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REMEDIATION WORK PLAN INTERIM ACTION IN SITU RECIRCULATION WELL TREATMENT AT OPERABLE UNIT 4 (OU 4) NTC ORLANDO FL

9/4/1997

BECHTEL

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REMEDIATION WORK PLAN

INTERIM REMEDIAL ACTION USING IN SITU RECIRCULATION WELL TREATMENT SYSTEM

OPERABLE UNIT 4
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

Prepared for

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

Under Contract No. N62467-93-D-0936

Prepared by

BECHTEL ENVIRONMENTAL, INC.
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SEPTEMBER 1997

Revision 0

Bechtel Job No. 22567

Approved: _____ 9-4-97
Project Engineer — Date

Approved: _____ 9-4-97
Project Manager — Date

Approved: _____
Navy Contracting Officer — Date

pb0031

ENGINEER'S CERTIFICATION

The engineering work described and professional opinions rendered in this document, *Remediation Work Plan, Interim Remedial Action Using In Situ Recirculation Well Treatment System for Operable Unit 4, Naval Training Center, Orlando, Florida, Revision 0*, September 1997, were conducted or developed using commonly accepted engineering practices and standards. The scope of engineering services described in this document was conducted under the supervision of a professional engineer registered in the State of Florida.

J. R. Manning
9/5/97

J. R. Manning, PE
Project Engineer
Florida PE Number 0051803
Expires February 28, 1999

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ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
CHC	chlorinated hydrocarbons
CLEAN	Comprehensive Long-Term Environmental Action, Navy
ComQAP	Comprehensive Quality Assurance Plan
DO	Delivery Order
DRMO	Defense Reutilization and Marketing Office
EPA	U.S. Environmental Protection Agency
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
IRA	interim remedial action
NAVFACENGCOM	Naval Facilities Engineering Command
NTC	Naval Training Center
OPT	Orlando Partnering Team
OU	operable unit
O&M	Operations and Maintenance
PLC	program logic control
PM&SP	Performance Monitoring and Sampling Plan
PP	project procedure
PSHP	Program Safety and Health Plan
PVC	polyvinyl chloride
QC	Quality Control
QCP	Quality Control Program Plan
QCPA	Quality Control Program Plan Addendum
RAC	Response Action Contractor
RAM	Responsibility Assignment Matrix
ROICC	Resident Officer in Charge of Construction
RTU	remote telemetry unit
RWP	Remediation Work Plan
SBP	SBP Technologies, Inc.
SSHP	Site Safety and Health Plan
TOC	total organic carbon
VOC	volatile organic compounds

UNITS OF MEASURE

bgs	below ground surface
in.	inch
ft	foot/feet
lb.	pound
ppb	parts per billion

EXECUTIVE SUMMARY

Bechtel Environmental, Inc. (Bechtel) has been contracted by the Department of the Navy, Naval Facilities Engineering Command (NAVFACENGCOM), Southern Division, to provide remedial services as the Navy's Environmental Response Action Contractor (RAC). Under Delivery Order (DO) 0064, Task 1, of the Prime Contract N62467-93-D-0936, Bechtel has been contracted to prepare a Remediation Work Plan (RWP) for interim remedial action (IRA) of Operable Unit 4, Area C at the Naval Training Center (NTC) in Orlando, Florida. After approval of the RWP by the Florida Department of Environmental Protection (FDEP), Bechtel intends to implement this RWP as part of the same DO. The *Interim Remedial Action Conceptual Design and Performance Specification Operable Unit 4, Naval Training Center, Orlando, Florida,* (ABB-ES 1997a), provides the basis for the initiation of the RWP.

The objective of the IRA is to gain control both horizontally and vertically of groundwater exceeding 100 parts per billion (ppb) for total volatile organic compounds (VOCs). The contaminated groundwater plume is migrating from a suspected source area near Building 1100, the former laundry and dry cleaning facility, toward Lake Druid. To achieve this objective, the IRA recommends installing a recirculating/in situ stripping remedy for groundwater remediation. Site groundwater is contaminated with chlorinated hydrocarbons including tetrachloroethene (PCE), trichlororethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE) resulting from activities associated with the former laundry and dry cleaning facility.

This RWP describes the activities necessary to implement the IRA. A general description of the activities to be initiated by Bechtel upon approval of the RWP by FDEP is provided. Appendixes include the IRA *Performance Monitoring and Sampling Plan* (Appendix A), *Remedial Design* (Appendix B), and *Construction/ Installation Plan* (Appendix C). Other planning documents, including the Site-Specific Safety and Health Plan Addendum and the task-specific addendum to the *Quality Control Program Plan*, will be issued separately from the RWP.

1.0 INTRODUCTION

Bechtel Environmental, Inc. (Bechtel) has been contracted by the Department of the Navy, Naval Facilities Engineering Command, Southern Division, to provide environmental remediation services as the Navy's Response Action Contractor (RAC). Under Delivery Order (DO) 0064 of the Prime Contract N62467-93-D-0936, Bechtel has been contracted to prepare a Remediation Work Plan (RWP) for remediation of Operable Unit (OU) 4, Area C, of the Naval Training Center (NTC) in Orlando, Florida, and to perform the interim remedial action (IRA) in accordance with the approved RWP. The in situ groundwater stripping technology to be used in implementing the IRA is based on proprietary technology for which SBP Technologies Inc. (SBP) is the sole U.S. distributor. Bechtel has awarded a subcontract to SBP to design and install the in situ groundwater stripping wells. This technology may also be referred to as recirculation wells or "UVB" wells.

1.1 SITE DESCRIPTION

The Naval Training Center (NTC) is located in the western portion of the City of Orlando, Florida (Figure 1-1). The area of concern, OU 4, is located in Area C (Figure 1-2) of the NTC and occupies approximately 46 acres. Area C is the location of a former laundry and dry cleaning facility and portions of the site currently serve as the Defense Reutilization and Marketing Office (DRMO). The site is surrounded by urban development to the north and south, Lake Druid to the west, and an office park to the east.. The area of investigation comprises approximately 6 acres and includes the eastern shore area of Lake Druid. Four of these acres are densely vegetated with large trees and heavy undergrowth. The remaining two acres have been classified as wetlands by the U.S. Department of the Interior, Fish and Wildlife Service (ABB-ES 1997b). Drawing S-1 (ABB-ES, May 1997), located in Appendix D, provides a mapping of the approximate boundaries of the delineated wetland area.

Hazardous materials, such as dry cleaning solvents and the waste generated from the dry cleaning process, were reportedly poorly managed. The wastewater from the process was allowed to discharge into the sanitary sewer through badly deteriorated trenches in the floor. The trenches emptied into a single pipe connected to a settling and surge tank. Due to the volume of wastewater discharged by the laundry machines, a 30,000-gallon surge tank was installed in the mid-1960s. Sludge was removed from this tank annually and disposed of by the DRMO. Additionally, discharges of the water contaminated with chlorinated solvents reportedly occurred on the property, including direct release into Lake Druid.

Site-specific information indicates that the groundwater beneath the site is impacted with chlorinated hydrocarbons (CHCs), including tetrachloroethene (PCE), trichlororethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE) resulting from activities associated with the former laundry and dry cleaning facility at the site. Investigations conducted to date by ABB-Environmental Services, Inc. (ABB-ES) indicated the level of CHCs is greater than 1,000 ppb in the "hot spot" area from the former laundry and dry cleaning location (Building 1100) westward to the lake and into the lake (Figure 1-3). The source produced a westward migrating plume increasing in width and, in part, in depth, toward the lake. A detailed description of the efforts to define the extent of the contaminated groundwater plume is provided in the *Focused Feasibility Study, Operable Unit 4* (ABB-ES 1997b).

1.2 REFERENCE DOCUMENTS

Reference documents on which this RWP is based include the *Interim Remedial Action Conceptual Design and Performance Specification, Operable Unit 4* (ABB-ES 1997a); the *Performance Monitoring and*

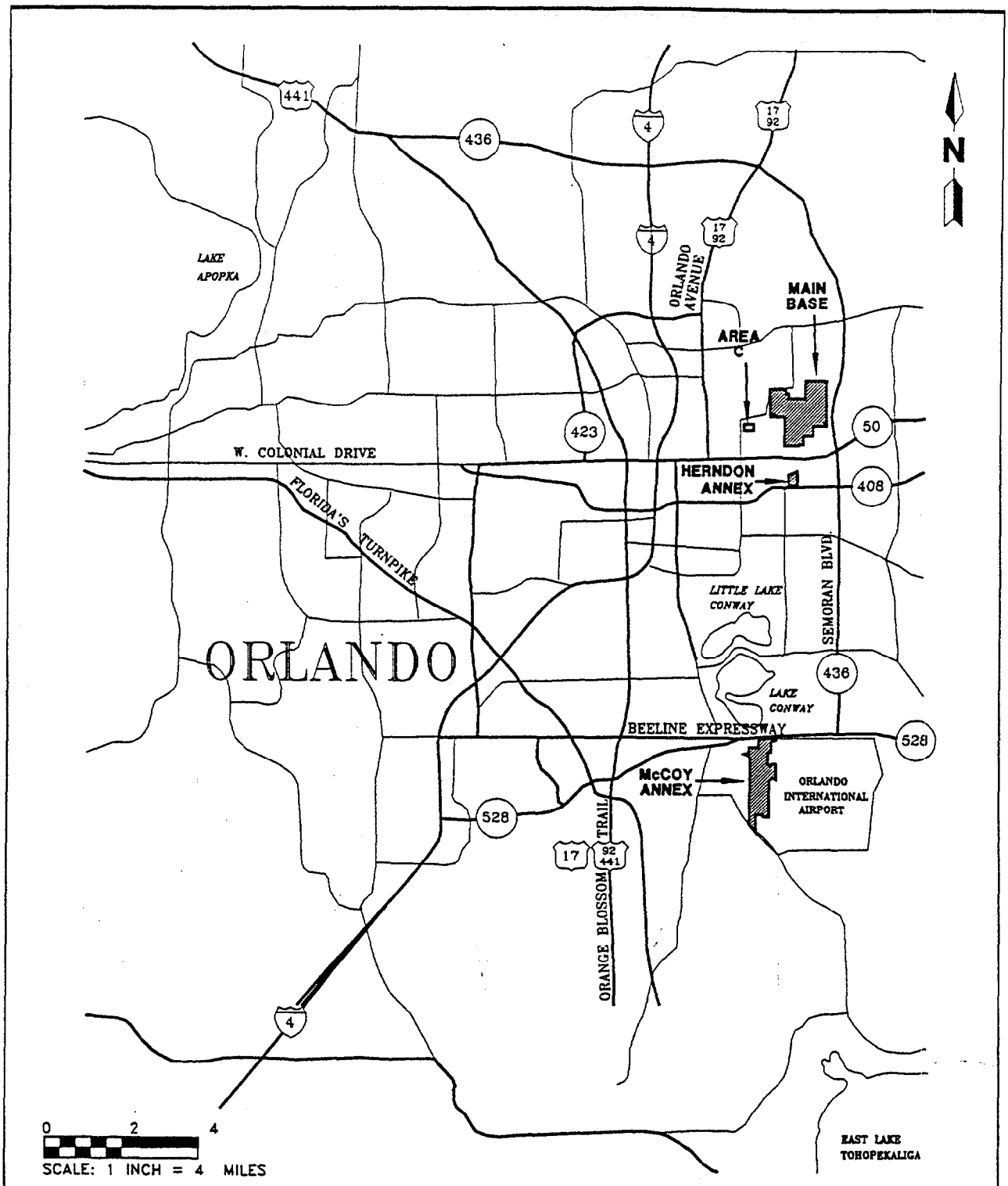

FIGURE 1-1
SITE LOCATION MAP

Source: ABB-ES, 1997b

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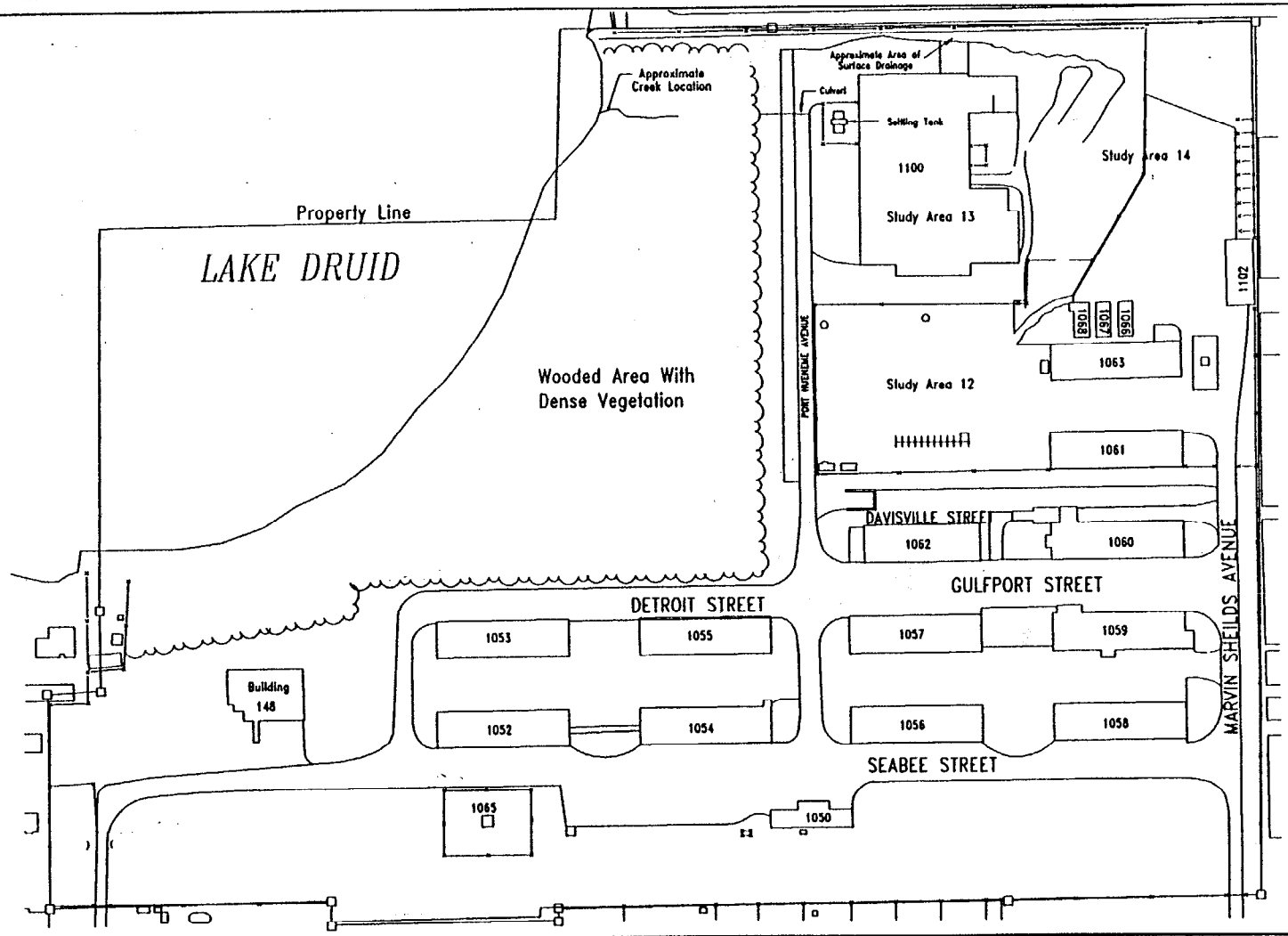
INTERIM REMEDIAL ACTION
FOCUSED FIELD INVESTIGATION
REPORT, OPERABLE UNIT 4

NAVAL TRAINING CENTER
ORLANDO, FLORIDA



0 125 250
SCALE: 1 INCH = 250 FEET

Source: ABB-ES, 1997b

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FIGURE 1-2
MAP OF AREA C

INTERIM REMEDIAL ACTION
FOCUSED FIELD INVESTIGATION
REPORT OPERABLE UNIT 4

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

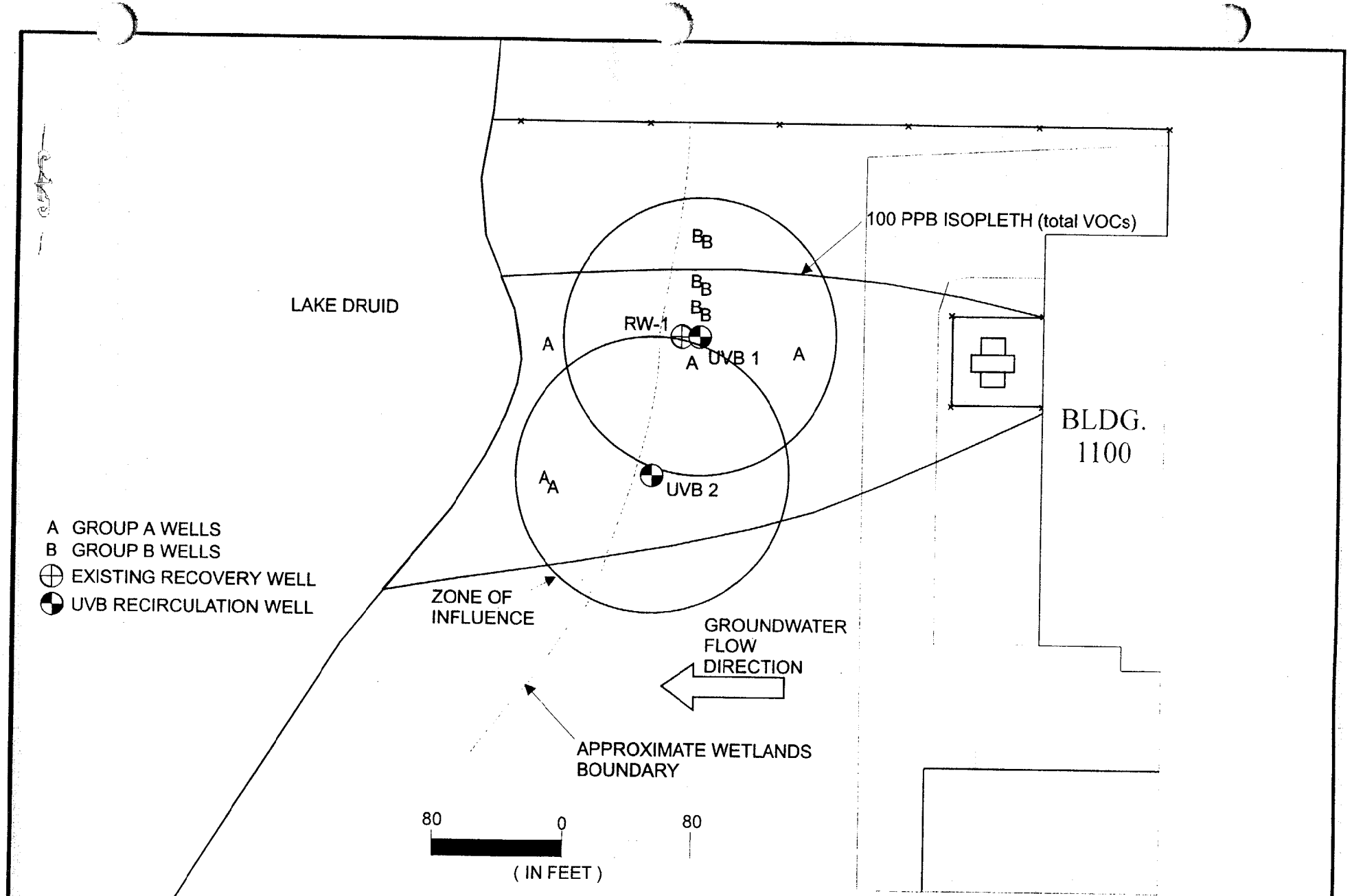


FIGURE 1-3
RECIRCULATION AND MONITORING WELL LOCATION MAP
ORLANDO TRAINING CENTER, OU 4
ORLANDO, FLORIDA

SBP Technologies, Inc.
Environmental Engineers and Bioremediation Specialists

Sampling Plan (Appendix A); the *Remedial Design Plan* (Appendix B); the *Construction/Installation Plan* (Appendix C); and the *Interim Remedial Action Focused Field Investigation Report, Operable Unit 4* (ABB-ES 1997b).

2.0 REMEDIATION ACTIVITIES

The objective of the IRA is to intercept and treat contaminated groundwater which is currently migrating toward Lake Druid. The groundwater plume has been defined as the area bounded both horizontally and vertically by the 100 ppb contaminant contour. This "capture zone" is approximately 200 ft in width and 45 ft in depth below ground surface (bgs).

To achieve this objective, the IRA recommends installing a recirculating/in situ stripping remedy for groundwater control and treatment. The IRA is based on a performance oriented conceptual design by ABB-ES which has been reviewed and approved by the Florida Department of Environmental Protection (FDEP). The process involves proprietary technologies for in situ removal of chlorinated solvents without discharge of groundwater at the surface. Existing and newly installed groundwater monitoring wells will be used to monitor the performance of the system.

2.1 RESPONSIBILITY ASSIGNMENT MATRIX

The execution of the IRA at OU 4 will be a shared responsibility between the Navy and its CLEAN and RAC contractors. The CLEAN contractor, ABB-ES, has selected the remediation technology and provided the conceptual design basis for the recirculation wells. During the implementation phase, ABB-ES will retain the lead responsibility for performance monitoring and sampling and will prepare the remedial action and closure reports. The RAC contractor, Bechtel, and its lower-tier subcontractors will procure, install, and operate the recirculation wells. To ensure all parties involved in the IRA have a clear understanding of the shared responsibilities, a responsibility matrix (RAM) has been developed. The RAM is a "living document" to be used by the project team in coordinating work across organizational boundaries. It lists each major task or element of the IRA and assigns a responsibility code to each participant for that task. Appendix E contains the RAM for the IRA at OU 4.

2.2 PRE-CONSTRUCTION ACTIVITIES

Pre-construction activities will include all document preparation, review, and submittals necessary to obtain approvals from the Navy as well from local, state, or federal regulatory agencies as required to begin construction. Bechtel will review the *Remedial Design* and the *Construction/ Implementation Plan* prepared by SBP. These documents are included as Appendixes B and C to this RWP and provide further details on the design and construction methods. The basis for these final design documents and submittals is the *Interim Remedial Action Conceptual Design and Performance Specification for Operable Unit 4* (ABB-ES 1997a). All permits required for implementation of the IRA shall be obtained prior to initiation of construction or prior to startup of the associated treatment systems.

2.3 PERMITS

The recirculation wells are exempted from the requirement to obtain either a consumptive use permit or a underground injection permit since the scope of the IRA is to treat and recharge the contaminated

groundwater in the same aquifer. This work will be conducted in accordance with a FDEP-approved Remedial Design; therefore, no permitting in these areas is necessary. Further, no permit is required for the abandonment of existing groundwater recovery well OLD-13-RW1 since its casing is less than 6 in. in diameter. Construction permits will be required for the recirculation wells. An appropriately licensed driller will be used to install the wells. Application for the construction permits will be made to the St. Johns River Water Management District.

An air emissions permit is not anticipated to be required based on conservative estimates of VOC emissions levels (i.e., 1.86 lbs./day VOC emissions from each well versus 15 lbs./day allowable) from the recirculation wells. The Central District of FDEP has been notified in writing of the planned installation of the recirculation wells and their estimated lbs./day VOC emissions. In addition, Bechtel will comply with the substantive requirements of the Florida Administrative Code (FAC) 62 341.475 for dredging and filling in wetland areas (i.e., Noticed General Permit). Information on the limited work to be performed in the wetland areas has been provided to the Central District Environmental Resource Permitting department.

In addition to the permits issued by local or state authorities, a permit is required from NTC Orlando for general excavation. It is further expected that well development water may be containerized, sampled, and discharged into the NTC sewer system under the terms of NTC's existing Industrial User Discharge Permit issued by City of Orlando Environmental Services Department.

2.4 MOBILIZATION

Once notice to proceed has been given to Bechtel by the Navy, mobilization activities will commence. Bechtel will mobilize a work force, support equipment, material, and subcontractors necessary to complete the work.

2.4.1 Pre-Construction Meeting

Before beginning the physical work, a pre-construction meeting will be held with the Resident Officer in Charge of Construction (ROICC), Public Works, and other base personnel. This meeting will discuss execution of the work; site access; staging areas; transportation routes; and contact personnel for utilities, fire, environmental, safety and health, quality control, security, and waste management. Particular emphasis will be placed on pre-construction planning and coordination regarding work in or in proximity to delineated wetland areas.

2.4.2 Temporary Facilities

Bechtel will meet with NTC personnel to arrange for possible use of onsite office space and secured lay-down areas of equipment and materials. Equipment lay-down areas required by Bechtel or any Bechtel subcontractor will be identified before mobilization. A hookup for potable water for decontamination, safety and health, and miscellaneous usage is available near Building 1100, the former laundry and dry cleaning facility. A portable toilet and a storage container for tools, small supplies, safety and health equipment, and other miscellaneous supplies will be staged to the site. NTC Orlando will provide 230 V, 3-phase electrical service to a power pole located within 100 ft of the nearest recirculation well.

2.4.3 Utility Interference Identification

Before the start of any excavation or intrusive activity, the Bechtel Site Superintendent will review available utility drawings at the NTC and perform all the necessary utility clearances and contacts or ensure the Subcontractor has made the appropriate contacts. This will include contacting the SUNSHINE Utility Locators, NTC Public Works Office, and the ROICC. Bechtel or its subcontractors will use an underground utilities locator device for finding existing utilities before any intrusive work in an area.

2.5 WELL ABANDONMENT

Due to the potential adverse impact of existing groundwater recovery well OLD-13-RW1 on the groundwater recirculation zone around the two proposed recirculating wells, OLD-13-RW1 is to be abandoned. The well casing and surface completion structure will be removed and the borehole overdrilled and grouted. Additional details on the abandonment methods and equipment are provided in Appendix C. Due to the size of the well (i.e., 5-in. casing), no permits are required for its abandonment.

2.6 GROUNDWATER TREATMENT

Groundwater treatment will be accomplished using a proprietary in-well vapor stripping technology. Two recirculation/in situ stripping wells will be installed for groundwater treatment and 11 groundwater monitoring wells will be installed to evaluate the performance of the system. A detailed system design including drawings, plans, specifications, calculations, dimensions, criteria, and supplemental details is provided in Appendix B. Details on how the treatment system and ancillary features will be constructed is provided in the Construction/Installation Plan in Appendix C.

2.6.1 Recirculation Wells

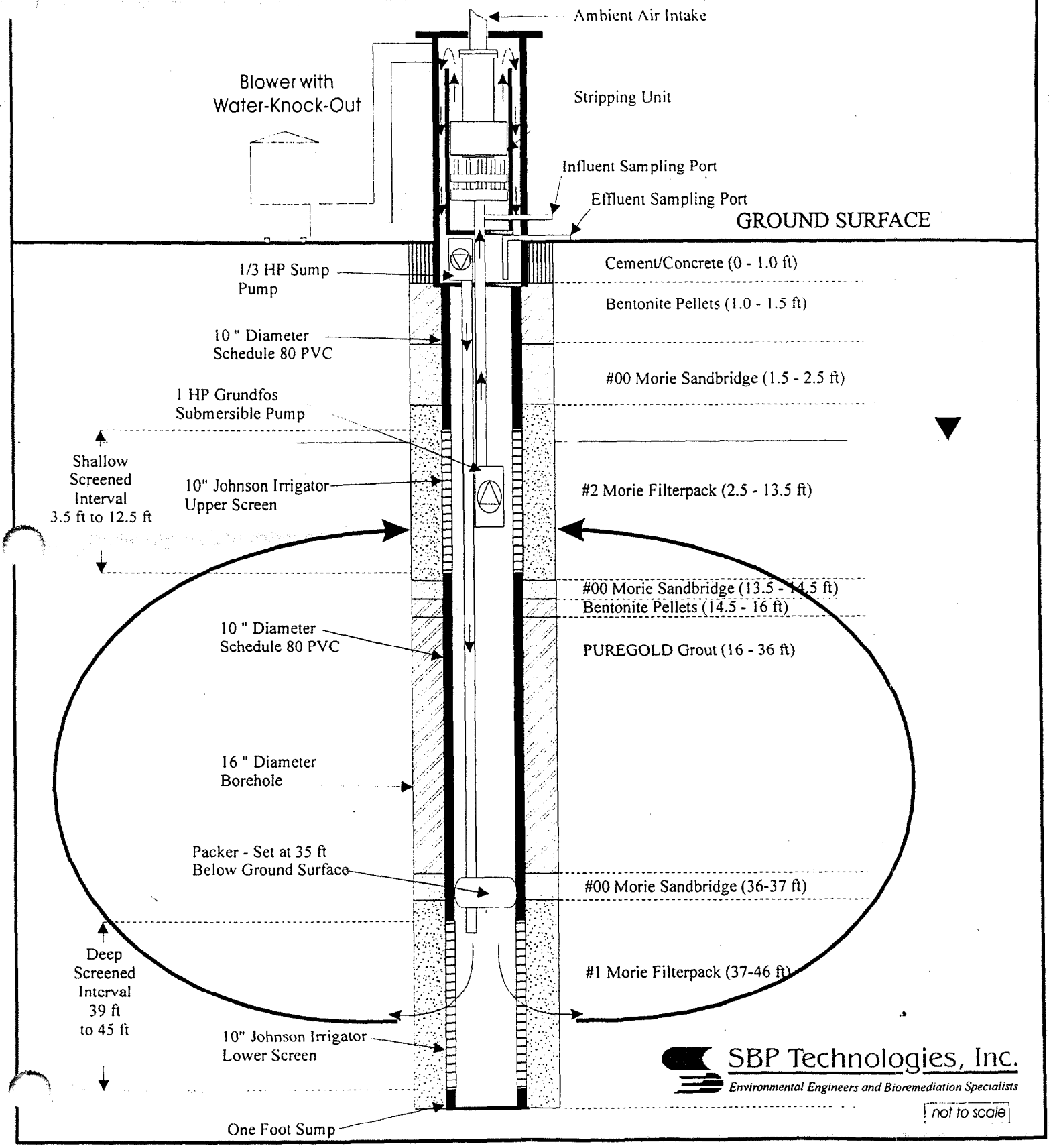
Two recirculation/in situ stripping wells will be installed to an approximate depth of 45 ft bgs. Each well will be constructed of 10-in. diameter stainless steel well screen and Schedule 80 polyvinyl chloride (PVC) casing. A lower screen will be installed from an approximate depth of 39 to 45 ft and an upper screen from a depth of 3.5 to 12.5 ft. Figure 2-1 is a schematic diagram of the planned recirculation well. The location of the two recirculating wells is depicted on Figure 1-3. The location of the wells shall be determined by Bechtel and will be surveyed to determine both horizontal coordinates and elevations. Slight adjustments to the elevation of the screened intervals may be made in the field based upon observed groundwater elevations during the drilling of the wells. Bechtel will coordinate any such adjustments with the ROICC.

Recirculating well UVB-1 will be installed simultaneously with the Group A monitoring wells and UVB-2 will be installed with the Group B monitoring wells. Separate drill rigs and crews will be used for the monitoring wells and the recirculating wells.

2.6.2 Monitoring Wells

Eleven groundwater monitoring wells will be installed for evaluating the performance of the treatment system. All wells will be constructed of 2-in. diameter Schedule 40 polyvinyl chloride well screen and casing. Five wells will be installed as Group A wells and six wells will be installed as Group B wells Drawing S-1 in Appendix D illustrates the locations of both the Group A and Group B monitoring wells.

FIGURE 2-1
UVB CIRCULATION WELL SCHEMATIC
ORLANDO NAVAL TRAINING CENTER, OU 4
ORLANDO, FLORIDA



Group A wells will be installed to evaluate the in situ groundwater treatment system's effects on the surficial aquifer. Group A wells OLD-13-21B, OLD-13-22B, and OLD-13-23B will be screened from a depth of 27 to 32 ft bgs. Wells OLD-13-24A and OLD-13-25B will be screened from 1 to 11 ft bgs and 16 to 21 ft bgs, respectively. These wells will be located by Bechtel and the location confirmed by ABB-ES before mobilizing the drilling subcontractor. All Group A monitoring wells will be installed and a baseline round of sampling performed before the startup of the recirculation wells. Appendix A provides a description of the baseline sampling program which is to be performed by ABB-ES.

Group B wells will be installed in three clusters of two wells per cluster. Each cluster will include one well screened from 18 to 20 ft bgs and one well screened from 38 to 40 ft bgs. The cluster wells will be installed at locations 10, 25, and 60 ft north of the northernmost recirculation well.

Monitoring wells OLD-13-23B, OLD-13-24A, and OLD-13-25B are located in a delineated wetland area. Installation of these wells will require compliance with the substantive requirements of FAC 62 341.475 for dredging and filling in wetland areas. These wells will be installed along the cleared path of an existing access route into the wetland area. Minor adjustments to their relative locations may be made to minimize vegetation clearing and surface disturbance in the wetland area. Appendix C contains an Environmental Protection Plan which further addresses mitigative measures to be taken to avoid adverse impacts to the wetland.

The monitoring wells will be installed generally in accordance with the requirements listed in the *Performance Monitoring and Sampling Plan* (PM&SP) found in Appendix A. The wells will be constructed of 2-in. Schedule 40 PVC, flush-joint pipe for the well casing and screen. The screen size will be 0.010-in. slot. The method of construction for the wells will be according to the guidelines of the U.S. Environmental Protection Agency (EPA) Region 4 *Environmental Investigation Standard Operations Procedures and Quality Assurance Manual* (EPA 1996). Six monitoring wells will be equipped with pressure transducers and associated data loggers to measure and record water level data. The transducers will be installed on the Group B monitoring wells.

2.6.3 Equipment Installation

Equipment installation at the recirculation wells includes aerator assemblies, submersible pumps, sump pumps, remote telemetry units (RTU), and associated piping, valves, and sample ports. All equipment will be installed in accordance with manufacturer's recommendations. Installation details and locations are provided in Appendix C.

2.7 RECIRCULATION WELL COMPOUND

Two secured compound areas will be constructed, one for each recirculation well. The layout and construction details for the compounds are provided in Appendix C. Each compound will typically consist of an 8-ft × 8-ft slab-on-grade surrounded by a 6 ft high security fence with warning and notification signs. The surface completion of the recirculating wells and any associated equipment located above the ground surface will be inside the fenced compound area.

2.8 ELECTRICAL AND TELEPHONE SERVICE

Electrical service will be supplied by overhead line from a power pole to be set within 100 ft of the nearest recirculating well compound. The power pole will be set and service extended to it by NTC Orlando.

Power supplied to the compound areas shall be 230 volt, 3-phase. Electrical service from the power pole to the compound areas will be extended by SBP. The installation of all electrical services shall be performed by a Florida-licensed electrician. All systems and services shall conform to the National Electrical Code and the authority having jurisdiction. The main service location and new power pole locations shall be coordinated with the RIOCC.

NTC Orlando Public Works Office will coordinate installation of overhead telephone lines to the recirculation well compound areas. Bechtel will coordinate with SBP and with the Public Works Office to terminate the telephone lines at the RTU terminals.

2.9 SURVEY

All locations for monitoring wells, recirculation wells, utilities, and compound areas will be surveyed before construction. After the installation of the compounds, wells, and other utilities, an as-built survey to document the final locations will be performed. Included in the survey will be riser elevation and horizontal coordinates of all newly installed recirculation and monitoring wells. Reference points (Northing and Easting) and elevations will be obtained as required to be consistent with data available for the other site monitoring wells. One existing monitoring well elevation will be verified during this survey.

2.10 STARTUP TESTING AND PERFORMANCE DEMONSTRATION

Startup testing and performance requirements include general equipment testing during system startup and performance demonstration and monitoring during operations and maintenance (O&M). Startup testing details are provided in Appendixes A and C. All performance monitoring and testing recommended by the PM&SP (Appendix A) will be performed by ABB-ES. All equipment-specific testing and startup procedures will be provided by SBP or the equipment vendor(s). Any testing and sampling recommended by the recirculation well vendor beyond the scope of the PM&SP (Appendix A) will be performed by SBP.

2.10.1 General Equipment Testing

After the recirculation well installation is complete, both mechanical and electrical components in the system will be inspected using standard construction practice. After the physical installation is approved and electrical devices energized, the vacuum blower and pumps will be initially bumped to ensure proper rotation. The system will be evaluated for excessive noise or vibration. Any leaks of groundwater or air will be noted and corrected if present. Written records of all tests performed by SBP or lower-tier subcontractors will be prepared and submitted for review and approval by Bechtel. These test reports will include date, test performed, test equipment used, personnel involved, items tested, and test results.

Specific testing required for electrical systems will include insulation resistance tests on all power wiring. A megohm meter will be used to verify insulating capability of conductors used for power distribution. All wiring will be visually checked for proper connections and absence of damage to the insulation. Ground rods and conductors will be checked to ensure installation in conformance to NFPA 70 (National Electrical Code).

2.10.2 Performance Demonstration

Performance demonstration requires seven consecutive days of satisfactory operation following system startup, testing, and balancing. Satisfactory operation means that effluent groundwater samples

(i.e., groundwater being reintroduced to the aquifer after air stripping) meet the specified treatment sphere discharge criteria, air emissions are less than 15 lbs./day VOCs, and a change in piezometric head is measured in the Group B monitoring wells indicative of hydraulic gradients being impacted by the recirculated groundwater. It does not mean that the overall performance of the recirculation well will be optimized within a seven-day period.

2.10 SITE RESTORATION

The site will be returned to existing conditions. All disturbed areas will be mulched and seeded with grass indigenous to the area. The *Environmental Protection Plan*, an appendix to the *Construction and Installation Plan* (ref. Appendix C of the RWP), contains additional descriptions of measures to be taken to minimize the risk of damages to natural resources. The plan provides specific direction on mitigative actions to be employed when working in the wetland area as well as construction areas outside the wetland boundary.

3.0 WASTE MANAGEMENT

General waste management practices used on this project will be as defined in Bechtel's *Program Level Waste Management Plan* (Bechtel 1996). In addition, a task-specific waste management plan is included as an appendix to the *Construction/Installation Plan* (Appendix C). There are several waste management activities that are anticipated during this remedial action, including identification, containerization and disposal of:

- Construction debris
- Drill spoils (cuttings)
- Decontamination water
- Well purge and development water
- Personal protective equipment and other incidentally contaminated materials
- Other non-hazardous solid wastes.

The Bechtel Site Superintendent will coordinate with NTC personnel to evaluate options for on-base disposal of any non-hazardous material (i.e., discharge of decontamination and well development water).

3.1 WASTE MINIMIZATION

Construction activities at this site will be controlled to minimize the amount of materials that must eventually be disposed of. Waste minimization is an important goal and will be implemented during all site operations. These practices will include:

- Limiting extraneous materials taken into exclusion zones
- Decontamination of equipment used to support onsite activities
- Use of consumable items that can be compacted or otherwise volume reduced
- Segregating potentially hazardous waste from non-hazardous waste

3.2 WASTE DISPOSAL

Offsite waste disposal will be required for any soil cuttings that are classified as hazardous waste in accordance with 40 CFR Part 261. Liquid wastes such as well development water and decontamination

water may also require offsite disposal if analytical data will not allow discharge to the City of Orlando publicly owned treatment works (POTW). Waste treatment and disposal facilities have been pre-identified for the disposal of these wastes. Non-hazardous waste will be disposed at a local Subtitle D sanitary landfill. Additional details on waste management are provided in the *Construction/ Implementation Plan* (Appendix C).

The Bechtel Site Superintendent is responsible for maintaining the Bechtel Navy RAC waste tracking logs and ensuring they are kept up to date. Waste profiles and manifests will be prepared by SBP, reviewed by Bechtel, and signed by the Navy as the waste generator. No wastewater will be discharged to the NTC Orlando sewer system without advance approval from the City of Orlando Environmental Services Department.

4.0 SAMPLING AND ANALYSIS

Sampling and analysis at OU-4 will be a shared responsibility between the Navy's CLEAN and RAC Contractors, ABB-ES and Bechtel respectively. In general, ABB-ES will perform the system monitoring activities described in the PM&SP (Appendix A) whereas Bechtel and its subcontractors will perform the sampling associated with waste characterization and management activities. The PM&SP (Appendix A) outlines the sampling and reporting approach to document the effectiveness of the IRA. Any additional testing required to optimize the performance of the recirculation wells or confirm appropriate operational parameters will be performed by SBP as part of routine system O&M. These requirements will be identified in an O&M plan to be prepared by SBP before system startup.

Bechtel's approved *Comprehensive Quality Assurance Program Plan* (ComQAP) is presently on file with FDEP (#940316). Any sampling activities performed by Bechtel will be in accordance with existing Navy RAC Project Procedures which are based on the *Department of Environmental Regulation Standard Operating Procedures for Laboratory Operations and Sample Collection Activities* (FDEP 1992). This section outlines the specific field methods and techniques that will be used to collect soil, water, and vapor samples during the course of the activities outlined in this work plan. This section also provides an overview of the groundwater monitoring plan.

4.1 SAMPLING PROTOCOL

The following Bechtel Navy RAC Project Procedures (PPs) will be utilized for this work except as noted in the PM&SP (Appendix A).

- PP 6003 Sample Identification and Data Coding
- PP 6004 Field Logbook Management
- PP 6005 Chain-of-Custody Record Procedures
- PP 6006 Sample Tracking
- PP 6010 Sample Containers, Preservation and Aliquot Requirements
- PP 6011 Sample Packaging and Shipment
- PP 6021 Groundwater Sampling
- PP 6024 Decontamination of Field Sampling Equipment
- PP 6025 Soil Sampling

4.2 FIELD SAMPLING AND ANALYSIS

Samples identified in this section will be collected in accordance with the previously identified project procedures. Analysis of these samples will be in accordance with the EPA criteria for the defined method or by the procedure identified as appropriate. Sampling efforts can be segregated on the basis of these data objectives:

- Subsurface Soils (waste characterization)
- Drill Spoils Disposal Sampling (waste characterization)
- Liquid Disposal Sampling (waste characterization)
- System Startup Sampling
- Groundwater Monitoring
- System Performance Monitoring.

4.2.1 Subsurface Soils Sampling

Soil samples for total organic carbon (TOC) will be collected with a split-spoon sampler during the drilling of all boreholes for the Group A and Group B monitoring wells. Soil samples will be collected at intervals shown in Table 4-1 below. Bechtel will provide the split spoon samples for sample preparation and analysis by ABB-ES. ABB-ES will take direct custody of the samples as they are collected during the drilling operations.

Table 4-1
Soil Sampling for Total Organic Carbon

New Well ID	8 to 10 ft bgs	18 to 20 ft bgs	30 to 32 ft bgs	48 to 50 ft bgs
OLD-13-21B		X	X	
OLD-13-22B		X	X	
OLD-13-23B		X	X	
OLD-13-24A	X			
OLD-13-25B		X	X	
Group B wells as required		X	X	X

Note: bgs = below ground surface

4.2.2 Drill Spoils Disposal Sampling

After drilling and well installation, the drill spoils will be contained in either 55-gallon drums or roll-off bins. For 55-gallon drums, a composite sample of spoils will be collected from the contained material at each well location. For roll-off bins, each roll-off bin will be sampled in two locations at three depths to provide a single composite sample. All samples will be analyzed to determine the profile and disposition of the waste material. Samples will be analyzed for VOCs by EPA Method 8260. Additional analysis may be required based on specific waste profiling requirements of the selected treatment and disposal facilities.

4.2.3 Liquid Disposal Sampling

Well development and purge water and decontamination water will be containerized in temporary storage tanks. Water sampling and analyses will be performed for waste profiling and disposition. The water may be treated onsite, if necessary, and discharged to the NTC Orlando sewer system. Analytical requirements will be determined on a case-specific basis by the City of Orlando Environmental Services Department. Due to previous experience of the city in coordinating for disposal of well development water from site characterization activities at OU-4, it is anticipated sampling requirements may be limited to VOCs by EPA Method 8260, pH, and total suspended solids. Inorganics have been previously characterized and are well below discharge limits.

4.2.4 System Startup Sampling

During the course of the initial system startup, samples will be collected. These will be grouped into two categories: (1) initial baseline samples collected before initial testing of the system and (2) system startup sampling.

Initial Baseline Samples

The initial baseline data will be collected and evaluated by ABB-ES. Sampling and analyses will be in accordance with the requirements specified in the PM&SP (Appendix A).

System Startup Sampling

SBP will perform sampling and analyses of influent and effluent from the recirculation wells and effluent from the vapor stack (off-gas emissions) to document conformance with discharge and emissions criteria. Influent and effluent samples will be analyzed using EPA Method 8260 and off-gas emissions will be analyzed using EPA Method 18. In addition to the sampling and analysis listed above, data shall be recorded during each sampling event regarding system flow rates, pressures readings, vacuum gauge readings, and proper functioning of groundwater pumping and off-gas systems.

4.2.5 Groundwater Monitoring

Groundwater monitoring for contaminants of concern and physical data (level, pressure gradients, etc.) will be performed by ABB-ES in accordance with the requirements specified in the PM&SP (Appendix A).

4.2.6 System Performance Monitoring Sampling and Reporting

System performance monitoring and reporting after the baseline sampling event and the recirculation wells startup will be performed by ABB-ES in accordance with the requirements specified in the PM&SP (Appendix A). Bechtel will provide ABB-ES copies of O&M records and any analytical test results pertinent to the operation of the recirculation wells.

5.0 OPERATIONS AND MAINTENANCE

A complete O&M plan will be created no later than thirty days before start of the O&M phase. At the end of the 7-day performance demonstration, the system will be operated in the routine O&M mode. Bechtel

will continue the system operations for a period of one year or for an additional period of time as directed by the Navy.

5.1 OPERATIONS AND MAINTENANCE PLAN

A final O&M plan will be created during the system installation. This plan will include all necessary information to operate, maintain, troubleshoot, and repair the system and to monitor its operation. The plan will also include frequency of inspections, maintenance, operations monitoring, and a list (with warranties) of expected consumables and minor, miscellaneous parts required for routine servicing. The plan will provide procedures for all activities that may be required during the operational phase and shall contain copies of all warranties, as-built drawings, manufacturer contacts, trouble shooting guides, servicing guides, and other pertinent information.

5.2 SYSTEM OPERATIONS AND MAINTENANCE

System O&M will be performed by SBP for the purpose of ensuring the continued operation of the recirculation wells at performance levels which allow the IRA objectives of groundwater control and treatment to be met. The O&M phase of the project will include monitoring the system status using the RTU and periodic site visits. The following is a summary of activities to be conducted during each site visit:

- Visually inspect the system to locate any apparent leaks in liquid or vapor piping.
- Inspect all motors and drive systems to verify normal performance.
- Record system operating parameters such as flow rate, total volume groundwater processed, vacuum levels, off-gas temperature and VOC concentration (by Organic Vapor Analyzer), and total system run time.
- Verify proper operation of all alarms and interlocks.
- Perform any scheduled lubrication in accordance with the manufacturer's recommendations.
- Perform general housekeeping at the compound areas.

5.3 SYSTEM EVALUATION

During the course of the normal O&M, the system will be periodically evaluated for effectiveness in achieving the remediation goal. Groundwater analytical data will be compared to the original baseline data. Analytical parameters will be plotted to demonstrate changes in the system. Vapor effluent concentrations will be evaluated quarterly to confirm conformance with air emission criteria. These parameters will be reviewed, evaluated, and used to estimate the contaminant mass removal for the system. System evaluation will be performed by ABB-ES in accordance with the PM&SP (Appendix A).

5.4 GROUNDWATER MONITORING

Groundwater monitoring will be performed by ABB-ES in accordance with the PM&SP (Appendix A).

5.5 REPORTING

Reporting will include system operation and maintenance reports and system performance reports. System O&M reports will be prepared and submitted to the Navy by Bechtel and the system performance reports prepared and submitted to the Navy by ABB-ES. In addition, Bechtel will submit a construction completion report at the completion of all initial construction activities and recirculation well performance demonstration.

5.5.1 Operation and Maintenance Reports

Bechtel will submit to the Navy an O&M report within 45 days of each O&M visit by SBP. The report shall provide a written summary of the O&M visit and any significant activities such as repairs, major adjustments, or unusual operating conditions. The report shall also include a copy of SBP's logbook entries for the O&M visit and any field activity reports. Summaries of all operating parameters or physical measurements will be provided as well as a listing of personnel onsite and time required for each O&M task. Recommendations shall be provided for any future modifications to equipment or process controls.

5.5.2 System Performance Reports

System performance monitoring will be provided to the Navy by ABB-ES in accordance with the requirements specified in the PM&SP (Appendix A). These reports will be submitted on a periodic basis as letter reports and an annual report. These documents will serve to communicate the system's effect on the aquifer and sediment and surface water of Lake Druid.

5.5.3 Construction Completion Report

Bechtel will submit a construction completion report to the Navy, including a summary of construction methods and activities, copies of test reports and results, drilling logs, photographic logs, waste management records, and record drawings.

6.0 QUALITY ASSURANCE

Appropriate quality control (QC) criteria are developed and included in the site-specific addendum to the quality control plan (QCP). This site-specific plan, called the QCP addendum (QCPA), is based on the Navy-approved QCP for the prime contract. Bechtel will implement, maintain, and comply with Navy-approved prime contract QCP and the site-specific QCPA. The QCPA will be provided under a separate cover.

7.0 SAFETY AND HEALTH

The *Program Safety and Health Plan* (PSHP) defines the policies for the Navy RAC project. A site safety and health plan (SSHP) has been prepared for each of the Navy RAC bases. An addendum to the SSHP will be provided to the Navy under separate cover and will define task-specific requirements for the remediation activities at OU 4 that are described in the RWP.

8.0 ENVIRONMENTAL PROTECTION

An environmental protection plan has been prepared and is included as a part of the *Construction/ Installation Plan* (Appendix C). The plan describes measures to be taken to minimize impacts to base natural resources and specifically addresses limited intrusive work to be performed in the wetland area near the eastern shoreline of Lake Druid.

9.0 PROJECT MANAGEMENT

9.1 PROJECT ORGANIZATION

As the Environmental RAC for the Navy, Bechtel provides management of field activities, which includes all activities necessary to implement field work delineated in work plans. Typically, these activities include development and procurement of subcontract services; development, implementation, and overview of plans; collection and review of data, including sampling results, sample tracking and custody; quality assurance/quality control submittals, and technical guidance to onsite personnel; report preparation; cost management; and schedule control.

9.2 SCHEDULE

The schedule for the implementation of the field actions described in this RWP will be finalized once the RWP is approved by the Navy and the FDEP. Field work is currently expected to commence in October of 1997. When the schedule has been finalized, a copy will be forwarded to the Navy. A copy of an updated schedule will be provided to the Navy in the Technical Financial Monthly Report or more often as requested.

REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1997a. *Interim Remedial Action Conceptual Design and Performance Specification Operable Unit 4, Naval training Center, Orlando, Florida.* Orlando, Florida. May.

ABB-ES, 1997b. *Interim Remedial Action, Focused Field Investigation Report, Operable Unit 4, Draft, Orlando, Florida.* Orlando, Florida. May.

Bechtel (Bechtel Environmental, Inc.) 1996. *Navy Response Action Contract Program Waste Management Plan.* September

EPA (U.S. Environmental Protection Agency), 1996. *Region 4 Environmental Investigation Standard Operating Procedures and Quality Assurance Manual.* May.

FDEP (Florida Department of Environmental Protection), 1992. *Department of Environmental Regulation Standard Operating Procedures for Laboratory Operations and Sample Collection Activities.*

SBP Technologies, Inc., 1997. *Proposal, In Situ Recirculation Wells Treatment System, OU-4, Orlando, Florida*. Pensacola, Florida. September

APPENDIX A

PERFORMANCE MONITORING AND SAMPLING PLAN

ABB Environmental Services, Inc.

PERFORMANCE MONITORING AND SAMPLING PLAN (PM&SP)

1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), under contract to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), has prepared this PM&SP for the Interim Remedial Action (IRA) at Operable Unit (OU) 4, Former Drycleaning and Laundry Facility, at the Naval Training Center (NTC), Area C, in Orlando, Florida. The PM&SP is being conducted under contract number N62467-89-D-0317-90. This plan presents the framework for the baseline monitoring, operational (performance) monitoring and reporting to support the effectiveness of the proposed IRA remedial system. All monitoring well installations and sampling efforts described herein shall be in accordance with the U.S. Environmental Protection Agency (USEPA) Region IV Environmental Investigations Standard Operations Procedures and Quality Assurance Manual (EISOPQAM), May 1996 and/or the FDEP and EPA approved NTC, Orlando POP.

1.1 Site Conditions Results of previous site investigation activities at OU 4, Area C, at NTC, Orlando indicate that volatile organic compounds (VOCs) are present within the surficial aquifer and the surface water and sediment of Lake Druid. Due to the nature of the VOC contamination and its presence in Lake Druid, adjacent to a residential community, an IRA is necessary, as required by the Orlando Partnering Team (OPT).

1.2 Technical Overview Groundwater containing VOCs discharging to the lake will be contained/controlled through the use of recirculating/*in situ* well stripping technology, designed to intercept and treat the VOC plume upgradient of Lake Druid. The technology creates a circulation sphere within the affected part of the aquifer. While groundwater travels through the recirculation sphere, it is aerated, volatilizing the VOCs, which are subsequently transported out of the well by means of negative pressure created by a vacuum blower. If necessary, the VOCs in the offgas can be treated.

1.3 Objective of Performance Monitoring and Sampling Plan The performance monitoring and sampling plan is designed to evaluate and validate the performance, progress, and effectiveness of the recirculating/*in situ* well stripping groundwater treatment system. This evaluation will include monitoring of (1) treatment of associated groundwater; (2) the hydraulic effect of the recirculating/*in situ* stripping well on the surficial aquifer; and (3) the system's effects on contaminant concentrations of the sediment and surface water of Lake Druid. In addition, possible needs and methods of improving the treatment system's performance will be identified. This monitoring plan will define performance and analytical evaluations for

- overall system performance,
- operating parameters and efficiencies for the treatment system,
- vapor emissions from the treatment system, and
- performance adjustments.

The PM&SP may be revised depending on the requirements of the selected vendor. An operation and maintenance (O&M) plan will be developed by the Response Action Contract (RAC) contractor, as represented in the Responsibility Assignment Matrix

(RAM). The O&M plan will address specific O&M needs, actions, and reporting format for maintenance of the recirculating/*in situ* well stripping system.

1.4 Overview The remainder of the PM&SP presents the plans for monitoring and sampling (data baseline and system operations), data management, evaluation and reporting.

2.0 MONITORING AND SAMPLING PLAN

This section presents the rational of the monitoring and sampling plan as it relates to data quality objectives (DQOs), baseline activities, and performance to support the effectiveness of the recirculation/*in situ* stripping technology while in operation.

2.1 DQOs Soil, sediment, surface water, and groundwater samples will be analyzed in accordance with USEPA Level IV DQOs. DQOs will remain consistent with the Focused Field Investigation (FFI), OU4, November 1996, and as discussed in the Project Operations Plan (POP), Section 3.2, Data Quality Objectives (ABB-ES, 1994a).

2.2 Baseline Activities Groundwater, surface water, and sediment samples will be collected and analyzed to establish baseline contaminant concentrations and media-specific characteristics prior to the activation of the treatment system. All baseline sampling efforts will begin within 1 month prior to the treatment system activation/startup operations. The baseline results will be the foundation for tracking treatment system effectiveness.

A baseline will also be established for water-level and/or piezometric heads. The piezometric baseline will be obtained by monitoring precipitation trends while measuring water levels in monitoring wells, piezometers, drive-point wells and staff gauges. All baseline piezometric monitoring efforts will begin within 1 month of the treatment system activation/startup operations a .d continue weekly until system installation and startup. The baseline results will be the foundation for tracking treatment system effectiveness regarding the sphere of influence.

2.2.1 Additional Groundwater Monitoring Locations To evaluate the *in situ* groundwater treatment system's effects on the surficial aquifer, one additional drive point well and five additional groundwater monitoring wells will be installed. Of the five additional groundwater monitoring wells, OLD-13-21B, OLD-13-22B, and OLD-13-23B are proposed for the vicinity of the existing monitoring well clusters, as illustrated on Figure B-1. The three monitoring wells will be screened from 27-32 feet below land surface (bls). The other two additional wells are proposed for the area located along the shoreline approximately 125 feet south from OLD-13-09A (Figure B-1). These two proposed monitoring wells, OLD-13-24A and OLD-13-25B, will be screened from 1-11 feet bls, and 16-21 feet bls, respectively.

The additional monitoring wells will be constructed similar to the existing monitoring wells installed during the OU4 IRA FFI. Refer to Figure B-2 for a typical monitoring well construction detail. The monitoring wells will be installed by a licensed well driller. Each well will be developed upon installation to ensure proper connection of the filter pack with the surrounding

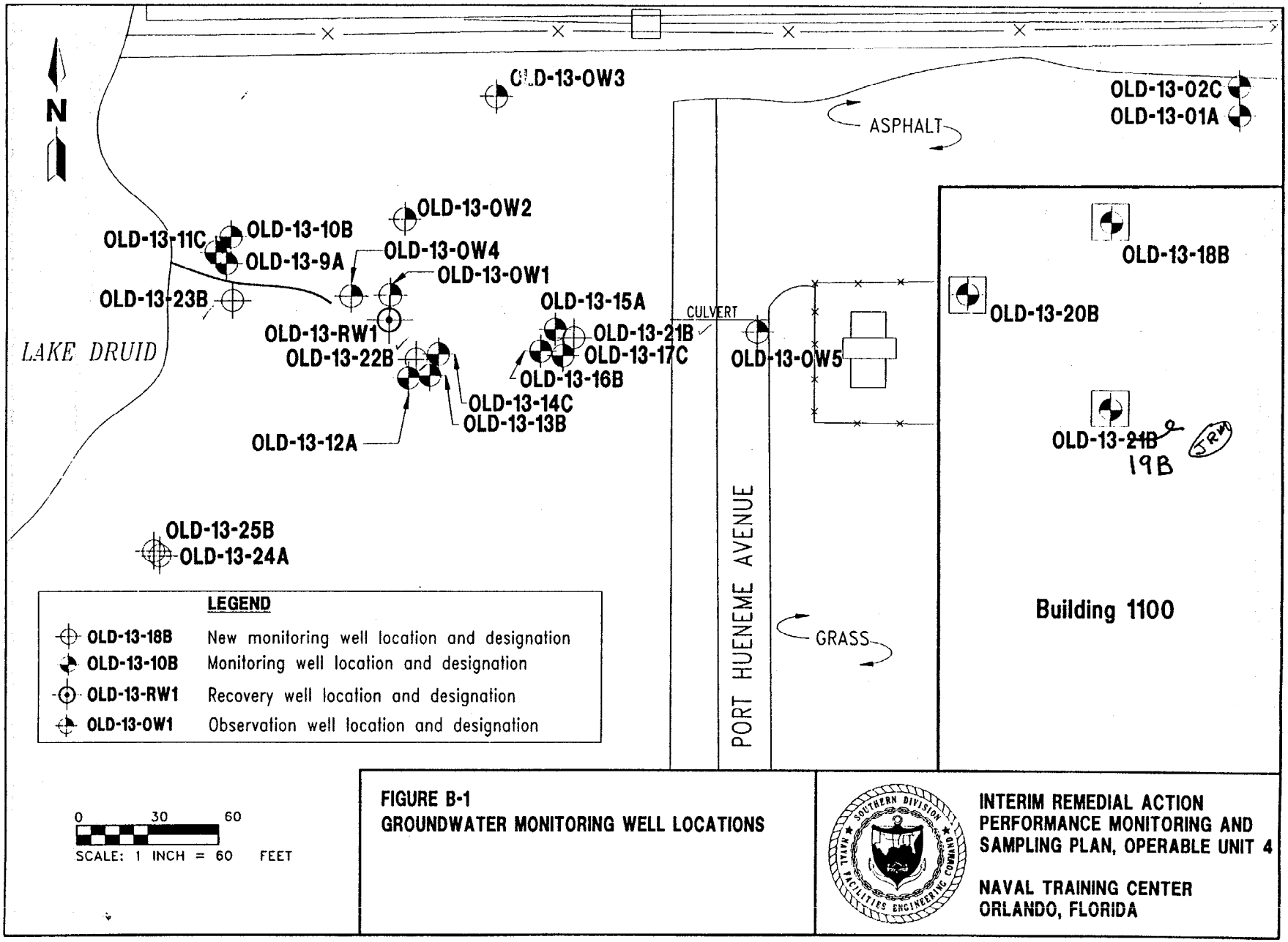


FIGURE B-1
GROUNDWATER MONITORING WELL LOCATIONS

INTERIM REMEDIAL ACTION PERFORMANCE MONITORING AND SAMPLING PLAN, OPERABLE UNIT 4

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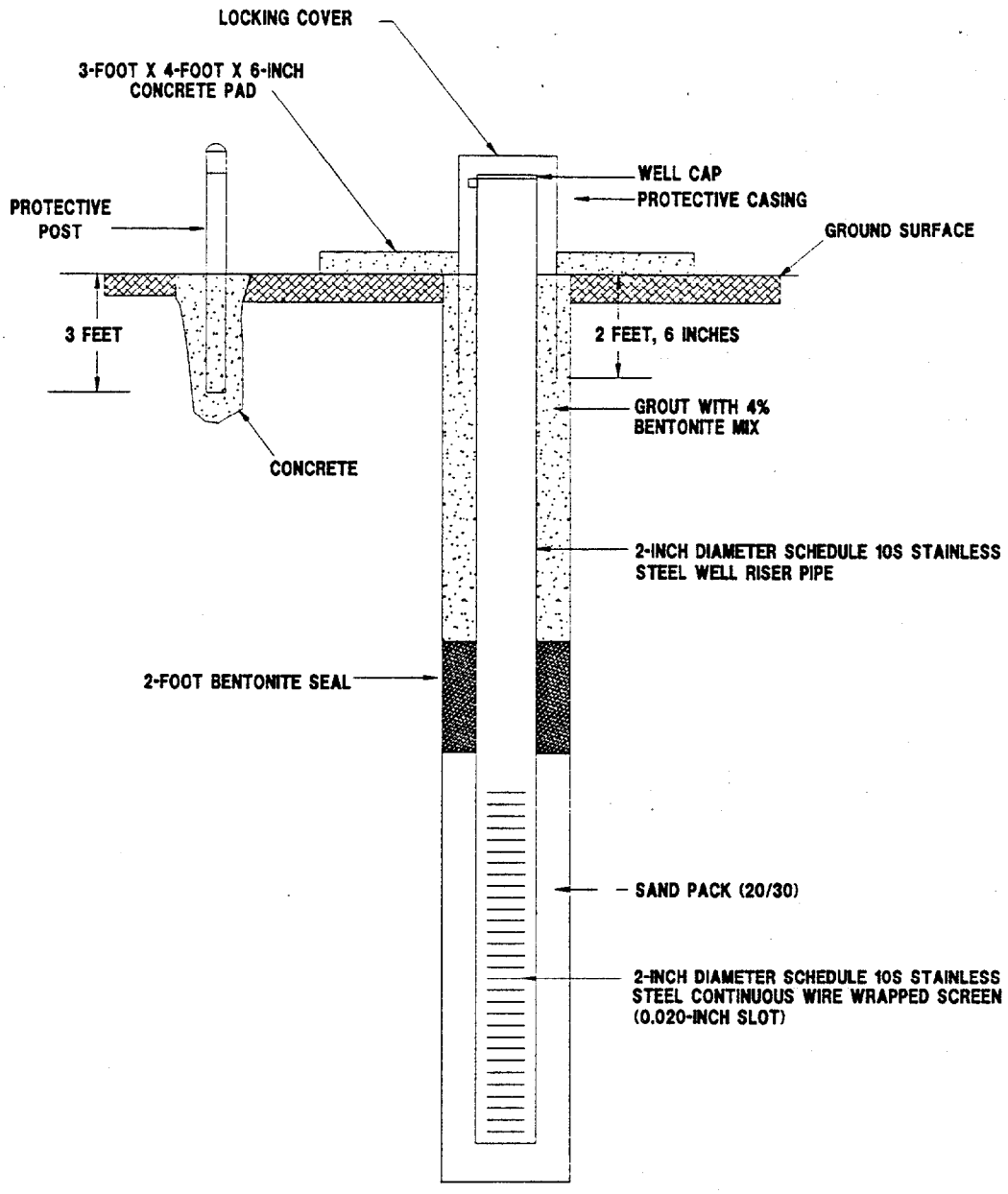

FIGURE B-2
MONITORING WELL DIAGRAM, SINGLE CASED, ABOVEGROUND COMPLETION

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INTERIM REMEDIAL ACTION PERFORMANCE MONITORING AND SAMPLING PLAN, OPERABLE UNIT 4

NAVAL TRAINING CENTER ORLANDO, FLORIDA

formation. All well installation and development activities will be done in a manner consistent with the guidelines prescribed in Section 4.4 of the POP.

The additional drive point well (DP-11) will be installed in the lake approximately 100 feet south of DP-5, as shown on Figure B-3. DP-11 will be installed in accordance with the procedures defined in the FFI (ABB-ES, 1996c).

Additional monitoring points (monitoring wells/piezometers) may also be required by the proprietary vendor for monitoring the performance of the recirculation/*in situ* stripping system.

2.2.2 Sampling and Analysis Soil samples for total organic carbon (TOC) will be collected with a split-spoon sampler during the drilling of the proposed groundwater monitoring wells. Results of these analyses will be used to support fate and transportation evaluation. TOC samples will be collected at intervals shown in Table B-1.

Table B-1
TOC Soil Sampling Plan

Interim Remedial Action
Conceptual Design and Performance Specification
Operable Unit 4
NTC, Orlando, Florida

	8 to 10 feet bls	18 to 20 feet bls	30 to 32 feet bls	48 to 50 feet bls
OLD-13-21B		x	x	
OLD-13-22B		x	x	
OLD-13-23B		x	x	
OLD-13-24A	x			
OLD-13-25B		x	x	
Additional wells as required by the vendor		x	x	x

Notes: TOC = top of casing.
bls = below land surface.

To evaluate the *in situ* groundwater treatment system's effects on the surficial aquifer, groundwater samples will be collected from an array of existing groundwater monitoring wells and drive point wells, including the five proposed groundwater monitoring wells and drive point well. The monitoring wells include OLD-13-09A, OLD-13-10B, OLD-13-11C, OLD-13-12A, OLD-13-13B, OLD-13-14C, OLD-13-15A, OLD 13-16B, OLD-13-17C, OLD-13-21B, OLD-13-22B, OLD-13-23B, OLD-13-24A, and OLD-13-25B (Drawing, B-1). The letter identifier at the end of the monitoring well number signifies shallow, intermediate, and deep well depths with an A, B, or C, respectively.

The drive point wells include DP-1, DP-2, DP-3, DP-4, DP5, and DP-11. Samples from the conventional wells will be used to support evaluation of VOC concentrations in the groundwater migrating toward Lake Druid. Samples from the drive point wells will be utilized to determine the VOC concentrations in groundwater entering Lake Druid from below the lake bottom.

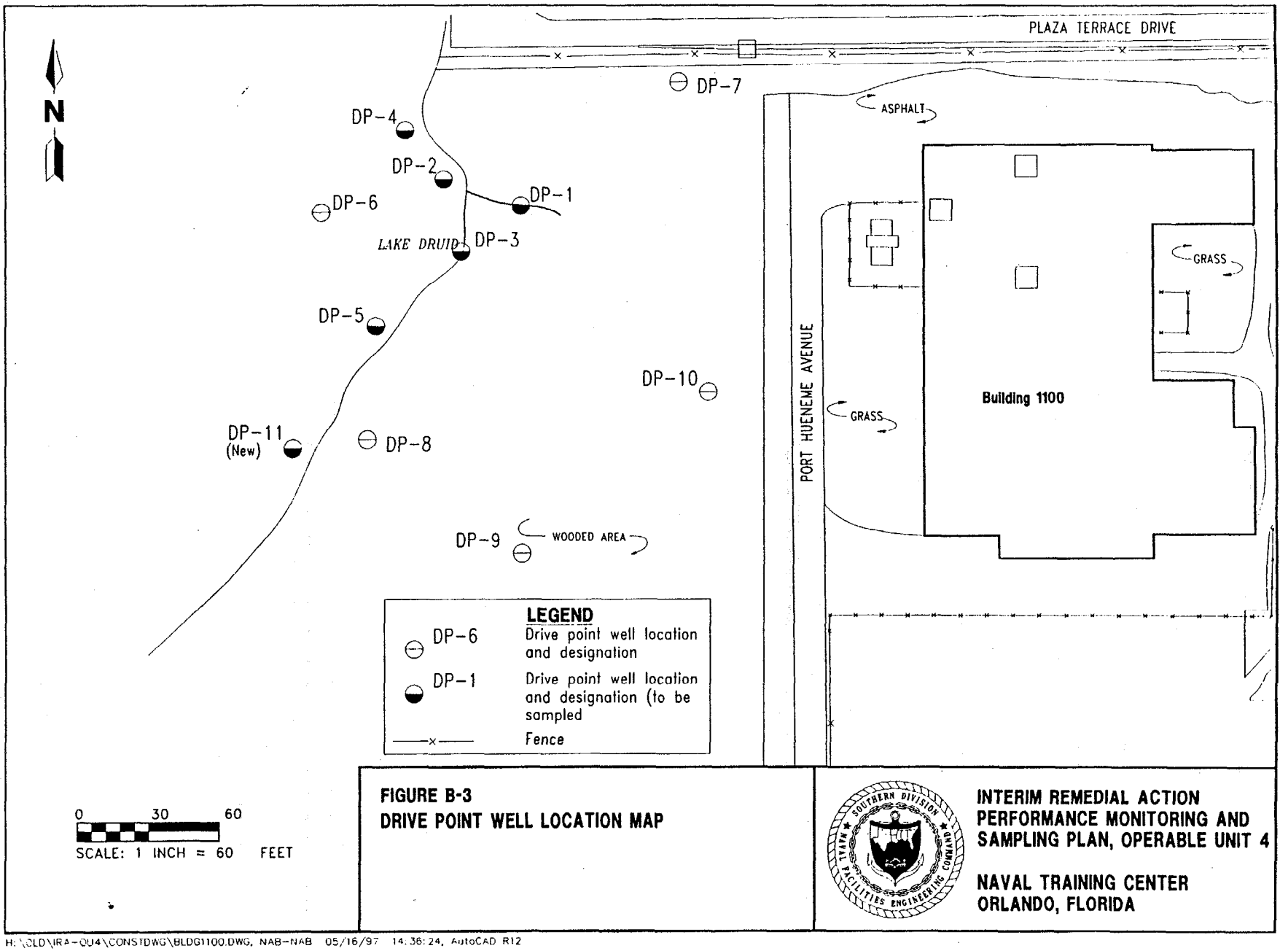

FIGURE B-3
DRIVE POINT WELL LOCATION MAP

INTERIM REMEDIAL ACTION PERFORMANCE MONITORING AND SAMPLING PLAN, OPERABLE UNIT 4

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The drive point wells include DP-1, DP-2, DP-3, DP-4, DP5, and DP-11. Samples from the conventional wells will be used to support evaluation of VOC concentrations in the groundwater migrating toward Lake Druid. Samples from the drive point wells will be utilized to determine the VOC concentrations in groundwater entering Lake Druid from below the lake bottom.

The monitoring well network will be used to monitor the size of the treatment cell and to provide locations to monitor changes in VOC concentrations within the plume. Final well locations and screened intervals will also consider the system monitoring requirements of the chosen vendor. In the event that a third recirculating/*in situ* stripping well is installed to aggressively target the source of contamination, additional monitoring wells may be needed.

To further evaluate the effects on Lake Druid due to the *in situ* groundwater treatment system's operation, surface water and sediment samples will be collected for analysis and to support treatment system evaluation. These samples will be collected from locations adjacent to selected drive point wells along the shoreline (DP-1 through DP-5, DP-11), as shown on Figure B-3. Sediment samples and surface water samples will be collected using the same procedures defined in the FFI.

The following parameters will be collected in the field from groundwater and surface water samples: dissolved oxygen (DO), redox potential (Eh), pH, temperature, specific conductivity, and turbidity. Groundwater, surface water, and sediment samples will be submitted to a certified laboratory for analysis of halogenated volatile organics using USEPA Method 8010, filtered and unfiltered manganese and iron, nitrate/nitrite, ammonia, phosphate, sulfate/sulfide, DCE epoxide, acetic acid, CO_2, and TOC. Samples for analysis of methane/ethane/ethylene will be submitted to the treatability laboratory. Soil samples will be submitted to a certified laboratory for TOC analysis only.

2.3 Performance Monitoring and Sampling This section presents the approach for performance monitoring and sampling, which will be compared to the baseline data in order to measure the effectiveness of the recirculation/*in situ* stripping technology.

2.3.1 Startup Monitoring During the first three days of startup, head response measuring the influence of the recirculation well(s) will be monitored continuously. After the third day, head response monitoring will scale back to hourly; however, the monitoring schedule may change depending on the observed system performance.

Daily samples of the recirculation system(s) influent and effluent will be collected during the first three days of startup. The frequency of influent and effluent sampling will be adjusted based on these results though the end of startup.

2.3.2 Hydraulic Monitoring The head response study will utilize a data logging system. The data logger will take hourly head readings and will continue for 1 year to provide system hydraulic performance data on a seasonal basis. Continued monitoring may be scaled back if data demonstrates the sphere of influence has encompassed the remedial design goal during all seasonal or daily influences.

Precipitation and barometric effects will be monitored on a daily basis in the vicinity of OU4. During the execution of the pumping test at OU4, barometric fluctuations proved to be insignificant; however, precipitation had a direct effect on the aquifer.

Up to three staff gauges will be manually monitored continuously during baseline activities and during the operation of the recirculation/*in situ* stripping well system to monitor surface water changes. Two staff gauges are already in place, and a third may be added if greater coverage of the shoreline is required.

2.3.3 Sampling and Analysis During the initial phase of operation, the following monitoring wells will be sampled: OLD-13-09A, OLD-13-12A, OLD-13-15A, OLD-13-18B, OLD-13-19B, OLD-13-20B, OLD-13-21A, and OLD-13-22B. Table B-2 summarizes the initial operational performance monitoring and sampling schedule that will follow the baseline monitoring and sampling activities. Performance sampling activities will begin 3 days (week 1 on Table B-2) following treatment system startup. As shown in Table B-2, groundwater sampling of the selected monitoring wells and drive points, DP-1, DP-2, and DP-3 will be performed biweekly during the first 2 months of performance monitoring. The sampling frequency will taper off as the program progresses to quarterly monitoring, as shown in Table B-2.

Table B-2
Performance Monitoring and Sampling Frequency

Interim Remedial Action
Conceptual Design and Performance Specification
Operable Unit 4
NTC, Orlando, Florida

Week	Head Response Monitoring	Influent/ Effluent Sampling	Groundwater Monitoring Well Sampling	Groundwater Sampling DP-1, DP-2, DP-3	Groundwater Sampling DP-4, DP-5, DP-11	Vapor Emissions Sampling	Sediment and Surface Water Sampling
Startup	x	x					
1	x	x	x	x		x	
2	x	x	x	x			
4	x	x	x	x		x	
7	x	x	x	x			
11	x	x	x	x	x		x
16	x	x	x	x	x	x	x
28	x	x	x	x	x	x	x
40	x	x	x	x	x	x	x
52	x	x	x	x	x	x	x

Sample collection from surface water/sediment locations and groundwater drive point locations DP-4, DP-5, DP-11 will not occur until evidence is gathered demonstrating the effectiveness of the treatment system by noting a decrease in VOCs in groundwater obtained from drive point wells within the lake (DP-1, DP-2 and DP-3). When the system's influence or effect is suspected to have spread to the outer sample collection localities, manifested by a decrease in VOCs in groundwater, then samples from surface water/sediment locations and groundwater drive point locations DP-4, DP-5, DP-11 will be collected. If a notable decrease

has not occurred within 10 weeks (5 rounds), samples from these areas will be collected and analyzed to evaluate possible effects from the groundwater treatment system.

Following the 16th week, all performance sampling should be done on a quarterly basis. All sampling should be performed consistently from one event to another and should be consistent with previous sampling events and procedures outlined in the POP (ABB-ES, 1994a). Groundwater and surface water samples will have the following parameters measured in the field: DO, Eh, pH, temperature, specific conductivity, and turbidity. Groundwater, surface water, and sediment samples will be submitted to a certified laboratory for analysis of halogenated volatile organics using USEPA Method 8010, and for filtered and unfiltered manganese and iron, nitrate/nitrite, ammonia, phosphate, sulfate/sulfide, DCE epoxide, acetic acid, CO_2, and TOC. Samples for analysis of methane/ethane/ethylene will be submitted to the treatability laboratory for analysis.

Vapor emissions produced by the treatment system are anticipated to be low enough to qualify for an exemption from an air permit by the Florida Department of Environmental Protection (FDEP). In the event that an air permit is required, vapor emissions will be sampled and analyzed as instructed by FDEP. Otherwise, vapor emissions will be collected and sampled for volatile organic emissions during week 1, week 4, week 16 and then quarterly for 1 year. Vapor analysis will confirm that the system is generating low-level emissions and assist in evaluating the stripping efficiency of the system. The sampling frequency may be modified based on vendor requirements.

Sample locations and frequency are dependent on the location of the treatment system and vendor performance estimates. The proposed monitoring plan may change depending on the specifics of the treatment system. The continuous evaluation of performance data may also affect sample locations and frequency. For example, surface water and sediment sampling may occur sooner if VOC concentrations in the drive points decrease faster than predicted.

3.0 DATA MANAGEMENT PLAN Sample handling/tracking and data management will be consistent with the FFI Workplan and POP. QA/QC samples will be collected per the guidelines set forth in the POP.

4.0 EVALUATION PLAN This section presents the approach used to evaluate the effectiveness of the recirculation/*in situ* stripping technology based on performance monitoring and sampling data.

4.1 Hydraulic Performance The head response study will be used to evaluate and verify the sphere of influence the recirculating/*in situ* stripping well has on the surficial aquifer. The data collection of precipitation, atmospheric conditions, barometric effects, and surface water changes at OU 4 will assist in interpreting trends spikes and other fluctuations in aquifer conditions during system operation. These measurements along with the chemical data will provide operation/performance data in order to fine tune the system by adjusting each recirculation/*in situ* stripping well's air flow rate, water flow rate, or both to improve performance.

4.2 Chemical and Biological Performance Data gathered during the *in situ* groundwater treatment system's operation will assist in evaluating the effectiveness and performance of the treatment system by comparing it to the baseline data. Groundwater chemistry and its influence on VOC contaminants and plume characteristics will be evaluated, as well as other trends in the data. Degradation of VOC concentrations due to biological activity will be evaluated to support system performance, conclusions, and recommendations.

5.0 REPORTING System performance reporting will be provided to the OPT on a periodic basis as letter reports and an annual report. These documents will serve to communicate the system's effect on the aquifer and sediment and surface water of Lake Druid. A better understanding through diagnosis of hydraulic and chemical changes provides a basis to improve the systems efficiency. These Performance Monitoring Reports are not meant to replace or supply information on the system's operation, functional characteristics, preventative maintenance, or repair/-replacement activities. The RAC contractor is responsible for reporting these O&M concerns.

A letter report summarizing the baseline sampling event will be submitted to the OPT. The letter will include groundwater, surface water, and sediment contaminant concentrations and media-specific characteristics. It will also include TOC analytical results of the subsurface soil samples.

Letter reports summarizing the sampling events and performance monitoring of the system will be submitted to the OPT monthly for the first quarter, then will be reported on a quarterly basis. The letter will include groundwater, surface water, and sediment contaminant concentrations and media-specific characteristics, as well as, comparative analysis with the baseline sampling.

An annual report summarizing all sampling events will be submitted to the OPT. The report will include comparative analysis of baseline sampling data to performance monitoring and sampling data for each medium and a cleanup trend analysis. In addition, the report will include conclusions and recommendations for consideration to enhance system operations.

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APPENDIX B

REMEDIAL DESIGN

SBP Technologies, Inc.

REMEDIAL DESIGN FOR UVB WELLS
OPERABLE UNIT 4 (OU-4)
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

Prepared for:

Bechtel Environmental, Inc.
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Bechtel Job No. 22567
SBP Project No. T7027.10
Contract No. N62467-93-D-0936
Subcontract No. 22567-304-SC-0734

SEPTEMBER 3, 1997

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APPENDICES

Appendix A Well Specifications
Appendix B Design Calculations

LIST OF ACRONYMS

ABB-ES	ABB Environmental Services
als	above land surface
bls	below land surface
cfm	Cubic feet per minute
CHC	Chlorinated Hydrocarbons
COI	Constituents of Interest
DCE	Cis-1,2-Dichloroethylene
dBA	decibels
DO	Dissolved Oxygen
DRMO	Defense Reutilization and Marketing Office
HDPE	High density polyethylene
HP	horsepower
IRA	Interim Remedial Action
K	hydraulic conductivity
lbs	pounds
mg/l	milligrams per liter
MW	Monitoring well
NTC	Naval Training Center
OSHA	Occupational Safety and Health Administration
OU-4	Operable Unit 4
PCE	Perchloroethylene
ppb	Parts per billion
ppm	Parts per million
Q	pumping rate
RW	Recovery well
SBP	SBP Technologies, Inc.
TCE	Trichloroethylene
TWA	Time weighted average
UVB	Vacuum Vaporizer Well
VOC	volatile organic compound

1.0 PROJECT OVERVIEW

1.1 Site Background

The Orlando Naval Training Center (NTC) is located in the western portion of the City of Orlando, Florida. The area of concern, Operable Unit 4 (OU-4) is located in Area C of the NTC and occupies approximately 46 acres. The site is surrounded by urban development to the north and south, Lake Druid to the west, and an office park to the east. The site is the former location of a dry cleaning and laundry facility and currently serves as the Defense Reutilization and Marketing Office (DRMO). The area of investigation comprises approximately six acres and includes the eastern shore area of Lake Druid. Four of these acres are densely vegetated with large trees and heavy undergrowth. The remaining two acres have been classified as wetlands by the U.S. Department of the Interior, Fish and Wildlife Service (ABB-ES, 1996). Figure 1 shows a layout of the site including the proposed circulation and monitoring wells.

Hazardous materials, such as dry cleaning solvents and the waste generated from the dry cleaning process, were reportedly poorly managed. The wastewater from the process was allowed to discharge into the sanitary sewer through badly deteriorated trenches in the floor. The trenches emptied into a single pipe connected to a settling and surge tank. Due to the volume of wastewater discharged by the laundry machines, a 30,000-gallon surge tank was installed in the mid-1960s. Sludge was removed from this tank annually and disposed of by the DRMO. Additionally, discharges of the water contaminated with chlorinated solvents reportedly occurred on the property, including direct release into Lake Druid (Bechtel, 1997).

Site specific information supplied to SBP Technologies, Inc. (SBP) indicates that groundwater beneath the site is impacted with chlorinated hydrocarbons (CHCs) including perchloroethylene (PCE), trichloroethylene (TCE) and cis-1,2-dichloroethylene (DCE) resulting from activities associated with the former dry cleaning facility at the site. Investigations conducted to date by ABB-ES indicated the level of CHCs is greater than 1,000 parts per billion (ppb) in the "hot spot" area from the former dry cleaning location (Building 1100) westward to the lake and into the lake.

The source produced a westward migrating plume increasing in width and, in part, depth toward the lake.

1.2 Project Objectives

The overall objectives of the Interim Remedial Action (IRA) include: (a) remediation of the surficial aquifer, and (b) remediation of the surface water and sediment of Lake Druid. The objective of this subcontract, however, is to intercept and treat the most contaminated portion of groundwater in the surficial aquifer to prevent its migration into the lake (Bechtel, 1997). The capture zone was defined in the Interim Remedial Action Conceptual Design and Performance Specification (ABB-ES, 1997) as 200 feet in width and approximately 46 feet in depth (see Figure 1).

The scope of work consists of furnishing all equipment, labor, supervision, technical expertise, supplies and materials to successfully perform all facets of the design, installation and operation and maintenance of the systems. ABB-Environmental Services (ABB-ES) is the Navy's designated CLEAN II Contractor and will conduct the performance monitoring activities.

2.0 TECHNOLOGY DESCRIPTION OVERVIEW

2.1 Principles of UVB Technology

Two vacuum-vaporizer well systems, known as UVBs, will be installed at the OU-4 site. Each system develops a vertical groundwater circulation cell around the remediation well (Figure 2). The circulating groundwater mobilizes and transports volatile and semi-volatile contaminants in soil and groundwater to the well, where they are removed using a combination of physical (e.g., air stripping) and biological (e.g., enhanced biodegradation) processes.

The UVB technology provides a means of remediating soil and groundwater *in situ*. The groundwater circulation cell that it induces transports the mobile fractions of the dissolved and residual contaminants to a central well casing for treatment. The primary treatment is often physical removal and is comprised of air stripping via an *in situ* stripping reactor. As a result, the dissolved oxygen (DO) levels in the groundwater passing through the well can increase up to around 10 milligrams per liter (mg/l) within the aquifer. Case studies have shown that the increased DO concentrations in the circulating groundwater around the UVB well (as a result of *in situ* stripping) enhance bioremediation by promoting indigenous microorganisms to degrade contaminants.

The design for each of the UVB systems to be used at OU-4 incorporates a groundwater well with two screen sections, two pumps (one submersible pump for extraction and one sump pump for injection), a groundwater stripping reactor located inside the extended well casing, and an above-ground vacuum blower used to generate the negative pressure inside the well. As a result of the reduced atmospheric pressure created inside the well by the blower, air enters the well through a fresh air inlet connected to the stripping reactor. The air forms bubbles as it jets through the pin hole plate of the stripping reactor and mixes in a counter-current flow process with the influent groundwater inside the treatment well casing. A mass transfer of contaminants from the water phase to the air phase takes place as the rising bubbles expand and release the volatilized contaminant to the air exhausted from the well casing.

The circulation is induced by using the upper screen as the influent screen. Groundwater is pumped to the stripping reactor by the extraction pump. Treated or air stripped water is pumped downward inside the UVB well and out through the lower screen using a re-injection pump. The groundwater flows out horizontally with a vertical upward component in the aquifer, creating a reverse circulation. A three-dimensional torroidal groundwater flow field (vertical circulation) develops with water entering the remediation well through the upper screen and returning to the aquifer through the lower screen segment.

Due to the presence of a natural groundwater flow, the total amount of water circulating around the UVB well at any given time consists of: 1) a portion of upgradient groundwater captured by the influent screen section, and 2) groundwater being recirculated. The ratio of water being recirculated to the water being captured from upgradient is typically 85%. An equal portion of captured, upgradient groundwater entering the circulation cell will exit through the downstream release zone. These flow dynamics and the dimensions of the capture zone, circulation cell, and release zone can be calculated using design aids based on numerical simulations of groundwater flow hydraulics.

An added benefit of using negative pressure to strip VOCs in-well is that the increased expansion of air bubbles result in a higher mass transfer per linear foot of the stripping zone. In addition, the high rate of air bubble expansion leads to adiabatic cooling, thus the effluent air is very low in moisture (typical relative humidity ranges from 20 to 30%).

2.2 Site-Specific Application of UVB Technology

Groundwater charged with constituents of interest (COI) mobilized from the circular flow path enters the UVB through the upper, influent screen section and is pumped to the stripping reactor. After volatiles have been removed by the air stripping unit (due to the negative pressure environment inside the well chamber), the treated groundwater exits the stripping unit and is directed vertically downward through the UVB well. Figure 2 shows a schematic UVB well construction diagram and Figure 3 presents more complete well details. The clean water is dispersed radially into the aquifer through the

lower, effluent screen. A reverse, torroidal circulation flow-pattern develops in the saturated zone, continuously mobilizing and transporting dissolved phase constituents to the stripping zone. No groundwater mounding occurs around the UVB well, since the hydraulic pressure is lower at the upper screen interval and higher at the lower screen.

3.0 REMEDIAL DESIGN

3.1 Technology Design and Calculations

SBP will implement two (2) *in situ* UVB-400 groundwater circulation systems. The systems will treat impacted groundwater by mobilizing and transporting the contaminants via the groundwater circulation cell to the UVB wells and volatilizing these with *in situ* stripping.

Figure 2 shows a circulation well schematic diagram. Influent groundwater is pumped to a "vacuum stripping canister" located from 1 foot bls to 8 feet above land surface (als). Not only has stripping in a negative pressure environment proven to be very effective, but the "canister" stripping unit's design increases contact time between the groundwater and air, when compared to the "down-well" stripping reactors often installed with UVBs. After being treated, the groundwater cascades down through the annulus space between the canister and the outer wall into a collection zone below the stripping canister (see Figures 2 and 3). From here, the water is pumped by the re-injection pump (or sump pump; pump No. 2) through the lower screen section, creating a reverse flow, torroidal circulation zone. Well specifications are provided in Appendix A.

The proposed circulation flow is recommended due to the vertical distribution of the CHCs: very high concentrations near the groundwater table (in top 8 ft of saturated zone), and very low concentrations towards the bottom of the saturated zone. The high dissolved CHC concentrations are thus immediately drawn into the *in situ* stripping reactor through the upper screen section. The stripped and oxygenated water is then pumped vertically downward inside the UVB well before it is thrust out radially through the lower screen section.

The UVB system draws the groundwater level down slightly (less than 0.8 ft), which eliminates the chance of contaminated water flowing across the land surface and discharging into the lake.

The stripping efficiency of the UVB is designed to reduce CHC concentrations of the impacted groundwater to below the required effluent target concentrations, so that water

discharged through the lower screen is below ambient concentrations at that depth. Thus, higher concentrations of contaminants from the upper part of the aquifer will not be transported to the lower portion.

The stripping performance of the system can be monitored by sampling the groundwater influent (pre-stripping) and effluent (post-treatment) ports located at the surface (see Figure 2). Sampling influent and effluent COI concentrations directly inside the UVB well has shown to provide less biased results with respect to radial direction of sample. When taking samples from deep and shallow screened monitoring wells just outside the UVB, often the location of the well relative to the UVB (downgradient, upgradient or crossgradient) has influenced the influent concentrations, inhibiting accurate mass balance or COI removal calculations.

An air to water ratio of 100:1 (900 m^3/h:9 m^3/h) provides approximately 98% stripping efficiency (see Appendix B). This means that the 3,900 ppb initial VOC concentration in groundwater (Bechtel, 1997) will be reduced to 78 ppb. Once mixing and dilution take place in the circulation cell, we expect influent concentrations to be subsequently reduced. Only 39% of the water entering the influent screen is upgradient, captured groundwater, while the remaining 61% is treated, recirculating groundwater.

The air to water ratio requirements are based upon Henry's Law and depend upon concentration gradients, the internal groundwater flow rate and the UVB blower size. The stripping reactors at the OU-4 plume site are designed to be 98% efficient as a single pass system. The number of passes is based upon the rate of the natural groundwater flow (Q_O) through the upstream cross-section of the cell and the well's internal flow rate (Q). For this design, assuming complete mixing, 39% of the effluent that moves downstream will have passed at least once through the stripping zone; while the remaining 61% of the effluent will have passed through the stripping zone more than once. Less than complete mixing will cause most of the water to exit after a single pass. In such a case, the 98% stripping reactor efficiency provides a safety factor.

The size of the contaminant capture zone and circulation cell are based upon the following assumptions:

- Aquifer thickness is constant.
- The aquifer structure is assumed to be radially homogeneous with respect to hydraulic conductivities. Horizontal layers with different conductivities can be used. Each defined horizontal layer may be anisotropic, but may have only one vertical and one horizontal conductivity.
- The local, below-atmospheric pressure field near the well is neglected.
- Density effects are neglected.
- Steady-state conditions exist.
- For estimating the capture zone, only convective transport is considered.

The following aquifer parameters were used for system modeling and calculations:

• Darcian velocity	=	1.2×10^{-6} m/sec
• K_h (Horizontal Hydraulic Conductivity)	=	1.0×10^{-4} m/sec (Bechtel, 1997)
• K_v (Vertical Hydraulic Conductivity) (Note: vertical anisotropy assumed to be 10:1)	=	1.0×10^{-5} m/sec (estimated)
• Horizontal Hydraulic Gradient	=	0.012 (ABB-ES, 1997)
• Thickness of each Treatment Zone (Thickness in subsurface of demonstration location)	=	12.5 m (41 ft)
• Height of Upper Screen in Saturated Zone	=	2.7 m (9.0 ft)
• Height of Lower Screen in Saturated Zone	=	1.8 m (6.0 ft)
• Q, Internal Pumping Rate at each cell (upper and lower - extraction and recirculation rate)	=	9 m^3/hr (40 gpm)

Hydrogeologic Conditions (based on limited data from ABB-ES, 1997):

- Geology - mostly fine to slightly coarse grained gray to brown quartz sand with some silt and clay to 15 feet. A dry, dense, cemented sand layer was encountered at approximately 15 feet bls in most borings followed by black, reddish brown, gray and green well sorted quartz sand with minor silt to

approximately 60 feet. A sandy, silty clay was encountered at 63' in at least one boring.

- Saturated thickness - 65 feet
- Plume thickness - 45 feet (10 to 55 feet bls)
- Top of plume - 10 feet bls
- Porosity - 0.25 (estimated)
- Groundwater flow direction - west
- Gradient - 0.012
- K_h - 1.0 x 10^{-4} m/s, anisotropy assumed to be 10:1
- K_v - 1.0 x 10^{-5} m/s

Groundwater Constituents of Concern	Maximum Concentrations (μg/l)	Recirculation Well Treatment Requirements (μg/l)
• Trichloroethylene (TCE)	3800	80
• Perchloroethylene (PCE)	2600	8
• cis-1,2-Dichloroethylene (DCE)	800	70

(ABB-ES, 1996)

Based on the above assumptions and data provided, the circulation cell dimensions were calculated. The proposed UVB installation assumes a groundwater flow pattern as shown in Figure 2. The distance B_B is defined as the top width of the capture zone, and distance B_T is defined as the bottom width of the capture zone (see Figures 4 and 5) as calculated for an upstream distance from the UVB of 5H (H = height of saturated zone affected by the UVB); S is the stagnation points upstream and downstream of the system (S = the maximum expansion of the sphere of influence of the circulation cell around the UVB parallel to the direction of groundwater flow).

The size of the capture, treatment and release zones, the stagnation points and the time of particle travel can be calculated and are based upon models developed and validated by Herrling *et. al.* (1982). The mathematical modeling involves calculation of a radially symmetric flow field using a Galerkin finite element method with linear

slope functions and triangular elements. The natural horizontal flow field is then superimposed on a rectangular three-dimensional discretization by interpolating and adding the respective velocity vectors. A simple particle tracking method is then used to calculate the capture zone, stagnation points, etc. The actual calculations are performed using a protected, proprietary software program. Results are shown in Appendix B.

Circulation Cell

- Downstream and upstream stagnation point (S) from the UVB well = 27.0 m (88.6 ft)
- Bottom of the capture zone width (B_T) = 17.2 m (56.4 ft)
- Top of the capture zone width (B_B) = 84.6 m (277 ft)
- Crossgradient distance of circulation from UVB Well = 25.5 m (83.6 ft)
- The maximum separation distance between two UVBs systems perpendicular to groundwater flow (D) = 54.7 m (179 ft)
- Natural groundwater entering each circulation cell (Q_o) = 3.5 m^3/hr (15.4 gpm)

System Placement

Based on the approximate wetlands delineation (Subcontract Agreement Addendum 2, Figure 1-7) and system calculations, SBP will place the two systems as shown in Figure 1: one (UVB-1) just southeast of RW-1 and the second system (UVB-2) 85 ft south of UVB-1. These locations are approximately 10 feet east of the wetland boundary. The systems, spaced 85 feet apart, result in a 50% overlap of the capture zones (see Figure 4). The UVBs will extend to a depth of 46 feet bls (the base of the significantly impacted groundwater zone).

If a recirculation pump rate of approximately 40 gpm (9 m^3/hour) is assumed and a hydraulic conductivity of 1.0 x 10^{-4} m/sec is used, the effective radius of influence in the groundwater saturated zone will be about 88 ft parallel to the groundwater flow

and 83.6 ft perpendicular to the groundwater flow. Therefore, the total north-south capture zone (UVB-1 plus UVB-2) can contain and remediate the contaminant dissolved phase across an approximately 362 foot wide plume (85 + 277 ft), and the circulation cells will actively recirculate groundwater in a 252 foot wide zone (83.6 + 85 = 83.6).

It should be noted that SBP will supervise the abandonment of recovery well RW-1 prior to well installation activities. The recovery well is screened from 25 to 65 feet bls and, if left in place, may interfere with circulation cell development of UVB-1.

3.2 System Components

The following presents a brief description of system components and their functions. Component specifications are presented in Appendix A.

Blower

An ELEKTROR centrifugal blower will be provided for each UVB system. A 5.0 horsepower (HP) blower is required to maintain each UVB at a vacuum of 20 inches of water and 530 cfm of air flow. The blower is a 3-phase, 230-volt unit and is equipped with a moisture knock-out built into the high density polyethylene (HDPE) blower enclosure.

Submersible and Support Pumps

A Grundfos submersible, variable speed, stainless steel pump (1 HP, 230 volt, 6.3 amp, 3 phase) will be used as the influent pump and a Grundfos KP 250 sump pump (1/3 HP, 115 volt, 6.3 amp, single phase) will be used as the effluent pump to maintain the desired flow rate of groundwater through the UVB systems. The design flow rates are 40 gpm for both pumps.

Piping, Valves and Fittings

The function of the piping (1" to 4" HDPE, PVC and aluminum), valves and fittings is to complete connections between the water pumps and the centrifugal blowers.

Fixed Packer

The double-lip packer is a combination rubber/HDPE disc that is placed between the two well screens (see Figures 2 and 3). In addition, an inflatable packer will accompany the double-lip one. An air hose is connected from the inflatable portion to the surface; thus appropriate inflation, as well as pressure monitoring, is conducted at the well head. The packer combination is manufactured by IEG Technologies, Inc.

Canister Stripper

An enclosed stripping reactor optimally mixing air and water (described above). The stripper is proprietary and is made of HDPE. A schematic of the stripper is presented in Figures 2 and 3.

Flow Meters

Flow meters containing totalizers will be used to measure flow rate at each of the UVB systems. The location of the flow meters is presented in Figure 2 (on effluent groundwater pipe).

Electrical Panel

Electrical power will be taken from a pole with a transformer that will be placed on the west side of the adjacent road (Pt. Hueneme Avenue - see Figure 6). Bechtel will coordinate with the NTC to ensure the electricity is brought to within 100 feet of one of the UVB compounds.

The electrical panel will have a main switch to turn on and off the entire system, separate switches for each of the two pumps, a blower switch and a meter that will keep track of the amount of time the system is running. The panel will have a manual override for each pump, so that the pumps can be checked separately. Figure 7 presents an electrical one-line diagram of the control panel.

Telemetry System

Each UVB control panel will be equipped with a remote autodialer system. The

autodialer system will be hardwired to the control panel and will activate when either the groundwater pumps air or circulation blower malfunctions (current interruption either from the unit or external circuits). Once activated, the autodialer will call three preprogrammed telephone numbers (via hardwire telephone cable) and a recorded message will play. The numbers dialed will be SBP's Pensacola and White Plains offices and the Project Manager's home. The autodialer will call each number three times to ensure the message is received.

Noise Monitoring

The noise of the UVB blower unit will be monitored by SBP to ensure that audio emissions do not exceed 75 decibels at the equipment compound. SBP will employ a Cel 231 A-weighted, average direct read sound level meter to monitor the noise of the system in full operation. It will be calibrated both before and after each use with a Cel 282 calibrator, factory-set at 114 dBA. The A-weighted measurements will be recorded in slow response mode. All measurements will be taken outside the blower security fences, at various distances from each blower unit. Noise levels will be monitored for representative periods at each monitoring point, and the instrument's resulting Time Weighted Average (TWA) noise levels recorded. The TWA reading extrapolates the noise levels to an equivalent 8-hour exposure level for OSHA standards.

If the noise level exceeds 75 dBA, SBP will notify Bechtel immediately and prepare to shut down the system until the noise level can be amended. Measurements made at other sites proved to be below this required decibel measurement.

Labeling

In accordance with the Subcontract agreement, SBP will affix a permanent tag or label to all system components, piping, switches, alarms and instrumentation. Additionally, a durable sign measuring at least 18" by 24" shall be attached to the exterior of each of the UVB compound fences to identify the system and point of contact for notification of problems. Bechtel will provide the text for the sign.

3.3 Facilities and Structures

The well head for each UVB will be installed on a 8' by 8' concrete pad, with appropriate fencing as described in the Subcontract agreement and detailed in the Construction/Installation Plan. The well chambers will be covered and sealed with an HDPE cover with access ports for monitoring and sampling. The design conforms to OSHA safety standards. Piping for the off-gas emissions will be vented to the atmosphere (if <15 lbs/day total VOCs). A list of assumptions used in our design is as follows:

- Electrical service (3 phase, 230 volts, 100 amp) and telephone line will be provided to the site and will be located within 100 feet of the proposed equipment location. This work and service will be provided by Bechtel.

- Confirmation of existing underground utilities (if any) and their location will be delineated at the site location by Bechtel. SBP will notify local utility companies (via SUNSHINE) prior to initiation of fieldwork.

- SBP will notify Bechtel of any system shut down, regardless of cause. SBP will equip the systems with appropriate remote alarm and automatic notification telemetry which will signal shut down.

3.4 Air Treatment Systems

Air treatment will not be required due to the low amounts of CHCs removed per day (see calculations in Appendix B). Assuming a maximum total CHC concentration of 3,900 ppb in groundwater and a stripping efficiency of 100% (or total removal), a pumping rate of 39.6 gpm at each well will release 1.86 lbs/day CHCs per well to the atmosphere. Given a range of pumping rates from 20 gpm to 60 gpm, the emission range would be approximately 1.0 lb/day to 3.0 lbs/day. These values are well below the regulatory limit of 15 lbs/day.

3.5 Monitoring Wells

In addition to the UVB circulation wells, a total of 11 monitoring wells will be installed as requested in the Subcontract Agreement (see Figure 1). The five Group A wells will be placed, as directed by Bechtel in the subcontract agreement (also see Construction Plan), to evaluate the *in situ* groundwater treatment system's effects on the surficial aquifer. These wells may be adjusted slightly based on field constraints. The primary function of these wells is to complete the overall monitoring system for the groundwater contaminant plume and to be used for collecting samples for chemical analysis or for measuring water levels.

Six wells, designated as Group B wells, will also be installed in clusters of two each in three locations 15, 30 and 60 feet north of the northernmost circulation well (UVB-1). These wells will be located crossgradient (north-south) and extend to depths of 20 and 40 feet bls. Subsequent to approval by Bechtel, SBP may slightly alter the screened intervals of the wells based on field observations during drilling. Figure 1 represents the approximate location of the UVB wells and the monitoring wells. The Group B wells will be used for measuring head response to assess the effectiveness of the *in situ* circulation wells in meeting the interception component of the Subcontractor objective. Measurements from these wells will be used to determine the capture spheres of the UVBs, assuming homogeneous conditions for both circulating wells at the site.

All new wells will be surveyed after installation. The monitoring wells will be constructed in accordance with the well diagram included as Figure B-2 of the Subcontract Agreement. As per Addendum No. 3 (May 7, 1997), the monitoring wells will be constructed of rigid PVC.

The six Group B monitoring wells will be equipped with Troll 4000 pressure transducers\data loggers (or approved equivalent). The pressure transducers will enable ABB to collect exact groundwater levels and denote fluctuations in water levels throughout the life of the project.

3.6 System Remediation Performance

Measurement of pressure heads in monitoring wells spaced around the UVB wells will provide field validation of the radius of influence. System air and groundwater flow rates, well vacuum pressure and off-gas emissions will be measured on a regular basis. To monitor the reduction in the contaminant load within the aquifer, Bechtel/ABB will execute their monitoring plan. Contaminant mass extraction by the UVB system will be calculated over time, based upon samples collected by ABB from the UVB influent and effluent ports shown in Figure 3. The SBP design of the Air Treatment System includes sampling ports for compliance monitoring and measuring air flow velocity. ABB is responsible for these determinations, including pressure measurements for the determination of the zone of influence.

4.0 FLORIDA PROFESSIONAL GEOLOGIST CERTIFICATION

I hereby affix my seal to the Remedial Design for UVB Wells, Operable Unit 4 (OU-4), Naval Training Center, Orlando, Florida, in accordance with the applicable laws of the state.

Name:	Amy T. Twitty
License No.:	0001703
State:	Florida
Renewal Year:	1998

Amy T. Twitty

9-3-97

Date

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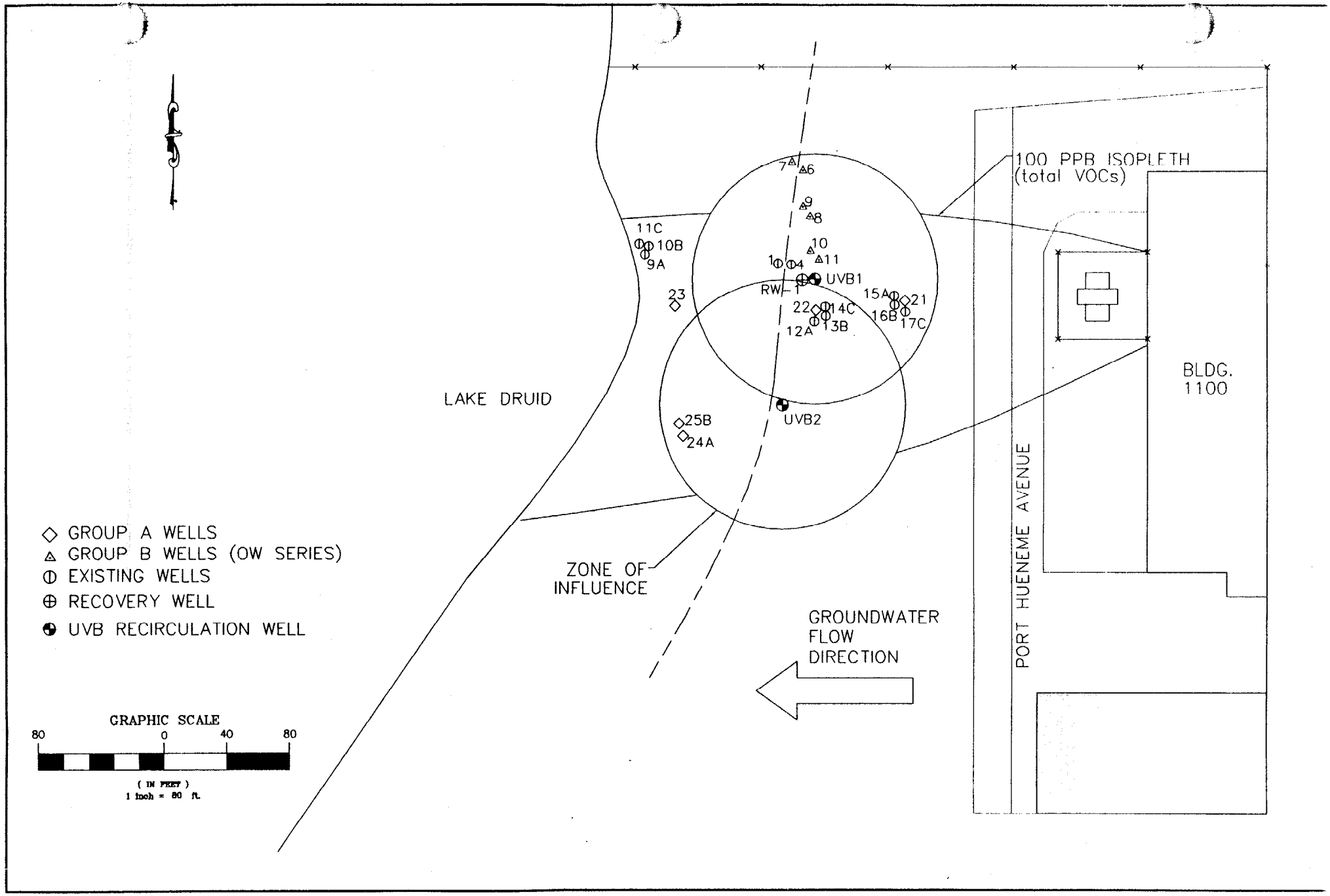
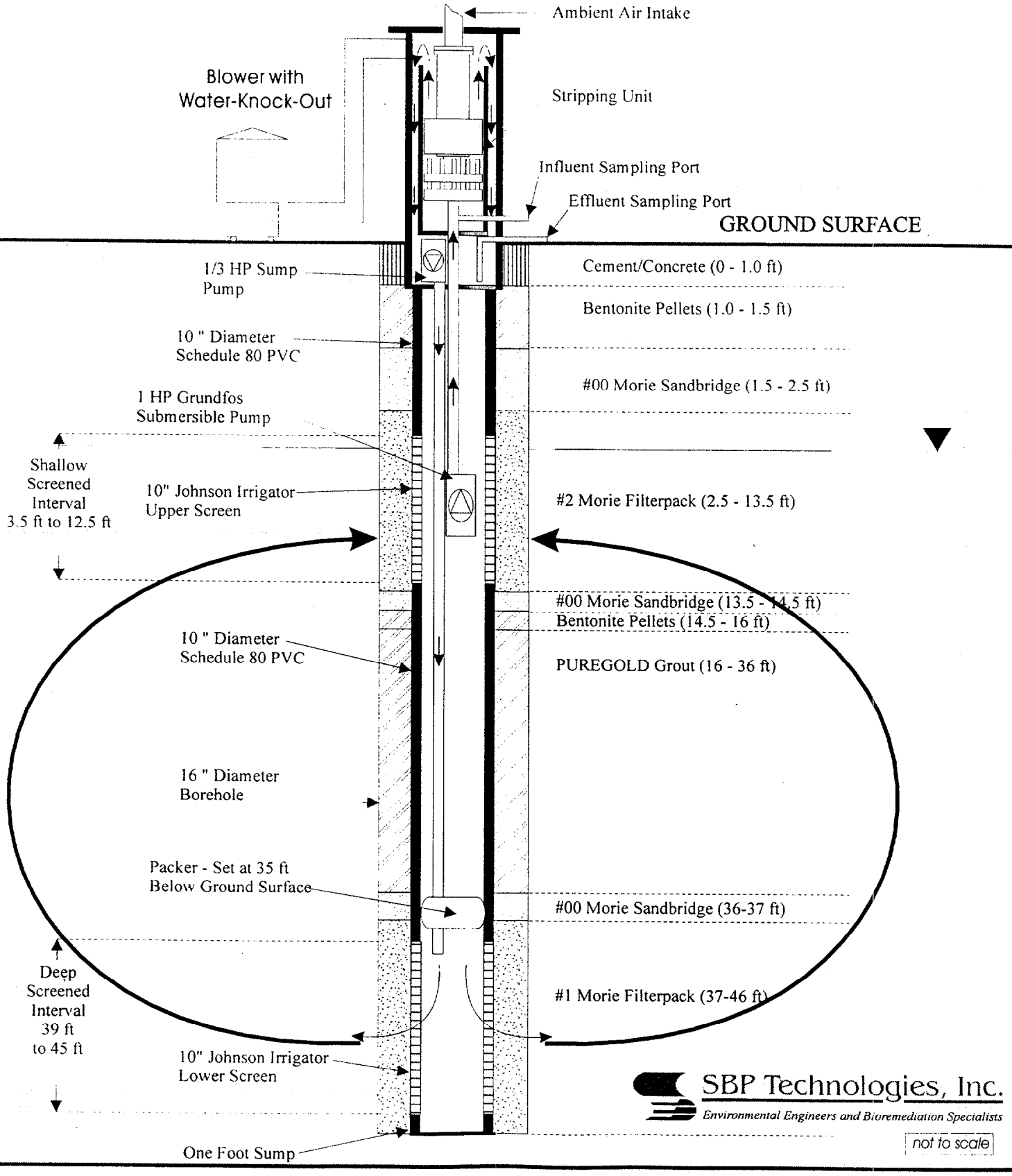


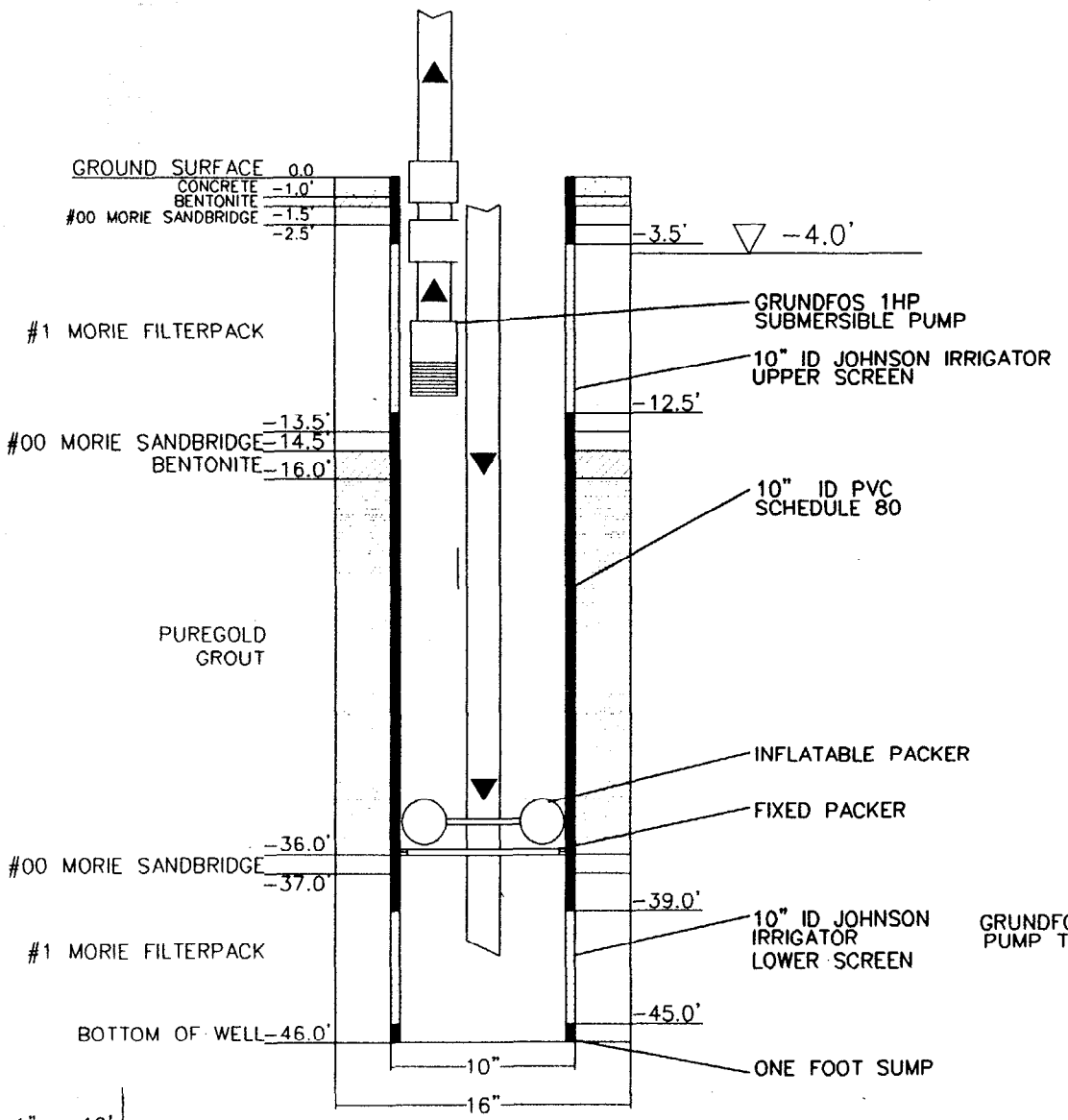
SBP Technologies, Inc.

Environmental Engineers
and Bioremediation Specialists
A Subsidary of The EICON Group, Inc.
Connecticut, Florida, Maryland
New York

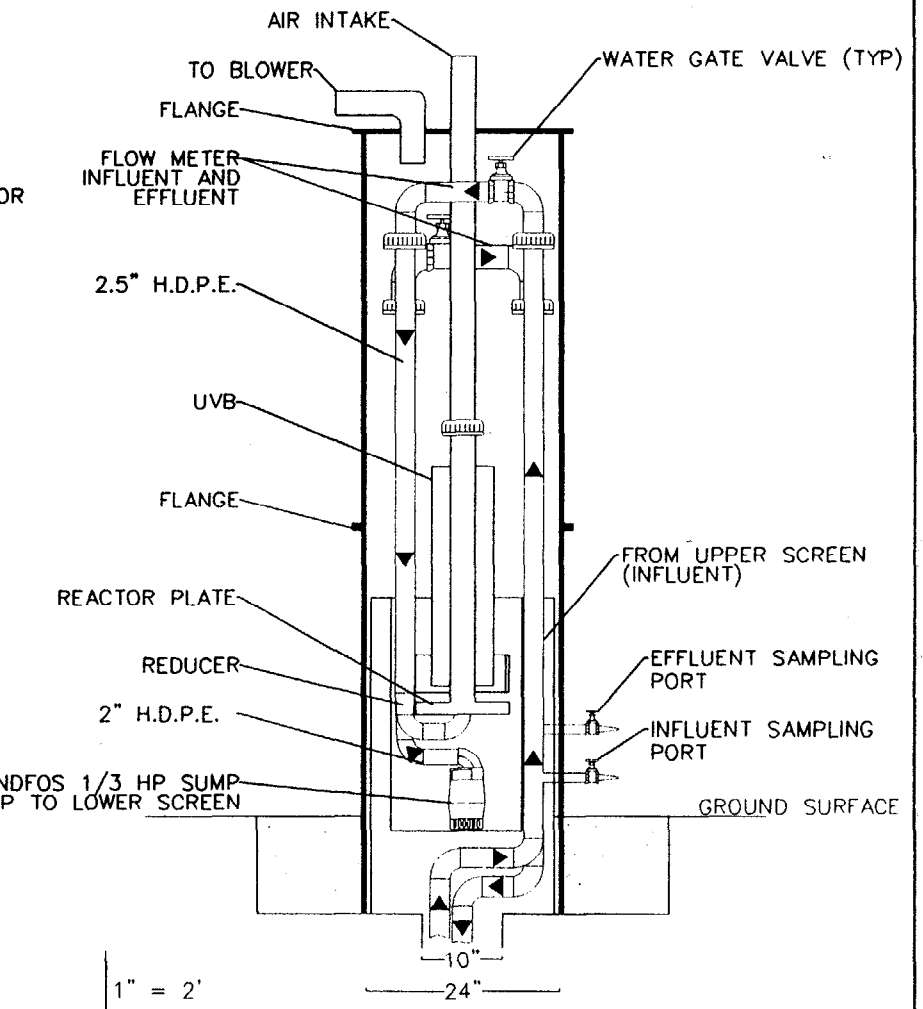
PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER		
DWG. TITLE	SITE PLAN	SCALE	AS NOTED
DRAWN BY	CAT	DWG. NO.	FIGURE 1
DATE	6/25/97	PROJECT NO.	T7027.10

FIGURE 2
UVB CIRCULATION WELL SCHEMATIC
ORLANDO NAVAL TRAINING CENTER, OU 4
ORLANDO, FLORIDA





WELL DETAIL



UVB CANISTER DETAIL

SBP Technologies, Inc.
Environmental Engineers
and Bioremediation Specialists
A Subsidary of The EICON Group, Inc.
Connecticut, Florida, Maryland
New York

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER, OU-4
DWG. TITLE	UVB WELL CONSTRUCTION DETAIL
SCALE	AS SHOWN
DRAWN BY	CAT
DWG. NO.	FIGURE 3
DATE	8/27/97
PROJECT NO.	T7027.10

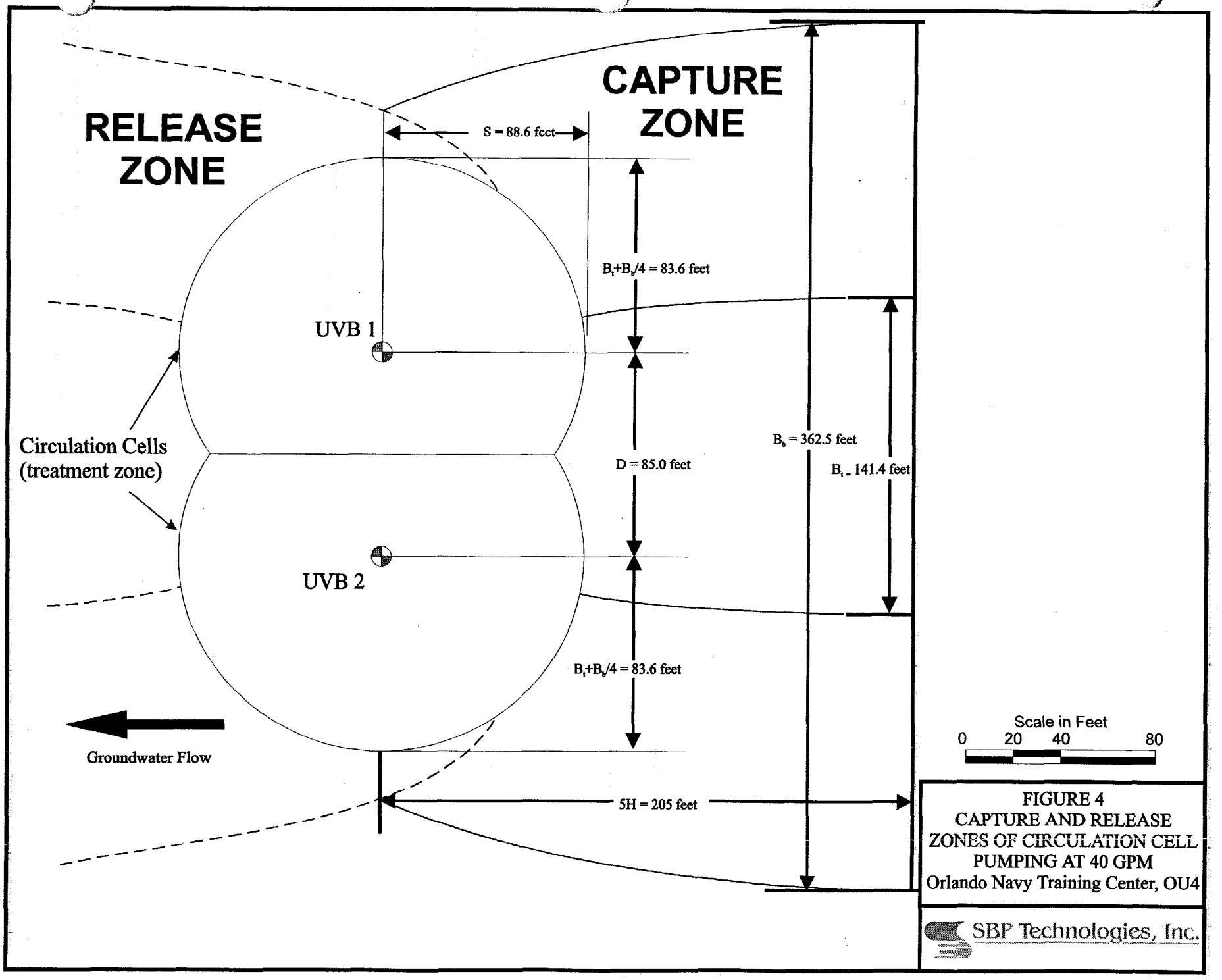
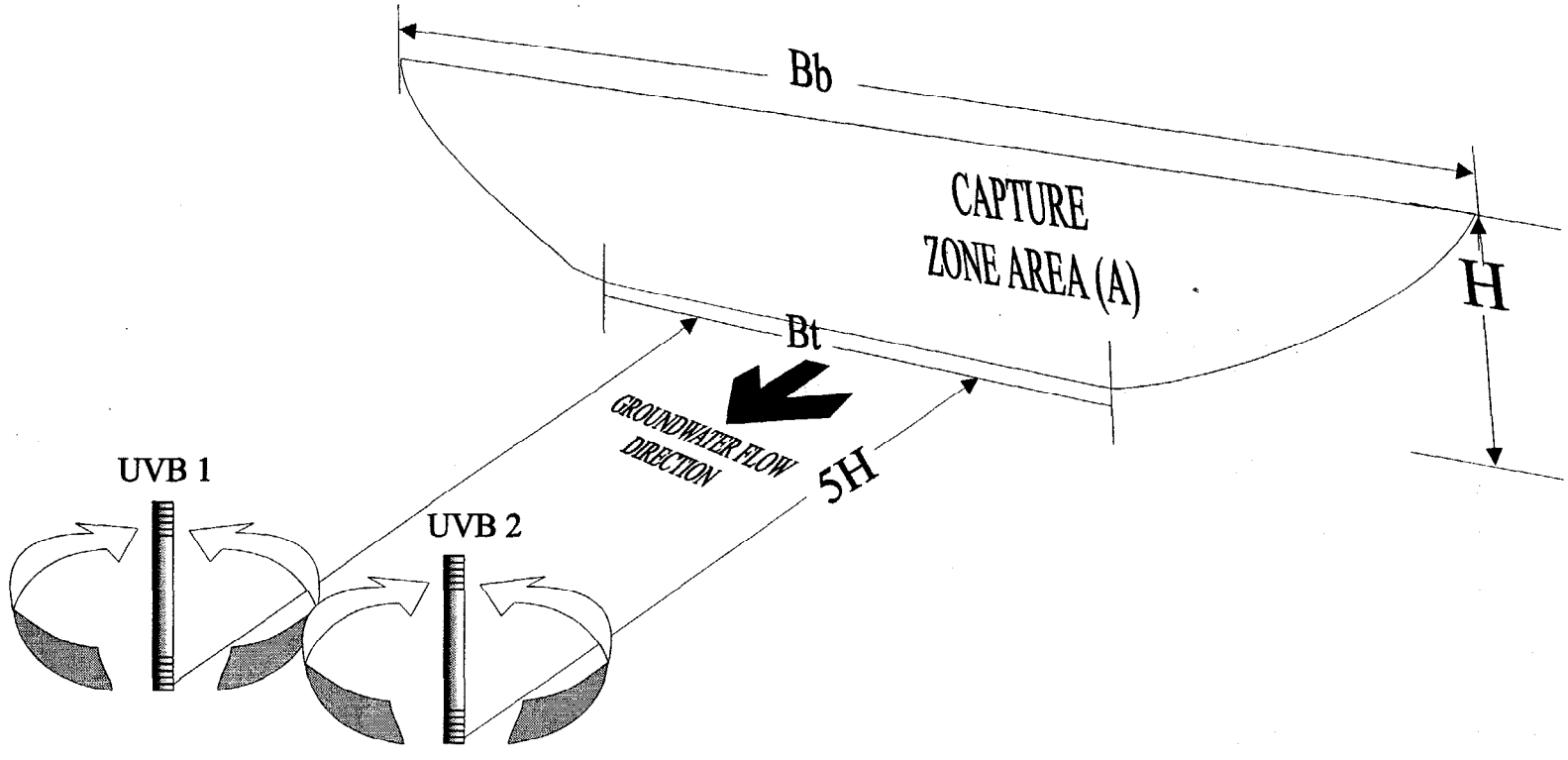


FIGURE 4
CAPTURE AND RELEASE
ZONES OF CIRCULATION CELL
PUMPING AT 40 GPM
Orlando Navy Training Center, OU4

SBP Technologies, Inc.

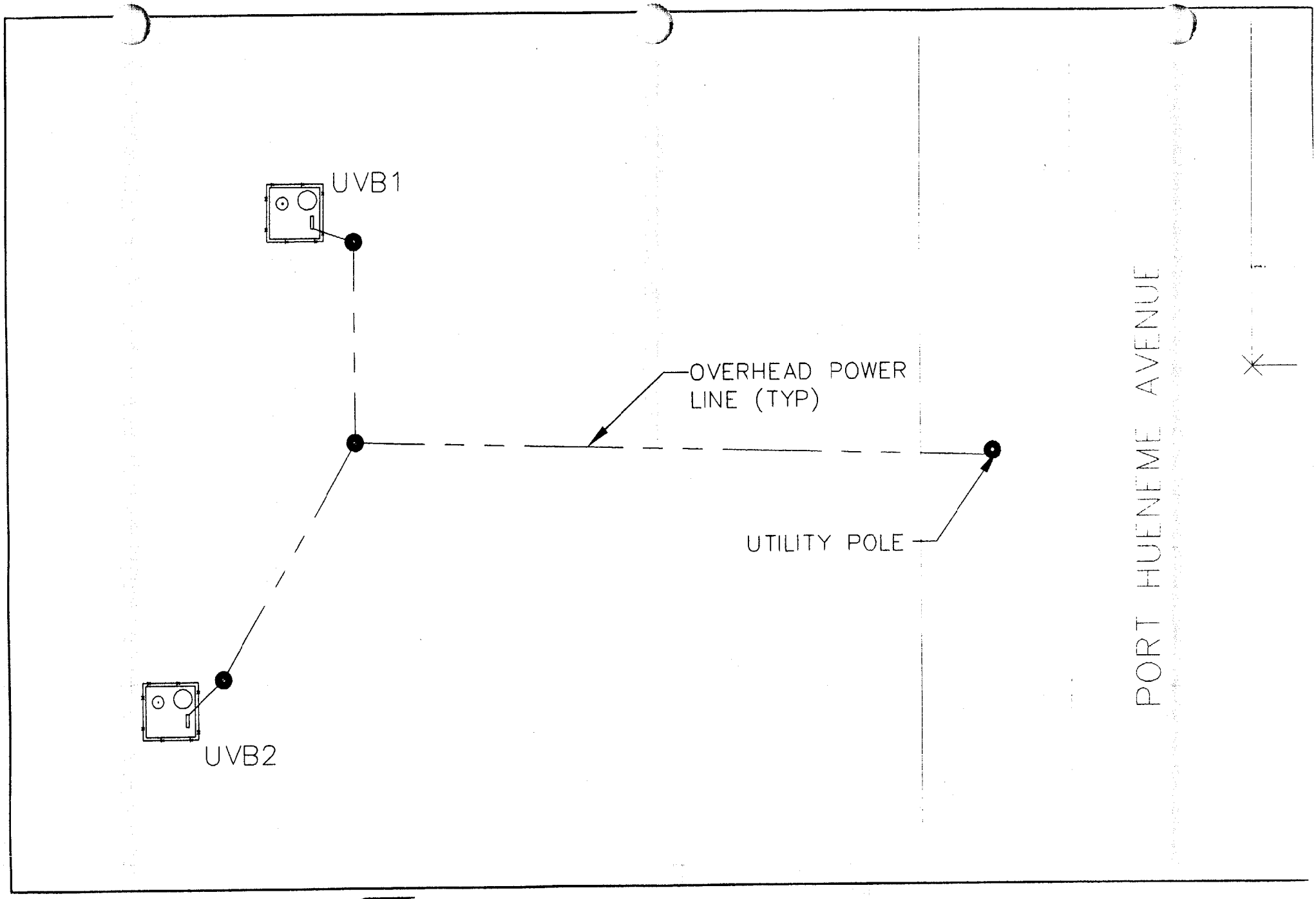


B_t = 141.4 feet
B_b = 362.5 feet
H = 41.0 feet
A = 8,866 feet^2

Not To Scale

FIGURE 5
CAPTURE AND RELEASE
ZONES OF CIRCULATION CELL
PUMPING AT 40 GPM
Orlando Navy Training Center, OU4

SBP Technologies, Inc.



SBP Technologies, Inc.

Environmental Engineers
and Bioremediation Specialists
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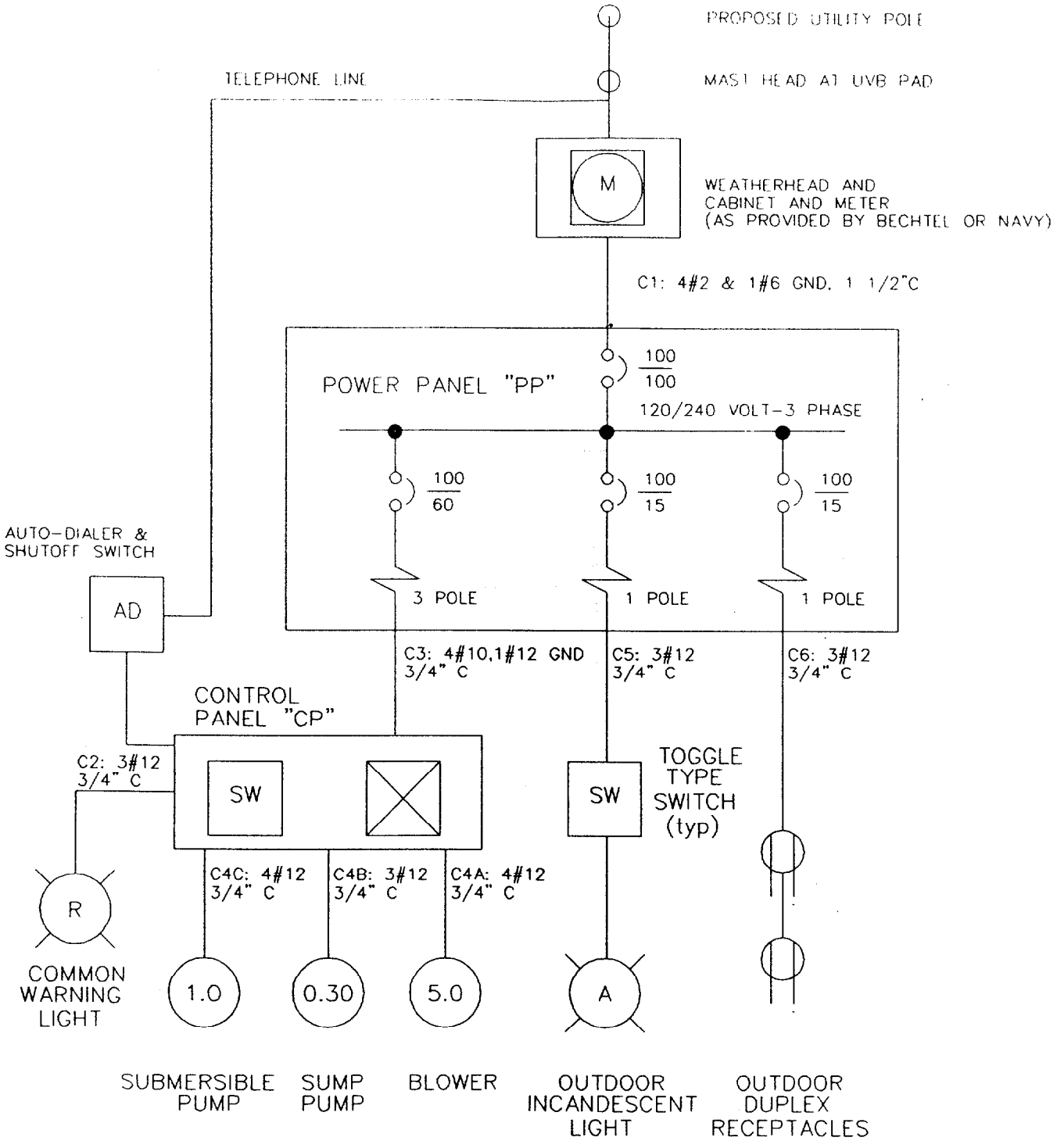
Connecticut, Florida, Maryland

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER, OU-4		
DWG. TITLE	ELECTRICAL POWER ROUTING	SCALE	1" = 20'
DRAWN BY	CAT	DWG. NO.	FIGURE 6
DATE	9/3/97	PROJECT NO.	T7027.10



TYPICAL SINGLE LINE DIAGRAM

SBP Technologies, Inc.
Environmental Engineers
and Bioremediation Specialists
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Connecticut, Florida, Maryland
New York

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER		
DWG. TITLE	SINGLE LINE DIAGRAM	SCALE	N/A
DRAWN BY	AJM	DWG. NO.	FIGURE 7
DATE	9-2-97	PROJECT NO.	T7027.10

APPENDIX A
WELL SPECIFICATIONS

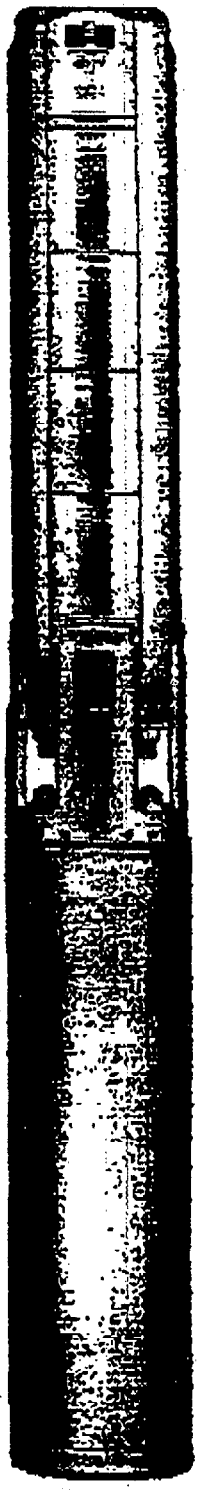
MODEL
60S

60 GPM

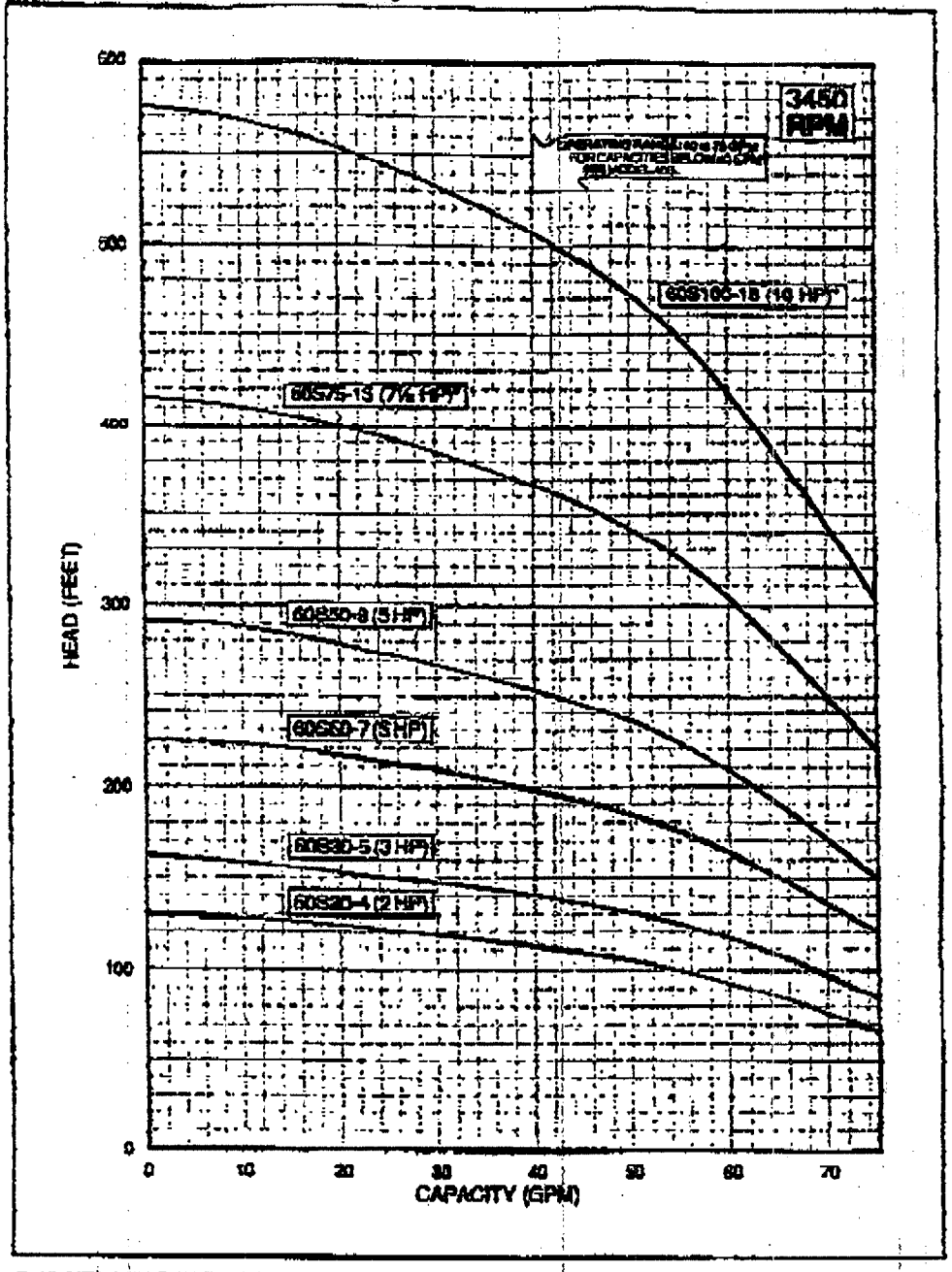
GRUNDFOS

FLOW RANGE
40 to 75 GPM

PUMP OUTLET
2" NPT



PERFORMANCE CURVES



DIMENSIONS AND WEIGHTS

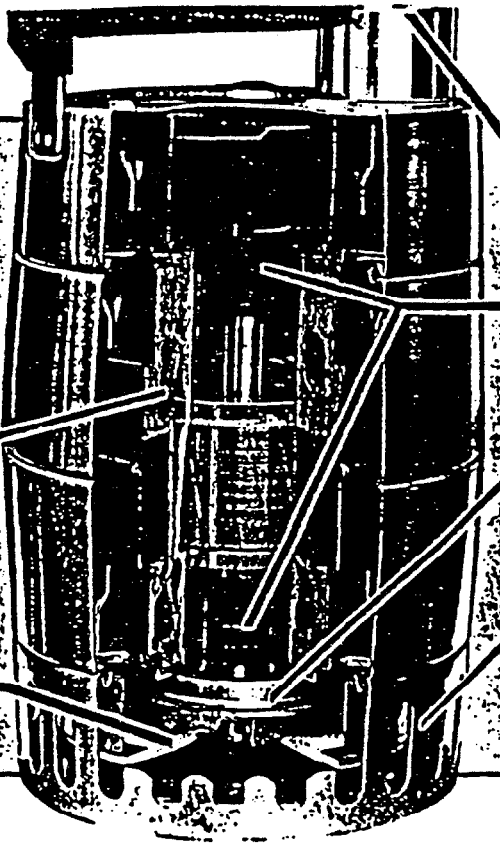
MODEL NO.	HP	LENGTH (INCHES)	WIDTH (INCHES)	APPROX. UNIT SHIPPING WT. (LBS.)
60S20-4	2	31 ¼	3 15/16	38
60S30-5	3	40 ¾	3 15/16	64
60S50-7	5	48 ¾	3 15/16	75
60S50-9	5	53 ¾	3 15/16	80
60S75-13	7½"	70	3 15/16	105
60S100-18	10"	97 ¼	3 15/16	160

Specifications are subject to change without notice.

* A 4-inch motor is provided as standard on these models.

a Better Sump Pump."

Built for years of trouble-free operation.



Sturdy Stainless-Steel Construction
including motor, shaft, impeller and pump body.

Water-Lubricated Motor
never needs oiling.

Hermetically Sealed Motor Windings
embedded in polyurethane-sealed in stainless-so they won't short out.

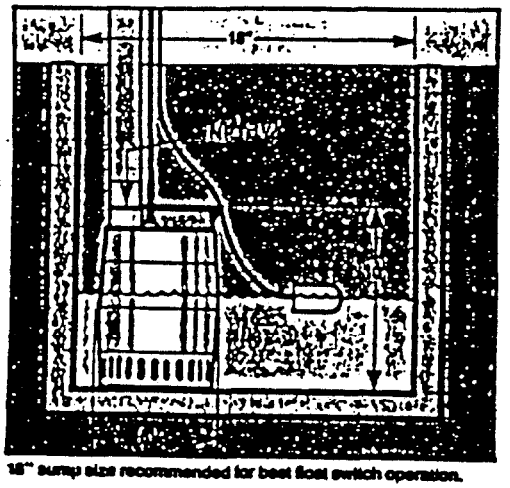
Reversible-Replaceable Wear Plate
for quick and easy service.

Solid Stainless Discharge
resists corrosion and cross-threading.

Extra Long-Life Bearings
heavy-duty special carbon.

Stainless-Steel "Cutter-Vane" Impeller
resists fiber build-up, handles sand and solids up to 3/8 inch.

Stainless Suction Screen
protects impeller, prevents jamming.



18" sump size recommended for best float switch operation.

Applications:

Use for:

- Clear or dirty sump water.
- Hot water, up to 95°F continuous, 122°F intermittent.
- Greywater and wastewater.
- Draining ponds and small excavations.
- Fresh water boat bailing.
- Tank Circulation or mixing.
- Shallow well water pump.

DO NOT use for:

- Raw Sewage.
- Gasoline, oil or other flammables.
- Corrosive liquids.
- Where water temp. exceeds 122°F in continuous operation.
- Applications where pump will run dry.

Dimensions, Weights, Electrical

Model	HP	Volts	Watts	Amps	Shipping Weight (lbs)*	Shipping Carton LxWxH (in)	Packaged Vol. (C.F.)
The Boss 200	⅓	115	710	6.3	16	10½x6½x12¾	5
The Boss 300	½	115	920	9.0	17½	10½x6½x12¾	5

*Not including float switch (1½ lbs)

Performance Table

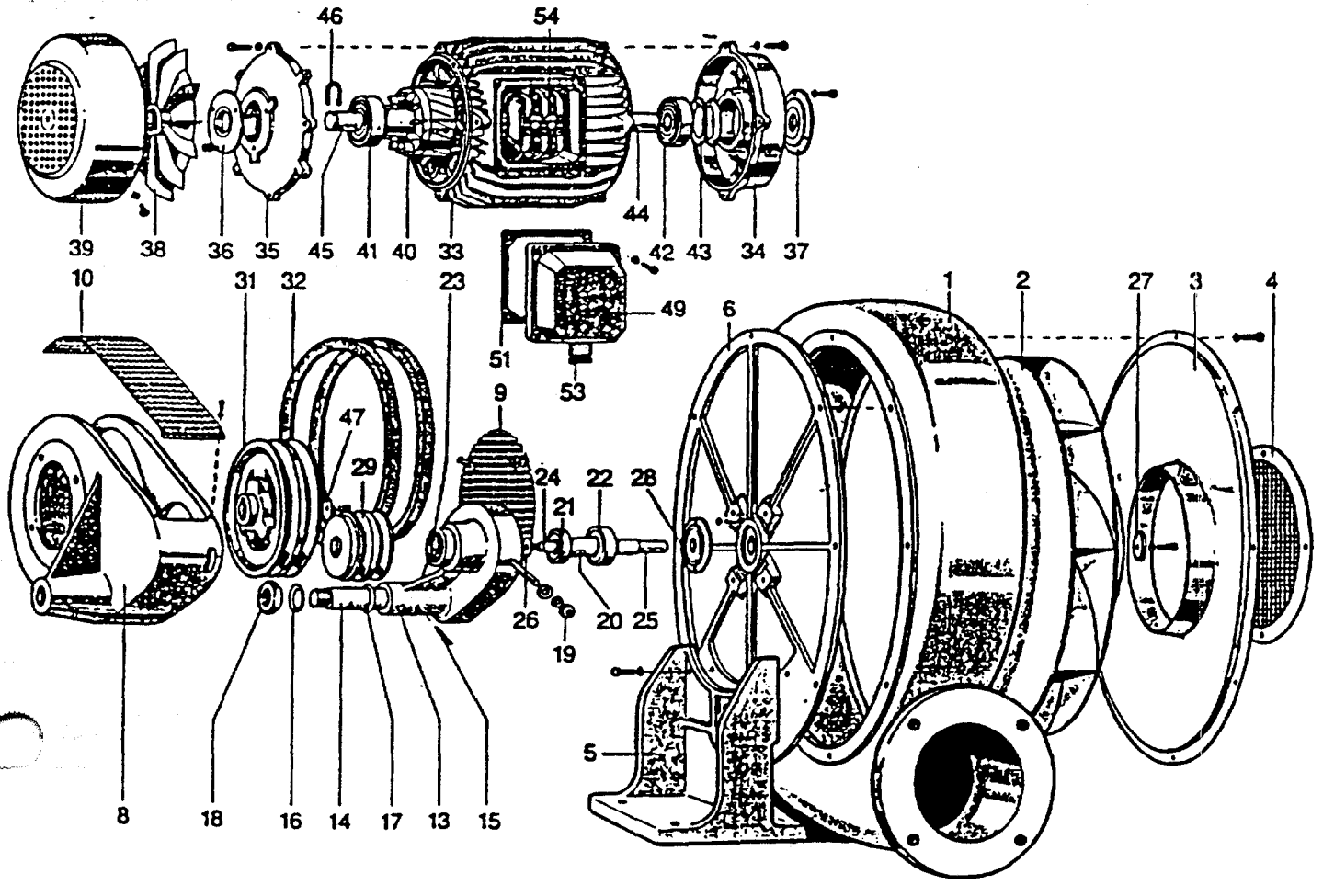
Model	HP	Total Head 4 Ft	6 Ft	8 Ft	10 Ft	12 Ft	14 Ft	16 Ft	18 Ft	20 Ft	22 Ft	24 Ft
		Flow (GPM)										
The Boss 200	⅓	53	47	41	35	28	22	13	5			
The Boss 300	½	72	69	64	60	56	48	40	33	23	13	2

GRUNDFOS®

Grundfos Pumps Corp. / 2555 Clovis Ave. / Clovis, CA 93612
Support Centers: Allentown, PA • Atlanta, GA • Mississauga, Ontario, Canada

KP SL 001 | 3/92
PRINTED IN USA

HRD2/3–HRD2/5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47
29
24
22
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21
26
20
25
19
5
8
18
16
14
17
13
15

1	blower housing "right"	13075	13075	13075	
or	blower housing "left"	13767	13767	13767	
2	impeller "right"	13768	13768	13768	
or	impeller "left"	13775	13775	13775	
3	housing cover lid	13361	13361	13361	
4	wire mesh guard	13771	13771	13771	
5	blower base	13941	13941	13941	
6	blower flange				
7		11392	11392	11392	
8	support flange A, B, G, H	11399	11399	11399	
or	support flange C, D, E, F	11429	11429	11429	
9	circular cover guard	11393	11393	11393	
10	belt cover guard				
11		St 2496	St 2496	St 2496	
12	flange housing complete A, B, G, H	St 2498	St 2498	St 2498	
or	flange housing complete C, D, E, F				
	consisting of items 13–29	11388	11388	11388	
13	flange housing A, B, G, H	11389	11389	11389	
or	flange housing C, D, E, F	11394	11394	11394	
14	pivot bolt	1424	1424	1424	
15	spiral stud	1418	1418	1418	
16	screw lock washer	1422	1422	1422	
17	screw lock washer	1417	1417	1417	
18	hexagonal nut	3254	3254	3254	
19	hexagonal nut	13942	13942	13942	
20	blower shaft	3060–2z	3060–2z	3060–2z	
21	ball bearing	3019–2z C3	3019–2z C3	3019–2z C3	
22	ball bearing	8349	8349	8349	
23	circlip	3061	3061	3061	
24	key	9606	9606	9606	
25	key	11093	11093	11093	
26	washer	11110	11110	11110	
27	washer	7400	7400	7400	
28	bearing cap	2244	2244	2244	
29	belt pulley				
30		11233	13889	2370	
31	V-belt pulley 50 Hz	13939	13940	11233	
or	V-belt pulley 60 Hz	1395	1394	1394	
32	V-belt 50 Hz	1395	1395	1395	
or	V-belt 60 Hz	10436	10458	10489	
33	cast-in stator complete	10424	10424	10491	
34	flanged bearing endshield	10429	10429	10474	
35	bearing endshield	10433	10433	10476	
36	bearing cap	—	—	10476	
37	bearing cap	10435	10435	10478	
38	cooling fan	10434	10434	10477	
39	fan guard	11432	11395	14463	
40	rotor complete	3201–2z	3201-2z	4067-2z	
41	ball bearing	12487	12487	4067-2z	
42	ball bearing	10439	10439	10483	
43	dished spring	8996	8996	8996	
44	key	6630	6630	6630	
45	key	9506	9506	5172	
46	circlip	11110	11110	11110	
47	washer				
48		14523	14523	14523	
49	terminal box				
50		10442	10442	10442	
51	terminal box gasket				
52		4411	4411	4411	
53	PG cable gland	12794	12794	12794	
54	terminal board				
55					
Design with temperature barrier S 484					
56	spacer ring	2193	2193	2193	
57	ventilating fan	2207	2207	2207	
58	blower shaft	13942/S 484	13942/S 484	13942/S 484	
59	ball bearing	3060–z	3060–z	3060–z	
60	ball bearing	3019–z C3	3019–z C3	3019–z C3	
Design with TMG shaft seal					
61	blower flange	13941/S 789	13941/S 789	13941/S 789	
62	TMG shaft seal	12881	12881	12881	

This manual should be available to the operating personnel all the time. The instructions should be read carefully before installation and startin operation. If strict notice is given to these instructions the blower will operate faultlessly for years.

1. General remarks

Elektror high pressure blowers are made of sturdy, light-weight cast aluminium the impellers from sheet aluminium respectively from sheet steel.

They are designed for conveying medium air volumes at high flow resistance.

The use of the units for aggressive and toxid media, for air of extremly high humidity as well as for media temperatures exceeding 80° C is limited only and subject to clarification with the company. Conveying of explosive gases is not permitted.

If the medium to be conveyes contains solid particles or other pollutions, they are to be removed before entering the blower by installing a filter on the intake side. Open discharge or intake ports should be fitted with suitable wire mesh guards. Attention should be given to careful and regular cleaning or replacement of clogged filters as the indicated performance data cannot be guaranteed otherwise.

With blowers the performance curves of which are limited in the higher volume range, care must be taken so as not to exceed the indicated maximum volume flow in order to avoid an overload of the motor. If the resistance of the connected systems is too small a reduction of the volume flow is possible by fitting a throttle flap. The units have to be installed in weather-protected places.

Provisions should be made for sufficient motor cooling. The permitted maximum temperature of conveyed medium and surroundings is 40° C. If equipped with a temperature barrier the maxiumum temperature of the conveyed medium is 180° C. The units should be mounted horizontally only.

2. Technical data

The various blower types as well as their technical data may be taken from our catalogue „Elektror High Pressure Blowers".

3. Installation

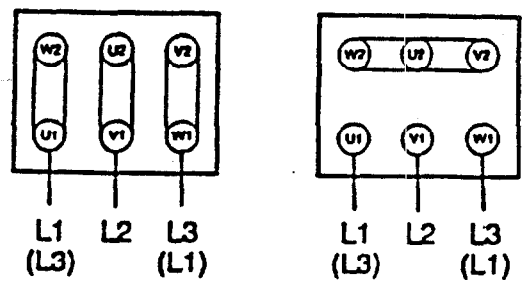
3.1. Check all parts for damage during transportation.

3.2. Elektrical connection is to be carried out according to the wiring diagram in the terminal box by skilled labour only. The respective VDE regulations and the directions of the local power supply company are to be complied with.

3.3. Protection of motor by overload switch; permitted max. current see rating plate.

3.4. Electrical connection diagram

Connection of three phase units



Δ-connection lower voltage

Y-connection higher voltage

3.5. Control of the correct rotational direction of the impeller is to be made by the air flow. The direction of the air flow must be in accordance with the arrow on the blower housing.
Reversing of the direction of rotation with three phase a.c. is possible by interchanging two wires (see connection diagram).

3.6. Mechanical connection of the blower.

4. Start of operation

4.1. If the rated current indicated on the rating plate ist being exceeded during operation, it should be checked whether the available supply voltage and frequency are in accordance with the embossed data. Some blowers cannot be operated with free air flow (see catalogue) and if in such a case the system's resistance is too small, current absorption will become too high and an overload of the motor will occur. By fitting a throttle flap on the intake or discharge side of the blower the volume flow will be reduced and an overload avoided.

5. Maintenance

High pressure blowers are equipped with enclosed grooved ball bearings which do not need lubrication. The grease filling is sufficient for the whole service life of the bearings.

Tension control of the V-belts is to be carried out in accordance with the indicated values on the rating plate. They are fixed to the support flange, item 8, to the blower flange, item 6, respectively to the blower base, item 5.

Retightening of the V-belts for models HRD 1/2 - HRD 2/5 is to be carried out as follows:

5.1. Remove cover guard, item 10.
5.2. Loosen hexagonal nut, item 18.
5.3. Increase tension of V-belts by tightening hexagonal nut, item 19 (see rating plate).
5.4. Tighten hexagonal nut, item 18.
5.5. Reassemble cover guard, item 18.

Retightening of the V-belts for models HRD 65/2 - HRD 65/7, HRD 60/3 and HRD 60/5 is to be carried out as follows:

5.6. Remove drive belt guard, item 7.
5.7. Adjust tension of V-belts by loosening or tightening nuts on the threaded bolt, item 10 (see rating plate).
5.8. Retighten hexagonal nuts on threaded bolt, item 10.
5.9. Reassemble drive belt guard, item 7.

Retightening of the V-belts for models HRD 7/12 - HRD 7/23 is to be carried out as follows:

5.10. Remove drive belt guard, item 7.
5.11. Loosen hexagonal nut, item 10, adjust tension of V-belts by tightening or loosening the adjusting screw, item 11 (see instruction plate), accordingly.
5.12. Tighten hexagonal nut, item 10.
5.13. Reassemble drive belt guard, item 7.
5.14. Attention should be given to exact alignment of the V-belt pulleys.

6. Repairs

6.1. Repair work on blowers should generally be done in the factory only. Exceptionally repairs may be carried out in a workshop possessing the necessary qualifications and facilities. Units with an explosion-proof motor must be repaired by the manufacturer only.

7. Warranty, technical details

7.1. Legal warranty begins with the day of shipment.
7.2. Our warranty is valid only if the instructions for installation and operation are strictly adhered to.
7.3. Technical details regarding installation, operating conditions and electrical connections may be obtained from the company's experts.

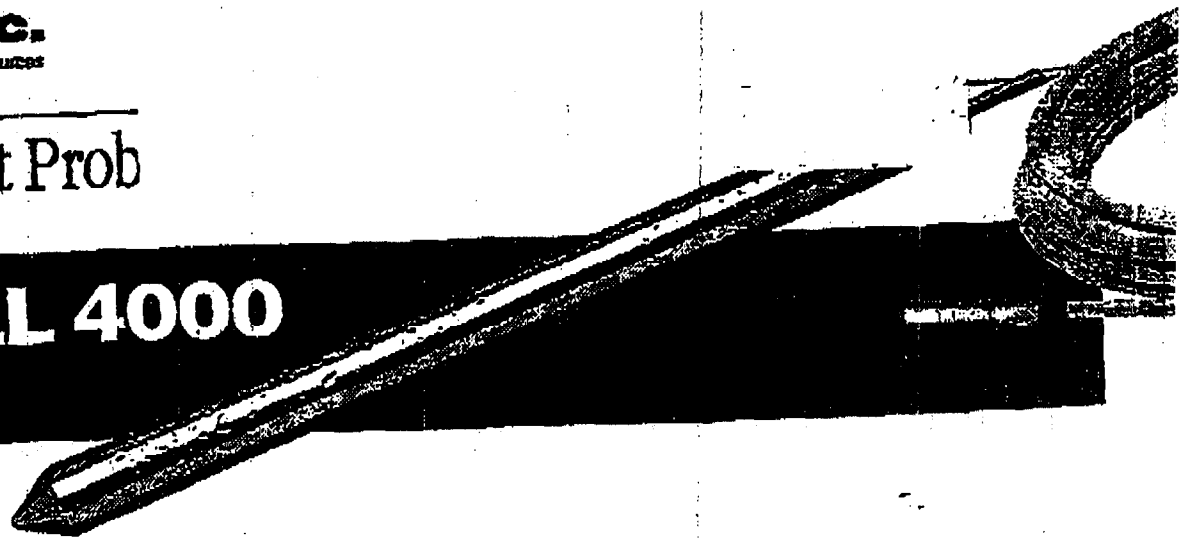
8. Spare parts list

When ordering spare parts please state serial number of the unit, type and part number in accordance with the following lists and drawings.

In-Situ Inc.
Helping monitor the earth's resources

Intelligent Prob

TROLL 4000



The TROLL (SP4000) is a fully submersible intelligent probe designed for monitoring water level and temperature. Its outside diameter of 1.5 inches allows easy access to 2-inch wells. With In-Situ's Windows-based software, Win-Situ (included with purchase), the TROLL can be easily programmed in the office or field. The TROLL connects either to a PC, which is used for programming and receiving stored data, or to other units via separately-supplied wiring or telemetry. The TROLL comes with linear, logarithmic, and event test types and can be used in many short- or long-term applications.

Applications:

- Unattended long-term monitoring of aquifers, lakes, streams, reservoirs, and waste disposal sites
- Aquifer tests, including collection of fast, early-time drawdown data for constant or stepped-rate tests
- Tidal and surface monitoring

Features:

- FCC certification as a Class B digital device
- Binary data transfer from the TROLL to a PC using Win-Situ software will convert the data to ASCII format or other data file formats
- 208 Kb for data storage
- Delayed start capability for synchronizing multi-well tests and for collecting data in remote areas accessible only part of the year
- Factory-replaceable lithium battery or user-replaceable alkaline battery
- Accuracy: ±0.05% of full scale from 0 to 30°C
- Integral water level sensor available in 15, 30, 100, or 250 psi; available either vented to atmosphere (i.e., "gauge-type") or non-vented (i.e., "absolute-type")
- Water level sensor can withstand up to 2X overpressuring without damage
- Available with RS422 or RS232 communications protocol; RS422 is an ideal choice where multiple TROLLs are installed in a well field and connected to a separately-supplied telemetry system, or to a computer via a separately-supplied converter and cable. RS232 can hook directly to a PC without the use of a converter, but cannot be linked with other units in a multiple installation.
- Automatic temperature compensation of water level readings
- 14-bit analog-to-digital converter
- 316 stainless steel tube with end-mounted integral pressure sensor
- Well-top system can mount in 2-inch wells or larger

Test Types:

Linear: Similar to the linear test from previous In-Situ instruments. Measurements are spaced evenly over time, at specified intervals from 3 seconds to one week.

Logarithmic: This test type incorporates true logarithmically-defined decaying-rate sampling. Measurement begins very rapidly, to capture early-time data for pump and slug tests, and then slows down and eventually becomes linear at your choice of interval.

Event Sampling: This test type lets you design a test whereby small and essentially insignificant changes in transducer measurements are not stored into the data file, but larger and more significant changes measured by the transducer are stored. This acts to minimize the size of a data file but stores all meaningful data.

Extended Warranty Plans

Extended warranty plans are available. Contact In-Situ Inc. for information.

APPENDIX B
DESIGN CALCULATIONS

APPENDIX B
DESIGN CALCULATIONS

The Naval Training Center OU-4 Site, Orlando, Florida

I. INPUT DATA (hydrogeologic and well construction)

	Metric	U.S.
Gradient I:	0.012	0.012
Hydraulic Conductivity k_h:	0.0001 m/s	28.3 ft/day
Darcy Velocity (k_h x I):	0.0000012 m/s	0.34 ft/day
Aquifer Thickness H:	12.5 m	41.0 ft
Upper screen length a_T:	2.74 m	9 ft
Lower screen length a_B:	1.8 m	6 ft
Pump rate Q:	9 m^3/hr	39.6 gpm

II. CALCULATED VALUES

Ratio a/H:	0.181
For numeric solution $Q/(H^2xv)$	13.33

Assuming a hydraulic conductivity anisotropy of 10:1, horizontal to vertical, results of circulation cell size calculations are as follows:

Stagnation Point S:	27.0 m	88.6 ft
Maximum Spacing D:	54.7 m	179.4 ft
Capture Zone Top Width B_t:	17.2 m	56.4 ft
Capture Zone Bottom Width B_b:	84.6 m	277 ft
Crossgradient Circulation distance:	25.5 m	83.6 ft
Captured Flow Q_0:	3.5 m^3/hr	15.4 gpm
Capture Zone Area A:	824 m^2	8866 ft^2
Percent influent GW Q_0/Q:	39%	

Appendix B
AIR DISCHARGE CALCULATIONS FROM GROUNDWATER
The Naval Training Center - OU-4 Site - Orlando, Florida

	A	B = A x 1,000	C	D	E = (B x C)/D	F	G = E x F	J
COMPOUND	Average Concentration in Groundwater * (ug/l)	Average Concentration in Groundwater (ug/cu. m)	UVB Air Stripping Efficiency	Air to Water Ratio	AIR Concentrations Entering Carbons (ug/cu. m)	Activated Carbon Stripping Efficiency	Post Treatment Air Concentrations (ug/cu. m)	Guidance Values (ACG) (ug/cu. m)
TCE	2,700	2,700,000	98.00%	100 :1	26,460	N/A	N/A	
PCE	500	500,000	98.00%	100 :1	4,900	N/A	N/A	
cis-1,2-DCE	700	700,000	98.00%	100 :1	6,860	N/A	N/A	
	0	0	0.00%	1 :1	0	0.00%	0.00	
	0	0	0.00%	1 :1	0	0.00%	0.00	
	0	0	0.00%	1 :1	0	0.00%	0.00	
	0	0	0.00%	1 :1	0	0.00%	0.00	

YEARLY DISCHARGE CALCULATIONS

	E	I	K	L = (E x K)/1E+09	M = (I x K)/1E+09	N = L x 52.91	O = M x 52.91	P = N x 365	Q = O x 365
COMPOUND	Pre-Control Concentrations (ug/cu. m)	Post-Control Concentrations (ug/cu. m)	AIR Flow Volume (cu. m/hour)	Pre-Control Total Discharge (kg/hour)	Post Control Total Discharge (kg/hour)	Pre-Control Total Discharge (lbs/day)	Post-Control Total Discharge (lbs/day)	Pre-Control Total Discharge (lbs/year)	Post-Control Total Discharge (lbs/year)
TCE	26,460	N/A	900	2.38E-02	N/A	1.26E+00	N/A	459.90	0.00
PCE	4,900	N/A	900	4.41E-03	N/A	2.33E-01	N/A	85.17	0.00
cis-1,2-DCE	6,860	N/A	900	6.17E-03	N/A	3.27E-01	N/A	119.23	0.00
	0	0.00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00
	0	0.00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00
	0	0.00	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00
Totals				3.44E-02	0.00E+00	1.82E+00	0.00E+00	664.30	0.00

* = Data taken from "Final Interim Remedial Action, Conceptual Design and Performance Specification" by ABB-ES, May 1997.

APPENDIX C

CONSTRUCTION/INSTALLATION PLAN

SBP Technologies, Inc.

CONSTRUCTION/INSTALLATION PLAN
OPERABLE UNIT 4 (OU-4)
ORLANDO NAVAL TRAINING CENTER
ORLANDO, FLORIDA

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LIST OF ACRONYMS

ABB-ES	ABB Environmental Services
als	above land surface
bls	below land surface
cfm	Cubic feet per minute
CHC	Chlorinated Hydrocarbons
COI	Constituents of Interest
DCE	Cis-1,2-Dichloroethylene
dBA	decibels
DO	Dissolved Oxygen
DRMO	Defense Reutilization and Marketing Office
HDPE	High density polyethylene
HP	horsepower
IRA	Interim Remedial Action
K	hydraulic conductivity
lbs	pounds
mg/l	milligrams per liter
MW	Monitoring well
NTC	Naval Training Center
OSHA	Occupational Safety and Health Administration
OU-4	Operable Unit 4
PCE	Perchloroethylene
ppb	Parts per billion
ppm	Parts per million
Q	pumping rate
RW	Recovery well
SBP	SBP Technologies, Inc.
TCE	Trichloroethylene
TWA	Time weighted average
UVB	Vacuum Vaporizer Well
VOC	volatile organic compound

1.0 PROJECT OVERVIEW

1.1 Site Background

The Orlando Naval Training Center (NTC) is located in the western portion of the City of Orlando, Florida. The area of concern, Operable Unit 4 (OU-4), is located in Area C of the NTC and occupies approximately 46 acres. The site is surrounded by urban development to the north and south, Lake Druid to the west, and an office park to the east. The site is the former location of a dry cleaning and laundry facility, and currently serves as the Defense Reutilization and Marketing Office (DRMO). The area of investigation comprises approximately six acres which includes the eastern shore area of Lake Druid. Four of these acres are densely vegetated with large trees and heavy undergrowth. The remaining two acres have been classified as wetlands by the U.S. Department of the Interior, Fish and Wildlife Service (ABB-ES, 1996). Figure 1 presents a layout of the site including proposed treatment and monitoring wells.

Hazardous materials, such as dry cleaning solvents and waste generated from the dry cleaning process, were reportedly poorly managed. Wastewater from the process was allowed to discharge into the sanitary sewer through badly deteriorated trenches in the floor. The trenches emptied into a single pipe connected to a settling and surge tank. Due to the volume of wastewater discharged by the laundry machines, a 30,000-gallon surge tank was installed in the mid-1960s. Sludge was removed from this tank annually and disposed of by the DRMO. Additionally, discharges of the water contaminated with chlorinated solvents reportedly occurred on the property, including direct release into Lake Druid (Bechtel, 1997).

Site specific information supplied to SBP indicates that groundwater beneath the site is impacted with chlorinated hydrocarbons (CHCs) including perchloroethylene (PCE), trichloroethylene (TCE) and cis-1,2-dichloroethylene resulting from activities associated with the former dry cleaning facility at the site. Investigations conducted to date by ABB-ES indicated the level of CHCs is greater than 1,000 parts per billion (ppb) in the "hot spot" area from the former dry cleaning location (Building

1100) westward to the lake and into the lake. The source produced a westward migrating plume increasing in width and, in part, depth towards the lake.

1.2 Project Objectives

The objectives of this project are to install and operate vertical groundwater circulation well treatment system (or systems) to intercept and treat groundwater in a capture zone defined by an isopleth corresponding to 100 ppb total CHCs both vertically and horizontally. The capture zone was defined in the Final Conceptual Design (ABB-ES 1997) as 200 feet in width and approximately 46 feet in depth.

The scope of work consists of furnishing all equipment, labor, supervision, technical expertise, supplies and materials to successfully perform all facets of the design, installation, operation and maintenance.

1.3 Project Team

1.3.1 SBP Technologies, Inc.

The SBP project team is keenly aware of the necessity for proper project management, quality control and assurance, cost control and timely submittal of work products. SBP will be in charge of all project management aspects related to this project through the chain of authority. Specific responsibilities of several key personnel are outlined below:

- Project Manager - Amy Twitty, P.G.
  - Overall project performance, including;
    Approval of all work plans
    Preconstruction scheduling
    Staff assignments
  - Representation of SBP Technologies, Inc. at project meetings
  - Meeting technical requirements of the project
  - Subcontractor Services
  - Primary contact to Bechtel Environmental, Inc.

- Project Geologist - Susanne Borchert, P.G.
  - Construction of project systems, day-to-day oversight of field activities during the construction and operation phases of the project
  - Timely preparation and submittal of project progress reports to client
  - Reports to Project Manager

- Construction Manager - Thomas Buzzi, P.E.
  - Responsible for coordination of all field activities conducted by SBP
  - Reports to Project Manager

- Site Health & Safety - Charles A. Taus, Joseph P. Shearn
  - Responsible for day-to-day implementation and enforcement of corporate health and safety policies at the site
  - Reports to Corporate Health and Safety Officer

1.3.2 Subcontractors

SBP will utilize subcontracted labor and equipment to complete various aspects of this project. Drilling services will be subcontracted to Alliance Environmental, Inc.; the technology system (UVB) will be supplied by IEG Technologies, Corp.; and miscellaneous field activities and materials will be subcontracted as needed. All subcontractors will report directly to the Project Manager. A description of each subcontractor follows:

- Alliance Environmental, Inc. (Alliance) Drilling Services
  1090 East Pine Log Road, Suite B
  Aiken, SC 29803
  (803) 642-1803

Alliance is a Florida-licensed well driller with offices in Aiken, South Carolina. The firm has considerable experience in drilling and installing large diameter wells, and is very familiar with the geological conditions present at the site through their previous well installations at OU-4. Alliance will be responsible for all drilling and clearing activities during the project.

- IEG Technologies, Corp. (IEG) - Technology Components Supplier
  5015-D West W.T. Harris Blvd.
  Charlotte, NC 28269
  (704) 599-4818

  IEG is a remediation technology firm located in Charlotte, North Carolina. IEG is dedicated to the *in situ* treatment soil and groundwater contaminated with hazardous waste, such as volatile and semi-volatile organic compounds, pesticides and herbicides through biological, chemical or physical processes. IEG will provide the system operations and maintenance manual.

2.0 TECHNOLOGY DESCRIPTION OVERVIEW

2.1 Principles of UVB Technology

Two vacuum-vaporizer well systems, known as UVBs, will be installed at the OU-4 site. Each system develops a vertical groundwater circulation cell around the remediation well. The circulating groundwater transports volatile and semi-volatile contaminants in soil and groundwater to the well where they are removed using a combination of physical (e.g., air stripping) and biological (e.g., enhanced biodegradation) processes. Figure 2 presents a UVB well schematic and Figure 3 presents the well construction detail.

The design for the UVB system proposed for OU-4 incorporates a groundwater well with two screen sections, a groundwater stripping reactor located inside the extended well casing, and an above-ground blower used to generate the negative pressure inside the well. As a result of the reduced atmospheric pressure created inside the well by the blower, air enters the well through a fresh air inlet connected to the stripping reactor. The air forms bubbles as it jets through the pin-hole plate of the stripping reactor and mixes with the influent groundwater in the well casing. A mass transfer of contaminants from the water phase to the air phase takes place as the rising bubbles expand, and release the volatilized contaminant to the air exhausted from the well casing.

2.2 Site-Specific Application of the UVB Technology

The circulation cell creates a flow from the lower to the upper UVB screen in the aquifer and is proposed for the OU-4 site. Groundwater charged with constituents of interest (COI) mobilized from the circular flow path enters the UVB through the upper, influent screen section and is pumped to the stripping zone. After volatiles have been removed by the ambient air that is passively drawn into the stripping unit (due to the negative pressure environment inside the well chamber), the treated groundwater exits the stripping unit and is directed vertically downward through the UVB well. The clean water is dispersed radially into the aquifer through the lower, effluent screen. A reverse, torroidal circulation flow-pattern develops in the

saturated zone, continuously mobilizing and transporting dissolved phase constituents to the stripping zone. No groundwater mounding occurs around the UVB well since the hydraulic pressure is lower at the upper screen interval and higher at the lower screen.

3.0 SYSTEM INSTALLATION

3.1 Pre-construction Meeting

SBP and the drilling Subcontractor, Alliance Environmental, will attend a Pre-Construction meeting at the NTC Orlando with Bechtel, and NTC personnel. The field activities will be discussed, and the meeting will last approximately two hours. SBP and its subcontractors will be notified concerning vehicle passes and personnel badges.

3.2 Planned Working Hours

Regular NTC working hours are between 7:00 a.m. and 5:00 p.m., Monday through Friday, excluding Government holidays. Work outside regular working hours shall be coordinated through Bechtel's Field Superintendent who will coordinate with the Navy Technical Representative. Base security will be notified for work after hours and on weekends. SBP will work Monday through Saturday, 7:00 a.m. until 5:00 p.m., as allowed.

3.3 Temporary Facilities

SBP will set up a temporary field trailer near Building 1100 during the field activities. The trailer will be used as an office and to store small equipment. SBP will arrange for electrical hookup of the trailer but no plumbing facilities will be in the trailer. A portable toilet will be maintained at the site for the duration of fieldwork. Potable water can be retrieved from Building 1100. SBP and Alliance will be responsible for transporting the water to the drilling and decon areas.

3.4 Exclusion Zone

All field activities will be conducted deep within a highly vegetated area on a military base and not accessible by the public. The exclusion zones will be the area immediately behind and within 20 feet of the drill rig and its support equipment. No smoking will be permitted at the site, and all workers in the exclusion zones will wear hard hats, safety glasses and steel toed shoes at all times.

3.5 Security Measures

Small equipment will be stored in the field trailer. Large equipment will either be stored in Building 1100 or secured on the support trucks (i.e., piping, sand bags). Once the fences are built around the UVB compounds, the gates will remain locked to secure the blowers and electrical panels.

3.6 Overview of Field Activities

The construction sequence at OU-4 consists of three phases: (a) Preconstruction activities which include any project work required prior to breaking ground at the site; (b) Construction activities which include all activities pertaining to the installation of the treatment system; and, (c) Startup activities will include all system modifications and startup procedures subsequent to system operation. Following startup, Operation and Maintenance (O&M) of the system will be conducted for a period of five years (see SBP's Operation and Maintenance Plan).

During installation of the UVB systems and requisite monitoring wells (Construction activities), the following field activities will take place. SBP or its subcontractor's will perform the following field activities.

- Site clearing (Alliance)
- Site preparation (SBP)
- Well Abandonment (Alliance)
- Drilling of UVB and monitoring wells (Alliance)
- Concrete work (SBP)
- Installation of blowers (SBP)
- Installation of UVB equipment (SBP and IEG Technologies, Inc.)
- Piping of system (SBP)
- System start-up and monitoring (SBP and IEG)
- Waste hauling/disposal (Advantage Environmental Services)
- Monitoring and Reporting (ABB and SBP)

ABB-ES is the Navy's CLEAN II contractor responsible for monitoring the performance of the UVB systems with respect to the objectives of the IRA.

3.7 Clearing

Prior to drilling, the site will be cleared of any brush or small trees that would hinder the drilling activities. No trees less than six inches in diameter will be removed without prior approval from the Navy. Clearing and grubbing will be performed only to the extent absolutely necessary to perform system installation. Limited intrusive activities such as trimming tree branches or cutting ground cover may be necessary to provide access to new monitoring well locations in the wetland area. Clearing procedures are detailed in the Environmental Protection Plan (Appendix A).

3.8 Site Preparation

Site preparation activities will provide access to the drilling site and identify any site hazards to be removed or avoided. Preparation will also include ground preparation (if needed) and staging of temporary decontamination areas.

A temporary decontamination pad will be constructed in the staging area designated to be south of Building 1100 on the asphalt pavement. The decontamination pad will be built above-grade and will be lined with heavy duty plastic sheeting of sufficient width to provide a seamless, lapless liner for the decontamination area. All cleaning of drill rod, auger flights, well screen and casing, etc., will be conducted above the plastic sheeting using non-wood saw horses or other appropriate means. The decontamination pad will be equipped with a containment sump for the easy removal of decontamination fluids.

3.9 Well Abandonment

Existing recovery well OLD-13-RW-1 (RW-1) is located approximately 15 feet northwest of the proposed location of UVB-1 (Figure 1). This recovery well is screened from approximately 25 to 65 feet bls and has the potential to interfere with the development of the circulation cell of UVB-1. This could produce a "shadowing" effect, and result in an area where the groundwater is not fully captured in the "shadow" behind RW-1. Therefore, SBP will supervise the abandonment of RW-1 prior to well installation activities. In accordance with Bechtel's Standard

Specifications for Well Drilling, Installation and Abandonment, the subcontracted drillers (Alliance) will overdrill the existing recovery well with 6¼" hollow-stem augers using a Mobil B-61 drill rig and making an 11" to 12" borehole.

Since the original well boring was approximately 12" in diameter, most of the filter material would be reamed out of the borehole. Approximately 1.2 cubic yards of filter pack (sand) and 0.75 cubic yards of cement will be removed from the borehole. The well materials will be decontaminated and will be left on-site along with the concrete. The filter media will be placed with other IDW (soil) from drilling activities. Any broken concrete, bollards, similar non-contaminated construction debris will be disposed of along with general construction waste. The borehole will be grouted to the surface following the extraction of the well casing.

According to the St. John's River Water Management District (SJRWMD), no well abandonment permit is necessary to abandon wells less than six inches in diameter, therefore, no abandonment permit is required.

3.10 Drilling

SBP will notify SUNSHINE utility locators 48 hour before drilling activities to locate any existing utilities on-site. SBP/Bechtel will also notify the NTC personnel five working days prior to any excavating/drilling activities in order to schedule with Public Works personnel to scan the area for unmarked utilities and to obtain a base excavation permit. Confirmation of existing underground utilities (if any) and their location will be delineated at the site location prior to drilling activities. SBP will verify the markings prior to any intrusive work.

All soil cuttings will be separated at the surface to reduce handling of potentially hazardous waste. All wastes will be managed in accordance with SBP's Waste Management Plan (Appendix B).

3.10.1 Monitoring Well Installation

In addition to the UVB circulation wells, a total of 11 monitoring wells will be installed as requested in the subcontract agreement. Figure 1 show the monitoring well locations. All monitoring wells will be installed by Alliance Environmental with a CME 55 all-terrain-vehicle (ATV) drill rig. No well permits are necessary for the monitoring wells since they are less than six inches in diameter. The five Group A wells will be placed as directed by Bechtel to evaluate the *in situ* groundwater treatment system's effects on the surficial aquifer. The primary function of these wells is to complete the overall monitoring system for the groundwater contaminant plume. The wells will be used to collect samples for chemical analysis or for measuring water levels. The Group A wells will be installed simultaneous with the UVB wells.

Six wells, designated as Group B wells, will also be installed in clusters of two each in three locations: 15, 30 and 60 feet north of the northernmost circulation well (UVB-1). These wells will be located cross gradient (north-south) and extend to depths of 20 and 40 feet bls. Subsequent to approval by Bechtel, SBP may slightly alter the screened intervals of the wells based on field observations during drilling. Figure 1 presents the approximate location of the UVB wells and the monitoring wells. The Group B wells will be installed subsequent to the Group A well installation and possibly concurrent with the final UVB well installation.

The following table presents the well construction details for the monitoring wells. Each well is 2" in diameter and has a five foot screened interval.

Well Number	Total Depth	Screen Interval
GROUP A WELLS	(feet bls)	(feet bls)
OLD-13-21	33	28-33
OLD-13-22	33	28-33
OLD-13-23	21	16-21
OLD-13-24	15	5-15
OLD-13-25	30	25-30
GROUP B WELLS		
OW-6	20	15-20
OW-7	40	35-40
OW-8	20	15-20
OW-9	40	35-40
OW-10	20	15-20
OW-11	40	35-40

The monitoring wells will be constructed in general accordance with the well diagram included as Figure B-2 of the Interim remedial Action Performance Sampling Plan (forwarded to SBP by Bechtel) referenced as Figure 4 to this document. The monitoring wells will be constructed of rigid, Schedule 40 PVC. Well screens will be 0.010-inch continuous wrap as specified in Appendix E of the Subcontract document (unless otherwise directed by Bechtel). Backfill material for the monitoring wells will consist of 20/30 silica sand filter pack tremmied to two feet above the well screens. Bentonite slurry seals will be placed to two feet above the sand pack. The wells will be grouted to the surface using Type I or Type II Portland cement and water. The grout will consist of no more than seven gallons of water per 94 lb bag of cement with a 4% bentonite mixture. All monitoring wells will be completed above grade with steel-enclosed, locking well covers (Figure 4).

Four guard posts will be installed around all above-ground wells or well clusters. The guard post construction will consist of steel pipe four inches in diameter with a minimum length of 6 ft. The guard posts will be installed to a minimum depth of 3 ft bls in a concrete footing and extend a maximum

of three feet above ground surface. Concrete shall also be poured into the steel pipe for additional strength. The posts shall be plumb and painted as directed by Bechtel.

3.10.2 UVB Well Installation

The UVB systems will be installed in ten inch inner diameter (ID) well casings. The location of each well is shown in Figure 1. The boreholes will be sixteen inches in diameter and will be advanced by a Bucyrus-Erie 22W or 60L cable tool drill rig. Alliance Environmental will procure the necessary permits prior to drilling. A well construction permit will be obtained from the SJRWMD. A consumptive use permit is not necessary for the UVB wells.

After borehole completion, well screens will be threaded to the riser pipe and set in the hole. The screens will be sand packed with a filter pack between the well screen and the natural formation materials. A layer of fine sand will be added below the upper and on top of each filter pack interval. The remaining space between screens will be composed of grout. A layer of bentonite chips will be placed above the grout below the upper UVB screen. Each well section will be isolated with packers to minimize the amount of development water removed. All well construction material will be installed as per the manufacturer's specification. A detailed well completion diagram is shown in Figures 2 and 3.

3.11 Well Development

Well development shall be conducted after well installation but prior to final hookup of the treatment system. The wells will be developed to increase yield and to remove fluids that may have been introduced during drilling operations. Development will be initiated no sooner than 24 hours and no later than 72 hours following completion of grouting.

Spent development water will be pumped into an on-site, 4,000-gallon holding tank, sampled for COI or other parameters as required for final treatment and then either disposed of into the City of Orlando's Waste Water Treatment Plant via the sanitary sewer or at a permitted off-site facility (see Waste Management Plan).

Recommended development of monitoring wells shall be accomplished by using a swab/surge block and accompanying assembly and a submersible pump. No air or water will be injected into the wells during development. Each well will be developed and surged by removing a minimum of five well volumes, until the water is clear and free of apparent turbidity and/or until field measurements of specific capacity, pH, conductivity, and temperature have stabilized. At well locations with very slow recharge or little water, wells will be developed to dryness three times.

3.12 Concrete Pads

One eight (8) foot by eight foot concrete pad will be installed as a foundation for the UVB equipment around each UVB well. The pad will be constructed of four (4) inch thick reinforced concrete on a 1½ inch crushed stone base eight (8) inches thick to divert storm water from entering the UVB compound. The wellhead, blower and electrical panel will be installed on the concrete pad. Figure 5 presents the layout of the equipment pad.

3.13 Fencing

The blower and wellhead will sit on a concrete pad and will be enclosed within a six foot high chain-link fence (Figure 5). The fence will be surrounded by barbed wire along the top for security purposes. There will be one, four foot gated entrance to each of the UVB well compounds that will be secured with a keyed lock.

3.14 Installation of Blowers

The 5 HP blowers will be installed on the concrete pads (Figure 5). The blowers will be used to induce the vacuum within the UVB wells and extract stripped contaminants. Vapors extracted from the subsurface will be emitted into the atmosphere without any treatment through a 4" HDPE stack at seven (7) feet above the cement pad.

Preliminary air emission calculations were performed for each system using a pumping rate of 40 gallons per minute (gpm) or 57,600 gallons per day (gpd) which corresponds to approximately 223,200 liters per day (L/d). At an approximate VOC

concentration of 3,900 micrograms per liter (μg/L), and a 100% removal efficiency, the mass flow was calculated as:

mass flow = 3,900 μg/L x 223,200 L/d = 870.5 grams per day or 2 lbs/day

This means that approximately 2 pounds of VOCs will be emitted into the atmosphere per day for *each* UVB system (total 4 lbs per day) based on a worst-case scenario. Approximately 30,000 μg/L would be the maximum groundwater VOC concentration it would take to exceed the Florida standard of 15 lbs per day. Once the circulation cells develop, a mixing of 39%, captured upgradient and 61% treated, clean groundwater occurs, further reducing the total concentration of VOCs in the influent upper screen of the UVB.

From past experience at similar sites, SBP suggests taking samples on Day 0 (at time study after system reaches steady state), Day 1 (24 hours after startup), Day 7, 21 (at end of each week) and then on an as-needed basis (no less than quarterly) to confirm a consistent low or decreasing value. The highest air emissions are always observed within the first week of operation and sharply decrease after the first month.

3.15 Installation of UVB Equipment

The UVB system, consisting of an air stripper, pumps and associated piping, will be installed following well development. Alliance will lower the internal UVB well components into the well as shown in Figures 2 and 3. This will include the HDPE pipe, pumps, packers, and hoses. All material will be installed to the top of the 10 inch well casing. The UVB stripping reactor will be installed on top of the well head. Figure 6 presents details of the packer, wellhead and flange. A description of the piping installation follows:

- A 2 $^{9}/_{16}$ inch (65 mm) discharge pipe will be placed in the center of the lower screen and below the packer for recirculating 40 gpm (9 m^3/hr) treated water.

- A packer will be placed between the upper and lower well screens.

- A submersible pump (Pump No. 1) will be located in the upper well screen and will pump 40 gpm (9 m^3/hr) of water up a 2 $^9/_{16}$ (65 mm) pipe to the stripper.

- A sump pump (Pump No. 2) will be placed in the annulus space between the stripper and the extended well-head casing. Treated groundwater collected in this area is pumped to the outlet below the packer through the 2 9/16 inch (65 mm) discharge pipe.

- The stripping reactor will have a fresh air intake pipe which extends above grade.

- The influent water pipe will be connected to the stripper will have an in-line flowmeter/totalizer. Treated water will be directed to a sump by gravity feed, from where it will be drawn in by Pump No. 2 and discharged to the lower screen.

- A flow meter will also be installed to monitor the flow of discharge water on the effluent line as a low water shutoff. The sump pump will be installed with two level switches. One will be a low level shutoff switch. The second switch will set as a high level shutoff switch (when water in the canister reaches 50% of capacity). Each pump and blower will have automatic sensors in case any one of the three units fail, the entire system shuts down and the autodialer goes into effect. Also, each pump will have a manual override located on the electrical control panel and can be turned off at any time.

Once the plumbing and internal equipment are connected, the top of the well will be sealed with a flange. The flange will have an opening for the fresh air intake pipe. The fresh air intake pipe will have a sampling port installed to monitor intake velocities. In addition, the 4" opening on the flange will be used to connect piping to the blower influent.

Once all connections are made, a system check will be conducted to ensure that:

- Water flows through the piping
- Sufficient vacuum is achieved in the well
- Flow meters function
- Intake air is sufficient
- Blower functions properly

3.16 Monitoring and Reporting

SBP will prepare a daily report for submittal to Bechtel after each work day. At a minimum, the daily report will include the following:

- Date and time of field activity
- Personnel on site
- Visitors on site
- Subcontractor(s) on site
- Equipment on site
- Activities completed during the day
- Projected activities for the following day
- Health & Safety monitoring results
- Signature of preparer

A copy of the daily report log is provided in Appendix C. The systems are designed for continuous operation. In case of a power or equipment failure, safety devices activate and a telemetry system notifies SBP personnel for immediate servicing. Bechtel will be notified within 24 hours on any non-maintenance shut down and a report will be filed within 48 hours. Following system optimization (one to three weeks after startup), routine O&M reports will be prepared by SBP biweekly on the following:

- Air flow rates into and out of the UVB well
- Packer pressure
- Flow meter readings
- Emission mass flow rate and concentration (VOCs)
- The condition of the fan belt and air hose
- The condition of the UVB moisture knock-out

- The condition of the packers and cables
- Vacuum gauge readings (adjust regulators as necessary)
- The condition of the fresh air pipe (check for bindings/clogging)
- Verify proper functioning of submersible and sump pumps
- Verify proper functioning of electrical system

3.17 Site Survey

SBP or its subcontractor will perform a field survey after fieldwork is completed. The purpose of the survey will be to determine the horizontal coordinates as well as the elevations of all treatment and monitoring wells. A complete set of the survey maps will be maintained on-site for the duration of the Operation and Maintenance.

3.18 Site Restoration

As described in the Environmental Protection Plan (Appendix A), SBP will restore the site to its original condition after work is completed. Exceptions to this will be in the road/access clearing that will remain cleared for the duration of the project. Some small bushes and trees may need to be removed for site access and well installation. The small, wild vegetation will not be replaced due to the density of the vegetation at the site. Minimal clearing will be performed in the wetland areas since existing access roads will be used.

3.19 Inspection Log

Appendix D presents the Inspection Schedule Log developed for this project. SBP will complete this log by identifying tasks and/or definable features of work from the design, plans, regulations and/or procedures for quality control inspection by Bechtel personnel. Each task will be monitored during the Preparatory, Initial, and Follow up phases and recorded in the Inspection Schedule Log.

3.20 Project Schedule

The construction project schedule is located in Appendix E and is based upon deadlines contained in Bechtel's subcontract agreement with SBP.

4.0 TESTING, STARTUP, AND BALANCING PLAN

In accordance with contract requirements, SBP has developed the following Testing, Startup, and Balancing Plan (TSBP) that describes procedures to help ensure technical compliance with the design, and operation of the UVB systems. The various components of the TSBP are described in detail below.

4.1 Pre-Startup Check

Pre-startup check is an important part of the TSBP. Pre-startup check will include identification and inspection of all equipment and materials shipped to the site. All equipment received will be identified against a check list. The equipment will be inspected for damages, and for specifications. Pre-startup check will also involve connecting the UVB components above ground and measuring dimensions to match the UVB well and screen intervals.

All mechanical and electrical equipment (blowers, pumps) will be tested above ground to ensure proper operation. All electrical connections will be checked for wiring, circuit breakers, etc. The site construction manager will be responsible for the pre-startup checks specifically the following:

4.1.1 UVB Installation

- HDPE stripper plate installed plumb and level
- HDPE sump installed
- Downhole submersible pump installed and operable
- Sump pump(s) installed and operable
- Flow meters (w/gate valve) installed and operable
- Piping properly anchored

4.1.2 Blower/Pump Installation

- Blower installed and operable
- Piping properly installed and supported; leakage test performed on joints and connections
- Installation of flexible conduit within specifications for bending
- Butterfly valves installed, marked and in operating condition

4.1.3 Electrical Installation

All electrical connections and installations completed and certified by licensed electrician in accordance with local codes (see Figures 7 and 7a).

- Motor Control Station (MCS) installed
- MCS switches properly marked
- MCS settings and relays
- Confirmed Motor Overload Protection settings
- Low Level Limit switch for shutoff of sump pump 1
- High Level Limit switch for reduction of downhole pump motor speed tested
- Indicator lights installed and tested
- Overload Protection installed and tested (system shutdown)
- All motors checked for proper rotation
- Pumps wired to downhole junction box
- Check all electrical connections for proper grounding

4.2 System Startup

System startup will begin after system installation (see Section 3.0), and will include operational testing of the subsurface and surface equipment prior to initial startup.

4.2.1 Subsurface System Checks

The subsurface systems include the two pumps, the two flow meters, and an inflatable packer. Pump No. 1 will be switched ON first to see if water can be extracted through the upper UVB screen. This will result in a rise in the water level inside the UVB casing. The pump will also be calibrated for flow rate using the in-line flow meter.

With the pump No 1 switched ON, and set at a flow rate of 40 gpm, pump No. 2 will be switched ON to see if it can pump treated water back into the aquifer through the lower UVB screen. This will be confirmed by observing a drop in water level in the UVB casing. This pump will also be calibrated using the in-line flow meter. The flow rate of pump No. 2 will also be set at 40 gpm.

Pressure will be placed (utilizing a portable compressor/air tank) on the inflatable packer will be monitored hourly to see if it holds steady.

4.2.2 Surface Equipment Checks

Surface equipment consists of a blower. The blowers will be turned ON, and checked for vacuum pulled on the well as well as influent and effluent air flow rates. Vacuum pulled on the well will be varied by controlling the butterfly valve on the blower. Typically, vacuum pulled should range from 20 inches of water (50 to 60 mbars). Influent air flow rate should range from 150 to 200 cubic feet per minute (cfm). Air flow measurements will be conducted using air velocity meters.

4.2.3 Steady State Operations Check

During the steady state operations check, the UVB system will be set to operate under optimum conditions (constant water level in the canister) of water flow, air flow and vacuum for a period of eight to ten hours (usually overnight). Operating conditions are measured after 10 hours of continuous operation to see changes, if any. Changes of +/- 10% in parameter values is considered to be a stable operation.

4.2.4 Control Systems Check

The control systems include those for controlling and adjusting the flow rates on the two pumps, the high and low water switches on the pumps, and the telemetry system.

The variable speed submersible pump will be checked to see if the range of specified flow rates can be obtained. The high and low water switches will be tested by intentionally switching the pumps OFF. The telemetry system will also be checked by intentionally switching OFF the power to the system.

4.2.5 Adjusting/Fine Tuning the Treatment System

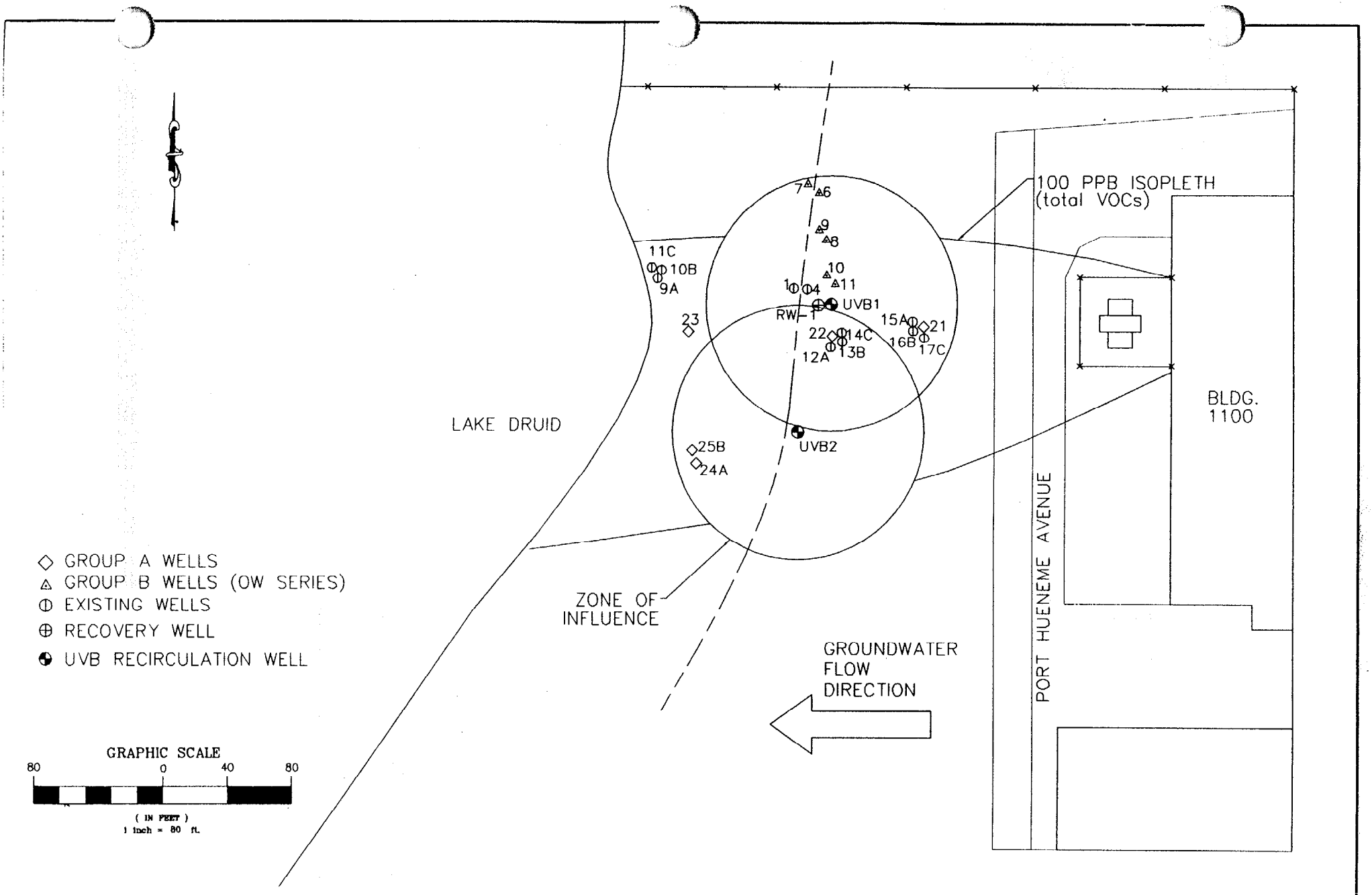
Adjusting and fine tuning the treatment system is based on operating the system at an air to water ratio which will maximize the stripping efficiency, and maximize the mobilization and transport of contaminants to the well for treatment. The optimal conditions are outlined in the design report. The stripping efficiency will be determined by analyzing groundwater influent and effluent samples for VOCs. The zone of influence of the circulation cell will be determined by conducting a pressure transducer test.

5.0 REFERENCES

ABB-ES, 1997, Interim Remedial Action, Conceptual Design and Performance Specification, Operable Unit 4, Draft, November 1996

ABB-ES, 1996, Interim Remedial Action, Focused Field Investigation (FFI) Report, Operable Unit 4, Draft, November 1996

Bechtel, 1997, Subcontract No. 22567-304-SC-0734, In Situ Recirculation Wells Treatment System, OU-4, Orlando, Florida

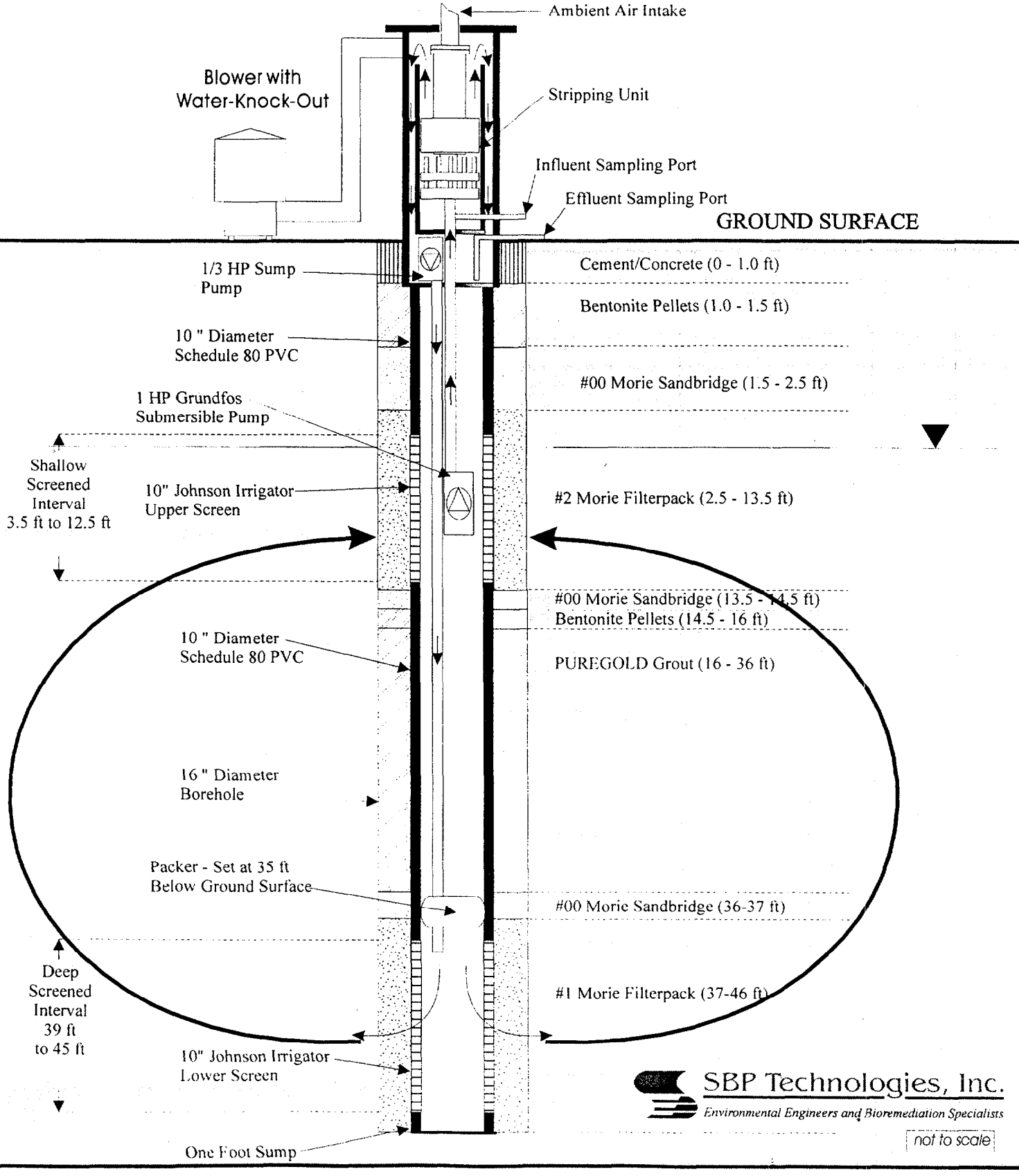


SBP Technologies, Inc.

Environmental Engineers
and Bioremediation Specialists
A Subsidary of The EICON Group, Inc.
Connecticut, Florida, Maryland

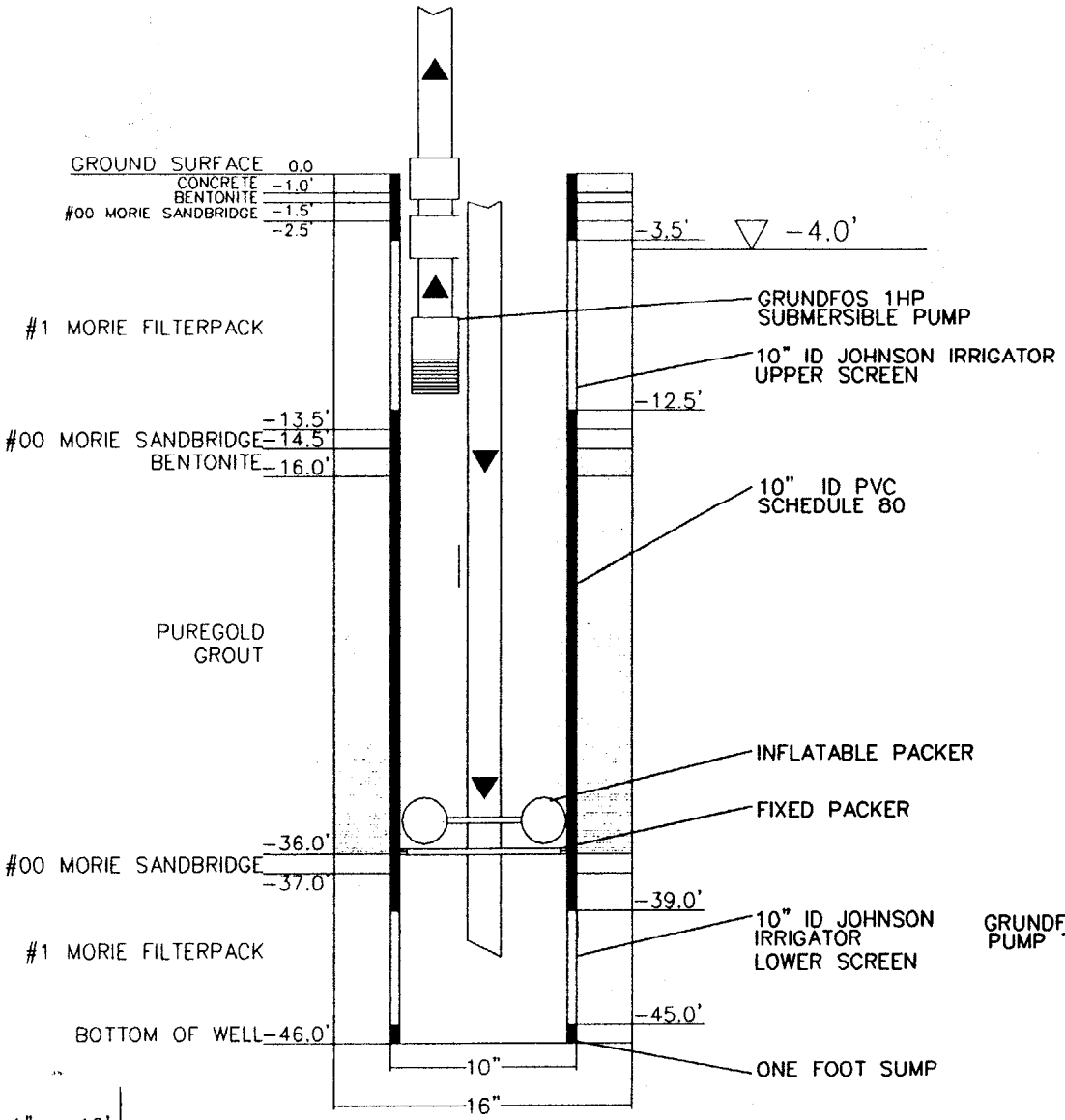
PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER		
DWG. TITLE	SITE PLAN	SCALE	AS NOTED
DRAWN BY	CAT	DWG. NO.	FIGURE 1
DATE	6/25/97	PROJECT NO.	T7027.10

FIGURE 2
UVB CIRCULATION WELL SCHEMATIC
ORLANDO NAVAL TRAINING CENTER, OU 4
ORLANDO, FLORIDA

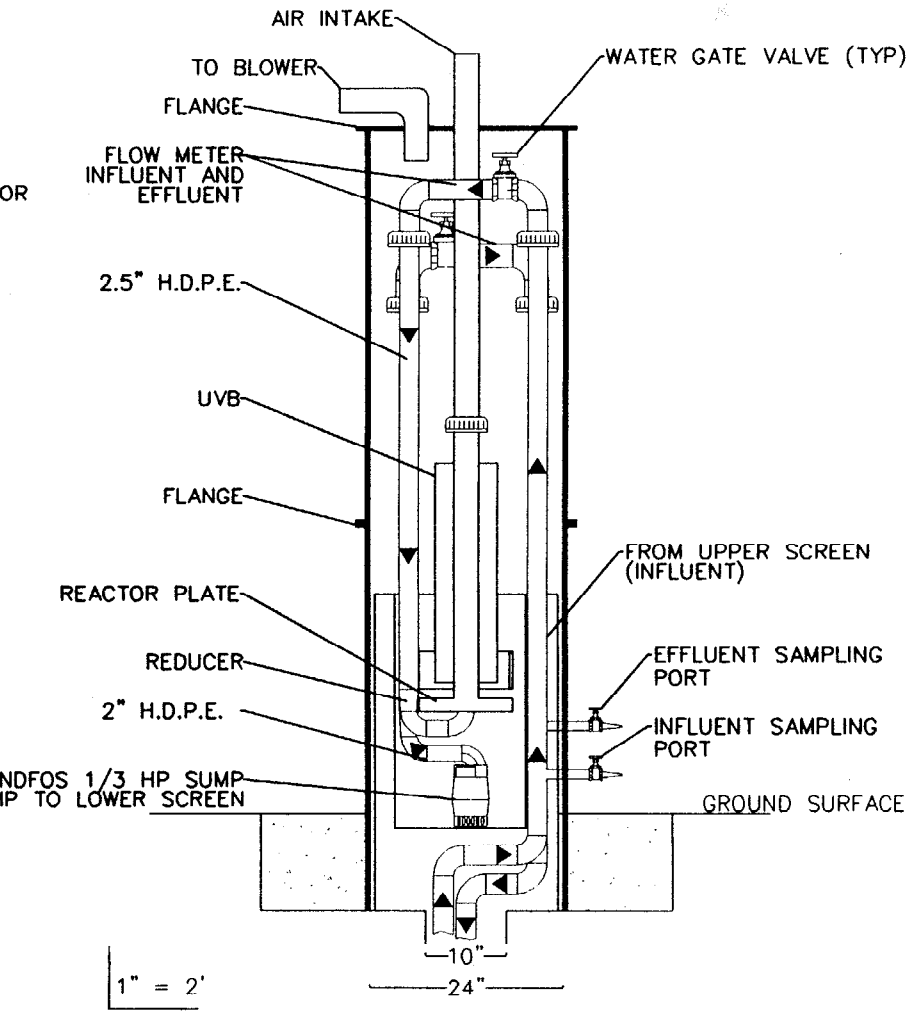


SBP Technologies, Inc.
Environmental Engineers and Bioremediation Specialists

not to scale



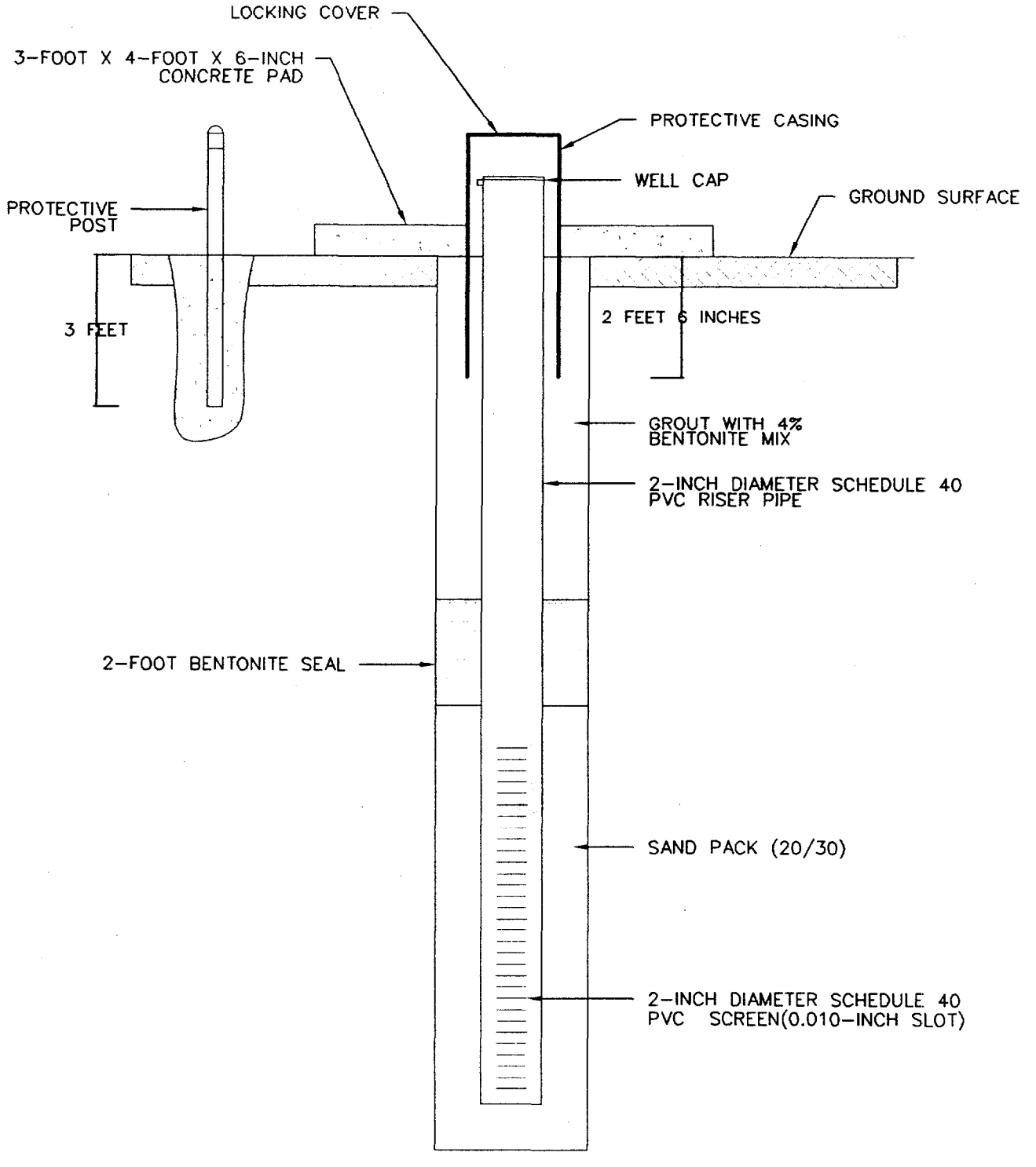
WELL DETAIL



UVB CANISTER DETAIL

SBP Technologies, Inc.
Environmental Engineers
and Bioremediation Specialists
A Subsidary of The EICON Group, Inc.
Connecticut, Florida, Maryland

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER, OU-4
DWG. TITLE	UVB WELL CONSTRUCTION DETAIL
SCALE	AS SHOWN
DRAWN BY	CAT
DWG. NO.	FIGURE 3
DATE	8/27/97
PROJECT NO.	T7027.10



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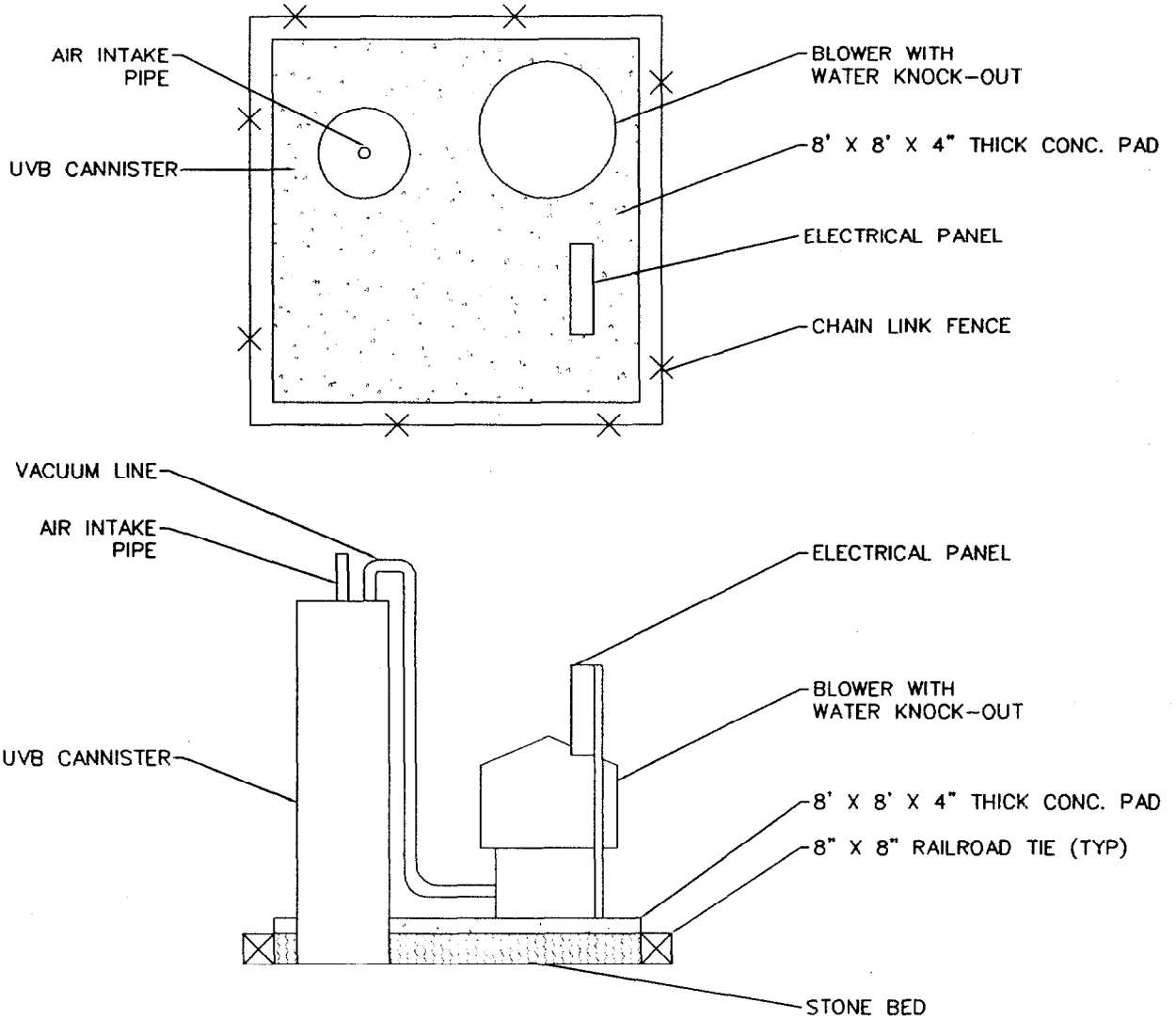
Connecticut, Florida, Maryland
New York

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER		
DWG. TITLE	MONITORING WELL DIAGRAM	SCALE	NOT TO SCALE
DRAWN BY	CAT	DWG. NO.	FIGURE 4
DATE	9/3/97	PROJECT NO.	T7027.10



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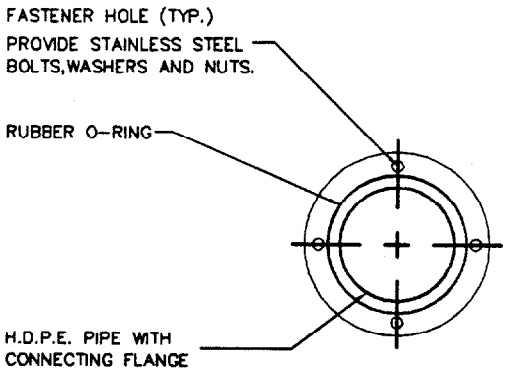
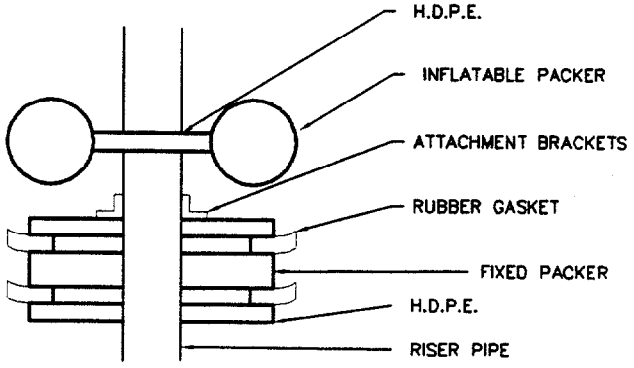
Connecticut, Florida, Maryland
New York

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER		
DWG. TITLE	EQUIPMENT PAD	SCALE	1" = 4'
DRAWN BY	CAT	DWG. NO.	FIGURE 5
DATE	8/27/97	PROJECT NO.	T7027.10



CONNECTION FLANGE DETAIL

NOT TO SCALE



PACKER DETAIL

NOT TO SCALE

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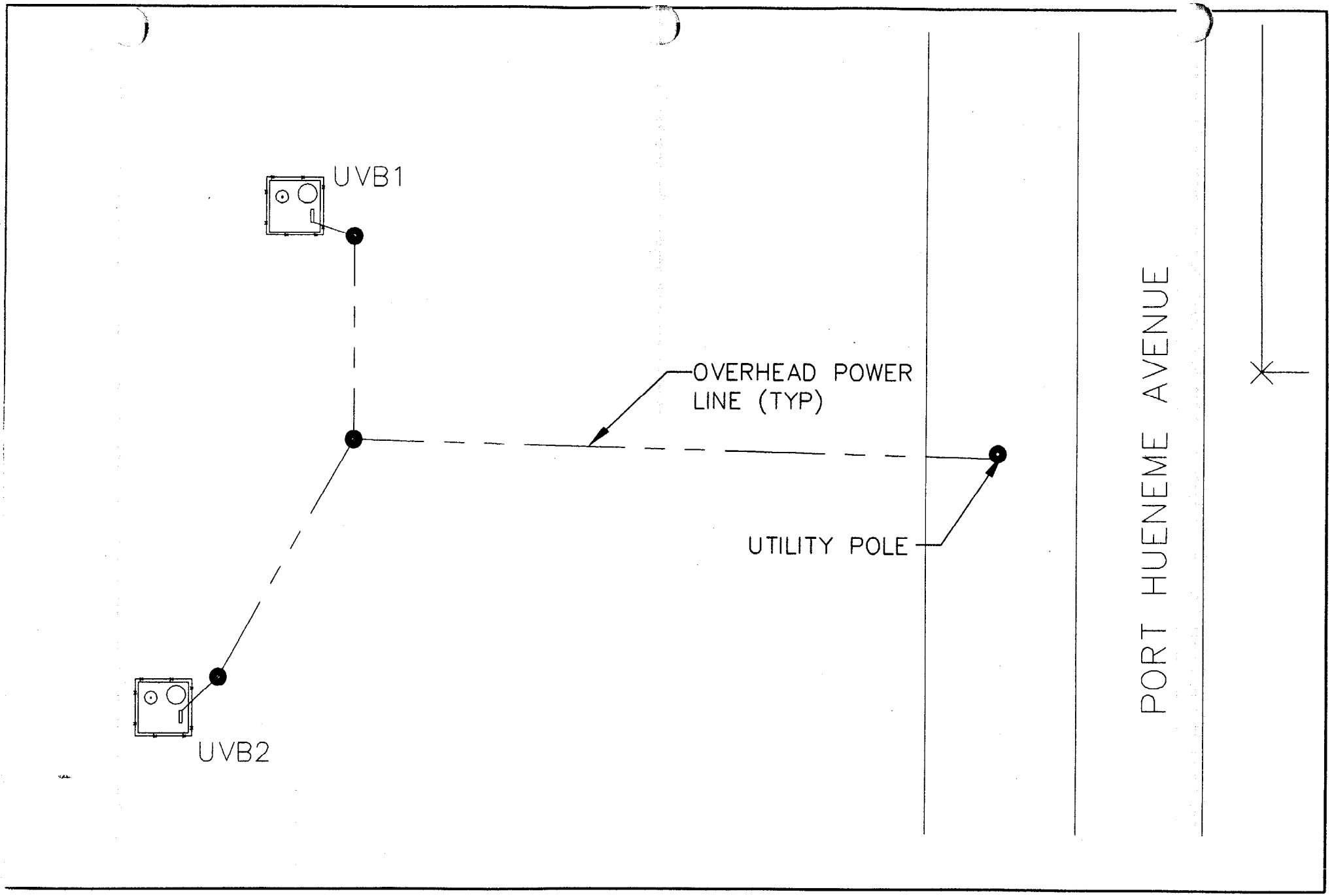
Connecticut, Florida, Maryland
New York

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER OU-4		
DWG. TITLE	PACKER & FLANGE DETAIL	SCALE	NTS
DRAWN BY	AJM	DWG. NO.	FIGURE 6
DATE	8-15-97	PROJECT NO.	T7027.10



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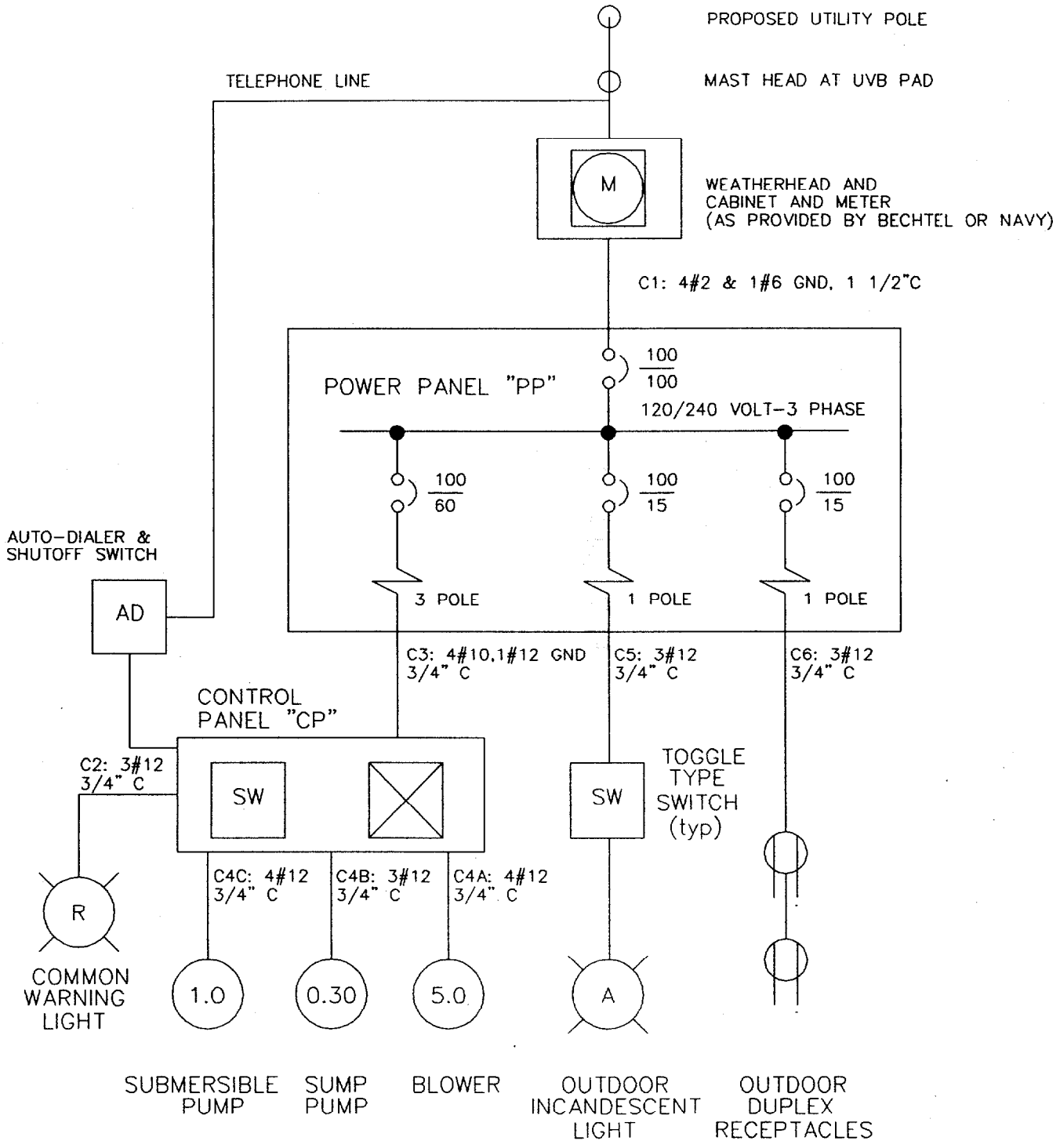
New York

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER, OU-4		
DWG. TITLE	ELECTRICAL POWER ROUTING	SCALE	1" = 20'
DRAWN BY	CAT	DWG. NO.	FIGURE 7
DATE	9/3/97	PROJECT NO.	T7027.10



TYPICAL SINGLE LINE DIAGRAM

SBP Technologies, Inc.
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New York

PROJECT TITLE	ORLANDO NAVAL TRAINING CENTER		
DWG. TITLE	SINGLE LINE DIAGRAM	SCALE	N/A
DRAWN BY	AJM	DWG. NO.	FIGURE 7A
DATE	9-2-97	PROJECT NO.	T7027.10

APPENDIX A
ENVIRONMENTAL PROTECTION PLAN

ENVIRONMENTAL PROTECTION PLAN
OPERABLE UNIT 4
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

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Bechtel Job No. 22567
SBP Project No. T7027.10
Contract No. N62467-93-D-0936
Subcontract No. 22567-304-SC-0734

SEPTEMBER 3, 1997

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FIGURES

Figure 1 Facility Map Area C and Location Map OU-4

1.0 DESCRIPTION OF THE ENVIRONMENTAL PLAN

1.1 General Overview and Purpose

The purpose of this Environmental Protection Plan is to outline the methods and responsibilities for protection of natural resources and the environment during implementation of the remedial activities at operable Unit 4 (OU-4). To accomplish this goal, SBP Technologies, Inc. (SBP) will comply with applicable Federal, State, local, and base environmental laws, properly control and dispose of all waste generated, document and report on pollution prevention measures, and prepare all reports required by outside agencies.

The objective of this project is to intercept and treat the most contaminated portion of the groundwater in the surficial aquifer to prevent it's migration into Lake Druid.

1.2 General Site Information

The Naval Training Center (NTC), Orlando, Florida, covers 2,019 acres in Orange County, Florida. The complex is comprised of four noncontiguous properties: the Main Base, Area "C," Herndon Annex, and McCoy Annex. The majority of the operational and training facilities within the NTC complex are located at the Main Base, which lies entirely within the city limits of Orlando. Area "C" is the primary supply center for the complex. All work under this contract will be performed in Area "C". A site location map has been attached as Figure 1.

NTC Orlando is scheduled to be closed by 1999. Remedial actions are necessary at NTC Orlando in order to meet the Department of the Navy's requirements for property disposal and reuse activities associated with the base closure.

Interim remedial actions for this project will consist of the installation of 11 groundwater monitoring wells and two groundwater circulation wells (UVBs) as well as the abandonment of existing recovery well RW-1.

2.0 PROTECTION OF NATURAL RESOURCES

SBP will preserve natural resources within the project boundaries. Preservation of natural resources will be achieved through the use of project procedures designed to minimize environmental impacts and restore areas that must be disturbed during the course of remedial activities.

2.1 Clearing

OU-4 is located in a heavily vegetated area with high grass, scrub brush and trees. Three of the monitoring wells are located within the wetlands. It will be necessary for SBP to clear some of the brush in order to install the wells in their appropriate locations. SBP will take due care to minimize the amount of clearing required to complete the field activities at OU-4. A smaller, all-terrain drill rig will be used to drill the monitoring wells in order to avoid unnecessary clearing in those areas. As directed by the Navy, through Bechtel, the small brush and trees will be laid aside and scattered throughout the site for natural decomposition. It is not anticipated that the removal of trees greater than six inches in diameter will be required. No trees greater than six inches in diameter will be removed without prior approval by the Navy.

2.2 Replacement

SBP will restore landscape features damaged by equipment operations. Work Plans will identify trees and other landscape features that will be removed or affected by the interim remedial action.

2.3 Temporary Construction

SBP will remove traces of temporary construction facilities such as equipment staging areas, decontamination facilities, excess soil or construction materials and stock pile areas. Every attempt will be made to ensure that any temporary construction will not disturb the wetland area. The equipment and waste staging area will be located outside the wetland boundary.

2.4 Fish and Wildlife Resources

Fish and wildlife will not be unnecessarily disturbed. Small tributaries, drainways and other significant native habitats will be protected by either total avoidance, or if passage is necessary, inflicting minimal impact. Where possible, any alteration to the habitat will be restored as quickly as possible. SBP will assist Bechtel and the Naval Training Center to coordinate any necessary actions with Natural Resource Trustees. Due care will be taken to protect the on-site male peacock at all times. Before heavy equipment is moved into an area, personnel will enter on foot and check for the peacock. If present, he will gently be encouraged to move from the area. The animal's response to any intrusion will be monitored and activities causing him stress will be stopped until he is safely out of the area. Prior to start-up, SBP will coordinate with Bechtel and the Navy's Natural Resource staff.

2.5 Wetland Areas

SBP will not disturb any wetland area without authorization. Bechtel and FDEP are aware that at least three 2-inch monitoring wells will be installed in the wetlands area on the eastern shore of Lake Druid. Measures to minimize wetland impact will include such activities as limited vegetation clearing and containerizing drill spoils and development water. Minor adjustments to well locations may be made to avoid excessive clearing. Proper notification on permitting will be obtained prior to work in the wetland areas. Approval may be required by an affected state or local agency, or the Army Corps of Engineers. Bechtel will assist the Naval Training Center in obtaining any necessary approvals.

3.0 PROTECTION OF HISTORICAL AND ARCHAEOLOGICAL RESOURCES

3.1 Objective

There are no known structures or features of historical significance in the work area. SBP will preserve and report to the Bechtel site superintendent historical or archaeological items or human skeletal remains discovered in the course of work. In the event that any such items are discovered, work shall be stopped immediately.

3.2 Methods

SBP will provide guidance and training to field operations supervisors on the importance and requirements related to historical resource protection.

4.0 PROTECTION OF SURFACE SOIL, VEGETATION, AND SURFACE WATERS

4.1 Ground Cover

Burnoff of ground cover will not be permitted. Some vegetation clearing will be necessary. Drill rig access will be bush-hogged while areas surrounding the monitoring wells may be cleared with a chain saw, machete or sickle. Limited manual clearing (i.e., trimming back brush or tree limbs) will be performed along existing access routes through the wetland area. No heavy equipment will be used in the wetland areas for clearing.

4.2 Erodible Soils

Protection against erosion will be implemented by using staked hay bales and/or silt fencing whenever necessary to prevent sedimentation of drainways which are tributaries to Lake Druid. Surface disturbance/grading is expected to be limited to an area approximately 15 ft X 15 ft at each UVB well.

4.3 Temporary Measures

The following methods will be used to prevent erosion and control sedimentation.

4.3.1 Mechanical Retardation and Control of Runoff

SBP will mechanically retard and control rate of runoff from the site. The stationing of staked hay bales and temporary silt fences, if necessary, should prove sufficient to retard and divert runoff to protected drainage courses.

4.3.2 Vegetation and Mulch

SBP will provide temporary protection on side and back slopes as soon as rough grading is completed if sufficient soil is exposed to require erosion protection. Slopes will be protected by accelerated growth of permanent vegetation, mulching, or netting.

5.0 PROTECTION OF THE ENVIRONMENT FROM POLLUTION DERIVED FROM OPERATIONS

5.1 Control and Disposal of Solid and Sanitary Wastes

Solid wastes will be collected, placed in containers, and regularly emptied at intervals to prevent the attraction of rodents or disease vectors. Debris, garbage, and sewage will be managed according to applicable Naval Training Center procedures and requirements in compliance with applicable laws and regulations.

General procedures for collecting, labeling, tracking, and properly disposing of solid wastes are addressed in the Navy RAC Program Waste Management Plan. Additional guidance is provided in the task-specific Waste Management Plan for OU-4.

5.2 Management and Disposal of Hazardous Waste

Procedures and requirements for the identification, storage, transportation, and disposal of hazardous waste, as defined in the Resource Conservation and Recovery Act (RCRA), are described in the task-specific Waste Management Plan.

5.3 Fugitive Emissions

SBP will monitor the production of fugitive emissions (i.e., dust) from drilling activities (visual inspection only). If high levels of dust are produced, the drillers will be instructed to wet the cuttings with potable water to lower the dust emissions.

6.0 NOTIFICATION OF ENVIRONMENTAL OCCURRENCES

Environmental occurrences will be recorded and reported to the Bechtel site superintendent. Bechtel will provide notification to the Resident Officer in Charge of Construction (ROICC) for NTC. For an emergency or an occurrence involving CERCLA/Superfund Amendments and Reauthorization Act (SARA) reportable event (e.g., spill), the event must be reported to the National Response Center (telephone number 1-800-424-8802).

7.0 WASTE MINIMIZATION AND POLLUTION PREVENTION

An important element of providing environmental protective measures is to minimize the volume and toxicity of all wastes that are generated, or existing wastes that are being managed, to the extent practical. To achieve this goal, management must maintain project employees' awareness of waste management policies, plans, procedures, and activities.

7.1 Volume Reduction

Due to decreasing available disposal space, increasing disposal costs, and liability associated with hazardous material, a greater emphasis is being placed on waste reduction. Because new waste will be generated as a result of response actions and not by process operations, only a limited number of waste minimization techniques are appropriate. Techniques that will be used to minimize the volume of newly generated waste include material segregation, consolidation, loss prevention, reuse, and good housekeeping.

The decontamination pad will be built to contain liquid. Decontamination fluid will not be pumped out of the containment until the end of the day allowing for volume loss due to evaporation. Soil waste from drilling activities will be segregated into two roll-off bins of potentially contaminated and potentially noncontaminated material. Personal Protective Equipment will be used conservatively and disposed only if it poses a contaminant threat or the integrity has been compromised.

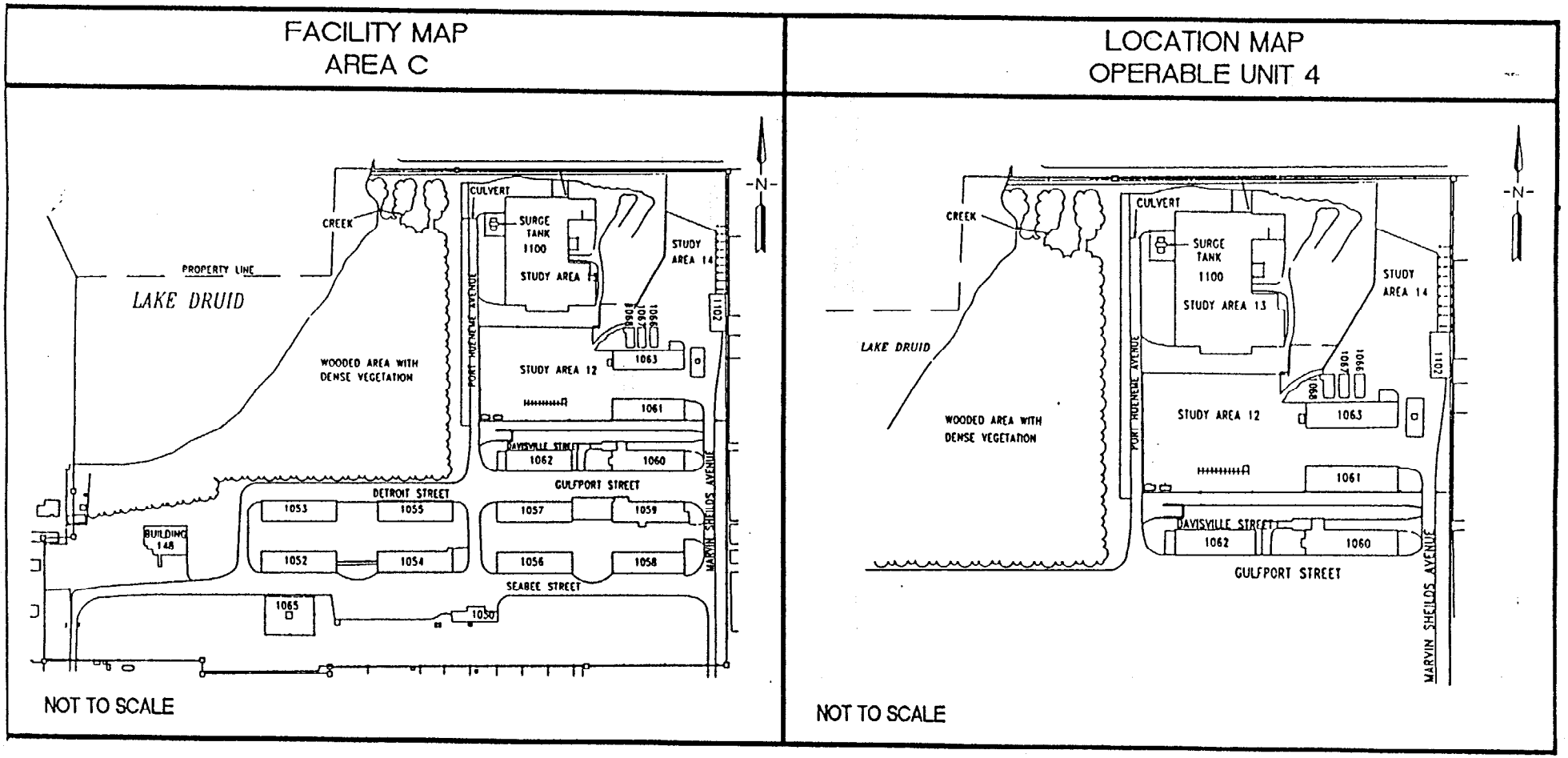
7.2 Reduction of Toxicity

The toxicity of waste managed as part of remedial activities must be reduced to meet RCRA requirements for hazardous waste disposal. Reduction of waste toxicity will be achieved when required by RCRA land disposal restrictions, as well as when appropriate to achieve CERCLA cleanup goals.

8.0 APPLICATIONS AND PERMITS

Prior to implementing the interim remedial action at the Naval Training Center, any necessary permit applications to perform this work will be filed with the appropriate agencies. SBP will obtain all permits pertinent to well installation and abandonment. Any wetland disturbance permits will be acquired by Bechtel. Permits requiring signature by the facility "owner" will be coordinated back through Bechtel to the responsible Naval Training Center personnel.

FIGURE 1
FACILITY/LOCATION MAP
NAVAL TRAINING CENTER OU-4
ORLANDO, FLORIDA



Source: Interim Remedial Action Conceptual Design and Performance Specification, Operable Unit 4, ABB-ES 1997

APPENDIX B
WASTE MANAGEMENT PLAN

WASTE MANAGEMENT PLAN
OPERABLE UNIT 4 (OU-4)
ORLANDO NAVAL TRAINING CENTER
ORLANDO, FLORIDA

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Bechtel Job No. 22567
SBP Project No. T7027.10
Contract No. N62467-93-D-0936
Subcontract No. 22567-304-SC-0734

SEPTEMBER 3, 1997

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3.2 Waste Storage, Sampling and Transportation 5
3.3 Waste Characterization 6
3.4 Waste Disposal 6

ATTACHMENTS

Attachment A Navy RAC Waste Tracking Log
Attachment B WTL-Form 1 Required Backup Information
Attachment C Waste Disposal Facility Information

1.0 INTRODUCTION

All activities dealing with investigation-derived waste (IDW) performed at the Naval Training Center (NTC) will comply with the Bechtel Navy RAC Program Waste Management Plan requirements. The purpose of this document is to outline the plan for the collection, containerization, interim storage, transportation and disposal of all waste material generated and/or disposed of during the course of work conducted at Operable Unit 4 (OU-4) at the NTC in Orlando, Florida.

During the installation of the groundwater monitoring wells and treatment wells at the facility, SBP will supervise the generation, characterization, and disposal of all IDW including soil cuttings, development/purge water, personal protective equipment (PPE) and vegetation.

2.0 DEFINITIONS

The following definitions may be used to understand the scope of work outlined in the following waste management plan:

Area of Concern (AOC) An AOC is the area delineated by the areal extent of potential contamination on the project site. This boundary may contain varying concentrations and types of hazardous substances and may contain uncontaminated areas. For the purpose of this work plan, the AOC will be considered represented by OU-4.

U.S. EPA "Contained- In" Policy requires any mixture of a non- solid waste (environmental media) and a Resource Conservation and Recovery Act (RCRA)-listed hazardous waste to be managed as a hazardous waste, as long as the material contains the listed hazardous waste above health-based standards.

Field Staging Area (FSA) is an area within the project site where IDW is stored until the site investigative activities are completed or a final disposal option is selected. This area will be posted as the FSA and will be checked for leaking containers weekly during field activities. This area will remain active until all containers have been disposed appropriately.

Additional empty drums, overpack, and absorbent materials will be kept at the FSA in the event of a leak or spill.

Hazardous Constituents are those constituents listed in 40 Code of Federal Regulations (CFR) Part 261, Appendix VIII.

Hazardous Substances, for the purposes of this plan, shall have the meaning set forth by Section 101(14) of CERCLA, 42 U.S. Code 9601(14).

IDW are discarded materials resulting from site investigation activities, such as decontamination, which in present form possess no inherent value or additional usefulness without treatment. Such waste may be: solid, semi-solid, liquid, or gaseous material that may or may not be hazardous as defined in 40 CFR Part 261. IDW may include materials such as used PPE, decontamination fluids (wash and rinse), drilling muds and cuttings, pumped monitoring well fluids, purge water, soil, and other materials from collection of samples and contaminated spill materials.

IDW will be classified as RCRA hazardous waste if it meets one of the following criteria:

- Contains a U.S. EPA-listed hazardous waste identified in 40 CFR 261, or

- Exhibits characteristics of hazardous waste, including ignitability, corrosivity, reactivity, or toxicity, as described in 40 CFR 261.

Land Disposal means placement in or on the land and includes, but is not limited to, placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, underground mine or cave, or concrete vault or bunker intended for disposal.

Land Disposal Restrictions (LDRs) are restrictions that prohibit the land disposal of certain RCRA hazardous wastes unless specific treatment standards are met. The U.S. EPA has established standards for specific hazardous wastes that are protective of human health and the environment when the wastes are land disposed. LDRs apply to waste management activities under RCRA.

Movement (Nonplacement) is an activity that consists of moving soil within the site, whether excavated or surface soil, along with RCRA hazardous wastes and CERCLA hazardous constituents contained in soil to consolidate the material within the AOC. Note that movement of soil with CERCLA constituents or radioactive constituents that do not contain RCRA hazardous waste would not trigger RCRA LDRs, even if moved outside the AOC.

Placement is an activity that consists of moving soil contaminated with RCRA hazardous wastes off-site or outside the AOC.

Wastewater is liquid waste consisting primarily of water without other liquid phases present that may result from groundwater well installation, development, and sampling activities, or from the cleaning of well installation or sampling equipment.

3.0 WASTE MANAGEMENT

Based on the documents reviewed for this project, groundwater at the site is contaminated with chlorinated solvents, however, the soil beneath the site may not be impacted. SBP will make every effort to minimize the amount of waste generated and to return "uncontaminated, non-hazardous" waste to its origin (i.e., soil, water). PPE will be decontaminated and handled as non-hazardous waste.

3.1 Waste Handling, Segregation, Containerization and Tracking

Non-reusable PPE will be decontaminated and collected daily in 2-ply, double-bagged durable plastic garbage bags, appropriately labeled, and disposed of in an SBP-supplied dumpster located at the NTC. All clean trash such as lunch bags and drink cans will also be placed in this dumpster.

Soil cuttings generated from the installation of monitoring wells and treatment wells will be segregated to the extent possible into potentially contaminated and potentially non-contaminated waste piles, based on visual, olfactory and PID readings. Soil that is assured to be contaminated will be placed in a lined, 15-18 yard roll-off container complete with a secured cover. Soil that does not appear to be contaminated will be placed in a separate roll-off container and properly secured.

Development water generated from the wells will be assumed to be impacted with chlorinated solvents and will be placed in an on-site 4,000 gallon high density polyethylene holding tank pending analytical results.

All brush and trees removed during site clearing will be cut down to minimal size and scattered across the site in remote areas, out of the way of any site activities and will be managed in such a way to minimize site disturbance.

All waste containers will be securely closed, cleaned, and labeled. Labels will be attached to the container at the onset and filled in with each addition identifying the source of material (well no.), date of addition, waste type, estimated volume (if liquid) or weight (if soil), and generator name. The labels will be completed using permanent markers.

The generation, storage, and final disposition of all hazardous and potentially non-hazardous waste will be tracked by SBP. A copy of the Navy RAC Waste Tracking Log (Attachment A) is included in this plan. The log will be completed by SBP personnel. Attachment B describes the procedure for filling out the log sheet.

3.2 Waste Storage, Sampling and Transportation

All waste containers will be stored at the FSA located at the northwestern corner of Building 1100 on the asphalt. Container contents will undergo chemical analyses to determine the method of disposal. All companies involved in sample collection and analyses will have an FDEP-approved Comprehensive Quality Assurance Plan (CompQAP). The appropriate number of samples (based on soil volume) will be collected from the soil roll-off containers.

Soil samples will be initially sampled for total VOCs to determine if the soil has been impacted with any of the constituents of concern (COC). If the COC levels are below the established cleanup criteria (to be agreed upon by the Navy and Bechtel), the clean soil may be disposed of on-site. If, however, the COC concentrations are above the established cleanup goals, the soil will be treated as a hazardous waste. In order to be disposed of off-site in a permitted facility, soil samples will undergo a more rigorous analytical suite. In this case, soil samples will be analyzed for Toxic Characteristic Leaching Procedure (TCLP) metals (8) in accordance with EPA Method Nos. 1311 and 6010, TCLP copper and zinc (EPA Method No. 6010), VOCs (EPA Method No. 8260), total organic carbon (TOC; EPA Method No. 415.1) and polychlorinated biphenyls (PCBs; EPA Method No. 8080). All laboratory analyses will be performed by PC&B Environmental Laboratories, Inc. of Oviedo, Florida.

Water samples will be analyzed for eight RCRA metals, cooper and zinc, VOCs, TOC and PCBs (EPA Method No. 608). Following receipt of analytical results from water samples, the results will be compared to regulatory levels and disposal options and/or additional classification criteria will be determined.

Field activities are scheduled to last for approximately one month and most wastes will be generated within the first few weeks. SBP will dispose of all wastes immediately following receipt of laboratory results and will ensure that all hazardous wastes are removed from the site within 90 days of containerization.

3.3 Waste Characterization

All contaminated waste will be classified as either non-hazardous or RCRA hazardous. These terms are defined in Section 2.0.

Site historical data has established that prior laundry facility operation caused chlorinated solvent contamination of groundwater in the area. The IDW is anticipated to contain RCRA-listed waste resulting from disposal activities that occurred after the effective date of RCRA regulations (November 19, 1980). Therefore, the IDW will be managed as a hazardous waste per U.S. EPA's "Contained-In" Policy.

IDW classification (non-PPE) will be evaluated on the basis of comparison of analytical results obtained during the Remedial Investigation (RI) to publicized regulatory guidance values for water, soil, and sediment. Soil and sediment results will be evaluated for hazardous characteristics, as determined by RCRA, by comparing sample analytical results to total extraction limits as described in 40 CFR 261, Appendix II, Method 1311, TCLP, item 1.2, which states, "If a total analysis of the waste demonstrates that the individual contaminants are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory thresholds could not possibly be exceeded, the TCLP need not be run." Thus, the IDW could not be considered a RCRA hazardous waste. However, it may be the Navy's position to dispose of all waste off-site that contains any hazardous constituents regardless of the levels. If so, SBP will dispose of all waste off site in permitted facilities.

3.4 Waste Disposal

SBP will notify Bechtel 72 hours in advance of any waste shipments. Wastewater generated from decontamination activities and well installations will be temporarily stored at the FSA. Samples collected for characterization of this IDW will be evaluated for acceptability for disposal at the City of Orlando Waste Water Treatment Plant (WWTP) via the sanitary sewer at the former on-site laundry facility

(Building 1100). If the IDW wastewater contamination is at a level that cannot be disposed of at the WWTP, then the IDW wastewater will be disposed at a permitted facility. SBP will submit all waste disposal certificates to Bechtel within seven calendar days after disposal.

Analyses of samples collected that are representative of the applicable IDW will be evaluated regarding on-site disposal of soil. If no detectable levels of constituents are detected in the soil cuttings generated from drilling activities, the soil could be used as clean fill material in areas identified by the Navy. If concentrations are such that on-site disposal is not permitted, then the IDW will be stored at the FSA and disposed of, consistent with the final remedy. The Navy will sign all waste profiles and manifests as the generator.

The incidental contact with waste or contaminated media by PPE, which is typical of CERCLA site investigations, does not warrant management of PPE as hazardous, solid waste.

Advantage Environmental Services, Inc. has been subcontracted to handle waste disposal. Attachment C presents a list of the proposed disposal facilities and transporters and pertinent permit information.

ATTACHMENT A

WASTE TRACKING LOG

Navy RAC
Waste Tracking Log

Site:_____ Page ___ of ___

Delivery Order:_____ Log Dates: From _____ to _____ Completed by:_____

Tracking Number	Subcontract Number	Waste Description	Estimated Quantity	Transporter	Disposal Facility	Date Generated	Date of Disposal

ATTACHMENT B

WTL - REQUIRED BACKUP INFORMATION

WTL - Form 1 Required Backup Information

- **Tracking number** - This is the Hazardous Waste Manifest number, bill of lading, container number or other unique identification number that will positively identify the specific materials disposed of in single unit, shipment, or container.

- **Subcontract Number** - This is the subcontract number, delivery order, job number, or identifying cost code for the waste materials involved.

- **Waste description** - This is a summary detail, key word, or identifying code that will indicate the waste involved. (See Waste Management Plan for additional details on waste classification). This information should be backed up by analytical results when required by regulation or project instructions. (RCRA codes should be used if known, such as D001, U005, etc.) Separate log books that identify samples taken, sampled by, dates sampled, and analytical details should be referenced and available to support this description. Documented client or process knowledge can also support the characterization or description of the waste involved. Any other information that helps identify what the waste classification is and what process generalized it should be referenced and available to support this detail (i.e., surveyed locations, map points, or correspondence from the client).

- **Estimated Quantities** - Estimated quantities should be included along with the wastedescription to help in identifying the wastesource and its characteristics. The quantities will also help provide engineering information for completion reports at the end of the job.

- **Transporter** - If waste is moved from one point to another, either on- or offsite, the transporter needs to be identified. This detail should include a name, with backup provided that will link the name with the subcontract number, transporters certifications, EPA ID Number, address and contacts, as required. All waste manifests, shipping papers, or related documentation needs to be included or referenced in this backup. If possible, manifest numbers should be included with the details on the form.

- **Disposal Facility** - All locations where the waste is treated, recycled, disposed of, and/or stored needs to be recorded. These locations can be recorded as the name of the facility or site location, with backup information available that identifies the owner of the site, Bechtel subcontract number, the EPA ID number, permits, or certifications related to this site (particularly those related to approval to accept the wastes in question), and other related details such as address, contact and phone number. If a CERCLA Offsite regulatory notification is required, this information must be included in this backup detail. A certificate of disposal or receipt accepting the waste at the facility must be included with this backup documentation. A weigh bill from the municipal solid waste facility or local dump is appropriate for non-hazardous debris or solid waste. For hazardous wastes, a signed, returned copy of the hazardous waste manifest must be provided to the generator within a limited period of time. (See related Sections of the Waste Management Plan and Environmental Compliance Plan)

- **Date of Generation and Date of Disposal** - Record the date of generation of the waste materials (i.e., excavated the soil, demolished the building, pumped the water, etc. or dates containers began to be filled) or, if generation date is not known, the date Bechtel became responsible for he wastes, and the date accepted by the disposal facility (not the transport) for treatment or disposal. These dates have regulatory implications and need to be accurate. All dates should be backed up by receipts or log book notes (i.e., daily reports) that confirm and corroborate the activity. The date of disposal for hazardous waste needs to conform with the certificate of disposal/destruction and should not be filled in until this certificate is received and checked for accuracy.

ATTACHMENT C

WASTE DISPOSAL FACILITY INFORMATION

ADVANTAGE
Environmental Services, Inc.

Hazardous Waste ▲ Management ▲ Transportation ▲ Disposal

Project: Orlando Naval Training Center

Client Contact: Amy Twitty, SBP Technologies
850-470-2619
850-470-0058 Fax

Generator: Orlando Naval Training Center

Wastestreams: Soil Contaminated With Tetrachloroethylene
Water Contaminated With Tetrachloroethylene

Disposal Facilities: Bulk Material

EQ-The Environmental Quality Company
49350 North I-94 Service Drive
Belleville, MI 48111
EPA ID#: MID000724831

LTTL (Less Than Truck Load) Material

Laidlaw Environmental Services, Inc.
5303 126th Avenue North
Clearwater, FL 34620
FLD981474802

Transporters: Bulk Material

GSS
3340 Highway 92 East
Lakeland, FL 33801
EPA ID#: LAD034190215

Terra First, Inc.
P. O. Box 1249
Vernon, AL 35592
EPA ID#: ALD981023492

LTTL (Less Than Truck Load) Material

Laidlaw Environmental Services, Inc.
5303 126th Avenue North
Clearwater, FL 34620
FLD981474802

APPENDIX C

OPERATION AND MAINTENANCE INSPECTION REPORT

Operation and Maintenance Inspection Report

Project Name: Orlando Naval Training Center			Bechtel Job No. 22567	Date:	
Location: Orlando, FL			Weather:	Temp.:	Time:
SBP Project No.: T7027.10			Well Designation:		
Operating Parameter	UVB - 1	UVB - 2	NOTES		
Air flow rate into UVB well					
Air flow rate out of UVB well					
Packer pressure					
Influent flow rate (lower screen)					
Effluent flow rate (upper screen)					
Hours of Operation					
Moisture in knockout (Yes/No) Amount					
Vacuum gauge reading (20 mbar normal)					
Condition of sample hoses					
Condition of packer hose					
Condition of Air intake					
Verify proper operation of air treatment system					
Verify proper functioning of electrical panal					
Condition of vault and vault cover	N/A				

Action Items

Inspectors Name: **Signature:**

APPENDIX D

INSPECTION SCHEDULE LOG

OU 4, Area C
Naval Training Center, Orlando, Florida
Delivery Order # 0064
Contract # N62467-93-D-0936

APPENDIX D
Inspection Schedule Log

Inspection Phase and Schedule												
Workplan Reference	Cklst No.	Definable Feature of Work/ Required Inspections	Preparatory			Initial			Follow-up			Remarks
			Schedule	Actual	By	Schedule	Actual	By	Schedule	Actual	By	
		Remediation Activities										
		Health & Safety										
		Recovery Well Abandonment										
		UVB Well Drilling										
		Monitoring Well Drilling										
		System Installation										
		Pre-startup Checks										
		Startup and Balancing										

APPENDIX D
Inspection Schedule Log

Inspection Phase and Schedule												
Workplan Reference	Cklst No.	Definable Feature of Work/ Required Inspections	Preparatory			Initial			Follow-up			Remarks
			Schedule	Actual	By	Schedule	Actual	By	Schedule	Actual	By	
		Waste Management										
		IDW Sampling										
		IDW Storage & Disposal										
		Sampling and Analysis										
		System performance - Startup										
		System performance - Bi-weekly										
		System performance - Quarterly										
		Groundwater S&A - Quarterly										

APPENDIX D
Inspection Schedule Log

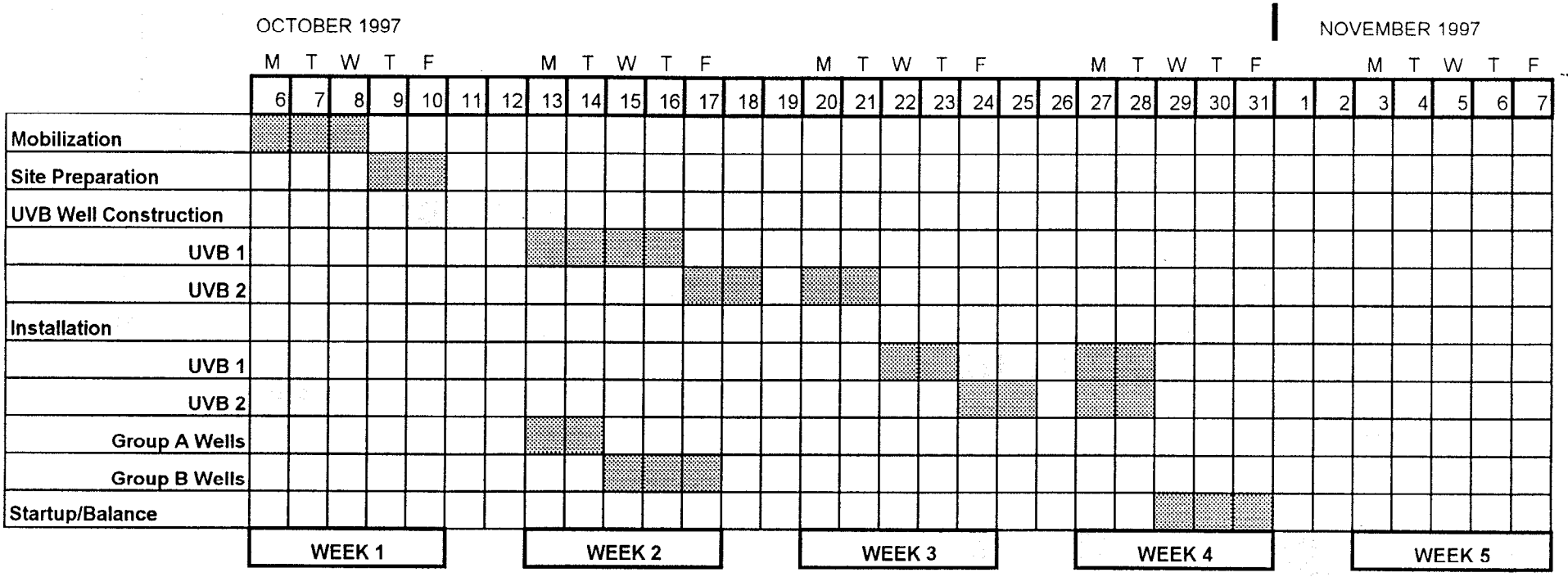
Inspection Phase and Schedule												
Workplan Reference	Cklst No.	Definable Feature of Work/ Required Inspections	Preparatory			Initial			Follow-up			Remarks
			Schedule	Actual	By	Schedule	Actual	By	Schedule	Actual	By	
		Operations and Maintenance										
		Quarterly O&M Checks										
		General Management										
		Field Activities Overview										
		Fencing & Security										
		Site Facilities & Logs										
		Surveys/As-Builts										
		Record Keeping										

APPENDIX E

UVB SYSTEM INSTALLATION SCHEDULE

PREPARED 8/27/97

APPENDIX E
UVB SYSTEM INSTALLATION SCHEDULE OF FIELD ACTIVITIES
for The Naval Training Center, OU-4, Orlando, Florida



APPENDIX D

DRAWINGS

INDEX

S-1	Index Sheet (Site Plan)	ABB-ES, May 1997
P-1	Conceptual Process Diagram	ABB-ES, May 1997

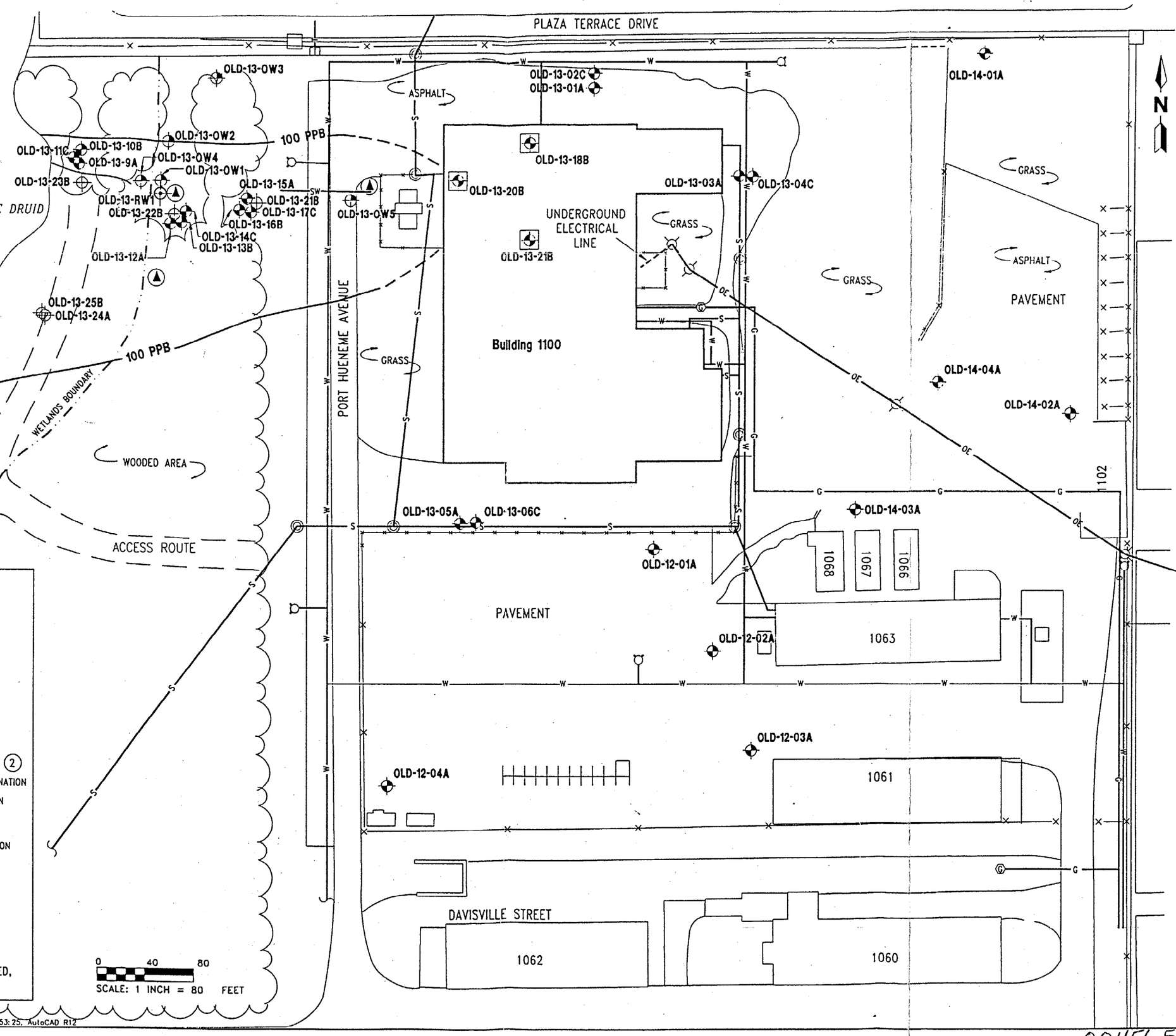
NOTES:

(1) WETLAND DELINEATION DEFINED DURING THE FOCUSED FIELD INVESTIGATION BY ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

(2) ACTUAL RECIRCULATION WELL LOCATIONS TO BE DETERMINED FOLLOWING FINAL DESIGN

(3) THE EXISTING UTILITIES SHOWN ON THIS DRAWING ARE SHOWN DIAGRAMMATICALLY AND IT IS NOT TO BE INFERRED THAT THE LOCATIONS SHOWN ARE PRECISE.

(4) TO BE STAMPED AS CONCEPTUAL DESIGN/ PERFORMANCE SPECIFICATION, PREPARED FOR RESPONSE ACTION CONTRACT, NOT FOR CONSTRUCTION.



LEGEND

—SW—	STORM WATER CULVERT
— S —	SANITARY SEWAGE
— G —	GAS LINE
— OE —	OVERHEAD ELECTRICAL
— · · —	WETLANDS BOUNDARY
	MANHOLE
	ELECTRICAL POLE
	HYDRANT
	TREELINE
	RECIRCULATION WELLS (ESTIMATED LOCATION) (2)
OLD-13-22A	NEW MONITORING WELL LOCATION AND DESIGNATION
OLD-13-10B	MONITORING WELL LOCATION AND DESIGNATION
OLD-13-RW1	RECOVERY WELL LOCATION AND DESIGNATION
OLD-13-OW1	OBSERVATION WELL LOCATION AND DESIGNATION
OLD-13-22A	MICROWELL LOCATION AND DESIGNATION
G	GAS METER
— T —	TELEPHONE LINE
T	TELEPHONE JUNCTION BOX
— W —	WATER LINE
—100 PPB—	VOLATILE ORGANIC COMPOUND CONTOUR LINE, DASHED WHERE INFERRED, IN PARTS PER BILLION

0 40 80
SCALE: 1 INCH = 80 FEET

DESIGNED BY: J. NASH
DRAWN BY: J. KAPRAL
CHECKED BY: H. FAIRCLOTH
DRAWING NO.:
F.P.E.:
PROJ. ENG.:
OV. DR.:

REV.	DESCRIPTION	PREP BY	DATE	APPR'VD

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
SOUTHERN DIVISION
CHARLESTON, S.C.
ORLANDO
UNIT
INTERIM REMEDIAL ACTION OPERABLE UNIT 4
INDEX SHEET
APPROVED
DATE
EFD FOR COMMANDER, NAVFAC

SEAL AREA

RECORD DRAWING DATE

CODE I.D. NO.	80091
DRAWING SIZE:	D
SPEC. NO 06-	
CONTR. NO.	N62467-89-D-0317/107
NAVFAC DRAWING NO.	465928
SHEET	1 OF 3

S-1

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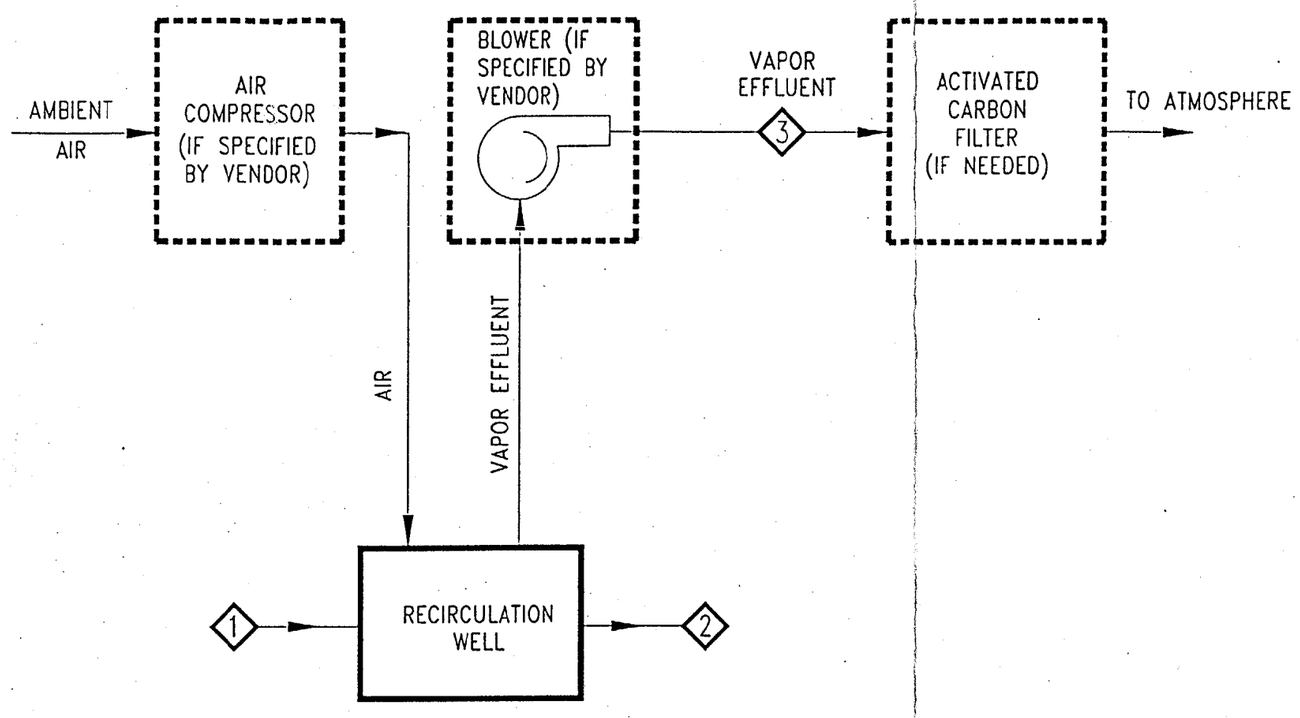
00456 FB12

ASSUMPTIONS: WATER FLOW: 8 M^3/HR PER SYSTEM AIR/WATER RATIO: 50:1	①	②	③
	GROUNDWATER INFLUENT	GROUNDWATER EFFLUENT	VAPOR[3] EFFLUENT
ORGANICS	(ug/l)		(lb/yr/system)
cis - 1,2 - DICHLOROETHYLENE	700	< = 70 ug/l [1]	108
TETRACHLOROETHYLENE	500	< = 8.85 ug/l [2]	77
TRICHLOROETHYLENE	2700	< = 80.7 ug/l [2]	416
INORGANICS	(ug/l)		
ALUMINUM	160		
IRON	1000		
LEAD	6		
MAGNESIUM	3700		
SODIUM	12000		
ZINC	42		
GENERAL CHEMISTRY	(mg/l)		
ALKALINITY AS $CaCO_3$	253		
CHLORIDE	22		
HARDNESS AS $CaCO_3$	276		
RESIDUE, FILTERABLE (TDS)	14		
RESIDUE, NON FILTERABLE (TSS)	ND		
SULFATE	16		
SULFIDE	0.2		
TOTAL ORGANIC CARBON	110		
TOTAL SOLIDS	ND		

NOTES:

1. DERIVED FROM FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION, GROUNDWATER GUIDANCE CONCENTRATIONS
2. DERIVED FROM FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION, SURFACE WATER QUALITY. STANDARDS COMPLETE ANALYTICAL RESULTS FOUND IN APPENDIX A, FFS
   - ND NOT DETECTED
   - ug/l MICROGRAMS PER LITER
   - mg/l MILLIGRAMS PER LITER
   - TDS TOTAL DISSOLVED SOLIDS
   - TSS TOTAL SUSPENDED SOLIDS
   - $CaCO_3$ CALCIUM CARBONATE
   - M^3/HR CUBIC METERS PER HOUR
3. MAXIMUM ESTIMATED VAPOR EMISSIONS BASED ON 100 PERCENT REMOVAL EFFICIENCY AT A WATER FLOW RATE OF 8 M^3/HR AND MAXIMUM GROUNDWATER CONCENTRATIONS SHOWN IN COLUMN ①. (SEE APPENDIX A).
4. TO BE STAMPED AS CONCEPTUAL DESIGN/PERFORMANCE SPECIFICATION, PREPARED FOR RESPONSE ACTION CONTRACT, NOT FOR CONSTRUCTION.



CONCEPTUAL PROCESS FLOW DIAGRAM

DESIGNED BY: M. HAWES
DRAWN BY: J. KAPRAL
CHECKED BY: H. FAIRCLOTH
BRANCH HEAD:
P.E.:
PROJ. ENG.:
DIV. DIR.:

REV. DESCRIPTION — PREP BY — DATE — APPRVD

DEPARTMENT OF THE NAVY — SOUTHERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND, CHARLESTON, S.C.

UNIT — ORLANDO 4

INTERIM REMEDIAL ACTION OPERABLE UNIT 4
CONCEPTUAL PROCESS DIAGRAM

APPROVED — DATE — CTO FOR COMMANDER, NAVFAC

SEAL AREA

RECORD DRAWING DATE

CODE I.D. NO. 80091
DRAWING SIZE. D
SPEC. NO. 06-
CONTR. NO. N62467-89-D-0317/107
NAVFAC DRAWING NO. N65928
SHEET 3 OF 3
P-1

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APPENDIX E

RESPONSIBILITY ASSIGNMENT MATRIX

Responsibility Assignment Matrix

Interim Remedial Action
Conceptual Design and Performance Specification
Operable Unit 4
NTC, Orlando, Florida

Task	CLEAN	RAC	SOUTHNAV-FACENGCOM	Activity	FDEP	USEPA	ROICC
Focused Field Investigation	L	S	A	A	A	A	NA
Focused Feasibility Study	L	S	A	A	A	A	NA
Remedial Investigation	L	S	A	A	A	A	NA
Technology Review	L	S	A	A	A	A	NA
Determination of PSC Characteristics	L	S	R	R	R	R	NA
Performance Design	L	S/R	A	A	A	A	R
Design Specifications & Shop Drawings	R/A	L	A	A	R	R	R
Permitting	S	L	R	R	A	NA	R
Utility Clearance and Access Requirements	S	L	R	A	NA	NA	R
Construction	S	L	S/A	S	NA	NA	A
Operations and Maintenance	S	L	R	R	R	R	R
Performance Monitoring, Sampling and Reporting	L	S	R	R	R	R	NA
As-Builts	S	L	A	R	R	R	A
Remedial Action/Closure Reports	L	S	R/A	A	A	A	R

Notes: NTC = Naval Training Center.
CLEAN = Comprehensive Long-Term Environmental Action, Navy.
RAC = remedial action contract.
SOUTHNAVFACENGCOM = Southern Division, Naval Facilities Engineering Command.
FDEP = Florida Department of Environmental Protection.
USEPA = U.S. Environmental Protection Agency.
ROICC = resident officer in charge of construction.
PSC = Potential Source of Contamination
L = lead responsibility.
S = support responsibility.
R = review responsibility.
A = approval.
NA = not applicable.