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SAMPLING AND ANALYSIS PLAN FOR ZONE A SITE 41 BUILDING 191 UST 191NW AND AST 191 CNC CHARLESTON SC

8/1/2000

J A JONES ENVIRONMENTAL SERVICES

SAMPLING AND ANALYSIS PLAN
FOR
ZONE A/ SITE 41- BUILDING 191
UST 191NW and AST 191

SITE IDENTIFICATION # 00936

Charleston Naval Complex
Charleston, South Carolina

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

Contract Number N62467-99-C-0960

August 2000

SAMPLING AND ANALYSIS PLAN
FOR
ZONE A/ SITE 41-BUILDING 191
UST 191NW and AST 191

SITE IDENTIFICATION # 00936

Charleston Naval Complex
Charleston, South Carolina

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, South Carolina 29406

Submitted by:
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August 2000

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TABLE OF CONTENTS

Section **Page**

ACRONYMS ..... **iii**

1.0 INTRODUCTION1-1
1.1 GENRAL SITE DESCRIPTION 1-1
1.2 OBJECTIVE 1-1
2.0 RECEPTOR SURVEY **2-1**
2.1 FATE AND TRANSPORT MODELING 2-1
2.2 SITE-SPECIFIC TARGET LEVELS 2-2
2.3 SOIL LEACHING SSTL 2-2
3.0 PROPOSED REMEDIATION TECHNOLOGY **3-1**
4.0 MONITORING WELL INSTALLATON AND ABANDONMENT **4-1**
4-1 MONITORING WELL INSTALLATION 4-1
4-2 MONITORING WELL ABANDONMENT 4-1
4-3 SURVEYING 4-1
4-4 EQUIPMENT DECONTAMINATION 4-1
5.0 PROPOSED GROUNDWATER MONITORING PROGRAM **5-1**
5-1 MONITORING FREQUENCY AND REPORTING 5-1
5-2 ANALYTICAL PARAMETERS 5-2
5-3 FIELD MEASUREMENTS 5-2
5-4 GROUNDWATER LEVEL MEASUREMENTS 5-3
5-5 SAMPLE HANDLING 5-3
5-6 SAMPLE PACKING AND SHIPPING 5-3
5-7 FIELD QA/QC 5-4
5-8 CONTROL LIMITS 5-4
5-9 RECORDKEEPING 5-4
5-10 SITE MANAGEMENT AND BASE SUPPORT 5-4

REFERENCES **R-1**

APPENDICES

APPENDIX A.....LEACHABILITY MODELS

APPENDIX B.....FIELD FORMS

APPENDIX C.....BORING LOGS

APPENDIX D.....MONITORING WELL SHEETS

TABLES

TABLE 1 /PAGE 2-1 ..... UTILITY RECEPTORS

TABLE 2 /PAGE 2-2 .....RBSL FOR COCs

TABLE 3 / PAGE 2-3 .....SSTLs

TABLE 4 /PAGE 5-1 .....SAMPLING SCHEDULE

TABLE 5 /PAGE 5-4 ..... CONTROL LIMITS

FIGURES

FIG 1 ... . SITE LOCATION MAP

FIG 2 ... .SITE VICINITY MAP

FIG 3 ... .SOIL BORING LOCATIONS

FIG 4 ... .MONITORING WELL LOCATIONS AND GROUNDWATER COCs

FIG 5 ... . GROUNDWATER POTENTIOMETRIC MAP

FIG 6 ... . SITE LAYOUT MAP

FIG 7 ... . CROSS SECTION A-A

FIG 8 ... .CROSS SECTION B-B

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
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
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
TTNUS	Tetra Tech NUS
UST	Underground Storage Tank

1.0 INTRODUCTION

This Sampling and analysis Plan (SAP) has been prepared by CH2M-JONES, LLC. The plan is designed for Zone A/ Site 41-Building 191; Underground Storage Tank (UST) 191NW and Aboveground Storage Tank (AST) 191 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: 00936. This SAP provides methods to further evaluate the applicability of intrinsic remediation and monitoring well abandonment as a corrective action for UST 191 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 as shown in Figure 1. 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 2. (Tetra Tech, NUS [TTNUS], Standard Limited Assessment (SLA) for UST 191 1999).

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. A site vicinity map, which exhibits adjacent properties and structures, vicinity roads, current utilities, and vicinity surface drainage, is included as Figure 2.

Building 191was constructed in 1961. The facility served as a humidity-controlled warehouse for photo-chemical and computer software. UST 191NW was a 1,500-gallon steel UST which provided diesel fuel to the buildings diesel-powered condenser units. Aboveground Storage Tank (AST) 191 was a 550-gallon steel AST which provided fuel oil to the buildings boiler for heating (TTNUS, SLA Report ,2000).

1.2 Objective

This CAP presents the groundwater monitoring plan to assess the down gradient plume migration and intrinsic bioremediation/natural attenuation of petroleum hydrocarbons contamination in order to validate the assumptions and calculations used in the in the SLA completed by TTNUS 2000. Details for the abandonment of monitoring wells at this site are also included in this plan.

2.0 RECEPTOR SURVEY

A receptor survey of the site vicinity was conducted by TTNUS personnel to identify potential receptors for petroleum hydrocarbon contamination. The site map Figure 2 depicts the public utilities located within 250 feet of the former UST 191NW and AST 191 study area. Specific information concerning the depth of utilities bls is currently unavailable, however, utilities at this site generally are between 2 to 6 feet bls. The following utility receptors were located:

TABLE 1

UTILITY	ON-SITE OR DISTANCE/ DIRECTION FROM SITE	DEPTH TO UTILITY
Gas	Not believed to be within a 250 ft radious of Bldg. 191	See additional comments
Electrical	5 ft southwest of former UST 191NW	See additional comments
Sewer	20 ft north and 90 ft east of Bldg. 191	See additional comments
Storm Drain	10 ft northwest, 70 ft west and 150 ft west, 200 ft east of Bldg. 191	See additional comments
Water	100 ft east of Bldg. 191	See additional comments

Additional Comments: Detailed utility maps of the Building 191 area exist only for storm drainage. All other utility location are based upon site reconnaissance of water meters, fire hydrants, and manhole covers.

According to the SLA report completed by TTNUS, a survey of groundwater users within a 7-mile radius of CNC was conducted by the South Carolina Water Resources Commission to ascertain the extent of any shallow groundwater usage. Results of the water use investigation revealed that no drinking water wells, which utilize the shallow aquifer, are located within a 4- mile radius of CNC. Irrigation wells are not identified within 1,000 feet of the site. Numerous monitoring wells are located within 1,000 feet of the site. No basements are located on the CNC property.

There are no city, county or state-zoning ordinances, the property (CNC) is currently owned by the federal government. Information concerning zoning ordinances was obtained from the SOUTHDIV Remedial Project Manager located at 2155 Eagle Drive, North Charleston, South Carolina 29406 (TTNUS, 1999).

2.1 Fate and Transport Modeling

No groundwater concentrations exceeded the SCDHEC Risk Based Screening Levels (RBSLs); therefore, fate and transport modeling is not required.

2.2 Site-Specific Target Levels

According to the SLA, the only potential receptor as a construction worker ingesting or dermally contacting soil while working in a utility trench Site soil concentrations were compared with RBSLs for ingestion or dermal contact with surficial soil. Surficial soil was not impacted at the site; however, for the construction worker pathway, exposure to subsurface soil is evaluated as surface soil because the worker is expected to have direct contact with the subsurface soil. The calculations for dermal contact and incidental ingestion can be found in the SLA completed by TTNUS. As shown below, no soil concentrations exceeded the Risk-based Screening Levels (RBSL); therefore , a construction worker ingesting or contacting impacted soil is not considered at risk and not considererd for further analysis.

TABLE 2

Compound of Concern	Maximum Concentration (mg/kg)	RBSL for Ingestion or Dermal Contact with Soil-Commercial (mg/kg)	Exceed the RBSL
Benzene	<.006	200	No
Toluene	<.006	410,000	No
Ethylbenzene	<.006	200,000	No
Xylenes	<.006	1,000,000	No
Total BTEX	ND	N/A	No
Naphthalene	2.237	41,000	No
Benzo(a)anthracene	<.430	3.9	No
Benzo(b)fluoranthene	J260	3.9	No
Benzo(k)fluoranthene	<.460	39	No
Chrysene	J300	390	No
Dibenzo(a,h)anthrecene	<.460	0.39	No

- **J indicates an estimated value less than the laboratory's practical quantitation limit.**

2.3 Soil Leaching SSTL

SSTLs were calculated for Naphthalene concentrations leaching from subsurface soil to groundwater using the SCDHEC Soil Leachability Model and Selected Minimum RBSLs. The input parameters for the leachability model were determined using the figures in the SCDHEC Risk-based Corrective Action Guidelines (January 1998), soil quality and grain size data, and the Selected Minimum RBSLs calculated for the site. The soil leaching SSTLs calculated Naphthalene is provided in the following table (TTNUS 2000).

TABLE 3

Chemical of Concern	Concentration in SB-05 (mg/kg)	Soil Leaching SSTL (mg/kg)
Naphthalene	2.237	54

The soil leaching SSTL for Naphthalene is 54 mg/kg, which is above the maximum naphthalene concentration detected (2.237 mg/kg), indicating the soil naphthalene levels will not leach into the groundwater at concentrations above RBSL for a construction worker.

3.0 PROPOSED REMEDIATION TECHNOLOGY

Based on the results of the Tier I and Tier II modeling, an Intrinsic Remediation with a monitoring period of 18 months will be performed for the site. The monitoring program will consist of sampling initially all of the surrounding wells adjacent to the source point, and only sampling selected wells thereafter. The proposed monitoring program is described in detail in Sections 4.0 and 5.0 of this plan.

4.0 MONITORING WELL INSTALLATION AND ABANDONMENT

4.1 Monitoring Well Installation

Because of the amount and locations of monitoring wells located in and around this site, no monitoring wells will be installed as part of this plan.

4.2 Monitoring Well Abandonment

Eight monitoring wells will be abandoned at Building 191 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

4.3 Surveying

Because no monitoring wells will be installed at this site, a new survey will not be conducted.

4.4 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 Environmental Protection Agencies (EPA) " Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM).

5.0 PROPOSED GROUNDWATER MONITORING PROGRAM

5.1 Monitoring Frequency and Reporting

The groundwater monitoring program proposed at building 191 will be performed in accordance with SCDHEC and consist of the following:

TABLE 4

Sampling Date	Monitoring Wells Sampled	Field Measures	Laboratory Analytical
Second half[1] 2000	MW-01, MW-001, MW-07, MW-8D, MW05	T°, pH, Conductivity, Depth to water, total depth, Turbidity	Naphthalene 8260 BTEX 8260 Sulfate, Nitrate, Total dissolved iron, alkalinity, methane
first half[2] 2001	MW-01, MW-001, MW-07, MW-8D, MW05	T°, pH, Conductivity, Depth to water, total depth, Turbidity	Naphthalene 8260 BTEX 8260 Sulfate, Nitrate, Total dissolved iron, alkalinity, methane
Second half 2000	MW-01, MW-001, MW-07, MW-8D, MW05	T°, pH, Conductivity, Depth to water, total depth, Turbidity	Naphthalene 8260 BTEX 8260 Sulfate, Nitrate, Total dissolved iron, alkalinity, methane

1. **second half: July through December**
2. **first half: January through June**

- **Frequency:** Initially all monitoring wells at this site will be sampled. Thereafter, groundwater samples will be collected from wells MW-01 as a source well, MW-043-001 as the up gradient well and MW-07 as the down gradient well.

- **Reporting:** Semi-annual groundwater monitoring reports will be submitted to SCDHEC.

Included in the semi-annual reports will be field and analytical information from the certified laboratory indicating well numbers, analytical methods used, date sampled, date analyzed, and method detection limits.

At the end of the 18-month period, a performance evaluation will be submitted to SCDHEC providing the effectiveness of the intrinsic biodegradation/natural attenuation occurring and any recommendations for the site.

- **Groundwater Sampling**

Prior to any groundwater sampling, each well will be measured for water levels and total depth and each well will be purged in accordance the EPA EISOPQAM.

5.2 Analytical Parameters

The following constituents will be analyzed for each groundwater sample:

- Naphthalene using method 8270.
- BTEX using method 8260.

The following parameters will be analyzed in order to evaluate the effectiveness of intrinsic remediation:

- Nitrate (NO^{-3})
- Sulfate (SO^{-4})
- Total dissolved iron
- Methane (CH_4)
- Alkalinity

5.2 Field Measurements

The following parameters will be sampled in the field:

- Temperature
- pH
- Dissolved Oxygen
- Depth to water table
- Depth of well
- Turbidity
- Specific Conductance

Field measurements will be recorded in the field book and in field forms provided in Appendix B of section 7.

5.3 Groundwater Level Measurements

Groundwater measurements will be taken from all monitoring wells at the site during each sampling event. All water level measurements will be taken on the same day as anticipated sampling.

Measurements will be taken with an electrical water level meter or interface probe if floating product is present using the highest part of the top of the casing as a reference point for determining depths to water and total depths. Water level measurements will be recorded to the nearest 0.01 foot in the field book.

5.4 Sample Handling

Sample Handling will be conducted with the following references:

EPA EISOPQAM (EPA May, 1996)

5.5 Sample Packing and Shipping

The following forms will be completed to complete the packing/shipping process:

- Sample labels
- Chain-of-custody labels
- Appropriate labels applied to shipping coolers
- Chain-of-custody forms
- Federal express air bills

5.6 Quality Control

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 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.

5.7 Control Limits

TABLE 5

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.

5.8 Record keeping

In addition to records kept in logbooks, forms will be kept on log sheets for soil and groundwater.

5.9 Site Management and Base Support

Throughout the investigation activities, work on the CNC will be coordinated through SOUTHDIV and SCDHEC.

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

REFERENCES

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

Tetra Tech NUS, Inc.; 1999 Standard Limited Assessment for Site 41 (Building 191), Charleston, South Carolina.

Tetra Tech NUS, Inc.; 2000 Standard Limited Assesment for Site 41 (Building 191), Charleston, South Caolina.

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.

IN-SITU SOIL RISK EVALUATION

SOUTH CAROLINA
Department of Health and Environmental Control (DHEC)

Site Data

SITE ID #	00936	COUNTY	Charleston
FACILITY NAME	Site 41, Building 191		
STREET ADDRESS	Charleston Naval Complex, North Charleston, SC		

Soil Risk Evaluation Data

					Figure
TPH		**290**	mg/kg		
Soil % SAND (Estimated)		**28**	%		
Soil % CLAY (Estimated)		**25**	%		
Worst Case Soil Analyses	Benzene		mg/kg	Cs	
	Toluene		mg/kg	Cs	
	Ethylbenzene		mg/kg	Cs	
	Xylenes		mg/kg	Cs	
	Naphthalene	**2.237**	mg/kg	Cs	
	MTBE		mg/kg	Cs	
Natural Organic Carbon Content		**11200**	mg/kg	foc	
Average Annual Recharge		25	cm	Hw	
Distance from highest Soil Impact to water table		**0**	cm	L	
Bulk Density of Soil		*1.27*	g/cc	Bd	1
Wetting Front Suction		*32*	cm	Hf	2
Soil Hydraulic Conductivity		*9.00E-05*	cm/sec	Kf	3
Porosity		*0.52*	decimal %	Φ	4
Residual Water Content		*0.08*	decimal %	Wr	5

List possible human exposure pathways from surface soil.
Soil leaching to groundwater - utility trench

Site Specific Data in Bold.

Soil Leachability Figures C- through C5.

IN-SITU SOIL RISK EVALUATION

CALCULATIONS:

Equation Set I - Determine soil pore water concentration resulting from physical partioning (Cw).

Step 1 - Calculate the total organic carbon content (fcs) of the soil.

fcs = (foc + TPH/1.724)*1E-6 = 0.0114 decimal %

Step 2 - Calculate the concentration of COC in soil pore water (Cw) directly in contact with the contaminate soil.

Cw = Cs*((Wr *1g/cc + Bd)/((Bd*Koc*fcs) + Wr + ((ø-Wr)*H'))) = 0.01 mg/l

Equation Set II - Determine the velocity of the soil pore water (Vw)

Step 1 - Calculate the air filled porosity (f) in decimal percent.

f = ø - Wr = 0.44 decimal %

Step 2 - Determine the time for water to percolate through the vadose zone soil (from depth of worst case soil sample to the water table at site).

t = (f/Kf)*(L-(Hw-Hf))*(ln(Hw + ((L-Hf)/(Hw-Hf)))) = 0 seconds

Step 3 - Determine the velocity of the water (Vw) in feet per year.

Vw = (L/30.48cm/ft)/(t/31,500,000sec/year) = 24098816 ft/year

Equation Set III - Determine the organic retardation effect (Vc) of the contaminant.

Step 1 - Calculate the soil/water distribution coefficient (Kd) (ml/g) for uncontaminated soil.

Kd = Koc*foc*1E-6 = 17.2816 ml/g

Step 2 - Calculate the retardation effect of natural soil organic matter on COC migration.

Vc = Vw*(1 + ((Bd*Kd)/ø)) = 557,753 ft/year

IN-SITU SOIL RISK EVALUATION

SOUTH CAROLINA
Department of Health and Environmental Control (DHEC)

Site Data

SITE ID # 00936
FACILITY NAME Site 41, Building 191

Instructions

Provide results, separately, for each constituent in the worst case soil analysis.

Data

List Constituent: NAPHTHALENE
(BTEX, Napth.)

				Table
Bioremediation "half-life"	48	days	t 1/2	1
Soil/water partitioning coefficient	1543	ml/g	K oc	1

Results

				Equation Set	Step
Total Organic Carbon Content	0.0114	decimal %	f cs	I	1
Leachate Concentration	0.010	mg/l	C w	I	2
Air Filled Porosity	0.44	decimal %	f	II	1
Infiltration Rate Time	0	seconds	t	II	2
Velocity of Water	24,098,816	ft/year	V w	II	3
Soil/Water Distribution Coefficient	17.28	ml/g	K d	III	1
Contaminant Percolation Rate	557,753	ft/year	V c	III	2
Time to Reach Groundwater	0	days	T c	IV	1
Concentration reaching Groundwater	1.63	mg/l	C p	IV	2
Site Specific Target Level	**54**	mg/kg	C sstl	V	

Conclusions

Does concentration of chemical of concern in soil exceed SSTL? NO

Risk of Human Exposure due to contaminated soil.

_____ YES X _____ NO

IN-SITU SOIL RISK EVALUATION

Construction Worker Incidental Ingestion RBSLs

	BW	AT	IR	ED	EF	Target	CSF oral	Rfd oral	RBSL
	kg	day	L/day	yrs	days/yr	Risk or HQ			mg/L
Benzene	70	25550	0.01	1	90	1.00E-06	2.90E-02		6.85E+01
Toluene	70	365	0.01	1	90	1.0	NA	2.00E-01	5677.778
Ethylbenzene	70	365	0.01	1	90	1.0	NA	1.00E-01	2838.889
Xylene	70	365	0.01	1	90	1.0	NA	2.00E+00	56777.78
Naphthalene	70	365	0.01	1	90	1.0	NA	4.00E-02	1135.556

Prepared By: _____ Reviewed By: _____

Minimum Construction Worker RBSLs

	Dermal	Incidental Ingestion	Inhalation	Minimum
	RBSL	RBSL	RBSL	RBSL
	mg/L	mg/L	mg/L	mg/L
Benzene	0.85	68.52	0.15	0.15
Toluene	23.98	5677.78	5.19	5.19
Ethylbenzene	6.05	2838.89	14.70	6.05
Xylene	102.33	56777.78	102.12	102.12
Naphthalene	1.63	1135.56	2.63	1.63

Prepared By: _____ Reviewed By: _____

Monitor' Vell Data
Contract . .K Order No.

Well Identification	Date/Time	Total Depth of Well	Depth to Product	Depth to Water	pH	Temperature (°C)	Conductivity (ms/cm)	Dissolved O_2 (mg/l)	Turbidity (NTU)	Sample ID

IN-SITU SOIL RISK EVALUATION

SOUTH CAROLINA
Department of Health and Environmental Control (DHEC)

Site Data

SITE ID #	00936	COUNTY	Charleston
FACILITY NAME	Site 41, Building 191		
STREET ADDRESS	Charleston Naval Complex, North Charleston, SC		

Soil Risk Evaluation Data

					Figure
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Soil Analyses	Toluene		mg/kg	Cs	
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	Xylenes		mg/kg	Cs	
	Naphthalene	**2.237**	mg/kg	Cs	
	MTBE		mg/kg	Cs	
Natural Organic Carbon Content		**11200**	mg/kg	foc	
Average Annual Recharge		25	cm	Hw	
Distance from highest Soil Impact to water table		**0**	cm	L	
Bulk Density of Soil		*1.27*	g/cc	Bd	1
Wetting Front Suction		*32*	cm	Hf	2
Soil Hydraulic Conductivity		*9.00E-05*	cm/sec	Kf	3
Porosity		*0.52*	decimal %	Φ	4
Residual Water Content		*0.08*	decimal %	Wr	5

List possible human exposure pathways from surface soil.
Soil leaching to groundwater - utility trench

Site Specific Data in Bold.

Soil Leachability Figures C- through C5.

IN-SITU SOIL RISK EVALUATION

SOIL LEACHABILITY MODEL FOR NAPHTHALENE

RISK-BASED CORRECTIVE ACTION FOR PETROLEUM RELEASES

SITE INFORMATION:

Site: Site 41, Building 191

Location: Charleston Naval Complex, North Charleston, SC

REFERENCES:

(1) SCDHEC, RBCA For Petroleum Releases, June 1995, Appendix B, Figure 1.
(2) SCDHEC, RBCA For Petroleum Releases, June 1995, Appendix B, Table 2.
(3) SCDHEC, RBCA For Petroleum Releases, June 1995, Appendix B, Input Parameters.
(4) SCDHEC, RBCA For Petroleum Releases, June 1995, Appendix B, Table 1.
(5) SCDHEC, RBCA For Petroleum Releases, June 1995, Appendix B, Figure 2.
(6) SCDHEC, RBCA For Petroleum Releases, June 1995, Appendix B, Figure 3.
(7) SCDHEC, RBCA For Petroleum Releases, June 1995, Appendix B, Figure 4.
(8) SCDHEC, RBCA For Petroleum Releases, June 1995, Appendix B, Figure 5.

INPUT:

COC	Chemical of Concern		NAPHTHALENE
Bd	Soil Bulk Density (1)	g/cm3	1.27
Crsbl	Risk Based Screening Level	mg/L	1.63
Cs	Concentration of COC in soil	mg/kg	2.237
DAF	Dilution/Attenuation Factor (2)	unitless	2
foc	Organic Carbon Content in Soil (3)	mg/kg	11200
H'	Henry's Law Constant (4)	unitless	0.002
Hf	Wetting front suction head (always negative) (5)	cm	-32
Hw	Average Annual Recharge (3)	cm	25
Kf	Soil Hydraulic Conductivity (6)	cm/s	0.0001
Koc	Soil/Water Partioning Coefficient (2)	ml/g	1543
L	Depth between soil sample with greatest COC concentration to groundwater.	cm	0
ø	Porosity (7)	unitless	0.52
t1/2	Biodegradation "half life" (2)	days	48
TPH	Total Petroleum Hydrocarbons, EPA Method 3550	mg/kg	290
Wr	Residual Water Content (8)	volume fraction	0.08

CALCULATIONS:

Equation Set I - Determine soil pore water concentration resulting from physical partioning (Cw).

Step 1 - Calculate the total organic carbon content (fcs) of the soil.

fcs = (foc + TPH/1.724)*1E-6 = 0.0114 decimal %

Step 2 - Calculate the concentration of COC in soil pore water (Cw) directly in contact with the contaminate soil.

Cw = Cs*((Wr *1g/cc + Bd)/((Bd*Koc*fcs) + Wr + ((ø-Wr)*H'))) = 0.01 mg/l

Equation Set II - Determine the velocity of the soil pore water (Vw)

Step 1 - Calculate the air filled porosity (f) in decimal percent.

f = ø - Wr = 0.44 decimal %

Step 2 - Determine the time for water to percolate through the vadose zone soil (from depth of worst case soil sample to the water table at site).

t = (f/Kf)*(L-(Hw-Hf))*(ln(Hw + ((L-Hf)/(Hw-Hf)))) = 0 seconds

Step 3 - Determine the velocity of the water (Vw) in feet per year.

Vw = (L/30.48cm/ft)/(t/31,500,000sec/year) = 24098816 ft/year

Equation Set III - Determine the organic retardation effect (Vc) of the contaminant.

Step 1 - Calculate the soil/water distribution coefficient (Kd) (ml/g) for uncontaminated soil.

Kd = Koc*foc*1E-6 = 17.2816 ml/g

Step 2 - Calculate the retardation effect of natural soil organic matter on COC migration.

Vc = Vw*(1 + ((Bd*Kd)/ø)) = 557,753 ft/year

Equation Set IV - Determine biodegradation rates and provide final COC concentration (Cf) at depth of concern.

Step 1 - Calculate the time (Tc) in days required for the COC to reach groundwater.

Tc = 365 day/yr*((L/30.48cm/ft)/Vc) = 0.00 days

Step 2 - Calculate estimated concentration of COC in the soil pore water (Cp) necessary to protect groundwater.

Cp = 10^(log (Crsbl) + ((Tc/2.3)*(0.693/t1/2))) = 1.63 mg/l

COC concentration in soil pore water (Cp) is greater than Crsbl, therefore the SSTL must be calculated.

Equation Set V - Calculate the Site Specific Target Level (SSTL) for the COC in soil.

Csstl for NAPHTHALENE in soil = Cp*DAF*(((Bd*Koc*fcs) + Wr + (F*'H''))/(Wr*1g/cc + Bd)) = 53.990779 mg/kg

PREPARED BY: Date 10/11/99

CHECKED BY: Date 10/12/99

IN-SITU SOIL RISK EVALUATION

SOUTH CAROLINA
Department of Health and Environmental Control (DHEC)

Site Data

SITE ID # 00936
FACILITY NAME Site 41, Building 191

Instructions

Provide results, separately, for each constituent in the worst case soil analysis.

Data

List Constituent: NAPHTHALENE
(BTEX, Napth.)

				Table
Bioremediation "half-life"	48	days	t 1/2	1
Soil/water partitioning coefficient	1543	ml/g	K oc	1

Results

				Equation Set	Step
Total Organic Carbon Content	0.0114	decimal %	f cs	I	1
Leachate Concentration	0.010	mg/l	C w	I	2
Air Filled Porosity	0.44	decimal %	f	II	1
Infiltration Rate Time	0	seconds	t	II	2
Velocity of Water	24,098,816	ft/year	V w	II	3
Soil/Water Distribution Coefficient	17.28	ml/g	K d	III	1
Contaminant Percolation Rate	557,753	ft/year	V c	III	2
Time to Reach Groundwater	0	days	T c	IV	1
Concentration reaching Groundwater	1.63	mg/l	C p	IV	2
Site Specific Target Level	**54**	mg/kg	C sstl	V	

Conclusions

Does concentration of chemical of concern in soil exceed SSTL? NO

Risk of Human Exposure due to contaminated soil.

_____ YES X NO

IN-SITU SOIL RISK EVALUATION

Construction Worker Dermal RBSLs

	Kow	MW	Kp	B	τ_{event}	c	b	t*	t_{event}	DAevent
			cm/hr	unitless	hr/event			hr	hr/event	
Benzene	199.5262315	78.1	0.11551543	0.392637855	2.87E-01	6.32E-01	6.03E-01	6.90E-01	1	eq 3.3
Toluene	537.0317964	92.1	0.259561335	0.958068292	3.44E-01	1.13E+00	1.31E+00	1.33E+00	1	eq 3.2
Ethylbenzene	1412.537545	106.2	0.569219802	2.256154884	4.13E-01	2.36E+00	4.39E+00	1.70E+00	1	eq 3.2
Xylene*	1584.893192	106.2	0.638675123	2.531447415	4.13E-01	2.63E+00	5.31E+00	1.72E+00	1	eq 3.2
Naphthalene	1995.262315	128.2	0.605452393	2.636638957	5.48E-01	2.73E+00	5.69E+00	2.29E+00	1	eq 3.2

	BW	AT	EV	ED	EF	SA	CSF derm	Rfd derm	Target	RBSL	RBSL
	kg	day	events/day	yrs	days/yr	cm^2	$(mg/kg\text{-}day)^{-1}$	mg/kg-day	Risk or HQ	mg/L	mg/L
Benzene	70	25550	1	1	90	4500	2.99E-02	NA	1.00E-06		8.52E-01
Toluene	70	365	1	1	90	4500	NA	1.60E-01	1.0	2.40E+01	
Ethylbenzene	70	365	1	1	90	4500	NA	9.70E-02	1.0	6.05E+00	
Xylene*	70	365	1	1	90	4500	NA	1.84E+00	1.0	1.02E+02	
Naphthalene	70	365	1	1	90	4500	NA	3.20E-02	1.0	1.63E+00	

* Kow and MW values for xylene, m-

Prepared By: _____

Reviewed By: _____

Construction Worker Incidental Ingestion RBSLs

	BW	AT	IR	ED	EF	Target	CSF oral	Rfd oral	RBSL
	kg	day	L/day	yrs	days/yr	Risk or HQ			mg/L
Benzene	70	25550	0.01	1	90	1.00E-06	2.90E-02		6.85E+01
Toluene	70	365	0.01	1	90	1.0	NA	2.00E-01	5677.778
Ethylbenzene	70	365	0 01	1	90	1.0	NA	1.00E-01	2838.889
Xylene	70	365	0.01	1	90	1.0	NA	2.00E+00	56777.78
Naphthalene	70	365	0.01	1	90	1.0	NA	4.00E-02	1135.556

Prepared By: _____ Reviewed By: _____

Construction Worker Inhalation RBSLs

Chemical	TR (carc)	HI (nonc)	BWadult	AT	Sfi (carc)	RfD (nonc)	IR air	EF	ED	RBSLair	H	RBSLwater
			kg	yr	$[mg/kg\text{-}day]^{-1}$	[mg/kg-day]	m^3/day	day/yr	yr	mg/m^3	cm^3/cm^3	mg/L
Benzene	1 00E-06	NA	70	70	2.90E-02	NA	20	90	1	3.43E-02	2.26E-01	0.152
Toluene	NA	1	70	1	NA	1.10E-01	20	90	1	1.56E+00	3.01E-01	5.187
Ethylbenzene	NA	1	70	1	NA	2 90E-01	20	90	1	4.12E+00	2.80E-01	14 701
Xylenes	NA	1	70	1	NA	2	20	90	1	2.84E+01	2.78E-01	102.118
Naphthalene	NA	1	70	1	NA	3.71E-04	20	90	1	5 27E-03	2.00E-03	2.633

Prepared By: _____

Reviewed By: _____

Minimum Construction Worker RBSLs

	Dermal	Incidental Ingestion	Inhalation	Minimum
	RBSL	RBSL	RBSL	RBSL
	mg/L	mg/L	mg/L	mg/L
Benzene	0.85	68.52	0.15	0.15
Toluene	23.98	5677.78	5.19	5.19
Ethylbenzene	6.05	2838.89	14.70	6.05
Xylene	102.33	56777.78	102.12	102.12
Naphthalene	1.63	1135.56	2.63	1.63

Prepared By: _____ Reviewed By: _____

Monitor' Well Data
Contract .K Order No.

Well Identification	Date/Time	Total Depth of Well	Depth to Product	Depth to Water	pH	Temperature (°C)	Conductivity (ms/cm)	Dissolved O_2 (mg/l)	Turbidity (NTU)	Sample ID

BORING LOG

PROJECT NAME: CNC Site 41 Bldg 191
BORING NUMBER: 41 B01
PROJECT NUMBER: N0219 Zone A
DATE: 6/14/99
DRILLING COMPANY: Columbia
GEOLOGIST: BX
DRILLING RIG:
DRILLER: Kandy

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	...nter BZ**
	1					Lt. Br.	Silty Sand		Dry				
	2						↓		Moist	0	0	0	0
	3					Lt.	Sand & Rock (1")						
	4		2.4/4			Lt. Br.	Silty Sand		Moist	0	0	0	0
	5					Lt. Br.	Silty Sand (Pebbles)						
	6					Br. Br.	Silt, Sand		Saturated				
	7					Ol.	Silty Sand		↓				
	8		4/4			Ol	Sandy Clay		↓				
	9						Clay & Sand		↓				
	10						↓		↓				
	11						↓		↓				
	12		4/4				↓		↓				

** ... rock coring, enter rock brokeness

** ... monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes Temp No Well I.D. #:

BORING LOG

PROJECT NAME: CNC Site 41 Bldg 191
PROJECT NUMBER: Navy N0219 Zone A
DRILLING COMPANY: Columbia
DRILLING RIG:
BORING NUMBER: 41 B62
DATE: 6/4/99
GEOLOGIST:
DRILLER: Kandy

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Lt. Br.	~~Silty Sand~~						
	2												
	3					Lt. Br.	Silty Sand		Dry	0	0	0	0
	4		2/4			Dr. B.	Sandy Clay		↓				
	5					Lt. Brn	Silty Sand		Moist	70	0	0	0
	6						↓		Saturated				
	7		2/~~4~~3			B. Brn.	Clayey Sand		↓				
	8												
	9		~~1~~										
	10												
	11												
	12												

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes Temp. No Well I.D. #:

BORING LOG

PROJECT NAME: CNC Site 41
OJECT NUMBER: ND219 Zone A
RILLING COMPANY: Columbia
DRILLING RIG: Geo Probe
BORING NUMBER: 41B03 (10' step out)
DATE: 6/4/99.
GEOLOGIST:
DRILLER: Kandy

Sample No. and Type or RQD	Depth (FL) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Dr. Br.	~~Fine~~						
	2												
	3					Dr. Br.	Fine Sand		Dry	0	0	0	0
	4		2.1/4			↓	Silty Sand		Moist				
.020	5									9	0	0	0
	6					Dr. Gry.	Sandy Clay		Moist				
	7						↓		Saturated				
	8		2.7/4	2.7/4		Dr. Gry.	Clayey Sand		↓				
.26	9					Gr.	Clayey Sand		Saturated				
	10						↓			12	5	0	0
	11						Silty Sand						
	12		3/4				↓		↓				
0.34	13												
	14												
	15												
	16		2.5/4			Gr.	Clayey Sand		↓				
	17												
	18												
	19						↓						
	20		3.1/4			↓	Fine Sand		↓				
	21												
	22												
	23												
	24		4/4			↓	↓		↓				
	25					↓	↓		↓				

When rock conng, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes Temp No Well I.D. #:

BORING LOG

PROJECT NAME: EWC Site 41 Bldg 191
PROJECT NUMBER: ND219 Zone A
DRILLING COMPANY: Columbia
DRILLING RIG:

BORING NUMBER: 41B03
DATE: 6/4/94
GEOLOGIST:
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	26					Ol.	Fine Sand		Saturated				
	27						↓						
	24		4/4			Brown	Medium Sand						
	24												
	30		2										

* When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes ____ No ____ Well I.D. #:

BORING LOG

PROJECT NAME: CNC Site 41
PROJECT NUMBER: N0219 Zone A
DRILLING COMPANY: Columbia
DRILLING RIG:
BORING NUMBER: 41D04
DATE: 6/4/99
GEOLOGIST:
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Lt. Br.	Fine Sand		Dry				
	2												
	3						Silty Sand w/Clay			73	0	0	-
124	4		3/4			Br.	Sandy Clay (Pot. Color)		Moist 250	~~29~~	0	0	0
1	5					Br.	Silty Sand			350	0	0	0
	6					Dk. Gr.	Sandy Clay						
	7					Br-Gr.	Sandy Clay w/Silt						
31	8		4/4						Saturated				
	9					Gr	Fine Sand						
	10					~~Pot~~ Gr.	Sandy Clay			90	0	0	0
	11					Gr	~~Coa~~ Medium Sand						
39	12		4/4										

en rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes Temp No Well I.D. #:

BORING LOG

PROJECT NAME: CNC Site 41 BORING NUMBER: 41B05
PROJECT NUMBER: ND219 Bldg 191 DATE: 6/17/99
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Stratoprobe DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Brn	Silty Sand		Dry				
	2					↓	↓		↓	0			
	3					Brn	Clayey Sand		Moist				
	4		3 3/4										
.03	5					Brn	Clayey Sand		Moist				
	6					DK Brn	Clayey Sand		Saturated				
	7					↓	↓ Petro Odor		↓	110			
X	8		4/4			↓	↓		↓				
.306	9					↓	Clayey		↓				
	10					Olive Gray	~~Clay~~ Sandy ~~Clay~~						
	11					↓	↓		↓	150			
.304	12		3 4/4			↓	↓		↓				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #:

BORING LOG

PROJECT NAME: CNC Site 41 Bld 191
BORING NUMBER: 41 B06
PROJECT NUMBER: ND219 Zone A
DATE: 6/17/99
DRILLING COMPANY: Colum Sia
GEOLOGIST:
DRILLING RIG: Stratopicher
DRILLER: R. Brown

	Sample No. and Type or RQD	Depth (Ft) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ
		1					Brn	Silty Clayey Sand		Dry				
		2					↓	↓		↓				
		3					Dk Gray	Silty Clay		Moist	90			
335		4		4/4			↓	↓		↓				
		5						—			29			
	X	6					Gray	Silty Sand		Saturated				
		7					↓							
37		8		2.3/4			Olive Gray	Silty Clay		↓				
		9					Gray	Silty Sand			0			
		10					Gray	Silty Clay						
		11					Olive Gray	Silty Sand						
34		12		4/4				↓		↓				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #:

BORING LOG

PROJECT NAME: CWC Site 41 BORING NUMBER: 41 B 18
PROJECT NUMBER: N0219 Zone A DATE: 6/19/97
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Stratoprobe DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Brn	Clayey Sand		Dry				
	2												
	3								moist	0			
	4		4.2/4										
0833	5												
	6					Dk Gray	Silty Sandy Clay		Saturated				
	7									150			
X	8		3.5/4				Clayey Sand						
0835	9												
	10						No Recovery						
	11												
	12		/4										

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #:

BORING LOG

PROJECT NAME: CNC Site 41 BORING NUMBER: 41 B11
PROJECT NUMBER: ND219 Zone A DATE: 6/19/94
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Stratoprobe DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Brn	Silty Sand		Dry				
	2					Brn	Silt Sandy Clay						
	3					Red		O					
	4		4/4										
	5												
	6						Sandy Clay		Moist				
X	7					Red & Gray		O					
	8		4/4										
	9												
	10					Red & Gray	Silty Sand		Saturated				
	11												
	12		4.2/4										

* When rock conng, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes Tmp No Well I.D. #:

BORING LOG

PROJECT NAME: CWC Site 41 Bldg 191 BORING NUMBER: 41B12
PROJECT NUMBER: N0219 Zone A DATE: 6/19/99
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Strato probe DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Brn	Stiff sandy Clay		Dry				
	2					↓	↓		↓				
	3					Tan	Silty Sand		Moist				
24	4		4.5/6			Red	Stiff Silty Clay		↓				
	5					↓	↓		↓				
	6					↓	↓		↓				
X	7					Reddish Brn	Sandy Clay		↓				
26	8		4/4			↓	↓		↓				
	9						—		—				
	10						—		—				
	11					Brn	Clayey Sand		Saturated				
28	12		2/4			↓			↓				

*When rock coring, enter rock brokeness

** Include monitor reading in 6 foot intervals @ borehole Increase reading frequency if elevated reponse read

Drilling Area Background (ppm):

Remarks:

Converted to Well Yes Tens No Well I.D. #.

BORING LOG

PROJECT NAME: Cove Site 41 BORING NUMBER: 41B13
PROJECT NUMBER: N0219 Zone A DATE: 6/22/99
DRILLING COMPANY: Columbia GEOLOGIST: [illegible]
DRILLING RIG: Stratoprobe DRILLER: [illegible]

Sample No. and Type or RQD	Depth (Ft) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Pink	Silty Sand		Dry				
	2					Pink	Clayey Sand						
	3									9			
	4		2/4										
.40	5					DK Gray	Clayey Sand		Moist	45			
X	6						Sandy Clay						
	7						~~Silty~~ Sand - pale color		Saturated				
	8		2.5/4										
5.44	9						Sandy Soft Clay						
	10												
	11									30			
6.54	12		4/4				Clayey Sand - Orange Green						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): [ ]

Remarks:

Converted to Well: Yes Temp No _____ Well I.D. #: _____

BORING LOG

PROJECT NAME: CRC Site 41 BORING NUMBER: 41 B14
PROJECT NUMBER: ND219 Zone A DATE: 6/22/94
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Stratoprobe DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole **	Driller BZ
	1					Brn	Silty Sand		Dry				
	2					Dk Brn				50			
	3					Gray	Silty Clay						
	4		4/4			Dk Gray	Silty Sand		Moist				
0410	5						Silty Sand			170			
X	6						Clayey Sand						
	7								Saturated				
	8		4/4										
0413	9												
	10												
	11												
	12		/4										

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes Temp No Well I.D. #:

BORING LOG

PROJECT NAME: CWC Site 41 BORING NUMBER: 41B15
PROJECT NUMBER: ND219 Zone A DATE: 7/1/99
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Strata probe DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1			Hand Auger		Brn	Silty Sand		Moist				
	2					Grey	Silty Sandy Clay						
	3					Brn	Clayey Sand			7%	0	7%	0
	4												
	5												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes Temp No Well I.D. #:

BORING LOG

ROJECT NAME: CNC Site 41 BORING NUMBER: 41B16
PROJECT NUMBER: N0219 Zone A DATE: 7/11/99
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Stratoprobe DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample*	Sampler BZ*	Borehole**	Driller BZ**
	1			Hand Auger		Brn	Fine Silty Sand		Moist				
	2					↓	↓		↓				
	3						Chipped Wood			150	0	70	0
	4					↓	↓		↓				

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes Temp No Well I.D. #:

BORING LOG

PROJECT NAME: CNC Site 41
BORING NUMBER: 41B17
PROJECT NUMBER: ND219 Zone A
DATE: 7/1/99
DRILLING COMPANY: Columbia
GEOLOGIST:
DRILLING RIG: Stratoprobe
DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					Greenish Gray	Clayey Sand		Moist				
	2			Hand Auger		↓	↓		↓				
X	3					↓	Sandy Clay			400			
	4					↓	↓ w/ wood chips		↓				
	5					↓	↓		Saturated				
	6					↓	↓		↓				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes ____ No ____ Well I.D. #:

BORING LOG

PROJECT NAME: CWC Site 41 BORING NUMBER: 41B18
PROJECT NUMBER: N0219 Zone A DATE: 7/1/99
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Hand Auger DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ**	Borehole**	Driller BZ**
	1					Brn	Silty Sand		Moist				
	2												
	3					Brn	Sandy Clay			600	0	X	0
X	4					Gr							
	5						w/wood chips		Saturated				
	6										0	Sico	0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes [illegible] No _____ Well I.D. #: _____

BORING LOG

PROJECT NAME: CNC Site 41
PROJECT NUMBER: N0219 Zone A
DRILLING COMPANY: Columbia
DRILLING RIG:

BORING NUMBER: 41B19
DATE: 7/1/99
GEOLOGIST:
DRILLER: R. Brand

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1			Hand Auger			Asphalt w/base						
	2					Brn	Silty Sand		Moist				
	3					↓	↓		↓				
	4					Cement Grey	~~Sandy~~ Clayey Sand			20	0	0	0
	5					↓	↓		↓				
	6					↓	↓		↓				
	7					Brn.	Sand, Clay & wood chips		Saturated				
	8					Gray	Sandy Clay w/wood		↓				
	9		3'/4			L	↓		↓				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes Temp No _____ Well I.D. #: _____

BORING LOG

PROJECT NAME: CNC Site 41
BORING NUMBER: 41BZ0
PROJECT NUMBER: ND219 Zone A
DATE: 7/6/99
DRILLING COMPANY: Columbia
GEOLOGIST:
DRILLING RIG: Stratoprobe
DRILLER: R. Bacal

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample**	Sampler BZ**	Borehole**	Driller BZ**
	1						Asphalt w/ base						
	2					Brn	Clayey Sand		Moist				
	3					↓	↓			60	0	25, 0	0
X	4					↓	↓						
	5					Gray	Silty Clay		Wet				
	6			Hand Auger		Gray	Silty Clay - w/ wood chips		Saturday				
	7					↓	↓		↓				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes temp. No Well I.D. #:

BORING LOG

PROJECT NAME: C.W.C Site 41 BORING NUMBER: 41B21
PROJECT NUMBER: ND219 Zone A DATE: 7/6/99
DRILLING COMPANY: Columbia GEOLOGIST:
DRILLING RIG: Stratoprobe DRILLER: R.B. and

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1						Asphalt/base		Dry				
	2					dk brn	Sandy Clay		Moist				
	3									100	0	200	0
	4												
	5								Saturated				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): Ø

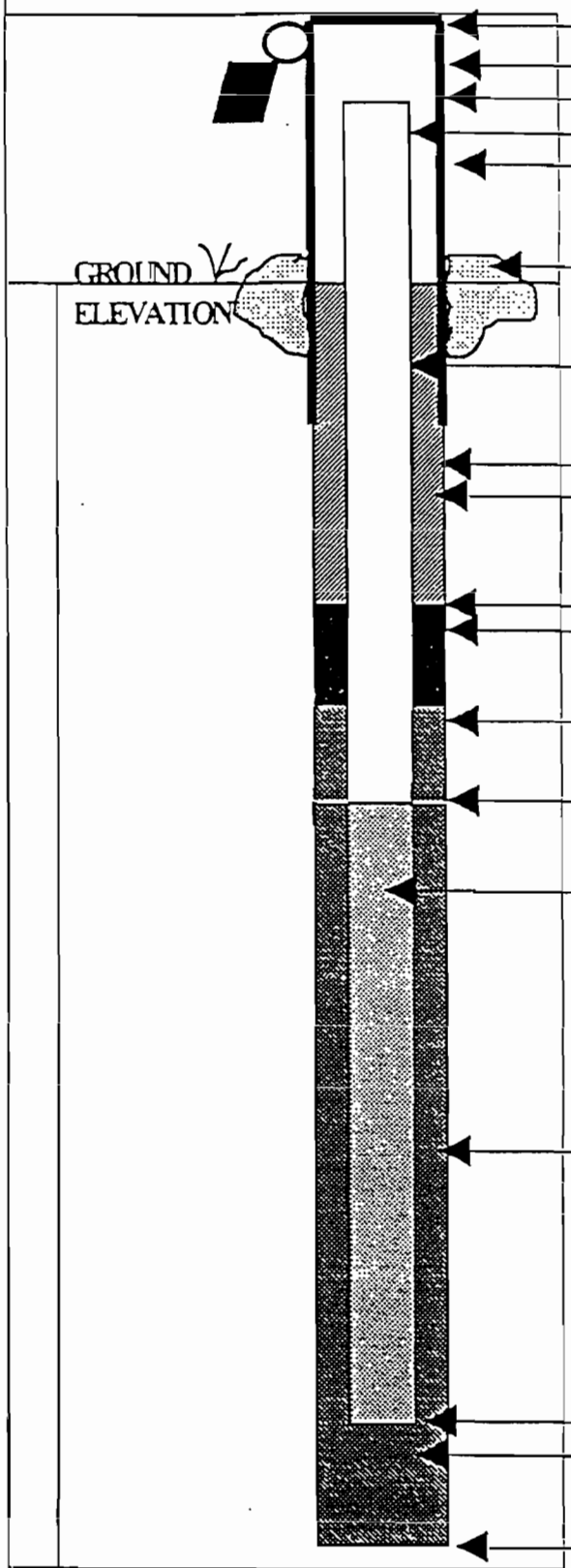
Remarks:

Converted to Well: Yes Temp No _____ Well I.D. #:

BORING NO.: CNC41-MW01

OVERBURDEN MONITORING WELL SHEET

PROJECT	CNC Site 41	LOCATION:	CNC41-MW01	DRILLER	
PROJECT NO.	CNC41 ND219	BORING		METHOD:	DPT
ELEVATION		DATE		DRILLING	
FIELD GEOLOGIST	Marty Ray			DEVELOPMENT:	NA



ELEVATION OF TOP OF SURFACE CASING: Flush

ELEVATION OF TOP OF RISER PIPE:

STICK-UP TOP OF SURFACE CASING:

STICK-UP RISER PIPE:

I.D. OF SURFACE CASING: 8"

TYPE OF SURFACE CASING: steel man-hole with cover

TYPE OF SURFACE SEAL: concrete pad 2'x2'x6"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Sch 40 PVC

BOREHOLE DIAMETER: 4.25"

TYPE OF SEAL: grout to 6" b/s

ELEVATION / DEPTH OF SEAL: 1'0"

TYPE OS SEAL: 30/65 sand

DEPTH TOP OF SAND PACK: 3'0"

ELEVATION / DEPTH TOP OF SCREEN: 4'0"

TYPE OF SCREEN: Sch 40 PVC

SLOT SIZE X LENGTH: 10 slot x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: 20/30

ELEVATION / DEPTHBOTTOM OF SCREEN: 14'0"

ELEVATION / DEPTH BOTTOM OF SAND PACK: 14'6"

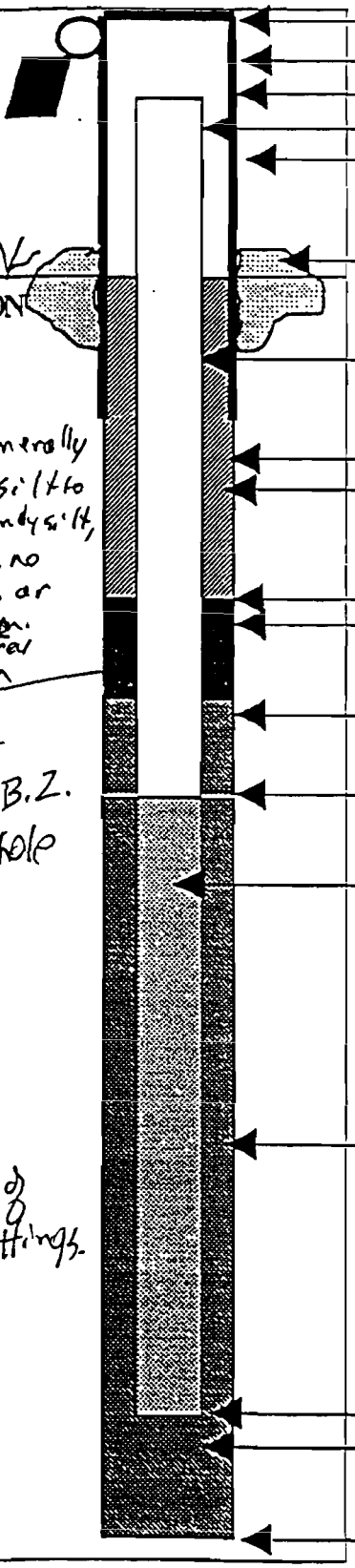
TYPE OF BACKFILL BELOW OBSERVATION WELL: 20/30

ELEVATION / DEPTH OF HOLE: 14'6"

BORING NO. CNC41-MW03

OVERBURDEN MONITORING WELL SHEET

PROJECT	CNC Site 41.	LOCATION:	Site 41/Zone A/B/91	DRILLER	Custom Drilling
PROJECT NO.	ND219	BORING	CNC41-MW03	METHOD:	~~DPT~~ 4.25" ID HSA
ELEVATION		DATE	7/13/99	DRILLING	Rod Fuller
FIELD GEOLOGIST	Mark Darrington			DEVELOPMENT:	NA



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK-UP TOP OF SURFACE CASING: Flush

STICK-UP RISER PIPE: Flush

I.D. OF SURFACE CASING: 8" ID x 10" OD

TYPE OF SURFACE CASING: Steel cover w/ Bolt-on lid/Flush (PEMCO)

TYPE OF SURFACE SEAL: Concrete Pad (Quickcrete) 2'x2'x6"

RISER PIPE I.D.: 2 in

TYPE OF RISER PIPE: PVC, Sch. 40, Flush threaded (F.T.)

BOREHOLE DIAMETER: 8.25 in

TYPE OF SEAL: Portland Cement Type I

ELEVATION / DEPTH OF SEAL: 11.5

TYPE OS SEAL: "Choke Sand" (30/65) VF Qtz. Sand

DEPTH TOP OF SAND PACK: 2

ELEVATION / DEPTH TOP OF SCREEN: 13

TYPE OF SCREEN: PVC, Sch. 40, F.T.

SLOT SIZE X LENGTH: 0.010 in x 10 ft.

I.D. OF SCREEN: 2 in.

TYPE OF SAND PACK: (20/30) F Qtz. Sand (Standard Sand (FM))

ELEVATION / DEPTH BOTTOM OF SCREEN: 113

ELEVATION / DEPTH BOTTOM OF SAND PACK: 113

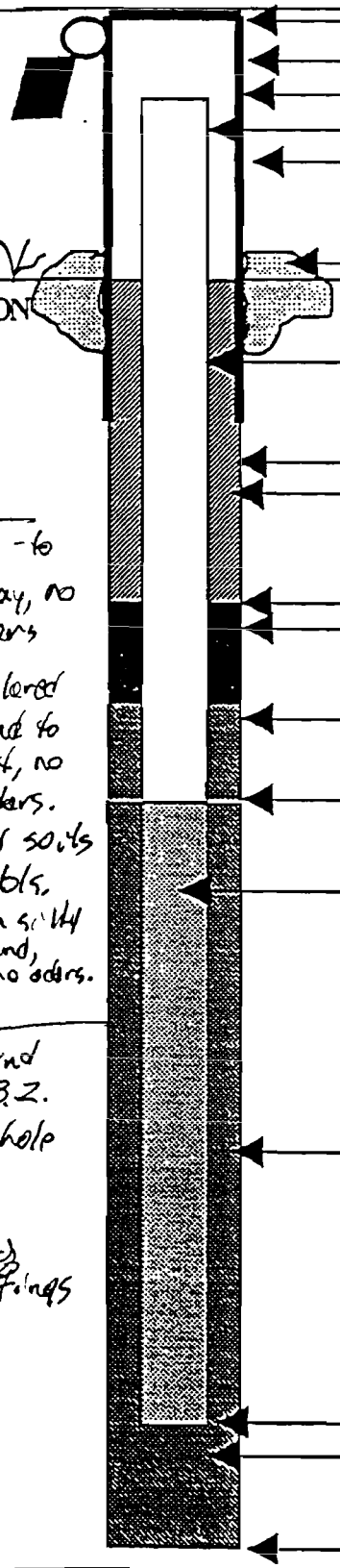
TYPE OF BACKFILL BELOW OBSERVATION WELL: (20/30) Qtz. Sand

ELEVATION / DEPTH OF HOLE: 113

BORING NO.: CNC41-MW05

OVERBURDEN MONITORING WELL SHEET

PROJECT	CNC Site 41	LOCATION:	Site 41/Zone A/B/91	DRILLER	Custom Drilling
PROJECT NO.	N0219	BORING	CNC41-MW05	METHOD:	~~DPT~~ 4.25" ID HSA
ELEVATION		DATE	7/13/99	DRILLING	Rod Fuller
FIELD GEOLOGIST	Mark Darrington			DEVELOPMENT: NA	



ELEVATION OF TOP OF SURFACE CASING:	
ELEVATION OF TOP OF RISER PIPE:	
STICK-UP TOP OF SURFACE CASING:	Flush
STICK-UP RISER PIPE:	Flush
I.D. OF SURFACE CASING:	8" ID x 10" OD
TYPE OF SURFACE CASING:	Steel Cover w/ Bolt-on lid / Flush (PEMCO)
TYPE OF SURFACE SEAL:	Concrete Pad (Quickcrete) 2'x2'x6"
RISER PIPE I.D.:	2 in
TYPE OF RISER PIPE:	PVC, Sch. 40, Flush Thread (F.T.)
BOREHOLE DIAMETER:	8.25 in
TYPE OF SEAL:	Portland Cement Type I
ELEVATION / DEPTH OF SEAL:	1 2
TYPE OS SEAL:	"Choke Sand" VF Qtz. sand
DEPTH TOP OF SAND PACK:	3
ELEVATION / DEPTH TOP OF SCREEN:	1 4
TYPE OF SCREEN:	PVC, Sch. 40, F.T.
SLOT SIZE X LENGTH:	0.010 in x 10 ft.
I.D. OF SCREEN:	2 in.
TYPE OF SAND PACK:	(20/30) Fine (F) Qtz. (Quartz) sand (Standard Sand ®)
ELEVATION / DEPTHBOTTOM OF SCREEN:	1 14
ELEVATION / DEPTH BOTTOM OF SAND PACK:	1 14
TYPE OF BACKFILL BELOW OBSERVATION WELL:	(20/30) Sand.
ELEVATION / DEPTH OF HOLE:	1 14

—	Soils
0 ↓ 7'	Red clay - to sandy clay, no petro. odors
7' ↓ 10	Olive colored silty sand to sand silt, no petro. odors. Saturated soils @ ≈ 8.0' bls.
10 ↓ 14	Orange/tan silty sand to sand, saturated, no odors.

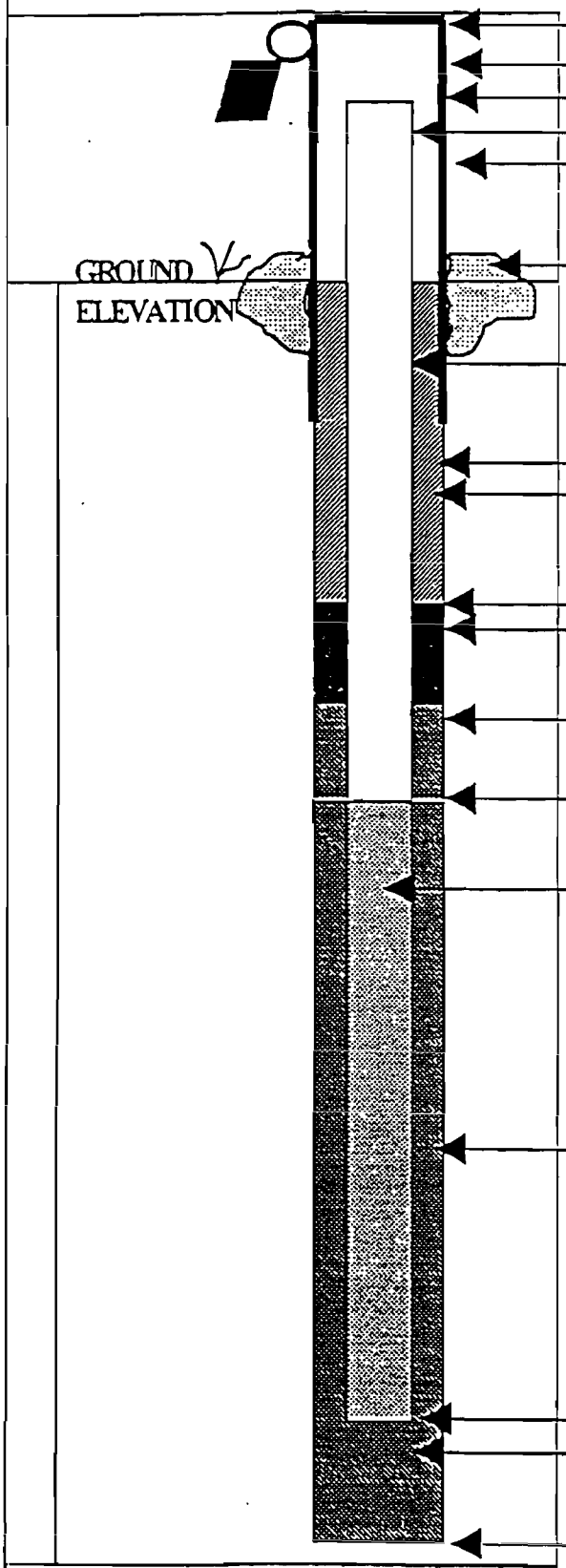
PID (ppm)

(0.0)	Background
(0.0)	Driller B.Z.
(0.0)	In Borehole
(1)	Drum of Soil Cuttings

BORING NO.: _____

OVERBURDEN MONITORING WELL SHEET

PROJECT	CNC Zone A Site 41	LOCATION:	Site 41 / Bldg. 191	DRILLER	Rod Fuller Custom Drilling
PROJECT NO.	7912 N0219	BORING	CNC 41-MW07	METHOD: DPT	Hollow Stem Auger 4
ELEVATION	-	DATE	8/3/99	DRILLING	
FIELD GEOLOGIST	Gerald Goode			DEVELOPMENT: NA	



ELEVATION OF TOP OF SURFACE CASING: _____

ELEVATION OF TOP OF RISER PIPE: _____

STICK-UP TOP OF SURFACE CASING: Flush

STICK-UP RISER PIPE: Flush

I.D. OF SURFACE CASING: 8" Steel manhole

TYPE OF SURFACE CASING: Steel Cover w/ Bottom Lid / Flush Pemco

TYPE OF SURFACE SEAL: Concrete Pad Quickcrete

RISER PIPE I.D.: 2 in

TYPE OF RISER PIPE: SCH 40 PVC

BOREHOLE DIAMETER: 8"

TYPE OF SEAL: Portland Cement Type I

ELEVATION / DEPTH OF SEAL: 2' BLS

TYPE OS SEAL: 30/65 Fine Standard Silica Sand

DEPTH TOP OF SAND PACK: 3' BLS

ELEVATION / DEPTH TOP OF SCREEN: 4' BLS

TYPE OF SCREEN: SCH 40 PVC

SLOT SIZE X LENGTH: 0.010 in x 10 ft

I.D. OF SCREEN: 2 inc

TYPE OF SAND PACK: 20/30 Standard Silica Sand

ELEVATION / DEPTHBOTTOM OF SCREEN: 14' BLS

ELEVATION / DEPTH BOTTOM OF SAND PACK: 14.5' BLS

TYPE OF BACKFILL BELOW OBSERVATION WELL: 20/30 Standard Silica Sand

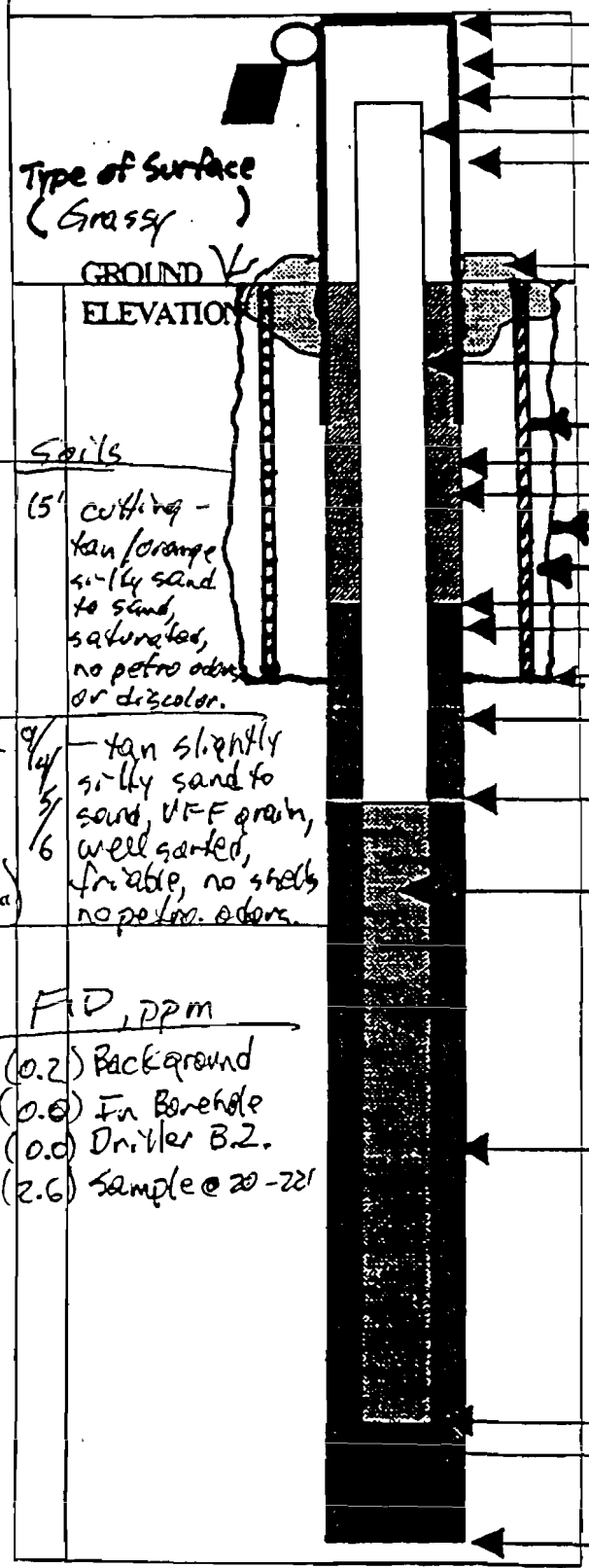
ELEVATION / DEPTH OF HOLE: 14.5' BLS

BORING NO. CNC41MW08D

OVERBURDEN MONITORING WELL SHEET

PROJECT	CNC Site 41	LOCATION	S. Yo 41/Zone A/B191	DRILLER	Custom Drilling
PROJECT NO.	ND219	BORING	CNC41-MW08D	METHOD:	[redacted] 8.25 HSA
ELEVATION		DATE	7/14/99	DRILLING	Rod Fuller.
FIELD GEOLOGIST	Mark Darrington			DEVELOPMENT:	[redacted]

Boring Methods: Surface Casing: 8.25 HSA Riser Casing



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK-UP TOP OF SURFACE CASING: Flush

STICK-UP RISER PIPE: Flush

I.D. OF SURFACE CASING: 8" Steel Manhole

TYPE OF SURFACE CASING: Bottom L.O Fusil (Pemco)

TYPE OF SURFACE SEAL: concrete mix

RISER PIPE I.D.: 2-inc Sch 40 (25 FT)

TYPE OF RISER PIPE:

Type of Surface Case (S.C.) PVC, Sch. 40 Dia. 6"

BOREHOLE DIAMETER:

TYPE OF SEAL:

Borehole Dia. 12.25 in

Type of S.C. Seal Portland Cement Type I

ELEVATION / DEPTH OF SEAL:

TYPE OS SEAL: Grout inside casing Saturated to 23' BLS

Depth of Surface Case 20.0'

Bentonite Seal 22 to 23' ft BLS

DEPTH TOP OF SAND PACK: 23' BLS

ELEVATION / DEPTH TOP OF SCREEN: 25' BLS

TYPE OF SCREEN: Sch 40 PVC .010-inch slot

SLOT SIZE X LENGTH: .010-inch X 10 FT

I.D. OF SCREEN: 2 inch

TYPE OF SAND PACK: 20/30 standard silica sand

ELEVATION / DEPTH BOTTOM OF SCREEN: 30' BLS

ELEVATION / DEPTH BOTTOM OF SAND PACK: 30.5' BLS

TYPE OF BACKFILL BELOW OBSERVATION WELL: 20/30 standard silica sand

ELEVATION / DEPTH OF HOLE: 30.5' BLS

Soils

(5' cutting - tan/orange silty sand to sand, saturated, no petro odor or discolor.

@20-22' Split Spoon (24"/24") 9/4/5/6 - tan slightly silty sand to sand, VF-F grain, well sorted, friable, no shells no petro. odors.

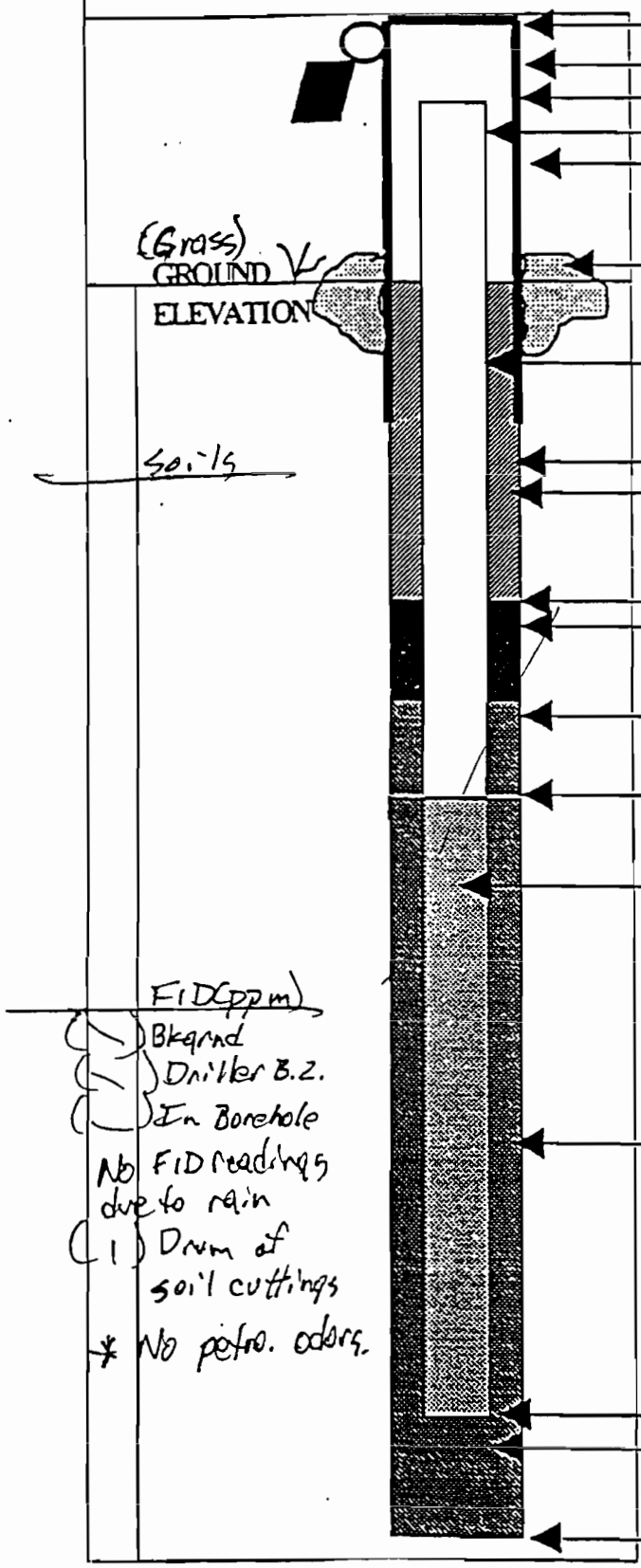
FID, ppm

(0.2) Background
(0.0) In Borehole
(0.0) Driller B.Z.
(2.6) Sample @ 20-22'

BORING NO. CNC 41-MW
Cadj. to load

OVERBURDEN MONITORING WELL SHEET

PROJECT	CNC Site 41.	LOCATION:	Site 41 Zone A/B191	DRILLER	Custom Drilling
PROJECT NO.	N0219	BORING	CNC41-MW06	METHOD:	~~DPT~~ 4.25" ID HSA
ELEVATION		DATE	7/13/99	DRILLING	Red Fuller
FIELD GEOLOGIST	Mark Darrington			DEVELOPMENT:	NA

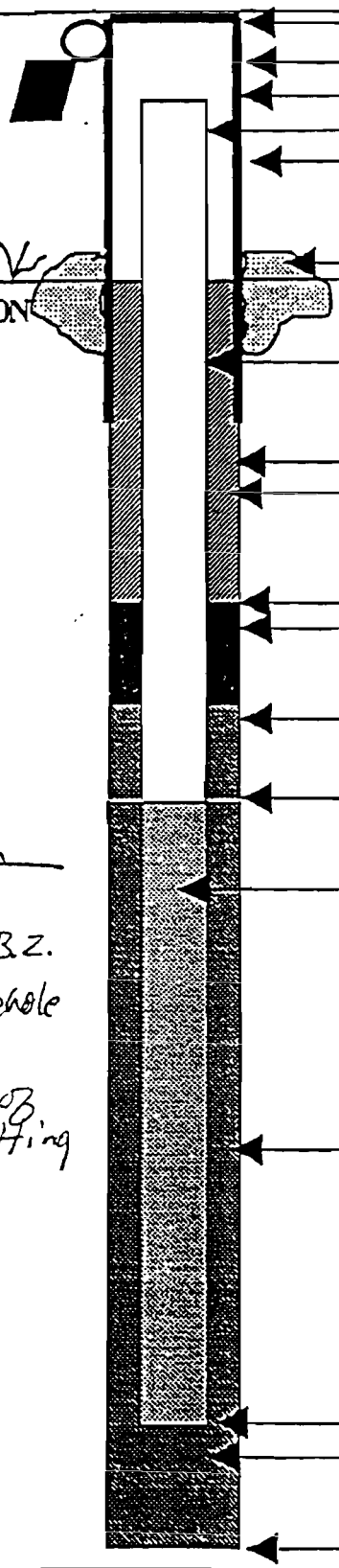


ELEVATION OF TOP OF SURFACE CASING: ____
ELEVATION OF TOP OF RISER PIPE: ____
STICK-UP TOP OF SURFACE CASING: Flush
STICK-UP RISER PIPE: Flush
I.D. OF SURFACE CASING: 8" ID x 10" OD
TYPE OF SURFACE CASING: Steel cover w/ Bolt-on lid / Flush (PEMCO)
TYPE OF SURFACE SEAL: Concrete Pad (Quickcrete) 2'x2'x6"
RISER PIPE I.D.: 2 in
TYPE OF RISER PIPE: PVC, Sch. 40, Flush Threaded (F.T.)
BOREHOLE DIAMETER: 8.25 in
TYPE OF SEAL: Portland Cement x Type I
ELEVATION / DEPTH OF SEAL: 12
TYPE OS SEAL: "Choke Sand" (30/65) MF Qtz. Sand
DEPTH TOP OF SAND PACK: 3
ELEVATION / DEPTH TOP OF SCREEN: 14
TYPE OF SCREEN: PVC, Sch. 40, F.T.
SLOT SIZE X LENGTH: 0.010 in x 10 ft.
I.D. OF SCREEN: 2 in.
TYPE OF SAND PACK: (20/30) Fine Qtz. (Standard sand ®)
ELEVATION / DEPTHBOTTOM OF SCREEN: 114
ELEVATION / DEPTH BOTTOM OF SAND PACK: 114
TYPE OF BACKFILL BELOW OBSERVATION WELL: (20/30) Fine sand
ELEVATION / DEPTH OF HOLE: 114

BORING NO. CNC41-MW04

OVERBURDEN MONITORING WELL SHEET

PROJECT	CNC Site 41	LOCATION	Site 41/Zone A/Area 1	DRILLER	Custom Drilling
PROJECT NO.	ND219	BORING	CNC41-MW04	METHOD:	~~DPT~~ 4.25" ID HSA
ELEVATION		DATE	7/13/99	DRILLING	Rod Fuller
FIELD GEOLOGIST	Mark Darrington			DEVELOPMENT: NA	



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK-UP TOP OF SURFACE CASING: Flush

STICK-UP RISER PIPE: Flush

I.D. OF SURFACE CASING: 8" ID x 10" OD

TYPE OF SURFACE CASING: Steel Cover w/ Bolt-on Lid/Flush (PEMCO)

TYPE OF SURFACE SEAL: Concrete Pad (Quikcrete) 2' x 2' x 6"

RISER PIPE I.D.: 2 in

TYPE OF RISER PIPE: PVC, Sch. 40 Flush Thread (F.T.)

BOREHOLE DIAMETER: 8.25 in

TYPE OF SEAL: Portland Cement Type I

ELEVATION / DEPTH OF SEAL: 12

TYPE OS SEAL: "Choke sand" (30/65) UF Qtz. sand

DEPTH TOP OF SAND PACK: 3

ELEVATION / DEPTH TOP OF SCREEN: 14

TYPE OF SCREEN: PVC, Sch. 40, F.T.

SLOT SIZE X LENGTH: 0.010 in x 10 ft.

I.D. OF SCREEN: 2 in.

TYPE OF SAND PACK: (20/30) F. Qtz. sand (standard sand)

ELEVATION / DEPTHBOTTOM OF SCREEN: 114

ELEVATION / DEPTH BOTTOM OF SAND PACK: 114

TYPE OF BACKFILL BELOW OBSERVATION WELL: (20/30) F Qtz. sand

ELEVATION / DEPTH OF HOLE: 114

FID, ppm

(0.4) Bkgrnd

(0.4) Driller B.Z.

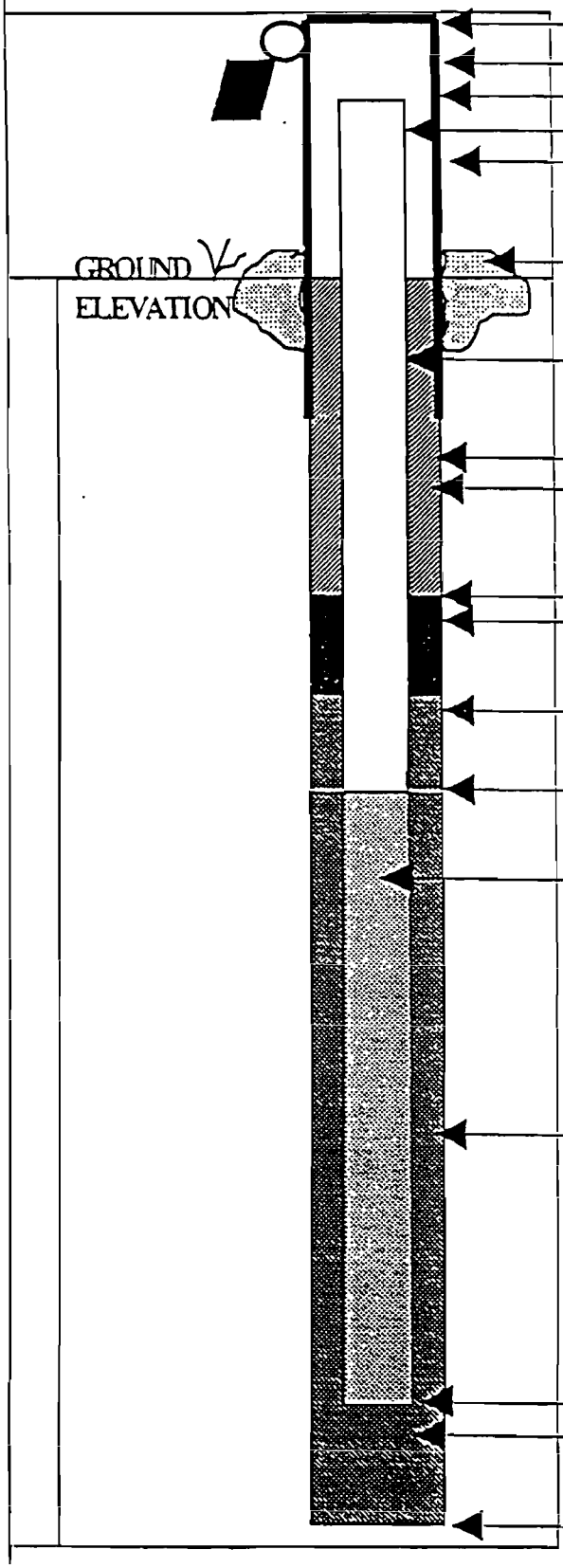
(3.7) In Borehole

(1) Drum of Soil Cutting

BORING NO.: CNC41-MW02

OVERBURDEN MONITORING WELL SHEET

PROJECT	CNC Site 41	LOCATION:	CNC41-MW02	DRILLER	Custom Drilling
PROJECT NO.	CNC41 ND219	BORING	CNC41-MW02	METHOD:	~~DRT~~
ELEVATION		DATE	6/30/99	DRILLING	HSA
FIELD GEOLOGIST	Marty Ray			DEVELOPMENT: NA	



ELEVATION OF TOP OF SURFACE CASING: Flush

ELEVATION OF TOP OF RISER PIPE:

STICK-UP TOP OF SURFACE CASING:

STICK-UP RISER PIPE:

I.D. OF SURFACE CASING: 8"

TYPE OF SURFACE CASING: steel man-hole w/cover

TYPE OF SURFACE SEAL: concrete pad 2'x2'x6"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: Sch 40 PVC

BOREHOLE DIAMETER: 4.25"

TYPE OF SEAL: gloJt to 6" bls

ELEVATION / DEPTH OF SEAL: 1'6"

TYPE OS SEAL: 30/65 sand

DEPTH TOP OF SAND PACK: 2'6"

ELEVATION / DEPTH TOP OF SCREEN: 3'10

TYPE OF SCREEN: Sch 40 PVC

SLOT SIZE X LENGTH: 10 slot x 10'

I.D. OF SCREEN: 2"

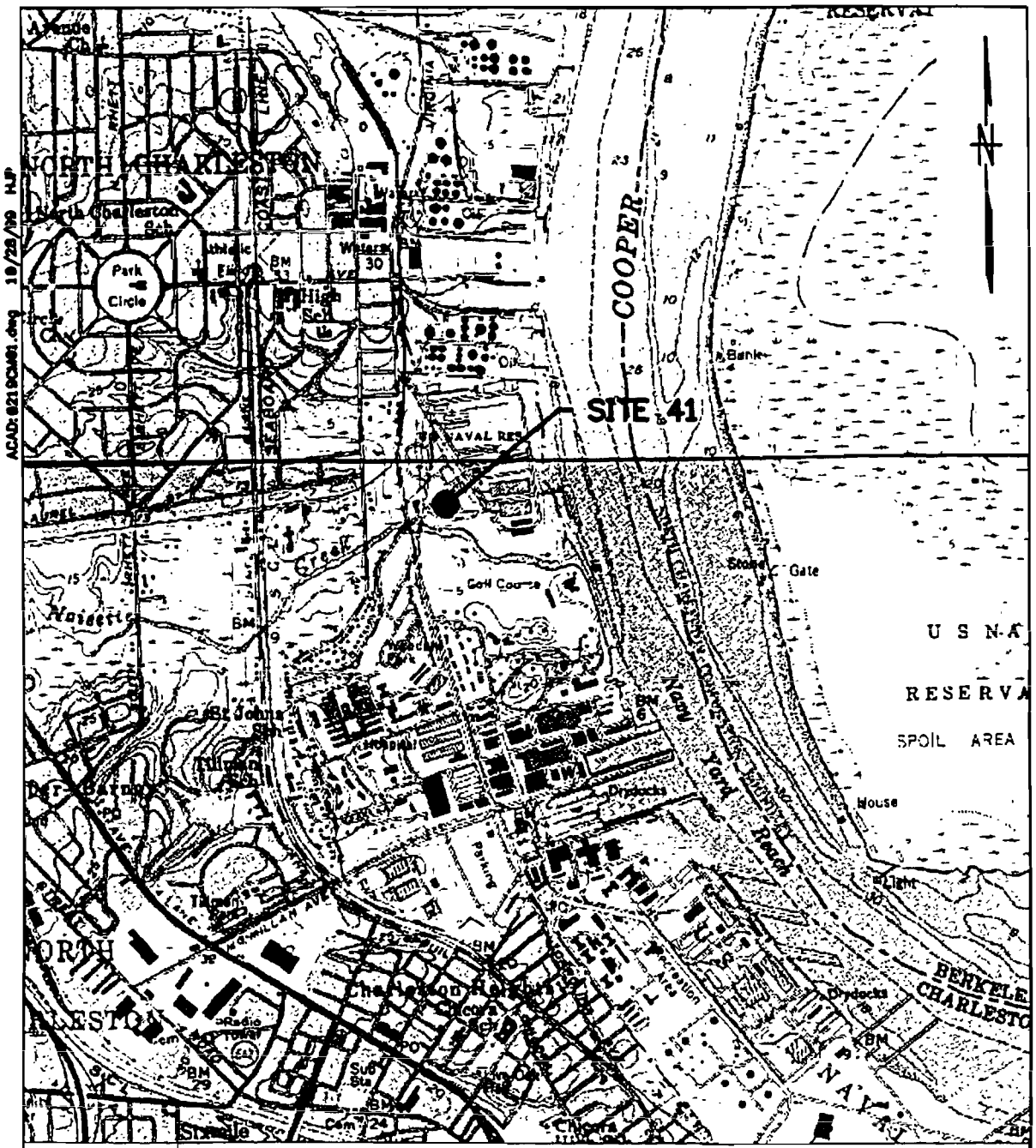
TYPE OF SAND PACK: 20/30 sand

ELEVATION / DEPTHBOTTOM OF SCREEN: 13'10"

ELEVATION / DEPTH BOTTOM OF SAND PACK: 13'16"

TYPE OF BACKFILL BELOW OBSERVATION WELL: 20/30 sand

ELEVATION / DEPTH OF HOLE: 13'16"



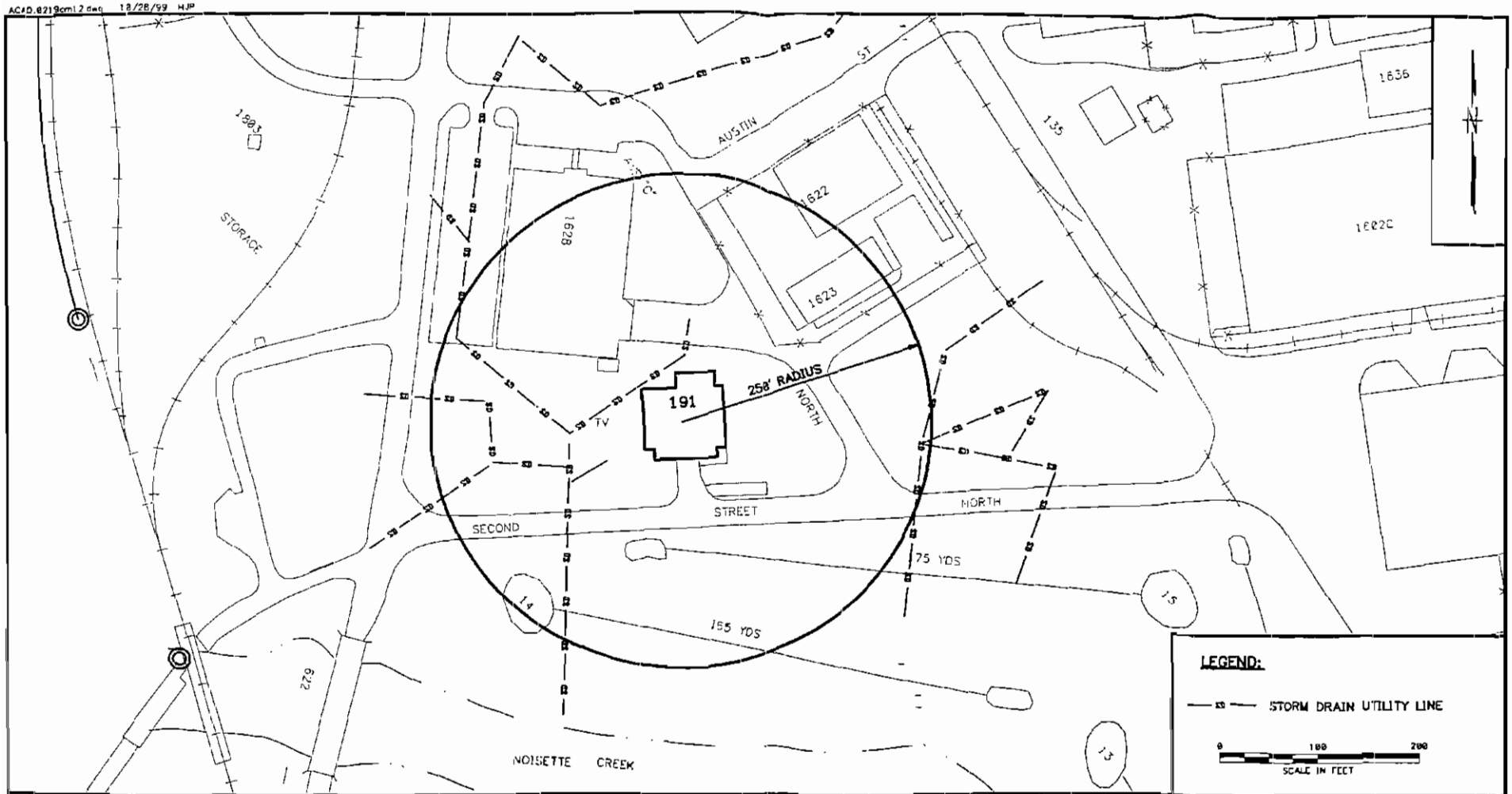
SOURCE: QUADRANGLE MAP SOUTH CAROLINA, REVISED 1979
QUADRANGLE MAP NORTH CHARLESTON REVISED, 1979

0 2000 4000
SCALE IN FEET

DRAWN BY HJP DATE 10/18/99	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND	SITE LOCATION MAP SITE 41, BUILDING 191 ZONE A, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA	CONTRACT NO. 0219
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1 / REV. 0

FORM CADD NO. 2REV_AV.DWG - REV 0 - 1/28/98

ACAD.0219cml2.dwg 12/28/99 HJP



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

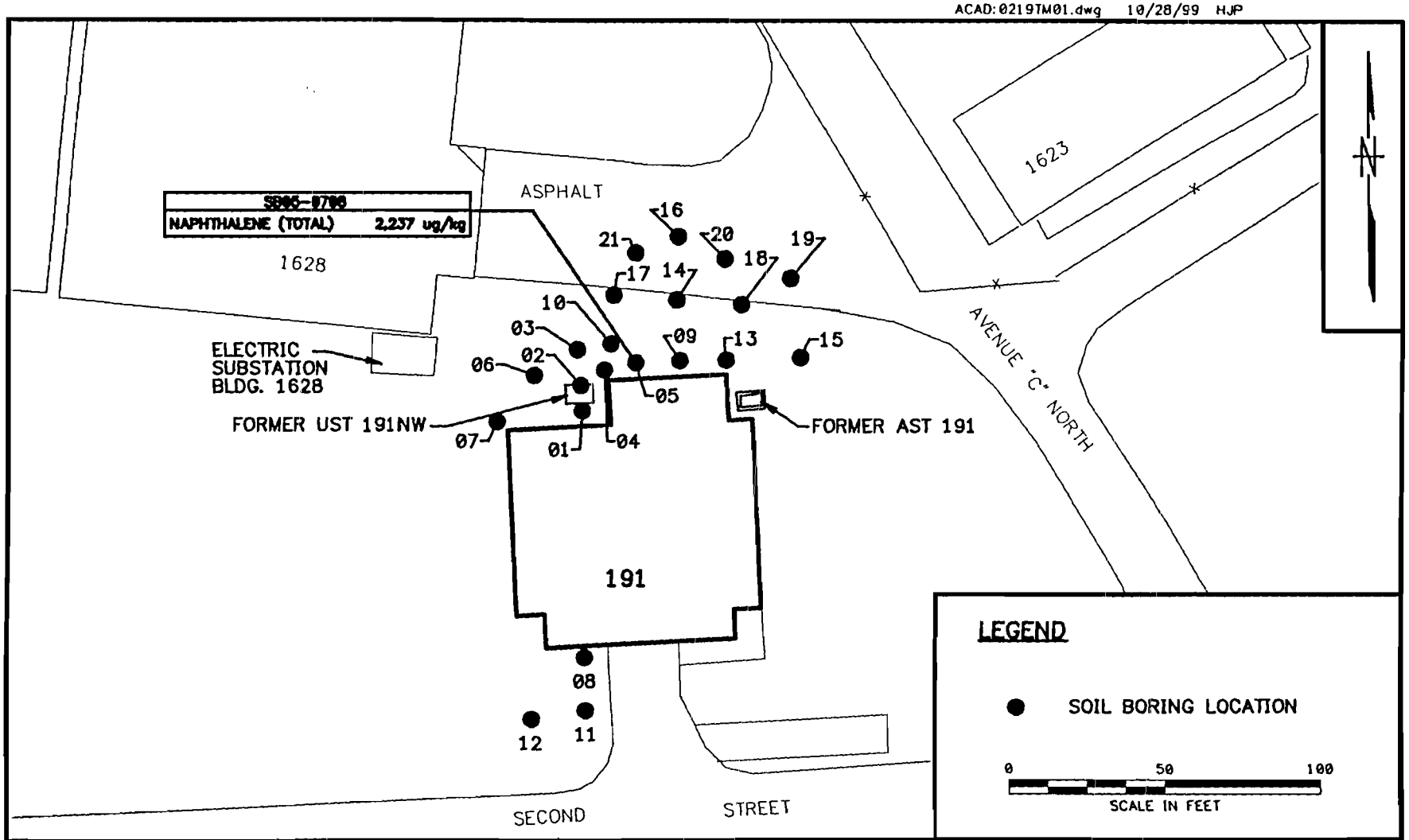
DRAWN BY HJP DATE 8/18/99
CHECKED BY DATE
COST/SCHED—AREA
SCALE AS NOTED

SITE VICINITY MAP
SITE 41, BUILDING 191
ZONE A, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0219
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2
REV. 0

FORM CADD NO. SDIV_BKDWG - REV 0 - 1/20/98

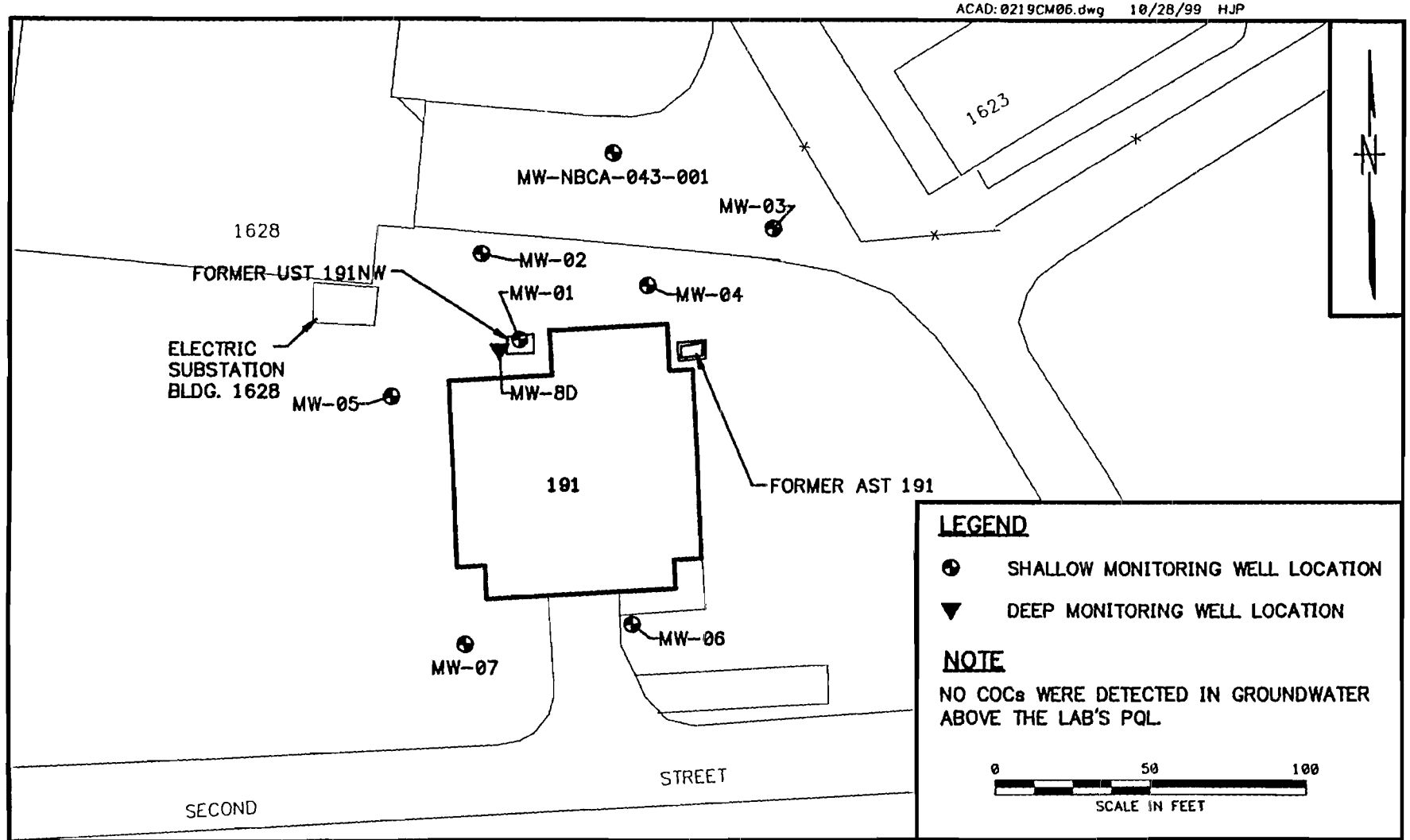
ACAD:0219TM01.dwg 10/28/99 HJP



DRAWN BY HJP DATE 10/18/99		SOIL BORING LOCATIONS AND SOIL COC MAP SITE 41, BUILDING 191 ZONE A, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA	CONTRACT NO. 0219
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3 REV. 0

FORM CADD NO. SDIV_AH.DWG - REV 0 - 1/20/98

ACAD:0219CM06.dwg 10/28/99 HJP



LEGEND

- ⊕ SHALLOW MONITORING WELL LOCATION
- ▼ DEEP MONITORING WELL LOCATION

NOTE

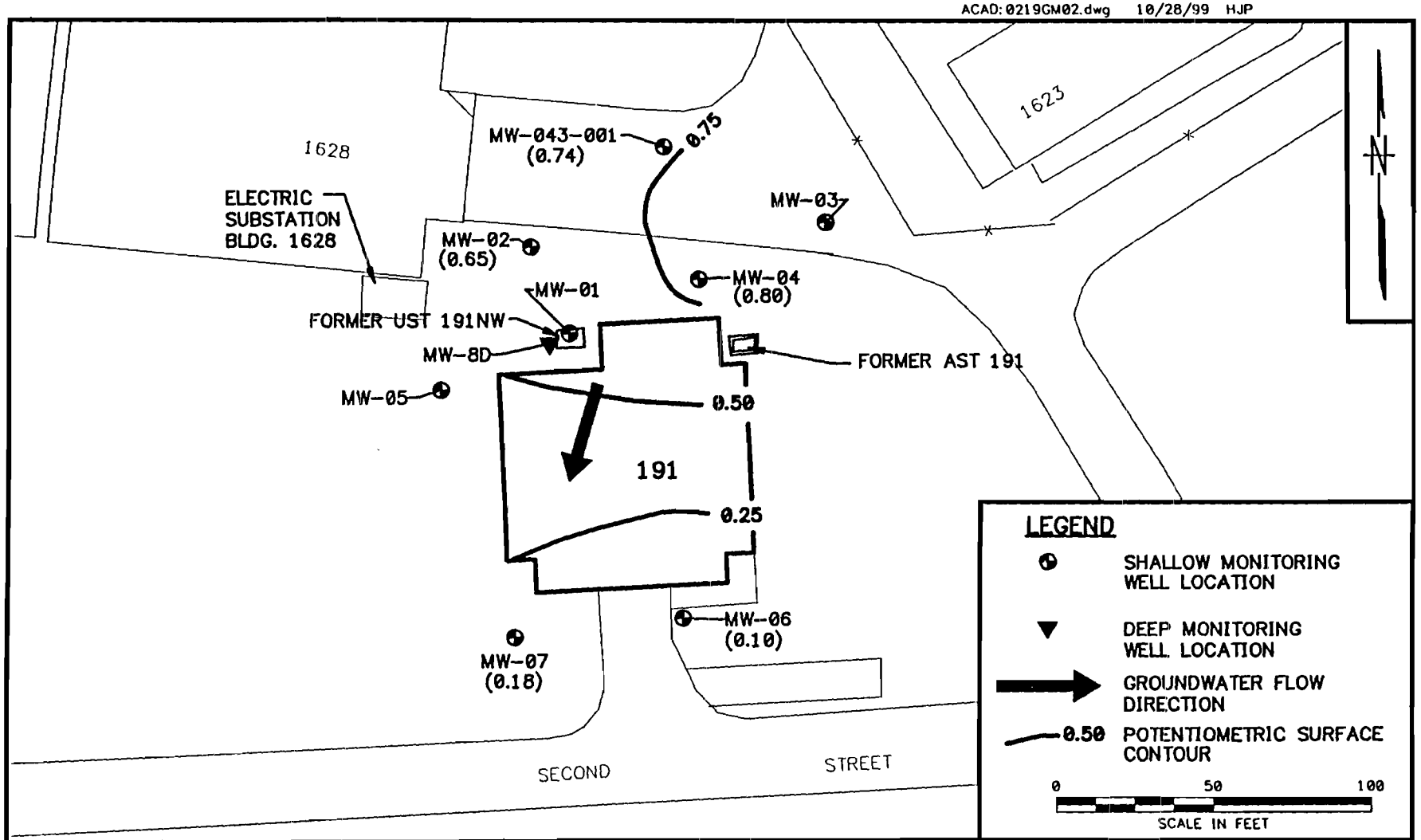
NO COCs WERE DETECTED IN GROUNDWATER ABOVE THE LAB'S PQL.

0 50 100
SCALE IN FEET

DRAWN BY HJP DATE 10/18/99	MONITORING WELL LOCATIONS AND GROUNDWATER COC MAP SITE 41, BUILDING 191 ZONE A, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA	CONTRACT NO. 0219
CHECKED BY DATE		APPROVED BY DATE
COST/SCHED-AREA		APPROVED BY DATE
SCALE AS NOTED		DRAWING NO. FIGURE 4 REV. 0

FORM CADD NO. SDIV_AH.DWG - REV 0 - 1/20/98

ACAD:0219GM02.dwg 10/28/99 HJP



DRAWN BY HJP DATE 10/19/99		GROUNDWATER POTENTIOMETRIC SURFACE MAP (TIDE-SYNCHRONOUS DATA) AUGUST 9 & 10, 1999 SITE 41, BUILDING 191 ZONE A, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA	CONTRACT NO. 0219
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 5 REV. 0

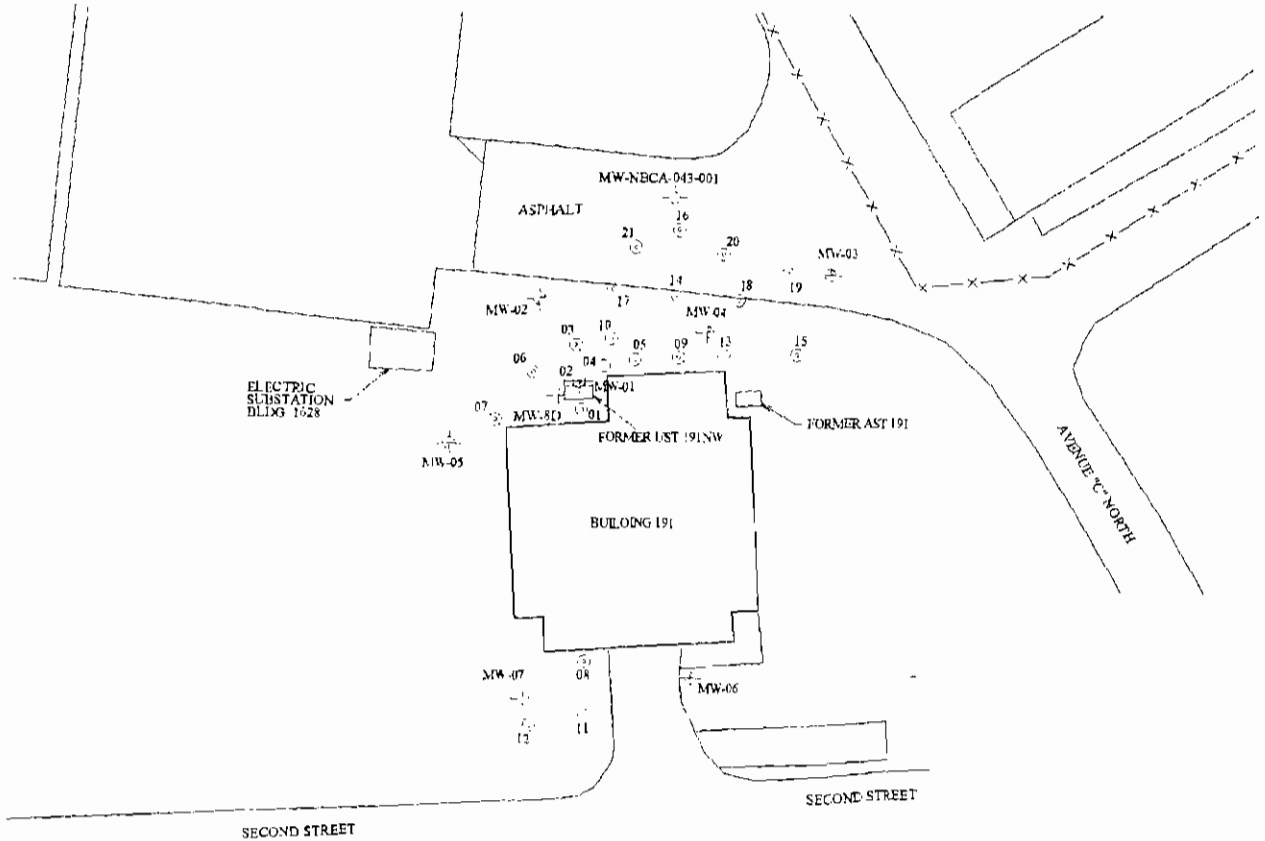
FORM CADD NO. SDIV_AH.DWG - REV 0 - 1/20/98

INTEGRATED SCIENCE & TECHNOLOGY, INC

LEGEND

— MONITORING WELL

— SOIL BORING



S MAP WAS CREATED BY:
...EGRATED SCIENCE & TECHNOLOGY, INC.
CHARLESTON, SOUTH CAROLINA

THIS MAP WAS COMPILED FROM BASE DRAWINGS AND/OR SKETCHES SUPPLIED BY OTHERS. IT IS TO BE USED ONLY AS AN APPROXIMATE SOURCE OF REFERENCE. WE ASSUME NO RESPONSIBILITY FOR THE ACCURACY OF BASE MAP RELATED INFORMATION CONTAINED HEREIN

0 40 80
SCALE IN FEET
(APPROXIMATE)

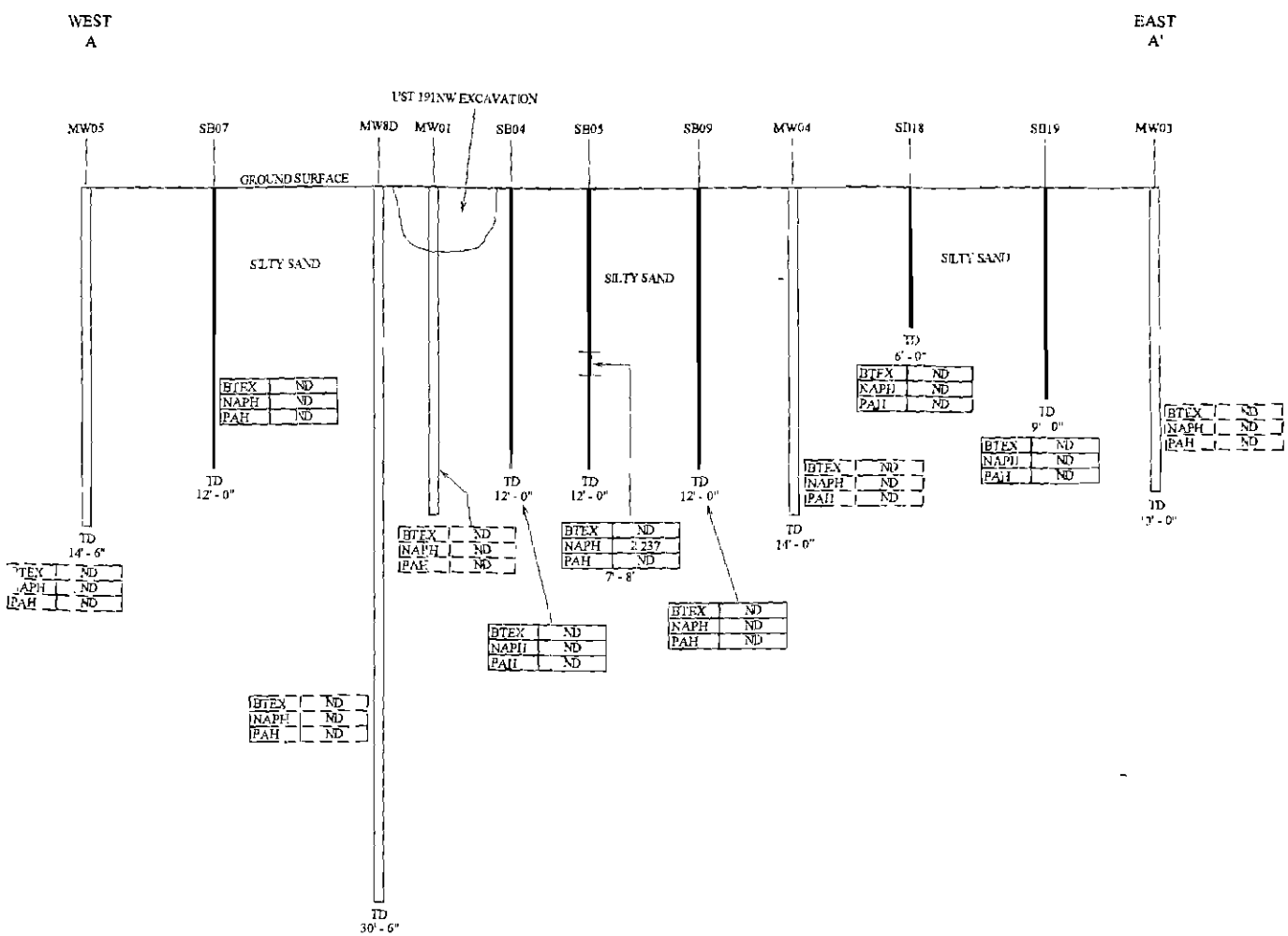
J.A. JONES
ENVIRONMENTAL SERVICES

DRAWN BY C. BROACH	DATE 08/29/2(
REVIEWED BY: B. CRAWFORD	PROJECT
APPROVED BY:	DRAWING

SITE LAYOUT MAP

SITE 41, BUILDING 191
ZONE A, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

FIGURE



LEGEND

MONITORING WELL OR BORING NUMBER — SB06

GROUND SURFACE

WELL OR BORING

TOTAL DEPTH OF BORING OR WELL (BGS) — TD 8' - 0"

BTEX	ND
NAPH	ND
PAH	ND

SOIL PARAMETER CONCENTRATIONS (mg/kg)

BTEX	ND
NAPH	ND
PAH	ND

GROUNDWATER PARAMETER CONCENTRATIONS (ug/L)

BTEX - BENZENE, TOLUENE, ETHYLBENZENE, AND TOTAL XYLENES

NAPH - NAPHTHALENE

PAH - POLYNUCLEAR AROMATIC HYDROCARBONS

ND - NOT DETECTED (BELOW LABORTORY DETECTION LIMITS)

0 15 30
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET

S MAP WAS CREATED BY:
GRATED SCIENCE & TECHNOLOGY, INC
CH STON, SOUTH CAROLINA

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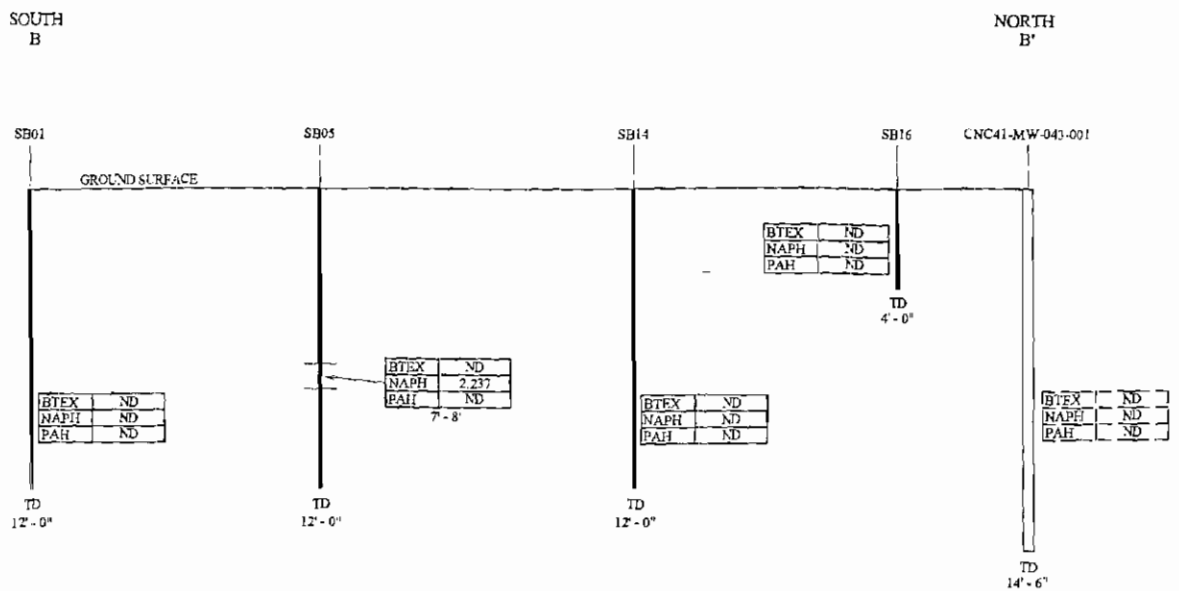
J.A. JONES ENVIRONMENTAL SERVICES

DRAWN BY C. Broach	DATE 08/29/2000
REVIEWED BY B. Crawford	PROJECT NO
APPROVED BY B. Crawford	DRAWING NO JA-03-02

GEOLOGIC CROSS SECTION A-A'

SITE 41, BUILDING 191
ZONE A, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

FIGURE



LEGEND

MONITORING WELL OR BORING NUMBER — SB06

GROUND SURFACE

WELL OR BORING

TOTAL DEPTH OF BORING OR WELL (BGS) — TD 8' - 0"

BTEX	ND
NAPH	ND
PAH	ND

SOIL PARAMETER CONCENTRATIONS (mg/kg)

BTEX	ND
NAPH	ND
PAH	ND

GROUNDWATER PARAMETER CONCENTRATIONS (µg/L)

BTEX - BENZENE, TOLUENE, ETHYLBENZENE, AND TOTAL XYLENES

NAPH - NAPHTHALENE

PAH - POLYNUCLEAR AROMATIC HYDROCARBONS

ND - NOT DETECTED (BELOW LABORTORY DETECTION LIMITS)

0 10 20
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET

S MAP WAS CREATED BY:
.GRATED SCIENCE & TECHNOLOGY, INC.
ARLESTON, SOUTH CAROLINA

- MAP WAS COMPILED FROM BASE DRAWINGS AND/OR SKETCHES SUPPLIED BY OTHERS. IT IS TO BE USED ONLY AS AN APPROXIMATE SOURCE OF REFERENCE. WE ASSUME NO RESPONSIBILITY FOR THE ACCURACY OF BASE MAP RELATED INFORMATION CONTAINED HEREIN

J.A. JONES
ENVIRONMENTAL SERVICES

DRAWN BY: C. Broach	DATE: 08/29/2000
REVIEWED BY: B. Crawford	PROJECT NO: -
APPROVED BY: B. Crawford	DRAWING NO: JA-03-03

GEOLOGIC CROSS SECTION B-B'

SITE 41, BUILDING 191
ZONE A, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

FIGURE