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CORRECTIVE ACTION PLAN FOR SITE 30 BUILDING NH 46, ZONE C CNC CHARLESTON SC

8/1/2000

CH2M HILL

CORRECTIVE ACTION PLAN
FOR
ZONE C/ SITE 30 Building NH-46

SITE IDENTIFICATION # 01206

Charleston Naval Complex
Charleston, South Carolina

SOUTHERN DIVISION
NAVAL ENGINEERING COMMAND

Contract Number N62467-99-C-0960

August 2000

CORRECTIVE ACTION PLAN
FOR
ZONE C/ SITE 30-BUILDING NH-46

SITE IDENTIFICATION # 01206

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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115 Perimeter Center Place NE
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Contract Number: N62467-99-C-0960

August 2000

PREPARED BY:

28- AUG 2000

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

APPROVED BY:

29 August 2000

Jed Heames
Site Superintendent
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. Garrison Date: _____

South Carolina Registration No. 14,220

SOUTH CAROLINA
J.A. JONES
MANAGEMENT
SERVICES, INC.
No. 002033
CERTIFICATE OF AUTHORIZATION

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ACRONYMS

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
QA	Quality Assurance
QC	Quality Control
RBSL	Risk-Based Screening Level
RDA	Redevelopment Authority
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 Corrective Action Plan (CAP) has been prepared by CH2M-JONES, LLC. The plan is designed for Zone C/ Site 30-Building NH-46 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: 01206. This CAP provides methods to further evaluate the applicability of intrinsic remediation and monitoring well abandonment as a corrective action for Building NH-46 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 1. (Tetra Tech, NUS [TTNUS], 2000).

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.

Site 30 is a closed underground storage tank (UST) system which utilized four USTs that provided fuel oil to the boilers at Building NH-46 at the Charleston Naval Complex (CNC), in Charleston South Carolina. Building NH-46 was constructed in 1941 and served as part of the Naval Hospital Complex. The building's boilers utilized four steel USTs, UST NH-46-1, UST NH-46-2, UST NH-46-3 and UST NH-46-4, located on the east side of the building to provide fuel oil to the boilers. Each UST was installed in 1941; however, the date the UST system was last in operation is unknown (TTNUS 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, Tier I and Tier II completed by TTNUS 1999 & 2000. Details for the abandonment of monitoring wells at Building NH-46 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. Figure 3 depicts the public utilities located within 250 feet of the Building NH-46 study area. Specific information concerning the depth of utilities below land surface (bls) is currently unavailable, however, utilities at this site generally are between 2 to 6 feet (ft) bls. Corrective action data summary forms are provided in Appendix A. The following utility receptors were located:

TABLE 1

Utility	On-Site or Distance/ Direction from Site	Depth to Utility
Electric	Enters Building NH-46 on the east side ~ 50-ft from the former UST tank bed.	2-6 ft bls
Gas	Enters Building 72 from the north ~ 85-ft northwest of the former UST-46 UST tank bed.	2-6 ft bls
Sanitary Sewer, water utility	Sanitary sewer is 10-ft east of the former UST site. Waterlines are located north and south of the building	2-6 ft bls
Storm Drain	25-ft east of the former UST 46. A sanitary storm sewar runs beneath Building 46 on the eastern side of the building.	2-6 ft bls

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. The nearest surface water body to UST NH-46 is Noisette Creek located approximately 1,000 feet to the north.

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

Fate and transport modeling from the Rapid Assessment predicts the groundwater naphthalene concentration at the source (tip of the downgradient plume) would migrate a distance downgradient of 30-feet after 10 years, and 56 feet after 20 years. At the outer edge of the plume migration after 10 or 20 years, the naphthalene groundwater concentrations would attenuate to the groundwater ingestion level of 0.010 mg/kg.

2.2 Site-Specific Target Levels

The soil leachability model was used in the SLA to determine soil SSTLs for benzene, ethylbenzene, and naphthalene protective of groundwater exposure for a construction worker from leaching.

TABLE 2

Chemical Of Concern	SSTL (mg/kg)	SourceArea Concentration (mg/kg)
Naphthalene	167	50
Benzene	0.89	0.34
Ethylbenzene	75	3.9

Based on the above table, a construction worker exposed to groundwater contaminated by leaching from on-site subsurface contaminated soil is not at risk.

3.0 PROPOSED REMEDIATION TECHNOLOGY

Based on the results of the RA 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. The Corrective Action Monitoring plan is provided in Appendix C.

4.0 MONITORING WELL INSTALLATION AND ABANDONMENT

4.1 Monitoring Well Installation

Because of the large amount 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

A total of fourteen monitoring wells will be abandoned at building NH-46 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

Surveying of any new monitoring wells will be conducted and certified by a South Carolina State Registered Land Surveyor. Datum to be used will be in accordance with USGS NAD' 27. The surveying subcontractor will report all elevations referenced to mean sea level.

After installation, the ground surface, top of the protective casing will be surveyed to within 0.01-foot vertical accuracy by a state-certified land surveyor. In addition the well will be surveyed to a 0.1-foot horizontal accuracy.

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 NH-46 will be performed in accordance with SCDHEC Corrective Action Guidance Document June, 1997, and consist of the following:

- **Frequency:** Initially all monitoring at this site will be sampled. Thereafter, groundwater samples will be collected from wells CNC30-MW01, CNC30-MW04 CNC30-MW10, CNC30-MW12D, CNC30-MW13D, and CNC30-MW05.

See figure 6/ section 7 for groundwater flow direction.

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

TABLE 3

Sampling date	Monitoring Wells Sampled	Field Measures	Laboratory Analytical
Second half [1]2000	CNC30-MW-01, MW-02, MW-03, MW-04, MW-05, MW-06, MW07, MW-08, MW-09, MW-10, MW-11, MW-12D, MW-13D, MW-14	T°, pH, DO, Conductivity, Depth to water, Total depth, Turbidity	Naphthalene 8260 BTEX 8260 Sulfate, nitrate, total dissolved iron, alkalinity, methane
First half[2] 2001	CNC30-MW-01, MW-04, MW-10, MW-12D, MW-13D, MW-05 * subject to change pending on first round of sampling	T°, pH, DO, Conductivity, Depth to water, Total depth, Turbidity	Naphthalene 8260 BTEX 8260 Sulfate, nitrate, total dissolved iron, alkalinity, methane
Second half[2] 2001	CNC30-MW-01, MW-04, MW-10, MW-12D, MW-13D, MW-05 * subject to change pending on first round of sampling	T°, pH, DO, Conductivity, Depth to water, Total depth, Turbidity	Naphthalene 8260 BTEX 8260 Sulfate, nitrate, total dissolved iron, alkalinity, methane

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 (or as needed), 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 8260.
- 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

5.3 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 D.

5.4 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.

5.5 Sample Handling

Sample Handling will be conducted with the following references:

EPA EISOPQAM (EPA May, 1996)
Charleston Naval Complex Sampling and Analysis Plan (June 1998).

5.6 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

5.7 Quality Check

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.

5.8 Control Limits

TABLE 4

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.

5.9 Record keeping

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

5.10 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

3. SCDHEC point of contact
   Paul Bristol
   South Carolina Department of Health and Environmental Control
   2600 Bull Street
   Columbia, SC 29201
   (843) 898-3559

REFERENCES

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

Tetra Tech NUS, Inc.; 2000 Rapid Assessment for Site 30 Building NH-46 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.

APPENDIX A

D H E C

PROMOTE PROTECT PROSPER

Corrective Action Data Summary
Division of Underground Storage Tank Management

GENERAL

Facility ID #: 01206 County: CHARLESTON

Facility Name: CHARLESTON NAVAL COMPLEX

Facility Address: 1545 HOBSON AVE., N. CHARLESTON, SC 29405

UST Owner/Operator: SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND (SOUTHDIV) Phone #: 843-820-7367

Address: 2155 EAGLE DRIVE N. CHARLESTON, SC 29406

Current use of facility/property: NOT IN USE

Current property owner name: SAME AS ABOVE

Current property owner address: SAME AS ABOVE

# of USTs: FOUR (46-1, 46-2, 46-3, 46-4) Replaced / Tested: _____ (Circle one) (date) Removed: ALL FOUR BETWEEN 8-15-96 to 09-18-96 (date)

Type of product: ☐ Gasoline ☐ Diesel ☐ Kerosene ☐ Waste Oil ☑ Other: FUEL OIL FOR BOILER (specify)

Previous Treatment: ☐ Yes ☑ No Effectiveness: _____

The release occurred in: ☐ UST Basin ☐ Dispensers ☐ Line ☑ Other Please specify: N/A

SEE SITE HISTORY IN RAPID ASSESSMENT TTNLS

EXPOSURE AND POINTS OF COMPLIANCE INFORMATION

the exposure points, points of compliance and the x, y, and z coordinates for each.

EP	PC	x	y	z
N/A				

SOIL SSTL's

Units: mg/Kg

CoC	SSTL
Benzene	0.89 mg/Kg
ETHYLBENZENE	75 mg/Kg
NAPHTHALENE	167 mg/Kg

Facility ID#: 01206 Facility Name: CHARLESTON NAVAL COMPLEX

TLs

These SSTLs are established for each point of compliance. _____				Units:
Chemical of Concern	MW-GW	MW-GW	MW-GW	MW-GW
Benzene				
ETHYL BENZENE	N/A			
NAPHTHALENE				

These SSTLs are established for each point of compliance. _____				Units:
Chemical of Concern	MW-GW	MW-GW	MW-GW	MW-GW

These SSTLs are established for each point of compliance. _____				Units:
Chemical of Concern	MW-GW	MW-GW	MW-GW	MW-GW

The technical file is available for review through the Freedom of Information Office.
Please call 803-734-5376 for an appointment.

Selected Remedial Approach

☐ Active ☑ Intrinsic

APPENDIX B

IN-SITU SOIL RISK EVALUATION

SOUTH CAROLINA
Department of Health and Environmental Control (DHEC)

Site Data

SITE ID #		COUNTY	Charleston
FACILITY NAME	Site 30, Building NH 46		
STREET ADDRESS	Charleston Naval Complex, North Charleston, SC		

Soil Risk Evaluation Data

					Figure
TPH		**5720**	mg/kg		
Soil % SAND (Estimated)		**97**	%		
Soil % CLAY (Estimated)		**3**	%		
Worst Case	Benzene	**0.34**	mg/kg	Cs	
Soil Analyses	Toluene		mg/kg	Cs	
	Ethylbenzene	**3.9**	mg/kg	Cs	
	Xylenes		mg/kg	Cs	
	Naphthalene	**50**	mg/kg	Cs	
	MTBE		mg/kg	Cs	
Natural Organic Carbon Content		**4825**	mg/kg	foc	
Average Annual Recharge		25	cm	Hw	
Distance from highest Soil Impact to water table		**76**	cm	L	
Bulk Density of Soil		1.45	g/cc	Bd	1
Wetting Front Suction		10	cm	Hf	2
Soil Hydraulic Conductivity		**1.43E-03**	cm/sec	Kf	3
Porosity		0.47	decimal %	Φ	4
Residual Water Content		0.04	decimal %	Wr	5

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

IN-SITU SOIL RISK EVALUATION

SOUTH CAROLINA
Department of Health and Environmental Control (DHEC)

Site Data

SITE ID # 0
FACILITY NAME Site 30, Building NH 46

Instructions

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

Data

List Constituent: BENZENE
(BTEX, Napth.)

				Table
Bioremediation "half-life"	16	days	t 1/2	1
Soil/water partitioning coefficient	81	ml/g	K oc	1

Results

				Equation Set	Step
Total Organic Carbon Content	0.0081	decimal %	f cs	I	1
Leachate Concentration	0.463	mg/l	C w	I	2
Air Filled Porosity	0.43	decimal %	f	II	1
Infiltration Rate Time	10,690	seconds	t	II	2
Velocity of Water	7,348	ft/year	V w	II	3
Soil/Water Distribution Coefficient	0.3908	ml/g	K d	III	1
Contaminant Percolation Rate	3,331	ft/year	V c	III	2
Time to Reach Groundwater	0.27	days	T c	IV	1
Concentration reaching Groundwater	0.1518	mg/l	C p	IV	2
Site Specific Target Level	**0.8912**	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

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 = 0.0081 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'))) = 0.4633 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 = 0.43 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))))) = 10,690 seconds

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

Vw = (L/30.48cm/ft)/(t/31,500,000sec/year) = 7,348 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 = 0.390825 ml/g

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

Vc = Vw/(1+((Bd*Kd)/ø)) = 3,331 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) = 0.27 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))) = 0.1518 mg/l

COC concentration in soil pore water (Cp) is greater than concentration necessary to protect groundwater (Cw), therefore the SSTL must be calculated.

SOIL LEACHABILITY MODEL FOR BENZENE

RISK-BASED CORRECTIVE ACTION FOR PETROLEUM RELEASES

SITE INFORMATION:

Site: [redacted]

Location: [redacted]

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		BENZENE
Bd	Soil Bulk Density (1)	g/cm3	1.45
Crsbl	Risk Based Screening Level	mg/L	0.15
Cs	Concentration of COC in soil	mg/kg	0.34
DAF	Dilution/Attenuation Factor (2)	unitless	8
foc	Organic Carbon Content in Soil (3)	mg/kg	4825
H'	Henry's Law Constant (4)	unitless	0.23
Hf	Wetting front suction head (always negative) (5)	cm	-10
Hw	Average Annual Recharge (3)	cm	25.00
Kf	Soil Hydraulic Conductivity (6)	cm/s	1.43E-03
Koc	Soil/Water Partioning Coefficient (2)	ml/g	81
L	Depth between soil sample with greatest COC concentration to groundwater.	cm	76
Φ	Porosity (7)	unitless	0.47
t1/2	Biodegradation "half life" (2)	days	16
TPH	Total Petroleum Hydrocarbons, EPA Method 3550	mg/kg	5720
Wr	Residual Water Content (8)	volume fraction	0.04

APPENDIX C

D H E C

PROMOTE PROTECT PROSPER

Corrective Action Monitoring Plan

.lity ID#: 01206

Proposed Monitoring Program

_____ Active Corrective Action ✓ Intrinsic Corrective Action

List method used to verify intrinsic remediation:

Tracer compounds: N/A

Time vs. concentration:

Other:

Proposed Sampling Parameters and Frequency

Parameter	Frequency	Well #
BTEX	~~SEMI ANNUAL~~	
NAPHTHALENE	SEMI ANNUAL	CNC30 MW01, MW04, MW10, MW12D
FIELD METHODS:		MW13D, MW05.
DO, T°, CONDUCTIVITY		
TOTAL DISSOLVED IRON,		
METHANE, ALKALINITY		

References

TTNUS, INC SLA REPORT 2000.

Appendix Check List

- [ ] Soil Quality Data Table
- [ ] Ground-Water Quality Data Table/Graph
- [ ] Potentiometric Data Table/Graph
- [ ] Site Map (topographic or county map)
- [ ] Tax Map
- [ ] Soil Impact Map
- [ ] Ground-Water Impact Map
- [ ] Cross Section
- [ ] Predicted Future Migration Map(s)
- [ ] North Arrow and Bar Scales on all maps

APPENDIX D

Monitor' Data
Contract ... 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

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: CNC Site 30
Project No.: N0164 Bldg NH46
Sampled By:
Field Analyst:
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: 30GLM0501
Sample Location: CNC30MW5
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 8 22 99	Color	ORP (Eh)	S.C.	Temp.	Turbidity	DO	Sal.	pH
Time:	(Visual)	(+/- mv)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	(%)	(SU)
Method:								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Dissolved Oxygen:

Equipment: HACH Digital Titrator OX-DT CHEMetrics (Range: 0-1 mg/L) Analysis Time: 0859

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
	x 0.01	= mg/L
	x 0.02	= mg/L

CHEMetrics: 0.4 mg/L

Notes:

Alkalinity:

Analysis Time: 0850

Equipment: HACH Digital Titrator AL-DT CHEMetrics (Range: _____mg/L) Filtered: ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	& 105	x 0.1	= 10.5 mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	&	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	&	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	&	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	&	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	&	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:	0	0	10.5

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT CHEMetrics (Range: _____mg/L) Analysis Time: 0854

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☒	10-50 mg/L	200 ml	0.3636 N	0.1
☒	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
	x 0.1	= mg/L
168	x 0.2	= 33.6 mg/L
	x 1.0	= mg/L
	x 2.0	= mg/L

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: CNC Site 30
Project No.: N0164 Bldg NH46
Sampled By: JA
Field Analyst: JA
Field Form Checked as per QA/QC Checklist (initials): [illegible]

Sample ID No.: 30GLMØ5Ø1
Sample Location: CNC3ØMWØ5
Duplicate: ☐
Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S^{2-}):

Equipment: DR-700 DR-8 __ HS-C Color Chart HS-WR Color Wheel Analysis Time: Ø907
Program/Module: 610nm 93 Other: _____
Concentration: Ø.Ø1 mg/L Filtered: ☐
Notes:

Sulfate (SO_4^{2-}):

Equipment: DR-700 DR-8 __ Other: _____ Analysis Time: _____
Program/Module: 91
Concentration: _____ mg/L Filtered: ☐
Standard Solution: ☐ Results: _____
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____
Notes:

Nitrite (NO_2^--N):

Analysis Time: Ø94Ø
Equipment: DR-700 DR-8 __ Other: _____ Filtered: ☐
Program/Module: 60
Concentration: Ø.Ø1Ø mg/L Reagent Blank Correction: ☐
Standard Solution: ☐ Results: ☐
Notes:

Nitrate (NO_3^--N):

Analysis Time: _____
Equipment: DR-700 DR-8 __ Other: _____ Filtered: ☐
Program/Module: 55
Concentration: _____ mg/L
Nitrite Interference Treatment: ☐
Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____
Notes:

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name: CNC Site 30
Project No.: N0164 Bldg NH46
Sampled By:
Field Analyst:
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.:
Sample Location:
Duplicate: ☐
Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn^{2+}):

Equipment: DR-700 DR-8 __ HACH MN-5 Other: _____ Analysis Time: 0920

Program/Module: 525nm 41

Concentration: 0.0 mg/L Filtered: ☐

Digestion: ☐

Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-700 DR-8 __ IR-18C Color Wheel Other: _____ Analysis Time: 0915

Program/Module: 500nm 33

Concentration: 0.81 mg/L Filtered: ☐

Notes:

Hydrogen Sulfide (H_2S):

Equipment: HS-C Other: _____ Analysis Time: _____

Concentration: 0.0 mg/L Exceeded 5.0 mg/L range on color chart: ☐

Notes:

QA/QC Checklist:

All data fields have been completed as necessary: ☑

Correct measurement units are cited in the SAMPLING DATA block: ☑

Mulitplication is correct for each *Multiplier* table: ☑

Final calulated concentration is within the appropriate *Range Used* block: ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☑

Title block is initialized by person who performed the QA/QC Ckecklist: ☑

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: CNC Site 30
Project No.: N0164 Bldg NH46
Sampled By:
Field Analyst:
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: 30GLm01 01
Sample Location: CNC30 mw5
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 8 22 95	Color	ORP (Eh)	S.C.	Temp.	Turbidity	DO	Sal.	pH
Time:	(Visual)	(+/- mv)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	(%)	(SU)
Method:								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Dissolved Oxygen:

Equipment: HACH Digital Titrator OX-DT CHEMetrics (Range: 0-1 mg/L) Analysis Time: 1044

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
_____	x 0.01	= mg/L
_____	x 0.02	= mg/L

CHEMetrics: 0.4 mg/L

Notes:

Alkalinity:

Analysis Time: 1035

Equipment: HACH Digital Titrator AL-DT CHEMetrics (Range: _____mg/L) Filtered: ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☒	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & 450	x 0.1	= 45 mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & 120	x 0.4	= 48 mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:	0	0	48

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Carb n Dioxide:

Equipment: HACH Digital Titrator CA-DT CHEMetrics (Range: _____mg/L) Analysis Time: 1040

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☒	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
_____	x 0.1	= mg/L
440	x 0.2	= 88 mg/L
_____	x 1.0	= mg/L
_____	x 2.0	= mg/L

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

40 . 2
0.0

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Page __ of __

Project Site Name: CNC Site 30
Project No.: N0164 Bldg NH46
Sampled By:
Field Analyst:
Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: 30GLM01/01
Sample Location:
Duplicate: ☐
Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S^{2-}):

Equipment: DR-700 DR-890 HS-C Color Chart HS-WR Color Wheel Analysis Time: 10 ~~11~~55 ~~9~~
Program/Module: 610nm 93 Other:

Concentration: 0.80 mg/L Filtered: ☐

Notes: "LIMIT" REACHED ON DR890. Sample v. blue after adding reagents.

Sulfate (SO_4^{2-}):

Equipment: DR-700 DR-8 __ Other: Analysis Time:
Program/Module: 91
Concentration: — mg/L Filtered: ☐

Standard Solution: ☐ Results:
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Nitrite (NO_2^--N):

Analysis Time: 1125
Equipment: DR-700 DR-8 __ Other: Filtered: ☐
Program/Module: 60
Concentration: 0.003 mg/L Reagent Blank Correction: ☐
Standard Solution: ☐ Results: ☐

Notes:

Nitrate (NO_3^--N):

Analysis Time:
Equipment: DR-700 DR-8 __ Other: Filtered: ☐
Program/Module: 55
Concentration: — mg/L
Nitrite Interference Treatment: ☐
Standard Solution: ☐ Results: Reagent Blank Correction: ☐
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: CNC Site 30

Project No.: N0164 Bldg NH46

Sampled By:

Field Analyst:

Field Form Checked as per QA/QC Checklist (initials): [illegible]

Sample ID No.: 30GLM0101

Sample Location:

Duplicate: ☐

Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn^{2+}):

Equipment: DR-700 DR-8 __ HACH MN-5 Other: _____ Analysis Time: 1108

Program/Module: 525nm 41

Concentration: 0.2 mg/L

Filtered: ☐

Digestion: ☐

Standard Solution: ☐ Results: _____

Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-700 DR-8 ~~5~~0 IR-18C Color Wheel Other: _____ Analysis Time: 1102

Program/Module: 500nm 33

Concentration: 0.21 mg/L

Filtered: ☐

Notes:

Hydrogen Sulfide (H_2S):

Equipment: HS-C Other: _____ Analysis Time: ~~1~~ 10 50

Concentration: 5.0 mg/L Exceeded 5.0 mg/L range on color chart: ☐

Notes:

QA/QC Checklist:

All data fields have been completed as necessary: ☑

Correct measurement units are cited in the SAMPLING DATA block: ☑

Mulitplication is correct for each *Multiplier* table: ☑

Final calulated concentration is within the appropriate *Range Used* block: ☑

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☑

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☑

Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☑

Title block is initialized by person who performed the QA/QC Ckecklist: ☑

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Page __ of __

Project Site Name: CNC Site 29
Project No.: ND164 Bldg NH46
Sampled By:
Field Analyst:
Field Form Checked as per QA/QC Checklist (initials): [illegible]

Sample ID No.: 29GLMØ3Ø1
Sample Location: CNC29MWØ3
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

Date: 7-27-99	Color	~~ORP (Eh)~~ Phos	S.C.	Temp.	Turbidity	DO	Sal.	pH
Time:	(Visual)	(+/- mv)	(mS/cm)	(°C)	(NTU)	(Meter, mg/l)	(%)	(SU)
Method:		5.80	.061	26.6	Ø	2.61	—	

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Dissolved Oxygen:

Equipment: HACH Digital Titrator OX-DT CHEMetrics (Range: 1-1Ø mg/L) Analysis Time: Ø925

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
_____	x 0.01	= mg/L
_____	x 0.02	= mg/L

CHEMetrics: 2 mg/L

Notes:

Alkalinity:

Analysis Time: _____

Equipment: HACH Digital Titrator AL-DT CHEMetrics (Range: _____mg/L) Filtered: ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☒	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & 16Ø	x 0.1	= 16 mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:	Ø	Ø	16

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT CHEMetrics (Range: _____mg/L) Analysis Time: Ø942

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
~~☒~~	10-50 mg/L	200 ml	0.3636 N	0.1
☒	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
~~205~~	x 0.1	= ~~20.5~~ mg/L
205	x 0.2	= 41 mg/L
_____	x 1.0	= mg/L
_____	x 2.0	= mg/L

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

2-279C

Page __ f __

Project Site Name: CNC29

Project No.: N0164

Sampled By:

Field Analyst:

Field Form Checked as per QA/QC Checklist (initials): [initials]

Sample ID No.: 29GFMØ3Ø1

Sample Location: CNC29MW3

Duplicate: ☐

Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S^{2-}):

Equipment: DR-700 DR-8 90 HS-C Color Chart HS-WR Color Wheel Analysis Time: Ø955

Program/Module: 610nm 93 Other:

Concentration: Ø.Ø1 mg/L Filtered: ☐

Notes:

Sulfate (SO_4^{2-}):

Equipment: DR-700 DR-8 9_ Other: Analysis Time:

Program/Module: 91

Concentration: mg/L Filtered: ☐

Standard Solution: ☐ Results:

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Nitrite (NO_2^--N):

Analysis Time: ~~[illegible]~~ 1020

Equipment: DR-700 DR-8 9Ø Other: Filtered: ☐

Program/Module: 60

Concentration: Ø.Ø25 mg/L Reagent Blank Correction: ☐

Standard Solution: ☐ Results: ☐

Notes:

Nitrate (NO_3^--N):

Analysis Time:

Equipment: DR-700 DR-8 __ Other: Filtered: ☐

Program/Module: 55

Concentration: mg/L

Nitrite Interference Treatment: ☐

Standard Solution: ☐ Results: Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

7.27.99

Page __ of __

Project Site Name: CNC Site 29

Project No.: N0164

Sampled By:

Field Analyst:

Field Form Checked as per QA/QC Checklist (initials): [illegible]

Sample ID No.: 29GFM03Ø1

Sample Location: CNC29MW3

Duplicate: ☐

Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn^{2+}):

Equipment: DR-700 DR-8__ HACH MN-5 Other: _____ Analysis Time: 1033

Program/Module: 525nm 41

Concentration: 0.2 mg/L Filtered: ☐

Digestion: ☐

Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-700 DR-89Ø IR-18C Color Wheel Other: _____ Analysis Time: 1025

Program/Module: 500nm 33

Concentration: Ø.Ø1 mg/L Filtered: ☐

Notes:

Hydrogen Sulfide (H_2S):

Equipment: HS-C Other: _____ Analysis Time: _____

Concentration: _____ mg/L Exceeded 5.0 mg/L range on color chart: ☐

Notes:

QA/QC Checklist:

All data fields have been completed as necessary: ☐

Correct measurement units are cited in the SAMPLING DATA block: ☐

Mulitplication is correct for each *Multiplier* table: ☐

Final calulated concentration is within the appropriate *Range Used* block: ☐

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☐

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☐

Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☐

Title block is initialized by person who performed the QA/QC Ckecklist: ☐

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: Site 30 Bldg NH46
Project No.: ND164 Zone C

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM0101
Sample Location: CNC30MW01
Sampled By: JA
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 8 22 99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1210	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:					-			

PURGE DATA:

Date: 8 22 99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method:	Initial	6.12	.117	29.1	7	0.18		
Monitor Reading (ppm):	1	6.12	.100	29.0	7	0.44		
Well Casing Diameter & Material	2	6.10	.098	29.0	11	0.89		
Type:	3	6.05	.100	28.8	13	0.75		
Total Well Depth (TD): 12.52								
Static Water Level (WL): 9.39								
One Casing Volume(gal/L): .50								
Start Purge (hrs): 1000								
End Purge (hrs): 1030								
Total Purge Time (min): 30								
Total Vol. Purged (gal/L): 2.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX EDB	HCl	3 x 40ml	
PAH	—	2 x 1 ltr.	
Dissolved Methane	HCl	3 x 40ml	
Anions	—	1 x 1g plastic	

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

874-5050

GROUNDWATER SAMPLE LOG SHEET

Pag ___ f ___

roject Site Name: CMC 30 Bldg NH46
Project No.: N0164 Zone C

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM02-01
Sample Location: MW-2
Sampled By: JH, RH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 7-11-99								
Time: 0909								
Method:								

PURGE DATA:

Date: 7-11-99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Slow Purge	Initial	5.85	.106	24.3	0	1.48		
Monitor Reading (ppm):	1	5.97	.108	24.5	0	1.50		
Well Casing Diameter & Material	2	5.97	.106	24.5	0	1.42		
Type: P.V.C. 2"	3	5.97	.106	24.5	0	1.25		
Total Well Depth (TD):	12.60							
Static Water Level (WL):	10.18							
One Casing Volume(gal/L):	.5 gal							
Start Purge (hrs): ~~0809~~	0809							
Purge (hrs):	0909							
Total Purge Time (min):	1 hr							
Total Vol. Purged (gal/L).								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
ISTEX / MTBE	HCl	3 x 40 ml vials	7-11-99
TPH	None	2 x 1 L Amber	"

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): James R. Hall

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: Zone C site 3Ø
Project No.: N0164 Zone C Bldg NH46

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type: _____
[] QA Sample Type: _____

Sample ID No.: 3ØGLMØ3Ø1
Sample Location: CNC3ØMWØ3
Sampled By: JA
C.O.C. No.: _____
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 8·22·95	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1610	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:					-			

PURGE DATA:

Date: 8·22·95	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method:	Initial	5.25	.973	26.2	8	1.97		
Monitor Reading (ppm):	1	4.99	.Ø66	25.9	2	2.ØØ		
Well Casing Diameter & Material	2	4.97	.Ø67	25.9	3	1.91		
Type:	3	4.96	.Ø66	26.1	1	1.9Ø		
Total Well Depth (TD): 14.67								
Static Water Level (WL): 1Ø.4Ø								
One Casing Volume(gal/L): ~~14.67~~ 4.27	.68							
Start Purge (hrs): 154Ø								
End Purge (hrs): 161Ø								
Total Purge Time (min):								
Total Vol. Purged (gal/L): 2.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX/EDB	HCl	3 x 40ml	
PAH	—	2 x 1 ltr.	

OBSERVATIONS / NOTES:

14.67
1Ø.4Ø
4.27

14
4.27
.16
2562
427Ø
4832

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

GROUNDWATER SAMPLE LOG SHEET

Pag ___ of ___

Project Site Name: CNC 30 Bldg NH46
Project No.: N0164 Zone C

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM04J1
Sample Location: MW-4
Sampled By: RH/EH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 7-12-99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 0902	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method: Slow purge	red/brown	6.48	.297	24.1	0	2.35		

PURGE DATA:

Date: 7-12-99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Slow Purge	Initial	6.35	.341	24.2	16	2.71		
Monitor Reading (ppm):	1	6.44	.301	24.2	6	2.66		
Well Casing Diameter & Material	2	6.45	.307	24.1	Ø	2.37		
Type: P.V.C. 2"	3	6.48	.297	24.1	0	2.35		
Total Well Depth (TD):	13.90							
Static Water Level (WL):	9.38							
One Casing Volume(gal/L):	0.8 gal							
Start Purge (hrs):	0742							
End Purge (hrs):	0902							
Total Purge Time (min):	80							
Total Vol. Purged (gal/L):	2.8 gal							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX	—	2 x 1L AMBER	✓
BTEX/MTBE	HCl	3 x 40mL	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible] [illegible]

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: Site 30 Bldg N446
Project No.: N0164 Zone C

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM05Ø1
Sample Location: CNC 30 MWS
Sampled By: JA
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 8 22 99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1225	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:								

PURGE DATA:

Date: 8 22 99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method.	Initial	5.Ø2	.191	27.3	115	Ø.79		
Monitor Reading (ppm):	1	5.36	.173	26.4	16	Ø.5Ø		
Well Casing Diameter & Material	2	5.39	.174	26.3	5	Ø.53		
Type:	3	5.39	.17Ø	26.2	3	Ø.36		
Total Well Depth (TD): 13.33								
Static Water Level (WL): 6.8Ø								
One Casing Volume(gal/L): 1.Ø4								
Start Purge (hrs): Ø8Ø5								
End Purge (hrs): Ø848								
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX/EDB	HCl	3 x 40ml	
PAH	—	2 x 1 ltr. amber	
Anions	—		
	—	1 x 9 plastic	
Dissolved Methane			
	HCl	3 x 40ml	

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

roject Site Name: CNC 30 Bldg NH46
Project No.: N0164 Zone C

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM06 01
Sample Location: MW-6
Sampled By: EH / RN
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 7-12-99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time. 1451	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:								

PURGE DATA:

Date: 7-12-99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Slow Purge	Initial	5.39	.182	24.5	644	2.45		
Monitor Reading (ppm).	1	5.27	.173	23.5	4	2.07		
Well Casing Diameter & Material	2	6.05	.172	23.6	Ø	2.77		
Type: P.V.C. 2"	3	6.19	.172	23.5	Ø	2.60		
Total Well Depth (TD):	13.30							
Static Water Level (WL):	6.58							
One Casing Volume(gal/L):	1.14 gal							
Start Purge (hrs):	1355							
J Purge (hrs):	1450							
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX, Nap. / MTBE	HCl	3x40ml Vials	
PAH	—	~~2x40ml~~ 2x1L amber	

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): James Blair

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: Zone C Site 30
Project No.: N0164 Zone C

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM07Ø1
Sample Location: CNC30MW07
Sampled By: SA
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 8 22 99								
Time: 1515	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:					-			

PURGE DATA:

Date:	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method:	Initial	6.58	.368	28.3	48	Ø.78		
Monitor Reading (ppm):	1	6.71	.313	26.Ø	21	Ø.77		
Well Casing Diameter & Material	2	6.68	.295	25.8	4	Ø.42		
Type:	3	6.71	.29Ø	25.8	2/1	0.47		
Total Well Depth (TD): 12.85								
Static Water Level (WL): 6.22								
One Casing Volume(gal/L): 1.06								
Start Purge (hrs): 1415								
End Purge (hrs): 1515								
Total Purge Time (min): 6Ø								
Total Vol. Purged (gal/L): 3.5 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX/EDB	HCl	3 x 40 ml	
PAH	—	2 x 1 ltr.	

OBSERVATIONS / NOTES:

12.85
6.22
6.63

3
6.63
11.16
~~3.9~~ 7.8
6.30

Circle if Applicable: 10108

MS/MSD	Duplicate ID No.:

Signature(s):

GROUNDWATER SAMPLE LOG SHEET

Pag ___ of ___

Project Site Name: CNC30 Zone C
Project No.: N0164 Bldg NH46

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM0801
Sample Location: MW-8
Sampled By: EH / R.H.
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 7-10-99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1745	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:	~~Clear~~	6.59	.369	28	16	1.52		

PURGE DATA:

Date: 7-10-99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Slow Purge	Initial	6.37	.423	28.5°	450	1.98		
Monitor Reading (ppm):	1	6.52	.399	28.2	3	1.66		
Well Casing Diameter & Material	2	6.56	.383	28.2	4	1.64		
Type: PVC / 2"	3	6.59	.369	28.0	16	1.52		
Total Well Depth (TD):	12.81							
Static Water Level (WL):	6.87							
One Casing Volume(gal/L):	.98							
Start Purge (hrs):	1600							
End Purge (hrs):								
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX/MTBE	HCl	3 x 4 ml Vials	7-10-99
PAH	None	2 x 1 L Amber	"

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): James B. Hill

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: CNC 30 Bldg NH46
Project No.: N0164 Zone C

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 306LM0901
Sample Location: MW-9
Sampled By: RH/EM
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 7/12/99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1134	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method: low flow					-			

PURGE DATA:

Date: 7/12/99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: low flow	Initial	6.84	.194	23.1	6	4.04		
Monitor Reading (ppm):	1	6.83	.172	22.7	Ø	3.35		
Well Casing Diameter & Material	2	6.87	.167	22.5	Ø	3.39		
Type: 2" PVC	3	6.89	.165	22.8	Ø	3.37		
Total Well Depth (TD): 15.36								
Static Water Level (WL): 9.60								
One Casing Volume(gal/L):	.92 gal							
Start Purge (hrs):	1028							
End Purge (hrs):	1134							
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX, Naph, MTBE	HCl	3 x 40ml vials	7-12-99
PAH	None	2x 1 L amber	7-12-99

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Jessica R[illegible]

GROUNDWATER SAMPLE LOG SHEET

Pag ___ of ___

Project Site Name: CNC 30 Zone C
Project No.: N0164 Bldg NH46

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM1001
Sample Location: MW-10
Sampled By: EH/RH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 7-10-99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1319	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:								

PURGE DATA:

Date: 7-10-99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Slow Purge	Initial	4.54	.394	25.9	92	1.46		
Monitor Reading (ppm): 0	1	4.68	.345	25.9	19	2.30		
Well Casing Diameter & Material	2	4.78	.335	25.6	5	1.40		
Type: PVC 2"	3	4.81	.337	24.9	1	1.62		
Total Well Depth (TD):	16.21							
Static Water Level (WL):	7.50							
One Casing Volume(gal/L):	1.412							
Start Purge (hrs):	1121							
End Purge (hrs):	1318							
Total Purge Time (min):								
Total Vol. Purged (gal/L):	4.5 gal							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX / MTBE	HCl	3 X 40 ml	7-10-99
PAH	None	2 x 1 L glass (Amber)	"

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: CNC 30 Zone C
Project No.: N0164 Bldg NH~~40~~

[] Domestic Well Data
[x] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 30GLM1101
Sample Location: MW-11
Sampled By: EH/R.N
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 7-10-99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1523	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:	Clear	6.59	4.34	25.3	55	1.60		

PURGE DATA:

Date: 7-10-99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Slow Purge	Initial	6.52	.435	26.1	37	1.99		
Monitor Reading (ppm):	1	6.53	.431	25.9	11	1.57		
Well Casing Diameter & Material	2	6.56	.433	25.6	11	1.42		
Type: 2", PVC	3	6.59	.434	25.3	55	1.60		
Total Well Depth (TD):	12.97							
Static Water Level (WL):	6.85							
One Casing Volume(gal/L):								
Start Purge (hrs): 1359	1359							
End Purge (hrs):	1522							
Total Purge Time (min):	~~1.012~~							
Total Vol. Purged (gal/L):	1.012							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX/MTBE	HCl	3 X 40ml Vials	
PAH	None	2 X 1L Amber Glass	

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [signature]

7-27-97

Weather: High of 97°F

1355 R. Hill arrived on site to purge & sample MW-12D

1409 Started purging MW-12D W/L=11.30'/TD=34.51' Vol.=3.73 gals

	pH	S.C.	Temp	Turbid	DO
Init	8.04	.205	28.4	204	2.55
1st	8.10	.199	28.2	263	2.50
2nd	8.09	.200	26.9	128	2.55
3th					

Note: MW-12D will be sampled for BTEX, Naph, MTBE, EDB & PAH

1721 Sampled MW-12D #30 GLM1281

1745 Exit Site.

GROUNDWATER SAMPLE LOG SHEET

Pag ___ of ___

Project Site Name: CNC 30 Bldg NH46
Project No.: N0164 Zone C

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 306L41301
Sample Location: MW-13D
Sampled By: RH/EH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 7/12/99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1006	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method: peristaltic-low flow	clear	6.94	0.162	23.5	0	2.84		

PURGE DATA:

Date: 7-12-99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: peristaltic-low flow	Initial	5.89	0.231	24.6	403	3.56		
Monitor Reading (ppm):	1	6.30	0.184	23.9	0	1.34		
Well Casing Diameter & Material	2	6.85	0.165	23.5	5	2.50		
Type: 2" PVC	3	6.94	0.162	23.5	0	2.84		
Total Well Depth (TD): 34.75'								
Static Water Level (WL): 9.22'								
One Casing Volume(gal/L): 4.2gal								
Start Purge (hrs): 0745	0745							
End Purge (hrs): 1006								
Total Purge Time (min): 141								
Total Vol. Purged (gal/L): 12.6								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PAH	—	2 x 1L AMBER	✓
BTEX / MTBE	HCl	3x40mL	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s):

GROUNDWATER SAMPLE LOG SHEET

Pag ___ of ___

Project Site Name: CNO JQ Bldg NH46
Project No.: ND164 Zone C

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: JQGLM1401
Sample Location: [illegible]
Sampled By: [illegible] / RH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 7-11-99	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1112	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method:	Clear	5.65	.116	26.9	Ø	0.94		

PURGE DATA:

Date: 7-11-99	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: Grab Pump	Initial	5.63	.131	25.5	Ø	1.91		
Monitor Reading (ppm):	1	5.59	.117	26.8	Ø	.74		
Well Casing Diameter & Material	2	5.65	.114	26.9	Ø	1.55		
Type:	3	5.65	.116	26.9	Ø	0.94		
Total Well Depth (TD):	12.06							
Static Water Level (WL):	7.03							
One Casing Volume(gal/L): 1.316	0945							
Start Purge (hrs):	0945							
End Purge (hrs).	1112							
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX/Nap/MTBE	HCl	3X 40 ml vials	7-11-99
PAH	None	2x 1 l amber	7-11-99

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: CNC30 **Project No.:**
Locati n: Site 30 **Personnel:** R. Hill, J. Krieger
Weather Conditions: Clear High of 88°F **Measuring Device:** Water Level Meter
Tidally Influenced: Yes ___ No ___ **Remarks:** F.U.

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Readin (feet)*	Thickness of Free Produc (feet)*	Groundwater Elevation (feet)*	Comments
MW-2	9.1.99	0805			10.35			
MW-14		0809			7.28			
MW 12D		0813			11.83			
MW-1		0815			9.62			
MW-3		0817			10.75			
MW-4		0819			9.57			
MW 13D		0821			9.39			
MW-9		0824			9.79			
MW-5		0827			7.20			
MW-6		0829			6.80			
MW-7		0832			6.64			
MW-8		0834			6.11			
MW-11		0841			7.16			
MW 10		0844			7.79			

* All measurements to the nearest 0.01 foot

APPENDIX E

BORING LOG OF MONITORING WELL USED IN AQUIFER CHARACTERIZATION EVALUATION

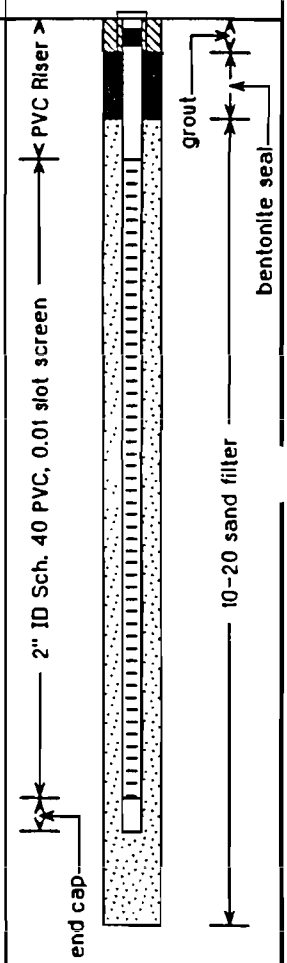
EnSafe/Allen & Hoshall

Monitoring Well NBCC047006

Project: *Zone C - Naval Base Charleston*	Coordinates: *2315164.71 E, 377240.48 N*
Location: *Charleston, SC*	Surface Elevation: *9.8 feet msl*
Started at *1330 on 4-5-95*	TOC Elevation: *12.27 feet msl*
Completed at *1445 on 4-5-95*	Depth to Groundwater: *7.53 feet TOC* Measured: *6-21-95*
Drilling Method: *4.25" ID (7.5" OD) HSA with split spoon*	Groundwater Elevation: *4.74 feet msl*
Drilling Company: *Alliance Environmental*	Total Well Depth: *12.1 feet bgs*
Geologist: *Peter Bayley*	Well Screen: *2.1 to 12.1 feet bgs*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	% RECOVERY	PID (ppm)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
								Surface conditions: soil and grass	
							SP	Sand: brown to dark gray, very fine to fine with some medium, trace of silt, soft, wet at 3.5'.	6.8 / 6.1
5			1	37	0				
10			2	0	0		SP	Sand: gray with orange FeOx banding in upper 3", very fine to fine with trace medium, trace silt, soft, wet; more brown in upper 5".	2 / 1.7
			3	75	0				
							SP	Sand: brown to dark brown, very fine to fine, trace silt, soft, wet, some granule to pebbly layer at 13.2-13.4'.	3.2 / 3.9
15			4	37	0				
20									

WELL DIAGRAM



APPENDIX E

SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

DOMENICO'S DILUTION/ATTENUATION EQUATION FOR GROUNDWATER TRANSPORT

Pr dicted 10-year Migration of Constituents in Groundwater

Parameter Descriptions:	Units
POE = Point of Exposure	
SSTL = Site-Specific Target Level	mg/L
$SSTL_{SOURCE}$ = Hydrocarbon Concentration in Plume Source Area protective of RBSLs at POE	mg/L
$SSTL_{COMP}$ = Hydrocarbon Concentration at Compliance Point protective of RBSLs at POE	mg/L
X_{POE} = x = Distance from Plume Source to POE (along Centerline)	m
X_{COMP} = x = Distance from POE to Compliance Point (along Centerline)	m
Y = Source Width (Perpendicular to Flow Direction)	m
Z = Source Depth (Perpendicular to Flow Direction in Vertical Plane)	m
K_s = Saturated Hydraulic Conductivity	m/sec
i = Groundwater Gradient	cm/cm
θ = Porosity in Saturated Zone	cm^3/cm^3

Parameter Descriptions.	Units
ρ_s = Soil Bulk Density	g/cm^3
f_{OC} = Fraction Organic Carbon in Soil	g-C/g-soil
α_x = Longitudinal Dispersivity = x/10	m
α_Y = Transverse Dispersivity = $\alpha_x/3$	m
α_Z = Vertical Dispersivity = $\alpha_x/20$	m
k_{OC} = Organic Carbon Partition Coefficient	cm^3-H_2O/g-C
k_D = Soil-Water Sorption Coefficient	cm^3-H_2O/g-soil
V = Pore Water Velocity	m/sec
R_C = Constituent Retardation Factor	
V/R_C = Maximum Transport Rate of Dissolved Constituent = $(K_s i)/(\theta R_C)$	m/sec
RBSL = Risk-Based Screening Level in Water Provided by SCDHEC (1998)	mg/L

Dilution & Attenuation without Biological Decay

Constituent	X_{POE} ft	X_{POE} m	Y m	Z m	t sec	K_s m/sec	i m/m	θ m^3/cm^3	ρ_s g/cm^3	α_x m	α_y m	α_z m	f_{OC} g-C/g-soil	k_{OC} cm^3-H_2O/g-C	k_D cm^3-H_2O/g-soil	V m/sec	R_C	C_{POE}/C_{SOURCE}
Naphthalene	45	13.7162	15	2	3.15E+08	1.43E-05	0 0150	0 47	1.45	1.37	0 46	0 07	4 83E-03	1543	7.444975	4.57E-07	23.969	2 392E-02

Source: South Carolina Department of Health and Environmental Control (SCDHEC) 1998 *Risk-Based Corrective Action for Petroleum Releases*, Bureau of Underground Storage Tank Management.

DOMENICO DILUTION/ATTENUATION MODEL WITHOUT BIOLOGICAL DECAY

$$\frac{C_X}{C_{SOURCE}} = \frac{1}{2} erfc\left[\frac{\left(x - \frac{vt}{R_c}\right)}{2\sqrt{\alpha_X \frac{vt}{R_c}}}\right] \times erf\left[\frac{Y}{4\sqrt{\alpha_Y x}}\right] \times erf\left[\frac{Z}{2\sqrt{\alpha_Z x}}\right]$$

Constituent	C_{SOURCE} mg/L	C_X mg/L
Naphthalene	0.410	0.010

Prepared By: _____

Reviewed By: _____

SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

DOMENICO'S DILUTION/ATTENUATION EQUATION FOR GROUNDWATER TRANSPORT

Predicted 20-year Migration of Constituents in Groundwater

Parameter Descriptions:	Units
POE = Point of Exposure	
SSTL = Site-Specific Target Level	mg/L
$SSTL_{SOURCE}$ = Hydrocarbon Concentration in Plume Source Area protective of RBSLs at POE	mg/L
$SSTL_{COMP}$ = Hydrocarbon Concentration at Compliance Point protective of RBSLs at POE	mg/L
X_{POE} = x = Distance from Plume Source to POE (along Centerline)	m
X_{COMP} = x = Distance from POE to Compliance Point (along Centerline)	m
Y = Source Width (Perpendicular to Flow Direction)	m
Z = Source Depth (Perpendicular to Flow Direction in Vertical Plane)	m
K_s = Saturated Hydraulic Conductivity	m/sec
i = Groundwater Gradient	cm/cm
θ = Porosity in Saturated Zone	cm^3/cm^3

Parameter Descriptions:	Units
ρ_s = Soil Bulk Density	g/cm^3
f_{oc} = Fraction Organic Carbon in Soil	g-C/g-soil
α_x = Longitudinal Dispersivity = x/10	m
α_y = Transverse Dispersivity = $\alpha_x/3$	m
α_z = Vertical Dispersivity = $\alpha_x/20$	m
k_{oc} = Organic Carbon Partition Coefficient	cm^3-H_2O/g-C
k_D = Soil-Water Sorption Coefficient	cm^3-H_2O/g-soil
V = Pore Water Velocity	m/sec
R_c = Constituent Retardation Factor	
V/R_c = Maximum Transport Rate of Dissolved Constituent = $(K_s i)/(\theta R_c)$	m/sec
RBSL = Risk-Based Screening Level in Water Provided by SCDHEC (1998)	mg/L

Dilution & Attenuation without Biological Decay

Constituent	X_{POE} ft	X_{POE} m	Y m	Z m	t sec	K_s m/sec	i m/m	θ m^3/cm^3	ρ_s g/cm^3	α_x m	α_y m	α_z m	f_{oc} g-C/g-soil	k_{oc} cm^3-H_2O/g-C	k_D cm^3-H_2O/g-soil	V m/sec	R_c	C_{POE}/C_{SOURCE}
Naphthalene	80	24.3843	15	2	6.31E+08	1.43E-05	0.0150	0.47	1.45	2.44	0.81	0.12	4.83E-03	1543	7.444975	4.57E-07	23.969	2.403E-02

Source: South Carolina Department of Health and Environmental Control (SCDHEC) 1998. *Risk-Based Corrective Action for Petroleum Releases*, Bureau of Underground Storage Tank Management.

DOMENICO DILUTION/ATTENUATION MODEL WITHOUT BIOLOGICAL DECAY

$$\frac{C_X}{C_{SOURCE}} = \frac{1}{2} erfc\left[\frac{\left(x - \frac{vt}{R_c}\right)}{2\sqrt{\alpha_X \frac{vt}{R_c}}}\right] \times erf\left[\frac{Y}{4\sqrt{\alpha_Y x}}\right] \times erf\left[\frac{Z}{2\sqrt{\alpha_Z x}}\right]$$

Constituent	C_{SOURCE} mg/L	C_X mg/L
Naphthalene	0.410	0.010

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ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA
Site 30

Groundwater SSTLs

Constituent	POE RBSLs mg/L	$SSTL_{SOURCE}$ mg/L	$SSTL_{COMP}$ mg/L
Naphthalene	0.01	0.010	5.658

$SSTL_{SOURCE}$ - Groundwater SSTLs in the source area protective of RBSLs at the off-site POE.
$SSTL_{COMP}$ - Groundwater SSTLs at the compliance well that are protective of RBSLs at the off-site POE.

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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
Ethylbenzene	6.05	2838.89	14.50	6.05
Naphthalene	1.63	1135.56	2.63	1.63

*No inhalation reference dose is available for xylenes; therefore, no inhalation RBSL can be calculated.

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Volatilization Factor: Groundwater to Ambient Air (VFwamb)

Chemical	Dair	Dwater	H	θ_{acap}	θ_{wcap}	θ_{as}	θ_{ws}	θ_T	Deff-cap	Deff-s
	cm^2/s	cm^2/s	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^2/s	cm^2/s
Benzene	0 093	1.10E-05	2.20E-01	0 038	0.342	0.33	0.15	0 48	1.36E-05	1.01E-02
Ethylbenzene	0 076	8 50E-06	3.20E-01	0 038	0.342	0 33	0 15	0 48	9.39E-06	8.22E-03
Naphthalene	0 072	9 40E-06	4 90E-02	0.038	0 342	0 33	0 15	0 48	2.92E-05	7 79E-03

Chemical	hcap	hv	Deff-ws	Uair	δair	Lgw	W	VFwamb	TR (carc)	HI (nonc)
	cm	cm	cm^2/s	cm/sec	cm	cm	cm	$mg/m^3/mg/L$		
Benzene	5	117	3.22E-04	225	200	122	1500	1.94E-05	1.00E-06	NA
Ethylbenzene	5	117	2.23E-04	225	200	122	1500	1.95E-05	NA	1
Naphthalene	5	117	6.55E-04	225	200	122	1500	8.77E-06	NA	1

Chemical	BWadult	AT	Sfi (carc)	RfD (nonc)	IR air	EF	ED	RBSLair	RBSLwater
	kg	yr	$[mg/kg\text{-}day]^{-1}$	[mg/kg-day]	m^3/day	day/yr	yr	mg/m^3	mg/L
Benzene	70	70	2.90E-02	NA	20	90	1	3.43E-02	1769.4
Ethylbenzene	70	1	NA	2.86E-01	20	90	1	4 06E+00	2 08E+05
Naphthalene	70	1	NA	3 71E-04	20	90	1	5 27E-03	6 00E+02

Reference American Society for Testing and Materials (ASTM) 1997 *Standard Guide for Risk-Based Corrective Action Applied to Petroleum Release Sites* Designation E 1739-95[ε1]

*No inhalation reference dose is available for xylenes, therefore, no RBSLs can be calculated

= South Carolina value
= Site-specific value or based on site-specific value
= Calculated value
= ASTM default value
= Value from EPA Integrated Risk Information System
= Assumptions for construction worker scenario

Construction Worker Inhalation RBSLs

Chemical	Dair	Dwater	H	θ_{acap}	θ_{wcap}	θ_{as}	θ_{ws}	θ_T	Deff-cap	Deff-s
	cm^2/s	cm^2/s	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^2/s	cm^2/s
Benzene	0.093	1.10E-05	2.20E-01	0.038	0.342	0.33	0.15	0.48	1.36E-05	1.01E-02
Ethylbenzene	0.076	8.50E-06	3.20E-01	0.038	0.342	0.33	0.15	0.48	9.39E-06	8.22E-03
Naphthalene	0.072	9.40E-06	4.90E-02	0 038	0.342	0.33	0.15	0.48	2.92E-05	7.79E-03

Chemical	hcap	hv	Deff-ws	Uair	δair	Lgw	W	VFwamb	TR (carc)	HI (nonc)
	cm	cm	cm^2/s	cm/sec	cm	cm	cm	$mg/m^3/mg/L$		
Benzene	5	117	3.22E-04	225	200	122	1500	1.94E-05	1.00E-06	NA
Ethylbenzene	5	117	2.23E-04	225	200	122	1500	1.95E-05	NA	1
Naphthalene	5	117	6.55E-04	225	200	122	1500	8.77E-06	NA	1

Chemical	BWadult	AT	Sfi (carc)	RfD (nonc)	IR air	EF	ED	RBSLair	RBSLwater
	kg	yr	$[mg/kg\text{-}day]^{-1}$	[mg/kg-day]	m^3/day	day/yr	yr	mg/m^3	mg/L
Benzene	70	70	2.90E-02	NA	20	90	1	3.43E-02	1769.4
Ethylbenzene	70	1	NA	2.86E-01	20	90	1	4.06E+00	2.08E+05
Naphthalene	70	1	NA	3.71E-04	20	90	1	5.27E-03	6.00E+02

*No inhalation reference dose is available for xylenes; therefore, no RBSL can be calculated for xylene.

Construction Worker Inhalation RBSLs

Chemical			Dair	Dwater	H	θ_{acap}	θ_{wcap}	θ_{as}	θ_{ws}	θ_T	Deff-cap	Deff-s
			cm^2/s	cm^2/s	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^3/cm^3	cm^2/s	cm^2/s
Benzene			0 093	1 10E-05	2 26E-01	0 038	0 342	0 33	0 15	0 48	1 35E-05	1 01E-02
Ethylbenzene			0 076	8 50E-06	2 80E-01	0 038	0 342	0 33	0 15	0 48	9 85E-06	8 22E-03
Naphthalene			0 072	9 40E-06	2 00E-03	0 038	0 342	0 33	0 15	0 48	5 79E-04	7 83E-03

Chemical			hcap	hv	Deff-ws	Uair	δair	Lgw	W	VFwamb	TR (carc)	HI (nonc)
			cm	cm	cm^2/s	cm/sec	cm	cm	cm	$mg/m^3/mg/L$		
Benzene			5	117	3 18E-04	225	200	122	1500	1 97E-05	1 00E-06	NA
Ethylbenzene			5	117	2 34E-04	225	200	122	1500	1 79E-05	NA	1
Naphthalene			5	117	5 17E-03	225	200	122	1500	2 83E-06	NA	1

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 15
Ethylbenzene	NA	1	70	1	NA	2 86E-01	20	90	1	4 06E+00	2 80E-01	14 50
Naphthalene	NA	1	70	1	NA	3 71E-04	20	90	1	5 27E-03	2 00E-03	2 63

*No inhalation reference dose is available for xylenes, therefore, no RBSL can be calculated for xylene

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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
Ethylbenzene	70	365	0.01	1	90	1.0	NA	1.00E-01	2838.889
Naphthalene	70	365	0.01	1	90	1.0	NA	4.00E-02	1135.556

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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	199.526231	78.1	0.11551543	0 39263786	2.87E-01	6.32E-01	6.03E-01	6.90E-01	1	eq 3.3
Ethylbenzene	1412 53754	106.2	0 5692198	2.25615488	4.13E-01	2.36E+00	4.39E+00	1.70E+00	1	eq 3 2
Naphthalene	1995.26231	128.2	0.60545239	2.63663896	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
Ethylbenzene	70	365	1	1	90	4500	NA	9.70E-02	1.0	6.05E+00	
Naphthalene	70	365	1	1	90	4500	NA	3 20E-02	1 0	1.63E+00	

Factor A	Factor 1	Factor 2
	7.18E-01	0.782661
1.01E+00		
1.24E+00		

* Kow and MW values for xylene, m-

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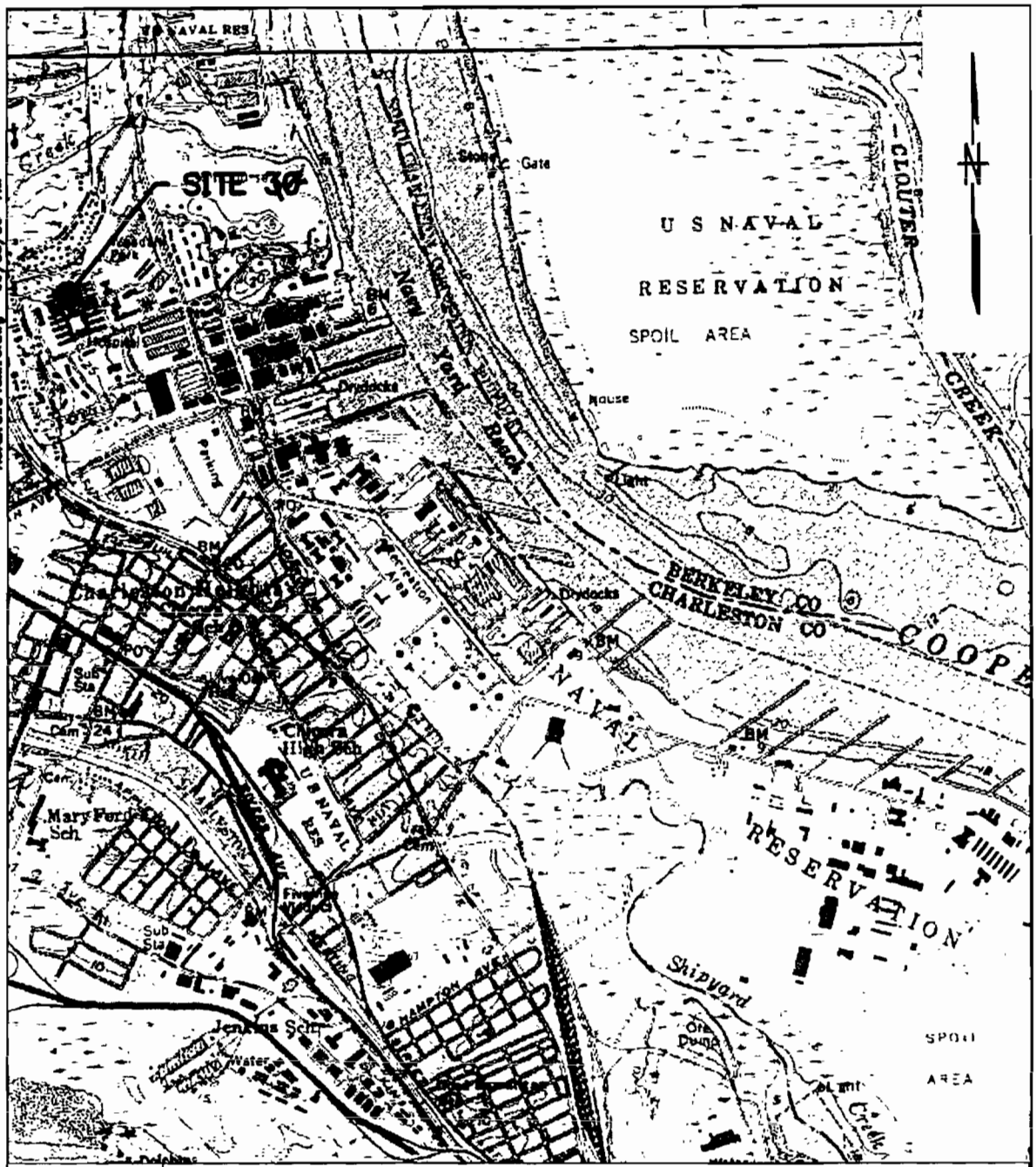

SOURCE: QUADRANGLE MAP SOUTH CAROLINA, REVISED 1979
QUADRANGLE MAP NORTH CHARLESTON REVISED, 1979

0 2000 4000
SCALE IN FEET

DRAWN BY HJP DATE 11/5/99		SITE LOCATION MAP SITE 30, BUILDING NH 46 ZONE C, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA	CONTRACT NO. 0164
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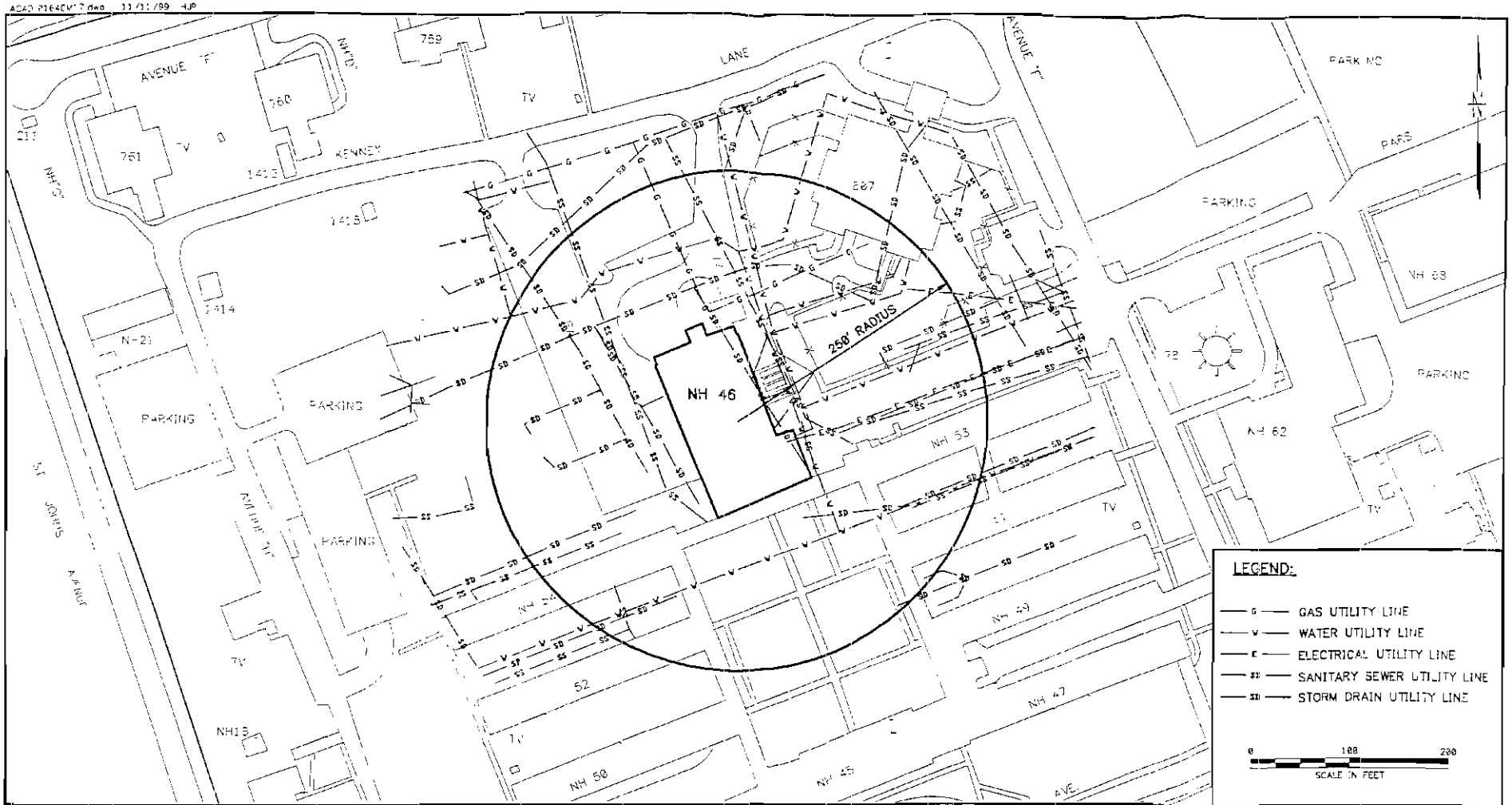
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1 REV. 0

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

ACAD 2164CV17.dwg 11/11/99 HJP



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SCALE AS NOTED

SITE VICINITY MAP
SITE 38, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

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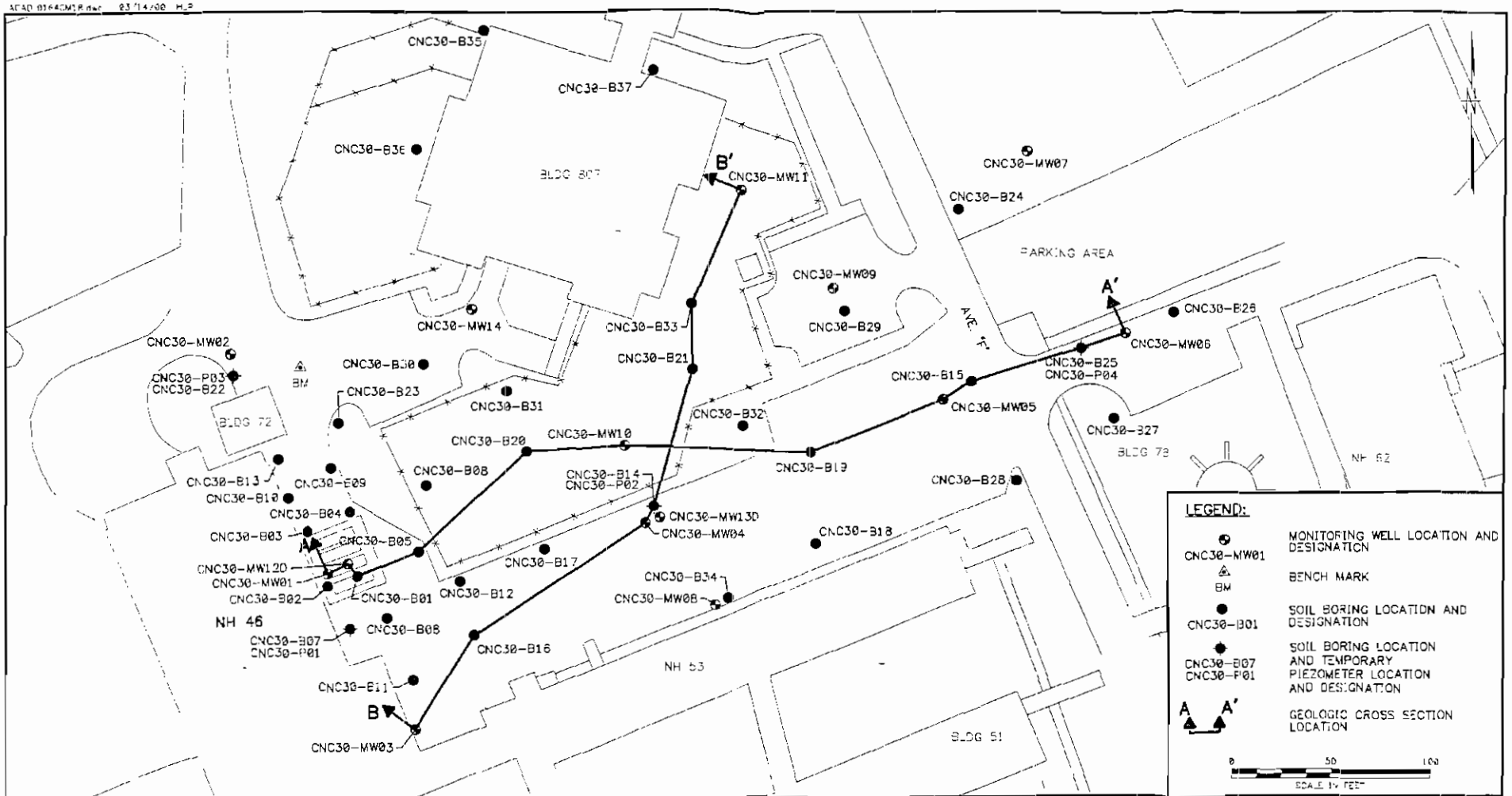
DRAWING NO. FIGURE 2 REV. 0

FORM CADD NO SD.V_BH.DWG - REV 0 - 1/29/98

ACAD 0164GM18.dwg 03/14/00 HJP



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SITE MAP AND SAMPLING LOCATIONS
SITE 36, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO 0164
APPROVED BY DATE
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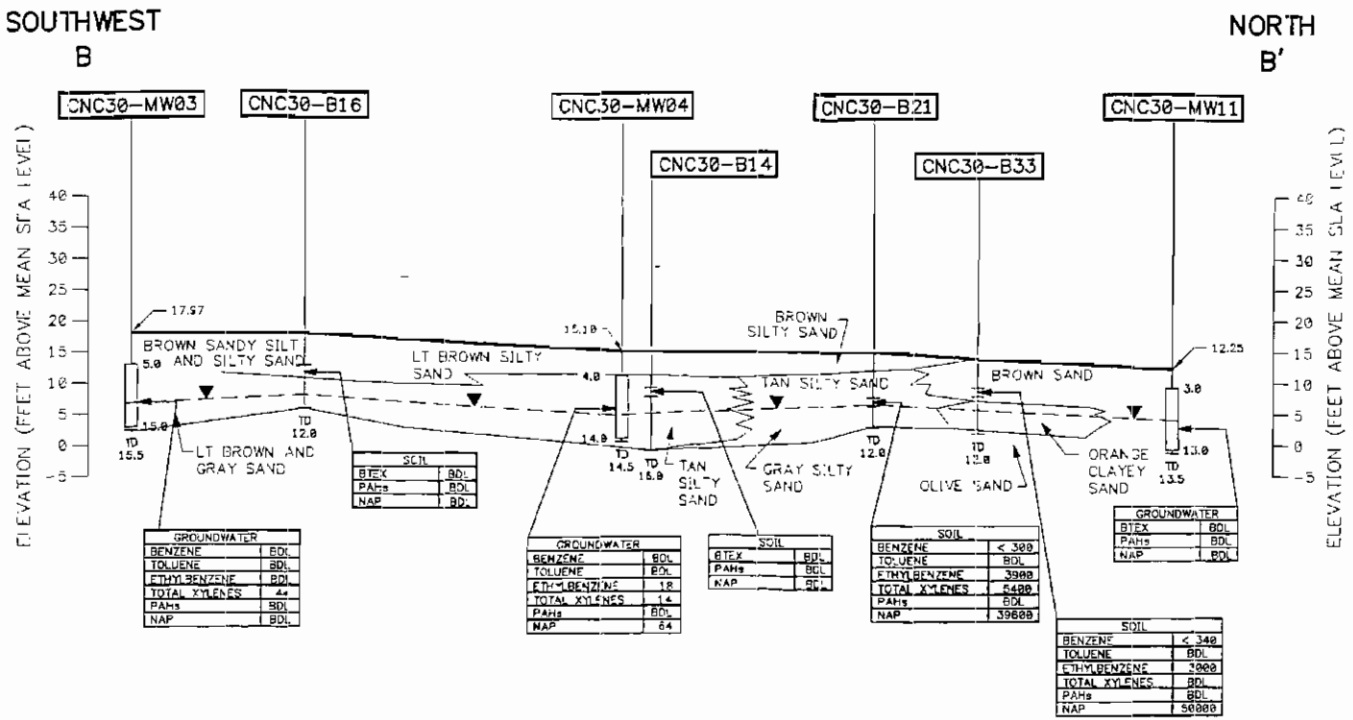
DRAWING NO. FIGURE 3
REV. 1

FORM CA30 NO SDN_BH.DWG - REV 0 - 1/20/98

ACAD 0164QX06.dwg 03/14/00 HJP



LEGEND:

MONITORING WELL OR BORING NUMBER — CNC30-MW03

GROUND SURFACE ELEVATION — 7.45

GROUND SURFACE

APPROXIMATE POTENTIOMETRIC SURFACE

TOP OF MONITORED INTERVAL (FT BGS) — 5.0

LITHOLOGIC CONTACT (INFERRED BETWEEN BORINGS)

BOTTOM OF MONITORED INTERVAL (FT BGS) — 15.0

TOTAL DEPTH OF WELL OR BORING (FT BGS) — TD 15.5

SOIL AND GROUNDWATER DATA AT DEPTH SAMPLE LOCATIONS
SOIL (ug/kg)
GROUNDWATER (ug/L)

GROUNDWATER	
BENZENE	BDL
TOLUENE	BDL
ETHYLBENZENE	18
TOTAL XYLENES	14
PAHs	BDL
NAP	64

BTEX = BENZENE, TOLUENE, ETHYLBENZENE AND TOTAL XYLENES
NAP = NAPHTHALENES
PAHs = POLYNUCLEAR AROMATIC HYDROCARBONS
BDL = BELOW DETECTION LIMITS
44 = ESTIMATED CONCENTRATION

NOTE:

SOME BDL BENZENE CONCENTRATIONS REPORTED ABOVE THE BENZENE RBSL OF 5 ug/kg.

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GEOLOGICAL CROSS SECTION B-B'
SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

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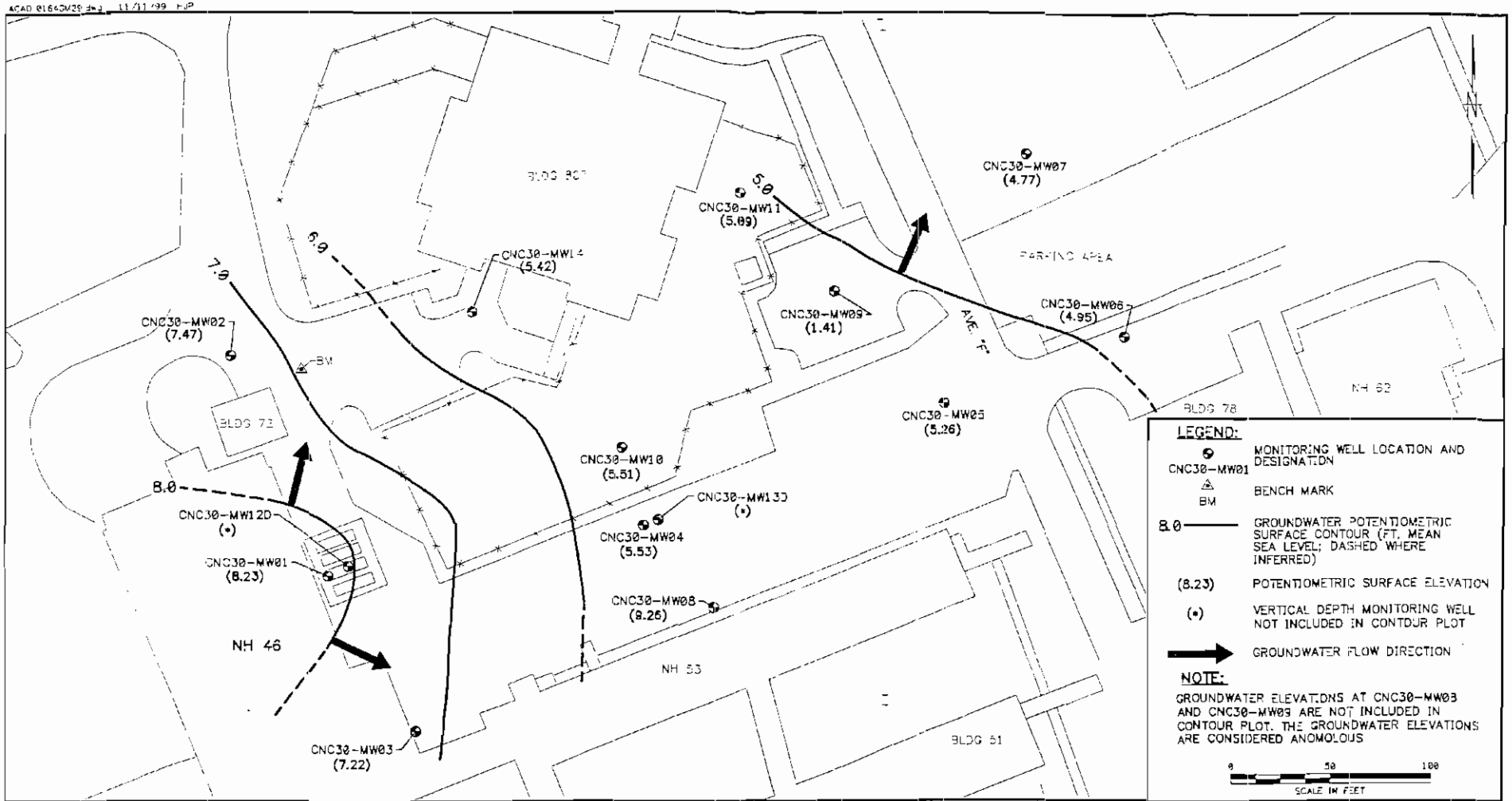
REV. 1

FORM CADD NO IDIV_BASVG - REV 0 - 1/20/98



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GROUNDWATER POTENTIOMETRIC MAP
(SEPTEMBER 11, 1999)
SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

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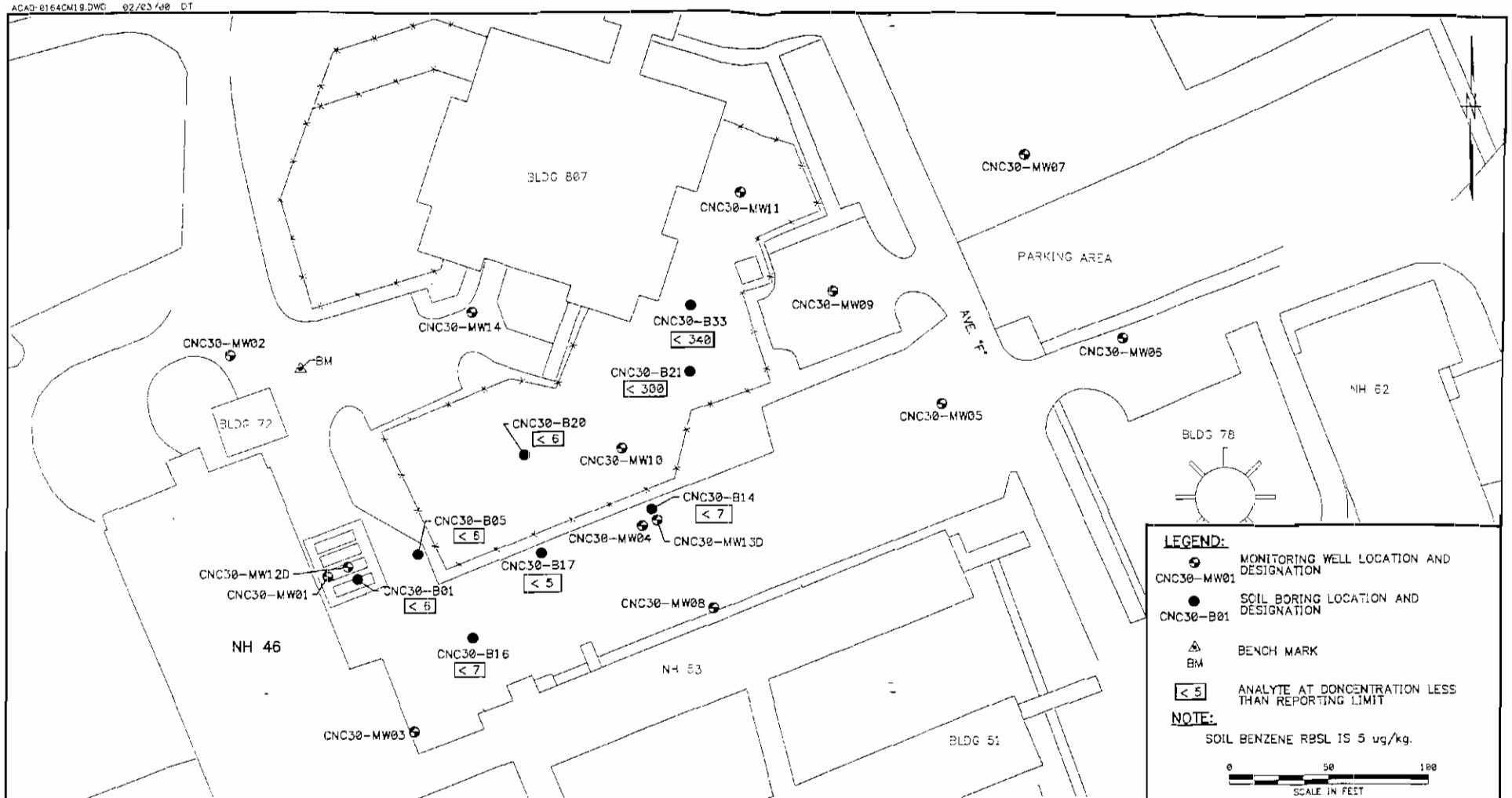
DRAWING NO. FIGURE 6
REV. 0

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

ACAD-0164CM19.DWG 02/03/00 DT



NO	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES
1	1-25-00	REVISION TO DRAFT RAR	G.G		P.C.	

DRAWN BY HJP DATE 11/9/99
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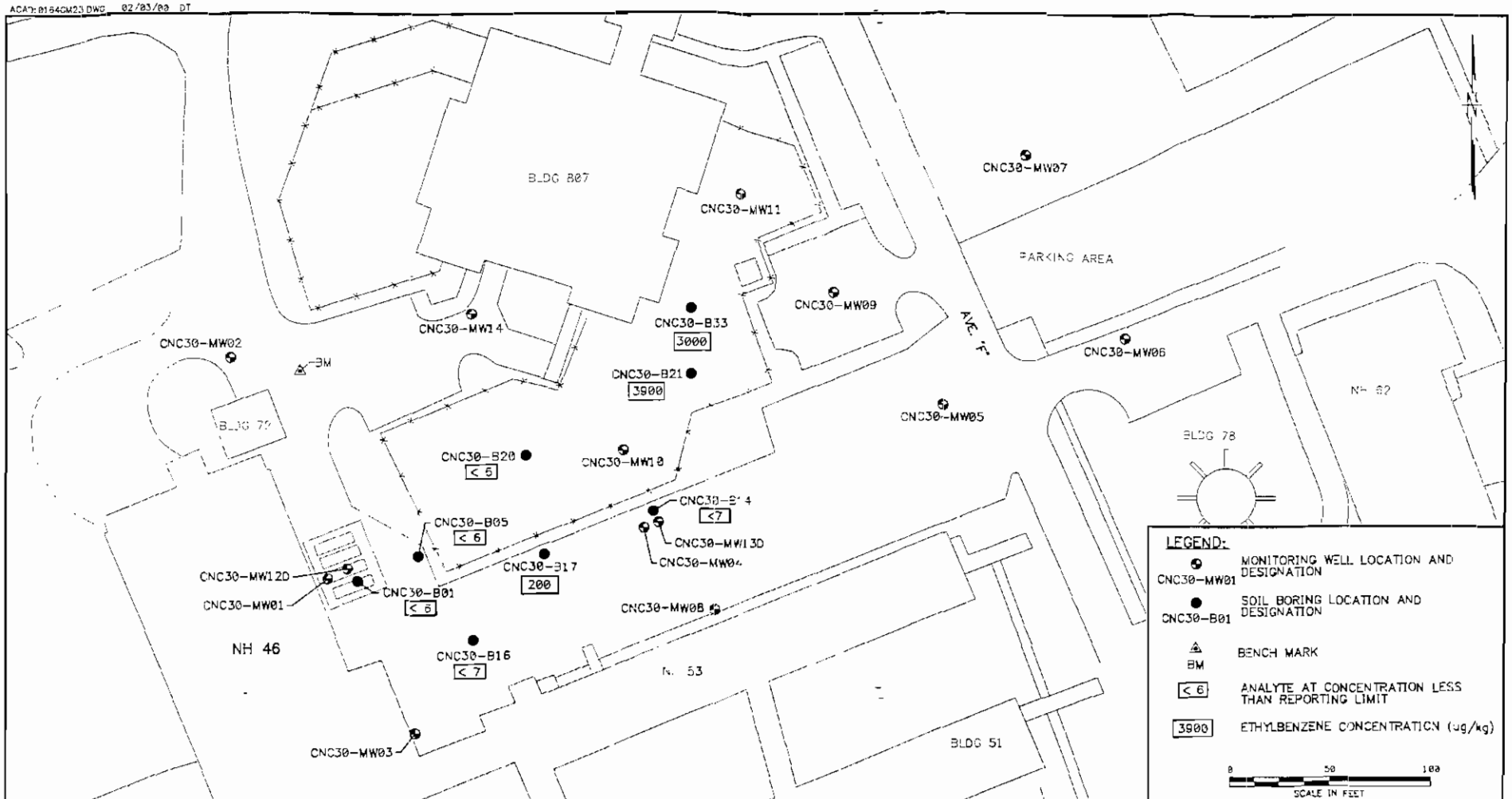
SCALE AS NOTED

BENZENE SOIL CONCENTRATION MAP
SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0164
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 7 REV. 1

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

ACAD:0164CM23.DWG 02/03/00 DT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES
1	1-28-00	REVISION TO DRAFT RAR	G.G.		P.C.	

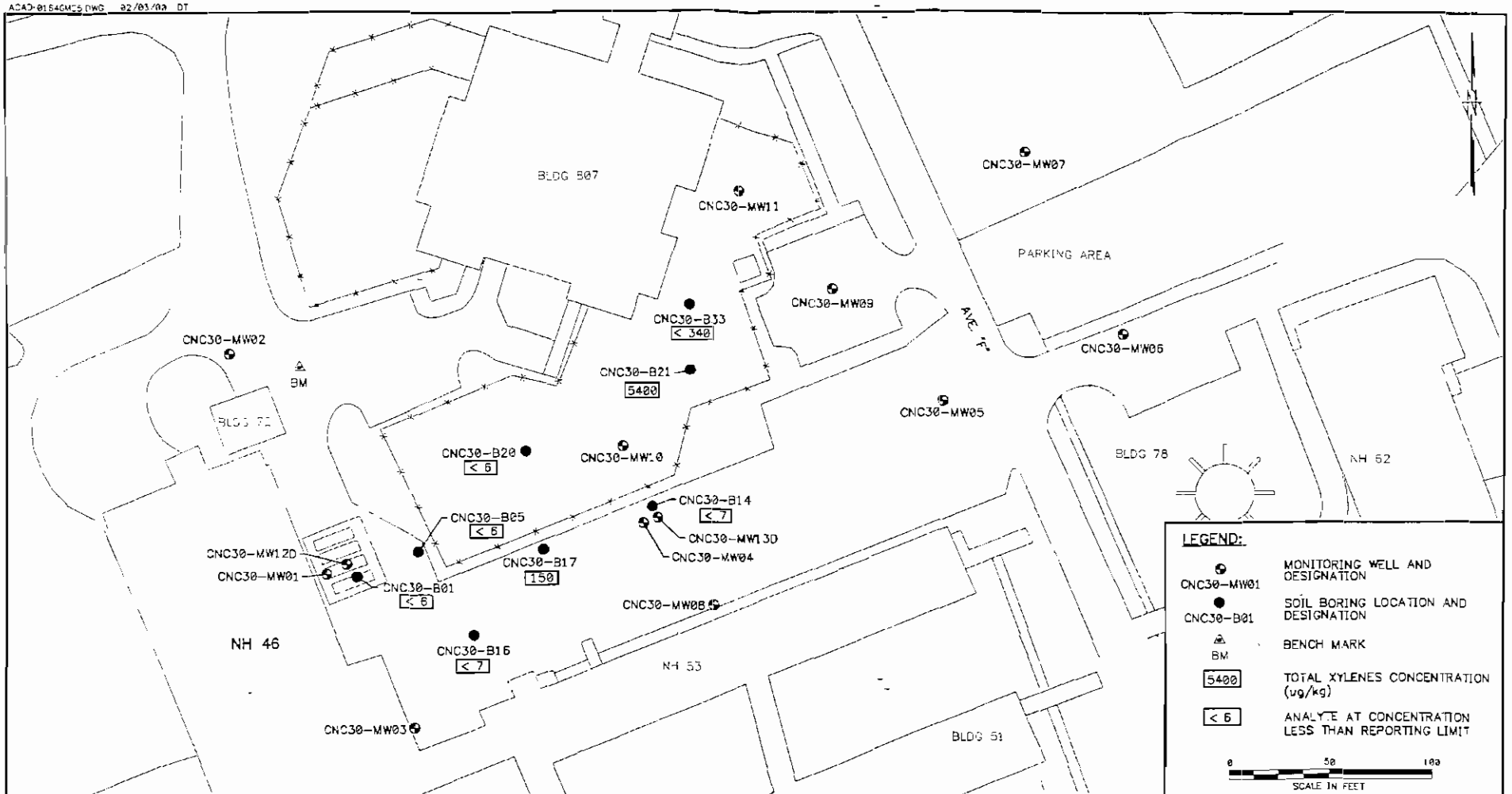
DRAWN BY HJP DATE 11/8/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

ETHYLBENZENE SOIL CONCENTRATION MAP
SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0164
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 8
REV. 1

FORM CADD NO SDIV_BH.DWG - REV 0 - 1/10/98

ACAD:0164GM25.DWG 02/03/00 DT



NO	DATE	REVISIONS	BY	CHKD	APPD
1	1-26-00	REVISION TO DRAFT RAR	G.G.		P.C.

REFERENCES

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CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

TOTAL XYLENES SOIL CONCENTRATION MAP
SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0164
APPROVED BY DATE
APPROVED BY DATE
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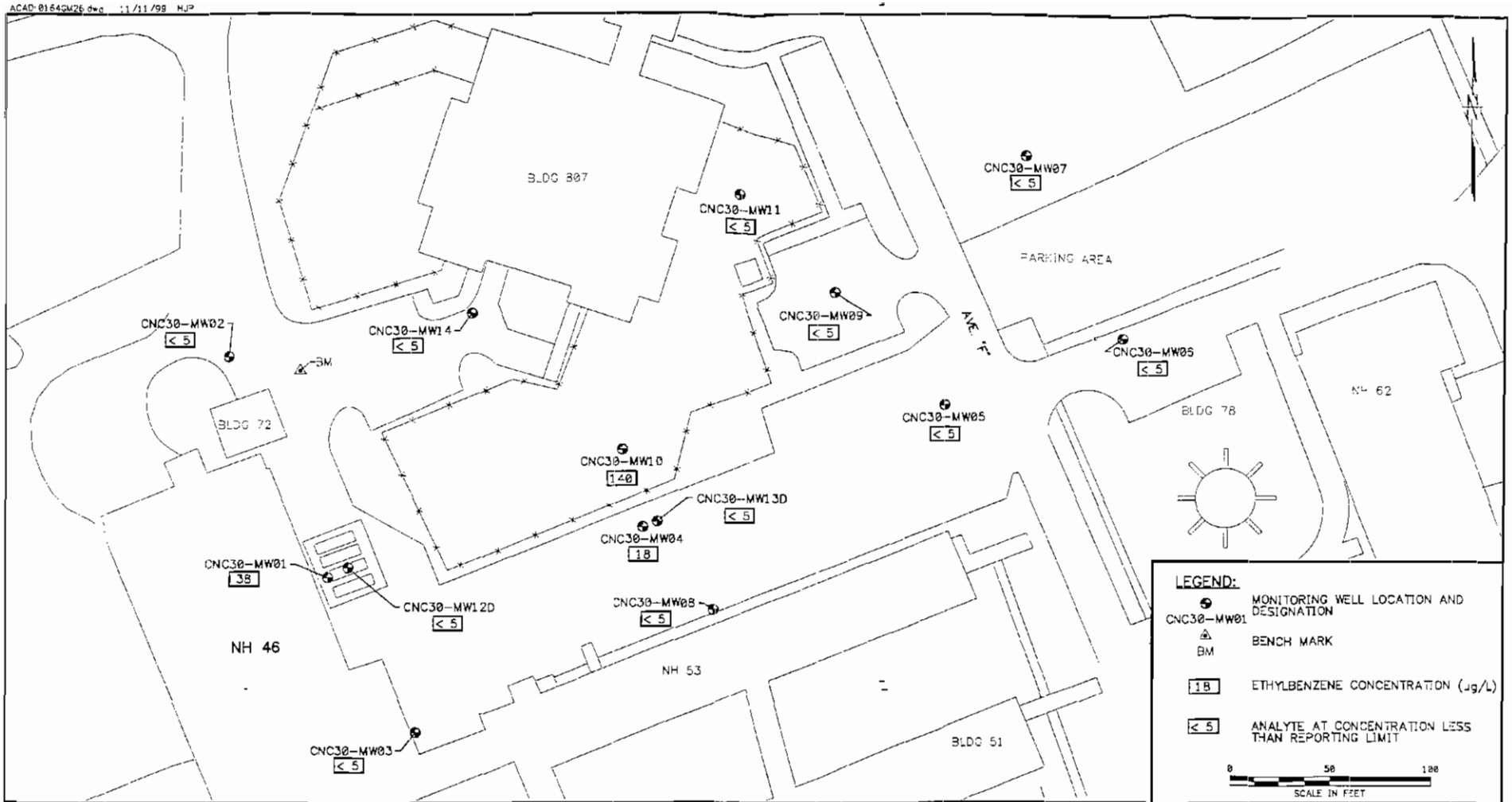
REV. 1

FORM CADD NO. 3DIV_BH.DWG - REV 0 - 1/20/98

ACAD: 0164GM26.dwg 11/11/99 HJP



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 11/5/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

ETHYLBENZENE GROUNDWATER CONCENTRATION MAP
SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0164
APPROVED BY DATE
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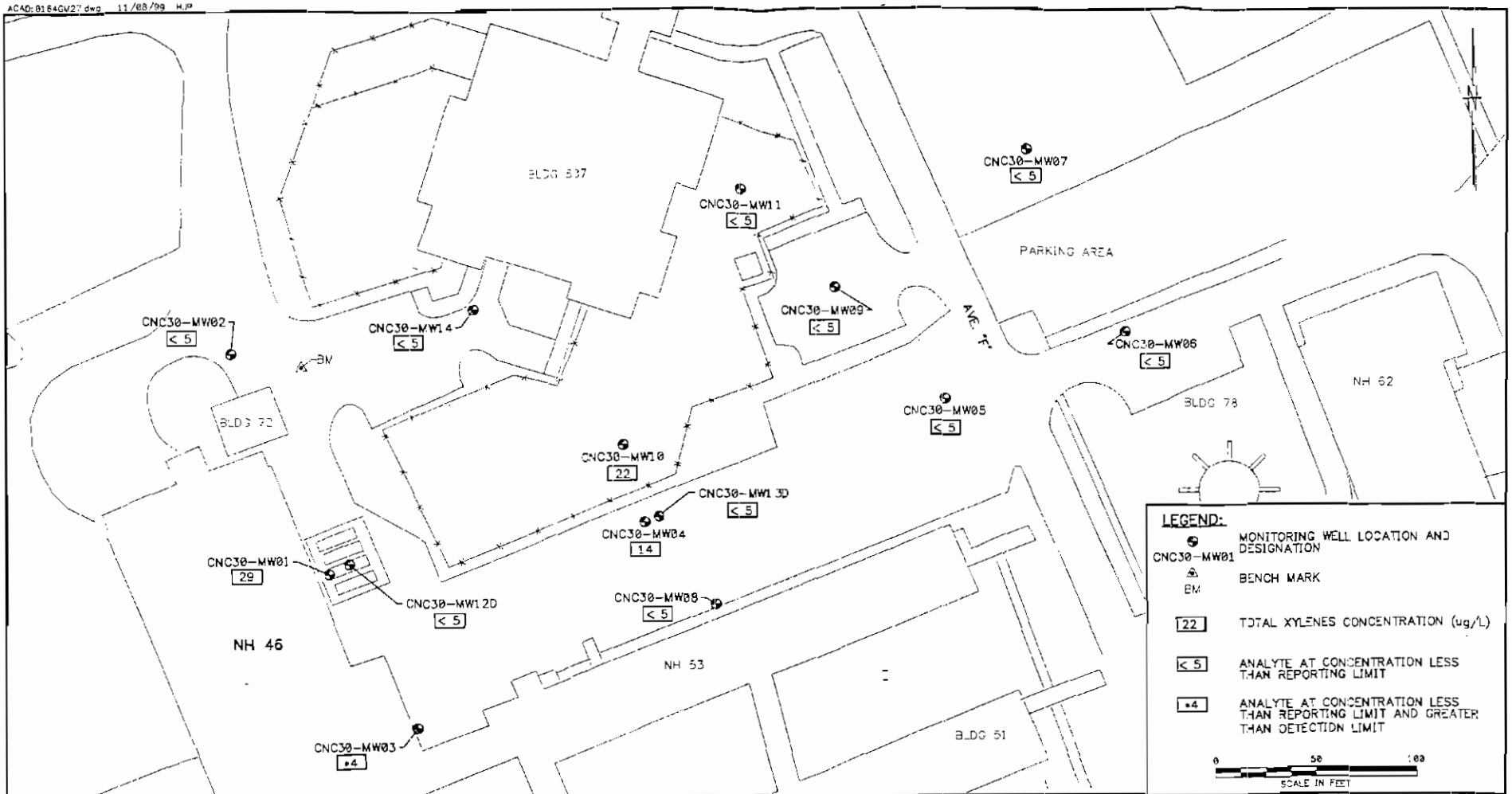
DRAWING NO. FIGURE 11
REV. 0

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

ACAD:0164GW27.dwg 11/08/99 HJP



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

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CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

TOTAL XYLENES GROUNDWATER CONCENTRATION MAP
SITE 30, BUILDING NN 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

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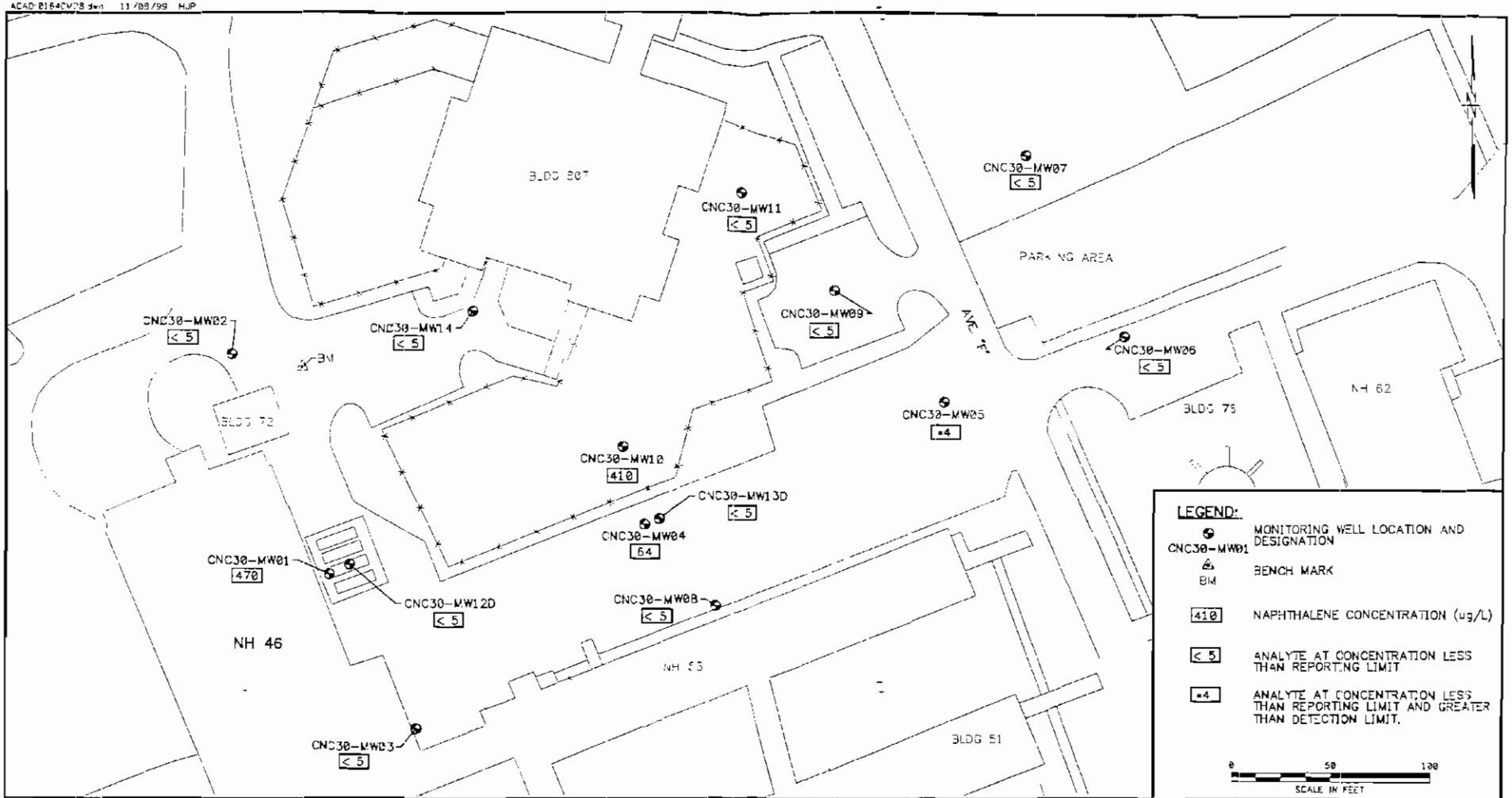
REV. 0

FORM CADD NO. SOV_EH.DWG — REV 0 — 1/20/99

ACAD: 0164CM28.dwg 11/08/99 HJP



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

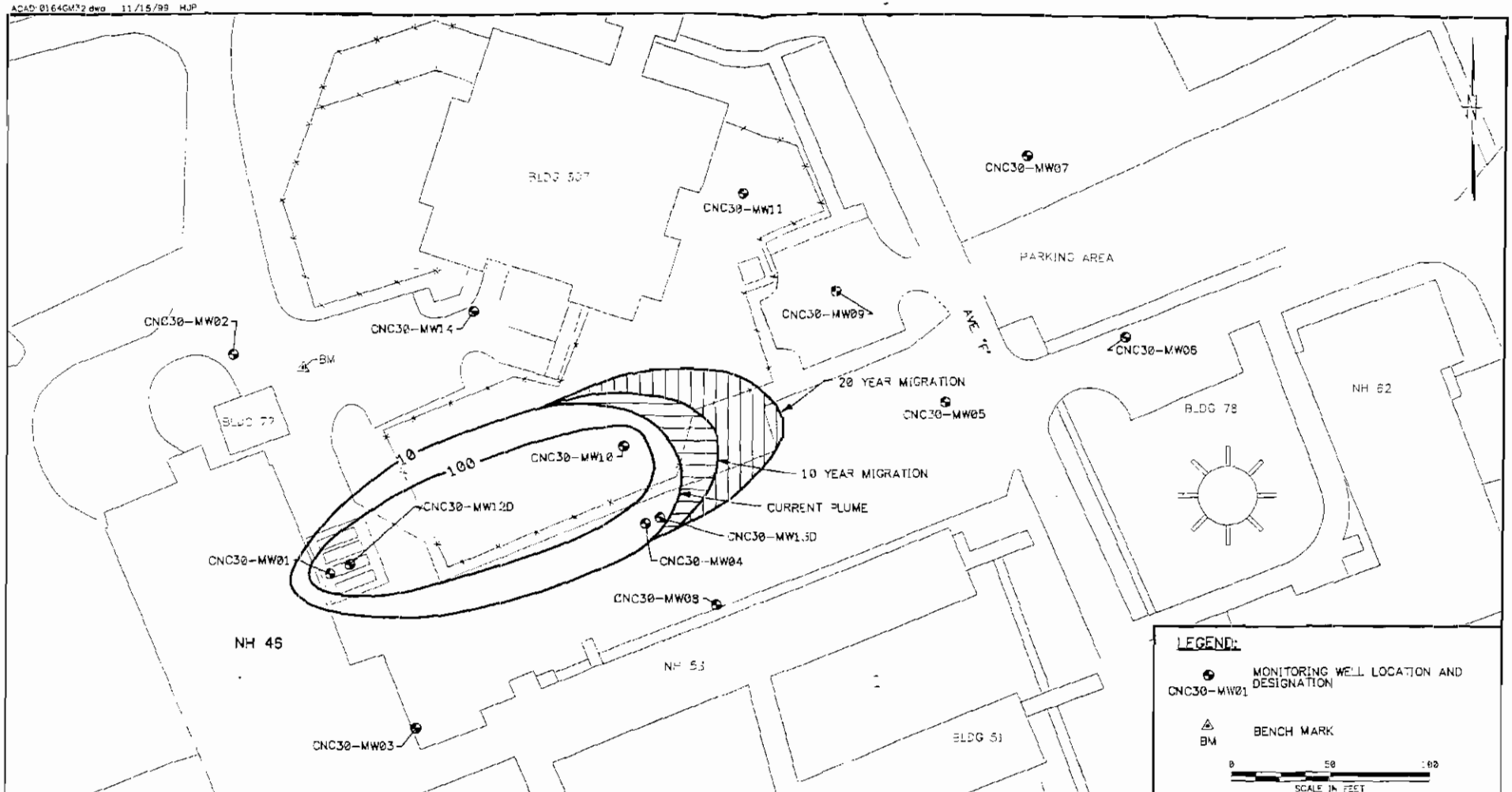
DRAWN BY HJP DATE 11/5/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

GROUNDWATER NAPHTHALENE CONCENTRATION MAP
SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0164
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO FIGURE 13
REV. 0

FORM CADD NO SDIV_BM.DWG — REV 0 — 1/30/98

ACAD: 0164GM32.dwg 11/15/99 HJP



NO	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 11/12/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

10-YEAR AND 20-YEAR PLUME MIGRATION
PREDICTION OF NAPHTHALENE
SITE 30, BUILDING NH 46
ZONE C, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 0164
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 14
REV. 0

FORM CADD KC SDIV_EM.DWG - REV 0 - 1/20/98