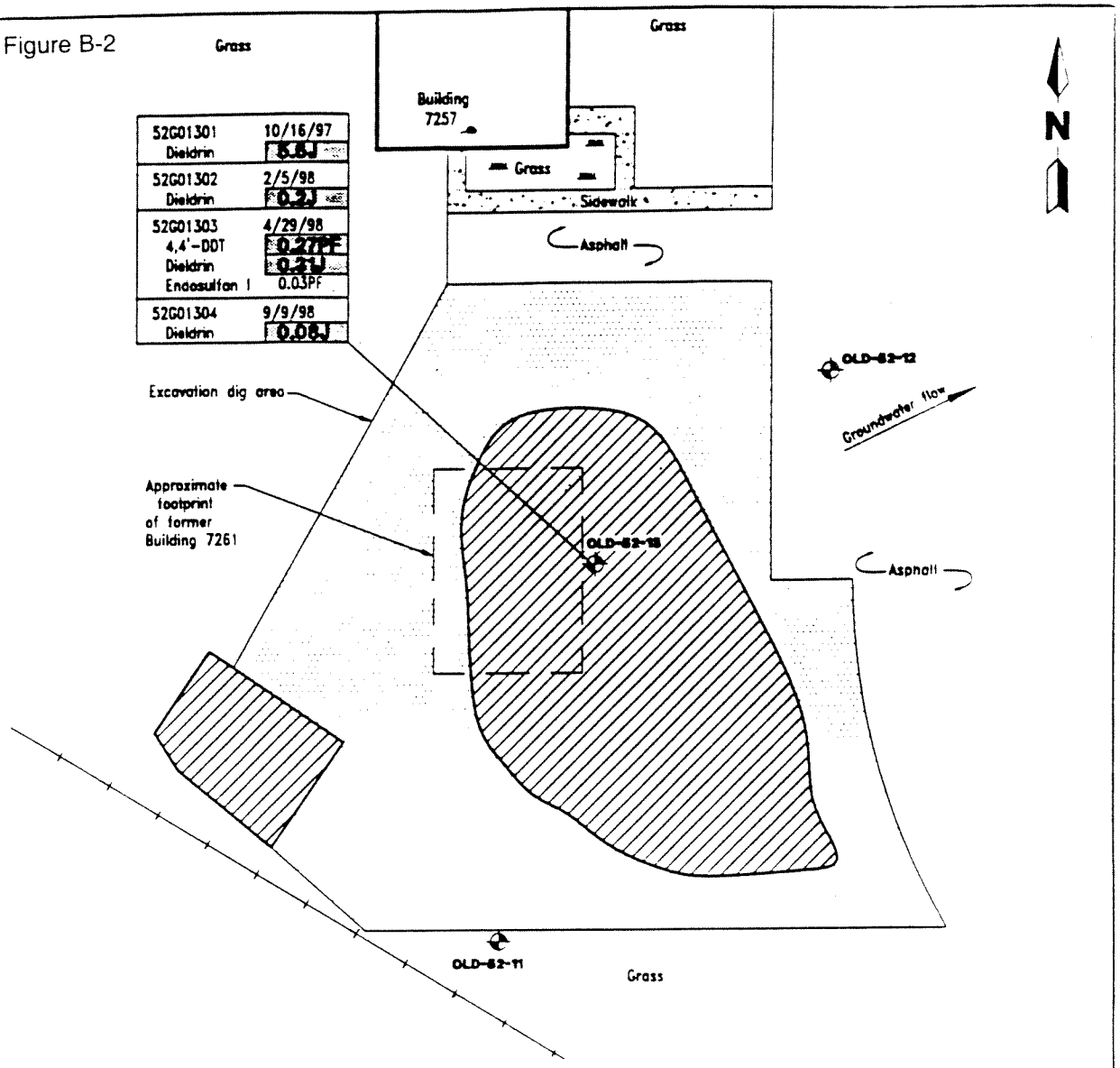
FIGURE B-1
SITE LOCATION MAP – MCCOY ANNEX

STUDY AREA 52
SOURCE: HLA, 1999

WORK PLAN FOR
GROUNDWATER SAMPLING

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

Figure B-2



LEGEND

OLD-52-11 Monitoring well location and designation

GCTL Groundwater cleanup target level

PF Percent difference between orginal and confirmation analyses is greater than 50 percent

DDT Dichlorodiphenyltrichloroethane

Area of excavation - approximately 4 feet deep

Area of excavation - approximately 2 feet deep

J Estimated concentration

Railroad line

NOTES:
All concentrations are in micrograms per kilogram.
Exceedances of GTCLs in chembox are bolded and shaded.

0 15 30
SCALE: 1 INCH = 30 FEET

FIGURE B-2
SUMMARY OF POSITIVE DETECTIONS IN GROUNDWATER - FIRST YEAR OF GROUNDWATER MONITORING STUDY AREA 52
SOURCE: HLA, 1999

WORK PLAN FOR GROUNDWATER SAMPLING

NAVAL TRAINING CENTER ORLANDO, FLORIDA

Samples will be collected and analyzed in accordance with U.S. Environmental Protection Agency (USEPA) Level IV Data Quality Objectives (DQOs). The sampling frequency will be evaluated following each sampling event and a recommendation will be provided to the OPT.

2.0 WELL LIST AND ANALYTICAL PARAMETERS

Well construction details are summarized on Table B-1 and well locations are shown on Figure B-2. The wells to be sampled, analytical parameters, rationale for sampling, contaminant of concern, and cleanup criterion are presented in the following tables.

Well Number	Analytical Parameters[(a)]	Rationale
OLD-52-11	Pesticides (Method 8181)	Upgradient well
OLD-52-12	Pesticides (Method 8181)	Downgradient well
OLD-52-13	Pesticides (Method 8181)	Source well

(a) Bottle requirements will be provided in the Field Instruction for each sampling event.

Contaminant of Concern	Cleanup Criterion
Dieldrin	0.005 µg/L GCTL

3.0 REFERENCES

FDEP (Florida Department of Environmental Protection), 1999. Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., May.

HLA (Harding Lawson Associates), 1999. Base Realignment and Closure Environmental Site Screening Report Interim Remedial Action, Study Area 52, Naval Training Center, Orlando, Florida, Unit Identification Code N65928, Contract No. N62467-89-D-0317/107, March.

TABLE B-1

WELL CONSTRUCTION DATA
STUDY AREA 52

McCOY ANNEX
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

Well Number	Date Installed	Well Type	Boring Depth (ft bls)	Boring Diameter (in.)	Well Depth (ft bls)	Top of Casing Elevation (ft)	Well Casing			Screen			Bentonite Seal Interval (ft)	Sand Pack Interval (ft)
							Diameter (in.)	Length (ft)	Interval (ft)	Diameter (in.)	Length (ft)	Interval (ft)		
OLD-52-06	12/17/96	II	10.0	2.00	10.0	94.22	0.5	4.0	0 - 4	0.5	6.0	6 - 10	1 - 2	2 - 10
OLD-52-11	10/13/97	II	14.0	10.00	14.0	93.14	2.0	4.0	0 - 4	2.0	10.0	4 - 14	1 - 2	2 - 10
OLD-52-12	10/13/97	II	13.0	10.00	13.0	91.73	2.0	3.0	0 - 3	2.0	10.0	3 - 13	1 - 2	2 - 10
OLD-52-13	10/13/97	II	13.0	10.00	13.0	91.36	2.0	3.0	0 - 3	2.0	10.0	3 - 13	1 - 2	2 - 10

APPENDIX C

OPERABLE UNIT 3
MAIN BASE

OPERABLE UNIT 3

MAIN BASE, NTC, ORLANDO

1.0 INTRODUCTION

1.1 SITE DESCRIPTION

Operable Unit (OU) 3 consists of Study Areas (SAs) 8 and 9, which are both former pesticide handling areas. These areas are located in the southeast corner of the Naval Training Center (NTC) Main Base, between Lake Baldwin and the former golf course (Figure C-1). SA 8, the former Golf Course Greens Keeper's Storage Area, has not been used for chemical storage since June 1998. It is located at the end of Trident Lane, and until recently consisted of several small storage buildings within a fenced area. Pesticides and herbicides, along with equipment used to maintain the golf course, were stored in this area for 20 to 30 years (HLA, 2000).

SA 9, the former Pesticide Handling and Storage Area, was the primary pesticide handling facility for the Main Base in the late 1960s and early 1970s. Pesticide mixing reportedly did not occur at this location after 1972, although chemicals may have been stored there up until the buildings were demolished in 1981. This area is located adjacent to Trident Lane, south and west of SA 8. All structures have been removed from both SAs 8 and 9.

1.2 BACKGROUND

Soil samples had elevated levels of arsenic (up to 577 mg/kg vs. a background screening level of 1 mg/kg). Groundwater had elevated levels of arsenic [up to 425 μg/L vs. 50 μg/L Maximum Contaminant Level (MCL)] (HLA, 1999a). A Preliminary Risk Evaluation was conducted indicating no ecological risk, but the risk to human health was higher than 1×10^{-6}. A round of groundwater samples was collected in March 1999 (Tetra Tech NUS, 1999) and additional soil removal actions have been performed. As stated in the Interim Record of Decision (HLA, 2000) No Further Action has been proposed for soils, and institutional controls and long-term monitoring have been recommended for groundwater.

Figures C-2 and C-3 show the potentiometric surface contours during the March 1999 sampling event. Figures C-4 and C-5 show groundwater concentrations exceeding Florida Groundwater Cleanup Target Levels (GCTLs) in March 1999.

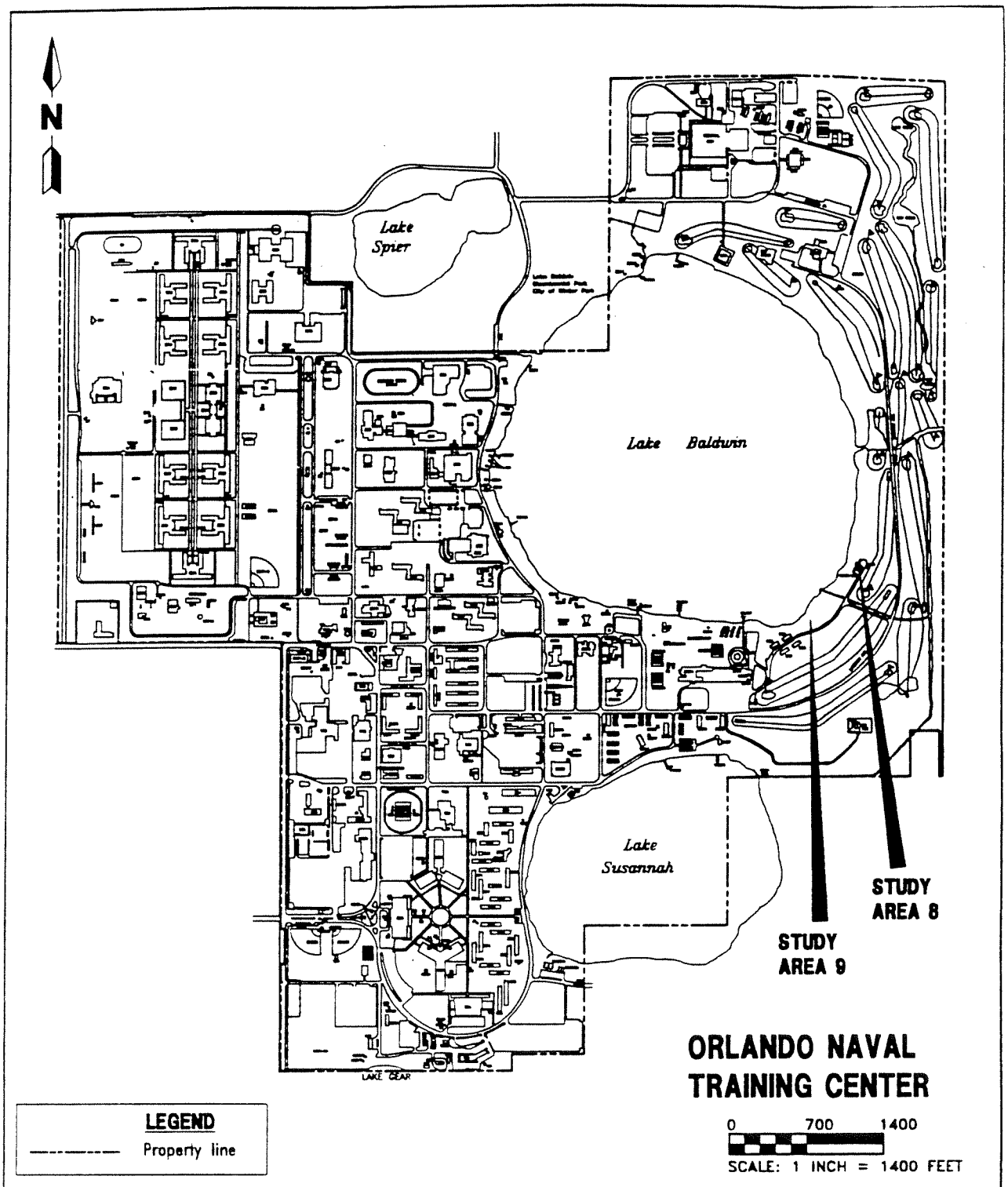
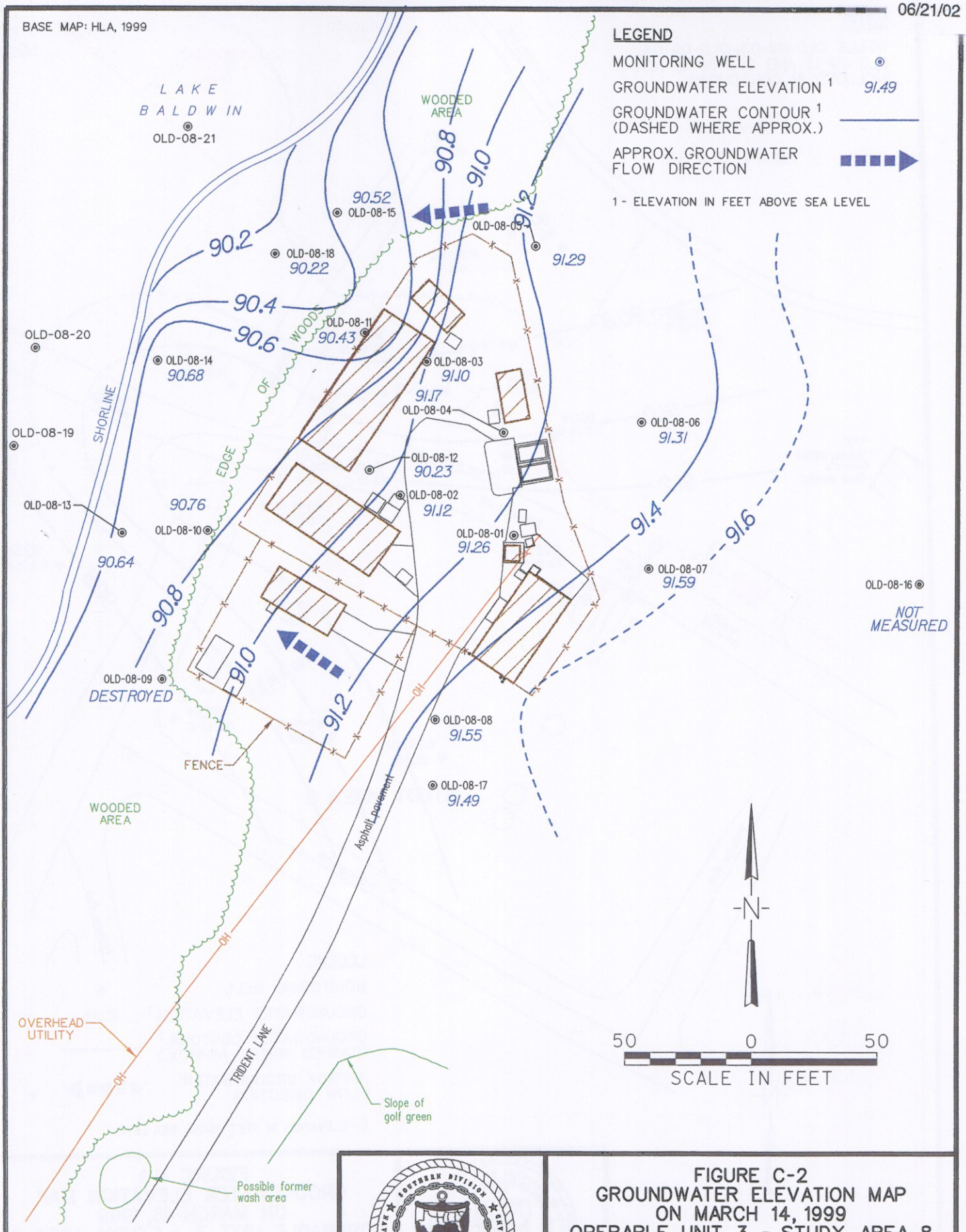


FIGURE C-1
SITE LOCATION MAP – MAIN BASE

OPERABLE UNIT 3
SOURCE: HLA, 1999

WORK PLAN FOR
GROUNDWATER SAMPLING

NAVAL TRAINING CENTER
ORLANDO, FLORIDA



NOTE:
WELL OLD-08-12 NOT INCLUDED IN CONTOURING.

FIGURE C-2
GROUNDWATER ELEVATION MAP
ON MARCH 14, 1999
OPERABLE UNIT 3 - STUDY AREA 8
GROUNDWATER MONITORING REPORT
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

n8-5x11v.dgn

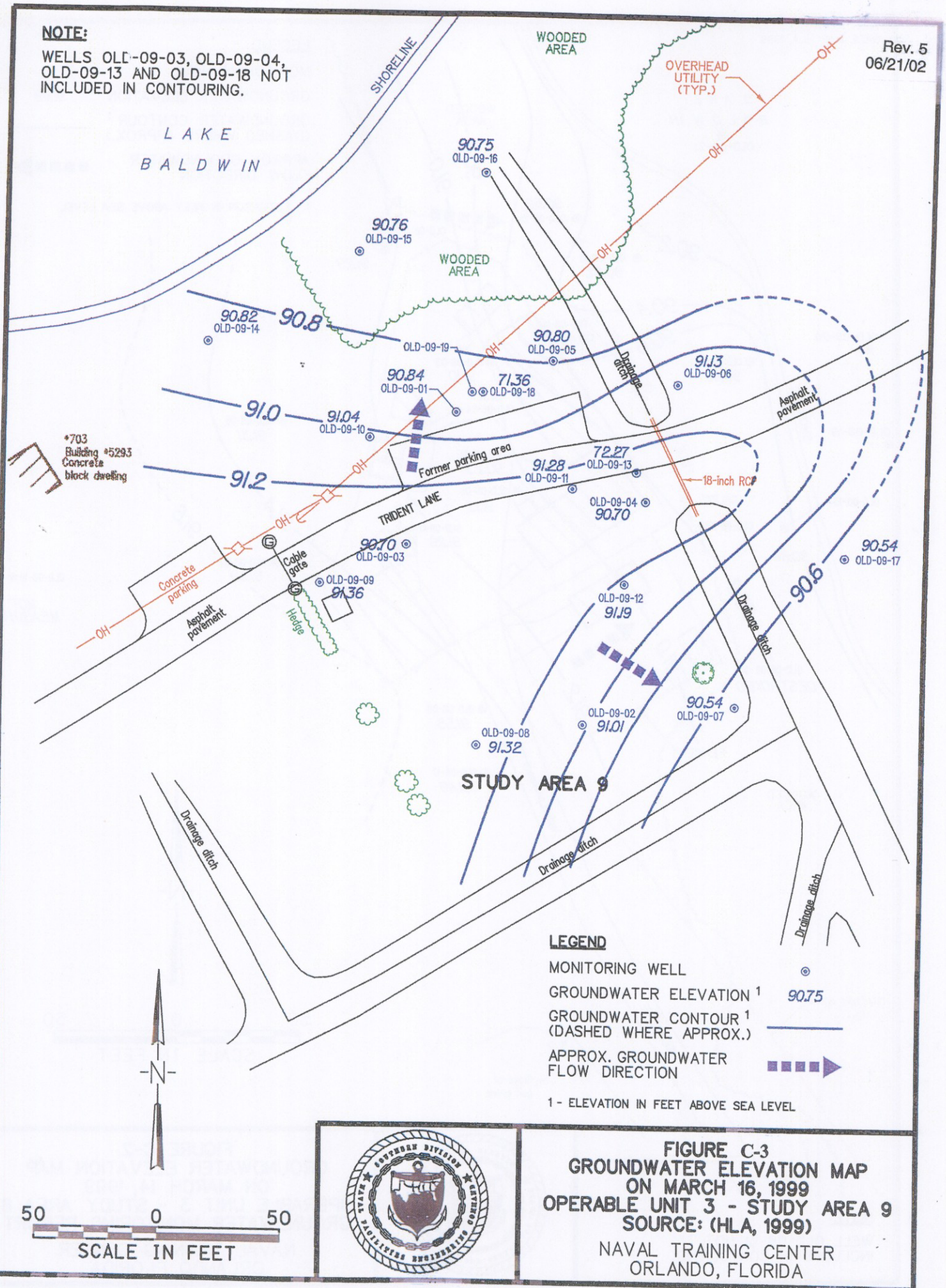


FIGURE C-3
GROUNDWATER ELEVATION MAP
ON MARCH 16, 1999
OPERABLE UNIT 3 - STUDY AREA 9
SOURCE: (HLA, 1999)
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

n8-5x11v.dgn

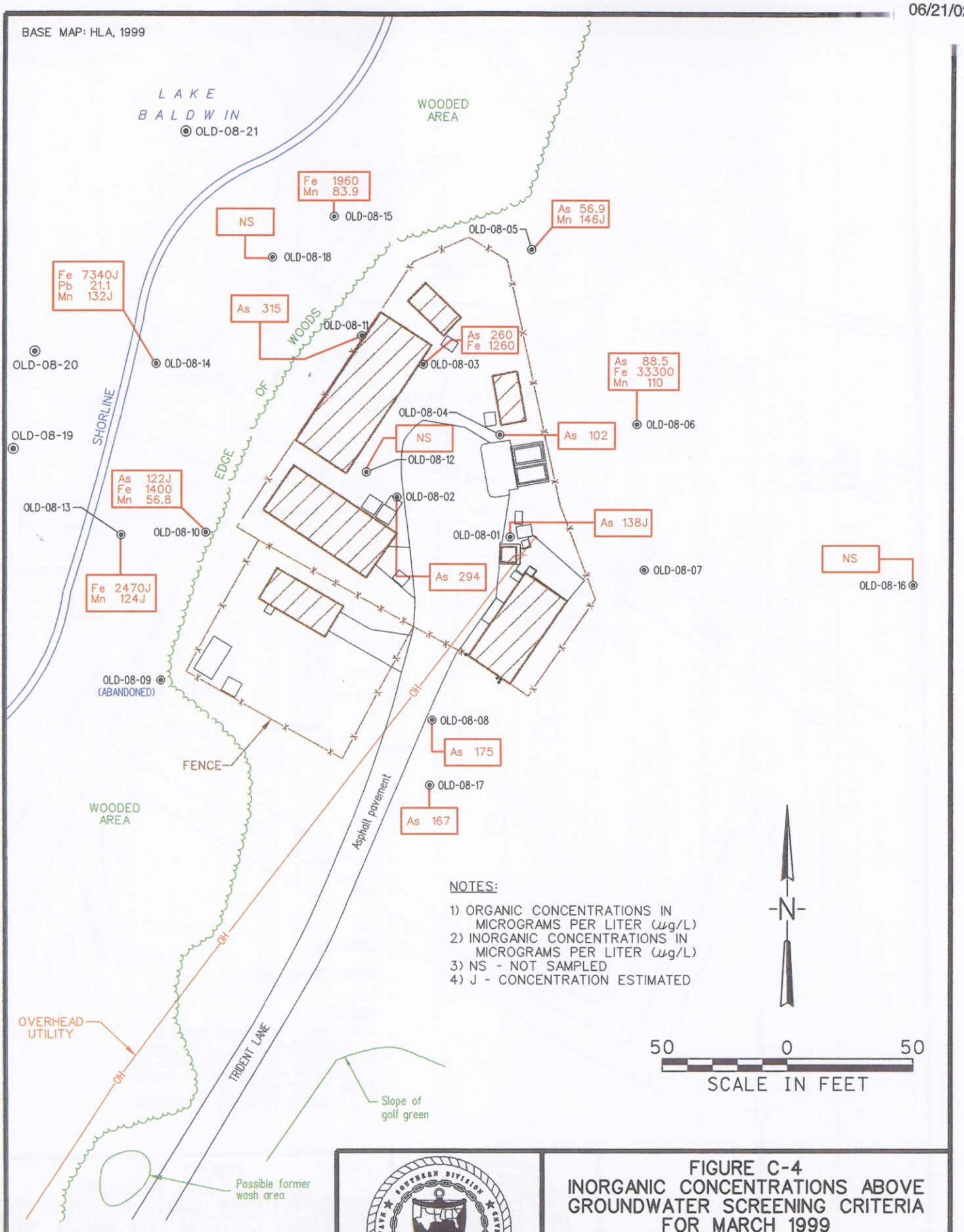
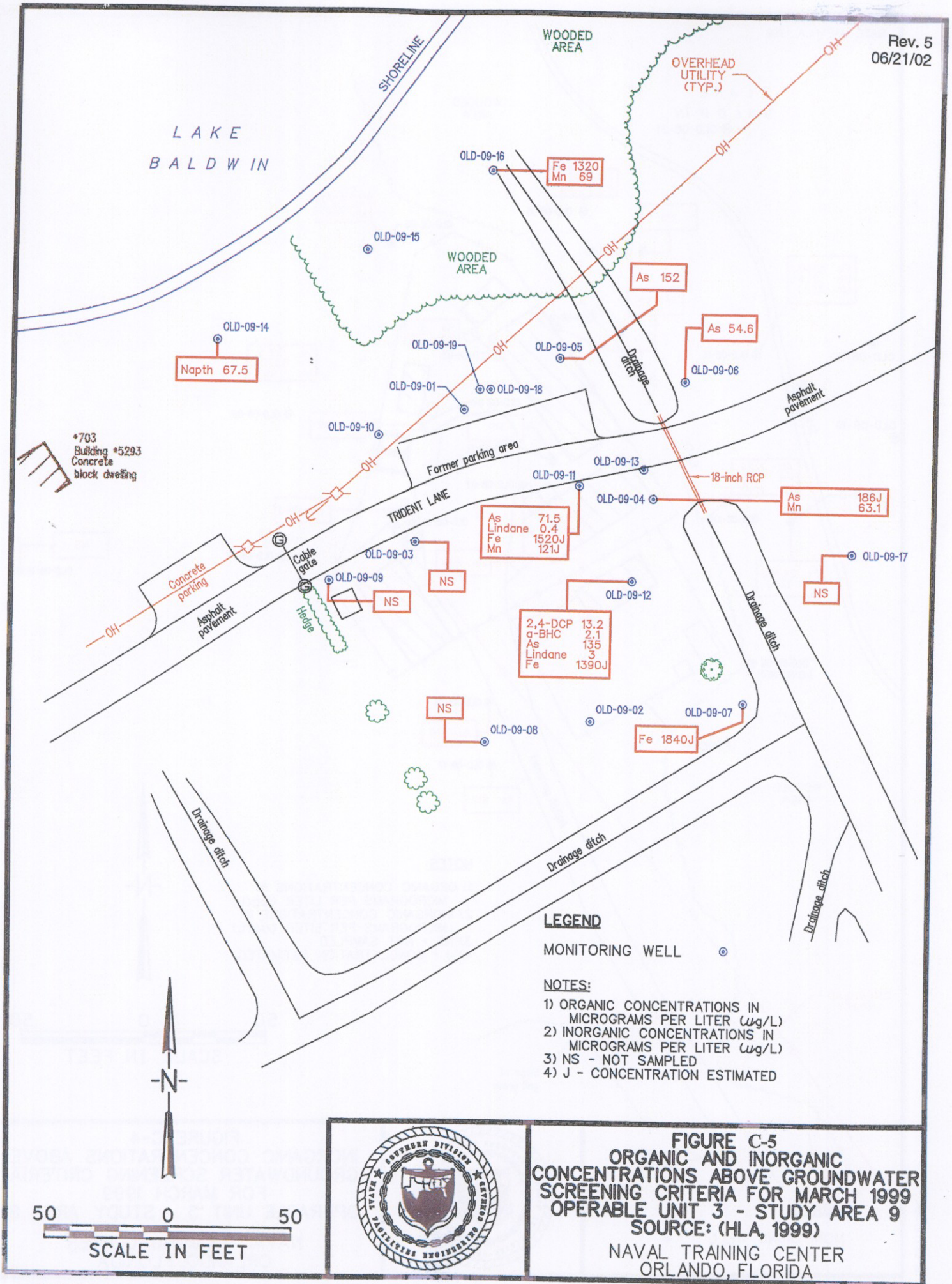


FIGURE C-4
INORGANIC CONCENTRATIONS ABOVE GROUNDWATER SCREENING CRITERIA FOR MARCH 1999
OPERABLE UNIT 3 - STUDY AREA 8

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

n8-5x11v.dgn



n8-5x11v.dgn

FIGURE C-5
ORGANIC AND INORGANIC CONCENTRATIONS ABOVE GROUNDWATER SCREENING CRITERIA FOR MARCH 1999
OPERABLE UNIT 3 - STUDY AREA 9
SOURCE: (HLA, 1999)
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

1.3 OBJECTIVES

The objective of this groundwater monitoring only event is to:

- Sample monitoring wells as appropriate based on historical positive detections and downgradient placement of wells.

The samples will be collected and analyzed in accordance with U.S. Environmental Protection Agency (USEPA) Level IV Data Quality Objectives (DQOs). The sampling frequency will be evaluated following each sampling event and a recommendation will be provided to the Orlando Partnering Team (OPT).

2.0 WELL LIST AND ANALYTICAL PARAMETERS

The wells to be sampled, analyses to be performed, and the rationale for selecting the wells and analyses are presented in Table C-1. Table C-2, which was taken from the Remedial Investigation and Feasibility Study report (HLA, 1999a) provides information on the well installation. The well locations are shown on Figures C-2 and C-3, and the contaminants of concern and cleanup criteria are listed below.

Contaminant of Concern	Cleanup Criteria	
2,4-Dichlorophenol	4 µg/L	GCTL
Arsenic	50 µg/L	GCTL
alpha-Hexachlorocyclohexane (a-BHC)	0.006 µg/L	GCTL
gamma-Hexachlorocyclohexane (Lindane)	0.2 µg/L	GCTL
Iron	300 µg/L	GCTL
Lead	15 µg/L	GCTL
Manganese	50 µg/L	GCTL
Naphthalene	20 µg/L	GCTL

3.0 REFERENCES

HLA (Harding Lawson Associates), 1999a. *Remedial Investigation and Feasibility Study, Operable Unit 3*, Naval Training Center, Orlando, Florida, Unit Identification Code N65928, Contract No. N62467-89-D-0317/136, June.

HLA, 2000. *Interim Record of Decision, Operable Unit 3*, Naval Training Center, Orlando, Florida, April.

Tetra Tech NUS, 1999. *Monitor Well Sampling at Operable Unit 3*, Main Base, Naval Training Center, Orlando, Florida, June.

TABLE C-1

SELECTION OF WELLS AND ANALYTICAL PARAMETERS
OPERABLE UNIT 3, MAIN BASE
NTC, ORLANDO

Well Number	Analytical Parameters[a]	Rationale
OLD-08-02	TAL Inorganics	Historical positive detections
OLD-08-05	TAL Inorganics	Historical positive detections
OLD-08-06	TAL Inorganics	Historical positive detections
OLD-08-10	TAL Inorganics, Herbicides	Historical positive detections
OLD-08-11	TAL Inorganics, Herbicides	Historical positive detections
OLD-08-13	TAL Inorganics	Historical positive detections
OLD-08-14	TAL Inorganics, Herbicides	Historical positive detections
OLD-08-17	TAL Inorganics	Historical positive detections
OLD-08-18	TAL Inorganics, Herbicides	Downgradient well
OLD-08-19	TAL Inorganics, Herbicides	Monitor discharge to lake
OLD-08-20	TAL Inorganics, Herbicides	Monitor discharge to lake
OLD-08-21	TAL Inorganics, Herbicides	Monitor discharge to lake
OLD-09-01	TAL Inorganics, Pesticides, Herbicides	Historical positive detections
OLD-09-03	TAL Inorganics, SVOCs, PAHs, Pesticides, Herbicides	Historical positive detections
OLD-09-04	TAL Inorganics, SVOCs, PAHs, Pesticides, Herbicides	Historical positive detections
OLD-09-05	TAL Inorganics, Pesticides, Herbicides	Historical positive detections
OLD-09-06	TAL Inorganics, Pesticides, Herbicides	Historical positive detections
OLD-09-07	TAL Inorganics, Pesticides, Herbicides	Historical positive detections
OLD-09-11	TAL Inorganics, Pesticides, Herbicides	Historical positive detections
OLD-09-12	TAL Inorganics, SVOCs, PAHs, Pesticides, Herbicides	Historical positive detections
OLD-09-14	TAL Inorganics, SVOCs, PAHs, Pesticides, Herbicides	Historical positive detections
OLD-09-15	TAL Inorganics, SVOCs, PAHs, Pesticides, Herbicides	Downgradient well
OLD-09-17	TAL Inorganics, Pesticides, Herbicides	Historical positive detections

(a) Bottle requirements and analytical methods will be provided in the Field Instruction for each sampling event.

TABLE C-2

MONITORING WELL CONSTRUCTION SUMMARY
OPERABLE UNIT 3, MAIN BASE

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

Well	Type/Diameter (inches)	Date Installed	Total Depth (ft bls)	Screened Interval (ft bls)
OLD-08-01	MW/2.0	09/01/94	13.5	3 to 13
OLD-08-02	MW/2.0	08/31/94	13.5	3 to 13
OLD-08-03	MW/2.0	08/31/94	13.5	3 to 13
OLD-08-04	MW/2.0	09/01/94	13.5	3 to 13
OLD-08-05	microwell/0.5	10/08/97	10	1 to 10
OLD-08-06	microwell/0.5	10/08/97	10	1 to 10
OLD-08-07	microwell/0.5	10/08/97	10	1 to 10
OLD-08-08	microwell/0.5	10/08/97	10	1 to 10
OLD-08-09	microwell/0.5	10/08/97	10	1 to 10
OLD-08-10	microwell/0.5	10/10/97	10	1 to 10
OLD-08-11	microwell/0.5	10/10/97	10	1 to 10
OLD-08-12	microwell/0.5	10/09/97	29	23 to 29
OLD-08-13	microwell/0.5	11/24/97	7.14	1.13 to 7.13
OLD-08-14	microwell/0.5	11/24/97	7.13	1.12 to 7.12
OLD-08-15	microwell/0.5	11/24/97	7.23	1.22 to 7.22
OLD-08-16	microwell/0.5	02/04/98	10	1 to 10
OLD-08-17	microwell/0.5	02/04/98	9.9	0.9 to 9.9
OLD-08-18	microwell/0.5	02/06/98	11	1.5 to 10.5
OLD-09-01	MW/2.0	08/30/94	13.5	3 to 13
OLD-09-02	MW/2.0	1986	12	7 to 12
OLD-09-03	MW/2.0	1986	12	7 to 12
OLD-09-04	MW/2.0	1986	12	7 to 12
OLD-09-05	microwell/0.5	10/06/97	10	1 to 10
OLD-09-06	microwell/0.5	10/06/97	10	1 to 10
OLD-09-07	microwell/0.5	10/06/97	12	3 to 12
OLD-09-08	microwell/0.5	10/06/97	11	2 to 11
OLD-09-09	microwell/0.5	10/06/97	10	1 to 10
OLD-09-10	microwell/0.5	10/07/97	10	1 to 10
OLD-09-11	microwell/0.5	10/07/97	10	1 to 10
OLD-09-12	microwell/0.5	10/07/97	10	1 to 10
OLD-09-13	microwell/0.5	10/07/97	29	23 to 29
OLD-09-14	microwell/0.5	11/25/97	7.40	1.39 to 7.39
OLD-09-15	microwell/0.5	11/25/97	7.19	1.18 to 7.18
OLD-09-16	microwell/0.5	11/25/97	7.12	1.11 to 7.11
OLD-09-17	microwell/0.5	02/04/98	10.1	0.93 to 9.93
OLD-09-18	microwell/0.5	02/05/98	30.10	23.6 to 29.6
OLD-09-19	MW/2.0	07/30/99	30.5	25.5 to 30.5

Notes: bls = below land surface
MW – monitoring well

APPENDIX D

BUILDING 2273
MAIN BASE

BUILDING 2273
MAIN BASE

1.0 INTRODUCTION

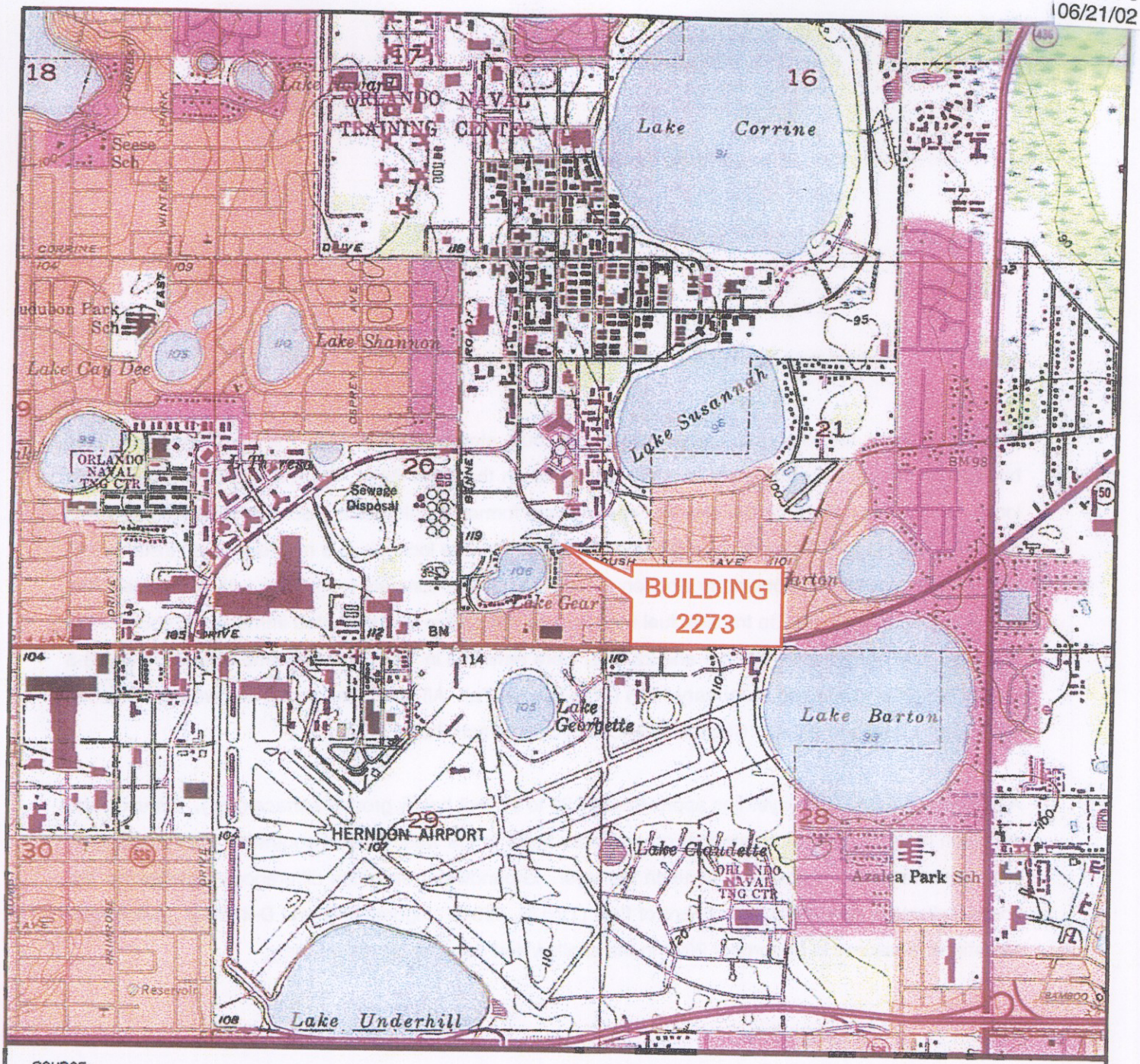
1.1 SITE DESCRIPTION

Building 2273 is the site of a former heating oil bulk storage facility near the southern Main Base boundary. Figure D-1 shows the location of the site on the Main Base. Figure D-2 shows the former location of Building 2273 on the site, the approximate former location of the underground storage tanks (USTs), monitoring well locations, underground utilities, and the location of a new deep well installed off-site. Building 2273 was a one-story wooden structure built on a concrete foundation with a basement that contained the pumps used to transfer fuel from four 11,750-gallon USTs located immediately south of the building. Two of the USTs (2273-1 and 2273-2) were removed in 1993 and the remaining USTs (2273-3 and 2273-4) were removed in January 1996 (ABB-ES, 1997a). All structures on the site were demolished during Base Realignment and Closure (BRAC) Act closure activities.

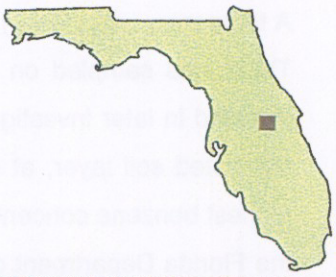
A partially cemented soil layer lies approximately 20 to 27 feet below ground surface (bgs). Groundwater elevation measurements indicate that groundwater flows to the west or west-southwest above this layer. A southeasterly flow is observed beneath the layer. Groundwater elevation differences between the two zones indicate a downward component of flow (TtNUS, 2001). Figures D-3 and D-4 show groundwater elevations measured in December 2001 in the shallow and deep wells, respectively.

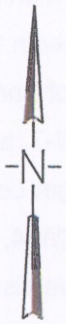
1.2 BACKGROUND

A temporary well (TW-1) was installed near the product lines, and a petroleum sheen was detected when TW-1 was sampled on February 21, 1996 (ABB-ES, 1997a). Samples from deeper monitoring wells installed in later investigations indicate that contaminated groundwater also occurs beneath the partially cemented soil layer, at depths to 45 feet bgs. Benzene is the primary contaminant of concern. The highest benzene concentration observed to date, 5.8 µg/L, was detected in deep well DW-7, and exceeds the Florida Department of Environmental Protection (FDEP) Groundwater Cleanup Target Level (GCTL) of 1 µg/L (FDEP, 1999). Other benzene exceedances have been observed in wells MW-4, DW-2, and DW-9. Observed concentrations of ethylbenzene, xylenes, and naphthalene isomers have also exceeded GCTLs (TtNUS, 2001). The nature of the contaminants (fuel fractions suggests that the UST pit



SOURCE:
TAKEN FROM U.S.G.S. TOPOGRAPHIC QUADRANGLE
ORLANDO EAST, FLORIDA (1980 EDITION).





2000 0 2000
SCALE IN FEET

FIGURE D-1
USGS TOPOGRAPHIC MAP
BUILDING 2273 - MAIN BASE
GROUNDWATER SAMPLING WORK PLAN

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

n8_5x11v.dgn

4707995 L./DATE: k:\dgn\navy\orlando\sites\bldg2273\ 2273-012.dgn/2-1-02 GROUNDWATER SAMPLING WORK PLAN

CTO 0024

Rev. 5
06/21/02

LEGEND

- MONITORING WELL
- DEEP MONITORING WELL
- COMPLIANCE WELL
- TEMPORARY WELL
- PIEZOMETER
- DESTROYED WELL
- SOIL BORING
- INDICATES WELL TO BE SAMPLED

GRASS
GRASS
GRASS
GRASS
GRAVEL
GRAVEL
TRUCK LOADING ZONE
FORMER BUILDING 139
FORMER BUILDING 2273 (PUMP HOUSE)
MW-7
MW-4
DW-10
MW-6
DW-5
DW-11
CW-1
CW-2 (PLUGGED AND ABANDONED)
UNDERGROUND POWER CABLE
DW-2
MW-1
MW-2
DW-1
TW-1
DW-3
MW-3
DW-8
SB-1
DW-6
MW-8
DW-4
CW-3
MW-5
CW-4
DW-9
MW-9
DW-7
UGE
SA
NG
FORMER UST LOCATION (2273-3 & 2273-4)
FORMER UST LOCATION (2273-1& 2273-2)
SANITARY SEWER LINE
UNDERGROUND NATURAL GAS LINE
FENCE (TYP.)
DW-12

-N-

20 0 20
SCALE IN FEET

FIGURE D-2
SITE MAP

BUILDING 2273 - MAIN BASE
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

n11x17h.dgn

CAD FILE NO./DATE: k:\dgn\navy\orlando\sites\bldg2273\ 2273-008.dgn/3-14-02 Groundwater Sampling Work Plan

Rev. 5
06/21/02

LEGEND

MONITORING WELL

DEEP MONITORING WELL

GROUNDWATER ELEVATION [1] 106.12

POTENTIOMETRIC SURFACE ISOCON [1] (DASHED WHERE APPROX.)

GROUNDWATER FLOW DIRECTION (APPROX.)

1 - ELEVATION IN FEET ABOVE MEAN SEA LEVEL

GRASS
GRAVEL
GRASS
GRAVEL
GRASS
GRASS
GRASS
GRASS

DW-10
MW-6 106.35
DW-5
DW-11
DW-11
MW-4 106.90
MW-7 107.30
DW-8
DW-6
MW-8 106.20
DW-9
MW-9 106.97
DW-7
DW-12

106.25
106.50
106.75
107
107.25
106

TRUCK LOADING ZONE

FORMER BUILDING 2273 (PUMP HOUSE)

FORMER BUILDING 139

UNDERGROUND POWER CABLE
UGE
UGE
UGE
SA
SA
SA
NG
NG
NG

FORMER UST LOCATION (2273-3 & 2273-4)

FORMER UST LOCATION (2273-1& 2273-2)

SANITARY SEWER LINE

UNDERGROUND NATURAL GAS LINE

FENCE (TYP.)

N

20 0 20
SCALE IN FEET

FIGURE D-3
GROUNDWATER POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER ZONE
DECEMBER 12, 2001

BUILDING 2273 - MAIN BASE
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

CTO 0024

D-5

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Rev. 5
06/21/02

LEGEND

MONITORING WELL

DEEP MONITORING WELL

GROUNDWATER ELEVATION [1] 103.26

POTENTIOMETRIC SURFACE ISOCON [1] (DASHED WHERE APPROX.)

GROUNDWATER FLOW DIRECTION (APPROX.)

1 - ELEVATION IN FEET ABOVE MEAN SEA LEVEL

NOTE:
WELL DW-5 NOT INCLUDED IN CONTOURING.

GRASS
GRASS
GRASS
GRASS
GRASS
GRAVEL
GRAVEL
TRUCK LOADING ZONE
FORMER BUILDING 139
FORMER BUILDING 2273 (PUMP HOUSE)
MW-4
MW-7
DW-10 99.47
MW-6
DW-5 103.66
DW-11 98.96
DW-8 98.73
DW-6 99.26
MW-8
DW-9 100.93
MW-9
100.06
DW-7
DW-12 98.97
UNDERGROUND POWER CABLE
UGE
SA
NG
FORMER UST LOCATION (2273-3 & 2273-4)
FORMER UST LOCATION (2273-1 & 2273-2)
SANITARY SEWER LINE
FENCE (TYP.)
UNDERGROUND NATURAL GAS LINE
101
100.5
100
99.5
99
-N-
20 0 20
SCALE IN FEET

FIGURE D-4
GROUNDWATER POTENTIOMETRIC SURFACE MAP
DEEP AQUIFER ZONE
DECEMBER 12, 2001

BUILDING 2273 - MAIN BASE
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

CTO 0024

D-7

4707995

n11x17h.dgn

CAD FILE NO./DATE: k:\dgn\navy\orlando\sites\bldg2273\ 2273-011.dgn/2-1-02 GROUNDWATER SAMPLING WORK PLAN

is the source of contamination. Figure D-5 shows the groundwater exceedances observed through the most recent sampling round (June 2001).

The possibility that contaminated groundwater may have migrated off-site at the south site boundary suggested the need for an additional deep, off-site well. Tetra Tech NUS personnel installed the new well, DW-12, in June 2001. Well DW-12 lies southeast of the UST pit, outside the site's south security fence, and is screened from 37 to 42 feet bgs.

1.3 OBJECTIVES

The objectives of the groundwater monitoring at Building 2273 are to:

- Perform quarterly synoptic water level surveys of all wells on-site prior to each sampling event to evaluate groundwater flow in both the shallow and deep zones.
- Sample wells MW-4, MW-6, MW-8, DW-6, DW-7, and DW-8 quarterly for Target Compound List (TCL) volatile organic compounds (VOCs).
- Sample wells DW-5, DW-8, and DW-11 quarterly for polynuclear aromatic hydrocarbons (PAHs), due to historical exceedances of 1-methylnaphthalene and 2-methylnaphthalene in well DW-5.
- Sample wells MW-4, MW-6, and MW-7 for total recoverable petroleum hydrocarbon (TRPH) due to exceedances in wells MW-4 and MW-7 in June 2001.
- During the first quarterly event, sample well DW-8 for Target Analyte List (TAL) inorganics due to historical exceedances for lead in wells CW-1 and DW-3. If there is an exceedance, DW-8 will be sampled for TAL inorganics during subsequent events.

Samples will be collected quarterly and analyzed for VOCs using U.S. Environmental Protection Agency (USEPA) Method SW-846 8260B. Samples for TAL inorganics will be analyzed using USEPA Method SW-846 6010B/7000A Series 9012B. USEPA Method SW-846 8310 or SW-846 8270C SIM will be used for PAH analysis. The FL PRO Method will be used for TRPH analysis.

Figure D-2 shows the well locations and Table D-1 shows the well construction details. The wells to be sampled, analytical parameters, rationale for sampling, well designation as source or perimeter, contaminants of concern, and cleanup criteria are presented in the following tables.

Rev. 5
06/21/02

LEGEND

- ASTERISK INDICATES WELLS SAMPLED
- MONITORING WELL
- DEEP MONITORING WELL
- PIEZOMETER
- DESTROYED WELL
- TEMPORARY WELL
- COMPLIANCE WELL

WELL I.D. — DW-7 — SAMPLE COLLECTION DATE
SCREENED INTERVAL TO NEAREST FOOT — 40 TO 45 — 10/2/99
ANALYTE — BENZENE — 5.8 — ANALYTE CONCENTRATION[1,2]

NOT ANALYZED NA

ESTIMATED VALUE J

SCREENING CRITERIA

ANALYTE	GCTL[1]	BGSV[1]
BENZENE	1	-
ETHYLBENZENE	30	-
LEAD	15	4
1-METHYLNAPHTHALENE	20	-
2-METHYLNAPHTHALENE	20	-
NAPHTHALENE	20	-
TOTAL VOCs	50	-
TOTAL XYLENES	20	-
TRPH	5000	-

GCTL=GROUNDWATER CLEANUP TARGET LEVEL
BGSV=BACKGROUND SCREENING VALUE

1-CONCENTRATION IN MICROGRAMS PER LITER (ug/L)
2-BOLD CONCENTRATION INDICATES EXCEEDANCE

MW-4				
5 TO 15	10/1/96	9/30/99	11/30/00	6/14/01
BENZENE	**3.2**	**1-J**	0.18-J	<1
TRPH	NA	NA	NA	**15000**

MW-7CW-1		
5 TO 15	12/9/96	6/14/01
TRPH	3600	**<17,000**

DW-5				
27 TO 32	6/24/97	10/2/99	11/30/00	6/14/01
1-METHYLNAPHTHALENE	16	**21/20**	**25/22**	15
2-METHYLNAPHTHALENE	**22**	**28/27**	**36/33**	**22**
NAPHTHALENE	**46**	15/14	12/11	8-J

DW-1			
27 TO 32	10/9/96	1/2/97	6/24/97
ETHYLBENZENE	**237**	11.8	5.4
TOTAL VOCs	**1387**	**122.6**	**255.4**
TOTAL XYLENES	**1150**	**110.8**	**250**

CW-1	
UNKNOWN	8/15/95
LEAD	**19.5**

DW-2			
40 TO 45	12/9/96	1/2/97	6/24/97
BENZENE	**4.8**	**<1**	**3.3**
TOTAL VOCs	36.7	**13.6**	**53.3**
TOTAL XYLENES	**24.9**	**11.5**	**46**

DW-3			
25 TO 30	12/9/96	1/2/97	6/24/97
LEAD	**15**	<3	<3

DW-9				
38 TO 43	4/17/00	6/2/00	11/30/00	6/12/01
BENZENE	**1.2**	0.45-J	0.28-J	<1/<1

DW-6			
38 TO 43	10/1/99	11/30/00	6/12/01
TOTAL XYLENES	**100**	<1	<5

MW-1	
4 TO 14	7/25/96
TOTAL VOCs	**57.6**
TOTAL XYLENES	**30.6**

TW-1	
UNKNOWN	2/21/96
ETHYLBENZENE	**30**
TOTAL VOCs	**530**
TOTAL XYLENES	**500**

DW-7			
38 TO 43	10/2/99	11/30/00	6/11/01
BENZENE	**5.8**	**3.2**	**5**

GRASS, GRAVEL, TRUCK LOADING ZONE, FENCE (TYP.), GATE, UNDERGROUND POWER CABLE, UNDERGROUND NATURAL GAS LINE, UGE, NG, SA, FORMER BUILDING 2273 (PUMP HOUSE), FORMER BUILDING 139, FORMER UST LOCATION (2273-3 & 2273-4), FORMER UST LOCATION (2273-1& 2273-2), SANITARY SEWER LINE, PZ-1, PZ-2, MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, DW-1, DW-2, DW-3, DW-4, DW-5, DW-6, DW-7, DW-8, DW-9, DW-10, DW-11, DW-12, CW-1, CW-2, CW-3, CW-4, TW-1, SB-1

-N-

20 0 20
SCALE IN FEET

NOTE:
DATA ARE SHOWN FOR LOCATIONS WITH PAST OR CURRENT SCREENING CRITERIA EXCEEDANCES.

FIGURE D-5
GROUNDWATER EXCEEDANCES
JUNE 2001

BUILDING 2273 - MAIN BASE
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

D-11

CTO 0024

n11x17h.dgn

CAD FILE NO./DATE: k:\dgn\navy\orlando\sites\bldg2273\ 2273-007.dgn/3-14-02 Groundwater Sampling Work Plan
4707995

TABLE D-1

SUMMARY OF MONITORING WELLS
BUILDING 2273, MAIN BASE
NAVAL TRAINING CENTER, ORLANDO, FLORIDA

Monitoring Well	Total Depth and [Screen Depth][a] (feet bgs)	Status	Well Location
MW-1	14 [4 to 14]	Destroyed during utility construction.	
MW-2	14 [4 to 14]	Destroyed during utility construction.	
MW-3	15 [4 to 14]	Destroyed during utility construction.	
MW-4	15 [5 to 15]	Cross gradient of UST pit.	Approximately 40 feet NNE of Bldg. 2273.
MW-5	15 [5 to 15]	Destroyed during utility construction.	
MW-6	15 [5 to 15]	Cross gradient of UST pit.	Approximately 40 feet NW of Bldg. 2273.
MW-7	15 [5 to 15]	Upgradient of UST pit.	Approximately 65 feet NE of Bldg. 2273.
MW-8	15 [5 to 15]	Downgradient of UST pit.	Approximately 10 feet SW of NW corner of UST pit.
MW-9	15 [5 to 15]	Downgradient of UST pit.	Approximately 40 feet W of SW corner of UST pit.
DW-1	32 [27 to 32]	Destroyed during utility construction.	
DW-2	45 [40 to 45]	Destroyed during utility construction.	
DW-3	30 [25 to 30]	Destroyed during utility construction.	
DW-4	32 [27 to 32]	Destroyed during utility construction.	
DW-5	32 [27 to 32]	Upgradient of UST pit.	In loading area N of Building 2273.
DW-6	43.5 [38 to 43]	Cross gradient, very near UST pit.	Approximately 10 feet WSW of NW corner of UST pit.
DW-7	43 [38 to 43]	Cross gradient of UST pit.	Approximately 30 feet W of SW corner of UST pit.
DW-8	43 [38 to 43]	Upgradient, very near UST pit.	Approximately 5 feet NE of NE corner of UST pit.
DW-9	43 [38 to 43]	Cross gradient, west of UST pit.	Approximately 70 feet W of SW corner of UST pit.
DW-10	40 [34.5 to 39.5]	New upgradient well installed April 2001.	Creates pair with MW-6.
DW-11	40.5 [35 to 40]	New cross gradient well installed April 2001.	Approximately 15 feet E of NE corner of Bldg. 2273.
DW-12	42.5 [37 to 42]	New downgradient well installed June 2001 off-site.	Approximately 60 feet SE of SE corner of UST pit.
CW-1	Unknown	Destroyed during utility construction.	
CW-2	Unknown	USTs have been removed; compliance monitoring no longer required. Abandoned.	
CW-3	Unknown	Destroyed during utility construction.	
CW-4	Unknown	Destroyed during utility construction.	

[a] - Rounded to the nearest 0.5 foot.
bgs - Below ground surface

It is anticipated that some wells may need to be replaced as a result of construction activities at this site. This list of wells to be sampled will be revised as needed to reflect these changes.

Well Number	Analytical Parameters	Rationale	Well Designation
MW-4	TCL VOCs (Method 8260) TRPH (FL PRO)	Cross gradient of UST pit. TRPH exceedance and historical benzene exceedance.	Source
MW-6	TCL VOCs (Method 8260) TRPH (FL PRO)	Cross gradient of UST pit. Downgradient of MW-4 and MW-7.	Perimeter
MW-7	TRPH (FL PRO)	TRPH exceedance	Source
MW-8	TCL VOCs (Method 8260)	Downgradient of UST pit.	Perimeter
DW-5	PAHs (Method SW-846 8310 or SW-846 8270C SIM)	Cross gradient of UST pit. Methylnaphthalene exceedance.	Source
DW-6	TCL VOCs (Method 8260)	Upgradient very near UST pit.	Perimeter
DW-7	TCL VOCs (Method 8260)	Upgradient of UST pit. Benzene exceedance.	Source
DW-8	TCL VOCs (Method 8260) TAL Inorganics[(a)] SW-846 6010B/7000A 9012B PAHs (Method SW-846 8310 or SW-846 8270C SIM)	Downgradient of DW-5. Downgradient of UST pit.	Perimeter
DW-11	PAHs (Method SW-846 8310 or SW-846 8270C SIM)	New well installed April 2001. Downgradient of DW-5.	Perimeter

(a) Analyze for during first sampling event, and in following sampling events if an exceedance is detected.

Detection limits for each chemical of concern will be at or below the FDEP GCTLs, as listed below.

Contaminant of Concern	GCTL
1-methylnaphthalene	20 µg/L
2-methylnaphthalene	20 µg/L
Benzene	1 µg/L
Ethylbenzene	30 µg/L
Lead	15 µg/L
Total xylenes	20 µg/L
TRPH	5000 µg/L

Holding times and bottle requirements (see note on table) are provided in the following table.

Parameter	Analytical Method	Bottle/Preservation Requirements[a]	Holding Time
TCL VOCs	SW-846 5030B 8260B	40-mL septum vial/ hydrochloric acid, 3 vials per sample	14 days
TAL Metals	SW-846 6010B/7000A 9012B	1-L plastic with nitric acid, 1 bottle per sample	6 months
PAHs	SW-846 8310 or SW-846 8270C SIM	1-L glass amber, 2 bottles per sample	7 day extraction/ 40 days
TRPH	FL PRO	1-L glass amber with hydrochloric acid, 2 bottles per sample	28 days

[a] Bottle requirements will be provided (and revised if appropriate) in the Field Instruction for each sampling event.

2.0 REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1997. *Contamination Assessment Report, Building 2273, Main Base*, Naval Training Center Orlando, Florida. March.

ABB-ES, 1997b. *Project Operations Plan for Site Investigations and Remedial Investigations*, Naval Training Center, Orlando, Florida.

FDEP (Florida Department of Environmental Protection), 1999. *Water Well Permitting and Construction Requirements, Florida Administrative Code*, Chapter 62-532, Section 500(4). Tallahassee, Florida, December.

FDEP, 2002. *DEP Standard Operating Procedures for Laboratory Operations and Sample Collection Activities,* DEP QA-001/01, January.

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