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CORRECTIVE ACTION PLAN FOR ZONE H BUILDING 661 UST 661 SITE IDENTIFICATION NUMBER 14437 WITH TRANSMITTAL CNC CHARLESTON SC

1/1/2001

J A JONES ENVIRONMENTAL SERVICES

CORRECTIVE ACTION PLAN
FOR
ZONE H/ BUILDING 661
UST 661

SITE IDENTIFICATION # 14437

Charleston Naval Complex
Charleston, South Carolina

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

Contract Number N62467-99-C-0960

January 2001

JA Jones Environmental Services

TRANSMITTAL FORM

Project:	**Charleston Naval Shipyard**		
DO Title:	Delivery Order '011	**DO Project Location:**	Charleston Naval Complex

Date: 19-Jan-01	**To:** Chuck Williams SCDHEC 2600 Bull Street Columbia , SC 29201-1708 803-898-4339	**From:** Brian R. Crawford J.A. Jones Environmental Services 1849 Avenue F North Charleston, South Carolina 29405 (843) 740-2780
Contract Number :		
Delivery Order Number		
011		
File Number		
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JAJ Subcontract Number	**Subcontractor/Supplier/Manufacturer:**	**Transmitted for:**	
na		Approval/Comment	
JAJ P.O. Number		Final document	
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Specification Section Number or Drawing	Qty	Description of Submittal	Date	Comments	Number of Copies
	1	CAP Zone H Bldg 661 (site # 14437)	01/19/01		1
	1	CAP Zone K Bldg 2524A-B (site # 00950)	01/19/01		

SENT		**GENERAL COMMENTS**
Enclosed	X	Original
Separate		
Fed Ex	X	
Mail		
Other		
Other		

CC: Project File Gary Foster Gabe Magwood Tony Hunt	**Signed:** 1-18-01 Brian R. Crawford, Engineer II

CORRECTIVE ACTION PLAN
FOR
ZONE H/ BUILDING 661
UST 661

SITE IDENTIFICATION # 14437

Charleston Naval Complex
Charleston, South Carolina

Submitted by:
CH2M-JONES, LLC.
115 Perimeter Center Place NE
Suite 700
Atlanta, Georgia 30346-1278

Contract Number: N62467-99-C-0960

January 2001

PREPARED BY:

01-15-01

Brian R. Crawford
Engineer II
CH2M-JONES, LLC.

APPROVED BY:

1-16-01

Jed Heames
Site Manager
CH2M-JONES, LLC.

CERTIFICATION

I certify that the information contained in this report is true, and complete to the best of my knowledge, information, and belief.

Approved By: R. Gwinn 1/19/07 J.A. Jones

South Carolina Registration No. 14220

TABLE OF CONTENTS

6.0 FIGURES

ACRONYMS AND ABBREVIATIONS

AST	Aboveground Storage Tank
bls	below land surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene Isomers
CAP	Corrective Action Plan
CNC	Charleston Naval Complex
COC	Chemical of Concern
DRO	Diesel Range Organics
EISOPQAM	Environmental Investigations Standard Operating Procedures and Quality Assurance Manual
EPA	Environmental Protection Agency
ft	foot
mg/kg	microgram per kilogram
mg/L	microgram per liter
OVA	Organic Vapor Analyzer
PAH	Polynuclear Areomatic Hydrocarbons
QC	Quality Control
RBSL	Risk-Based Screening Level
RDA	Redevelopment Authority
SAP	Sampling and Analysis Plan
SCDHEC	South Carolina Department of Health and Environmental Control

SOUTHDIV	Southern Division Naval Facilities Engineering Command
SSTL	Site-Specific Target Level
UST	Underground Storage Tank

1.0 INTRODUCTION

This Corrective Action Plan (CAP) has been prepared by CH2M-JONES, LLC. The plan is designed for Zone H/ Building 661; former Underground Storage Tank (UST) 661 located at the Charleston Naval Complex (CNC), Charleston, South Carolina.

The South Carolina Department of Health and Environmental Control (SCDHEC) has designated this site as Identification Number: 14437. This CAP provides methods to further evaluate the applicability of active and intrinsic remediation and monitoring well abandonment as a corrective action for UST 661 in accordance with SCDHEC Corrective Action Guidance, June 1997.

1.1 General Site Description

The CNC is in the city of North Charleston, on the west bank of the Cooper River in Charleston County, South Carolina. This installation consists of two major areas: an undeveloped dredge materials area on the east bank of the Cooper River on Daniel Island in Berkley County, and a developed area on the west bank of the Cooper River. The developed portion of the base is on the peninsula bounded on the west by the Ashley River and on the east by the Cooper River. The site is located within the developed portion of the base as shown in Figure 1.

The area surrounding CNC is "mature urban", having long been developed with commercial, industrial, and residential land use. Commercial areas are primarily west of CNC; industrial areas are primarily to the north of the base along Shipyard Creek.

Building 661 is a one-story brick building, which served as a communications center until base closure. The facility was constructed in 1968 and improved in 1987. This Underground Storage Tank was used to fuel the buildings emergency generator. In 1992, the steel underground fuel oil storage tank and piping were replaced with the double wall fiberglass tank and piping. During the removal of the previous tank, free product was discovered in the piping trench. Actions were taken to delineate the contamination (S&ME Assessment Report, 1996).

1.2 Objective

This CAP presents a groundwater monitoring plan to remove all historical known contaminates from the area, which are pertaining to this UST. Abandonment of monitoring wells at this site is also included in this plan.

2.0 ASSESSMENT SUMMARY

S&ME completed a Final Environmental Assessment Report, dated August 23, 1996, for Building 661, Zone H. The assessment information was used to develop this CAP. The information from the assessment is summarized in this section.

2.1 Assessment Information

The initial assessment activities began on August 08, 1994 and were completed August 12, 1994. To conduct an initial characterization of groundwater quality and to provide a preliminary horizontal delineation of the petroleum hydrocarbon plume, seventeen (17) groundwater samples were collected in a grid like pattern utilizing the KV^{tm} macho groundwater sampling system (Figure 3).

These samples, plus samples collected from a free product collection drum and from previously installed Monitoring Well 1 (MW-1) were analyzed on-site with S&ME's SRI Model 8610 Gas Chromatography (GC) system using a 0.53 millimeter wide-bore capillary column. Targeted parameters included all EPA Method 602 and 610 constituents including Benzene, Toluene, Ethylbenzene, and total Xylenes (BTEX) and Naphthalene. KV/GC survey results are summarized in Table 1 of the Assessment Report.

2.2 Soil Analytical Results

Soil samples were collected for laboratory analysis from the drill cuttings staged on plastic sheeting. The samples were analyzed for BTEX and PAH. Also, TPH was measured by Methods 3550 and 5030. The soil was then placed in 55- gallon steel drums for future disposal. No petroleum constituents were detected from the laboratory analysis.

2.3 Groundwater Analytical Results

In the assessment completed in 1994, a sheen of product was encountered during the second sampling event at MW-2. Dissolved petroleum constituents were most prevalent in MW-2, which contained 6,852.4 ppb PAH by EPA Method 610 and 988.8 ppb PAH by Method 8270. It appears that the extent of the dissolved product plume had been defined within the vicinity of this well. This was concluded by the fact that no dissolved petroleum constituents were identified in any other on-site well. A summary of groundwater analytical data from 1994 is presented in Table 2 of the Assessment Report.

Since the 1994 sampling, no free product has been encountered in any of the monitoring wells onsite at Building 661. Monitoring Well MW-2 is the only well that continues to have Chemicals of Concern (COC) above the RBSLs. The 1995 analytical results for MW-2 show higher levels of COCs, which by 1996 start to aggressively decrease. From 1996 to 1998 COC levels did not increase or decrease by any significant amount. Figure 7 shows a diagram of the COCs from 1995 to 1998 for MW-2.

3.0 PROPOSED CORRECTIVE ACTION

This CAP provides a method for active remediation of the site by enhanced bioremediation and implementing intrinsic remediation and monitoring well abandonment as a corrective action in accordance with SCDHEC Corrective Action Guidance, June 1997. Based on the results of the analytical data from 1994 to 1998, CH2M-Jones, LLC plans on implementing enhanced bioremediation (microbial and nutrient injection) at this site to remove COCs from groundwater and to reduce contaminant concentrations below SSTLs. When concentrations are reduced below the SSTLs, intrinsic remediation will be implemented until contaminant concentrations decrease below RBSLs or action levels approved by SCHDEC. The proposed active remediation plan is described in Section 4.0, and the proposed intrinsic remediation plan is described in Section 5.0.

3.1 Soil Remediation

Field screening and analytical results of soil sampling in the assessment did not indicate the presence of soil contamination from ground surface (S&ME August 23, 1996).

3.2 Groundwater Remediation

CH2M-Jones, LLC plans on implementing enhanced bioremediation (microbial and nutrient injection) at this site to remove COCs from groundwater and to reduce contaminant concentrations below SSTLs. All monitoring wells indicate levels of COCs below RBSLs except for MW-2, which, will be used as the source area for the enhanced bioremediation. All methods used for the enhanced bioremediation activities will be pre-approved by SCDHEC before implementing.

4.0 PROPOSED ACTIVE REMEDIATION

The proposed active remediation for the former UST 661 spill area is enhanced bioremediation. This decision was made based on the fact that the area has been sampled for six years with little evidence that trends of bioremediation activity are occurring at significant rates. A SCDHEC-approved bioremediation product will be utilized at the site.

4.1 Enhanced Bioremediation

The objective of this remediation effort is to treat the contaminated groundwater with microbial and nutrient products approved by the SCDHEC, with the objective of cleaning the groundwater to established standards for Diesel Range Organics (DRO) and PAHs in groundwater to RBSL standards in the vicinity of the former UST 661. The proposed treatment procedure for this remediation is the inoculation of added injection wells, which are proposed to be installed up gradient of the release. The highest concentrations of contaminants were found in monitoring well MW-2, which was near the release point. Monitoring wells both up and down gradient of the release have not shown evidence of contamination. This protocol is based upon the assumption that the monitoring wells MW-1, MW-3, MW-4, MW-5, and MW-6 continue to have shown no contamination, and that the plume isoconfined within the bounds of the present monitoring wells.

Inoculation will be made from the appropriate release point to cover a volume of groundwater down gradient from the release point, which will be inclusive of the expected volume of the plume. The soil is expected to be silty clay sand, and the hydraulic conductivity of the area is in the range of 0.021 to 0.34 feet per day (ft/day). Groundwater is expected to be encountered approximately two (2) feet bls. The contamination is primarily in the saturated zone, and the treatment zone will be targeted to the maximum depth of the monitoring wells, which is thirteen (13) feet bls. Due to the low hydraulic conductivity of the soil, the use of a soil penetrant (which will be approved by SCDHEC) to accelerate the inoculation process is deemed appropriate.

In order to reach the RBSLs for groundwater, it will be necessary to provide a co-substrate. The purpose of the co-substrate is to allow the microbes a supplemental carbon source of nutrients as the microbes are remediating the very low concentrations of hydrocarbons to the RBSL groundwater standards. Generally, hydrocarbon contaminants are difficult to remediate below perhaps 5.0 mg/L without the assistance of a co-substrate to sustain the microbes.

4.2 Monitoring Well Installation

No additional permanent monitoring wells are scheduled to be installed at site 661, however, temporary wells (Geoprobe injection wells) will be installed for injection purposes. All injection and well installation permits will be obtained prior to installation.

If any wells are unusable or new wells are warranted for any other reason, the wells will be installed to the same specification as existing monitoring wells unless site conditions change and warrant otherwise. The wells will be installed in accordance with South Carolina Well Standards

and Regulations R.61-71. A utility locate will be completed prior to any well installation activities. Any necessary permits will be acquired prior to well installation activities.

4.3 Surveying

Surveying of any new well locations will be conducted as a part of this CAP.

4.4 Soil Boring Schedule

Soils will not be sampled as a part of this plan. Historical analytical has shown that the soils in the contaminated area are below all RBSLs.

4.5 System Operation and Maintenance

System operation and maintenance will be conducted on an as needed basis. After the first thirty (30) days, one round of sampling will be collected in order to verify the impact of the bio-remediation, and a minimum of once after the one-hundred twenty (120) day period. The actual frequency of site visits will depend on the results of the sampling. System operation and maintenance will include the injection of the bacterial formula, nutrients, soil penetrant, and co-substrate as a slurry, into the ground. The operation and maintenance and sampling procedures will continue until groundwater levels meet the requirements in order to request no further action at this site.

4.6 Sampling and Analysis Plan

During system operation and maintenance, groundwater samples will be collected at system start-up, once after thirty days of treatment, and once after one hundred-twenty days of treatment. Additional sampling may be performed based on the performance of the treatment process.

The groundwater samples will be submitted to a certified laboratory for analysis of Benzene, Toluene, Ethylbenzene and Total Xylenes (BTEX) and naphthalene by EPA Method 8260, and Polynuclear Aromatic Hydrocarbons (PAHs) by EPA Method 8270.

Groundwater level measurements will be collected from all monitoring wells prior to all groundwater-sampling events. Measurements will be taken with an electrical water level indicator or interface probe if floating product is present. No groundwater samples will be collected if free product is measurable.

Three to six well volumes will be purged from each well prior to groundwater sampling. Field measurements of pH, groundwater temperature, specific conductance, dissolved oxygen, and turbidity will be taken during groundwater sampling events.

All sampling procedures will be conducted in accordance with EPA Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM), 1996. Any contaminated groundwater collected during the well sampling events will be containerized in DOT-approved (Specification 7H) 55-gallon drums and disposed of at a later date pending fluid contents analysis.

4.7 Reporting

Semi-annual monitoring reports will be submitted to SCDHEC. The reports will summarize and include copies of field and laboratory analytical data. Upon completion of active remediation, a Performance Evaluation Report will also be submitted to SCDHEC to summarizes the remediation activities, evaluate the soil and water quality data, and provide recommendations for the site.

4.8 Equipment Decontamination

All drilling equipment, augers, well casing and screens, and soil and groundwater sampling equipment involved in field sampling activities will be decontaminated according to the EPA EISOPQAM.

4.9 Sample Handling

Sample handling will be conducted in accordance to the following references: EPA EISOPQAM, Code of Federal Regulations 136, 1990, EPA Users Guide to Contract Laboratory Program, 1988, and the Comprehensive Sampling and Analysis Plan, 1996. The following forms will be completed for packing/shipping process: sample labels, chain-of-custody labels, appropriate labels applied to shipping coolers, and chain-of-custody forms.

4.10 Quality Control

In addition to periodic calibration of field equipment and the completions of the appropriate documentation, quality control (QC) samples will be collected during sampling events. QC samples may include field blanks, field duplicates, and trip blanks. Definitions of each can be found below as described by the EPA EISOPQAM:

- **Field Blank:** A sample collected using organic-free water, which has been run over/through sample collection equipment. These samples are used to determine if contaminants have been introduced by contact of the sample medium with sampling equipment. Equipment field blanks are often associated with collecting rinse blanks of equipment that has been field cleaned.

- **Field Duplicates:** Two or more samples collected from a common source. The purpose of a duplicate sample is to estimate the variability of a given characteristic or contamination associated with a population.

- **Trip Blank:** A sample, which is prepared prior to the sampling event in the actual container and is stored with the investigative samples throughout the sampling event. They are often packaged for shipment with the other samples and submitted for analysis. At no time after their preparation are trip blanks to be opened before they reach the laboratory. Trip blanks are used to determine if samples were contaminated during storage and/or transportation back to the laboratory (a measure of sample handling variability resulting in positive bias in contaminant concentration). If samples are to be shipped, trip blanks are to be provided with each shipment but not for each cooler.

4.11 Field Quality Assurance / Quality Control (QA/QC)

All sampling procedures will be conducted in accordance with EPA EISOPQAM. More information on field QC can be found in **Sections 4.8** through **4.10**.

QA/QC specifications for selected field measurements are summarized below.

Analysis	Control Parameter	Control Limit	Corrective Action
Air Monitoring	Check Calibration of OVA daily	Calibrate to manufactures specifications	Recalibrate. If unable to calibrate, replace.
pH of water	Continuing calibration check of pH 7.0 buffer	pH = 7.0	Recalibrate. If unable to calibrate, replace electrode.
Specific Conductance of water	Continuing calibration check of standard solution	> 1% of standard	Recalibrate.

4.12 Record keeping

In addition to required sampling documentation (see **Section 4.9**), standardized forms, log sheets and logbooks will be completed during all field activities.

5.0 PROPOSED INTRINSIC REMEDIATION

Upon completion of active remediation, if warranted, intrinsic remediation will be implemented until contaminant concentrations decrease below RBSLs or other action levels approved by SCHDEC. This CAP provides a method for implementing intrinsic remediation and monitoring well abandonment as a corrective action in accordance with SCDHEC Corrective Action Guidance, June 1997. The intrinsic remediation method may be modified based upon the results of active remediation.

5.1 Monitoring Well Installation

Assuming the existing wells are in good condition, no monitoring wells will be installed for the intrinsic remediation. If any wells are unusable or new wells are warranted for any other reason, the wells will be installed to the same specification as existing monitoring wells unless site conditions change and warrant otherwise.

5.2 Surveying

No new monitoring wells are scheduled to be installed as a part of the intrinsic remediation. Surveying of any new well locations will be conducted if warranted.

5.3 Soil Boring Schedule

No other soil borings are scheduled for the CAP unless site conditions change and warrant otherwise.

5.4 Monitoring Well Abandonment

All monitoring wells will be abandoned upon receiving approval by SCDHEC. The wells will be abandoned following the South Carolina Well Standards and Regulations R.61-71. The well abandonment will include grouting wells, removing stick-ups and removing all guard posts. Any well casing and screen removed will be decontaminated and disposed of as general refuse.

5.5 Sampling and Analysis Plan

After treatment, groundwater samples will be collected for a period of six (6) months from monitoring wells MW-1, MW-2, MW-3, MW-4, and MW-5. The groundwater samples will be submitted to a certified laboratory for analysis of BTEX and naphthalene by EPA Method 8260, PAHs by EPA Method 8270. The following parameters will also be considered for analysis in order to evaluate the effectiveness of intrinsic remediation is needed: nitrate (NO^{-3}), sulfate (SO^{-}_{4}), total and dissolved iron, methane (CH_4), and alkalinity.

Groundwater level measurements will be collected from all monitoring wells prior to all groundwater-sampling events. Measurements will be taken with an electrical water level indicator or interface probe if floating product is present. No groundwater samples will be collected if free product is measurable.

From three to six well volumes will be purged from each well prior to groundwater sampling. Field measurements of pH, groundwater temperature, specific conductance, dissolved oxygen, and turbidity will be taken during groundwater sampling events.

All sampling procedures will be conducted in accordance with EPA EISOPQAM. Any contaminated groundwater collected during the well sampling events will be containerized in DOT-approved (Specification 7H) 55-gallon drums and disposed of at a later date pending fluid contents analysis.

5.6 Reporting

Semi-annual monitoring reports will be submitted to SCDHEC. The reports will summarize and include copies of field and laboratory analytical data. Upon completion of 18 months of sampling, a Performance Evaluation Report will also be submitted to SCDHEC to summarizes the sampling activities, evaluate the soil and water quality data, and provide recommendations for the site.

The primary contacts for each are as follows:

1. SOUTHDIV point of contact
   Gabe Magwood
   Southern Division Engineering Command
   2155 Eagle Drive
   North Charleston, SC 29406
   (843) 820-7307

2. SOUTHDIV point of contact
   Tony Hunt
   Southern Division Engineering Command
   2155 Eagle Drive
   North Charleston, SC 29406
   (843) 820-7307

3. SCDHEC point of contact
   Michael Bishop
   South Carolina Department of Health and Environmental Control
   2600 Bull Street
   Columbia, SC 29201
   (843) 898-4339

REFERENCES

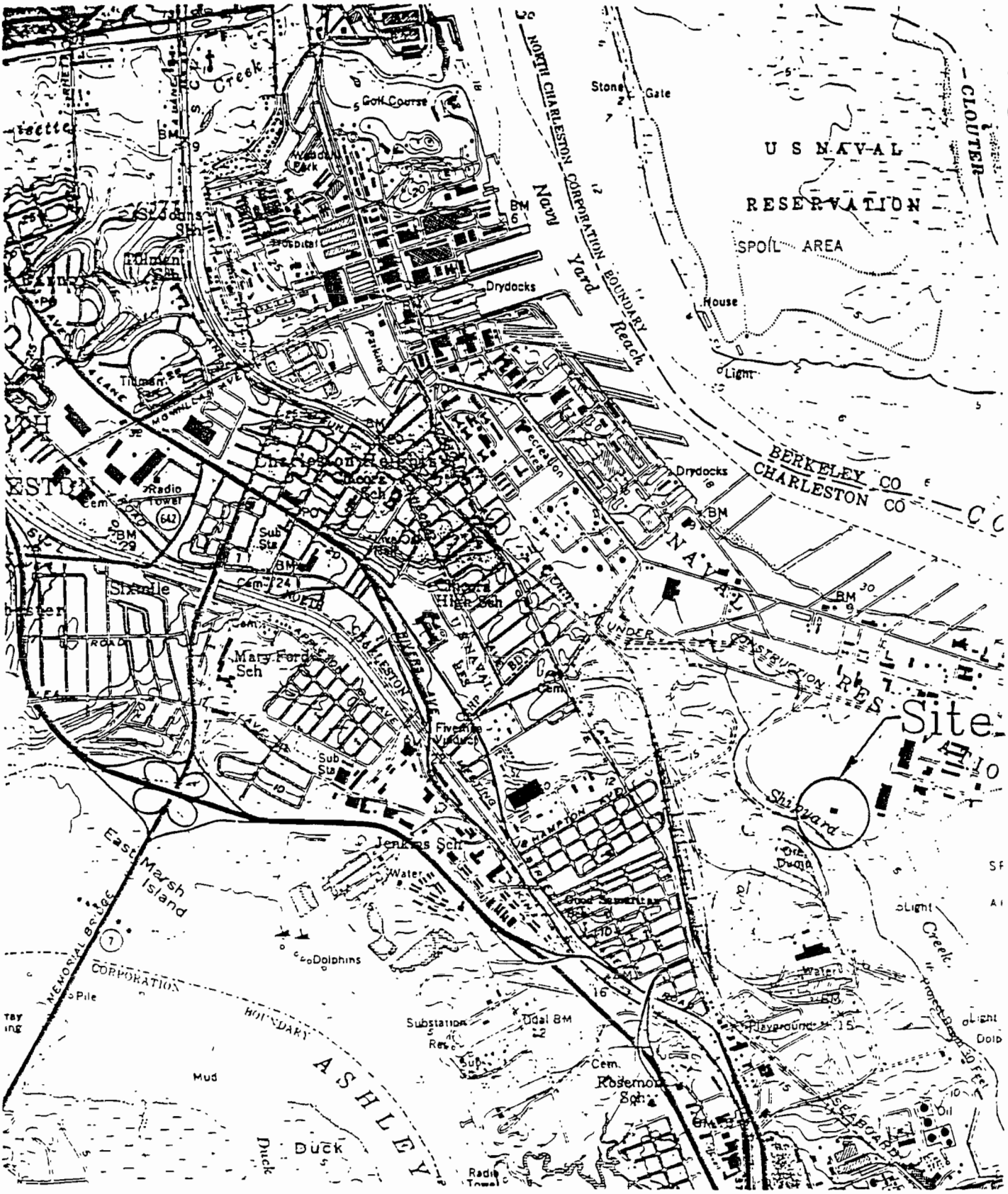
South Carolina Department of Health and Environmental Control.; 1997. Corrective Action Guidance.

S&ME; 1994, Assessment Report for Underground Storage Tank at the Charleston Naval Complex, Charleston, South Carolina.

United States Environmental Protection Agency.; 1990. Code of Federal Regulations 136.

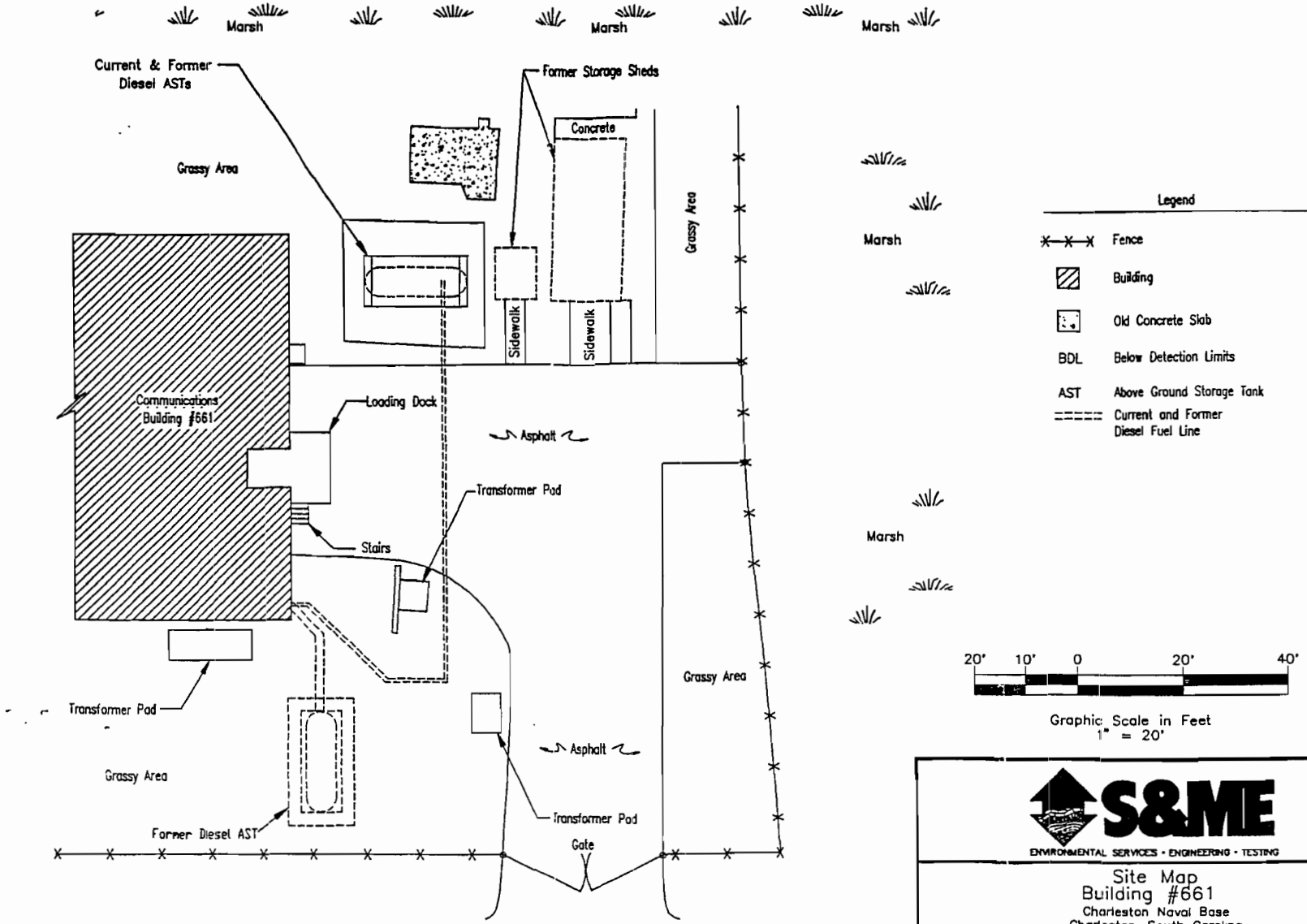
United States Environmental Protection Agency.; 1988. EPA Users Guide to Contract Laboratory Program.

United States Environmental Protection Agency.; 1996. EPA Environmental Investigations Standard Operating Procedures for Quality Assurance Manual.



Note: This Site Location Plan was derived from a USGS Charleston Quadrangle South Carolina 7.5 Minute Series (Topographic) Photorevised 1979.

SCALE: 1" = 2000'	S&ME ENVIRONMENTAL SERVICES · ENGINEERING · TESTING	Site Location Plan Building #661 Charleston Naval Base Charleston, South Carolina	FIGURE NO 1
CHECKED BY:			
DRAWN BY: NA			
DATE: 06-06-96		JOB NO: 1134-94-315	



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Site Map
Building #661
Charleston Naval Base
Charleston, South Carolina

SCALE:	DRAWN BY:	CHECKED BY:
1" = 20'	KLE	
JOB NO. 1134-94-315	DATE: 06-05-96	FIGURE NO. 2

SAMPLE ID NO.	TOTAL PAHs
DRUM-1	BDL
I-7	BDL
I-8	3.1
I-9	BDL
J-6	BDL
J-7	BDL
J-9/MW-1	BDL
K-6	BDL
K-7	3.0
K-8	BDL
K-9	BDL
L-7	BDL
L-8	BDL
M-6	BDL
M-7	11
M-8	77.1
M-9	BDL
N-7	BDL
N-8.5	28
N-9	2,326
N-10	BDL
N-11	BDL
O-8	BDL
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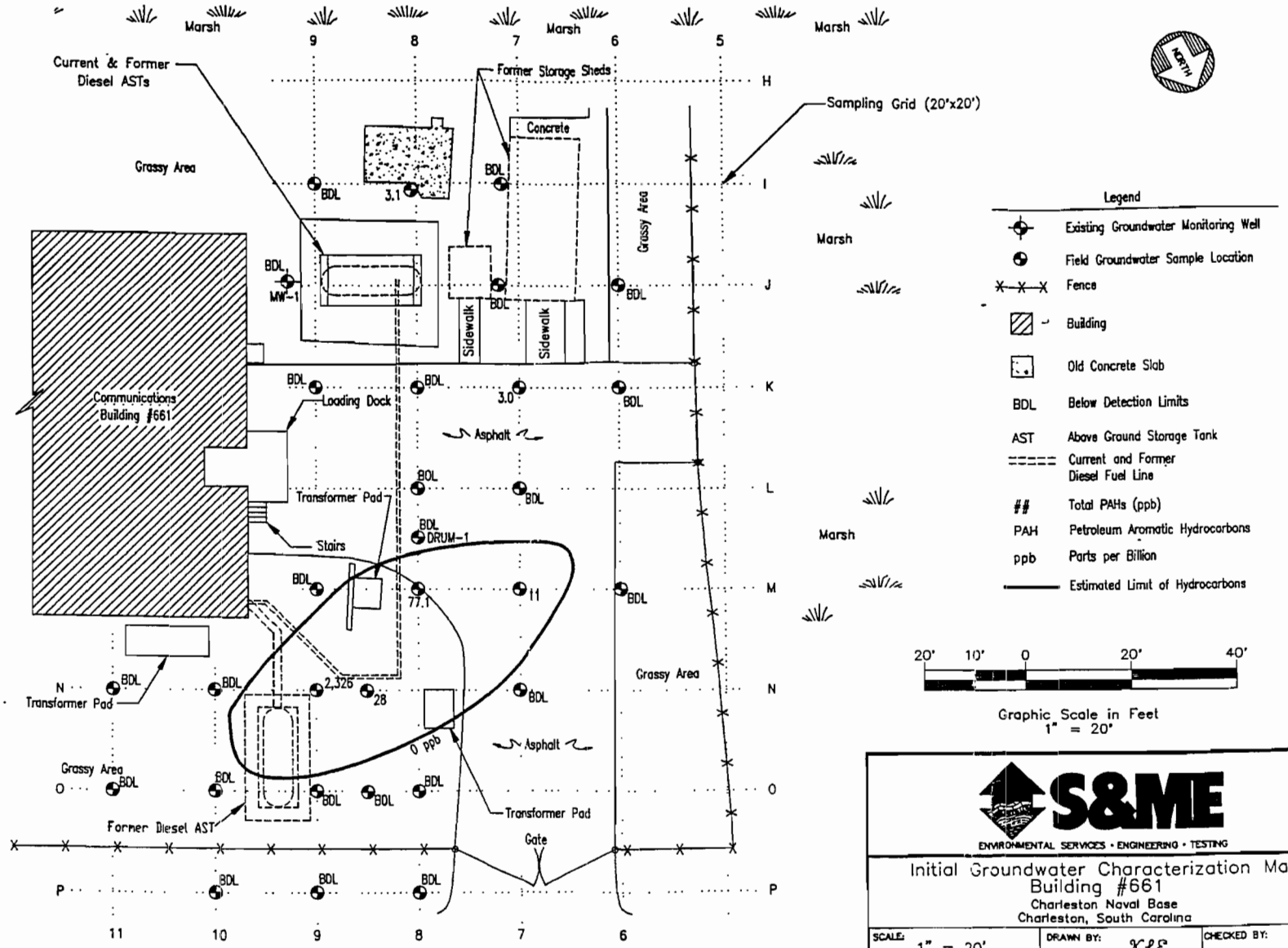
P-8	BDL
P-9	BDL
P-10	BDL



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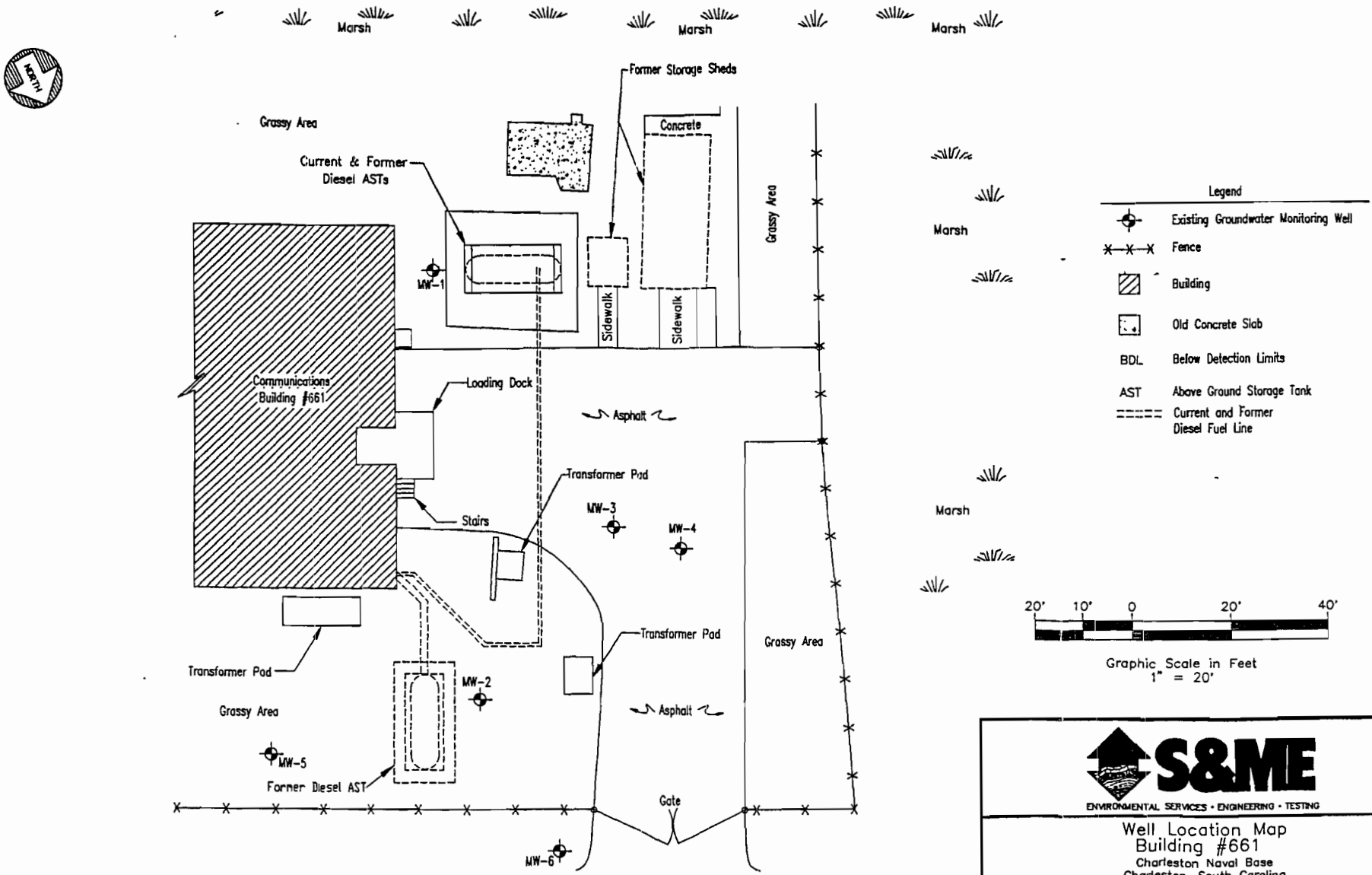
Initial Groundwater Characterization Map
Building #661
Charleston Naval Base
Charleston, South Carolina

SCALE: 1" = 20'	DRAWN BY: KLE	CHECKED BY:
JOB NO. 1134-94-315	DATE: 06-05-96	FIGURE NO. 3



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Well Location Map
Building #661
Charleston Naval Base
Charleston, South Carolina

SCALE:	DRAWN BY:	CHECKED BY:
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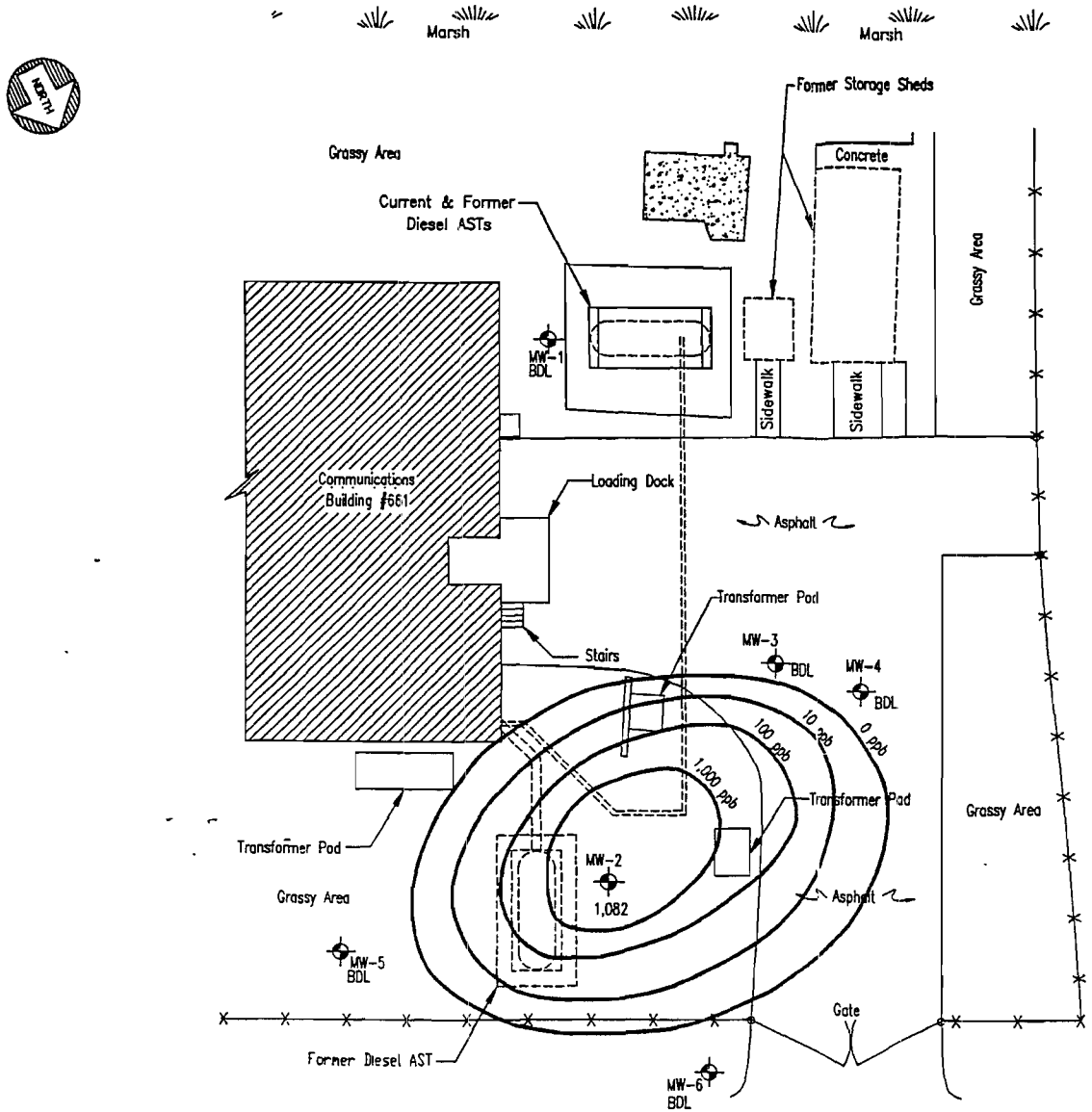
JOB NO. 1134--94--315	DATE: 06--06--96	FIGURE NO. 4



Legend

- Existing Groundwater Monitoring Well
- Fence
- Building
- Old Concrete Slab
- BDL — Below Detection Limits
- AST — Above Ground Storage Tank
- Current and Former Diesel Fuel Line
- # — Total PAHs in ppb
- PAH — Petroleum Aromatic Hydrocarbons
- ppb — Parts per Billion
- Estimated PAH Isoconcentration

20' 10' 0 20' 40'

Graphic Scale in Feet
1" = 20'

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Groundwater Isoconcentration Map
Building #661
Charleston Naval Base
Charleston, South Carolina

SCALE:	DRAWN BY:	CHECKED BY:
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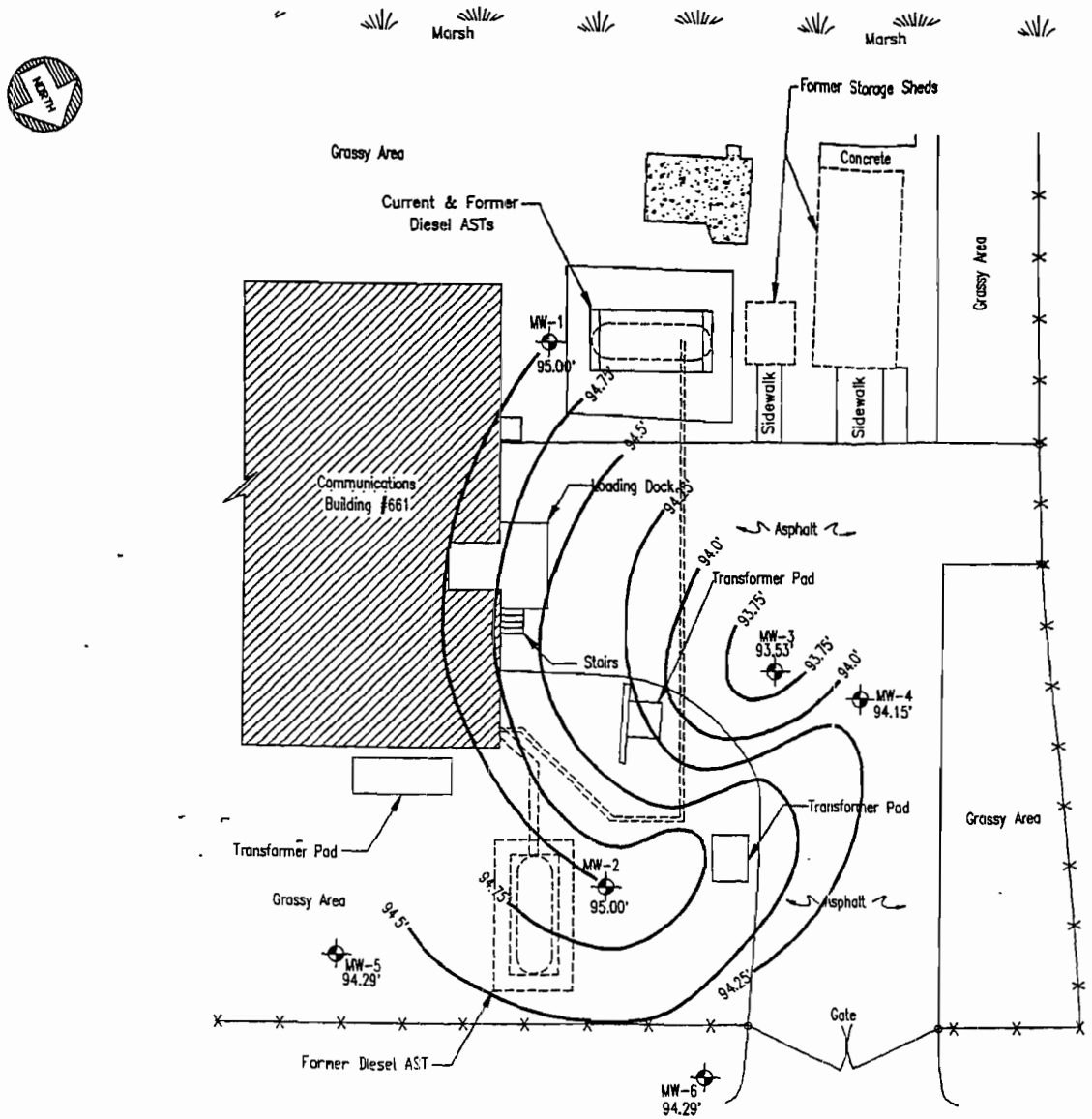
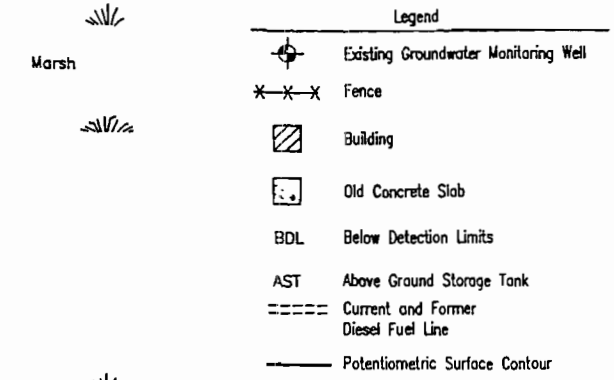
JOB NO. 1134-94-315	DATE: 06-06-96	FIGURE NO. 5





Note: Groundwater elevations are measured relative to a 100' arbitrary datum estoblished on-site.

Graphic Scale in Feet
1" = 20'

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Potentiometric Surface Map
Building #661
Charleston Naval Base
Charleston, South Carolina

SCALE:	DRAWN BY:	CHECKED BY:
1" = 20'	KLE	
JOB NO. 1134-94-315	DATE: 06-06-96	FIGURE NO. 6