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CNC CHARLESTON
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DRAFT RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION
REPORT VOLUME 5 OF 12 SECTIONS 10.8 TO 10.12 ZONE L CNC CHARLESTON SC
12/18/1998
ENSAFE INC.

**DRAFT ZONE L
RCRA FACILITY INVESTIGATION REPORT
CHARLESTON NAVAL COMPLEX**

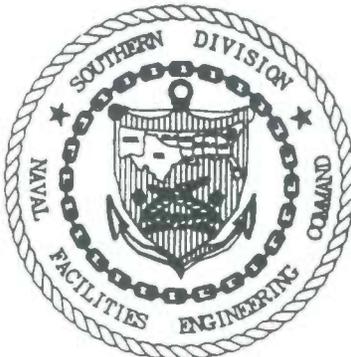


**VOLUME 5 OF 12
SECTIONS 10.8 TO 10.12**

**CTO-029
CONTRACT NO: N62467-89-D-0318**

Prepared for:

**Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina**



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December 18, 1998

10.8 SUBZONE H

The boundaries of Subzone H for the Zone L RFI are the areas investigated in the Zone H RFI. Data from the samples collected during the Zone H investigation have been compared to data collected for the Zone L investigation. Zone H sampling locations are presented in Figures 10.8.1 and 10.8.2.

10.8.1 Subzone H, SWMU 37

Sampling in Subzone H, SWMU 37, consisted of three shallow monitoring wells, 19 upper- and 17 lower-interval soil boring samples collected using a hand auger, and 33 soil and 45 groundwater samples collected using DPT. The monitoring well groundwater and soil boring samples were analyzed for VOCs, SVOCs, chlorinated pesticide, PCBs, metals, and cyanide. DPT samples were analyzed for VOCs, metals, and cyanide. Sampling locations are presented in Figures 10.8.3 through 10.8.9.

10.8.1.1 Nature of Contamination in SWMU 37, Subzone H, DPT Soil

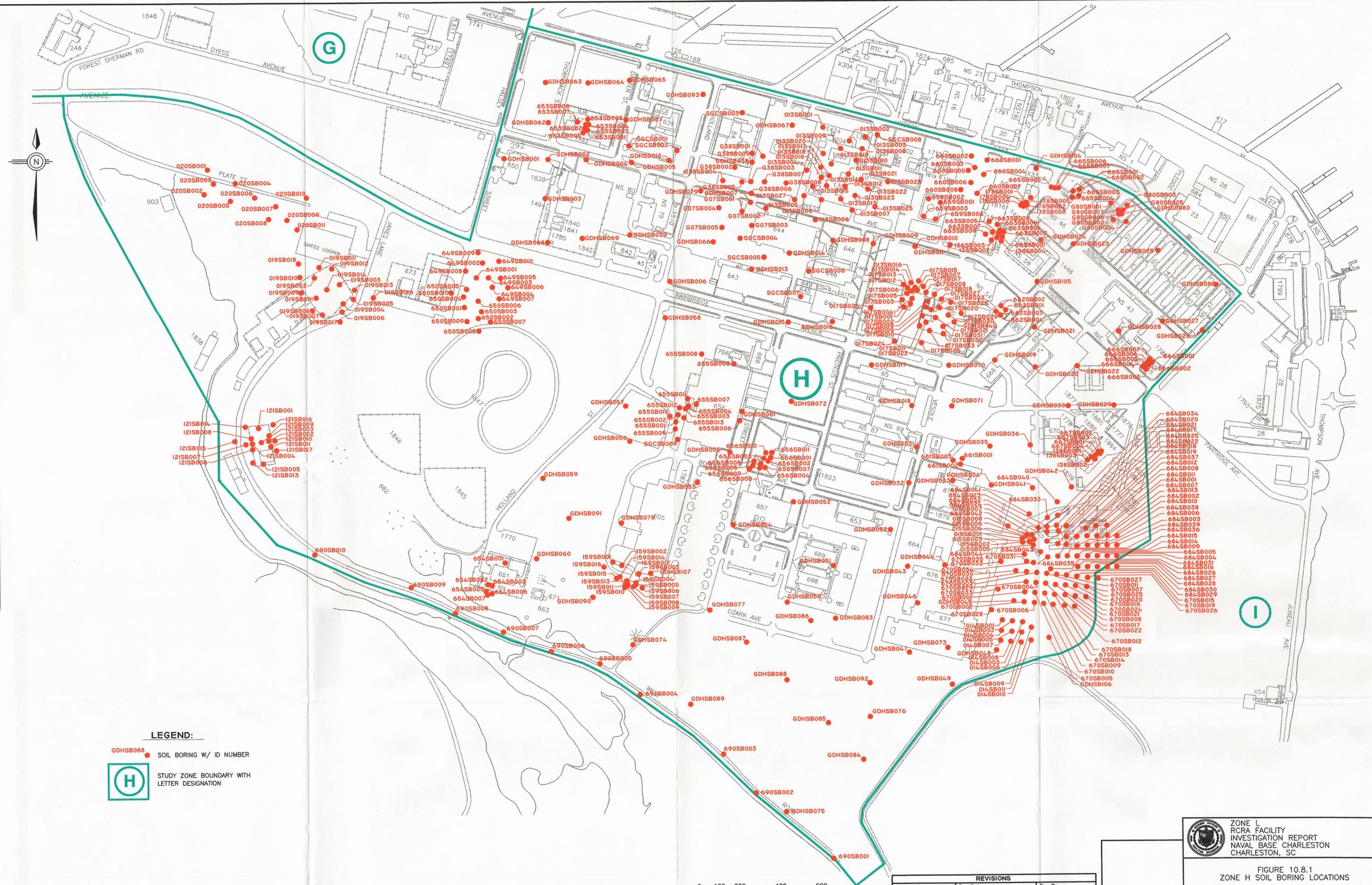
Organic compound analytical results for soil obtained by DPT are summarized in Table 10.8.1. Inorganic analytical results are summarized in Table 10.8.2. Appendix C contains the complete data report for all samples collected in Zone L.

Volatile Organic Compounds in DPT Soil

Acetone was detected at three locations, but none exceeded the RBC or SSL values.

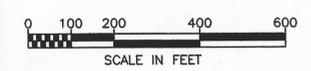
Metals/Cyanide Detected in DPT Soil

Aluminum(8/33), arsenic (30/3), chromium (1/33), iron (32/33), manganese (4/33), and thallium (3/33) exceeded RBC values for DPT soil samples. RBC exceedances are presented in Figure 10.8.3. Arsenic (1/33), chromium (13/33), and thallium (3/33) exceeded the SSL value. These exceedances are also summarized in Table 10.8.3.



LEGEND:

- GDHSB088 SOIL BORING W/ ID NUMBER
- H STUDY ZONE BOUNDARY WITH LETTER DESIGNATION



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**FIGURE 10.8.1
ZONE H SOIL BORING LOCATIONS**

Dr by: W. FAULK	Tr by: -
Ck by: C. VEROY	Appr by: T. HAVERKOST
Date: 11/25/98	DWG Name: 2912C094

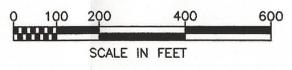
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LEGEND:

- GDH002 SHALLOW MONITORING WELL W/ ID NUMBER
- GDH03D DEEP MONITORING WELL W/ ID NUMBER
- (H)** STUDY ZONE BOUNDARY WITH LETTER DESIGNATION

NOTE:
 SAMPLES FROM ADJACENT ZONES SHOWN FOR REFERENCE
 IN LIGHTER COLOR



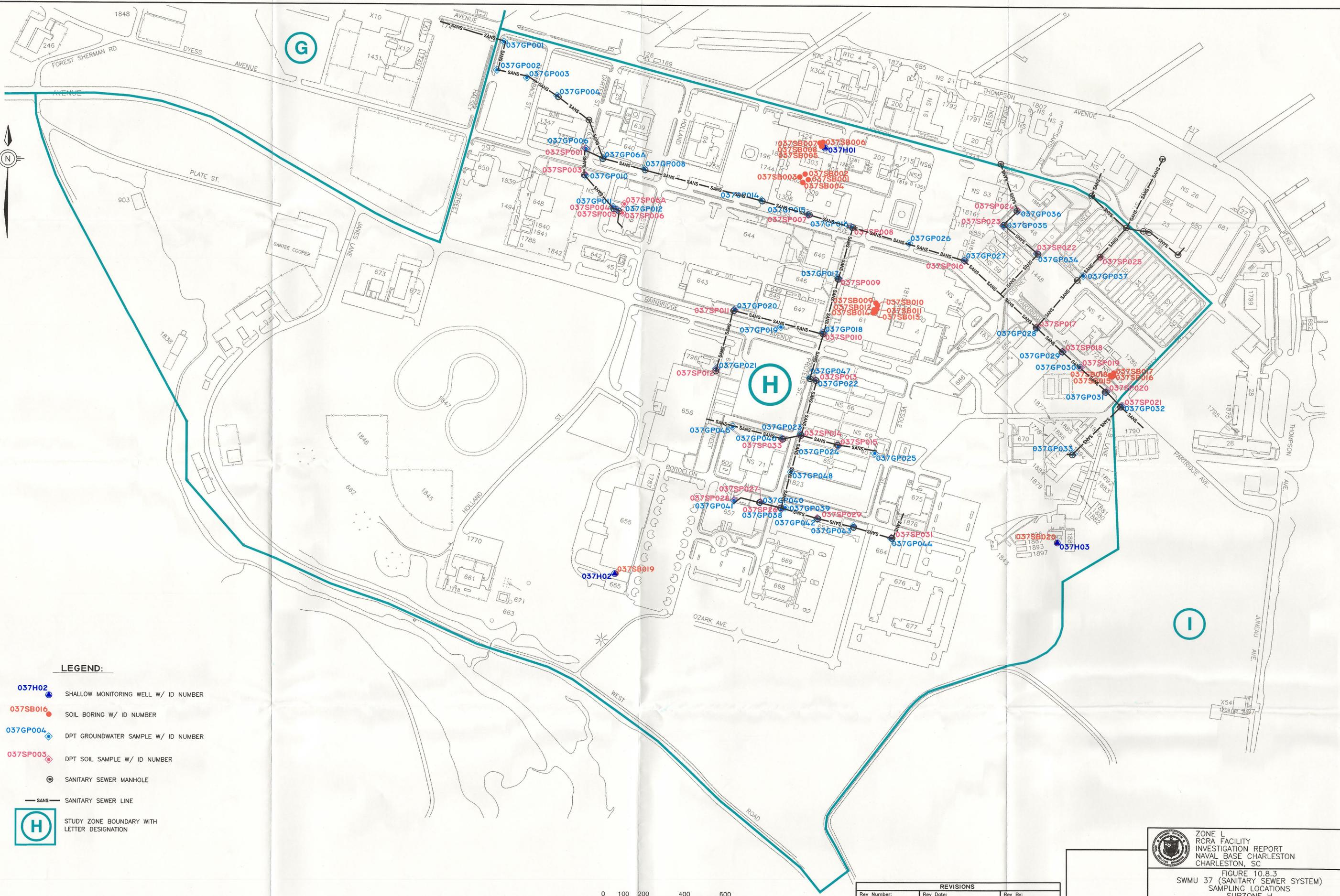
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**FIGURE 10.8.2
 ZONE H MONITORING WELL LOCATIONS**

Dr by: W. FAULK	Tr by: —
Ck by: C. VERNON	Appr by: T. HAVERKOST
Date: 11/25/98	DWG Name: 2912C095

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Of 1



LEGEND:

- 037H02 SHALLOW MONITORING WELL W/ ID NUMBER
- 037SB016 SOIL BORING W/ ID NUMBER
- ◇ 037GP004 DPT GROUNDWATER SAMPLE W/ ID NUMBER
- ◇ 037SP003 DPT SOIL SAMPLE W/ ID NUMBER
- ⊙ SANITARY SEWER MANHOLE
- SANS SANITARY SEWER LINE
- H STUDY ZONE BOUNDARY WITH LETTER DESIGNATION



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**FIGURE 10.8.3
SWMU 37 (SANITARY SEWER SYSTEM)
SAMPLING LOCATIONS
SUBZONE H**

Dr by: W. FAULK	Tr by: -
Ck by: C. VERNON	Appr by: T. HAVERKOST
Date: 12/14/98	DWG Name: 2912C096

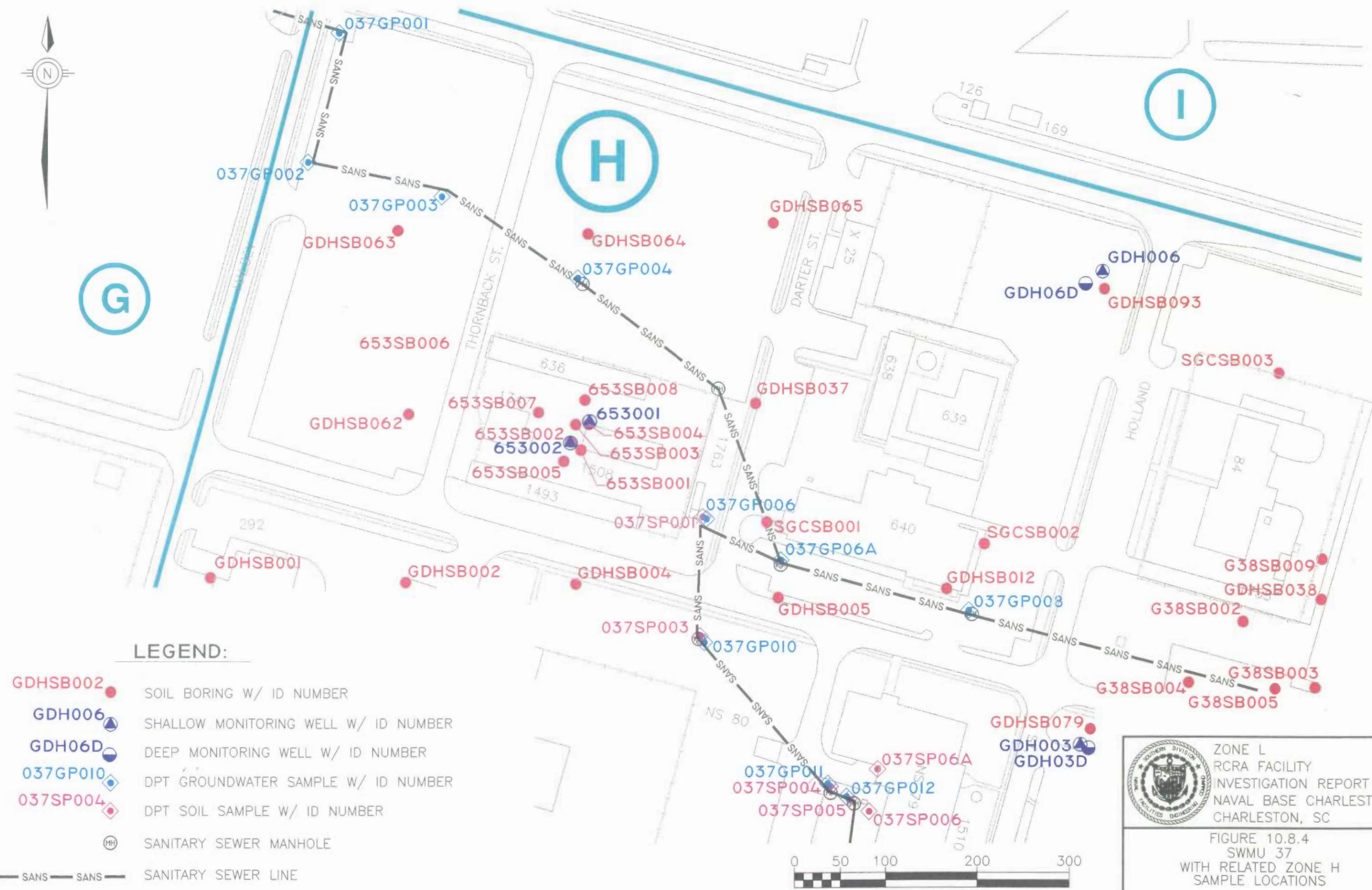
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LEGEND:

- GDHSB002 ● SOIL BORING W/ ID NUMBER
- GDH006 ● SHALLOW MONITORING WELL W/ ID NUMBER
- GDH06D ● DEEP MONITORING WELL W/ ID NUMBER
- 037GP010 ◆ DPT GROUNDWATER SAMPLE W/ ID NUMBER
- 037SP004 ◆ DPT SOIL SAMPLE W/ ID NUMBER
- ⊙ SANITARY SEWER MANHOLE
- SANS — SANITARY SEWER LINE



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FIGURE 10.8.4
 SWMU 37
 WITH RELATED ZONE H
 SAMPLE LOCATIONS



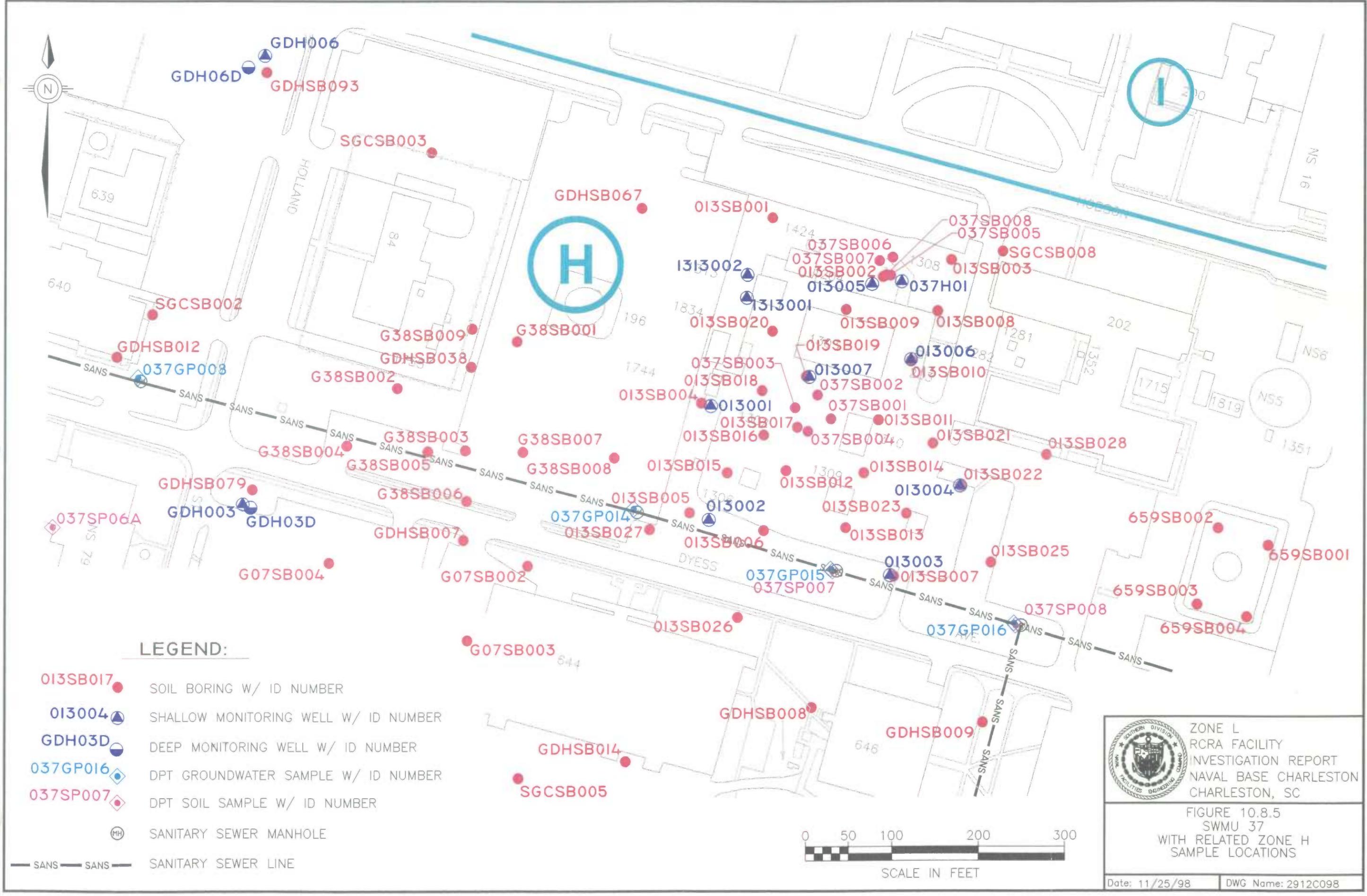
LEGEND:

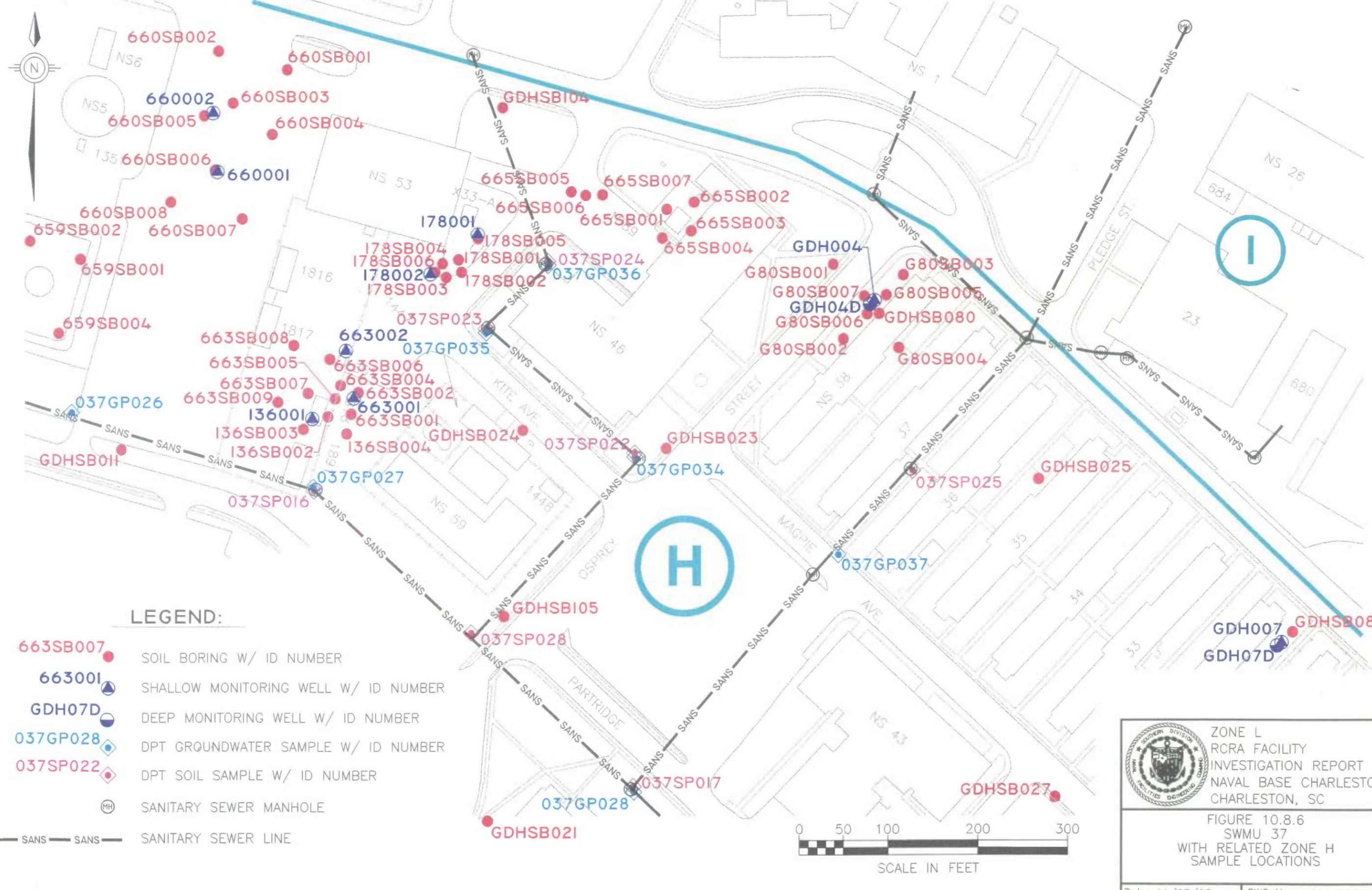
- 013SB017 SOIL BORING W/ ID NUMBER
- ▲ 013004 SHALLOW MONITORING WELL W/ ID NUMBER
- GDH03D DEEP MONITORING WELL W/ ID NUMBER
- ◆ 037GP016 DPT GROUNDWATER SAMPLE W/ ID NUMBER
- ◆ 037SP007 DPT SOIL SAMPLE W/ ID NUMBER
- MH SANITARY SEWER MANHOLE
- SANS SANITARY SEWER LINE



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FIGURE 10.8.5
 SWMU 37
 WITH RELATED ZONE H
 SAMPLE LOCATIONS





LEGEND:

- 663SB007 SOIL BORING W/ ID NUMBER
- ▲ 663001 SHALLOW MONITORING WELL W/ ID NUMBER
- GDH07D DEEP MONITORING WELL W/ ID NUMBER
- ◆ 037GP028 DPT GROUNDWATER SAMPLE W/ ID NUMBER
- ◆ 037SP022 DPT SOIL SAMPLE W/ ID NUMBER
- PH SANITARY SEWER MANHOLE
- SANS — SANITARY SEWER LINE

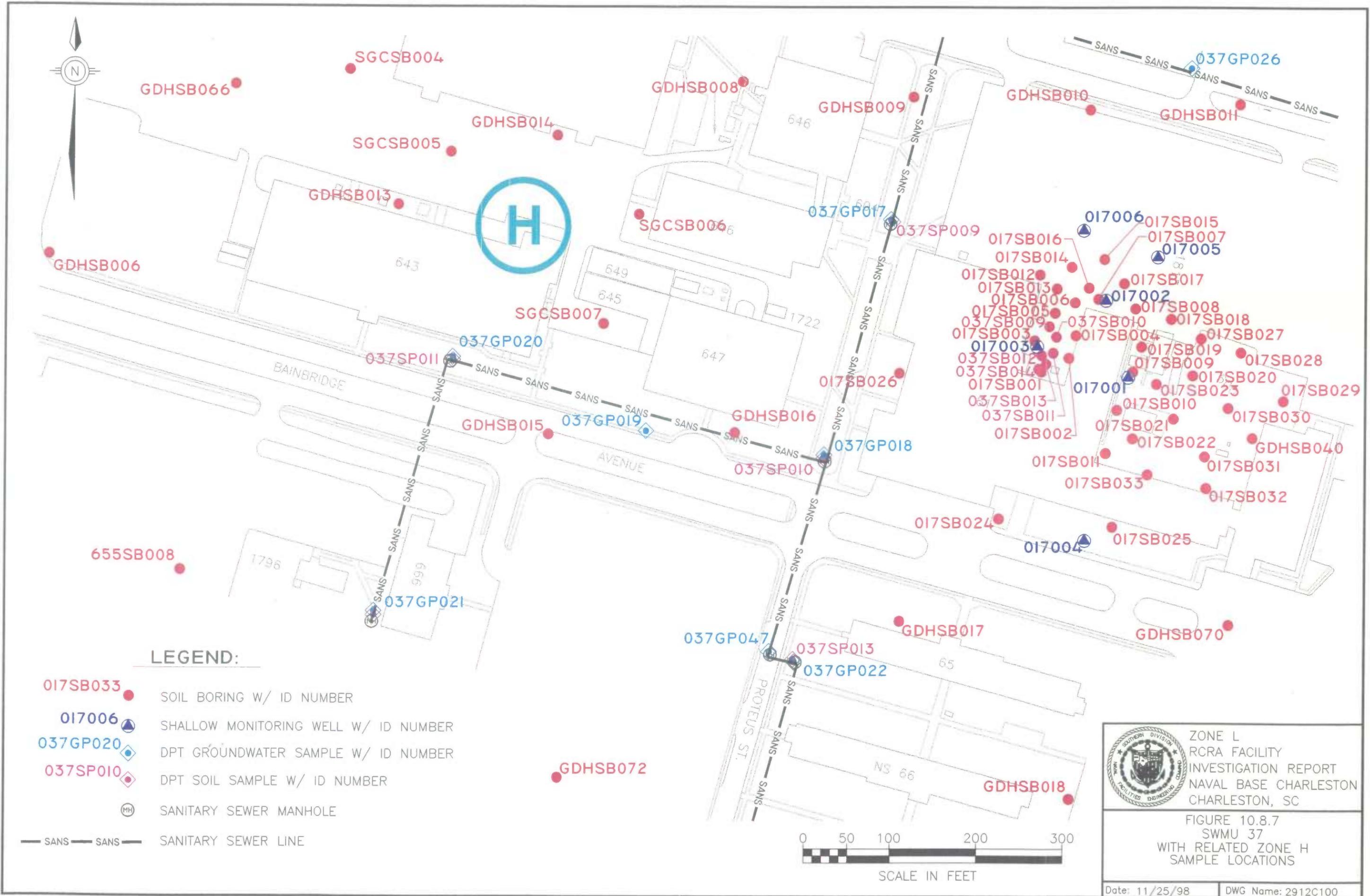




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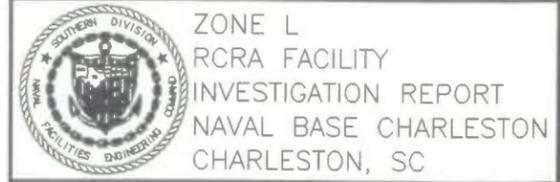
FIGURE 10.8.6
SWMU 37
WITH RELATED ZONE H
SAMPLE LOCATIONS

Date: 11/25/98 DWG Name: 2912C099



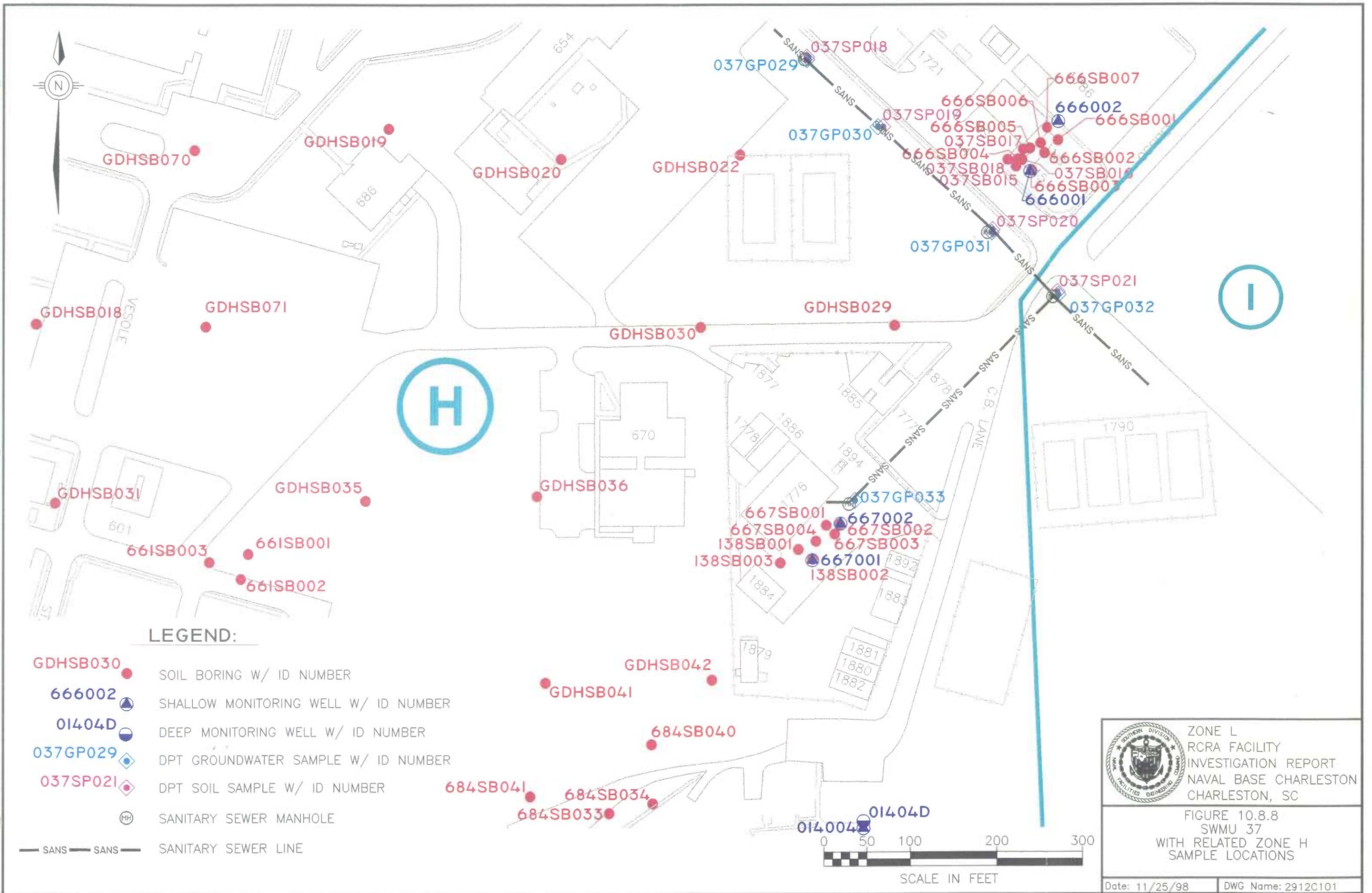
LEGEND:

- 017SB033 ● SOIL BORING W/ ID NUMBER
- 017006 ▲ SHALLOW MONITORING WELL W/ ID NUMBER
- 037GP020 ◆ DPT GROUNDWATER SAMPLE W/ ID NUMBER
- 037SP010 ◆ DPT SOIL SAMPLE W/ ID NUMBER
- Ⓜ SANITARY SEWER MANHOLE
- SANS — SANITARY SEWER LINE



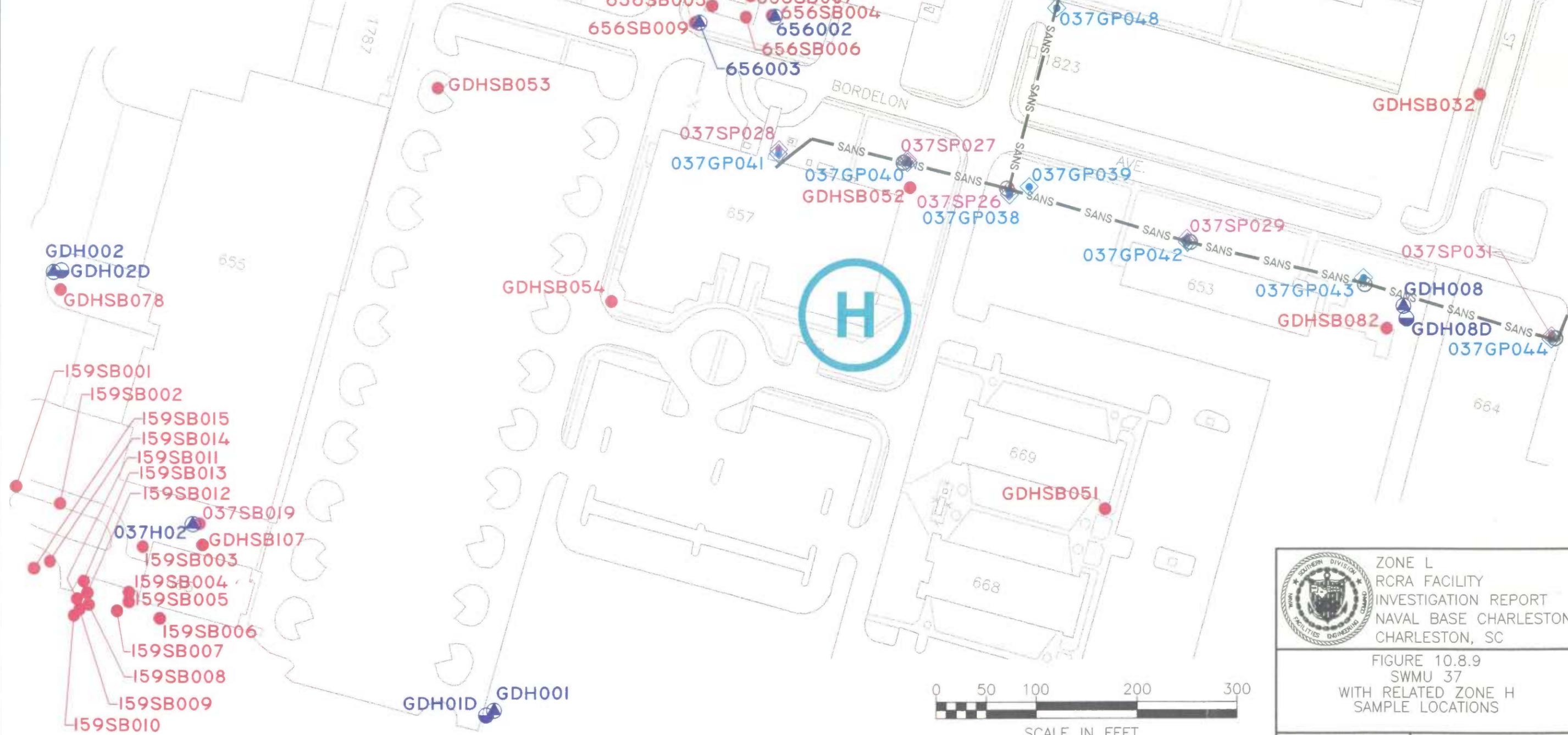
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FIGURE 10.8.7
SWMU 37
WITH RELATED ZONE H
SAMPLE LOCATIONS



LEGEND:

- GDHSB052 ● SOIL BORING W/ ID NUMBER
- 656003 ▲ SHALLOW MONITORING WELL W/ ID NUMBER
- GDH08D ● DEEP MONITORING WELL W/ ID NUMBER
- 037GP042 ◆ DPT GROUNDWATER SAMPLE W/ ID NUMBER
- 037SP027 ◆ DPT SOIL SAMPLE W/ ID NUMBER
- Ⓜ SANITARY SEWER MANHOLE
- SANS — SANITARY SEWER LINE




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 FIGURE 10.8.9
 SWMU 37
 WITH RELATED ZONE H
 SAMPLE LOCATIONS
 Date: 11/25/98 DWG Name: 2912C102

Table 10.8.1
SWMU 37, Zone L, Subzone H
Organic Compounds Detected in DPT Soil

Compound	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Volatile Organic Compounds ($\mu\text{g}/\text{kg}$)							
Acetone	3/33	6.15-117	44.6	780000	0	8000	NO

Notes:

- $\mu\text{g}/\text{kg}$ = Micrograms per kilogram
- RBC = Risk-based concentration
- GW = Groundwater
- SSL = Soil screening level
- Soil to GW = Generic SSLs based on DAF = 10, adapted from *USEPA Soil Screening Guidance: Technical Background Document*, May 1996 (first preference), or calculated using values from Table 6.2 in Zone H RFI Report

Table 10.8.2
SWMU 37, Zone L, Subzone H
Inorganic Detections for DPT Soil

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Reference Conc.	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Inorganic Elements (mg/kg)								
Cyanide (CN)	5/33	0.390-1.10	0.616	160	ND	0	20	NO
Aluminum (Al)	33/33	1530-16800	6619	7800	26000	8	560000 c	NO
Arsenic (As)	30/33	1.08-45.4	5.60	0.430	15.6	30	15	YES
Barium (Ba)	33/33	3.10-29.4	13.9	550	40.3	0	820	NO
Beryllium (Be)	28/33	0.230-0.860	0.458	16.0	1.37	0	32	NO
Cadmium (Cd)	1/33	0.410	0.410	7.80	1.05	0	4	NO
Calcium (Ca)	33/33	545-222000	34887	NA	NA	NA	NA	NO
Chromium (Cr)	33/33	3.50-40.8	17.1	39.0	59.1	1	19	YES
Cobalt (Co)	31/33	0.910-3.88	1.69	470	5.86	0	990 c	NO
Copper (Cu)	31/33	1.61-27.7	8.36	310	27.6	0	5600 c	NO
Iron (Fe)	33/33	680-20100	6529	2300	NA	32	NA	NO
Lead (Pb)	33/33	2.14-34.7	12.6	400	118	0	400	NO
Magnesium (Mg)	33/33	121-3960	1369	NA	NA	NA	NA	NO

Table 10.8.2
SWMU 37, Zone L, Subzone H
Inorganic Detections for DPT Soil

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Reference Conc.	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Manganese (Mn)	33/33	5.40-450	91.3	160	583	4	480 c	NO
Mercury (Hg)	13/33	0.040-0.560	0.128	NA	0.485	NA	1	NO
Nickel (Ni)	33/33	0.880-13.2	5.84	160	33.4	0	65	NO
Potassium (K)	33/33	68.3-1170	464.1	NA	NA	NA	NA	NO
Selenium (Se)	14/33	0.590-1.60	0.919	39.0	2.0	0	2.6	NO
Silver (Ag)	2/33	2.18-4.04	3.11	39.0	ND	0	17	NO
Sodium (Na)	33/33	137-1010	359	NA	NA	NA	NA	NO
Thallium (Tl)	3/33	1.28-2.49	1.79	0.55	1.1	3	0.36	YES
Vanadium (V)	33/33	2.50-42.9	15.9	55.0	73.0	0	3000	NO
Zinc (Zn)	33/33	3.70-114	32.2	2300	214	0	6200	NO

Notes:

- mg/kg = Milligrams per kilogram
- RBC = Risk-based concentration
- NA = Not applicable
- ND = Not detected
- GW = Groundwater
- SSL = Soil screening level
- c = Calculated SSL
- Soil to GW = Generic SSLs based on DAF = 10, adapted from *USEPA Soil Screening Guidance: Technical Background Document*, May 1996 (first preference), or calculated using values from Table 6.2 in Zone H RFI Report

Table 10.8.3
SWMU 37, Zone L, Subzone H, DPT Soil Sample Locations with
Metal Detections Exceeding RBCs and/or SSLs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	SSL Exceeded (Y/N)	RBC (mg/kg)	SSL (mg/kg)
Aluminum	037SP005H1	14600	Y	NA	7800	NA
	037SP006H1	15200	Y	NA		
	037SP008H1	9550	Y	NA		
	037SP020H1	10100	Y	NA		
	037SP021H1	8460	Y	NA		
	037SP027H1	11100	Y	NA		

Table 10.8.3
SWMU 37, Zone L, Subzone H, DPT Soil Sample Locations with
Metal Detections Exceeding RBCs and/or SSLs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	SSL Exceeded (Y/N)	RBC (mg/kg)	SSL (mg/kg)
	037SP029H1	15200	Y	NA		
	037SP031H1	16800	Y	NA		
Arsenic	037SP001H1	3.74	Y	N	0.43	15.0
	037SP002H1	2.36	Y	N		
	037SP003H1	4.56	Y	N		
	037SP005H1	9.74	Y	N		
	037SP006H1	10.0	Y	N		
	037SP007H1	2.63	Y	N		
	037SP008H1	45.4	Y	Y		
	037SP009H1	3.09	Y	N		
	037SP010H1	2.42	Y	N		
	037SP011H1	1.43	Y	N		
	037SP012H1	2.74	Y	N		
	037SP013H1	1.41	Y	N		
	037SP014H1	1.66	Y	N		
	037SP016H1	5.72	Y	N		
	037SP017H1	1.71	Y	N		
	037SP018H1	4.31	Y	N		
	037SP019H1	4.19	Y	N		
	037SP020H1	7.96	Y	N		
	037SP021H1	5.64	Y	N		
	037SP022H1	1.19	Y	N		
	037SP023H1	1.08	Y	N		
	037SP024H1	2.35	Y	N		
	037SP025H1	1.62	Y	N		
	037SP026H1	3.10	Y	N		
	037SP027H1	5.68	Y	N		
	037SP028H1	6.35	Y	N		
	037SP029H1	9.39	Y	N		

Table 10.8.3
SWMU 37, Zone L, Subzone H, DPT Soil Sample Locations with
Metal Detections Exceeding RBCs and/or SSLs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	SSL Exceeded (Y/N)	RBC (mg/kg)	SSL (mg/kg)	
	037SP030H1	4.77	Y	N			
	037SP031H1	9.62	Y	N			
	037SP06AH1	2.18	Y	N			
Chromium	037SP003H1	22.2	N	Y	39.0	19.0	
	037SP005H1	40.8	Y	Y			
	037SP006H1	32.1	N	Y			
	037SP008H1	27.2	N	Y			
	037SP018H1	20.6	N	Y			
	037SP019H1	24.7	N	Y			
	037SP020H1	26.7	N	Y			
	037SP021H1	24.6	N	Y			
	037SP024H1	20.6	N	Y			
	037SP027H1	26.2	N	Y			
	037SP028H1	32.8	N	Y			
	037SP029H1	29.8	N	Y			
	037SP031H1	31.8	N	Y			
	Iron	037SP001H1	5260	Y	NA	2300	NA
		037SP002H1	5270	Y	NA		
037SP003H1		6380	Y	NA			
037SP004H1		3000	Y	NA			
037SP005H1		20100	Y	NA			
037SP006H1		19100	Y	NA			
037SP007H1		4240	Y	NA			
037SP008H1		9340	Y	NA			
037SP009H1		3280	Y	NA			
037SP0010H1		3530	Y	NA			
037SP011H1		3820	Y	NA			
037SP012H1		4740	Y	NA			
037SP013H1		2800	Y	NA			

Table 10.8.3
SWMU 37, Zone L, Subzone H, DPT Soil Sample Locations with
Metal Detections Exceeding RBCs and/or SSLs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	SSL Exceeded (Y/N)	RBC (mg/kg)	SSL (mg/kg)
	037SP014H1	3860	Y	NA		
	037SP016H1	7270	Y	NA		
	037SP017H1	3260	Y	NA		
	037SP018H1	4320	Y	NA		
	037SP019H1	5160	Y	NA		
	037SP020H1	8820	Y	NA		
	037SP021H1	6730	Y	NA		
	037SP022H1	3140	Y	NA		
	037SP023H1	2740	Y	NA		
	037SP024H1	5040	Y	NA		
	037SP025H1	3050	Y	NA		
	037SP026H1	5620	Y	NA		
	037SP027H1	11100	Y	NA		
	037SP028H1	5200	Y	NA		
	037SP029H1	17400	Y	NA		
	037SP030H1	8400	Y	NA		
	037SP031H1	16500	Y	NA		
	037SP033H1	2510	Y	NA		
	037SP06AH1	3800	Y	NA		
Manganese	037SP005H1	332	Y	N	160	480
	037SP006H1	450	Y	N		
	037SP029H1	352	Y	N		
	037SP031H1	306	Y	N		
Thallium	037SP005H1	1.28	Y	Y	0.55	0.36
	037SP006H1	1.60	Y	Y		
	037SP029H1	2.49	Y	Y		

Notes:
 mg/kg = Milligrams per kilogram
 NA = Not Applicable
 RBC = Risk-Based Concentration
 SSL = Soil Screening Level

10.8.1.2 Nature of Contamination in SWMU 37, Subzone H, DPT Groundwater

Forty-five DPT groundwater samples from Subzone H were analyzed for VOCs, metals, and cyanide. Results for detected organic compounds are shown in Table 10.8.4. Results for detected inorganic chemicals are shown in Table 10.8.5.

Volatile Organic Compounds Detected in DPT Groundwater

As shown in Table 10.10.8.4, two VOCs were detected. These detections were compared to Tap Water RBC and MCL values. Chlorobenzene (2/45) at locations 037GP011 and 037GP040 exceeded the Tap Water RBC of 3.50 µg/L.

Metals/Cyanide Detected in DPT Groundwater

Analytical results for inorganic compounds in DPT groundwater samples are presented in Table 10.8.5. As stated in Section 10.0, detection values have not been compared to the RBC or MCL values.

Table 10.8.4
 SWMU 37, Zone L, Subzone H
 Organic Compounds Detected in DPT Groundwater

Compound	Freq of Detection	Range of Detected Conc.	Mean of Detected Conc.	Tap Water RBC	MCL	Number of Samples Exceeding RBC	Salt Wtr. Surf. Wtr. Chronic	Ground-water Migration Concern	Surface Water Migration Concern
Volatile Compounds (µg/L)									
Chlorobenzene	2/45	13.5-54.3	33.9	3.50	NA	2	105	YES	NO
Ethylbenzene	1/45	8.84	8.84	130	700	0	4.3	NO	YES

Notes:
 µg/L = Micrograms per liter
 RBC = Risk-based concentration
 MCL = Maximum contaminant level
 NA = Not applicable

Table 10.8.5
SWMU 37, Zone L, Subzone H
Inorganic Detections for DPT Groundwater

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.
Inorganic Elements ($\mu\text{g/L}$)			
Cyanide (CN)	9/45	5.20-46.8	12.9
Aluminum (Al)	45/45	4600-969000	101466
Antimony (Sb)	15/45	10.0-18.4	12.2
Arsenic (As)	39/45	10.8-242	71.4
Barium (Ba)	45/45	19.8-1240	231.4
Beryllium (Be)	23/45	2.20-20.0	6.99
Cadmium (Cd)	6/45	3.00-5.40	3.77
Calcium (Ca)	45/45	115000-1520000	363600
Chromium (Cr)	45/45	7.50-977	177.5
Cobalt (Co)	30/45	5.20-150	29.5
Copper (Cu)	41/45	7.50-207	61.0
Iron (Fe)	45/45	5130-418000	89992
Lead (Pb)	45/45	3.90-444	106.2
Magnesium (Mg)	45/45	10900-531000	156080
Manganese (Mn)	45/45	106-5420	1184
Mercury (Hg)	22/45	0.200-2.00	0.688
Nickel (Ni)	44/45	6.40-179	52.9
Potassium (K)	45/45	5220-210000	65839
Selenium (Se)	21/45	5.00-27.3	12.9
Silver (Ag)	1/45	10.1	10.1
Sodium (Na)	45/45	10500-4500000	1234947
Thallium (Tl)	4/45	10.7-17.3	13.4
Vanadium (V)	45/45	7.90-779	164.1
Zinc (Zn)	43/45	24.2-838	281.2

Notes:
 $\mu\text{g/L}$ = Micrograms per liter

10.8.1.3 Nature of Contamination in SWMU 37, Subzone H, Soil Borings

Nineteen surface and 17 lower interval samples were collected using a hand auger and analyzed for Vocs, SVOCs, metals, cyanide, chlorinated pesticides, and PCBs. Surface interval sample results were compared to RBC values, and lower-interval soil samples were compared to SSL values. Results are summarized in Tables 10.8.6 (organic) and 10.8.7 (inorganic). No VOCs were detected.

Semivolatile Organic Compounds Detected in Soil Borings

Eighteen SVOCs were detected in the 19 upper-interval soil boring samples. Benzo(a)pyrene, (2/19) found at sample locations 037SB010 and 037SB018, exceeded the RBC value of 88 µg/kg. One detection of benzo(b)fluoranthene at location 037SB010 exceeded the RBC of 880 µg/kg.

Chlorinated Pesticides Detected in Soil Borings

Twelve chlorinated pesticides were detected in the 19 surface interval samples analyzed for this parameter. Of these, one detection of heptachlor found at sample location 037SB002 (270 µg/kg) exceeded the RBC value of 140 µg/kg. One detection of gamma-chlordane at location 037SB002 exceeded the RBC value of 490 µg/kg. Endosulfan II and endrin aldehyde at location 037SB014 exceeded the SSL value.

Polychlorinated Biphenyls Detected in Soil Borings

One PCB, Aroclor-1260 (7/19), was detected in seven surface interval soil boring samples (locations 037SB009, 037SB010, 037SB011, 037SB012, 037SB013, 037SB014, and 037SB017). All exceeded the RBC of 83 µg/kg. Arochlor-1260 at locations 037SB011, 037SB013, and 037SB014 exceeded the SSL value.

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Table 10.8.6
 SWMU 37, Zone L, Subzone H
 Organic Compounds Detected in Soil Borings

Compound	Sampling Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Volatile Organic Compounds (µg/kg)								
2-Butanone (MEK)	Upper	1/19	74.0	74.0	4700000	0	3900 c	NO
	Lower	2/17	3.00-19.0	11.0	NA	NA		
Acetone	Upper	4/19	6.00-490	165.5	780000	0	8000	NO
	Lower	6/17	3.00-230	79.3	NA	NA		
Benzene	Upper	1/19	4.00	4.00	22000	0	15	NO
Carbon disulfide	Upper	1/19	6.00	6.00	780000	0	16000	NO
	Lower	1/17	2.00	2.00	NA	NA		
Ethylbenzene	Upper	1/19	1.00	1.00	780000	0	6500	NO
Methylene chloride	Lower	1/17	2.00	2.00	NA	NA	10	NO
Tetrachloroethene	Upper	1/19	1.00	1.00	12000	0	30	NO
Toluene	Upper	1/19	2.00	2.00	1600000	0	6000	NO
	Lower	1/17	2.00	2.00	NA	NA		
Xylene (Total)	Upper	1/19	9.00	9.00	16000000	0	70000 c	NO
Semivolatile Compounds (µg/kg)								
2-Methylnaphthalene	Lower	1/17	42.0	42.0	310000	0	230000 c	NO
Acenaphthylene	Upper	1/19	76.0	76.0	310000	0	96000 c	NO
Anthracene	Upper	1/19	110	110	2300000	0	5900000	NO
B(a)P Equiv.	Upper	7/19	5.00-939	192	88	2	1600 c	NO
	Lower	2/17	6.60-47.5	27.0	NA	NA		
Benzo(a)anthracene	Upper	4/19	51.5-500	177.9	880	0	800	NO
Benzo(a)pyrene	Upper	6/19	39.0-570	147.4	88	2	4000	NO
	Lower	1/17	39.0	39.0	NA	NA		
Benzo(b)fluoranthene	Upper	6/19	50.0-1500	330.5	880	1	2300	NO
	Lower	2/17	45.0-66.0	55.50	NA	NA		
Benzo(g,h,i)perylene	Upper	6/19	51.0-270	102.8	310000	0	12000000 c	NO
	Lower	2/17	45.0-49.0	47.0	NA	NA		
Benzo(k)fluoranthene	Upper	2/19	81.0-110	95.5	8800	0	24000	NO

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Organic Compounds Detected in Soil Borings

Compound	Sampling Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Benzoic acid	Upper	1/19	57.0	57.0	3100000	0	200000	NO
	Lower	1/17	150	150	NA	NA		
Butylbenzylphalate	Upper	3/19	37.0-65.0	46.7	1600000	0	930000	NO
	Lower	2/17	56.0-96.0	76.0	NA	NA		
Chrysene	Upper	4/19	78.5-660	238.1	88000	0	80000	NO
	Lower	1/17	53.0	53.0	NA	NA		
Di-n-butylphthalate	Upper	1/19	60.0	60.0	7800000	0	2300000	NO
Dibenz(a,h)anthracene	Upper	1/19	140	140	88	0	800	NO
Fluoranthene	Upper	5/19	3.00-580	202.4	310000	0	2100000	NO
	Lower	2/17	73.0-74.0	73.5	NA	NA		
Indeno(1,2,3-cd)pyrene	Upper	5/19	38.0-280	97.0	880	0	7000	NO
	Lower	1/17	39.0	39.0	NA	NA		
Naphthalene	Lower	1/17	53.0	53.0	310000	NA	42000	NO
Pentachlorophenol	Upper	1/19	545	545	5300	0	13	YES
Phenanthrene	Upper	2/19	39.0-140	89.5	310000	0	660000	NO
	Lower	2/17	36.0-56.0	46.0	NA	NA		
Pyrene	Upper	4/19	105-1800	546.3	230000	0	2100000	NO
	Lower	4/17	49.0-240	104.8	NA	NA		
bis(2-Ethylhexyl)phthalate (BEHP)	Upper	3/19	44.0-1600	563.7	4600	0	1800000	NO
	Lower	1/17	61.0	61.0	NA	NA		
Chlorinated Pesticides (µg/kg)								
4,4'-DDD	Upper	3/19	14.0-420	160.3	2700	0	8000	NO
	Lower	2/17	3.60-230	116.8	NA	NA		
4,4'-DDE	Upper	4/19	6.20-45.0	23.4	1900	0	27000	NO
	Lower	2/17	7.70-81.0	44.4	NA	NA		
4,4'-DDT	Upper	6/19	8.90-87.0	32.9	1900	0	16000	NO
	Lower	8/17	4.40-1950	272.5	NA	NA		
Dieldrin	Upper	3/19	3.00-8.20	5.97	40	0	2	YES
	Lower	1/17	3.80	3.80	NA	NA		

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Table 10.8.6
SWMU 37, Zone L, Subzone H
Organic Compounds Detected in Soil Borings

Compound	Sampling Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Endosulfan II	Upper	5/19	4.60-46.0	14.6	47000	0	9000	NO
	Lower	3/17	9.20-92.5	39.2	NA	NA		
Endrin	Upper	2/19	12.0-170	91.0	2300	0	500	NO
	Lower	2/17	4.70-28.0	16.4	NA	NA		
Endrin aldehyde	Upper	8/19	5.00-750	116.4	2300	0	500	YES
	Lower	5/17	11.0-2050	451.6	NA	NA		
Heptachlor	Upper	3/19	3.30-270	95.4	140	1	11000	NO
	Lower	2/17	8.80-57.0	32.9	NA	NA		
Heptachlor epoxide	Upper	4/19	2.00-58.0	17.9	70	0	330	NO
	Lower	4/17	1.90-90.0	28.6	NA	NA		
Methoxychlor	Upper	1/19	16.0	16.0	39000	0	80000	NO
alpha-Chlordane	Upper	4/19	1.80-360	94.7	490	0	5000	NO
	Lower	1/17	66.0	66.0	NA	NA		
gamma-Chlordane	Upper	7/19	1.60-970	153.7	490	1	5000	NO
	Lower	3/17	3.70-180	64.5	NA	NA		
Polychlorinated Biphenyls (µg/kg)								
Aroclor-1254	Lower	1/17	70.0	70.0	NA	NA	1000	NO
Aroclor-1260	Upper	7/19	110-18000	3110	320	4	1000	YES
	Lower	5/17	110-47000	10412	NA	NA		

Notes:

- µg/kg = Micrograms per kilogram
- RBC = Risk-based concentration
- NA = Not applicable
- GW = Groundwater
- SSL = Soil screening level
- c = Calculated SSL
- Soil to GW = Generic SSLs based on DAF = 10, adapted from USEPA Soil Screening Guidance: Technical Background Document, May 1996 (first preference), or calculated using values from Table 6.2 in Zone H RFI Report

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**Table 10.8.7
SWMU 37, Zone L, Subzone H
Inorganic Detections in Soil Borings**

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Reference Conc.	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Inorganic Elements (mg/kg)									
Cyanide (CN)	Upper	1/19	2.00	2.00	160	ND	0	20	NO
	Lower	1/17	0.140	0.140	NA	ND	NA		
Aluminum (Al)	Upper	19/19	1270-14500	5320	7800	26000	2	56000 c	NO
	Lower	17/17	2340-9825	5025	NA	46200	NA		
Antimony (Sb)	Upper	2/19	0.830-0.840	0.840	3.10	ND	0	2.7	YES
	Lower	3/17	0.380-7.70	2.98	NA	ND	NA		
Arsenic (As)	Upper	19/19	1.00-9.30	3.79	0.43	15.6	19	15	NO
	Lower	16/17	0.750-7.10	3.13	NA	22.5	NA		
Barium (Ba)	Upper	19/19	3.70-23.2	13.9	550	40.3	0	820	NO
	Lower	17/17	3.80-33.7	13.3	NA	43.8	NA		
Beryllium (Be)	Upper	15/19	0.110-0.680	0.330	16.0	1.37	0	32	NO
	Lower	10/17	0.130-0.520	0.290	NA	1.62	NA		
Cadmium (Cd)	Upper	19/19	0.080-1.00	0.250	7.80	1.05	0	4	NO
	Lower	14/17	0.070-0.550	0.180	NA	1.10	NA		
Calcium (Ca)	Upper	19/19	1880-291000	37951	NA	NA	NA	NA	NO
	Lower	17/17	3030-101000	17922	NA	NA	NA		
Chromium (Cr)	Upper	19/19	4.00-37.6	13.2	39	59.1	0	19	YES
	Lower	17/17	3.10-17.7	10.1	NA	84.2	NA		
Cobalt (Co)	Upper	18/19	0.530-20.4	3.21	470	5.86	0	990 c	NO
	Lower	14/17	0.590-1.80	1.20	NA	14.9	NA		
Copper (Cu)	Upper	17/19	1.10-71.6	15.6	310	27.6	0	5600 c	NO
	Lower	14/17	1.00-120	16.7	NA	31.6	NA		
Iron (Fe)	Upper	19/19	2010-15300	5346	2300	NA	17	NA	NO
	Lower	17/17	1350-13600	5023	NA	NA	NA		
Lead (Pb)	Upper	19/19	2.30-162	24.3	400	118	0	400	NO
	Lower	17/17	1.90-339	31.1	NA	68.7	NA		
Magnesium (Mg)	Upper	19/19	198-3170	1071	NA	NA	NA	NA	NO
	Lower	17/17	176-2210	788	NA	NA	NA		

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Table 10.8.7
SWMU 37, Zone L, Subzone H
Inorganic Detections in Soil Borings

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Reference Conc.	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Manganese (Mn)	Upper	19/19	11.5-206	64.6	160	583	2	480 c	NO
	Lower	17/17	7.20-101	38.9	NA	1410	NA		
Mercury (Hg)	Upper	6/19	0.040-0.350	0.130	NA	0.485	NA	1	NO
	Lower	3/17	0.080-0.170	0.110	NA	0.735	NA		
Nickel (Ni)	Upper	19/19	2.20-37.0	8.96	160	33.4	0	65	NO
	Lower	17/17	1.40-27.5	5.74	NA	29.9	NA		
Potassium (K)	Upper	19/19	140-1140	388	NA	NA	NA	NA	NO
	Lower	17/17	108-643	316	NA	NA	NA		
Selenium (Se)	Upper	10/19	0.340-1.10	0.580	39	2.00	0	2.6	NO
	Lower	5/17	0.340-1.40	0.700	NA	2.70	NA		
Sodium (Na)	Upper	13/19	167-607	309	NA	NA	NA	NA	NO
	Lower	10/17	199-436	304	NA	NA	NA		
Thallium (Tl)	Upper	1/19	0.950	0.950	0.55	1.10	1	0.36	YES
	Lower	1/17	0.630	0.630	NA	1.30	NA		
Tin (Sn)	Upper	6/19	0.970-2.00	1.49	4700	ND	0	5500 c	NO
	Lower	5/17	1.10-2.40	1.72	NA	ND	NA		
Vanadium (V)	Upper	18/19	4.40-141	27.8	55	73.0	3	3000	NO
	Lower	17/17	2.90-86.5	19.8	NA	132	NA		
Zinc (Zn)	Upper	19/19	7.70-214	51.1	2300	214	0	6200	NO
	Lower	17/17	5.50-79.5	24.4	NA	130	NA		

Notes:

- mg/kg = Milligrams per kilogram
- RBC = Risk-based concentration
- NA = Not applicable
- ND = Not detected
- GW = Groundwater
- SSL = Soil screening level
- c = Calculated SSL
- Soil to GW = Generic SSLs based on DAF = 10, adapted from *USEPA Soil Screening Guidance: Technical Background Document*, May 1996 (first preference), or calculated using values from Table 6.2 in Zone H RFI Report

Metals/Cyanide Detected in Soil Borings

Cyanide was detected in one of the surface and one of the lower-interval samples. Table 10.8.8 summarizes the locations of metals exceeding the residential RBCs: aluminum (2/19), arsenic (19/19), iron (17/19), manganese (2/19), thallium (2/19), and vanadium (3/19). Antimony (1/17) at location 037SB018 and thallium (1/17) at location 037SB015 exceeded the SSL values.

Table 10.8.8
 SWMU 37, Subzone H Surface Soil Sample Locations with
 Metal Detections Exceeding RBCs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	RBC (mg/kg)
Aluminum	037SB001H1	14500	Y	7800
	037SB013H1	9190	Y	
Arsenic	037SB001H1	9.30	Y	0.43
	037SB002H1	3.60	Y	
	037SB003H1	4.70	Y	
	037SB004H1	1.00	Y	
	037SB005H1	5.50	Y	
	037SB006H1	3.20	Y	
	037SB007H1	4.50	Y	
	037SB008H1	3.60	Y	
	037SB009H1	3.30	Y	
	037SB010H1	4.60	Y	
	037SB011H1	2.00	Y	
	037SB012H1	2.20	Y	
	037SB013H1	3.90	Y	
	037SB014H1	2.10	Y	
	037SB015H1	5.00	Y	
	037SB016H1	3.60	Y	
	037SB017H1	3.60	Y	
037SB018H1	4.60	Y		
037SB020H1	1.70	Y		

Table 10.8.8
SWMU 37, Subzone H Surface Soil Sample Locations with
Metal Detections Exceeding RBCs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	RBC (mg/kg)
Beryllium	037SB001H1	0.68	Y	0.15
	037SB002H1	0.31	Y	
	037SB003H1	0.43	Y	
	037SB005H1	0.46	Y	
	037SB006H1	0.32	Y	
	037SB007H1	0.39	Y	
	037SB008H1	0.34	Y	
	037SB009H1	0.28	Y	
	037SB010H1	0.44	Y	
	037SB011H1	0.22	Y	
	037SB012H1	0.22	Y	
	037SB013H1	0.30	Y	
	037SB014H1	0.30	Y	
	037SB020H1	0.15	Y	
Iron	037SB001H1	15300	Y	2300
	037SB002H1	5530	Y	
	037SB003H1	5760	Y	
	037SB005H1	4580	Y	
	037SB006H1	6070	Y	
	037SB007H1	7160	Y	
	037SB008H1	6220	Y	
	037SB009H1	4527	Y	
	037SB010H1	5110	Y	
	037SB011H1	3120	Y	
	037SB012H1	4970	Y	
	037SB013H1	8600	Y	
	037SB015H1	2490	Y	
	037SB016H1	2330	Y	

Table 10.8.8
SWMU 37, Subzone H Surface Soil Sample Locations with
Metal Detections Exceeding RBCs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	RBC (mg/kg)
	037SB017H1	4920	Y	
	037SB018H1	7140	Y	
	037SB020H1	3725	Y	
Manganese	037SB001H1	206	Y	180
	037SB005H1	185	Y	
Thallium	037SB001H1	0.95	Y	0.29
Vanadium	037SB015H1	77.60	Y	55.00
	037SB017H1	84.70	Y	
	037SB018H1	141.00	Y	

Notes:
 mg/kg = Milligrams per kilogram
 NA = Not Applicable
 RBC = Risk-based concentration

10.8.1.4 Nature of Contamination in Subzone H, SWMU 37, Monitoring Well Groundwater

Three monitoring wells were installed and samples were analyzed for VOCs, SVOCs, chlorinated pesticide, PCBs, metals, and cyanide. Detected compound are summarized in Table 10.8.9. No organic compounds were detected in the first-quarter monitoring well samples.

Metals/Cyanide Detected in Monitoring Well Groundwater

Arsenic and manganese exceeded Tap Water RBC values of 0.45 $\mu\text{g/L}$ and 73.0 $\mu\text{g/L}$ at well 037GW001. Iron exceeded the Tap Water RBC of 1100 $\mu\text{g/L}$, manganese exceeded the RBC of 84.0 $\mu\text{g/L}$, and thallium exceeded the RBC of 0.26 $\mu\text{g/L}$ at well 037GW002. Manganese and thallium exceeded Tap Water RBC values of 84 $\mu\text{g/L}$ and 0.29 $\mu\text{g/L}$ at well 037GW003.

Sample locations with detected concentrations of analytes that exceed RBC, SSL, or MCL values are shown in Figures 10.8.10 through 10.8.47.

Table 10.8.9
SWMU 37, Zone L, Subzone H
Inorganic Detections for First-Quarter Groundwater
Shallow Monitoring Wells

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Tap Water RBC	Reference Conc.	MCL	Number of Samples Exceeding RBC	Salt Wtr. Surf. Wtr. Chronic	Ground-water Migration Concern	Surface Water Migration Concern
Inorganic Elements (µg/L)										
Cyanide (CN)	1/3	2.80	2.80	73	ND	200	0	1	NO	YES
Aluminum (Al)	1/3	157	157	3700	ND	NA	0	NA	NO	NO
Arsenic (As)	1/3	2.80	2.80	0.045	21.5	50	1	36	YES	NO
Barium (Ba)	3/3	14.2-124	64.5	260	323	2000	0	NA	NO	NO
Calcium (Ca)	3/3	115000-158000	138000	NA	NA	NA	NA	NA	NO	NO
Chromium (Cr)	2/3	2.80-5.70	4.30	18	ND	100	0	50	NO	NO
Iron (Fe)	2/3	463-26800	13632	1100	NA	NA	1	NA	YES	NO
Magnesium (Mg)	3/3	8720-652000	265907	NA	NA	NA	NA	NA	NO	NO
Manganese (Mn)	3/3	182-440	275	73	2440	NA	3	NA	YES	NO
Nickel (Ni)	2/3	1.30-1.40	1.35	73	ND	100	0	8.3	NO	NO
Potassium (K)	3/3	11000-193000	82967	NA	NA	NA	NA	NA	NO	NO
Sodium (Na)	3/3	10300-5380000	2160100	NA	NA	NA	NA	NA	NO	NO
Thallium (Tl)	2/3	6.70-8.40	7.60	0.26	5.3	2	2	21.3	YES	NO
Vanadium (V)	1/3	3.00	3.00	26	ND	NA	0	NA	NO	NO

Notes:
 µg/L = Micrograms per liter
 RBC = Risk-based concentration
 MCL = Maximum contaminant level
 NA = Not applicable
 ND = Not detected

10.8.2 Fate and Transport Assessment for SWMU 37 in Subzone H

Section 10.8 contains short descriptions of the portions of SWMU 37 within Subzone H. Environmental media sampled as part of the RFI for these sites include surface soil, subsurface soil (soil borings and DPT samples), and shallow groundwater (monitoring wells). Potential constituent migration pathways investigated for SWMU 37 include soil to groundwater and groundwater to surface water. Soil to air and soil to sediment cross media fate and transport were determined not to be a concern.

The fate and transport screening comparison for SWMU 37 soil and groundwater samples included referencing of previous Zone RFI Reports when applicable. Contaminants of potential concern were identified for each sample media and sampling method in Section 10.8. The Zone H RFI Report was consulted to identify any sites within the subzone H that are associated geographically with the Zone L sample points. Analytical results from samples with overlapping sites were compared to data generated during the Zone H RFI. If concentrations at Zone L sample points associated with overlapping sites were higher than those of the referenced Zone H RFI Report or if new fate and transport COPCs were identified, further evaluation will be deferred to the Zone H RFI and included as an addendum. If Zone L sample concentrations were less than or equal to those in the Zone H RFI Report, it was assumed that the Zone L fate and transport conclusions would be similar to those of the Zone H RFI and no further evaluation is needed. Zone L sampling locations that are not associated with any overlapping sites are summarized in the fate and transport COPC tables and fate and transport evaluations provided in the following sections.

10.8.2.1 Soil to Groundwater Cross-Media Transport

SWMU 37

In Section 10.8, Tables 10.8.1, 10.8.2, 10.8.6 and 10.8.7 compare maximum detected organic and inorganic constituent concentrations in DPT soil samples and soil borings from SWMU 37 to SSLs considered protective of groundwater. To provide a conservative screen, generic soil screening

levels were used; leachate entering the aquifer was assumed to be diluted by a ratio of 10:1, with no attenuation of constituents in soil (DAF=10). Background reference values for inorganics were noted but did not enter into the screening process.

The screening comparisons in the four tables mentioned above identify the constituents with the potential to impact groundwater quality. Table 10.8.10 provides a summary of SWMU 37 soil samples reporting SSL exceedances, along with the names of associated Zone H sites overlapping the areas where some of these soil samples were collected. For samples with no overlapping Zone H sites, fate and transport concerns are evaluated below. In these evaluations, shallow groundwater monitoring wells within 200 feet downgradient of Zone L sampling locations were used for comparing local groundwater quality to soil concentrations.

Table 10.8.10
SWMU 37, Zone L, Subzone H
Fate and Transport COPCs

Exceedance Location	Overlapping Site	Fate and Transport COPCs	COPCs to be further Evaluated?	Reference Document
Soil Borings				
037SB001	SWMU 13	Chromium Thallium	Yes Yes	Table 5.4.1* Table 5.4.1*
037SB002	SWMU 13	Dieldrin Heptachlor	Yes No	Table 5.4.1* Table 5.4.1*
037SB003	SWMU 13	Chromium	Yes	Table 5.4.1*
037SB006	SWMU 13	Chromium	Yes	Table 5.4.1*
037SB009	SWMU 17	Aroclor-1260 Dieldrin	No ^a Yes	Table 5.6.1* Table 5.6.1*
037SB010	SWMU 17	Dieldrin	Yes	Table 5.6.1*
037SB011	SWMU 17	Aroclor-1260	No ^a	Table 5.6.1*
037SB012	SWMU 17	Aroclor-1260	No ^a	Table 5.6.1*
037SB013	SWMU 17	Aroclor-1260 Endrin Aldehyde	No ^a Yes	Table 5.6.1* Table 5.6.1*

Table 10.8.10
SWMU 37, Zone L, Subzone H
Fate and Transport COPCs

Exceedance Location	Overlapping Site	Fate and Transport COPCs	COPCs to be further Evaluated?	Reference Document
037SB014	SWMU 17	Aroclor-1260 Endrin Aldehyde	No ^a Yes	Table 5.6.1* Table 5.6.1*
037SB015	AOC 666	Thallium	Yes	Table 5.17.1*
037SB017	AOC 666	Dieldrin	Yes	Table 5.17.1*
037SB018	AOC 666	Antimony	Yes	Table 5.17.1*
037SB020	SWMU 14/AOC 684	Pentachlorophenol	Yes	Table 5.5.1*
DPT Soil				
037SP003	None	Chromium	Yes	None
037SP005	None	Chromium Thallium	Yes Yes	None None
037SP006	None	Chromium Thallium	Yes Yes	None None
037SP008	SWMU 13	Arsenic Chromium	Yes Yes	Table 5.4.1* Table 5.4.1*
037SP018	None	Chromium	Yes	None
037SP019	None	Chromium	Yes	None
037SP020	AOC 666	Chromium	Yes	Table 5.17.1*
037SP021	AOC 666	Chromium	Yes	Table 5.17.1*
037SP024	SWMU 178; AOC 665	Chromium	No ^a ; Yes	Tables 5.8.1; 5.16.1*
037SP027	AOC 656	Chromium	No ^a	Table 5.11.1*
037SP028	AOC 656	Chromium	No ^a	Table 5.11.1*
037SP029	AOC 656	Thallium	Yes	Table 5.11.1*
037SP031	None	Chromium	Yes	None
Groundwater				
037GW002	None	Cyanide Thallium	Yes Yes	None None
037GW003	SWMU 14	Thallium	Yes	Table 5.5.2*
DPT Groundwater				

Table 10.8.10
SWMU 37, Zone L, Subzone H
Fate and Transport COPCs

Exceedance Location	Overlapping Site	Fate and Transport COPCs	COPCs to be further Evaluated?	Reference Document
037GP040	AOC 656	Chlorobenzene	Yes	Table 5.11.1*
037GP046	AOC 656	Ethylbenzene	Yes	Table 5.11.1*

Notes:

*Zone H RFI Report (EnSafe, 1996)

^a Zone L concentrations are within the range of those in reference document.

Chromium was detected in all 19 upper-interval soil samples, all 17 lower-interval soil samples, and all 33 DPT soil samples. Chromium exceeded its soil to groundwater SSL of 19 mg/kg in six DPT soil samples: 037SP003 (22.2 mg/kg), 037SP005 (40.8 mg/kg), 037SP006 (32.1 mg/kg), 037SP018 (20.6 mg/kg), 037SP019 (24.7 mg/kg), and 037SP031 (31.8 mg/kg). However, these results are below the Zone H background chromium concentration of 84.2 mg/kg. Of these six DPT samples, only 037SP019 is within 200 feet of any downgradient shallow groundwater monitoring wells, 666001 (approximately 170 feet) and 666002 (approximately 200 feet). Chromium was never detected in either well during quarterly groundwater sampling with the exception of the fourth quarter in 666001, which had an estimated value of 1.3 µg/l. Although the chromium detection in 666001 indicates a completed soil to groundwater pathway, its low concentration indicates that soil concentrations are protective of groundwater quality.

Thallium was detected in three of 33 DPT soil samples and exceeded its soil to groundwater SSL of 0.36 mg/kg in two samples, 037SP005 (1.28 mg/kg) and 037SP006 (1.60 mg/kg). Only 037SP006 exceeds the thallium background concentration for Zone H subsurface soil of 1.30 mg/kg. No shallow groundwater monitoring wells exist within 200 feet downgradient of these DPT soil samples from which to evaluate the soil to groundwater pathway.

10.8.2.2 Groundwater to Surface Water Cross-Media Transport

SWMU 37

In Section 10.8, Tables 10.8.4, 10.8.5, 10.8.9 compare maximum detected organic and inorganic constituent concentrations in groundwater samples from DPT locations and shallow monitoring wells from SWMU 37 to RBCs, and to chronic ambient saltwater quality criteria values for the protection of aquatic life (saltwater surface water chronic screening values). For inorganics, maximum concentrations in groundwater are compared to the greater of (a) RBCs, or (b) background reference concentrations for groundwater, as well as to the saltwater surface water chronic values. To provide a conservative screen, no attenuation or dilution of constituents in groundwater is assumed before comparison to the relevant standards.

The screening comparisons in the three tables mentioned above identify the constituents with the potential to impact downgradient groundwater quality and surface water quality. Table 10.8.10 provides a summary of SWMU 37 groundwater samples reporting exceedances of RBCs or surface water screening levels, along with the names of overlapping Zone H sites. Fate and transport concerns at Zone L groundwater sampling locations not associated with any overlapping Zone H sites are evaluated below. In these evaluations, shallow groundwater monitoring wells within 200 feet of the Zone L sampling location were used for comparison since the Zone L sampling point may be downgradient or cross-gradient from similar groundwater concentrations.

Cyanide (RBC = 73 $\mu\text{g/l}$) and thallium (RBC = 0.26 $\mu\text{g/l}$) were detected at shallow well 037H02 at concentrations 2.80 $\mu\text{g/l}$ and 6.70 $\mu\text{g/l}$, respectively. Only cyanide exceeded its saltwater surface water chronic value of 1 $\mu\text{g/l}$. The Zone H background concentration from shallow groundwater for thallium is 5.3 $\mu\text{g/l}$; no background concentration was calculated for cyanide since non-detects accounted for over 90% of the sample population. No shallow groundwater monitoring wells exist within a 200 foot radius of 037H02 such that the persistence of these constituents in groundwater cannot be evaluated. However, cyanide and thallium were not

detected in any soil samples collected during the Zone H RFI at nearby AOC 159 or grid-based locations, indicating these exceedances at 037H02 are isolated.

10.8.2.3 Fate and Transport Summary

Two inorganics, thallium and chromium, were reported at concentrations exceeding their soil to groundwater SSLs in soil from Subzone H soil sample locations not associated with existing Zone H sites. Chromium detections did not, however, exceed its Zone H background for subsurface soil. At locations where the soil to groundwater pathway could be evaluated, chromium is not considered a threat to groundwater quality. Only one thallium sample also exceeded its Zone H background concentration for subsurface soil. However, the thallium soil to groundwater pathway could not be evaluated since no shallow groundwater monitoring wells exist within 200 feet downgradient of the soil exceedance locations.

Cyanide and thallium were the only inorganic constituents detected in groundwater samples posing a potential threat to groundwater quality. Only thallium exceeded its Zone H background concentration for shallow groundwater, but no shallow monitoring wells exist within a 200 foot radius from which to evaluate its persistence in groundwater. Cyanide, detected at more than 26 times lower than its RBC, is a potential threat to surface water quality since it exceeded its saltwater surface water chronic value. The nearest surface water body is Shipyard Creek, which lies 500 feet downgradient from this well location (037H02).

Samples collected from locations with overlapping Zone H sites will be evaluated in an addendum to the Zone H RFI report.

10.8.3 Human Health Risk Assessment for SWMU 37, Subzone H

10.8.3.1 Site Background and Investigative Approach

Section 10.8 provides a description for SWMU 37 as well as a discussion of the sampling activities that took place during the Zone L RFI activities.

10.8.3.2 COPC Identification

SWMU 37 Soil

Based on the screening comparisons described in Section 7 of this RFI and presented in Tables 10.8.2, 10.8.6, and 10.8.7, Aroclor-1260, arsenic, BEQs, gamma-chlordane, and thallium were identified as COPCs for soil. Table 10.8.11 provides a summary of SWMU 37 soil samples that reported exceedances along with any associated sites that overlapped the area where these soil samples were taken. Except for soil samples 037SP005 and 037SP006, all of the soil samples that reported exceedances were collected in the vicinity of an existing Zone H site. Thallium was the only COPC identified for samples 037SP005 and 037SP006. A risk assessment is provided to evaluate the significance of thallium soil concentrations. For the remainder of the COPCs identified for SWMU 37 subzone H, data generated during the Zone L RFI were compared to data generated during the Zone H RFI and the results of these comparisons are provided on Table 10.8.11. A reference to the Zone H RFI report is also provided so that these comparisons can be easily verified. It was assumed that if the data generated during the Zone L RFI were less than or within the range of the data generated during the Zone H RFI, then the conclusions for Zone L would be the similar and therefore no further evaluation would be necessary. Conversely, if for any reason the data generated during the Zone L RFI revealed something that was not evaluated during the Zone H RFI (data reported higher than that presented in the Zone H RFI, or new COPCs), then further evaluation should be deferred to the Zone H RFI and included as an addendum. Recommendations are provided in Section 11.

Table 10.8.11
SWMU 37, Zone L, Subzone H
Risk Assessment COPCs

Exceedance Location	Overlapping Site	Risk Assessment COPCs	COPCs to be further Evaluated?	Reference Document
Soil Boring				
037SB002	SWMU 13	gamma-Chlordane	Yes	Table 6.2.2.4*
037SB009	SWMU 17	Aroclor-1260	No ^a	Table 6.2.4.4*
037SB010	SWMU 17	BEQs	Yes	Table 6.2.4.4*
037SB011	SWMU 17	Aroclor-1260	No ^a	Table 6.2.4.4*
037SB012	SWMU 17	Aroclor-1260	No ^a	Table 6.2.4.4*
037SB013	SWMU 17	Aroclor-1260	No ^a	Table 6.2.4.4*
037SB018	AOC 666	BEQs	No ^a	Table 6.2.15.4*
DPT Soil				
037SP005	None	Thallium	Yes	None
037SP006	None	Thallium	Yes	None
037SP008	SWMU 13	Arsenic	Yes	Table 6.2.2.4*
037SP029	AOC 656	Thallium	Yes	Table 6.2.9.4*
Groundwater				
037GW002	None	Thallium	Yes	None
037GW003	SWMU 14	Thallium	Yes	Table 6.2.3.14*
DPT Groundwater				
037GP040	AOC 656	Chlorobenzene	Yes	Table 6.2.9.4*

Notes:

*Zone H RFI Report (EnSafe, 1996)

^a Zone L concentrations are within the range of those in reference document.

SWMU 37 Groundwater

Based on the screening comparisons described in Section 7 of this RFI and presented in Table 10.8.9, thallium was identified as a COPC for groundwater. Table 10.8.10 provides a summary of SWMU 37 groundwater samples that reported exceedances along with any associated sites that overlapped the area where these samples were taken. As shown, groundwater sample 037GW003 was collected in the vicinity of SWMU 14 and groundwater sample 037GP002 was not collected near any existing site. As a result, a risk assessment is provided to evaluate the significance of thallium concentrations reported in groundwater in the area of 037GW002. The thallium data generated from monitoring well 037GW003 were compared to data generated during the SWMU 14 RFI and the results of these comparisons are provided on Table 10.8.10. A reference to the SWMU 14 RFI report is also provided so that this comparison can be easily verified. It was assumed that if the thallium data generated from monitoring well 037GW003 were less than or within the range of the data generated during the SWMU 14 RFI, then the conclusions for Zone L would be the similar and therefore no further evaluation would be necessary. Conversely, if for any reason the data generated during the Zone L RFI reveals something that was not evaluated during the SWMU 14 RFI (data reported higher than that presented in the SWMU 14 RFI, or new COPCs), then further evaluation should be deferred to the SWMU 14 RFI and included as an addendum. Recommendations are provided in Section 11.

10.8.3.3 Exposure Assessment

Potentially Exposed Populations

Potentially exposed populations are current and future site workers and hypothetical future site residents. Future site resident and worker exposure scenarios were addressed in this risk assessment. The hypothetical future site worker scenario assumed continuous exposure to surface soil conditions and the use of shallow groundwater as a potable water source. Current site workers' exposure would be less than that assumed for the hypothetical future site worker scenario because of their limited soil contact and the fact that groundwater is not currently used onsite as

a source of potable or process water. Therefore, future worker assessment is considered to be conservatively representative of current site use. The future site resident scenario was built on the premise that current buildings would be removed and replaced with dwellings. In addition, the future site residents were assumed to use the shallow aquifer onsite as a source of drinking water.

Exposure Pathways

Exposure pathways for the site workers are dermal contact, incidental ingestion of surface soils, and ingestion of shallow groundwater through potable use. The exposure pathways for future residential land use are the same as those for the future site worker. In addition, the hypothetical future site worker scenario assumed continuous exposure to surface soil and groundwater conditions. Uniform exposure was assumed for all sample locations. Table 10.8.11a presents the justification for exposure pathways assessed in this HHRA.

Table 10.8.11a
Exposure Pathways Summary — SWMU 37
CNC — Subzone H
Charleston, South Carolina

Potentially Exposed Population	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Current Land Uses			
Current Site Users/Maintenance	Air, Inhalation of gaseous contaminants emanating from soil	No	Based on the COPCs identified in this HHRA, this would not be a significant pathway.
	Air, Inhalation of chemicals entrained in fugitive dust	No	This pathway was considered to be insignificant relative to the other soil pathways that were evaluated.
	Shallow groundwater, Ingestion of contaminants during potable or general use	No (Qualified)	Future land use assessment is considered to be conservatively representative of current receptors.
	Shallow groundwater, Inhalation of volatilized shallow groundwater contaminants	No	No volatile COPC were evaluated in the formal risk assessment.

Table 10.8.11a
Exposure Pathways Summary — SWMU 37
CNC — Subzone H
Charleston, South Carolina

Potentially Exposed Population	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
	Soil, Incidental ingestion	No (Qualified)	Future land use assessment is considered to be conservatively representative of current receptors.
	Soil, Dermal contact	No (Qualified)	Future land use assessment is considered to be conservatively representative of current receptors.
Future Land Uses			
Future Site Residents (Child and Adult) and Future Site Worker	Air, Inhalation of gaseous contaminants emanating from soil	No	Based on the COPCs identified in this HHRA, this would not be a significant pathway.
	Air, Inhalation of chemicals entrained in fugitive dust	No	This pathway was considered to be insignificant relative to the other soil pathways that were evaluated.
	Shallow groundwater, Ingestion of contaminants during potable or general use	Yes	COPCs were identified subsequent to risk-based and background screening comparisons.
	Shallow groundwater, Inhalation of volatilized contaminants during domestic use	No	No volatile COPC were evaluated in the formal risk assessment.
	Soil, Incidental ingestion	Yes	COPCs were identified subsequent to risk-based and background screening comparisons.
	Soil, Dermal contact	Yes	COPCs were identified subsequent to risk-based and background screening comparisons.
	Wild game or domestic animals, Ingestion of tissue impacted by media contamination	No	Hunting/taking of game and/or raising livestock is prohibited within the Charleston, South Carolina city limits.
	Fruits and vegetables, Ingestion of plant tissues grown in media	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Exposure Unit Area

With regard to soil pathways, the focus of the risk assessment for subzone H is the area located just to the west of Buildings NS 79. There were four soil samples (037SP004, 037SP005, 037SP006, and 037SP06A) collected in this area that were used to characterize the soil pathways for subzone H. With respect to the groundwater pathways, groundwater sample 037GP002 is located just to the north of Building 665.

Exposure Point Concentrations

As discussed in Section 7 of this RFI, UCLs were calculated for datasets consisting of at least 10 samples. Since there were only four soil samples used to represent the soil pathways for this risk assessment the maximum thallium concentration was used as its EPC. Similarly, the thallium concentration reported in groundwater sample 037GP002 was used to calculate groundwater pathway risk and hazard.

Quantification of Exposure

Soil

CDIs for ingestion and dermal contact with soils are shown in Tables 10.8.12 and 10.8.13, respectively.

Groundwater

CDIs for ingestion of groundwater are shown in Table 10.8.14.

10.8.3.4 Toxicity Assessment

Toxicity assessment terms and methods are discussed in Section 7 of this report. Table 10.8.15 presents toxicological information specific to each COPC evaluated in this risk assessment. This information was used in the quantification of risk/hazard associated with soil contaminants. Brief toxicological profiles for are provided in the following paragraphs.

Table 10.8.12
 Chronic Daily Intakes (CDI)
 Incidental Ingestion of Surface Soil
 SWMU 37, Subzone H
 Charleston Naval Complex
 Charleston, South Carolina

Chemical	Fraction Ingested from Contaminated Source *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Current Worker adult H-CDI (mg/kg-day)	Current Worker adult C-CDI (mg/kg-day)
Thallium	1	1.60	2.19E-06	2.05E-05	2.50E-06	7.83E-07	2.80E-07

NOTES:

- lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
- CDI Chronic Daily Intake in mg/kg-day
- H-CDI CDI for hazard quotient
- C-CDI CDI for excess cancer risk
- * Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.8.13
 Chronic Daily Intakes (CDI)
 Dermal Contact with Surface Soil
 SWMU 37, Subzone H
 Charleston Naval Complex
 Charleston, South Carolina

Chemical	Exposure Point Concentration (mg/kg)	Fraction Contacted from Contaminated Source *	Dermal Absorption Factor (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Current Worker adult H-CDI (mg/kg-day)	Current Worker adult C-CDI (mg/kg-day)
Thallium	1.60	1	0.001	8.99E-08	2.97E-07	5.62E-08	6.42E-08	2.29E-08

NOTES:

- CDI Chronic Daily Intake in mg/kg-day
- H-CDI CDI for hazard quotient
- C-CDI CDI for excess cancer risk
- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
- * Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.8.14
 Chronic Daily Intakes (CDI)
 Ingestion of COPCs in Groundwater
 SWMU 37, Subzone H
 Charleston Naval Complex
 Charleston, South Carolina

Chemical	Exposure Point Concentration (mg/liter)	Future	Future	Future	Future	Future
		Resident adult H-CDI (mg/kg-day)	Resident child H-CDI (mg/kg-day)	Resident lwa C-CDI (mg/kg-day)	Worker adult H-CDI (mg/kg-day)	Worker adult C-CDI (mg/kg-day)
Thallium	0.0067	1.84E-04	4.28E-04	1.01E-04	6.56E-05	2.34E-05

NOTES:

- lwa Lifetime weighted average
- CDI Chronic Daily Intake
- H-CDI Noncarcinogenic hazard based Chronic Daily Intake
- C-CDI Carcinogenic risk based Chronic Daily Intake

Table 10.8.15
 Toxicological Database Information
 for Chemicals of Potential Concern
 SWMU 37, Subzone H
 Charleston Naval Complex
 Charleston, South Carolina

Non-Carcinogenic Toxicity Data

Chemical	Oral Reference Dose (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty Factor Oral	Inhalation Reference Dose (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty Factor Inhalation
Inorganics								
Thallium	8E-05	a	L	Increased SGOT	3000		ND	

NOTES:

- a Integrated Risk Information System (IRIS)
- NA Not applicable or not available
- ND Not determined due to lack of information

Table 10.8.15 (continued)
 Toxicological Database Information
 for Chemicals of Potential Concern
 SWMU 37, Subzone H
 Charleston Naval Complex
 Charleston, South Carolina

Carcinogenic Toxicity Data

Chemical	Oral Slope Factor [(mg/kg/day)] ⁻¹	Inhalation Slope Factor [(mg/kg/day)] ⁻¹	Weight of Tumor Evidence Type
Thallium	ND	ND	

NOTES:

- a Integrated Risk Information System (IRIS)
- NA Not applicable or not available
- ND Not determined due to lack of information

Thallium is readily absorbed through the gut and skin. Primary effects are stomach and bowel disturbances, kidney and liver damage, and neurological disturbances. Thallium was used in the past as a rodenticide and ant killer, and its use for these purposes is now prohibited. This element remains in the body for a relatively long time, and could accumulate if the chronic dose is large. USEPA's oral RfD for Thallium is 0.00008 mg/kg-day (Klaassen, et al, 1986) (Dreisbach, et al, 1987).

10.8.3.5 Risk Characterization

Soil Pathways

Exposure to soil onsite was evaluated under both residential and site worker scenarios. For these scenarios, incidental ingestion and dermal contact exposure pathways were evaluated. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.8.16 and 10.8.17 present the computed carcinogenic risks and/or HQs associated with incidental ingestion of and dermal contact with soils, respectively.

Hypothetical Site Residents

The computed hazard indices computed for soil based on the adult resident were 0.03 for the soil ingestion pathway and 0.006 for the dermal contact pathway. The computed hazard indices based on child resident were 0.3 for the soil ingestion pathway and 0.02 for the dermal contact pathway.

Hypothetical Site Workers

Hazard indices for the ingestion and dermal pathways were 0.01 and 0.005, respectively.

Table 10.8.16
 Hazard Quotients and Incremental Lifetime Cancer Risks
 Incidental Surface Soil Ingestion
 SWMU 37, Subzone H
 Charleston Naval Complex
 Charleston, SC

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Current Worker adult Hazard Quotient	Current Worker adult ILCR
Thallium	7E-05	NA	0.031	0.29	ND	0.011	ND
SUM Hazard Index/ILCR			0.03	0.3	ND	0.01	ND

NOTES:

- NA Not available
- ND Not Determined due to lack of available information
- lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
- ILCR Incremental Lifetime Cancer Risk

Table 10.8.17
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact With Surface Soil
SWMU 37, Subzone H
Charleston Naval Complex
Charleston, SC

Chemical	Dermal Adjustment	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day) ⁻¹	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Current Worker adult Hazard Quotient	Current Worker adult ILCR
Thallium	0.2	1.4E-05	NA	0.0064	0.021	ND	0.0046	ND
SUM Hazard Index/ILCR				0.006	0.02	ND	0.005	ND

NOTES:

- NA Not available
- ND Not Determined due to lack of available information
- lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
- ILCR Incremental Lifetime Cancer Risk
 - Dermal to absorbed dose adjustment factor is applied to adjust for Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)

Groundwater Pathways

Exposure to groundwater was evaluated using point risk/hazard estimates under both residential and site worker scenarios. The groundwater pathway was evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well, drawing from the corresponding water-bearing zone, will be installed. For noncarcinogenic contaminants evaluated relative to future site residents, hazard was computed for a child resident. Table 10.8.18 presents the risk and hazard point estimates for the groundwater pathway.

Hypothetical Site Residents

For the groundwater ingestion pathway, the hazard indices for the child and adult resident are 6 and 3, respectively.

Hypothetical Site Workers

For the groundwater ingestion pathway, the hazard indices for the site worker is 0.9.

COCs Identified

Chemicals of concern were identified based on cumulative (all pathway) risk and hazard projected for this site. USEPA has established a generally acceptable risk range of 1E-4 to 1E-6, and a hazard index threshold of 1.0 (unity). In accordance with SCDHEC guidance, a COC was considered to be any chemical contributing to a cumulative risk level of 1E-6 or greater and/or a cumulative hazard index above 1.0, if its individual ILCR exceeded 1E-6 or hazard quotient exceeded 0.1. For carcinogens, this approach is relatively conservative, because a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is recommended by USEPA Region IV as the trigger for establishing COCs. The COC selection method presented was used to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the remedial goal options development process.

Table 10.8.18
Hazard Quotients and Incremental Lifetime Cancer Risks
Groundwater Ingestion
SWMU 37, Subzone H
Charleston Naval Complex
Charleston, South Carolina

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day) ⁻¹	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Thallium	7E-05	NA	2.6	6.1	ND	0.94	ND
SUM Hazard Index/ILCR			3	6	ND	0.9	ND

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk

Soils

Hypothetical Site Residents

No soil pathway COCs were identified for the residential scenario.

Hypothetical Site Workers

No soil pathway COCs were identified for the site worker scenario.

Groundwater

As shown on Table 10.8.19, thallium was identified as a groundwater pathway COC for the residential scenario and was not identified as a groundwater COC for the site worker scenario.

10.8.3.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative assumptions (i.e., future residential use) recommended by USEPA Region IV when assessing potential future and current exposure. The exposure assumptions made in the site worker scenario are highly protective and would tend to overestimate exposure.

Residential use of the site would not be expected, based on current site uses. If this area were to be used as a residential site, the buildings and other structures would be demolished, and the soil conditions would likely change — the soils would be covered with landscaping soil and/or a house. Consequently, exposure to current soil conditions would not be likely under a true future residential scenario. Current site worker's contact with impacted media is much less than is assumed in the exposure model that was used to assess this pathway. These factors indicate that exposure pathways assessed in this HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents.

Table 10.8.19
 Summary of Risk and Hazard-based COCs
 SWMU 37, Subzone H
 Charleston Naval Complex
 Charleston, South Carolina

Medium	Exposure Pathway		Future	Future	Future	Site Worker		Identification of COCs	
			Resident Adult Hazard Quotient	Resident Child Hazard Quotient	Resident Iwa ILCR	Hazard Quotient	ILCR		
Surface Soil	Incidental Ingestion	Thallium	0.031	0.29	ND	0.011	ND		
		Dermal Contact	Thallium	0.0064	0.021	ND	0.0046		ND
Soil Pathways Sum			0.04	0.3	ND	0.02	ND		
Groundwater Pathways	Ingestion	Thallium	2.6	6.1	ND	0.94	ND		1
		Groundwater Pathway Sum			3	6	ND		0.9

Notes:

ND Indicates not determined due to the lack of available risk information.

ILCR Indicates incremental excess lifetime cancer risk

HI Indicates hazard index

1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.

2- Chemical is a COC by virtue of projected future resident lifetime ILCR.

3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.

4- Chemical is a COC by virtue of projected site worker ILCR.

A basewide system provides drinking and process water to buildings throughout Zone H. This system is slated to remain in operation under the current base reuse plan. As a result, groundwater would not be expected to be used under future site use scenarios. Therefore, the scenario established to project risk/hazard associated with groundwater exposure is highly conservative, and associated pathways are not expected to be completed in the future.

Determination of Exposure Point Concentrations

The exposure point concentrations were set equal to the maximum concentrations for COPCs identified for this site. The EPCs used in the risk assessment provide a reasonable maximum estimate of chronic daily intakes. As a result, the EPCs would tend to overestimate risk and hazard.

Uncertainty in the Data

All of the DPT data were provided at DQO level II which adds to the uncertainty associated with some of the data used in this risk assessment. Usually QA/QC required for risk assessment is DQO level III or higher. The risk and hazard estimates provided in this risk assessment could be considered over- or underestimates due to the use of DQO level II data.

10.8.3.7 Risk Summary

Risk and hazard were assessed for the hypothetical site worker and the hypothetical future site resident under reasonable maximum exposure assumptions. In soils, the incidental ingestion and dermal contact pathways were assessed in this HHRA. The ingestion and inhalation pathways were evaluated for groundwater. To add perspective to the risk assessment point risk and hazard maps are presented below for soil. Point risk maps are based on the unlikely assumption that potential future site resident will be chronically exposed to specific points. Exposure to soil conditions is more likely the result of uniform exposure to the soil conditions over the entire site

rather than specific points. Risk maps are still useful because they allow the reader to visualize the contribution of risk or hazard index due to individual COCs.

Soil

Figures 10.8.48 and 10.8.49 illustrate point hazard estimates for soil pathways under a residential scenario and the site worker scenario, respectively. Table 10.8.20 provides the contribution of individual COPCs to cumulative hazard at each sample location for both the residential and site worker scenarios. As shown, none of the individual soil sample locations were associated with a hazard index above 1.

10.8.3.8 Remedial Goal Options

Soil

RGOs for were based on the site resident or site workers as presented in Table 10.8.21 for groundwater.



LEGEND

- NO COPCs DETECTED
- 0 to 0.1
- 0.1 to 0.5
- 0.5 to 1.0
- 1.0 to 3.0
- > 3.0



ZONE L - RCRA
 FACILITY INVESTIGATION
 NAVAL BASE CHARLESTON
 CHARLESTON, SC

FIGURE 10.8.48
 ZONE L - SUBZONE H
 SWMU 37

SOIL HAZARD INDEX
 RESIDENTIAL SCENARIO



LEGEND

- NO COPCs DETECTED
- 0 to 0.1
- 0.1 to 0.5
- 0.5 to 1.0
- 1.0 to 3.0
- > 3.0



ZONE L - RCRA
 FACILITY INVESTIGATION
 NAVAL BASE CHARLESTON
 CHARLESTON, SC

FIGURE 10.8.49
 ZONE L - SUBZONE H
 SWMU 37

SOIL HAZARD INDEX
 INDUSTRIAL SCENARIO

Table 10.8.20
 Point Estimates of Risk and Hazard
 SWMU 37, Subzone H, Surface Soil
 Charleston Naval Complex
 Charleston, South Carolina

Site	Location	Parameter	Concentration	Units	Residential		Site Worker	
					Hazard Index	Risk (E-06)	Hazard Index	Risk (E-06)
037	P004	No COPCs Detected	ND	mg/kg	NA	NA	NA	NA
037	P005	Thallium (Tl)	1.28	mg/kg	0.22	NA	0.011	NA
037	P006	Thallium (Tl)	1.6	mg/kg	0.27	NA	0.014	NA
037	P06A	No COPCs Detected	ND	mg/kg	NA	NA	NA	NA

Table 10.8.21
 Remedial Goal Options for Groundwater
 SWMU 37, Subzone H
 Charleston Naval Complex
 Charleston, South Carolina

Residential-Based Remedial Goal Options

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options			Risk-Based Remedial Goal Options			MCL mg/l
				0.1 mg/l	1.0 mg/l	3 mg/l	1E-06 mg/l	1E-05 mg/l	1E-04 mg/l	
Thallium	NA	7E-05	0.0067	0.00011	0.0011	0.0033	ND	ND	ND	0.002

NOTES:

- EPC Exposure point concentration
- NA Not applicable
- ND Not determined
- Remedial goal options were based on the child resident.
- mg/kg-day milligrams per kilogram per day
- mg/l milligrams per liter



LEGEND

● ZONE L SOIL BORING LOCATION

 SUBZONE BOUNDARY
  RAILROAD
  MANHOLE
 SANITARY SEWER LINE
  STORM SEWER LINE

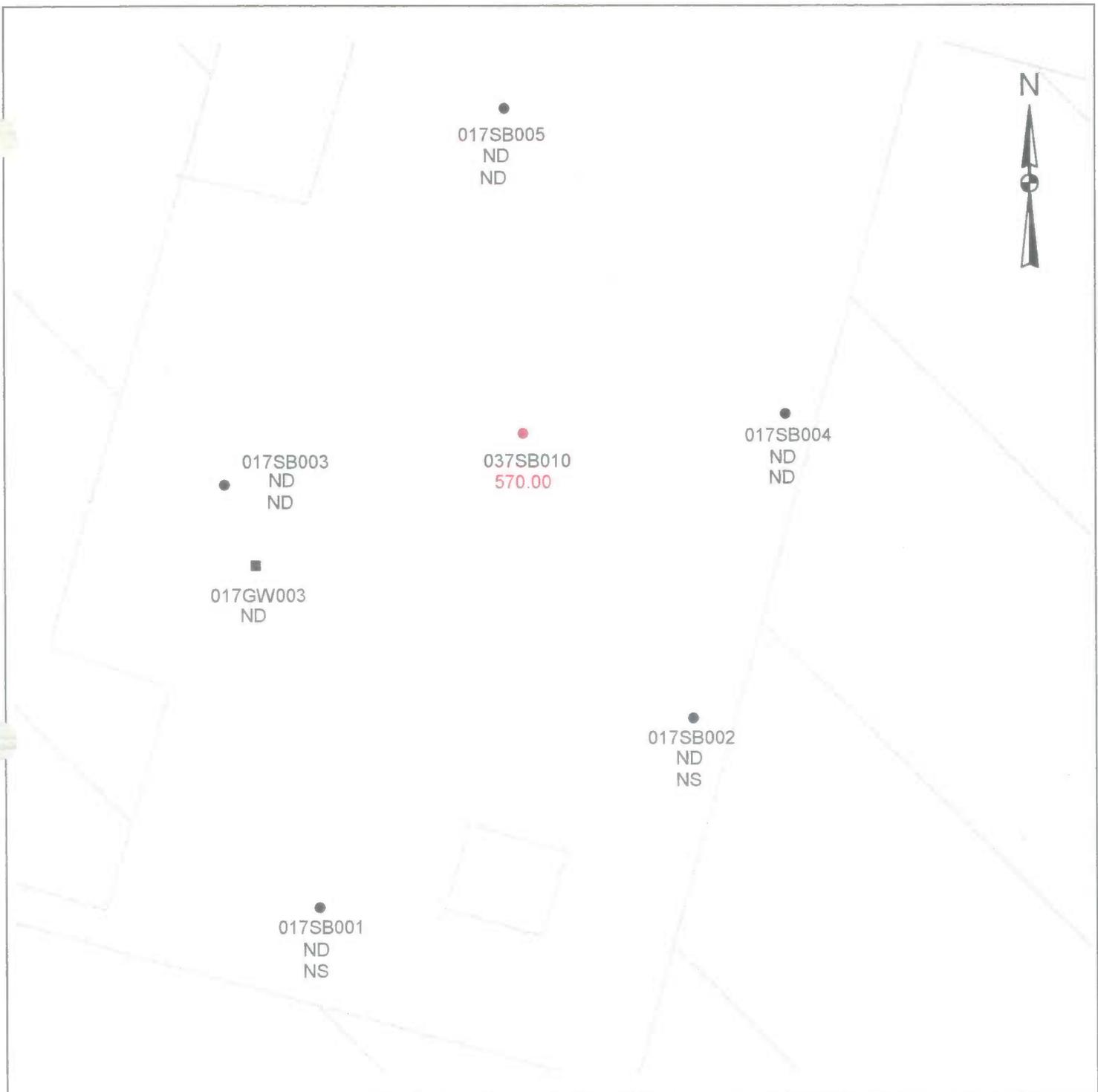
600 0 600 1200 Feet



ZONE L - RCRA
 FACILITY INVESTIGATION
 NAVAL BASE CHARLESTON
 CHARLESTON, SC

FIGURE 10.8.10
 ZONE L - SUBZONE H
 BENZO(A)PYRENE
 ZONE L EXCEEDANCES

RBC=88.0 ug/kg SSL=4000 ug/kg MCL=0.20 ug/L



LEGEND

- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

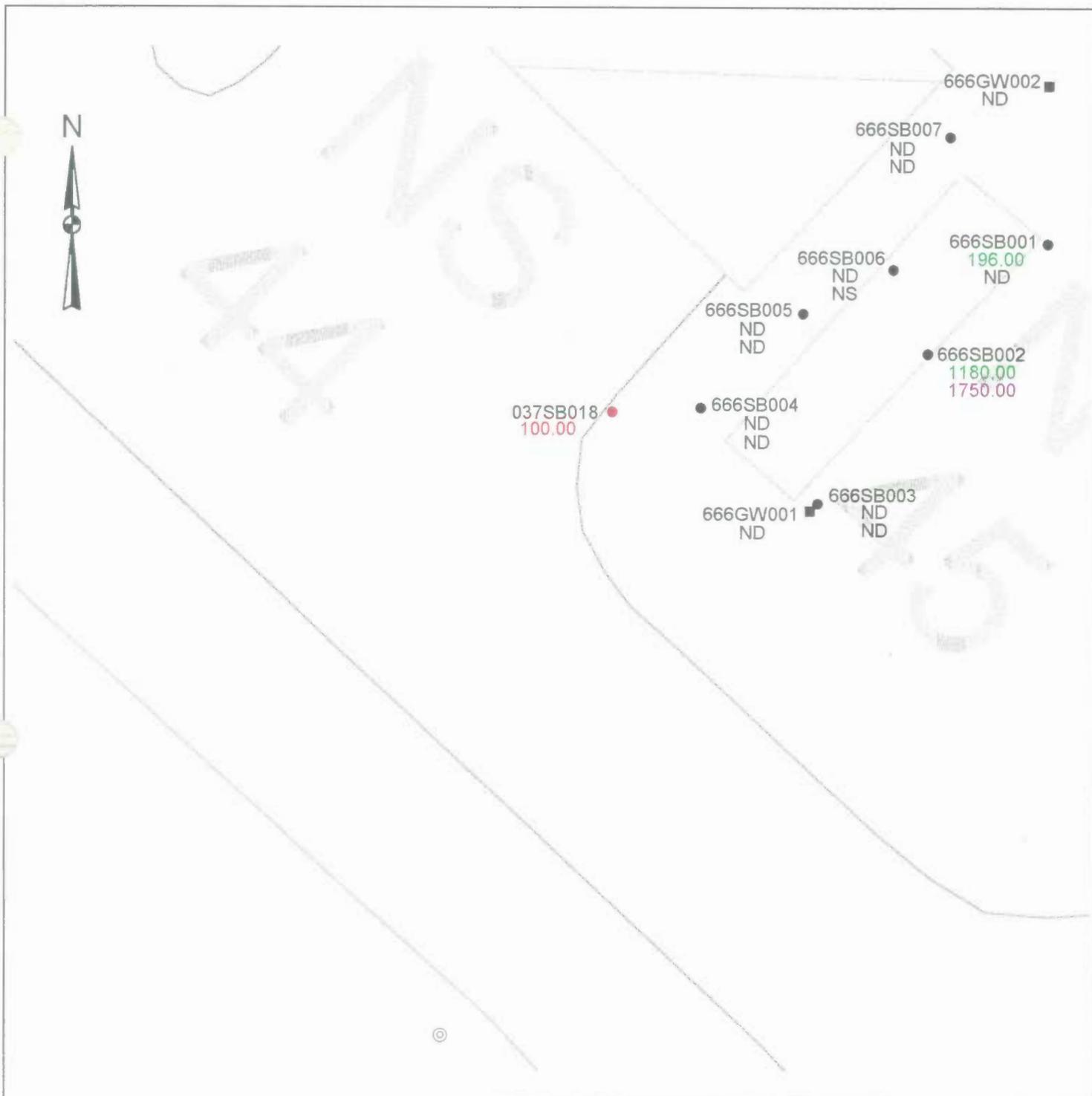
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ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.11
ZONE L - SUBZONE H
BENZO(A)PYRENE
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=88.0 ug/kg SSL=4000 ug/kg MCL=0.20 ug/L



LEGEND

- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

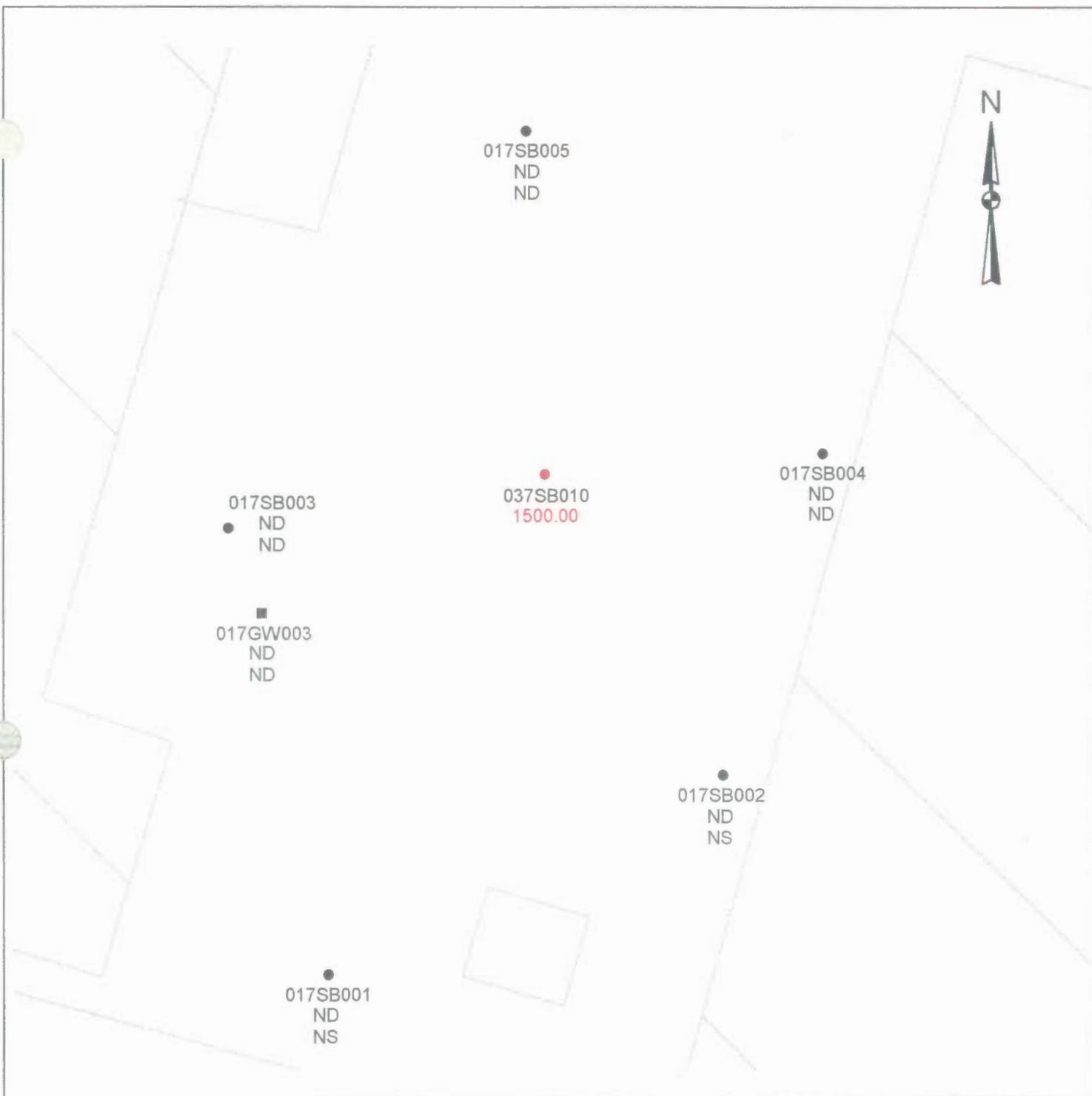
- ▬ SUBZONE BOUNDARY
 - ▬ RAILROAD
 - ⊙ MANHOLE
 - ▬ SANITARY SEWER LINE
 - ▬ STORM SEWER LINE
- 20 0 20 40 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.12
ZONE L - SUBZONE H
BENZO(A)PYRENE
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=88.0 ug/kg SSL=4000 ug/kg MCL=0.20 ug/L



LEGEND

- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ▬ SUBZONE BOUNDARY
- ▬ RAILROAD
- ⊙ MANHOLE
- ▬ SANITARY SEWER LINE
- ▬ STORM SEWER LINE

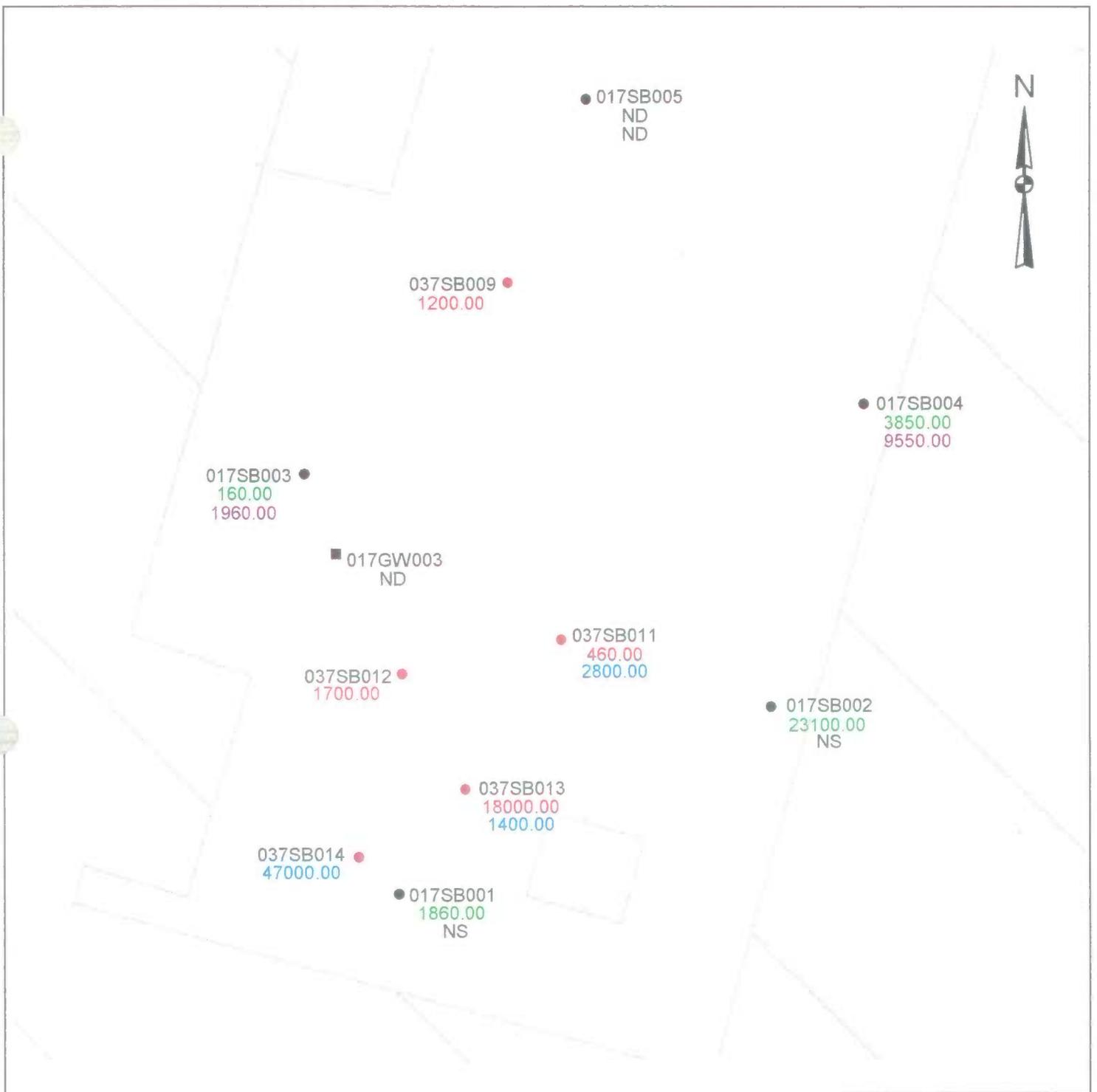
10 0 10 20 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.13
ZONE L - SUBZONE H
BENZO(B)FLUORANTHENE
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=880 ug/kg SSL=2300 ug/kg MCL=NONE



LEGEND

- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ▬ SUBZONE BOUNDARY
- ▬ RAILROAD
- ⊙ MANHOLE
- ▬ SANITARY SEWER LINE
- ▬ STORM SEWER LINE

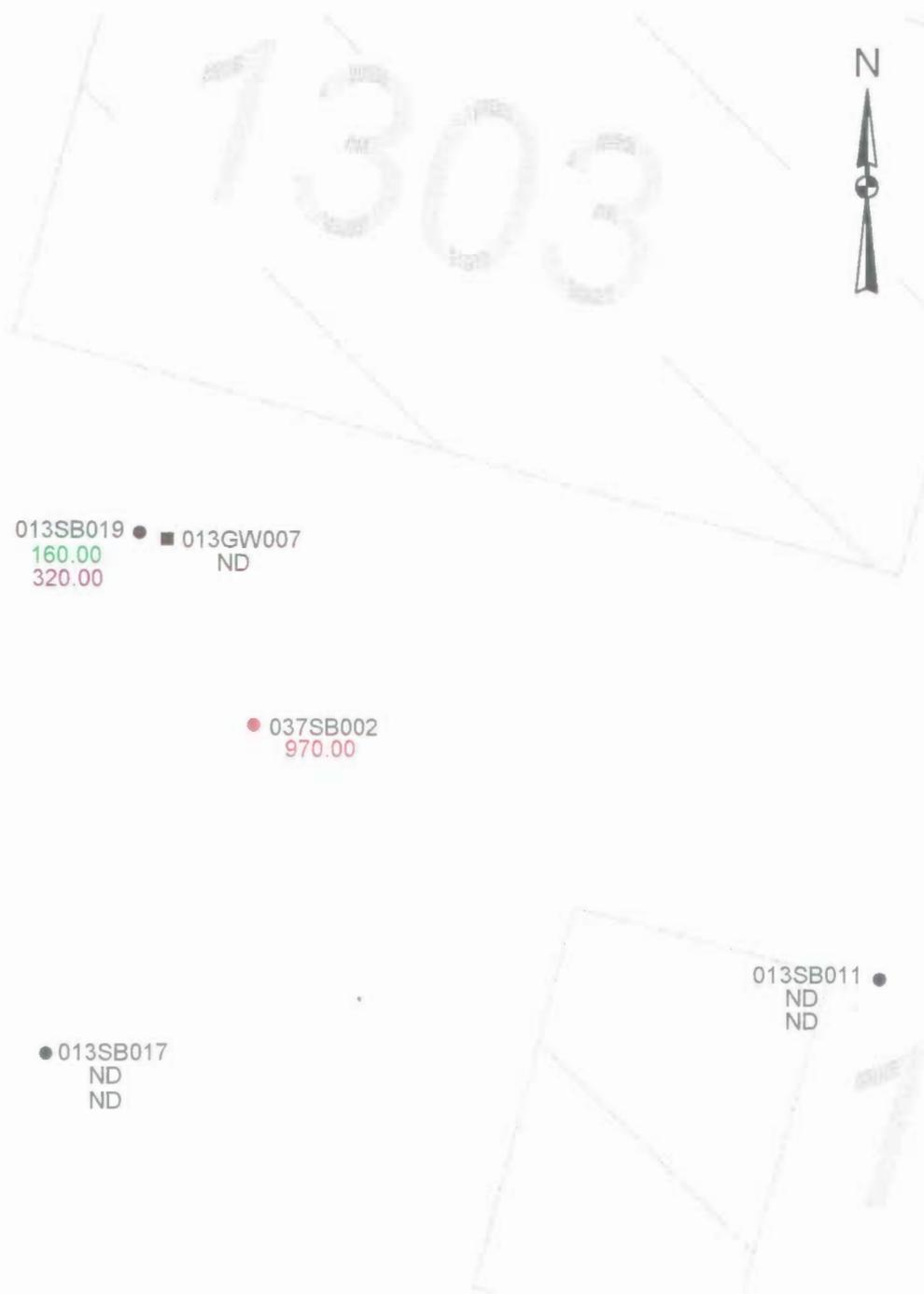
10 0 10 20 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.14
ZONE L - SUBZONE H
AROCOR-1260
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=320 ug/kg SSL=1000 ug/kg MCL=0.50 ug/L



● 013SB020
ND
ND

013SB019 ● 013GW007
160.00
320.00 ND

● 013SB018
ND
ND

● 037SB002
970.00

● 013SB011
ND
ND

● 013SB017
ND
ND

● 013SB016
ND
ND

LEGEND

- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

SUBZONE BOUNDARY
 RAILROAD
 MANHOLE
 SANITARY SEWER LINE
 STORM SEWER LINE

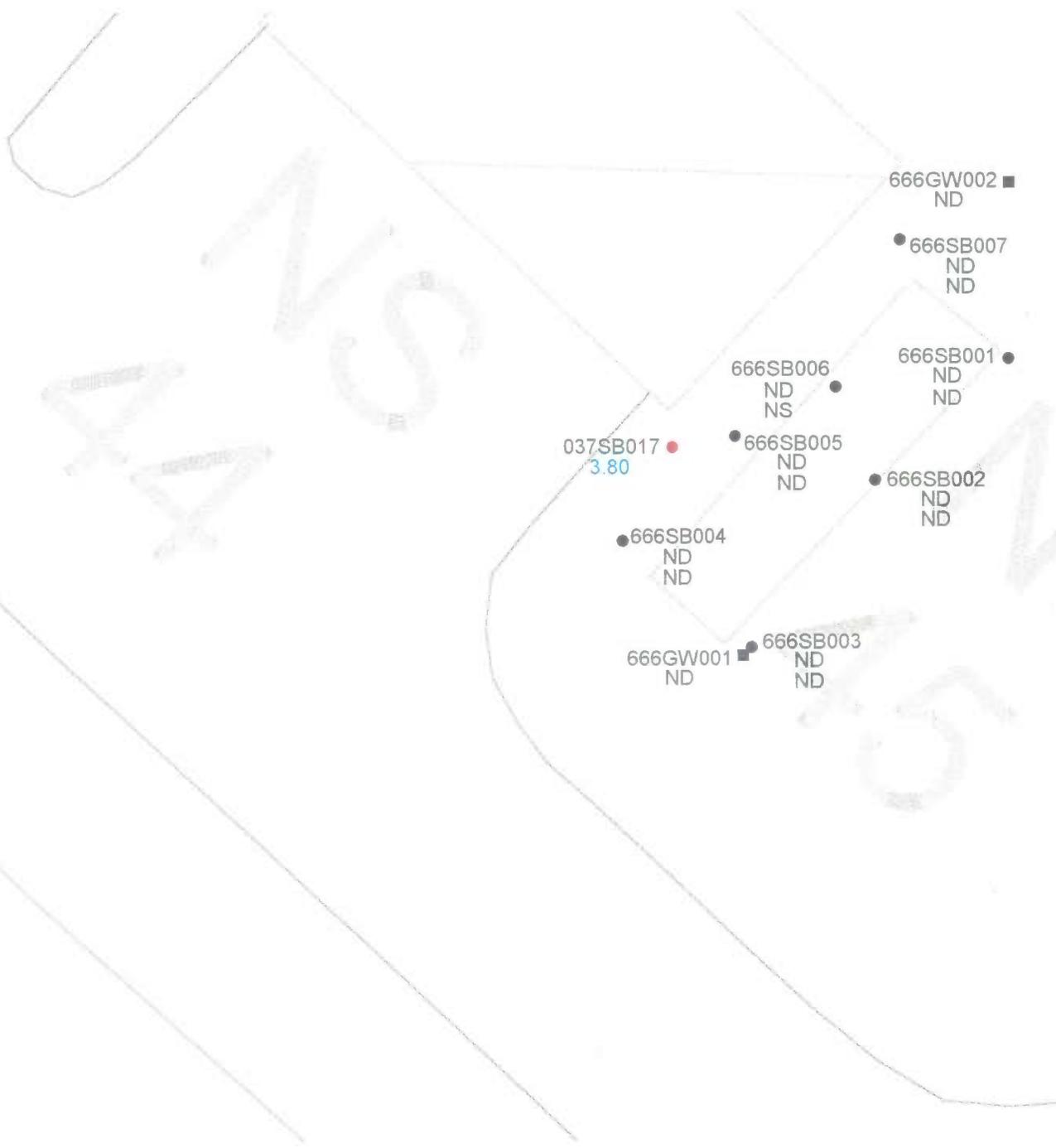
20 0 20 40 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.15
ZONE L - SUBZONE H
GAMMA-CHLORDANE
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=490 ug/kg SSL=5000 ug/kg MCL=2.00 ug/L



LEGEND

- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

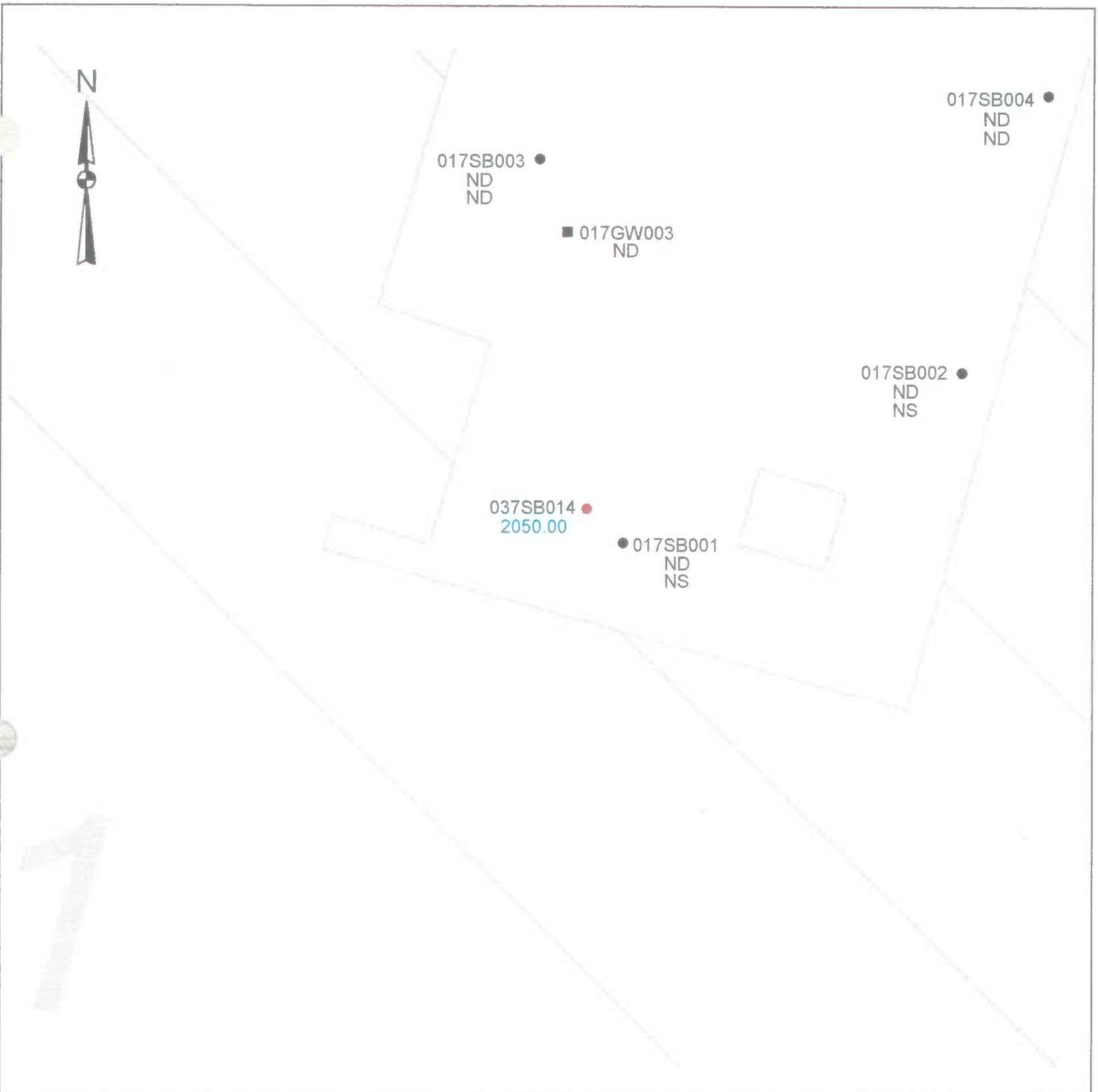
20 0 20 40 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.16
ZONE L - SUBZONE H
DIELDRIN
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=40.0 ug/kg SSL=2.00 ug/kg MCL=NONE



LEGEND

- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- ◎ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

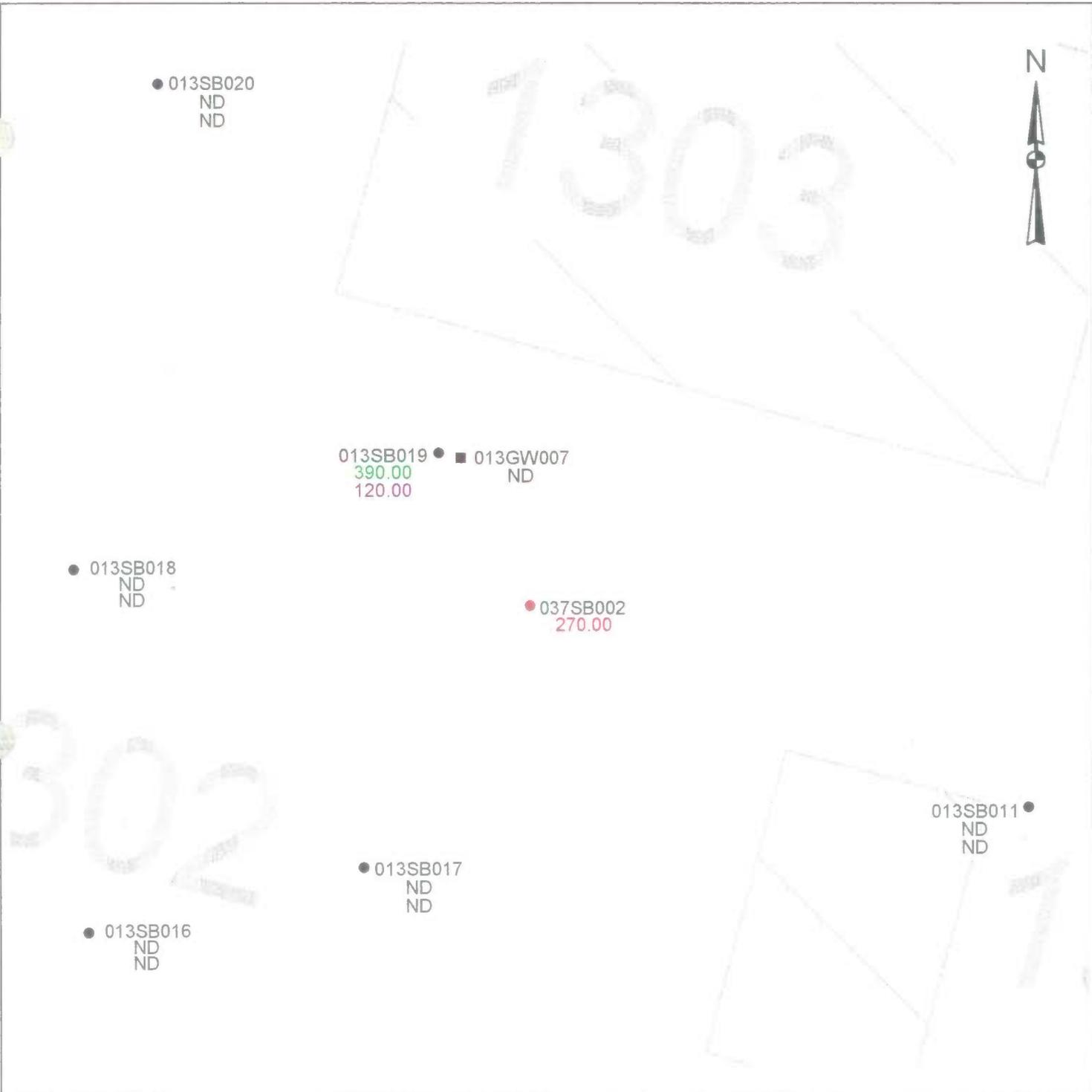
10 0 10 20 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.17
ZONE L - SUBZONE H
ENDRIN ALDEHYDE
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=2300 ug/kg SSL=500 ug/kg MCL=NONE



LEGEND

- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ▬ SUBZONE BOUNDARY
- ▬ RAILROAD
- ⊙ MANHOLE
- ▬ SANITARY SEWER LINE
- ▬ STORM SEWER LINE

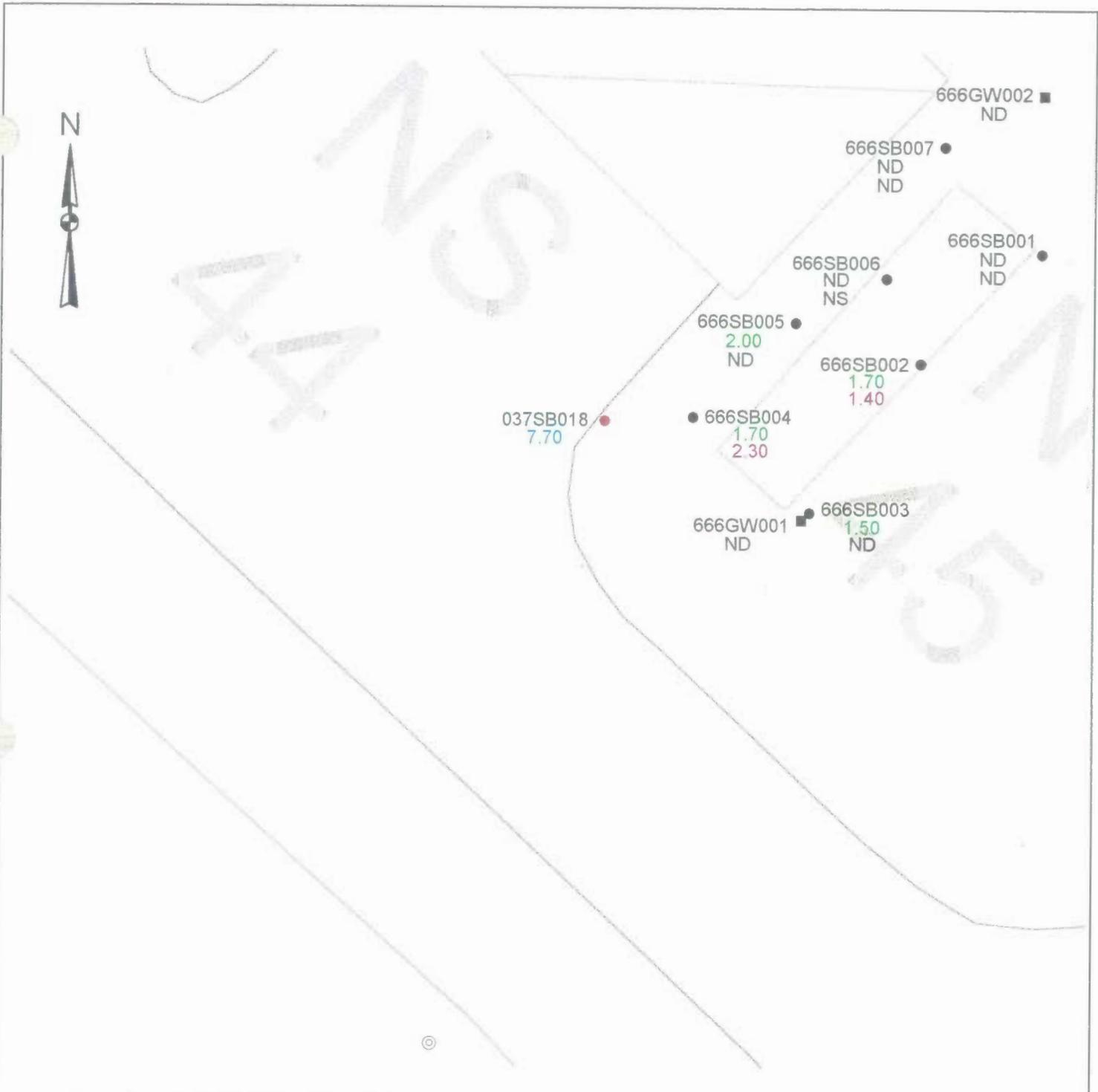
20 0 20 40 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.18
ZONE L - SUBZONE H
HEPTACHLOR EPOXIDE
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=70.0 ug/kg SSL=330 ug/kg MCL=0.20 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ~ SUBZONE BOUNDARY
- ~ RAILROAD
- ⊙ MANHOLE
- ~ SANITARY SEWER LINE
- ~ STORM SEWER LINE

20 0 20 40 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.19
ZONE L - SUBZONE H
ANTIMONY
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=3.10 mg/kg SSL=2.70 mg/kg MCL=6.00 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION

- SUBZONE BOUNDARY
- SANITARY SEWER LINE
- RAILROAD
- STORM SEWER LINE
- MANHOLE

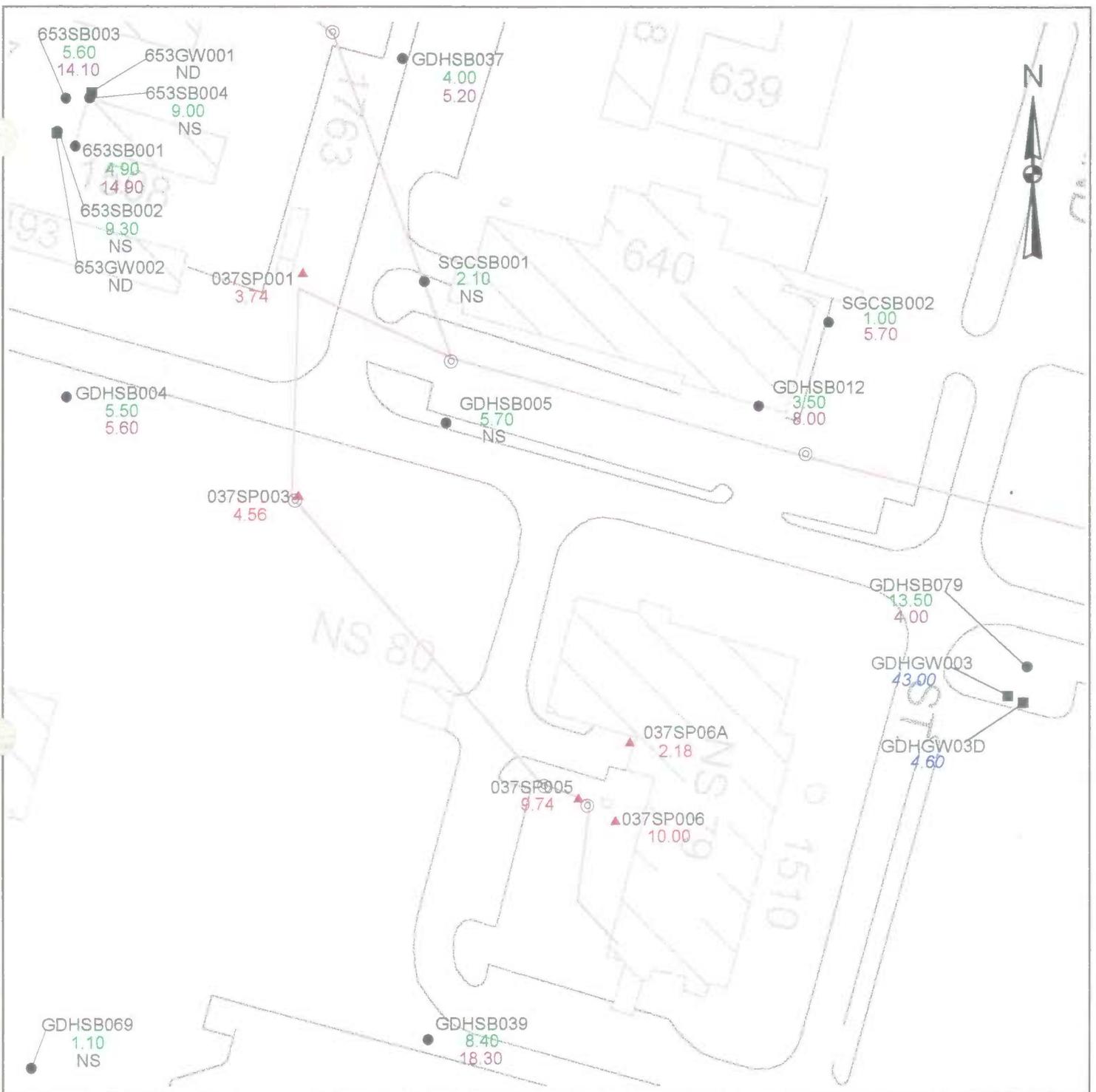
600 0 600 1200 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.20
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ▬ SUBZONE BOUNDARY
- ▬ RAILROAD
- ⊙ MANHOLE
- ▬ SANITARY SEWER LINE
- ▬ STORM SEWER LINE

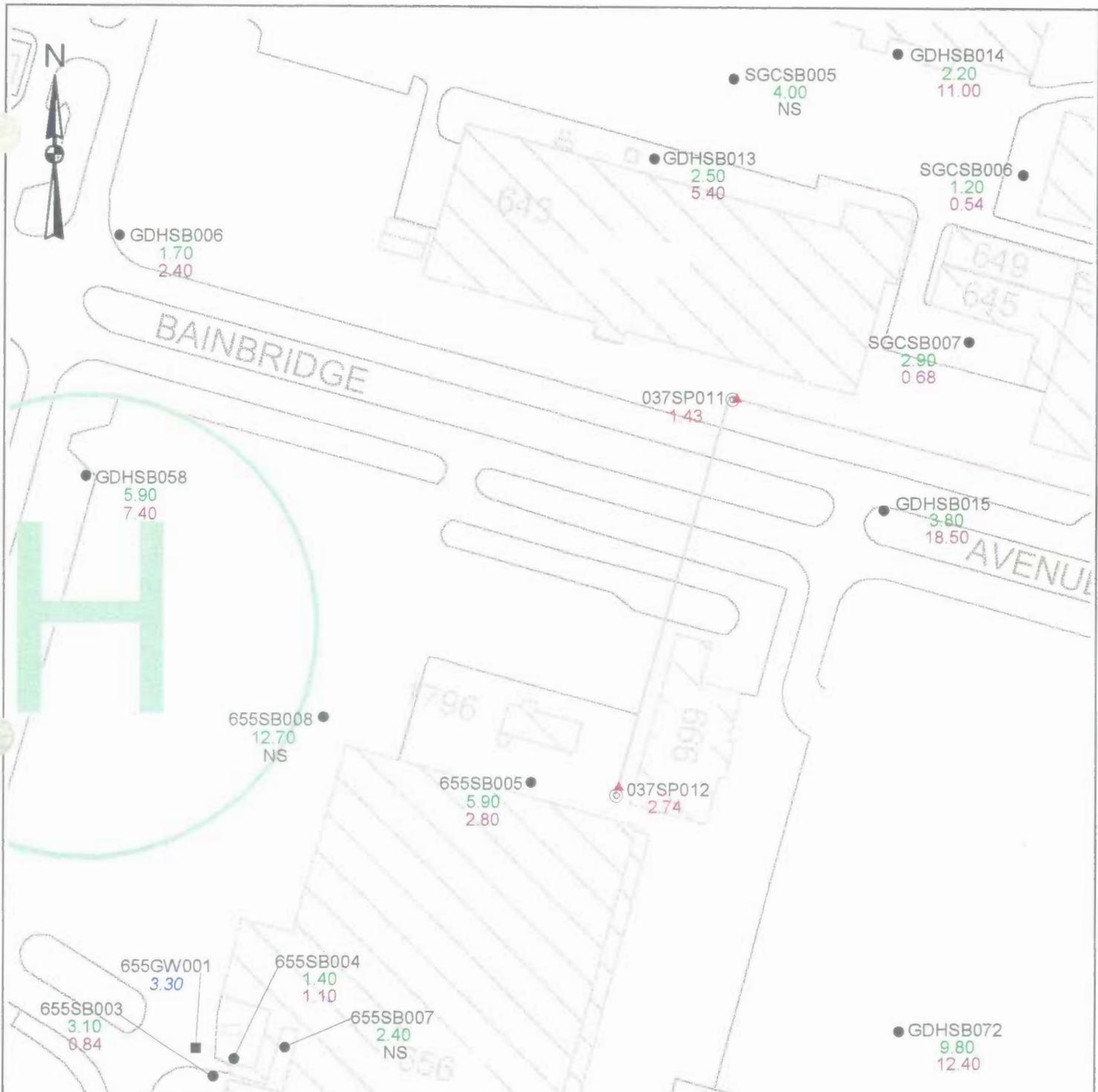
80 0 80 160 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.21
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- SANITARY SEWER LINE
- STORM SEWER LINE
- ⊙ MANHOLE

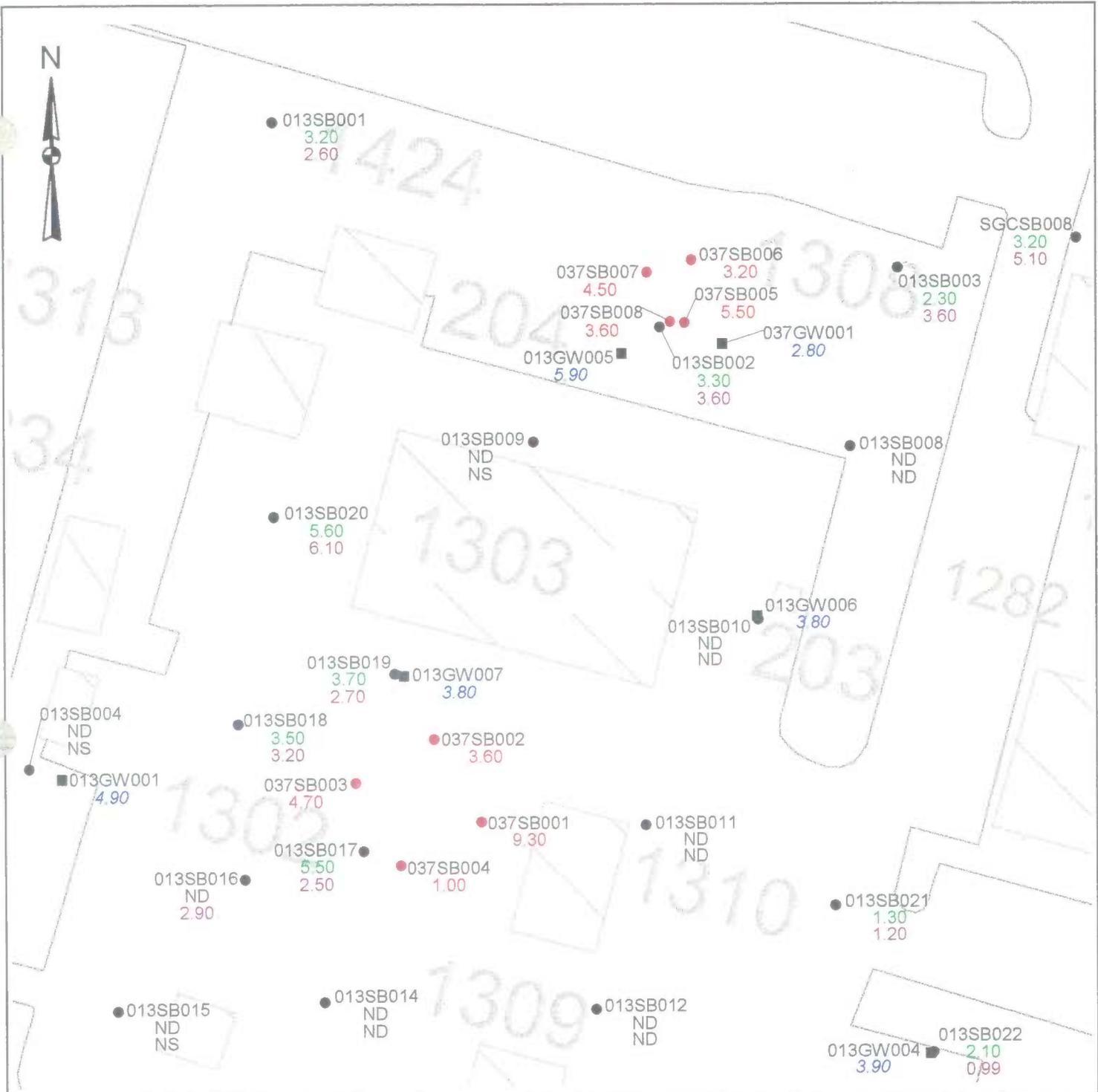


ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.22
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L

100 0 100 200 Feet



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

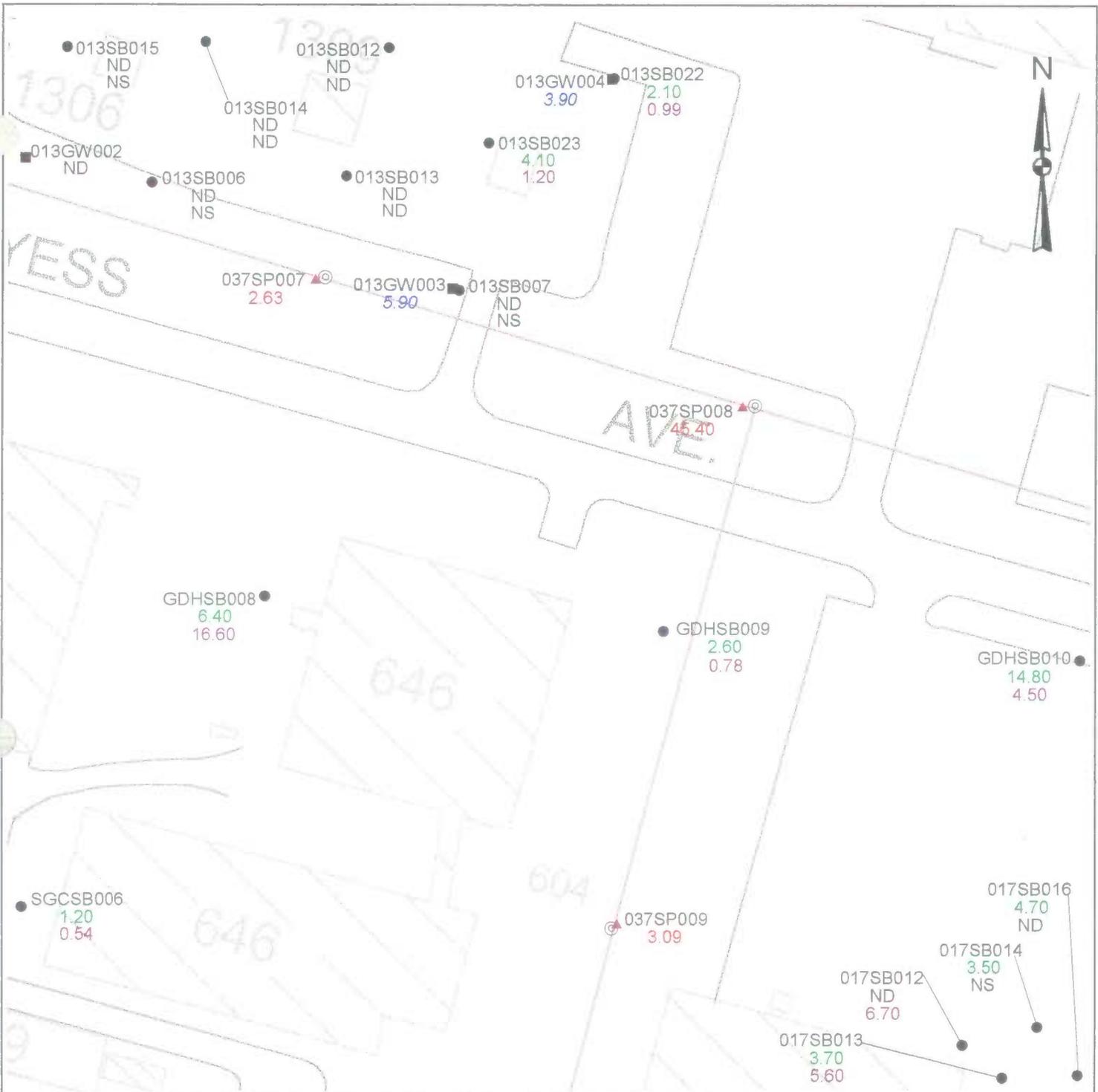
40 0 40 80 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.23
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

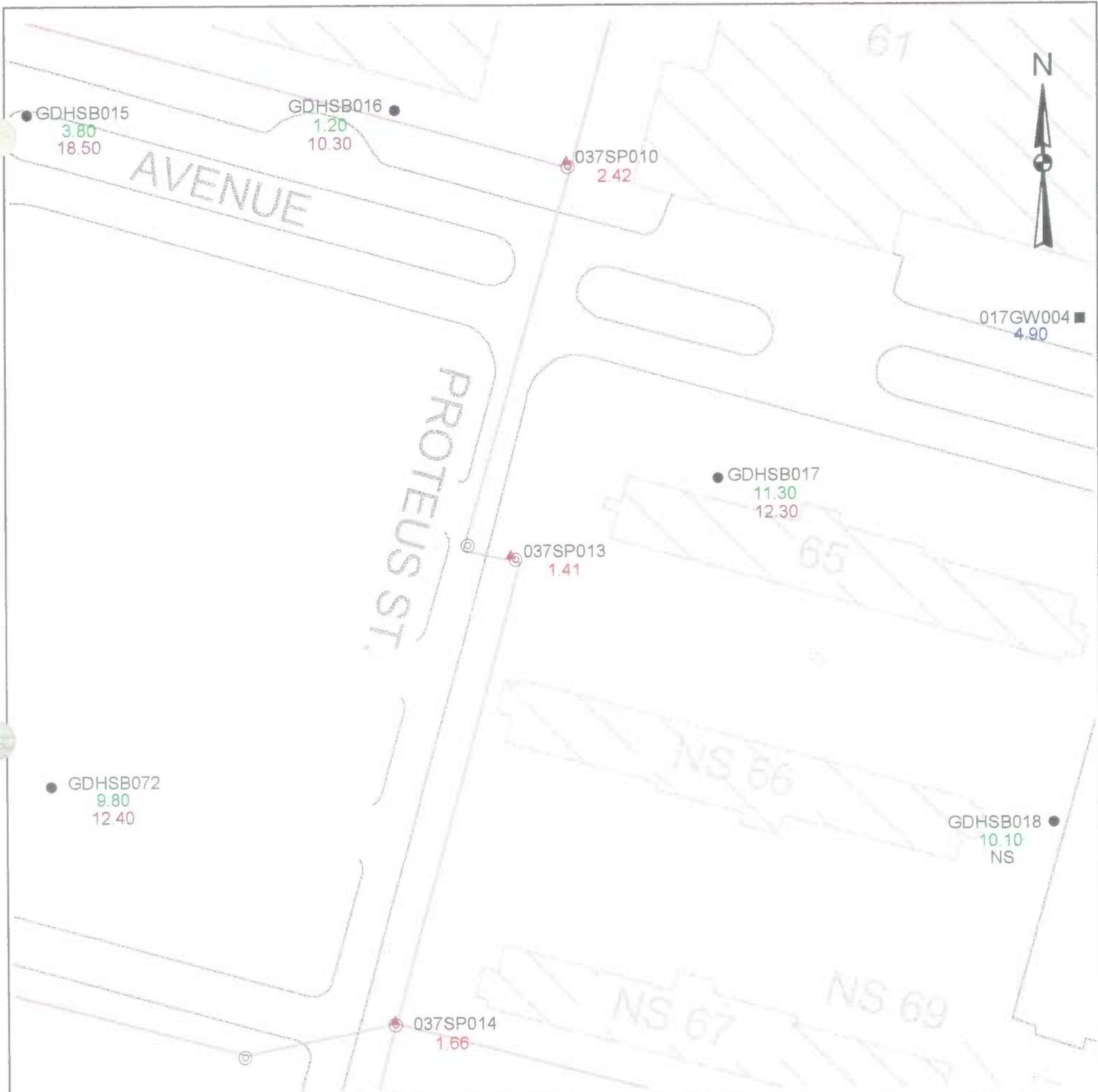


ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.24
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

60 0 60 120 Feet

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

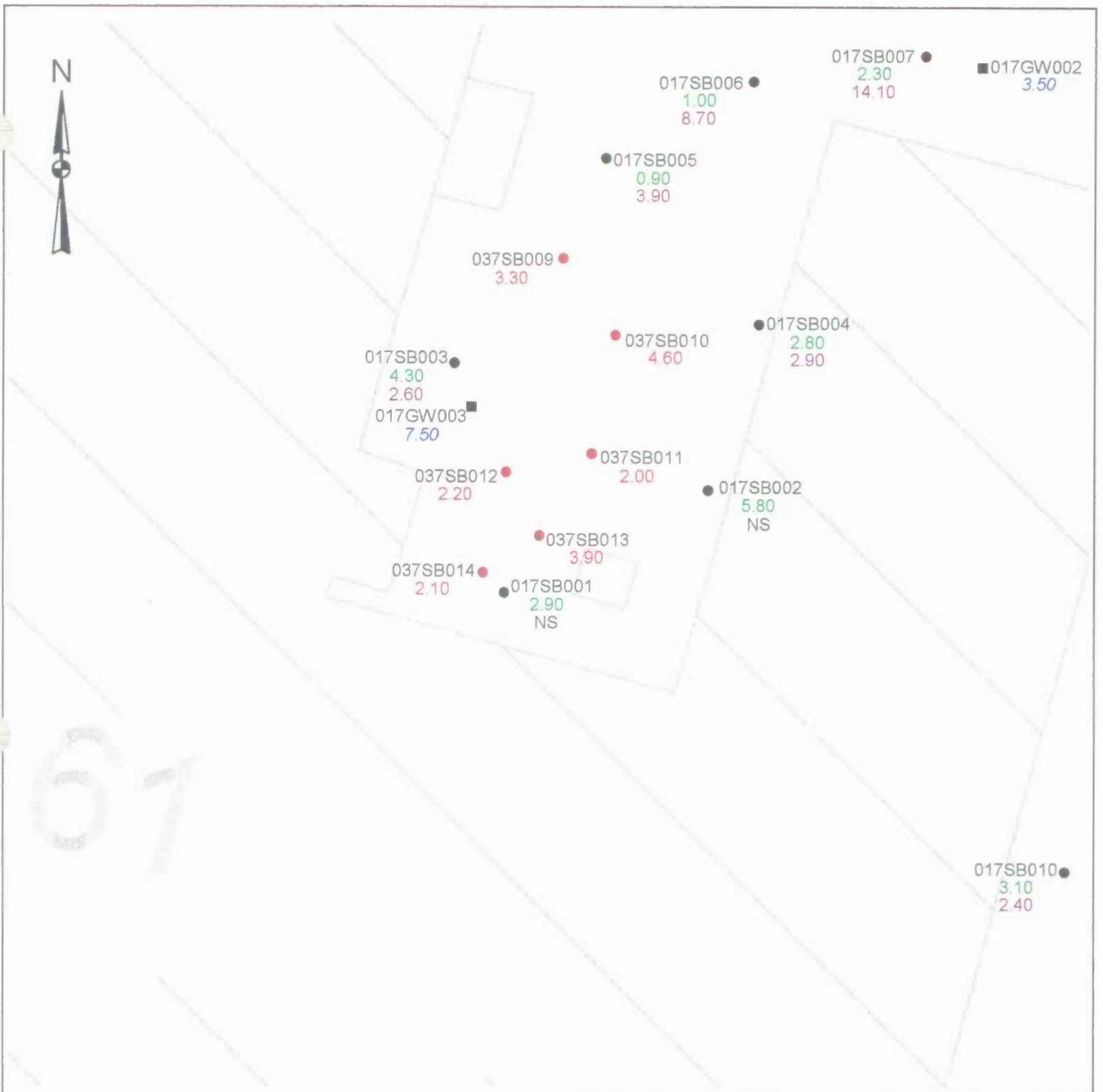
- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.25
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

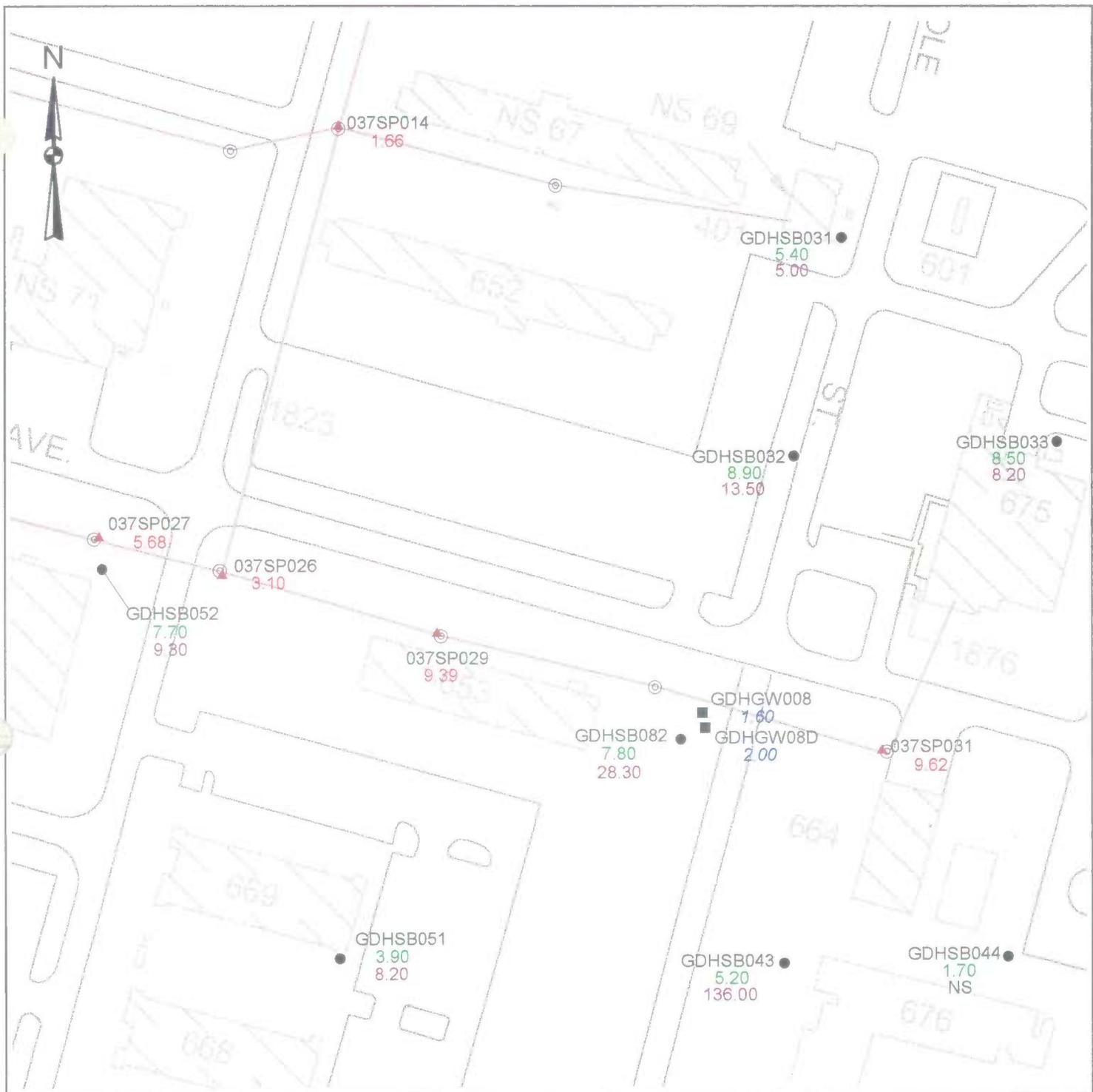
20 0 20 40 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.26
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
 - ZONE L SOIL BORING LOCATION
 - 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
 - 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
 - MONITORING WELL LOCATION
 - 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
 - ZONE H SOIL BORING LOCATION
 - 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
 - 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
 - ND NOT DETECTED
 - NS NO SAMPLE TAKEN
 - SUBZONE BOUNDARY
 - RAILROAD
 - ⊙ MANHOLE
 - SANITARY SEWER LINE
 - STORM SEWER LINE
- 100 0 100 200 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.27
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

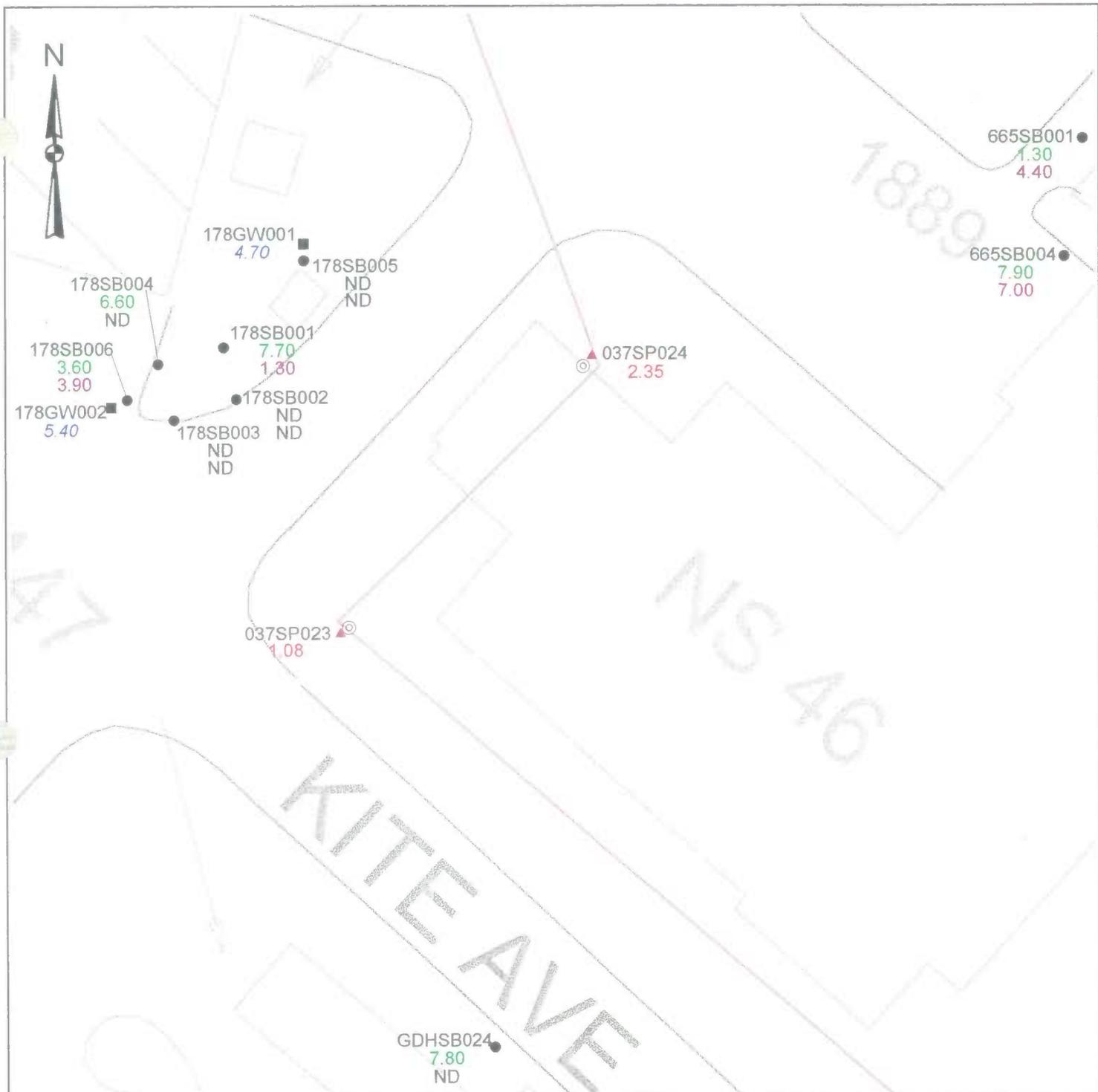
- ▲ ZONE L DPT SOIL LOCATION
 - ZONE L SOIL BORING LOCATION
 - 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
 - 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
 - MONITORING WELL LOCATION
 - 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
 - ZONE H SOIL BORING LOCATION
 - 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
 - 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
 - ND NOT DETECTED
 - NS NO SAMPLE TAKEN
 - SUBZONE BOUNDARY
 - RAILROAD
 - ⊙ MANHOLE
 - SANITARY SEWER LINE
 - STORM SEWER LINE
- 40 0 40 80 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.28
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

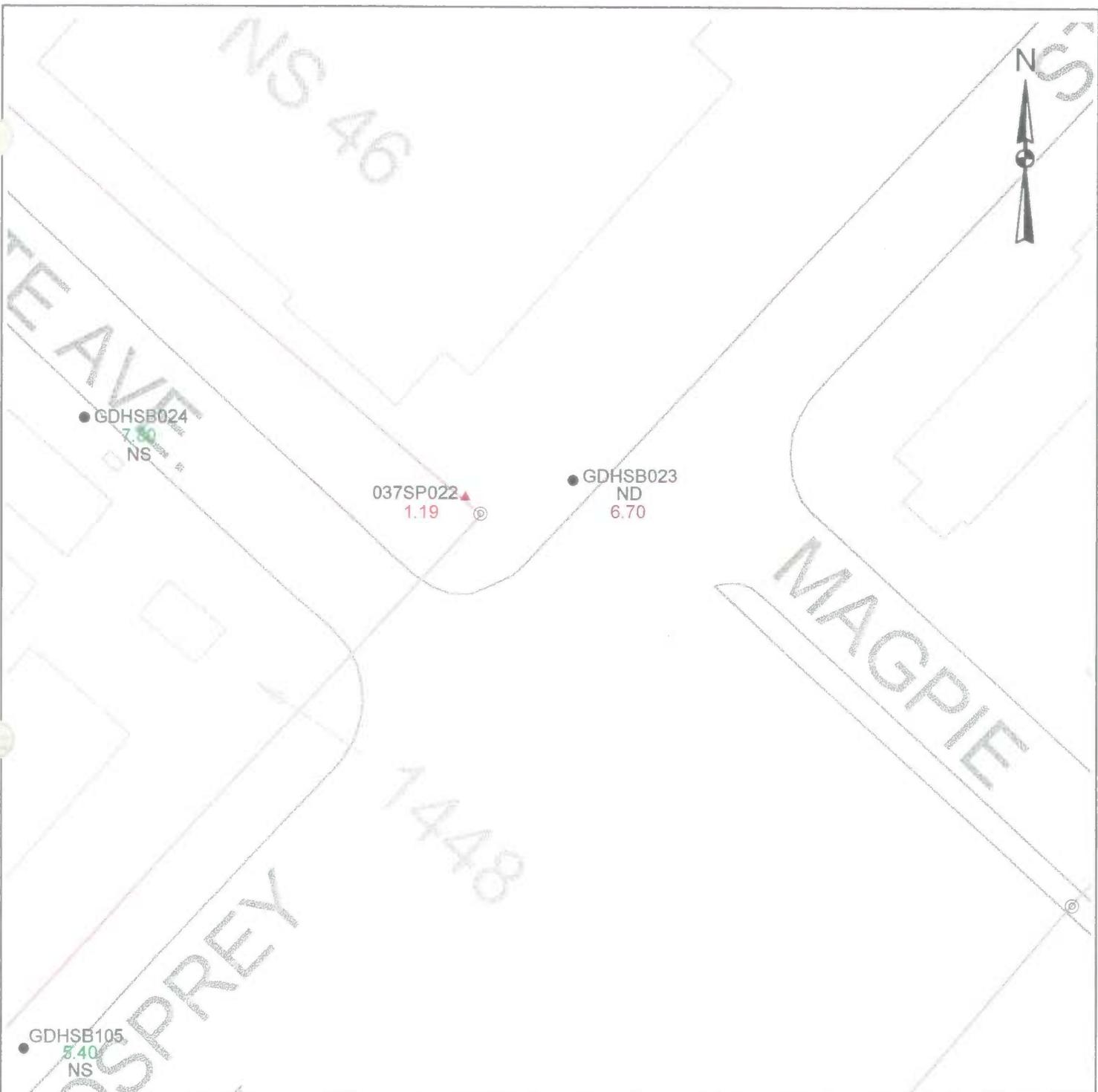
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- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.29
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

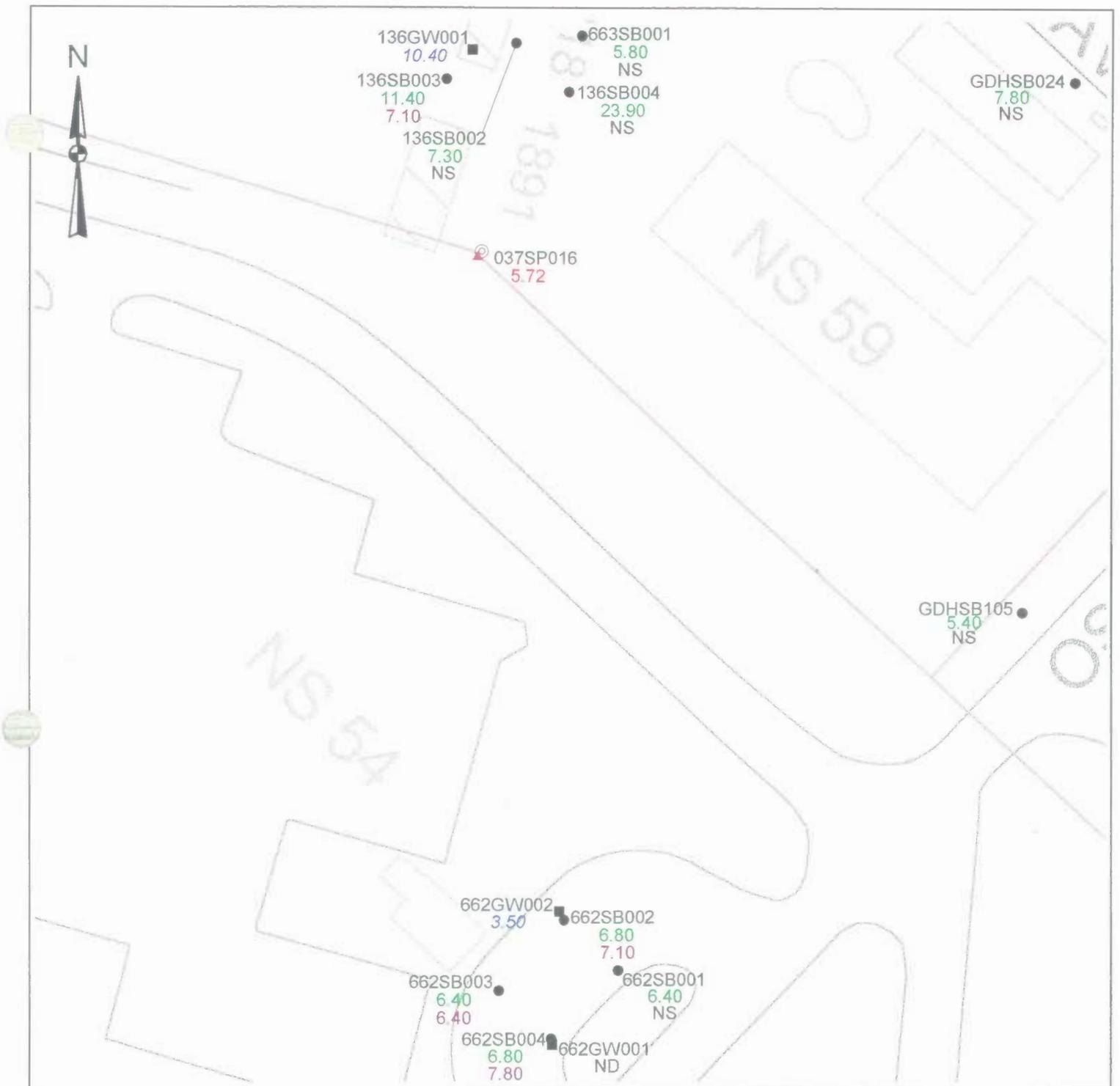
- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.30
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

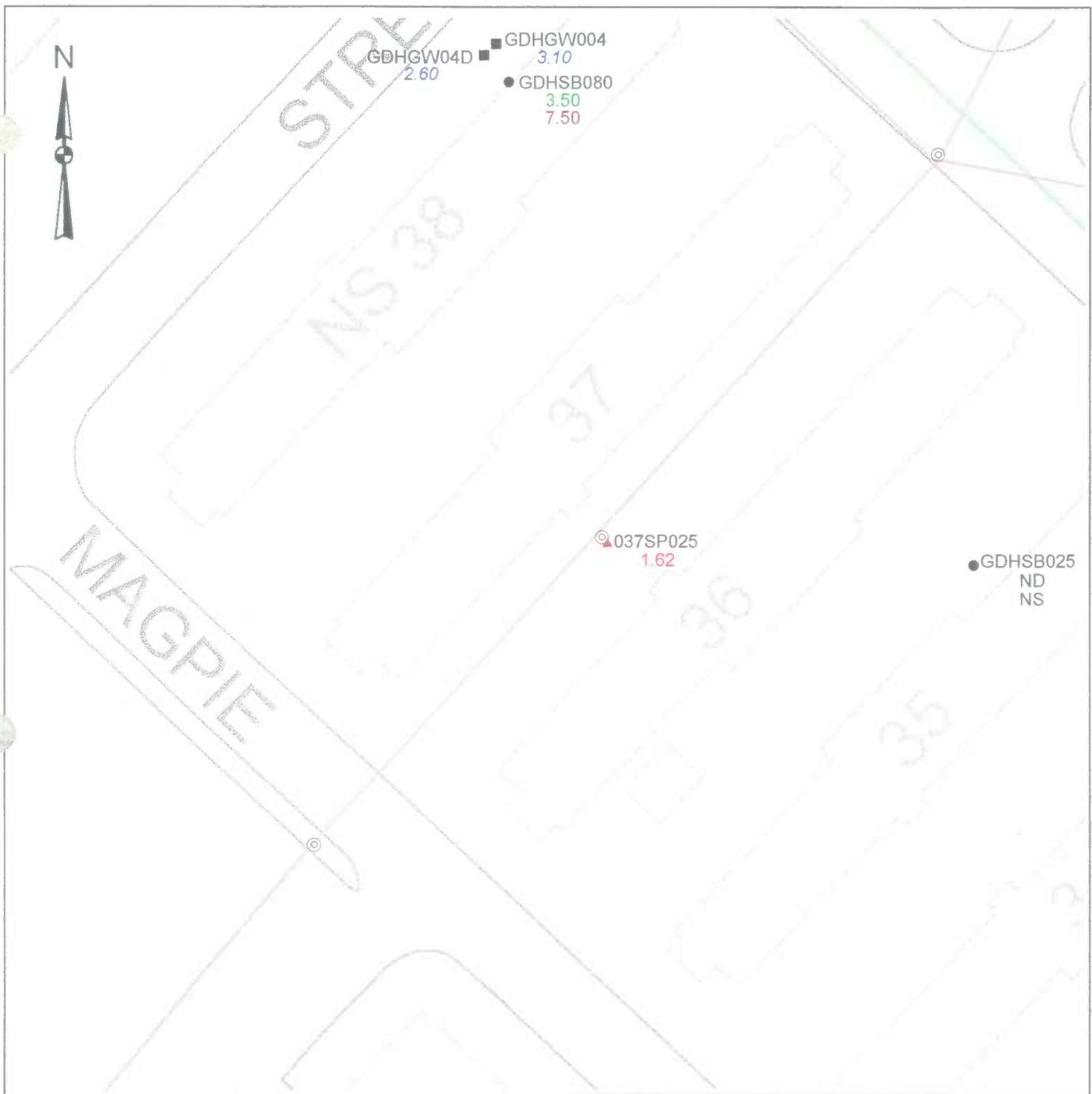
- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.31
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

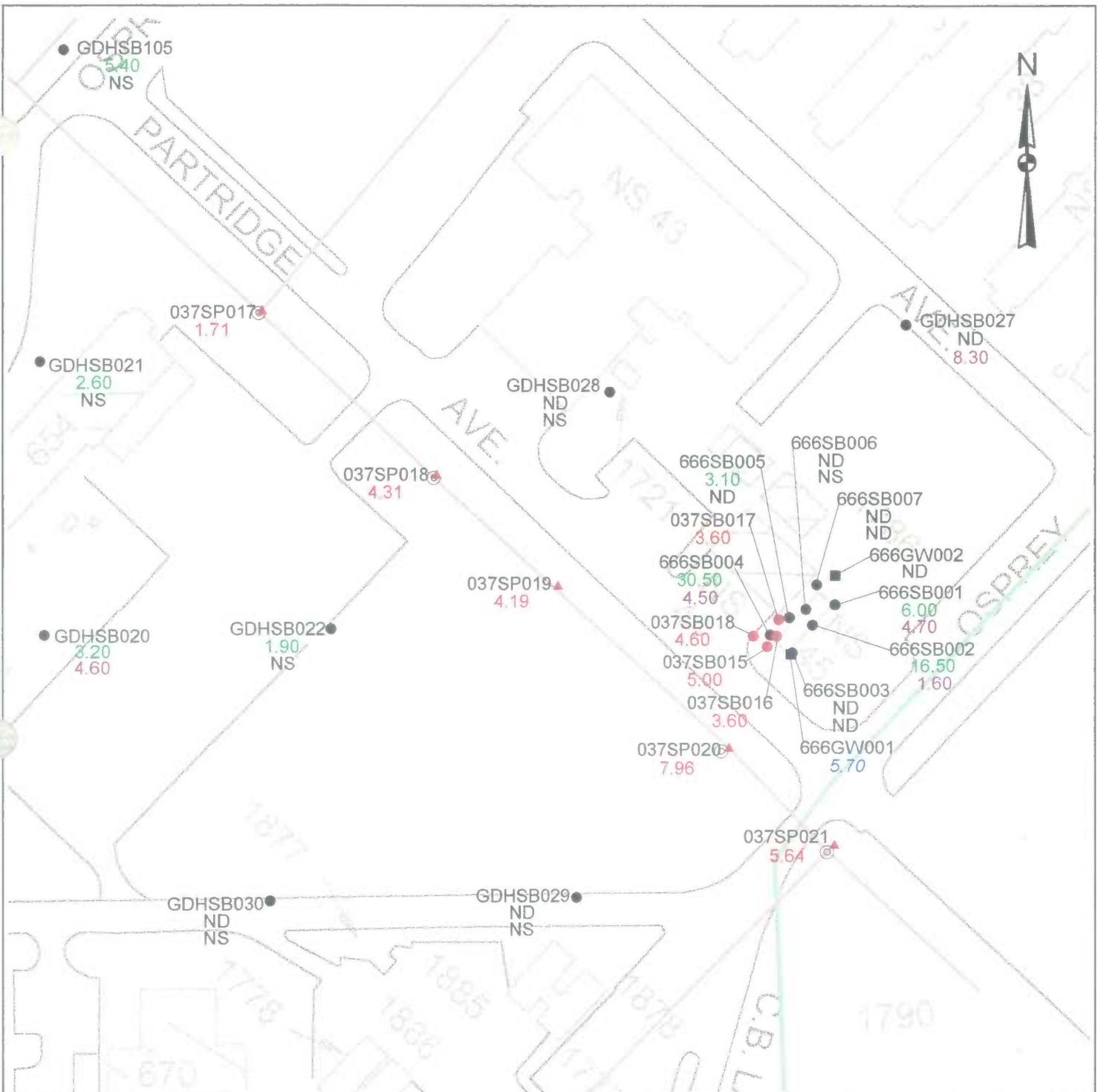
50 0 50 100 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.32
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ▬ SUBZONE BOUNDARY
- ▬ RAILROAD
- ⊙ MANHOLE
- ▬ SANITARY SEWER LINE
- ▬ STORM SEWER LINE

100 0 100 200 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.33
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



1984



014GW04D ■
4.00

014GW004 ■
3.60

684SB008 ●
1.90
5.10

684SB001 ●
ND
5.00

037SB020 ● ■ 037GW003
1.70 ND

684SB012 ●
0.89
NS

684SB011 ●
1.40
3.10

684SB007 ●
9.00
2.00

684SB002 ●
ND
7.00

684SB013 ●
2.80
2.20

684SB010 ●
5.20
NS

684SB006 ●
ND
4.50

684SB003 ●
8.50
ND

LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

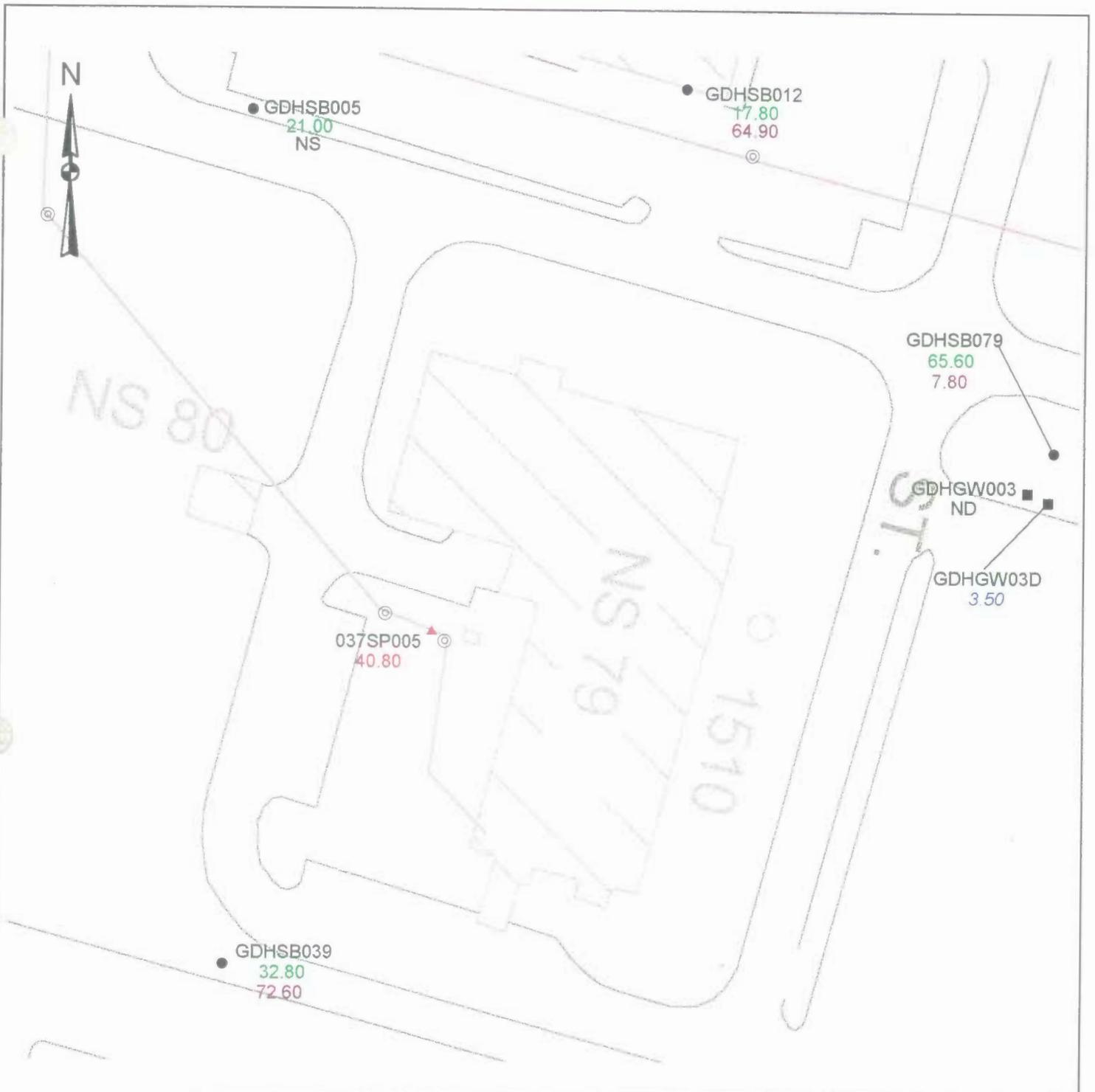
20 0 20 40 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.34
ZONE L - SUBZONE H
ARSENIC
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ▬ SUBZONE BOUNDARY
- ▬ RAILROAD
- ⊙ MANHOLE
- ▬ SANITARY SEWER LINE
- ▬ STORM SEWER LINE

60 0 60 120 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.35
ZONE L - SUBZONE H
CHROMIUM
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=39.0 mg/kg SSL=19.0 mg/kg MCL=100 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION

- SUBZONE BOUNDARY
- SANITARY SEWER LINE
- RAILROAD
- STORM SEWER LINE
- MANHOLE

600 0 600 1200 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.36
ZONE L - SUBZONE H
MANGANESE
ZONE L EXCEEDANCES

RBC=160 mg/kg SSL=480 mg/kg MCL=NONE



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

SUBZONE BOUNDARY
 RAILROAD
 © MANHOLE
 SANITARY SEWER LINE
 STORM SEWER LINE

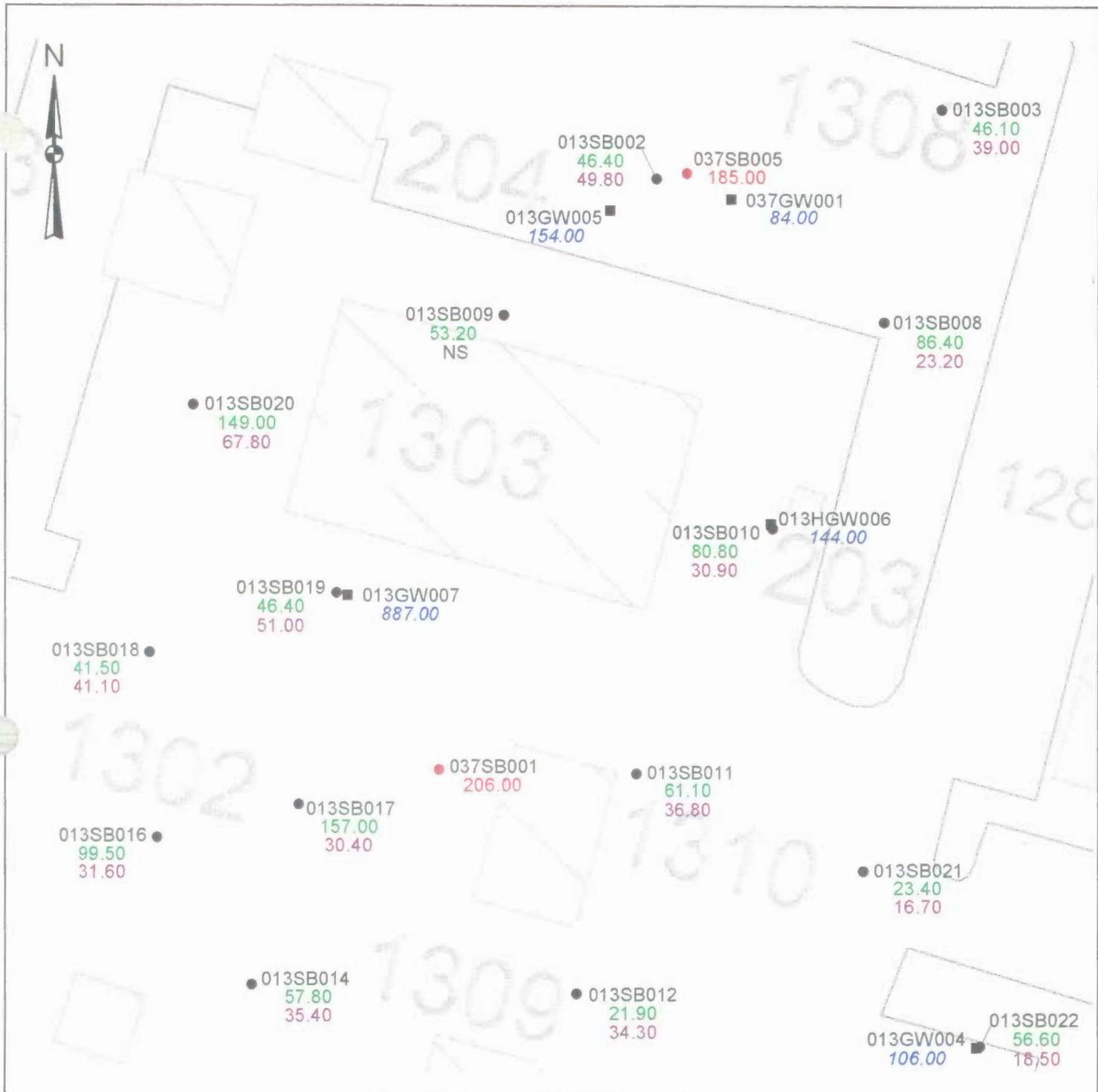
60 0 60 120 Feet



ZONE L - RCRA
 FACILITY INVESTIGATION
 NAVAL BASE CHARLESTON
 CHARLESTON, SC

FIGURE 10.8.37
 ZONE L - SUBZONE H
 MANGANESE
 ZONE L EXCEEDANCES WITH ZONE H
 SOIL AND GW CONCENTRATIONS

RBC=160 mg/kg SSL=480 mg/kg MCL=NONE



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- ⊗ SUBZONE BOUNDARY
- ⊗ RAILROAD
- ⊗ MANHOLE
- ⊗ SANITARY SEWER LINE
- ⊗ STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.38
ZONE L - SUBZONE H
MANGANESE
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=160 mg/kg SSL=480 mg/kg MCL=NONE



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.39
ZONE L - SUBZONE H
MANGANESE
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=160 mg/kg SSL=480 mg/kg MCL=NONE





LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- MONITORING WELL LOCATION

- SUBZONE BOUNDARY
- SANITARY SEWER LINE
- RAILROAD
- STORM SEWER LINE
- ⊙ MANHOLE

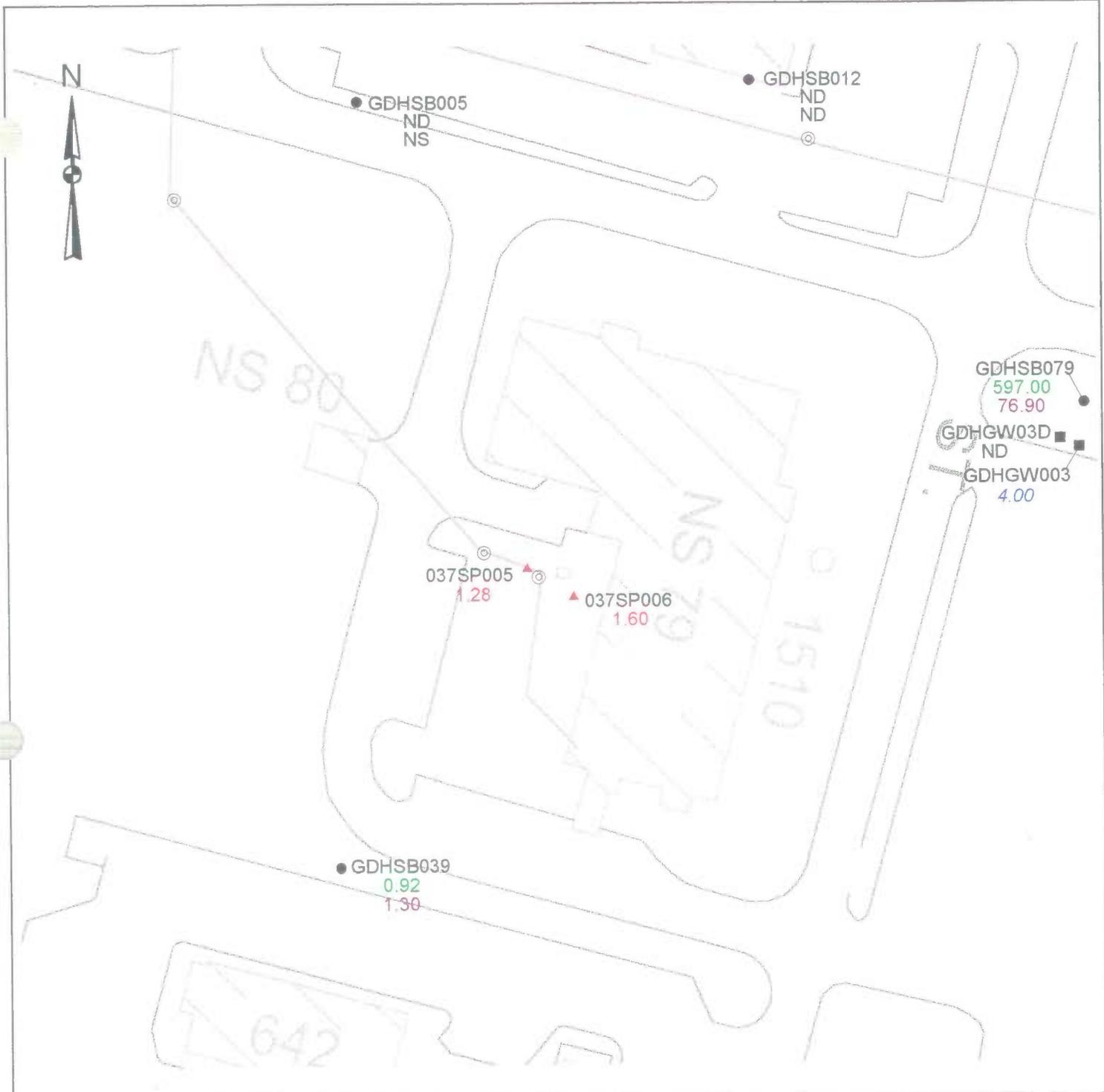
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ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.40
ZONE L - SUBZONE H
THALLIUM
ZONE L EXCEEDANCES

RBC=0.55 mg/kg SSL=0.36 mg/kg MCL=2.00 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

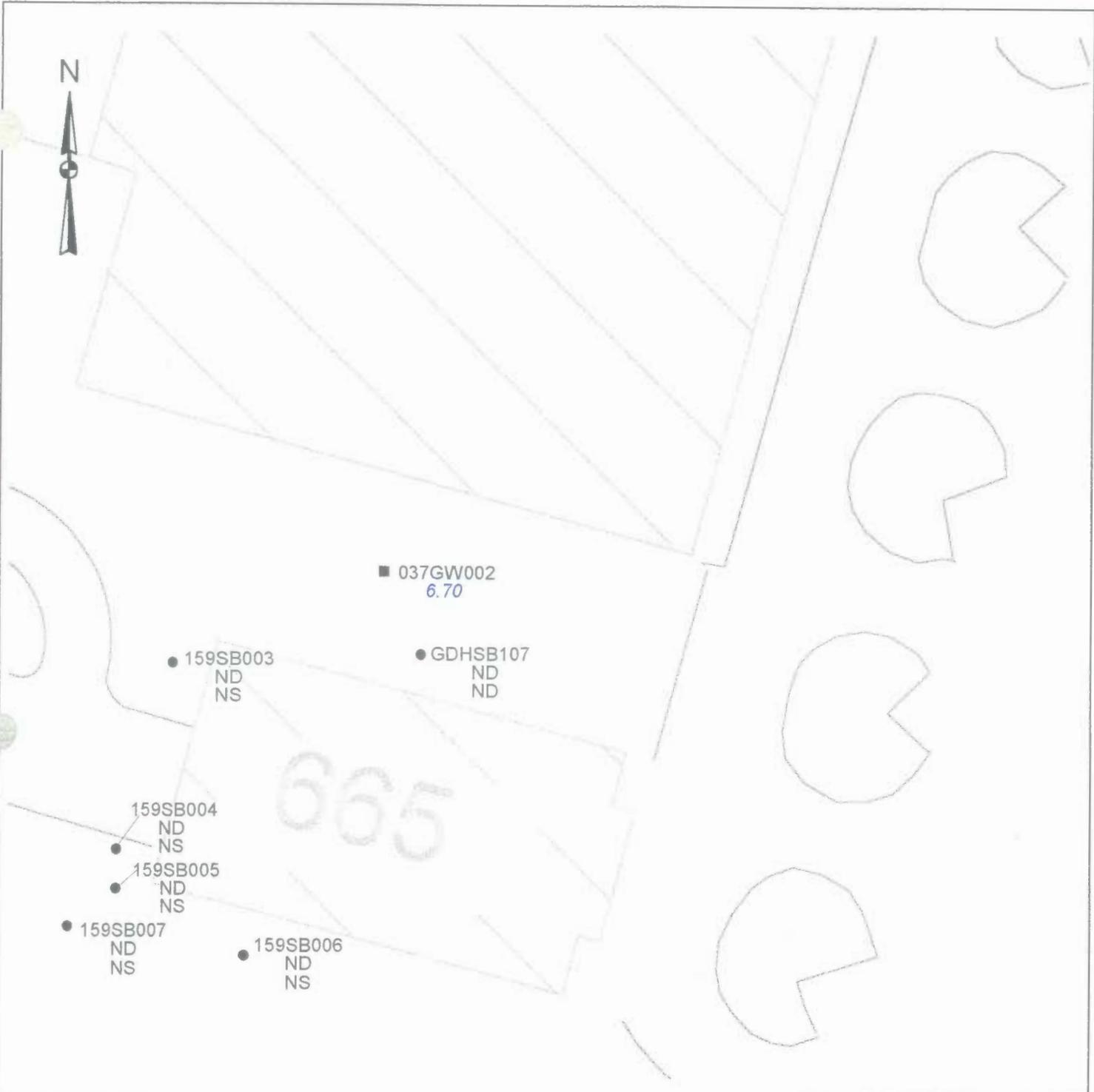
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ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.41
ZONE L - SUBZONE H
THALLIUM
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.55 mg/kg SSL=0.36 mg/kg MCL=2.00 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

30 0 30 60 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.42
ZONE L - SUBZONE H
THALLIUM
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.55 mg/kg SSL=0.36 mg/kg MCL=2.00 ug/L

013SB019 ● 013GW007
 ND ND
 ND ND



● 037SB001
 0.95

● 013SB011
 ND ND

● 013SB017
 ND ND

● 013SB014
 ND ND

● 013SB012
 ND ND

LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ▲ SUBZONE BOUNDARY
- ▲ RAILROAD
- ◎ MANHOLE
- ▲ SANITARY SEWER LINE
- ▲ STORM SEWER LINE

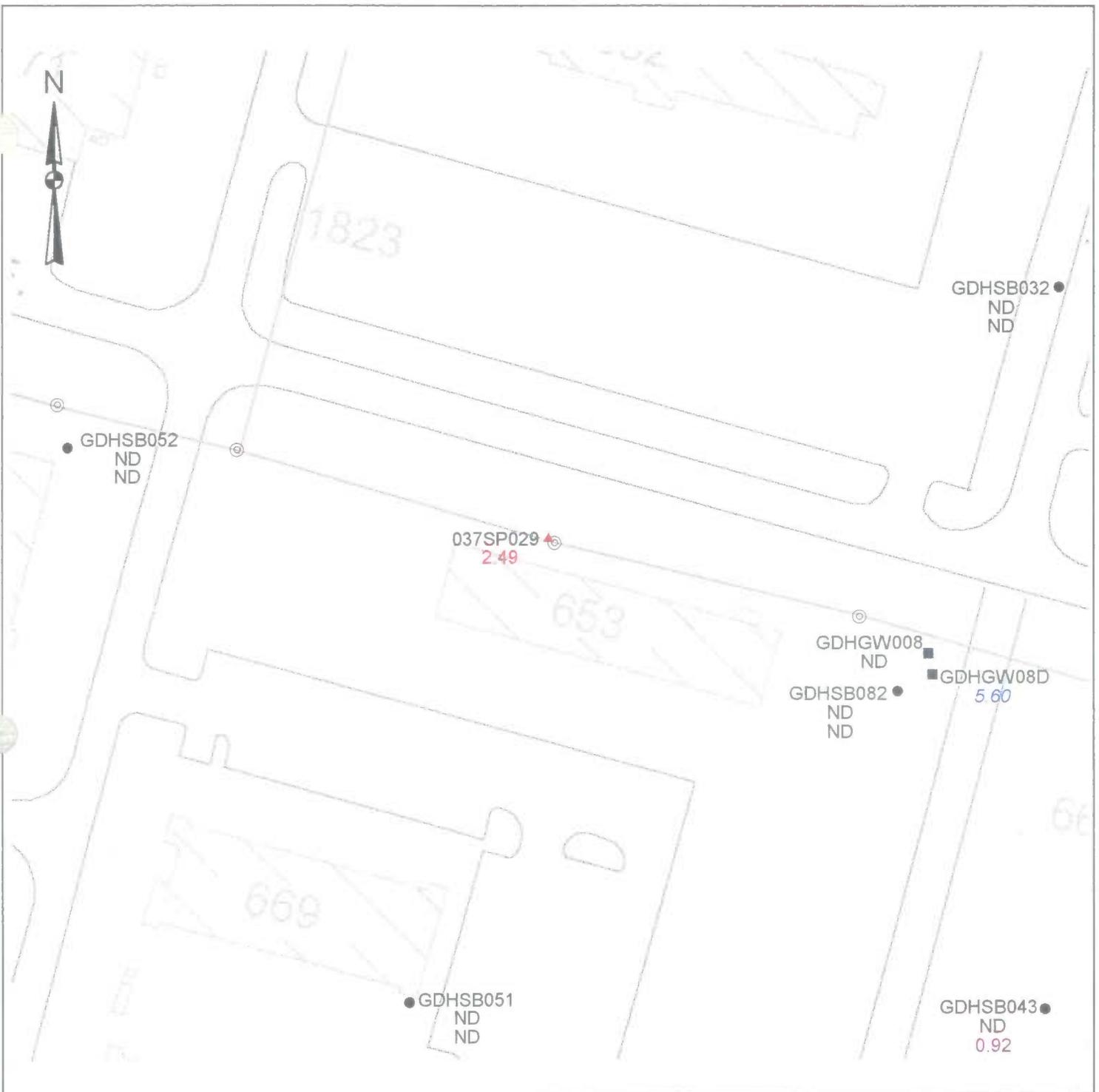
10 0 10 20 Feet



ZONE L - RCRA
 FACILITY INVESTIGATION
 NAVAL BASE CHARLESTON
 CHARLESTON, SC

FIGURE 10.8.43
 ZONE L - SUBZONE H
 THALLIUM
 ZONE L EXCEEDANCES WITH ZONE H
 SOIL AND GW CONCENTRATIONS

RBC=0.55 mg/kg SSL=0.36 mg/kg MCL=2.00 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

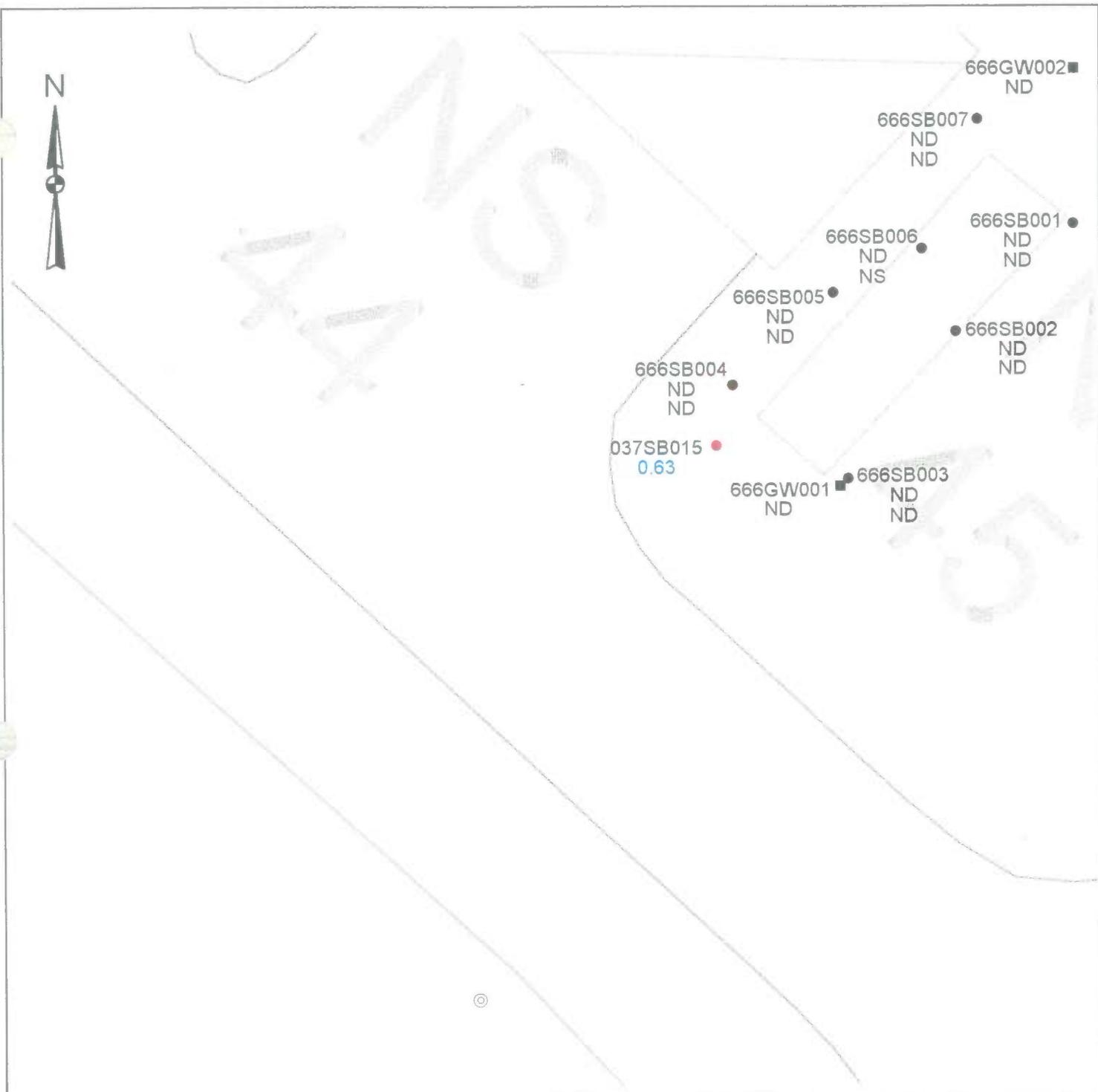
- SUBZONE BOUNDARY
- RAILROAD
- MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.44
ZONE L - SUBZONE H
THALLIUM
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.55 mg/kg SSL=0.36 mg/kg MCL=2.00 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE



ZONE L - RCRA
 FACILITY INVESTIGATION
 NAVAL BASE CHARLESTON
 CHARLESTON, SC

FIGURE 10.8.45
 ZONE L - SUBZONE H
 THALLIUM
 ZONE L EXCEEDANCES WITH ZONE H
 SOIL AND GW CONCENTRATIONS

RBC=0.55 mg/kg SSL=0.36 mg/kg MCL=2.00 ug/L

20 0 20 40 Feet



1984



014GW04D ■
22.40

014GW004 ■
ND

684SB008 ●
0.09
0.14

684SB001 ●
ND
ND

037GW003 ■
8.40

684SB011 ●
ND
0.86

684SB007 ●
ND
0.09

684SB002 ●
ND
ND

684SB012 ●
ND
NS

684SB013 ●
ND
ND

684SB010 ●
0.07
NS

684SB006 ●
ND
ND

684SB003 ●
ND
ND

LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

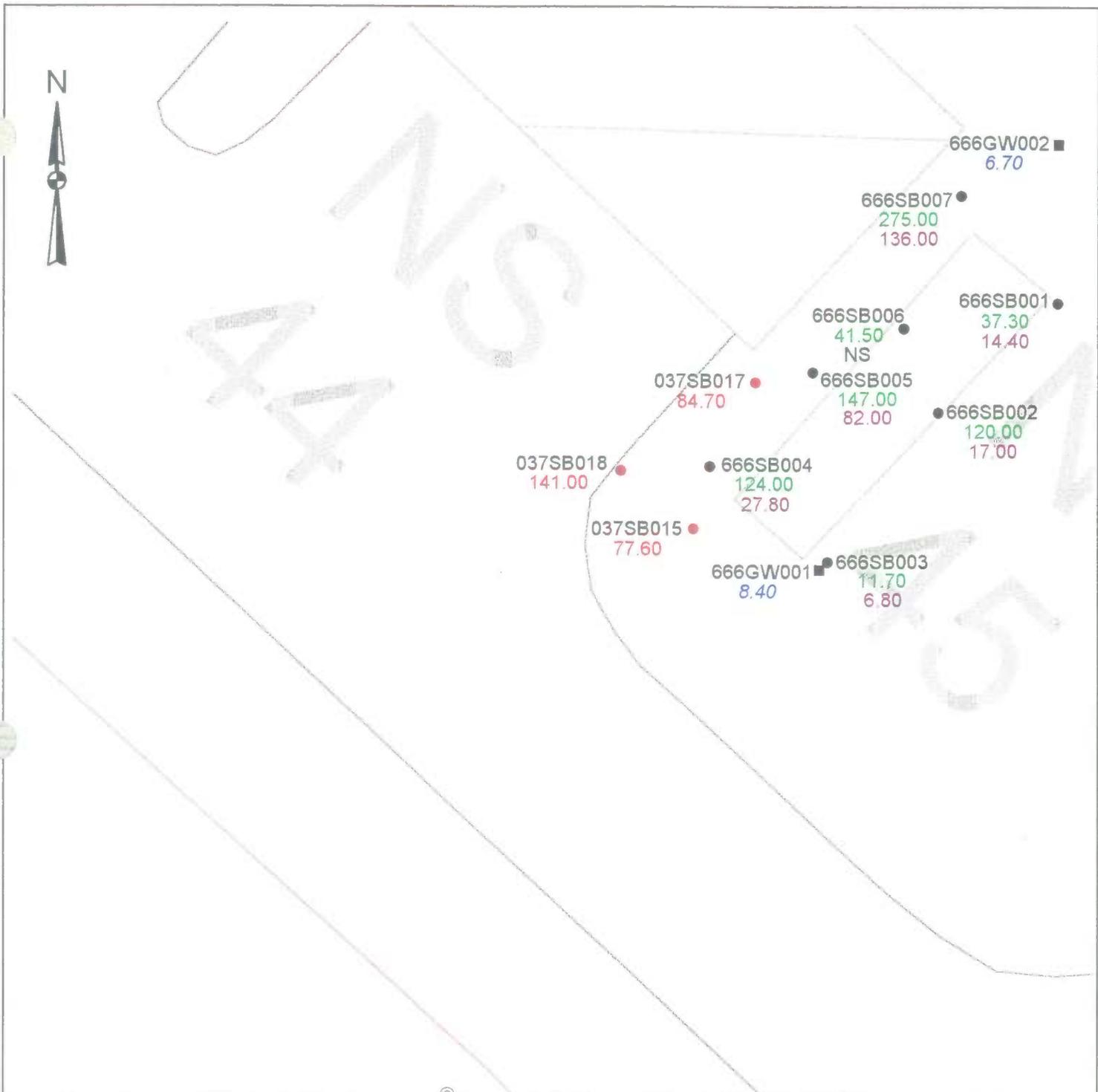
- ▭ SUBZONE BOUNDARY
- ▭ RAILROAD
- ⊙ MANHOLE
- ▭ SANITARY SEWER LINE
- ▭ STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.46
ZONE L - SUBZONE H
THALLIUM
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=0.55 mg/kg SSL=0.36 mg/kg MCL=2.00 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H SOIL BORING LOCATION
- 12.30 ZONE H SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- ▬ SUBZONE BOUNDARY
- ▬ RAILROAD
- ⊙ MANHOLE
- ▬ SANITARY SEWER LINE
- ▬ STORM SEWER LINE

20 0 20 40 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.8.47
ZONE L - SUBZONE H
VANADIUM
ZONE L EXCEEDANCES WITH ZONE H
SOIL AND GW CONCENTRATIONS

RBC=55.0 mg/kg SSL=3000 mg/kg MCL=NONE

10.9 Subzone I

The boundaries of Subzone I for the Zone L RFI are the areas investigated in the Zone I RFI. Data from the samples collected during the Zone I investigation have been compared to data collected for the Zone L investigation. Zone I sampling locations are presented in Figures 10.9.1 and 10.9.2.

10.9.1 Subzone I, SWMU 37

Sampling at Subzone I SWMU 37 consisted of one shallow monitoring well, five upper- (0-1') and two lower- (3-5') interval soil boring samples collected using a hand auger, and five soil and 12 groundwater samples collected using DPT. Shallow monitoring well groundwater and hand augured soil samples were analyzed for VOCs, SVOCs, chlorinated pesticides, PCBs, metals and cyanide. DPT samples were analyzed for VOCs, metals, and cyanide. The locations of the samples collected for Subzone I are presented in Figures 10.9.3 and 10.9.4.

10.9.1.1 Nature of Contamination in Subzone I, SWMU 37, DPT Soil

No organic compounds were detected in Subzone I DPT soils. Inorganic analytical results are summarized in Table 10.9.1. Appendix C contains the complete data report for all samples collected in Zone L.

Metals/Cyanide Detected in DPT Soil

As summarized in Table 10.9.1, arsenic (5/5), chromium (1/5), and iron (5/5) exceeded the RBC value, and chromium (5/5) exceeded the SSL value. The locations of the exceedances are summarized in Table 10.9.2.



LEGEND:

- 690SB022 ● SOIL BORING W/ ID NUMBER
- I STUDY ZONE BOUNDARY WITH LETTER DESIGNATION



REVISIONS			
Rev Number	Rev Date	Rev By	Rev By

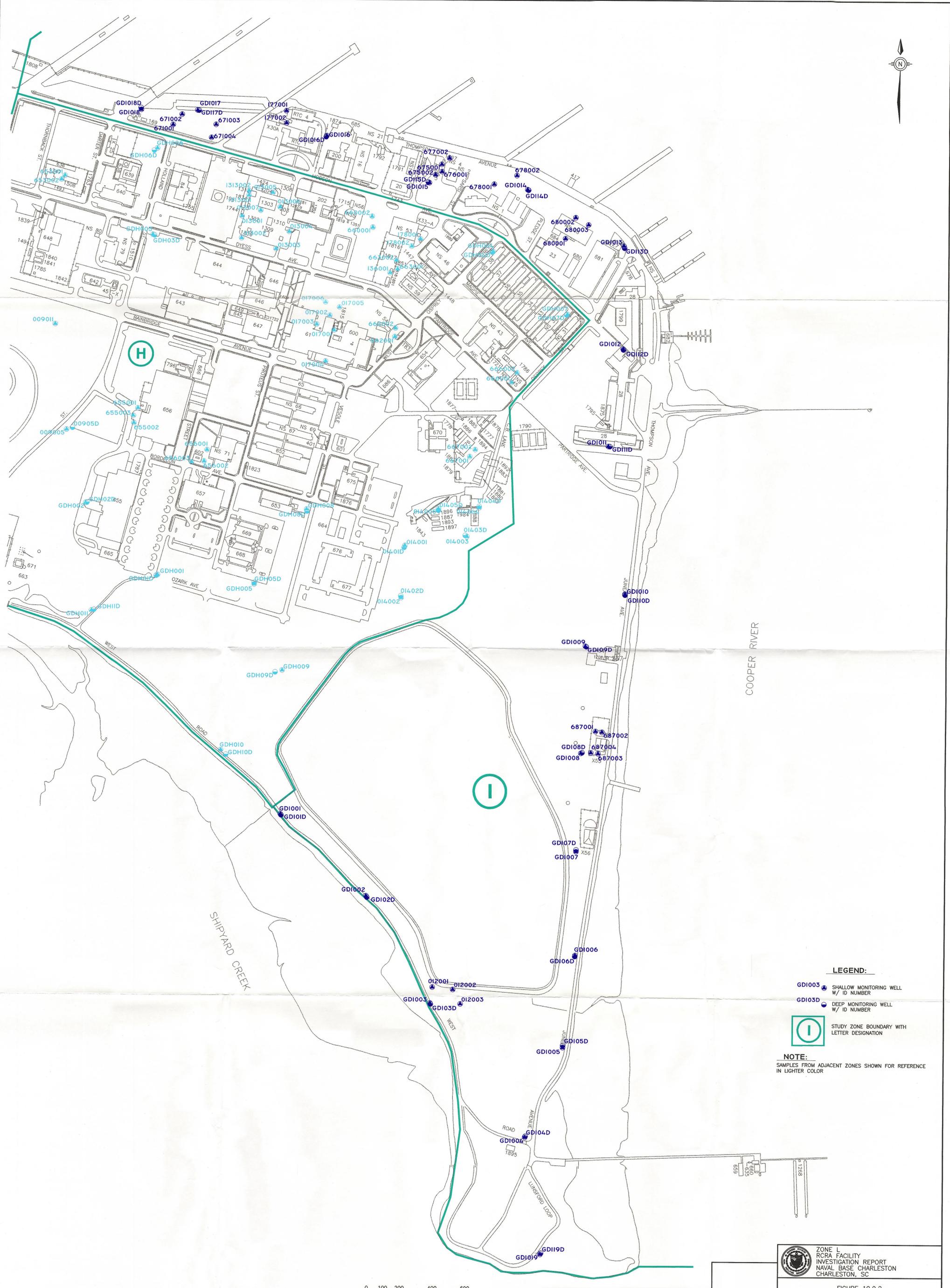


ZONE I
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CHARLESTON, SC

FIGURE 10.9.1
ZONE I SOIL BORING LOCATIONS

Dr by: W. FAULK	Tr by: -
Chk by: C. VERNON	Appr by: T. HAVERKOST
Date: 11/25/98	DWG Name: 2912C103

Sheet 1
of 1



LEGEND:

- GDI003 ● SHALLOW MONITORING WELL W/ ID NUMBER
- GDI03D ● DEEP MONITORING WELL W/ ID NUMBER



STUDY ZONE BOUNDARY WITH LETTER DESIGNATION

NOTE:
SAMPLES FROM ADJACENT ZONES SHOWN FOR REFERENCE IN LIGHTER COLOR



REVISIONS		
Rev Number:	Rev Date:	Rev By:
Rev Number:	Rev Date:	Rev By:
Rev Number:	Rev Date:	Rev By:

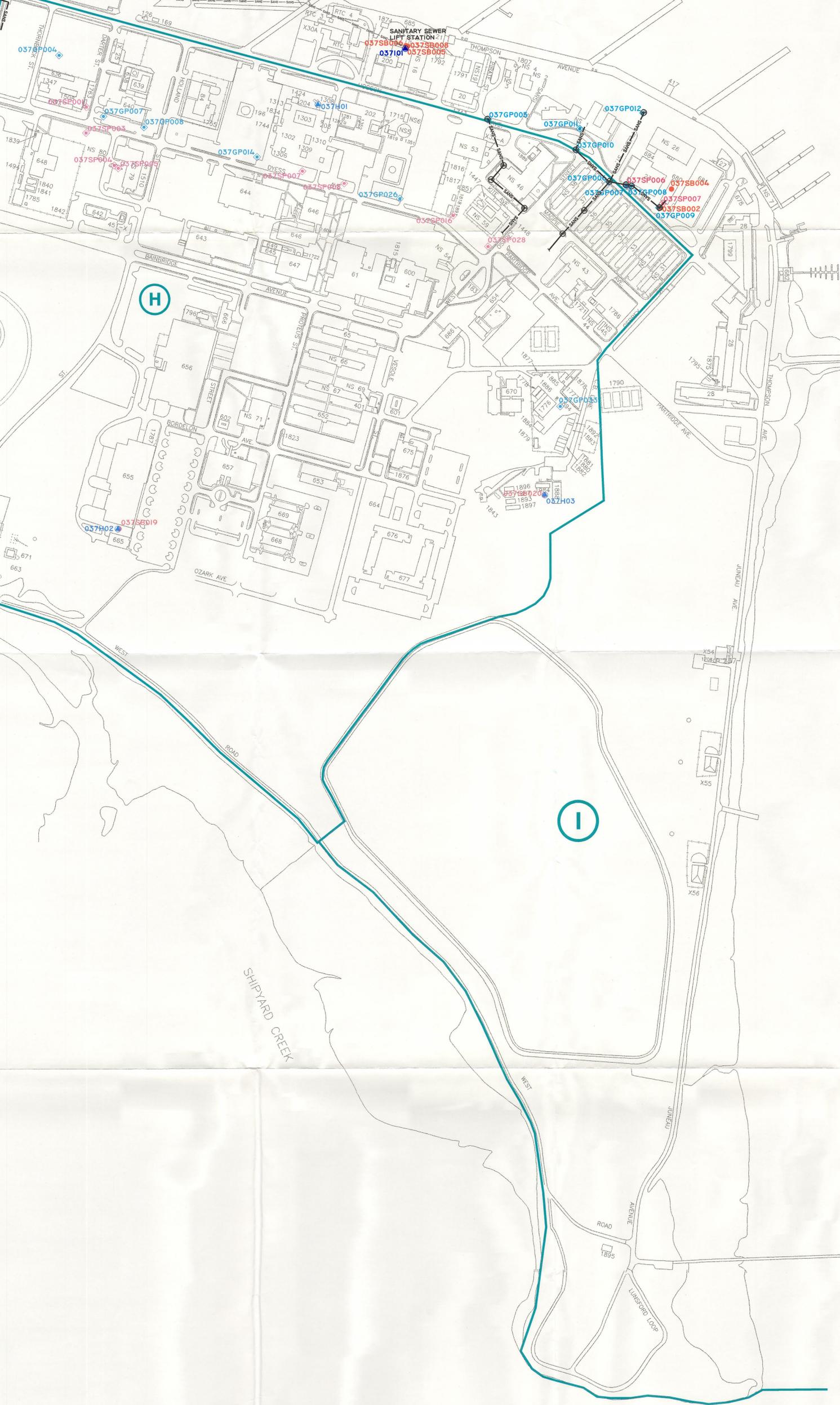


ZONE I
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FIGURE 10.9.2
ZONE I MONITORING WELL LOCATIONS



EXISTING SANITARY SEWER MAIN (SHOWN AS "NOT TO BE INVESTIGATED" ON THE ZONE L WORK PLAN) IS INCLUDED ON THIS PLAN FOR GENERAL INFORMATION ONLY



COOPER RIVER

SHIPYARD CREEK

LEGEND:

- 037H01 SHALLOW MONITORING WELL W/ ID NUMBER
- 037SB002 SOIL BORING W/ ID NUMBER
- 037GP005 DPT GROUNDWATER SAMPLE W/ ID NUMBER
- ◆ 037SP007 DPT SOIL SAMPLE W/ ID NUMBER
- ⊙ SANITARY SEWER MANHOLE
- SANS — SANITARY SEWER LINE
- I STUDY ZONE BOUNDARY WITH LETTER DESIGNATION

NOTE:
SAMPLES FROM ADJACENT ZONES SHOWN FOR REFERENCE IN LIGHTER COLOR

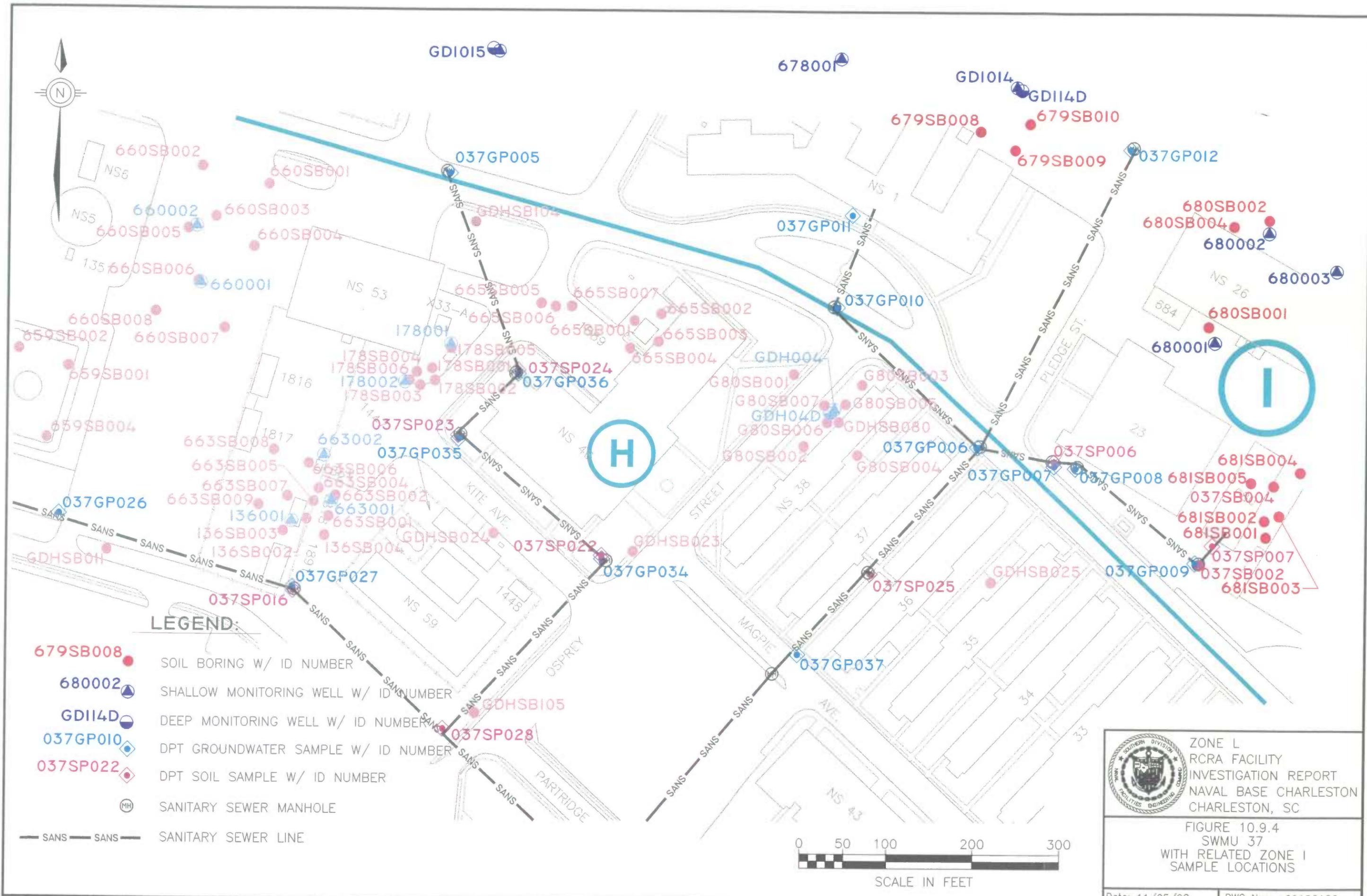
ZONE L
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INVESTIGATION REPORT
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CHARLESTON, SC

FIGURE 10.9.3
SWMU 37 (SANITARY SEWER SYSTEM)
SAMPLING LOCATIONS
SUBZONE I

Dr by: W. FAULK Tr by: —
Ck by: C. VERNY Appr by: T. HAVERKOST
Date: 11/25/98 DWG Name: 2912C105 Sheet 1 of 1

REVISIONS		
Rev Number:	Rev Date:	Rev By:

0 100 200 400 600
SCALE IN FEET



LEGEND:

- 679SB008 SOIL BORING W/ ID NUMBER
- ▲ 680002 SHALLOW MONITORING WELL W/ ID NUMBER
- GDII4D DEEP MONITORING WELL W/ ID NUMBER
- ◆ 037GP010 DPT GROUNDWATER SAMPLE W/ ID NUMBER
- ◆ 037SP022 DPT SOIL SAMPLE W/ ID NUMBER
- H SANITARY SEWER MANHOLE
- SANS — SANS — SANITARY SEWER LINE





ZONE L
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NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.4
SWMU 37
WITH RELATED ZONE I
SAMPLE LOCATIONS

Date: 11/25/98 DWG Name: 2912C106

Table 10.9.1
SWMU 37, Zone L, Subzone I
Inorganic Detections for DPT Soil

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Reference Conc.	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Inorganic Elements (mg/kg)								
Cyanide (CN)	1/5	0.37	0.37	160	ND	0	20	NO
Aluminum (Al)	5/5	5470-6600	5864	7800	27400	0	560000 c	NO
Arsenic (As)	5/5	2.40-5.34	3.69	0.430	21.6	5	15	NO
Barium (Ba)	5/5	10.5-26.3	17.5	550	54.2	0	820	NO
Beryllium (Be)	5/5	0.240-0.510	0.360	16.0	0.95	0	32	NO
Cadmium (Cd)	1/5	0.42	0.42	7.80	0.61	0	4	NO
Calcium (Ca)	5/5	3000-141000	54880	NA	NA	NA	NA	NO
Chromium (Cr)	5/5	10.6-51.9	22.1	39.0	34.5	1	19	YES
Cobalt (Co)	5/5	0.630-1.09	0.888	470	5.8	0	990 c	NO
Copper (Cu)	5/5	5.52-13.2	9.74	310	240	0	5600 c	NO
Iron (Fe)	5/5	3650-5470	4520	2300	NA	5	NA	NO
Lead (Pb)	5/5	7.25-23.4	14.4	400	203	0	400	NO
Magnesium (Mg)	5/5	703-5690	2115	NA	NA	NA	NA	NO
Manganese (Mn)	5/5	20.3-93.6	54.3	160	419	0	480 c	NO
Mercury (Hg)	2/5	0.050-0.070	0.060	NA	0.47	NA	1	NO
Nickel (Ni)	5/5	4.42-15.5	7.89	160	23.9	0	65	NO
Potassium (K)	5/5	230-939	453	NA	NA	NA	NA	NO
Selenium (Se)	2/5	0.590-1.13	0.860	39.0	1.49	0	2.6	NO
Sodium (Na)	5/5	220-851	434	NA	NA	NA	NA	NO
Vanadium (V)	5/5	13.3-22.0	17.1	55.0	113	0	3000	NO
Zinc (Zn)	5/5	17.8-36.4	29.1	2300	206	0	6200	NO

Notes:

- mg/kg = Milligrams per kilogram
- RBC = Risk-based concentration
- NA = Not applicable
- ND = Not detected
- GW = Groundwater
- SSL = Soil screening level
- c = Calculated SSL
- Soil to GW = Generic SSLs based on DAF = 10, adapted from *USEPA Soil Screening Guidance: Technical Background Document*, May 1996 (first preference), or calculated using values from Table 6.2 in Zone I RFI Report

Table 10.9.2
SWMU 37, Zone L, Subzone I DPT Soil Sample Locations with
Metal Detections Exceeding RBCs and/or SSLs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	SSL Exceeded (Y/N)	RBC (mg/kg)	SSL (mg/kg)
Arsenic	037SP001	3.31	Y	N		
	037SP005	3.22	Y	N	0.43	15.0
	037SP006	4.16	Y	N		
	037SP007	5.34	Y	N		
	037SP008	2.40	Y	N		
Chromium	037SP005	19.40	N	Y	39.0	19.0
	037SP007	51.90	Y	Y		
	037SP006	32.1	N	Y		
Iron	037SP001	5470	Y	NA	2300	NA
	037SP005	3650	Y	NA		
	037SP006	4730	Y	NA		
	037SP007	4400	Y	NA		
	037SP008	4350	Y	NA		

Notes:
 mg/kg = Milligrams per kilogram
 NA = Not Applicable
 RBC = Risk-based concentration
 SSL = Soil Screening Level

10.9.1.2 Nature of Contamination in Subzone I, SWMU 37, DPT Groundwater

Twelve DPT groundwater samples were collected for analysis of VOCs, metals, and cyanide. Results for detected inorganic chemicals are shown in Table 10.9.3. No organic compounds were detected.

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Metals/Cyanide Detected in DPT Groundwater

Analytical results for inorganic compounds in DPT groundwater samples are presented in Table 10.9.3. As stated in Section 10.0, detection values have not been compared to the RBC or MCL values.

Table 10.9.3
SWMU 37, Zone L, Subzone I
Inorganic Detections for DPT Groundwater

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.
Inorganic Elements (µg/L)			
Cyanide (CN)	1/12	15.6	15.6
Aluminum (Al)	12/12	2980-157000	25787
Arsenic (As)	8/12	14.2-191	57.8
Barium (Ba)	12/12	31.0-242	83.4
Beryllium (Be)	3/12	4.00-6.70	5.23
Calcium (Ca)	12/12	143000-1030000	348083
Chromium (Cr)	12/12	8.60-228	92.9
Cobalt (Co)	5/12	5.00-24.6	11.9
Copper (Cu)	11/12	7.80-117	33.8
Iron (Fe)	12/12	1700-155000	38418
Lead (Pb)	10/12	3.20-168	51.0
Magnesium (Mg)	12/12	3240-227000	71969
Manganese (Mn)	12/12	37.9-2680	612
Mercury (Hg)	1/12	0.260	0.260
Nickel (Ni)	11/12	8.00-90.7	35.1
Potassium (K)	12/12	6190-105000	34699
Selenium (Se)	4/12	6.50-10.2	8.25
Sodium (Na)	12/12	18200-1940000	505175
Thallium (Tl)	1/12	11.6	11.6

Table 10.9.3
SWMU 37, Zone L, Subzone I
Inorganic Detections for DPT Groundwater

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.
Vanadium (V)	12/12	8.90-262	77.3
Zinc (Zn)	11/12	36.2-464	168.5

Notes:
 µg/L = Micrograms per liter

10.9.1.3 Nature of Contamination in Subzone I, SWMU 37, Soil Borings 1
 Five surface and 2 lower interval samples were collected using a hand auger and analyzed for 2
 VOCs, SVOCs, chlorinated pesticides, metals, and cyanide. Analytical results are summarized 3
 in Tables 10.9.4 and 10.9.5. 4

Volatile Organic Compounds Detected in Soil Borings 6
 Three volatile organic compounds were detected in the five surface interval samples. None 7
 exceeded the RBC values. 8

Semivolatile Organic Compounds Detected in Soil Borings 10
 Ten SVOCs were detected in the five surface interval soil boring samples. One detection of 11
 benzo(a)pyrene found at sample location 037SB008 (180 µg/kg) exceeded the RBC value of 12
 88 µg/kg. 13

Chlorinated Pesticides Detected in Soil Borings 15
 None of the seven chlorinated pesticides detected in the five surface interval samples exceeded the 16
 RBC values. 17

Polychlorinated Biphenyls Detected in Soil Borings

No polychlorinated biphenyls were detected in the soil boring samples.

Metals/Cyanide Detected in Soil Borings

Arsenic (3/5), iron (5/5), and manganese (1/5) were detected exceeding the RBC values. None of the detected compounds exceeded the SSL values. The locations of RBC exceedances are summarized in Table 10.9.6.

Table 10.9.4
SWMU 37, Zone L, Subzone I
Organic Compounds Detected in Soil Borings

Compound	Sampling Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Volatile Organic Compounds ($\mu\text{g}/\text{kg}$)								
Tetrachloroethene	Lower	1/2	2.00	2.00	12000	0	30	NO
Toluene	Upper	1/5	3.00	3.00	1600000	0	6000	NO
Xylene (Total)	Upper	1/5	2.00	2.00	16000000	0	70000 c	NO
Semivolatile Compounds ($\mu\text{g}/\text{kg}$)								
B(a)P Equiv.	Upper	2/5	8.03-219	114	88	1	1600 c	NO
Benzo(a)anthracene	Upper	2/5	38.0-120	79.0	880	0	800	NO
Benzo(a)pyrene	Upper	1/5	180	180	88	1	4000	NO
Benzo(b)fluoranthene	Upper	2/5	38.0-140	89.0	880	0	2300	NO
Benzo(g,h,i)perylene	Upper	2/5	39.0-130	85.0	310000	0	12000000 c	NO
Benzo(k)fluoranthene	Upper	2/5	38.0-190	114	8800	0	24000	NO
Chrysene	Upper	2/5	50.0-140	95.0	8800	0	80000	NO
Fluoranthene	Upper	2/5	62.0-210	136	310000	0	2100000	NO
Indeno(1,2,3-cd)pyrene	Upper	1/5	110	110	880	0	7000	NO
Phenanthrene	Upper	1/5	160	160	310000	0	660000 c	NO
Pyrene	Upper	2/5	59.0-210	135	230000	0	2100000	NO

Table 10.9.4
SWMU 37, Zone L, Subzone I
Organic Compounds Detected in Soil Borings

Compound	Sampling Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Chlorinated Pesticides ($\mu\text{g}/\text{kg}$)								
4,4'-DDD	Upper	1/5	9.40	9.40	2700	0	8000	NO
4,4'-DDE	Upper	4/5	12.0-47.0	25.0	1900	0	27000	NO
	Lower	2/2	5.60-23.5	14.6	NA	NA		
4,4'-DDT	Upper	2/5	9.20-20.0	14.6	1900	0	16000	NO
	Lower	1/2	7.20	7.20	NA	NA		
Endrin ketone	Upper	1/5	13.0	13.0	2300	0	500	NO
Heptachlor epoxide	Upper	1/5	17.0	17.0	70	0	330	NO
	Lower	1/2	58.0	58.0	NA	NA		
alpha-Chlordane	Upper	1/5	2.00	2.00	490	0	5000	NO
	Lower	1/2	38.0	38.0	NA	NA		
gamma-Chlordane	Upper	2/5	1.80-4.90	3.35	490	0	5000	NO
	Lower	2/2	3.40-130	66.7	NA	NA		

Notes:

- $\mu\text{g}/\text{kg}$ = Micrograms per kilogram
- RBC = Risk-based concentration
- NA = Not applicable
- GW = Groundwater
- SSL = Soil screening level
- c = Calculated SSL
- Soil to GW = Generic SSLs based on DAF = 10, adapted from *USEPA Soil Screening Guidance: Technical Background Document*, May 1996 (first preference), or calculated using values from Table 6.2 in Zone I RFI Report

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**Table 10.9.5
SWMU 37, Zone L, Subzone I
Inorganic Detections for Soil Borings**

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Reference Conc.	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Inorganic Elements (mg/kg)									
Cyanide (CN)	Upper	2/5	0.360-1.50	0.930	160	ND	0	20	NO
Aluminum (Al)	Upper	5/5	4590-7490	6554	7800	27400	0	560000 c	NO
	Lower	2/2	4555-7630	6093	NA	18900	NA		
Arsenic (As)	Upper	3/5	2.30-4.50	3.10	0.43	21.6	3	15	NO
	Lower	2/2	2.40-4.20	3.30	NA	6.45	NA		
Barium (Ba)	Upper	5/5	10.2-34.5	19.8	550	54.2	0	820	NO
	Lower	2/2	8.70-15.8	12.3	NA	36	NA		
Beryllium (Be)	Upper	4/5	0.360-0.630	0.470	16.0	0.95	0	32	NO
	Lower	2/2	0.310-0.380	0.350	NA	0.67	NA		
Cadmium (Cd)	Upper	5/5	0.090-0.510	0.260	7.80	0.61	0	4	NO
	Lower	2/2	0.270-0.360	0.320	NA	0.54	NA		
Calcium (Ca)	Upper	5/5	1360-190000	82892	NA	NA	NA	NA	NO
	Lower	2/2	12035-24100	18068	NA	NA	NA		
Chromium (Cr)	Upper	5/5	7.90-32.0	15.4	39	34.5	0	19	YES
	Lower	2/2	12.7-22.9	17.8	NA	51.3	NA		
Cobalt (Co)	Upper	5/5	0.570-5.50	3.23	470	5.80	0	990 c	NO
	Lower	2/2	1.50-1.80	1.65	NA	3.48	NA		
Copper (Cu)	Upper	5/5	2.20-10.8	6.68	310	240	0	5600 c	NO
	Lower	2/2	6.15-10.8	8.48	NA	11.5	NA		
Iron (Fe)	Upper	5/5	2570-6570	4774	2300	NA	5	NA	NO
	Lower	2/2	4070-6650	5360	NA	NA	NA		
Lead (Pb)	Upper	5/5	4.20-13.1	8.68	400	203	0	400	NO
	Lower	2/2	7.95-15.9	11.9	NA	12.3	NA		
Magnesium (Mg)	Upper	5/5	313-2060	1108	NA	NA	NA	NA	NO
	Lower	2/2	809-1340	1075	NA	NA	NA		
Manganese (Mn)	Upper	5/5	49.2-319	124.2	160	419	1	480 c	NO
	Lower	2/2	29.6-54.7	42.2	NA	118	NA		

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 Section 10: Site-Specific Evaluations
 Revision: 0

Table 10.9.5
SWMU 37, Zone L, Subzone I
Inorganic Detections for Soil Borings

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Residential RBC	Reference Conc.	Number of Samples Exceeding RBC	Soil to GW SSL	Leaching Potential
Mercury (Hg)	Upper	1/5	0.040	0.040	NA	0.47	NA	1	NO
	Lower	1/2	0.060	0.060	NA	ND	NA		
Nickel (Ni)	Upper	5/5	2.40-12.5	6.32	160	23.9	0	65	NO
	Lower	2/2	4.10-7.00	5.55	NA	15.7	NA		
Potassium (K)	Upper	5/5	169-1140	534	NA	NA	NA	NA	NO
	Lower	2/2	347.5-450	398.8	NA	NA	NA		
Selenium (Se)	Upper	2/5	0.540-0.850	0.700	39	1.49	0	2.6	NO
	Lower	2/2	0.330-0.600	0.470	NA	1.77	NA		
Sodium (Na)	Upper	5/5	146-788	437	NA	NA	NA	NA	NO
	Lower	2/2	244.5-325	284.8	NA	NA	NA		
Tin (Sn)	Upper	1/5	1.50	1.50	4700	7.50	0	5500 c	NO
	Lower	1/2	1.70	1.70	NA	ND	NA		
Vanadium (V)	Upper	5/5	8.30-43.6	18.3	55	113	0	3000	NO
	Lower	2/2	13.0-18.8	15.9	NA	38.1	NA		
Zinc (Zn)	Upper	5/5	14.0-64.2	29.2	2300	206	0	6200	NO
	Lower	2/2	26.9-53.0	39.9	NA	36.2	NA		

Notes:

- mg/kg = Milligrams per kilogram
- RBC = Risk-based concentration
- NA = Not applicable
- ND = Not detected
- GW = Groundwater
- SSL = Soil screening level
- c = Calculated SSL
- Soil to GW = Generic SSLs based on DAF = 10, adapted from *USEPA Soil Screening Guidance: Technical Background Document*, May 1996 (first preference), or calculated using values from Table 6.2 in Zone I RFI Report

Table 10.9.6
SWMU 37, Zone L, Subzone I Surface Soil Sample Locations with
Metal Detections Exceeding RBCs

Metal	Sample ID	Concentration Detected (mg/kg)	RBC Exceeded (Y/N)	RBC (mg/kg)
Arsenic	037SB002I1	2.30	Y	0.43
	037SB004I1	2.50	Y	
	037SB005I1	4.50	Y	
Beryllium	037SB002I1	0.42	Y	0.15
	037SB004I1	0.63	Y	
	037SB005I1	0.46	Y	
	037SB006I1	0.36	Y	
Iron	037SB002I1	2570	Y	2300
	037SB004I1	6570	Y	
	037SB005I1	6220	Y	
	037SB006I1	4710	Y	
	037SB008I1	3800	Y	
Manganese	037SB006I1	319	Y	180

Notes:
mg/kg = Milligrams per kilogram
NA = Not Applicable
RBC = Risk-based concentration

10.9.1.4 Nature of Contamination in Subzone I, SWMU 37, Monitoring Well Groundwater

One monitoring well was installed and samples were analyzed for VOCs, SVOCs, chlorinated pesticide, PCBs, metals, and cyanide. Analysis of detected compounds are summarized in Table 10.9.7. No organic compounds were detected in the first-quarter monitoring well samples.

Table 10.9.7
SWMU 37, Zone L, Subzone I
Inorganic Detections for First-Quarter Groundwater
Shallow Monitoring Wells

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Tap Water RBC	Reference Conc.	MCL	Number of Samples Exceeding RBC	Salt Wtr. Surf. Wtr. Chronic	Ground-water Migration Concern	Surface Migration Concern
Inorganic Elements (µg/L)										
Aluminum (Al)	1/1	381	381	3700	1440	NA	0	NA	NO	NO
Antimony (Sb)	1/1	1.90	1.90	1.5	ND	6	1	NA	YES	NO
Arsenic (As)	1/1	4.00	4.00	0.045	23	50	1	36	YES	NO
Barium (Ba)	1/1	17.5	17.5	260	110	2000	0	NA	NO	NO
Calcium (Ca)	1/1	154000	154000	NA	NA	NA	NA	NA	NO	NO
Chromium (Cr)	1/1	2.10	2.10	18	14.3	50	0	50	NO	NO
Copper (Cu)	1/1	3.80	3.80	150	4.4	1300	0	2.9	NO	YES
Iron (Fe)	1/1	6390	6390	1100	NA	NA	1	NA	YES	NO
Magnesium (Mg)	1/1	27100	27100	NA	NA	NA	NA	NA	NO	NO
Manganese (Mn)	1/1	207	207	73	5430	NA	1	NA	YES	NO
Nickel (Ni)	1/1	3.00	3.00	73	13.3	100	0	8.3	NO	NO
Potassium (K)	1/1	13900	13900	NA	NA	NA	NA	NA	NO	NO
Sodium (Na)	1/1	46000	46000	NA	NA	NA	NA	NA	NO	NO

Table 10.9.7
SWMU 37, Zone L, Subzone I
Inorganic Detections for First-Quarter Groundwater
Shallow Monitoring Wells

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Tap Water RBC	Reference Conc.	MCL	Number of Samples Exceeding RBC	Salt Wtr. Surf. Wtr. Chronic	Ground-water Migration Concern	Surface Migration Concern
Vanadium (V)	1/1	1.90	1.90	26	14.0	NA	0	NA	NO	NO
Zinc (Zn)	1/1	8.50	8.50	1100	24.4	NA	0	86	NO	NO

Notes:

ug/L = Micrograms per liter
 RBC = Risk-based concentration
 MCL = Maximum contaminant level
 NA = Not applicable
 ND = Not detected

Metals/Cyanide Detected in Monitoring Well Groundwater

Antimony (1.90 µg/L), arsenic (4.00 µg/L), iron (6390 µg/L), and manganese (207 µg/L) exceeded the Tap Water RBC values of 1.5 µg/L, 0.045 µg/L, 1100 µg/L and 73.0 µg/L, respectively. None of these compounds exceeded their respective MCL values.

Sample locations with detected concentrations of analytes that exceed RBC, SSL or MCL values are shown in Figures 10.9.5 through 10.9.13.

10.9.2 Fate and Transport Assessment for SWMU 37 in Subzone I

Section 10.9 contains short descriptions of the portions of SWMU 37 within Subzone I. Environmental media sampled as part of the RFI for these sites include surface soil borings, subsurface soil borings, and shallow groundwater (monitoring wells and DPT samples). Potential constituent migration pathways investigated for SWMU 37 include soil to groundwater and groundwater to surface water. Soil to air and soil to sediment cross media fate and transport were determined not to be a concern.

The fate and transport screening comparison for SWMU 37 soil and groundwater samples included referencing of previous Zone RFI Reports when applicable. Contaminants of potential concern were identified for each sample media and sampling method (i.e., soil boring versus DPT soil sampling) in Section 10.9. The Zone I RFI Report was consulted to identify any sites within the subzone I that are associated geographically with the Zone L sample points. Analytical results from samples with overlapping sites were compared to data generated during the Zone I RFI. If concentrations at Zone L sample points associated with overlapping sites were higher than those of the referenced Zone I RFI Report or if new fate and transport COPCs were identified, further evaluation will be deferred to the Zone I RFI and included as an addendum. If Zone L sample concentrations were less than or equal to those in the Zone I RFI Report, it was assumed that the

Zone L fate and transport conclusions would be similar to those of the Zone I RFI and no further evaluation is needed. Zone L sampling locations that are not associated with any overlapping sites are summarized in the fate and transport COPC tables and fate and transport evaluations provided in the following sections.

10.9.2.1 Soil to Groundwater Cross-Media Transport

In Section 10.9, Tables 10.9.1, 10.9.4 and 10.9.5 compare maximum detected organic and inorganic constituent concentrations in soil boring and DPT soil samples from SWMU 37 to SSLs considered protective of groundwater. To provide a conservative screen, generic soil screening levels were used; leachate entering the aquifer was assumed to be diluted by a ratio of 10:1, with no attenuation of constituents in soil (DAF=10). Background reference values for inorganics were noted but did not enter into the screening process.

The screening comparisons in tables mentioned above identify the constituents with the potential to impact groundwater quality. Table 10.9.8 provides a summary of SWMU 37 soil samples reporting SSL exceedances, along with the names of associated Zone I sites overlapping the areas where some of these soil samples were collected. Fate and transport concerns at Zone L sample locations not associated with any overlapping Zone I sites are evaluated below. In these evaluations, shallow groundwater monitoring wells within 200 feet downgradient of Zone L sampling locations were used for comparing local groundwater quality to soil concentrations.

**Table 10.9.8
 SMWU 37, Zone L, Subzone I
 Fate and Transport COPCs**

Exceedance Location	Overlapping Site	Fate and Transport COPCs	COPCs to be further Evaluated?	Reference Document
Soil Borings				
037SB004	AOC 681	Chromium	Yes	Table 10.6.7*
037SB005	None	Chromium	Yes	None

Table 10.9.8
SMWU 37, Zone L, Subzone I
Fate and Transport COPCs

Exceedance Location	Overlapping Site	Fate and Transport COPCs	COPCs to be further Evaluated?	Reference Document
037SB008	None	Chromium	Yes	None
DPT Soil				
037SP007	AOC 681	Chromium	Yes	Table 10.6.7*

Notes:

*Zone I RFI Report (EnSafe, 1996)

Chromium was detected in all five soil borings and all five DPT soil samples, and was reported exceeding its soil to groundwater SSL of 19 mg/kg in two soil boring samples, 037SB005 (upper-interval of 19.0 mg/kg) and 037SB008 (lower-interval of 22.9 mg/kg). However, these two chromium detections are below the Zone I chromium background reference concentrations of 34.5 mg/kg for surface soil and 51.3 mg/kg for subsurface soil. SWMU 37 shallow well 037I01 is approximately 20 feet away from both soil borings and had an estimated first-quarter chromium concentration of 2.1 µg/L, which is less than the Zone I chromium background concentration in shallow groundwater of 14.3 µg/L. No downgradient monitoring wells exist in this locale.

10.9.2.2 Groundwater to Surface Water Cross-Media Transport

In Section 10.9, Table 10.9.7 compares maximum detected inorganic constituent concentrations in monitoring well samples from SWMU 37 to RBCs, and to chronic ambient saltwater quality criteria values for the protection of aquatic life (saltwater surface water chronic screening values). For inorganics, maximum concentrations in groundwater are compared to the greater of (a) RBCs, or (b) background reference concentrations for groundwater, as well as to the saltwater surface water chronic values. To provide a conservative screen, no attenuation or dilution of constituents in groundwater is assumed before comparison to the relevant standards.

The screening comparisons in the table mentioned above does not identify any constituents with the potential to impact downgradient groundwater quality.

10.9.2.3 Fate and Transport Summary

Although chromium was detected at concentrations exceeding its SSL of 19 mg/kg in two soil boring samples not associated with any overlapping Zone L sites, the low chromium concentration in a nearby shallow well (037I01) indicates that current conditions in soil are protective of groundwater quality at this site. Furthermore, the chromium SSL is based on the assumption that all detected chromium is hexavalent chromium. In reality, the highest reported hexavalent chromium detection in any Zone L soil sample was 3.98 mg/kg.

Zone L SSL exceedances in soil samples were isolated occurrences. Samples collected from locations with overlapping Zone L sites will be evaluated in an addendum to the Zone L RFI report.

10.9.3 Human Health Risk Assessment for SWMU 37, Subzone I

10.9.3.1 Site Background and Investigative Approach

Section 10.9 provides a description for SWMU 37 as well as a discussion of the sampling activities that took place during the Zone L RFI activities.

10.9.3.2 COPC Identification

SWMU 37 Soil

Based on the screening comparisons described in Section 7 of this RFI and presented in Tables 10.9.1, and 10.9.4, BEQs and chromium were identified as COPCs for soil. Table 10.9.9 provides a summary of SWMU 37 soil samples that reported exceedances along with any associated sites that overlapped the area where these soil samples were taken. Soil sample 037SB008 was collected in a area of Zone I were there were no existing sites. BEQs were the

only COPCs identified for sample 037SBP008. A risk assessment is provided to evaluate the significance of BEQ soil concentrations. The chromium data from soil sample 037SP007 were compared to data generated during the AOC 681 RFI and the results of this comparison is provided on Table 10.9.9. A reference to the Zone I RFI report is also provided so that this comparison can be easily verified. It was assumed that if the chromium data from soil sample 037SP007 was less than or within the range of the data generated during the AOC 681 RFI, then the conclusions would be the similar and therefore no further evaluation would be necessary. Conversely, if for any reason the chromium data revealed something that was not evaluated during the AOC 681 RFI (data reported higher than that presented in the AOC 681 RFI, or new COPCs), then further evaluation should be deferred to the AOC 681 RFI and included as an addendum. Recommendations are provided in Section 11.

Table 10.9.9
SMWU 37, Zone L, Subzone I
Risk Assessment COPCs

Exceedance Location	Overlapping Site	Risk Assessment COPCs	COPCs to be further Evaluated?	Reference Document
Soil Boring				
037SB008	None	BEQs	Yes	None
DPT Soil				
037SP007	AOC 681	Chromium	Yes	Table 10.6.10*
Groundwater				
037GW001	None	Antimony	Yes	None

Notes:

*Zone I RFI Report (EnSafe, 199?)

SWMU 37 Groundwater

Based on the screening comparisons described in Section 7 of this RFI and presented in Table 10.9.7, antimony was identified as a COPC for groundwater. Table 10.9.9 provides a summary of SWMU 37 groundwater samples that reported exceedances along with any associated sites that overlapped the area where these samples were taken. As shown, groundwater sample 037GP001 was not collected near any existing site. As a result, a risk assessment is provided to evaluate the significance of antimony concentrations reported in groundwater in the area of 037GW001.

10.9.3.3 Exposure Assessment

Potentially Exposed Populations

Potentially exposed populations are current and future site workers and hypothetical future site residents. Future site resident and worker exposure scenarios were addressed in this risk assessment. The hypothetical future site worker scenario assumed continuous exposure to surface soil conditions and the use of shallow groundwater as a potable water source. Current site workers' exposure would be less than that assumed for the hypothetical future site worker scenario because of their limited soil contact and the fact that groundwater is not currently used onsite as a source of potable or process water. Therefore, future worker assessment is considered to be conservatively representative of current site use. The future site resident scenario was built on the premise that current buildings would be removed and replaced with dwellings. In addition, the future site residents were assumed to use the shallow aquifer onsite as a source of drinking water.

Exposure Pathways

Exposure pathways for the site workers are dermal contact, incidental ingestion of surface soils, and ingestion of shallow groundwater through potable use. The exposure pathways for future residential land use are the same as those for the future site worker. In addition, the hypothetical future site worker scenario assumed continuous exposure to surface soil and groundwater

conditions. Uniform exposure was assumed for all sample locations. Table 10.9.10 presents the justification for exposure pathways assessed in this HHRA.

Table 10.9.10
Exposure Pathways Summary – SWMU 37
CAC – Subzone I
Charleston, South Carolina

Potentially Exposed Population	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Current Land Uses			
Current Site Users/Maintenance	Air, Inhalation of gaseous contaminants emanating from soil	No	Based on the COPCs identified in this HHRA, this would not be a significant pathway.
	Air, Inhalation of chemicals entrained in fugitive dust	No	This pathway was considered to be insignificant relative to the other soil pathways that were evaluated.
	Shallow groundwater, Ingestion of contaminants during potable or general use	No (Qualified)	Future land use assessment is considered to be conservatively representative of current receptors.
	Shallow groundwater, Inhalation of volatilized shallow groundwater contaminants	No	No volatile COPC were evaluated in the formal risk assessment.
	Soil, Incidental ingestion	No (Qualified)	Future land use assessment is considered to be conservatively representative of current receptors.
	Soil, Dermal contact	No (Qualified)	Future land use assessment is considered to be conservatively representative of current receptors.
Future Land Uses			
Future Site Residents (Child and Adult) and Future Site Worker	Air, Inhalation of gaseous contaminants emanating from soil	No	Based on the COPCs identified in this HHRA, this would not be a significant pathway.
	Air, Inhalation of chemicals entrained in fugitive dust	No	This pathway was considered to be insignificant relative to the other soil pathways that were evaluated.
	Shallow groundwater, Ingestion of contaminants during potable or general use	Yes	COPCs were identified subsequent to risk-based and background screening comparisons.

Table 10.9.10
Exposure Pathways Summary – SWMU 37
CAC – Subzone I
Charleston, South Carolina

Potentially Exposed Population	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
	Shallow groundwater, Inhalation of volatilized contaminants during domestic use	No	No volatile COPC were evaluated in the formal risk assessment.
	Soil, Incidental ingestion	Yes	COPCs were identified subsequent to risk-based and background screening comparisons.
	Soil, Dermal contact	Yes	COPCs were identified subsequent to risk-based and background screening comparisons.
	Wild game or domestic animals, Ingestion of tissue impacted by media contamination	No	Hunting/taking of game and/or raising livestock is prohibited within the Charleston, South Carolina city limits.
	Fruits and vegetables, Ingestion of plant tissues grown in media	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Exposure Unit Area

With regard to soil pathways, the focus of the risk assessment for Subzone I is the Sanitary Sewer Lift Station. There were three soil samples (037SP005, 037SP006, and 037SP007) collected in this area that were used to characterize the soil pathways for Subzone H. With respect to the groundwater pathways, groundwater sample 037GP001 is located at the Sanitary Sewer Lift Station as well.

Exposure Point Concentrations

As discussed in Section 7 of this RFI, UCS were calculated for datasets consisting of at least 10 samples. Since there were only three soil samples used to represent the soil pathways for this risk assessment the maximum BEQ concentration was used as its EPC. Similarly, the antimony

concentration reported in groundwater sample 037GP001 was used to calculate groundwater pathway risk and hazard.

Quantification of Exposure

Soil

CDIs for ingestion and dermal contact with soils are shown in Tables 10.9.11 and 10.9.12, respectively.

Groundwater

CDIs for ingestion of groundwater are shown in Table 10.9.13.

10.9.3.4 Toxicity Assessment

Toxicity assessment terms and methods are discussed in Section 7 of this report. Table 10.9.14 presents toxicological information specific to each COPC evaluated in this risk assessment. This information was used in the quantification of risk/hazard associated with soil contaminants. Brief toxicological profiles are provided in the following paragraphs.

Antimony belongs to the same periodic group as arsenic. This element is absorbed slowly through the gastrointestinal tract, which is the target of this element. Another target is the blood, where antimony concentrates. Due to frequent industrial use, the primary exposure route for antimony to the general population is food. Antimony is also a common air pollutant from industrial emissions. USEPA has not classified antimony as a carcinogen, and the oral RfD is 0.0004 mg/kg-day (Klaassen, et al, 1986).

Table 10.9.11 Chronic Daily Intakes (CDI) Incidental Ingestion of Surface Soil, SWMU 37, Subzone I

Table 10.9.11
 Chronic Daily Intakes (CDI)
 Incidental Ingestion of Surface Soil
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Chemical	Fraction Ingested from Contaminated Source *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Current Worker adult H-CDI (mg/kg-day)	Current Worker adult C-CDI (mg/kg-day)
Benzo(a)pyrene equiv.	1	0.58	8.00E-07	7.47E-06	9.14E-07	2.86E-07	1.02E-07

NOTES:

- lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
- CDI Chronic Daily Intake in mg/kg-day
- H-CDI CDI for hazard quotient
- C-CDI CDI for excess cancer risk
- * Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.9.12
 Chronic Daily Intakes (CDI)
 Dermal Contact with Surface Soil
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Chemical	Exposure Point Concentration (mg/kg)	Fraction Contacted from Contaminated Source *	Dermal Absorption Factor (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident Iwa C-CDI (mg/kg-day)	Current Worker adult H-CDI (mg/kg-day)	Current Worker adult C-CDI (mg/kg-day)
Benzo(a)pyrene equiv.	0.58	1	0.01	3.28E-07	1.08E-06	2.05E-07	2.34E-07	8.37E-08

NOTES:

- CDI Chronic Daily Intake in mg/kg-day
- H-CDI CDI for hazard quotient
- C-CDI CDI for excess cancer risk
- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
- * Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.9.13
 Chronic Daily Intakes (CDI)
 Ingestion of COPCs in Groundwater
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Chemical	Exposure Point Concentration (mg/liter)	Future	Future	Future	Future	Future
		Resident adult H-CDI (mg/kg-day)	Resident child H-CDI (mg/kg-day)	Resident lwa C-CDI (mg/kg-day)	Worker adult H-CDI (mg/kg-day)	Worker adult C-CDI (mg/kg-day)
Antimony	0.0019	5.21E-05	1.21E-04	2.86E-05	1.86E-05	6.64E-06

NOTES:

- lwa Lifetime weighted average
- CDI Chronic Daily Intake
- H-CDI Noncarcinogenic hazard based Chronic Daily Intake
- C-CDI Carcinogenic risk based Chronic Daily Intake

Table 10.9.14
 Toxicological Database Information
 for Chemicals of Potential Concern
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Non-Carcinogenic Toxicity Data

Chemical	Oral Reference Dose (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty Factor Oral	Inhalation Reference Dose (mg/kg/day)	Confidence Level	Critical Effect	Uncertainty Factor Inhalation
Inorganics								
Antimony	0.0004	a	L	Decreased lifespan	1000		ND	
Carcinogenic PAHs/PCBs								
Benzo(a)pyrene equivalents	ND				ND			

NOTES:

- a Integrated Risk Information System (IRIS)
- NA Not applicable or not available
- ND Not determined due to lack of information

Table 10.9.14 (continued)
 Toxicological Database Information
 for Chemicals of Potential Concern
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Carcinogenic Toxicity Data

Chemical	Oral Slope Factor [(mg/kg/day)] ⁻¹	Inhalation Slope Factor [(mg/kg/day)] ⁻¹	Weight of Evidence	Tumor Type
Antimony	ND	ND		
Carcinogenic PAHs/PCBs				
Benzo(a)pyrene equivalents	7.3	a	3.1	a B2 Forestomach

NOTES:

- a Integrated Risk Information System (IRIS)
- NA Not applicable or not available
- ND Not determined due to lack of information

Benzo(a)pyrene equivalents include the following list of polynuclear aromatic hydrocarbons: 1

Benzo(a)anthracene	TEF	0.1	2
Benzo(a)pyrene	TEF	1.0	3
Benzo(b)fluoranthene	TEF	0.1	4
Benzo(k)fluoranthene	TEF	0.01	5
Chrysene	TEF	0.001	6
Dibenz(a,h)anthracene	TEF	1.0	7
Indeno(1,2,3-cd)pyrene	TEF	0.1	8

Some PAHs are toxic to the liver, kidney, and blood. However, the toxic effects of the PAHs 9
 above have not been well established. There are no RfDs for the PAHs above due to a lack of 10
 data. All PAHs listed above are classified by USEPA as B2 carcinogens, and their carcinogenicity 11
 is addressed relative to that of benzo(a)pyrene, having an oral SF of 7.3 (mg/kg-day)⁻¹. Toxicity 12
 Equivalency Factors, also set by USEPA, are multipliers that are applied to the detected 13
 concentrations, which are subsequently used to calculate excess cancer risk. These multipliers are 14
 discussed further in the exposure and toxicity assessment sections. Most carcinogenic PAHs have 15
 been classified as carcinogenic due to animal studies using large doses of purified PAHs. There 16
 is some doubt as to the validity of these listings, and the SFs listed in USEPA's RBC table are 17
 provisional. However, these PAHs are carcinogens when the exposure involves a mixture of other 18
 carcinogenic substances (e.g., coal tar, soot, cigarette smoke). As listed in IRIS, the basis for the 19
 benzo(a)pyrene B2 classification is that human data specifically linking benzo(a)pyrene to a 20
 carcinogenic effect are lacking. There are, however, multiple animal studies in many species 21
 demonstrating benzo(a)pyrene to be carcinogenic by numerous routes. 22

Benzo(a)pyrene has produced positive results in numerous genotoxicity assays. At the June 1992 23
 CRAVE Work Group meeting, a revised risk estimate for benzo(a)pyrene was verified (see 24

Additional Comments for Oral Exposure). This section provides information on two aspects of the carcinogenic risk assessment for the agent in question: the USEPA classification and quantitative estimates of exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in application of a low-dose extrapolation procedure and presented as the risk per (mg/kg)-day. The unit risk is the quantitative estimate in terms of either risk per $\mu\text{g/L}$ drinking water or risk per $\mu\text{g/m}^3$ air breathed. The third form in which risk is presented is drinking water or air concentration providing cancer risks of 1 in 10,000 or 1 in 1,000,000. The Carcinogenicity Background Document provides details on the carcinogenicity values found in IRIS. Users are referred to the Oral Reference Dose and Reference Concentration sections for information on long-term toxic effects other than carcinogenicity.

As listed in IRIS, the basis for the dibenz(a,h)anthracene and benzo(b)fluoranthene B2 classification is because of no human data and there is not sufficient data from animal bioassays. Benzo(b)fluoranthene produced tumors in mice after lung implantation, intraperitoneal or subcutaneous injection, and skin painting. As listed in IRIS, the basis for the benzo(a)anthracene B2 classification is because of no human data and there is not sufficient data from animal bioassays. Benzo(a)anthracene produced tumors in mice exposed by gavage; intraperitoneal, subcutaneous or intramuscular injection; and topical application. Benzo(a)anthracene produced mutations in bacteria and in mammalian cells, and transformed mammalian cells in culture. As listed in IRIS the basis for the benzo(k)fluoranthene B2 classification is because of no human data and there is not sufficient data from animal bioassays. Benzo(k)fluoranthene produced tumors after lung implantation in mice and when administered with a promoting agent in skin-painting studies. Equivocal results have been found in a lung adenoma assay in mice. Benzo(k)fluoranthene is mutagenic in bacteria. (Klaassen, et al., 1986).

10.9.3.5 Risk Characterization

Soil Pathways

Exposure to soil onsite was evaluated under both residential and site worker scenarios. For these scenarios, incidental ingestion and dermal contact exposure pathways were evaluated. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.9.15 and 10.9.16 present the computed carcinogenic risks and/or HQs associated with incidental ingestion of and dermal contact with soils, respectively.

Hypothetical Site Residents

The site resident ILCRs for the ingestion and dermal contact pathways were calculated to be 7E-06 and 3E-06, respectively.

Hypothetical Site Workers

The site worker ILCRs for the ingestion and dermal contact pathways were calculated to be 7E-07 and 1E-06, respectively.

Groundwater Pathways

Exposure to groundwater was evaluated under both residential and site worker scenarios. The groundwater pathway was evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well, drawing from the corresponding water-bearing zone, will be installed. For noncarcinogenic contaminants evaluated relative to future site residents, hazard was computed for a child resident. Table 10.9.17 presents the risk and hazard estimates for the groundwater pathway.

Hypothetical Site Residents

For the groundwater ingestion pathway, the hazard indices for the child and adult resident are 0.3 and 0.1, respectively.

Table 10.9.15

Hazard Quotients and Incremental Lifetime Cancer Risks
 Incidental Surface Soil Ingestion
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day) ⁻¹	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Current Worker adult Hazard Quotient	Current Worker adult ILCR
Benzo(a)pyrene equiv.	NA	7.3	ND	ND	6.7E-06	ND	7.4E-07
SUM Hazard Index/ILCR			ND	ND	7E-06	ND	7E-07

NOTES:

- NA Not available
- ND Not Determined due to lack of available information
- lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
- ILCR Incremental Lifetime Cancer Risk

Table 10.9.16
 Hazard Quotients and Incremental Lifetime Cancer Risks
 Dermal Contact With Surface Soil
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Chemical	Dermal Adjustment	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day) ⁻¹	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Current Worker adult Hazard Quotient	Current Worker adult ILCR
Benzo(a)pyrene equiv.	0.5	NA	14.6	ND	ND	3.0E-06	ND	1.2E-06
SUM Hazard Index/ILCR				ND	ND	3E-06	ND	1E-06

NOTES:

- NA Not available
- ND Not Determined due to lack of available information
- lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
- ILCR Incremental Lifetime Cancer Risk
 - Dermal to absorbed dose adjustment factor is applied to adjust for Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)

Table 10.9.17
Hazard Quotients and Incremental Lifetime Cancer Risks
Groundwater Ingestion
SWMU 37, Subzone I
Charleston Naval Complex
Charleston, South Carolina

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-i	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Antimony	0.0004	NA	0.13	0.30	ND	0.046	ND
SUM Hazard Index/ILCR			0.1	0.3	ND	0.05	ND

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk

Hypothetical Site Workers

For the groundwater ingestion pathway, the hazard indices for the site worker is 0.05.

COCs Identified

Chemicals of concern were identified based on cumulative (all pathway) risk and hazard projected for this site. USEPA has established a generally acceptable risk range of 1E-4 to 1E-6, and a hazard index threshold of 1.0 (unity). In accordance with SCDHEC guidance, a COC was considered to be any chemical contributing to a cumulative risk level of 1E-6 or greater and/or a cumulative hazard index above 1.0, if its individual ILCR exceeds 1E-6 or whose hazard quotient exceeds 0.1. For carcinogens, this approach is relatively conservative, because a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is recommended by USEPA Region IV as the trigger for establishing COCs. The COC selection method presented was used to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the remedial goal options development process. Table 10.9.18 presents the summary of COCs identified for this risk assessment.

Soils

Hypothetical Site Residents

BEQs were identified as soil pathway COCs for the residential scenario.

Hypothetical Site Workers

BEQs were identified as soil pathway COCs the site worker scenario.

Groundwater

No groundwater pathway COCs were identified for this risk assessment.

Table 10.9.18
 Summary of Risk and Hazard-based COCs
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Medium	Exposure Pathway		Future	Future	Future	Site Worker		Identification of COCs
			Resident Adult Hazard Quotient	Resident Child Hazard Quotient	Resident Iwa ILCR	Hazard Quotient	ILCR	
Surface Soil	Incidental Ingestion	Benzo(a)pyrene equiv.	ND	ND	6.7E-06	ND	7.4E-07	2
	Dermal Contact	Benzo(a)pyrene equiv.	ND	ND	3.0E-06	ND	1.2E-06	2 4
Sum of All Pathways			ND	ND	1E-05	ND	2E-06	
Groundwater Pathways	Ingestion	Antimony	0.13	0.30	ND	0.046	ND	
Groundwater Pathway Sum			0.1	0.3	ND	0.05	ND	

Notes:

- ND Indicates not determined due to the lack of available risk information.
- ILCR Indicates incremental excess lifetime cancer risk
- HI Indicates hazard index
- 1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
- 2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
- 3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
- 4- Chemical is a COC by virtue of projected site worker ILCR.

10.9.3.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative assumptions (i.e., future residential use) recommended by USEPA Region IV when assessing potential future and current exposure. The exposure assumptions made in the site worker scenario are highly protective and would tend to overestimate exposure.

Residential use of the site would not be expected, based on current site uses. If this area were to be used as a residential site, the buildings and other structures would be demolished, and the soil conditions would likely change — the soils would be covered with landscaping soil and/or a house. Consequently, exposure to current soil conditions would not be likely under a true future residential scenario. Current site worker’s contact with impacted media is much less than is assumed in the exposure model that is used to assess this pathway. These factors indicate that exposure pathways assessed in this HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents.

A basewide system provides drinking and process water to buildings throughout Zone I. This system is slated to remain in operation under the current base reuse plan. As a result, groundwater would not be expected to be used under future site use scenarios. Therefore, the scenario established to project risk/hazard associated with groundwater exposure is highly conservative, and associated pathways are not expected to be completed in the future.

Determination of Exposure Point Concentrations

The exposure point concentrations were set equal to the maximum concentrations for COPCs identified for this site. The EPCs used in the risk assessment provide a reasonable maximum estimate of chronic daily intakes. As a result, the EPCs would tend to overestimate risk and hazard.

Uncertainty in the Data

All of the DPT data were provided at DQO level II which adds to the uncertainty associated with some of the data used in this risk assessment. Usually QA/QC required for risk assessment is DQO level III or higher. The risk and hazard estimates provided in this risk assessment could be considered over- or underestimates due to the use of DQO level II data.

10.9.3.7 Risk Summary

Risk and hazard were assessed for the hypothetical site worker and the hypothetical future site resident under reasonable maximum exposure assumptions. In soils, the incidental ingestion and dermal contact pathways were assessed in this HHRA. The ingestion and inhalation pathways were evaluated for groundwater. To add perspective to the risk assessment, point risk and hazard maps are presented below for soil. Point risk maps are based on the unlikely assumption that potential future site resident will be chronically exposed to specific points. Exposure to soil conditions is more likely the result of uniform exposure to the soil conditions over the entire site rather than specific points. Risk maps are still useful because they allow the reader to visualize the contribution of risk or hazard index due to individual COCs.

Soil

Figures 10.9.14 and 10.9.15 illustrates point risk estimates for soil pathways under a residential scenario and the site worker scenario, respectively. Table 10.9.19 provides the contribution of individual COPCs to cumulative risk at each sample location for both the residential and site worker scenarios. As shown, BEQs contribute to risk estimates above 1E-06 at locations 037SB005 and 037SB008 for the residential scenario. BEQs also contribute to risk estimates marginally above 1E-06 at the same locations for the site worker scenario.

10.9.3.8	Remedial Goal Options	1
	Soil	2
	RGOs for were based on the site resident or site workers as presented in Table 10.9.20 for soil.	3



COOPER RIVER

1874

685

NS 21

037SB006 ● 037SB008
● 037SB005

200

NS 16

1792

LEGEND

- NO COPCs DETECTED
- < 1E-6
- 1E-6 to 5E-6
- 5E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4



ZONE L - RCRA
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NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.14
ZONE L - SUBZONE I
SWMU 37

SOIL POINT RISK
RESIDENTIAL SCENARIO

50 0 50 100 Feet





COOPER RIVER

1874

685

NS 21

037SB006 ● 037SB008
● 037SB005

200

NS 16

1792

LEGEND

- NO COPCs DETECTED
- < 1E-6
- 1E-6 to 5E-6
- 5E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.15
ZONE L - SUBZONE I
SWMU 37

SOIL POINT RISK
INDUSTRIAL SCENARIO



Table 10.9.19
 Point Estimates of Risk and Hazard
 SWMU 37, Subzone I, Surface Soil
 Charleston Naval Complex
 Table 10.9.19
 Point Estimates of Risk and Hazard
 SWMU 37, Subzone I, Surface Soil
 Charleston Naval Complex
 Charleston, South Carolina

Site	Location	Parameter	Concentration	Units	Residential		Site Worker	
					Hazard Index	Risk (E-06)	Hazard Index	Risk (E-06)
037	B005	Benzo(a)pyrene equiv.	438.53	ug/kg	NA	7.26	NA	1.48
037	B006	No COPCs Detected	ND	ug/kg	NA	NA	NA	NA
037	B008	Benzo(a)pyrene equiv.	584.04	ug/kg	NA	9.67	NA	1.97

Table 10.9.20
 Remedial Goal Options Surface Soil
 SWMU 37, Subzone I
 Charleston Naval Complex
 Charleston, South Carolina

Residential-Based Remedial Goal Options

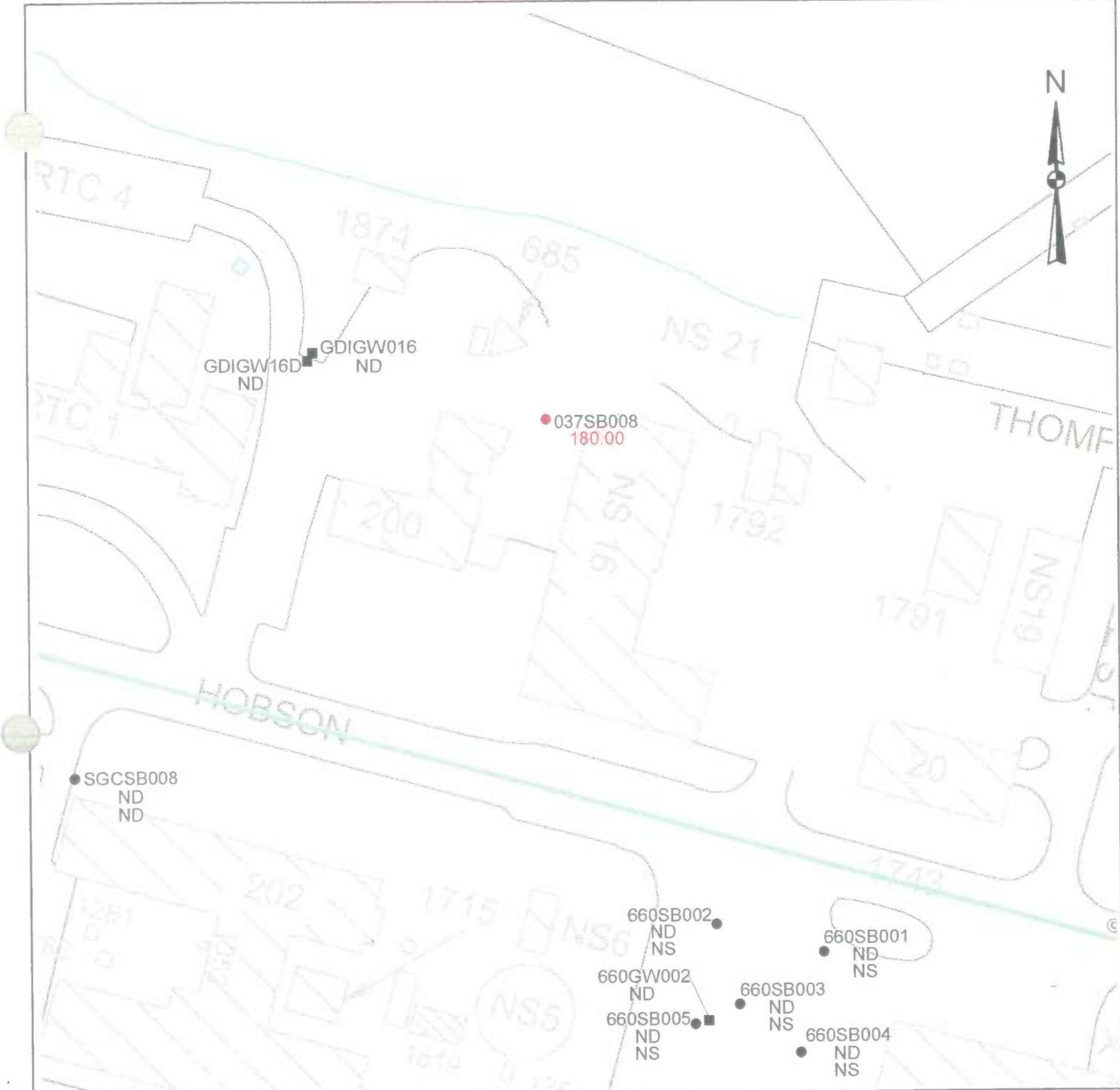
Chemical	Slope Factor (mg/kg-day) ⁻¹	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options			Risk-Based Remedial Goal Options			Background Concentration mg/kg
				3 mg/kg	1 mg/kg	0.1 mg/kg	1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	
Benzo(a)pyrene equiv.	7.3	NA	0.58	ND	ND	ND	0.060	0.60	6.0	NA

Worker-Based Remedial Goal Options

Chemical	Slope Factor (mg/kg-day) ⁻¹	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options			Risk-Based Remedial Goal Options			Background Concentration mg/kg
				3 mg/kg	1 mg/kg	0.1 mg/kg	1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	
Benzo(a)pyrene equiv.	7.3	NA	0.58	ND	ND	ND	0.30	3.0	30	NA

NOTES:

- EPC Exposure point concentration
- NA Not applicable
- ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or site worker for noncarcinogens
- mg/kg-day milligrams per kilogram per day
- mg/kg milligrams per kilogram



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (ug/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H OR I SOIL BORING LOCATION
- 12.30 ZONE H OR I SURFACE SOIL CONC. (ug/kg)
- 12.30 ZONE H OR I SUBSURFACE SOIL CONC. (ug/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN
- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.5
ZONE L - SUBZONE I
BENZO(A)PYRENE
ZONE L EXCEEDANCES WITH ZONES H AND I
SOIL AND GW CONCENTRATIONS

RBC=88.0 ug/kg SSL=4000 ug/kg MCL=0.20 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION

- SUBZONE BOUNDARY
- RAILROAD
- MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

900 0 900 1800 Feet



ZONE L - RCRA
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NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.6
ZONE L - SUBZONE I
ARSENIC
ZONE L EXCEEDANCES

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H OR I SOIL BORING LOCATION
- 12.30 ZONE H OR I SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H OR I SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

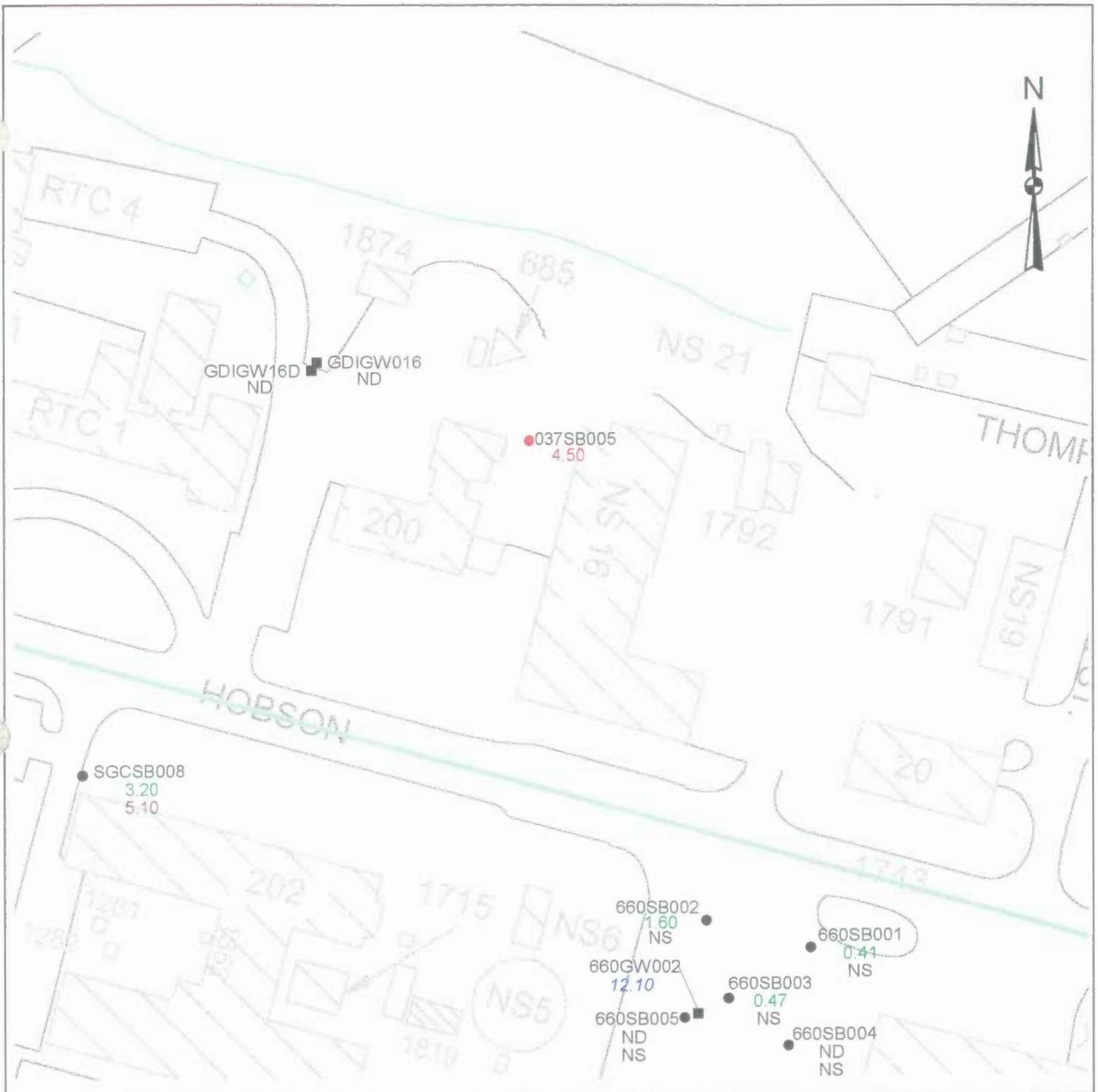
SUBZONE BOUNDARY
 RAILROAD
 © MANHOLE
 SANITARY SEWER LINE
 STORM SEWER LINE



ZONE L - RCRA
 FACILITY INVESTIGATION
 NAVAL BASE CHARLESTON
 CHARLESTON, SC

FIGURE 10.9.7
ZONE L - SUBZONE I
ARSENIC
ZONE L EXCEEDANCES WITH ZONES H AND I
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H OR I SOIL BORING LOCATION
- 12.30 ZONE H OR I SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H OR I SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

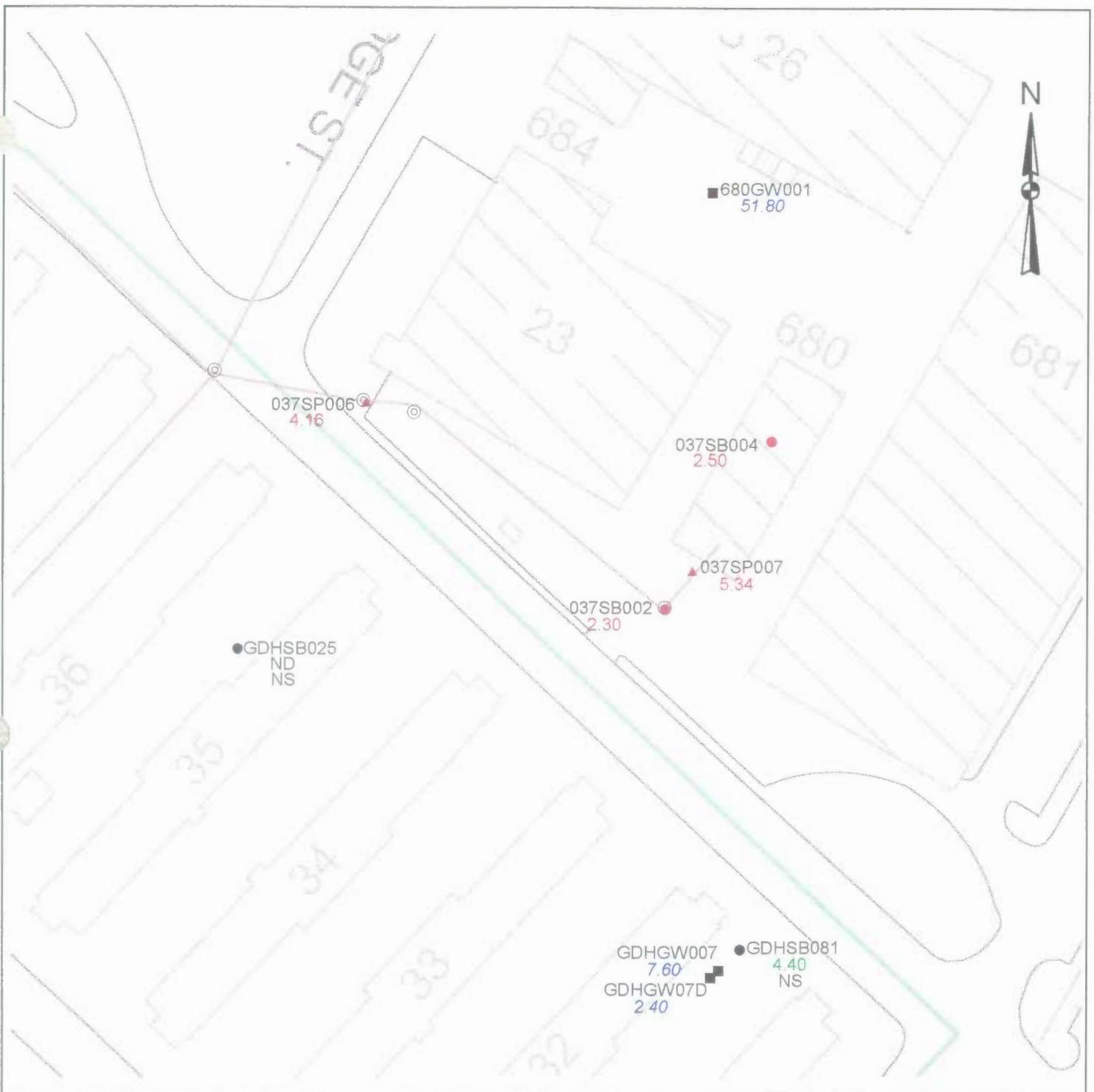
90 0 90 180 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.8
ZONE L - SUBZONE I
ARSENIC
ZONE L EXCEEDANCES WITH ZONES H AND I
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H OR I SOIL BORING LOCATION
- 12.30 ZONE H OR I SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H OR I SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- SANITARY SEWER LINE
- RAILROAD
- STORM SEWER LINE
- MANHOLE

70 0 70 140 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.9
ZONE L - SUBZONE I
ARSENIC
ZONE L EXCEEDANCES WITH ZONES H AND I
SOIL AND GW CONCENTRATIONS

RBC=0.43 mg/kg SSL=15.0 mg/kg MCL=50.0 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION

- SUBZONE BOUNDARY
- SANITARY SEWER LINE
- RAILROAD
- STORM SEWER LINE
- MANHOLE

900 0 900 1800 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.10
ZONE L - SUBZONE I
CHROMIUM
ZONE L EXCEEDANCES

RBC=39.0 mg/kg SSL=19.0 mg/kg MCL=100 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H OR I SOIL BORING LOCATION
- 12.30 ZONE H OR I SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H OR I SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- ⊙ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

90 0 90 180 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.11
ZONE L - SUBZONE I
CHROMIUM
ZONE L EXCEEDANCES WITH ZONES H AND I
SOIL AND GW CONCENTRATIONS

RBC=39.0 mg/kg SSL=19.0 mg/kg MCL=100 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H OR I SOIL BORING LOCATION
- 12.30 ZONE H OR I SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H OR I SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- RAILROAD
- ◎ MANHOLE
- SANITARY SEWER LINE
- STORM SEWER LINE

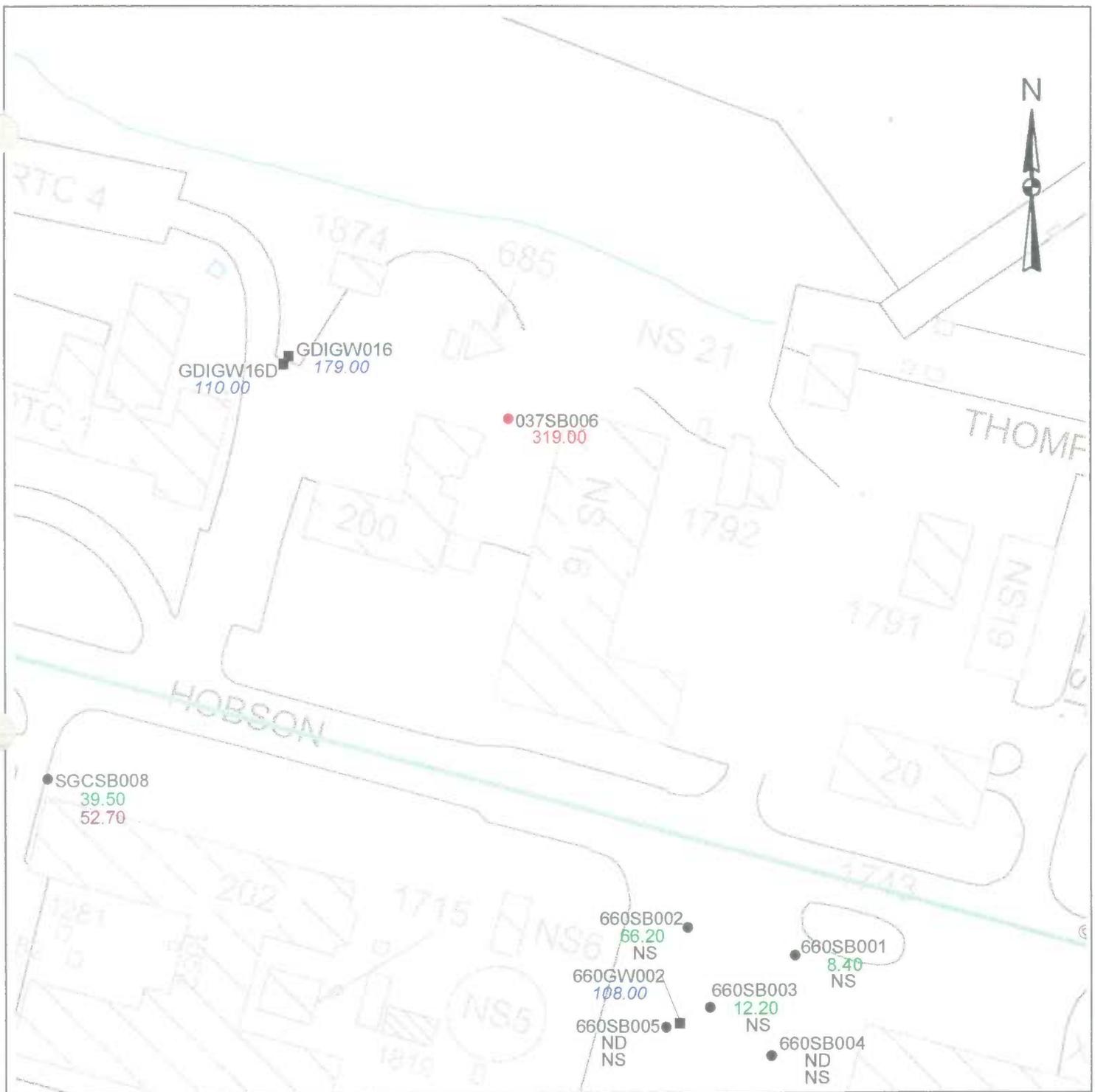
70 0 70 140 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.12
ZONE L - SUBZONE I
CHROMIUM
ZONE L EXCEEDANCES WITH ZONES H AND I
SOIL AND GW CONCENTRATIONS

RBC=39.0 mg/kg SSL=19.0 mg/kg MCL=100 ug/L



LEGEND

- ▲ ZONE L DPT SOIL LOCATION
- ZONE L SOIL BORING LOCATION
- 12.30 ZONE L DPT OR SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE L SUBSURFACE SOIL CONC. (mg/kg)
- MONITORING WELL LOCATION
- 12.30 MAXIMUM QUARTERLY GW CONC. (ug/L)
- ZONE H OR I SOIL BORING LOCATION
- 12.30 ZONE H OR I SURFACE SOIL CONC. (mg/kg)
- 12.30 ZONE H OR I SUBSURFACE SOIL CONC. (mg/kg)
- ND NOT DETECTED
- NS NO SAMPLE TAKEN

- SUBZONE BOUNDARY
- SANITARY SEWER LINE
- RAILROAD
- STORM SEWER LINE
- MANHOLE

90 0 90 180 Feet



ZONE L - RCRA
FACILITY INVESTIGATION
NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.9.13
ZONE L - SUBZONE I
MANGANESE
ZONE L EXCEEDANCES WITH ZONES H AND I
SOIL AND GW CONCENTRATIONS

RBC=160 mg/kg SSL=480 mg/kg MCL=NONE

10.10 Second Round DPT Sampling

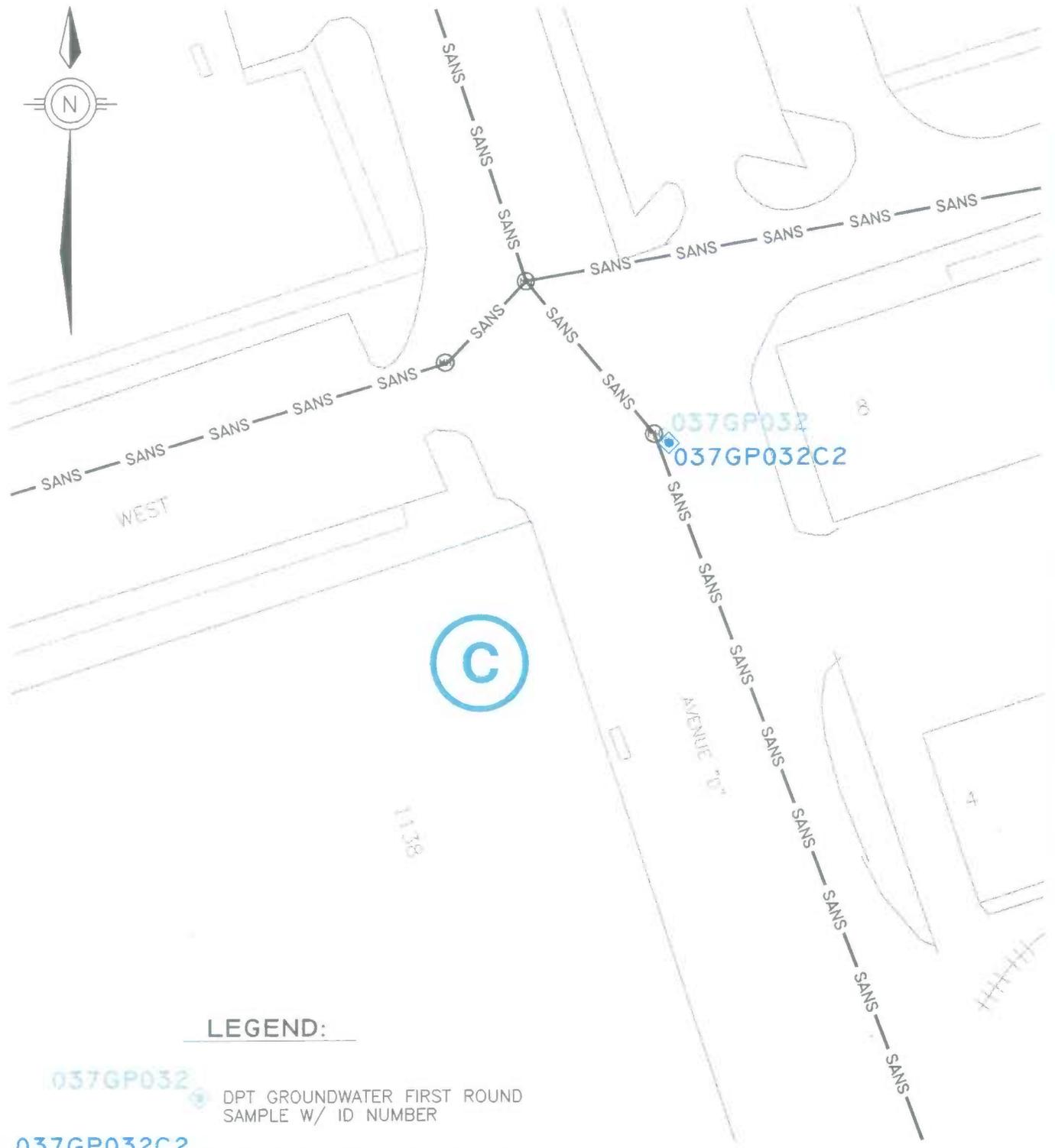
Second round DPT sampling for the Zone L investigation consisted of 45 groundwater samples which were analyzed for VOCs at all locations and at particular locations SVOCs were also analyzed. Second round DPT sampling occurred at Subzones, C, E, F, G, and H to help delineate the extent of contamination or determine the possible presence of contaminants in groundwater in areas where there are no existing monitoring well locations. The second round sample locations, along with the associated first round sample locations, are presented in Figures 10.10.1 through 10.10.9. Appendix C contains the second round DPT analytical results.

10.10.1 Subzone C

One DPT groundwater sample was collected at location 037GP032C2 and analyzed for VOAs due to the detected concentration of acetone (680 $\mu\text{g/l}$) at 037GP032C1. The high concentration of acetone was suspected from decontamination procedures used during DPT sample collection. Isopropyl alcohol was used as a decontamination fluid and acetone is a contaminate of isopropyl alcohol. The second round analysis detected acetone at 15 $\mu\text{g/l}$. No other volatile organic compounds were detected.

10.10.2 Subzone E

A total of 5 DPT groundwater samples in SWMU 37 and 12 DPT groundwater samples in AOC 699 were collected and analyzed for VOAs and SVOAs. An additional analysis of Diesel and Gasoline Range Organics was performed at location 699GP085E2 because of the presence of free product. Second round sampling occurred at these locations because field logbooks detailed descriptions of possible petroleum contamination of first round samples. With the exception of sample 699GP085E2, the samples did not detect any results that exceeded MCL values. The SVOA and Gasoline Range Organics analyses detected compounds that reflect the presence of petroleum products. Dibenzofuran (160,000 $\mu\text{g/kg}$), fluorene (140,000 $\mu\text{g/kg}$), phenanthrene



LEGEND:

037GP032

DPT GROUNDWATER FIRST ROUND
SAMPLE W/ ID NUMBER

037GP032C2

DPT GROUNDWATER SECOND ROUND
SAMPLE W/ ID NUMBER



SANITARY SEWER MANHOLE



SANITARY SEWER LINE



SCALE IN FEET

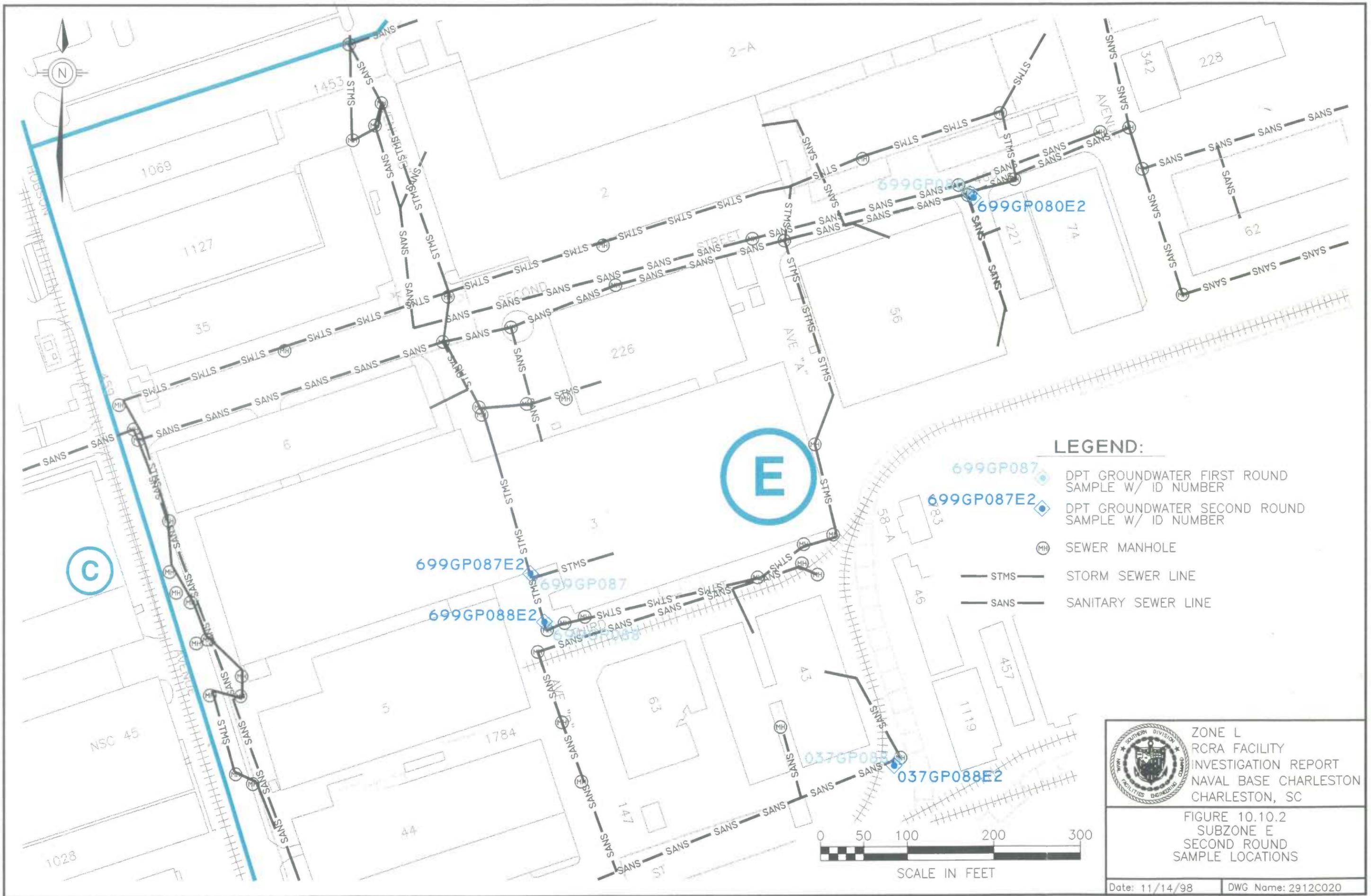


ZONE L
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CHARLESTON, SC

FIGURE 10.10.1
SUBZONE C
SECOND ROUND
SAMPLE LOCATION

Date: 11/13/98

DWG Name: 2912C019



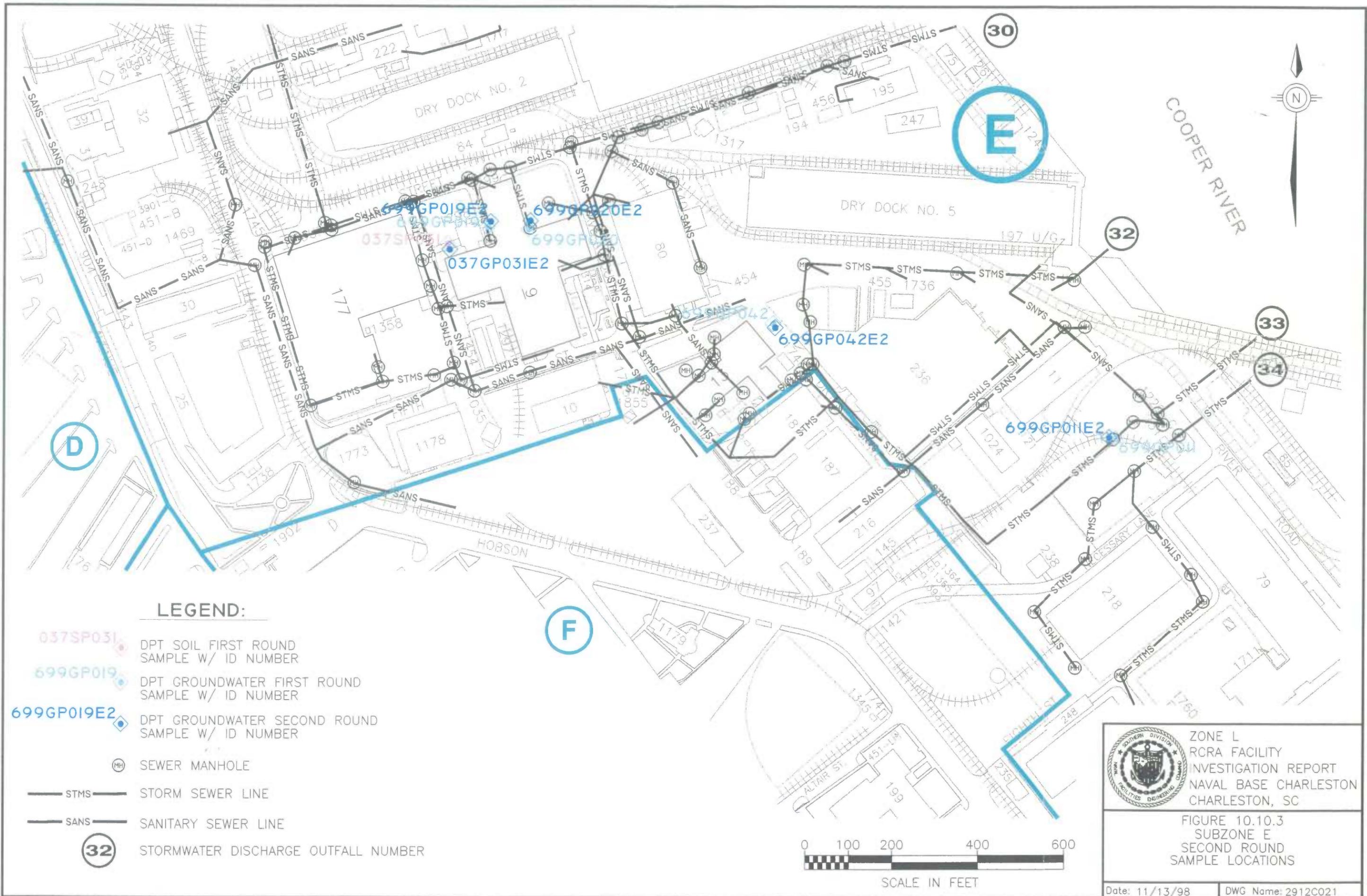
- LEGEND:**
- 699GP087 DPT GROUNDWATER FIRST ROUND SAMPLE W/ ID NUMBER
 - ◆ 699GP087E2 DPT GROUNDWATER SECOND ROUND SAMPLE W/ ID NUMBER
 - ⊙ MH SEWER MANHOLE
 - STMS — STORM SEWER LINE
 - SANS — SANITARY SEWER LINE



ZONE L
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FIGURE 10.10.2
 SUBZONE E
 SECOND ROUND
 SAMPLE LOCATIONS

Date: 11/14/98 DWG Name: 2912C020



LEGEND:

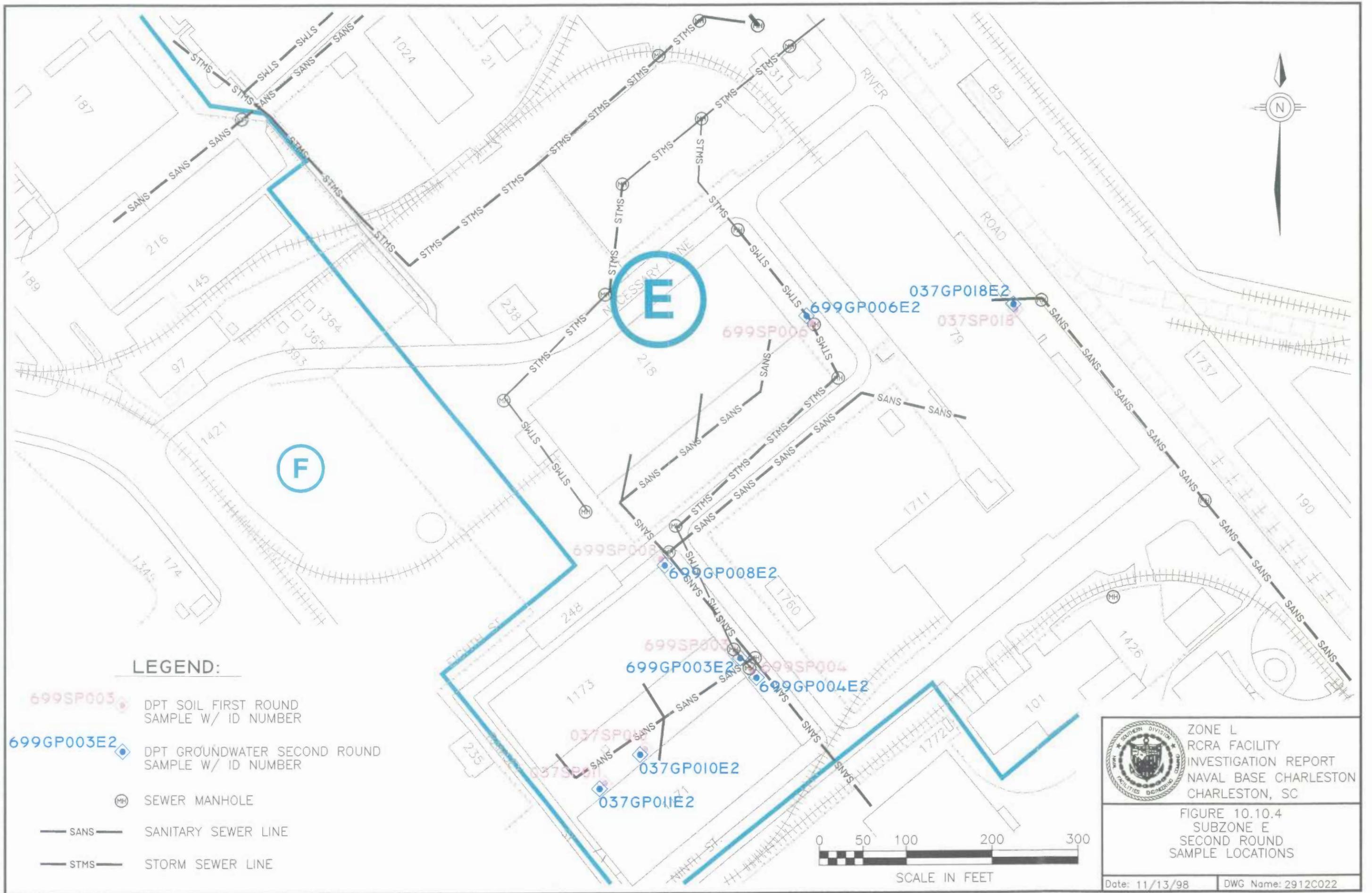
- 037SP031 DPT SOIL FIRST ROUND SAMPLE W/ ID NUMBER
- 699GP019 DPT GROUNDWATER FIRST ROUND SAMPLE W/ ID NUMBER
- 699GP019E2 DPT GROUNDWATER SECOND ROUND SAMPLE W/ ID NUMBER
- MH SEWER MANHOLE
- STMS STORM SEWER LINE
- SANS SANITARY SEWER LINE
- 32 STORMWATER DISCHARGE OUTFALL NUMBER

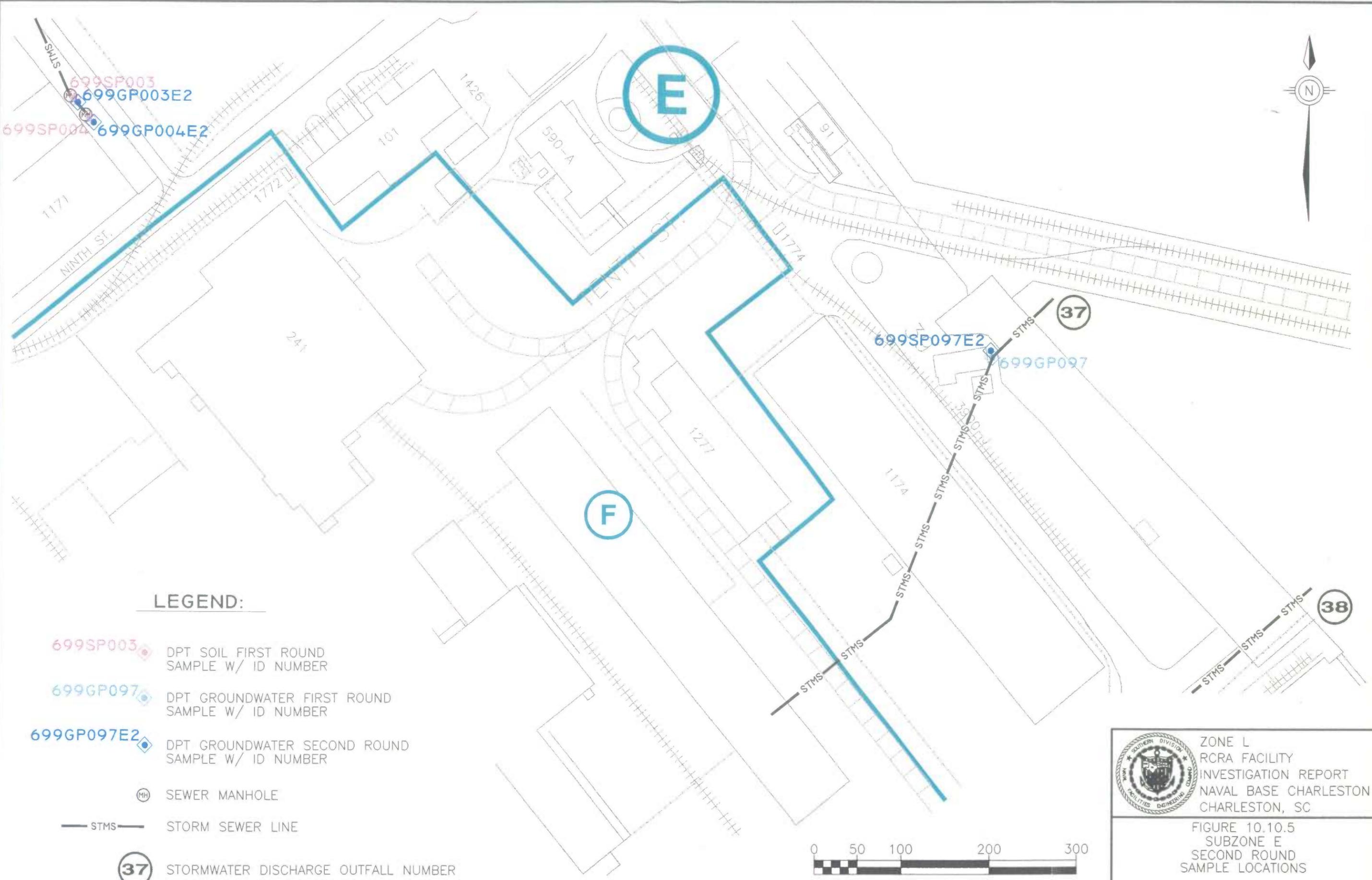


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FIGURE 10.10.3
SUBZONE E
SECOND ROUND
SAMPLE LOCATIONS

Date: 11/13/98 DWG Name: 2912C021





LEGEND:

- ◆ 699SP003 DPT SOIL FIRST ROUND SAMPLE W/ ID NUMBER
- ◆ 699GP097 DPT GROUNDWATER FIRST ROUND SAMPLE W/ ID NUMBER
- ◆ 699GP097E2 DPT GROUNDWATER SECOND ROUND SAMPLE W/ ID NUMBER
- ⊙ (MH) SEWER MANHOLE
- STMS — STORM SEWER LINE
- ⊙ (37) STORMWATER DISCHARGE OUTFALL NUMBER

	ZONE L RCRA FACILITY INVESTIGATION REPORT NAVAL BASE CHARLESTON CHARLESTON, SC
	FIGURE 10.10.5 SUBZONE E SECOND ROUND SAMPLE LOCATIONS
Date: 11/13/98 DWG Name: 2912C023	

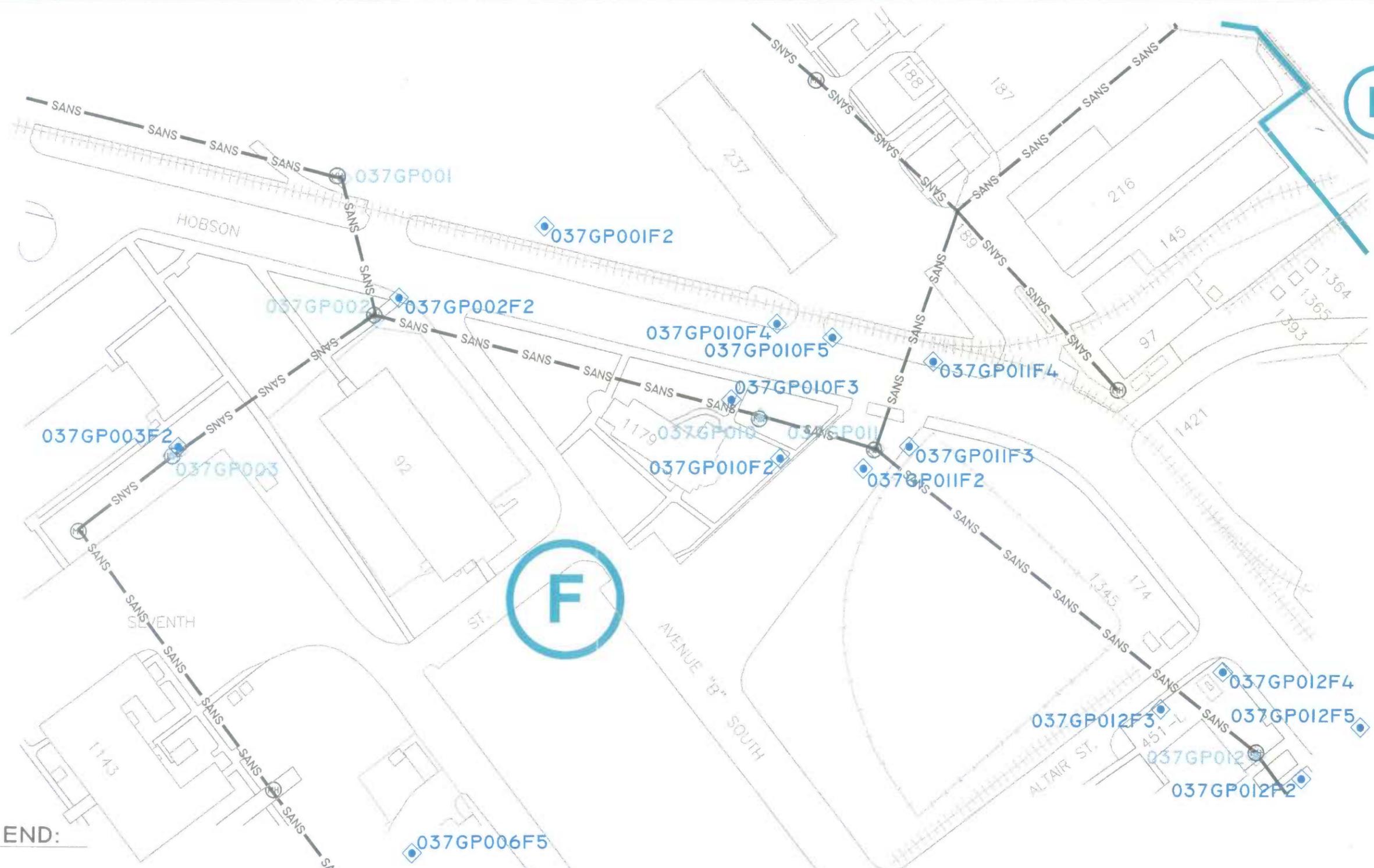


E

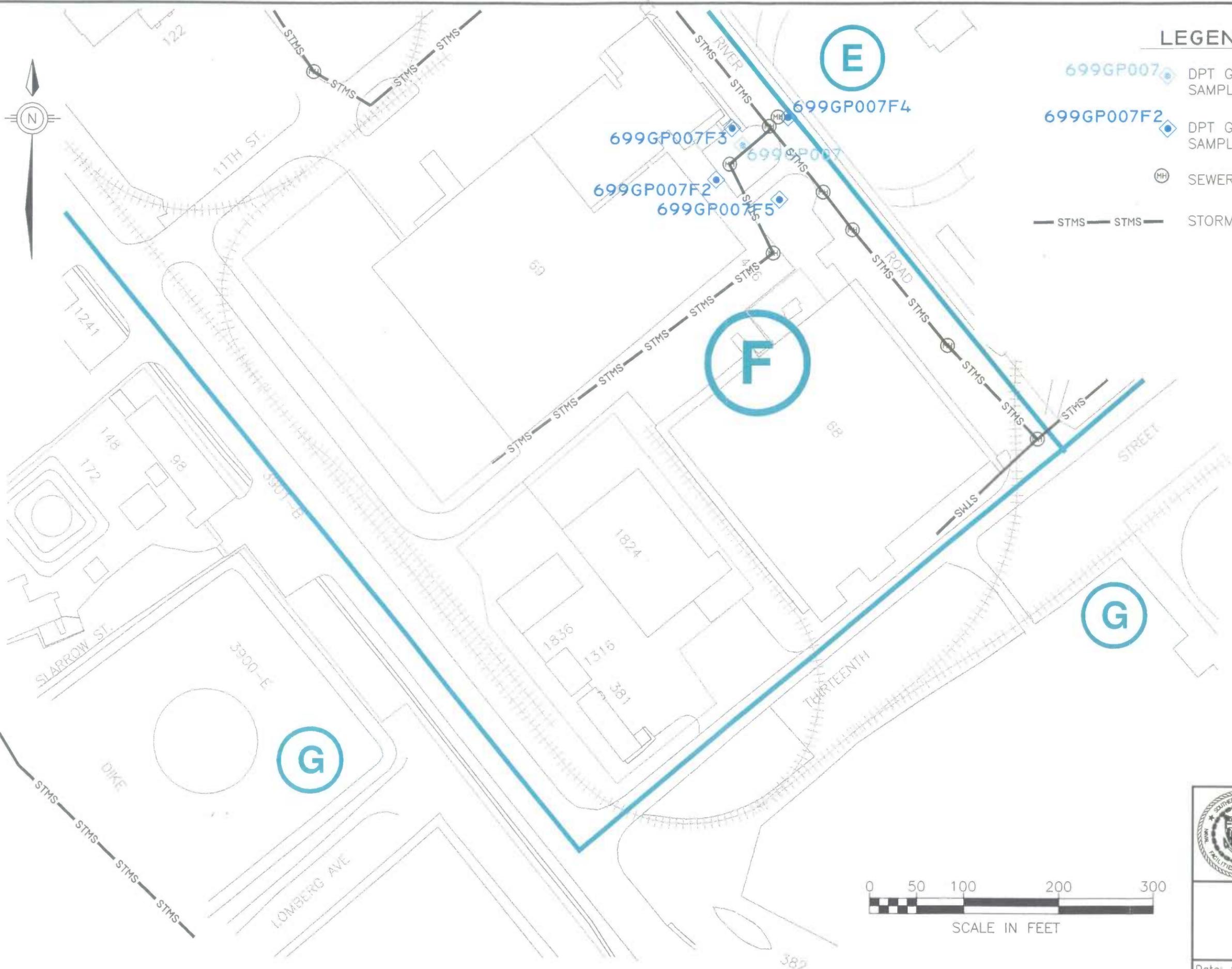
F

LEGEND:

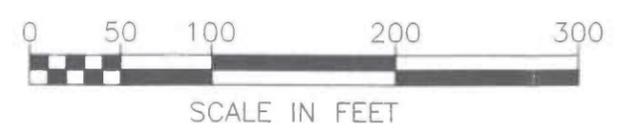
-  DPT GROUNDWATER FIRST ROUND SAMPLE W/ ID NUMBER
-  DPT GROUNDWATER SECOND ROUND SAMPLE W/ ID NUMBER
-  SEWER MANHOLE
-  SANITARY SEWER LINE



	ZONE L RCRA FACILITY INVESTIGATION REPORT NAVAL BASE CHARLESTON CHARLESTON, SC
	FIGURE 10.10.6 SUBZONE F SECOND ROUND SAMPLE LOCATIONS
Date: 11/14/98	DWG Name: 2912C024



- LEGEND:**
- 699GP007 DPT GROUNDWATER FIRST ROUND SAMPLE W/ ID NUMBER
 - 699GP007F2 DPT GROUNDWATER SECOND ROUND SAMPLE W/ ID NUMBER
 - SEWER MANHOLE
 - STMS — STMS — STORM SEWER LINE



	ZONE L RCRA FACILITY INVESTIGATION REPORT NAVAL BASE CHARLESTON CHARLESTON, SC
	FIGURE 10.10.7 SUBZONE F SECOND ROUND SAMPLE LOCATIONS
Date: 11/14/98	DWG Name: 2912C025



LEGEND:

037SP012 ♦ DPT SOIL FIRST ROUND SAMPLE W/ ID NUMBER

037GP012G2 ♦ DPT GROUNDWATER SECOND ROUND SAMPLE W/ ID NUMBER

⊕ SANITARY SEWER MANHOLE

— SANS — SANS — SANITARY SEWER LINE

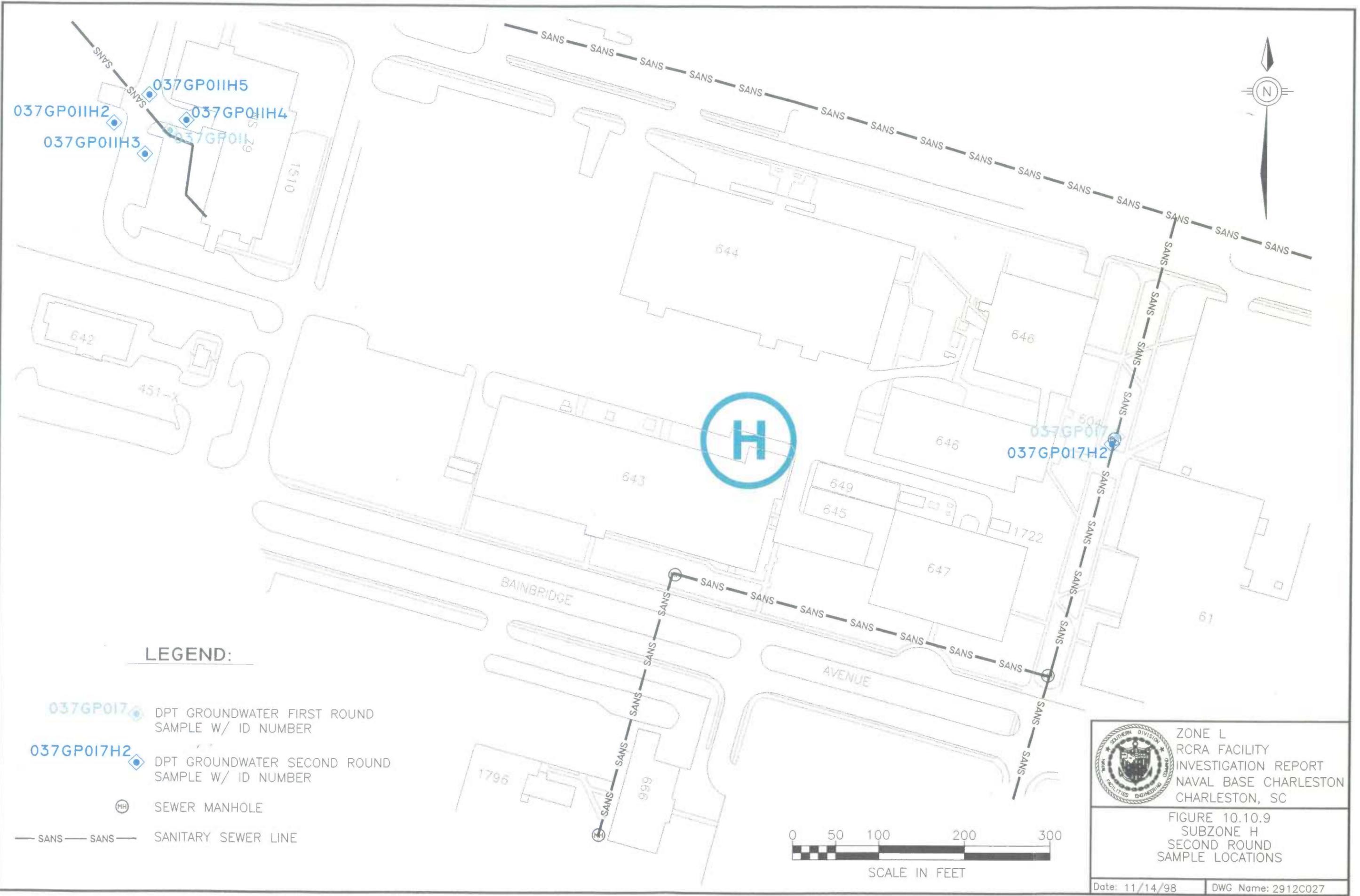


ZONE L
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NAVAL BASE CHARLESTON
CHARLESTON, SC

FIGURE 10.10.8
SUBZONE G
SECOND ROUND
SAMPLE LOCATION

Date: 11/14/98

DWG Name: 2912C026



LEGEND:

- 037GP017 DPT GROUNDWATER FIRST ROUND SAMPLE W/ ID NUMBER
- 037GP017H2 DPT GROUNDWATER SECOND ROUND SAMPLE W/ ID NUMBER
- SEWER MANHOLE
- SANITARY SEWER LINE

	<p>ZONE L RCRA FACILITY INVESTIGATION REPORT NAVAL BASE CHARLESTON CHARLESTON, SC</p>
	<p>FIGURE 10.10.9 SUBZONE H SECOND ROUND SAMPLE LOCATIONS</p>
Date: 11/14/98	DWG Name: 2912C027

(290,000 $\mu\text{g}/\text{kg}$), fluoranthene (42,000 $\mu\text{g}/\text{kg}$), Pyrene (77,000 $\mu\text{g}/\text{kg}$), benzo(a) anthracene (45,000 $\mu\text{g}/\text{kg}$), benzo(b)fluoranthene (14,000 $\mu\text{g}/\text{kg}$), benzo(k)fluoranthene (17,000 $\mu\text{g}/\text{kg}$), and benzo(a)pyrene (18,000 $\mu\text{g}/\text{kg}$) were the detected SVOA compounds. The Gasoline Range Organics detection was 18,000 $\mu\text{g}/\text{l}$.

10.10.3 Subzone F

A total of 18 DPT groundwater samples in SWMU 37 and 4 DPT groundwater samples were collected and analyzed for VOAs. VOA analyses at locations 037GP001F2 037GP002F2, and 037GP003F2 did not detect any volatile compounds. Locations adjacent to 037GP006F1 were sampled because of detections of tetrachloroethene. Tetrachloroethene was not detected at any of the second round locations adjacent to 037GP006F1. Compounds that were detected did not exceed MCL values.

At location 037GP010F1, 4 adjacent second round samples were collected because of a tetrachloroethene detection in the first round. Tetrachlorethene was not detected in the any of the second round samples.

At location 037GP011F1, 3 adjacent second round samples were collected because of a tetrachloroethene detection in the first round. Tetrachlorethene was not detected in the any of the second round samples.

At location 037GP012F1, 4 adjacent second round samples were collected because of a tetrachloroethene detection in the first round. Tetrachlorethene was not detected in the any of the second round samples.

At location 699GP007F1, 4 adjacent second round samples were collected because vinyl chloride and cis-1,2-dichloroethene were detected in the first round sample. Vinyl chloride (15 $\mu\text{g/l}$) and cis-1,2-dichloroethene (13 $\mu\text{g/l}$) were detected at location 699GP007F4. Vinyl chloride exceeded the MCL value of 2 $\mu\text{g/l}$. The other locations did not have MCL exceedances.

10.10.4 Subzone G

A second round DPT groundwater sample was collected at 037SP012G1 because of trichlorethane and tetrachlorethane detections. The second sample did not detect either compound in VOA analysis.

10.10.5 Subzone H

At location 037GP011H1, 4 adjacent second round samples were collected because of chlorobenzene was detected in the first round sample. There were no VOA compounds detected in the second round.

10.10.6 Fuel Distribution System

The Fuel Distribution System (FDS) at CNC encompasses the entire pipeline distribution system and many petroleum-related sites in Zones F and G, and traverses areas in Zones E, F, and G, as well as areas investigated for Zone L. The field investigation and contamination assessment results of the FDS are addressed in the *Fuel Distribution System Contaminations Assessment Report* (EnSafe, September 1998).

FDS sample points were compared to adjacent Zone L sample points to determine if petroleum contamination from the FDS affected areas of Zone L. FDS sample locations with VOA detections in Subzones E, F, and G and in close proximity to Zone L sample locations are shown in Tables 10.11.1, 10.11.2, and 10.11.3 and are presented in Figure 10.11.1. All detections for

FDS sample points were compared with the detections for Zone L sample points. No volatile organic compounds associated with petroleum contamination (benzene, ethylbenzene, toluene, or xylene) were detected in the Zone L samples. In Subzone E, cyanide was detected for the FDS samples and the Zone L sample. The FDS sample FDSSH024 in Subzone F had detections of acetone and 2-butanone as did the Zone L samples 037SP025 and 037SP026. Also in Subzone F, acetone was detected in FDSSC097 and 037SP013. In Subzone G, cyanide was detected in FDS01E and FDS07A and in the nearby Zone L samples 037SB010 and 037GP014.

10.10.7 Catch Basins

Sediment samples were collected in catch basins in the Zones E, F, and G RFI investigations and the data was compared to Zone L sample results. The samples collected were addressed with each Zone investigated to date and are therefore identified with the specific AOCs and SWMUs which may have contributed contamination to the catch basins and as such are addressed on a site-specific basis. The sample locations of the catch basins are presented in Figure 10.12.1. The results for the samples collected from the catch basins are summarized in Appendix C. Arcview figures presented in Subzones E, F, and G were reviewed to locate possible Zone L sample locations adjacent to the catch basins.

10.10.8 Zone E

SWMU 25 Catch Basin

One catch basin was sampled at SWMU 25 during the Zone E RFI investigation and analyzed for VOCs, SVOCs, chlorinated pesticides, PCBs, metals, cyanide, and organotins. Polynuclear aromatic hydrocarbons (PAHs) results ranged from 1400 $\mu\text{g}/\text{kg}$ to 45000 $\mu\text{g}/\text{kg}$. There were no Zone L samples collected in the area proximal to this catch basin. Section 10 of the Zone E RFI Report contains the results of SWMU 25 samples collected in the vicinity of this site.

SWMUs 170 and 171 Catch Basins

Four catch basins are located in the vicinity of SWMU 170 and two near SWMU 171 where samples were collected and analyzed for PCBs. Each sediment sample detected Arochlor 1260 with results ranging from 46 $\mu\text{g}/\text{kg}$ to 200 $\mu\text{g}/\text{kg}$. There were no Zone L samples collected in the area proximal to these catch basins. Section 10 of the Zone E RFI Report contains the results of SWMUs 170 and 171 samples collected in the vicinity of this site.

SWMU 173 Catch Basins

Three catch basins are located in the vicinity of SWMU 173. Samples were collected for each of these and analyzed for VOCs, SVOCs, chlorinated pesticides, PCBs, metals, cyanide, and organotins. PAHs results ranged from 93 $\mu\text{g}/\text{kg}$ to 930 $\mu\text{g}/\text{kg}$. There were no Zone L samples collected in the area proximal to these catch basins. Section 10 of the Zone E RFI Report contains the results of SWMUs 173 and 83 and AOC 572 samples collected in the vicinity of this site.

AOC 539 Catch Basin

One catch basin is located in the vicinity of AOC 539. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, chlorinated pesticides, PCBs, and metals. PAHs results ranged from 180 $\mu\text{g}/\text{kg}$ to 15,000 $\mu\text{g}/\text{kg}$. There were no Zone L samples collected in the area proximal to this catch basin. Section 10 of the Zone E RFI Report contains the results of AOC 539 samples collected in the vicinity of this site.

AOC 546 Catch Basin

One catch basin is located in the vicinity of AOC 546. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, chlorinated pesticides, PCBs, metals, cyanide, and organotins. PAHs ranged from 740 $\mu\text{g}/\text{kg}$ to 33,000 $\mu\text{g}/\text{kg}$. There were no Zone L samples

collected in the area proximal to this catch basin. Section 10 of the Zone E RFI Report contains the results of AOC 546 samples collected in the vicinity of this site.

AOC 572 Catch Basin

One catch basin is located in the vicinity of AOC 572. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, and metals. VOA analysis detected toluene (3 $\mu\text{g}/\text{kg}$), ethylbenzene (2 $\mu\text{g}/\text{kg}$), and xylene (10 $\mu\text{g}/\text{kg}$). The SVOA analysis detected PAHs ranging from 110 $\mu\text{g}/\text{kg}$ to 5900 $\mu\text{g}/\text{kg}$. The results for Zone L samples collected proximal to this catch basin are presented in Figure 10.5.72 in the Subzone E section of the Zone L RFI Report and Section 10 of the Zone E RFI Report.

AOC 590 Catch Basin

One catch basin is located in the vicinity of AOC 590. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, and metals. PAHs ranged from 16,000 $\mu\text{g}/\text{kg}$ to 190,000 $\mu\text{g}/\text{kg}$. There were no Zone L samples collected in the area proximal to this catch basin. Section 10 of the Zone E RFI Report contains the results of AOC 590 samples collected in the vicinity of this site.

AOC 598 Catch Basin

One catch basin is located in the vicinity of AOC 598. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, and metals. PAHs ranged from 190 $\mu\text{g}/\text{kg}$ to 4400 $\mu\text{g}/\text{kg}$. There were no Zone L samples collected in the area proximal to this catch basin. Section 10 of the Zone E RFI Report contains the results of AOC 598 samples collected in the vicinity of this site.

AOC 599 Catch Basin

One catch basin is located in the vicinity of AOC 599. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, and metals. PAHs ranged from 230 $\mu\text{g}/\text{kg}$ to 11000 $\mu\text{g}/\text{kg}$. The results for a sample with an elevated arsenic concentration collected near this catch basin are presented in Figure 10.5.82 in the Subzone E section of the Zone L RFI Report. Section 10 of the Zone E RFI Report contains the results of AOC 599 samples collected in the vicinity of this site.

10.10.9 Zone F

AOC 619 Catch Basin

One catch basin is located in the vicinity of AOC 619. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, chlorinated pesticides, metals, and cyanide. PAHs ranged from 46 $\mu\text{g}/\text{kg}$ to 180 $\mu\text{g}/\text{kg}$. The locations and results for Zone L samples near this catch basin with concentrations of benzo(a)pyrene, arsenic, manganese, and thallium are presented in Figures 10.6.30, 10.6.44, 10.6.59, and 10.6.66 in Subzone F of the Zone L RFI Report. The results for samples collected in association with the Zone F RFI for AOCs 619 and 620 as well as SWMUs 004 and 036, locations proximal to this catch basin, are presented in Section 10 of the Zone F RFI Report.

SWMU 109 Catch Basins

Two catch basins are located in the vicinity of SWMU 109. One sediment sample was collected from each of these locations and analyzed for SVOCs, metals and cyanide. Figures 10.6.37 and 10.6.53 in the Subzone F section of the Zone L RFI Report present the locations and concentrations of samples collected near these locations with concentrations of arsenic and manganese. The results for samples from SWMU 109 collected in association with the Zone F RFI are presented in Section 10 of the Zone F RFI Report.

AOC 607 Catch Basins

Three catch basins are located in the vicinity of AOC 607. One sediment sample was collected from each of these locations and analyzed for VOCs, SVOCs, metals, and cyanide. PAHs ranged from 240 $\mu\text{g}/\text{kg}$ to 130,000 $\mu\text{g}/\text{kg}$. Concentrations of cis-1,2-dichloroethene, tetrachloroethene, trichloroethene, vinyl chloride, and arsenic samples from Zone L are presented in the Zone L RFI Report in Figures 10.6.19, 10.6.21, 10.6.24, 10.6.26, and 10.6.35. Section 10 of the Zone F RFI Report presents the results of AOC 607 samples collected in association with the Zone F RFI Report.

10.10.10 Zone G

SWMU 120 Catch Basin

One catch basin is located in the vicinity of SWMU 120. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, chlorinated pesticides, PCBs, and metals. Benzene (2 $\mu\text{g}/\text{kg}$), toluene (10 $\mu\text{g}/\text{kg}$), ethylbenzene (30 $\mu\text{g}/\text{kg}$), and xylene (270 $\mu\text{g}/\text{kg}$) were detected in the VOA analysis. PAHs ranged from 72 $\mu\text{g}/\text{kg}$ to 3000 $\mu\text{g}/\text{kg}$. There were no Zone L samples collected in the area proximal to this catch basin. Section 10 of the Zone G RFI Report contains the results of SWMU 120 samples collected in the vicinity of this site.

AOC 643 Catch Basin

One catch basin is located in the vicinity of AOC 643. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, and chlorinated pesticides, and PCBs. PAHs ranged from 140 $\mu\text{g}/\text{kg}$ to 14,000 $\mu\text{g}/\text{kg}$. The results and locations of samples with concentrations of benzo(a)pyrene, arsenic, copper, manganese, and vanadium are presented in Figures 10.7.12, 10.7.27, 10.7.31, 10.7.38, and 10.7.44, respectively in the Zone L RFI Report. In addition, samples collected in association with the Zone G RFI in the vicinity of this catch basin near AOC 643 are presented in the Section 10 of the Zone G RFI Report.

The Charleston Environmental Detachment is currently undergoing a clean up of the catch basins 1
located at CNS. 2

10.11 Fuel Distribution System

The Fuel Distribution System (FDS) at CNC encompasses the entire pipeline distribution system, and traverses areas in Zones E, F, and G, as well as areas investigated for Zone L. The field investigation and contamination assessment results of the FDS are addressed in the *Fuel Distribution System Contaminations Assessment Report* (EnSafe, September 1998). Figure 10.11.1 shows Zone L sample locations near FDS sample locations.

FDS sample points were compared to adjacent Zone L sample points to determine if petroleum contamination from the FDS affected areas of Zone L. FDS sample points in Subzones E, F, and G which are in close proximity to Zone L sample points are shown in Tables 10.11.1, 10.11.2, and 10.11.3 respectively. All detections for FDS sample points were compared with the detections for Zone L sample points. No volatile organic compounds associated with petroleum contamination [benzene, ethylbenzene, toluene, or xylene (total)] were detected in the Zone L samples. In Subzone E, cyanide was detected for the FDS samples and the Zone L sample. The FDS sample FDSSH024 in Subzone F had detections of acetone and 2-butanone (MEK) as did the Zone L samples 037SP025 and 037SP026. Also in Subzone F, acetone was detected in FDSSC097 and 037SP013. In Subzone G, cyanide was detected in FDS01E and in the nearby Zone L sample 037SB010. FDS07A also detected cyanide as did the nearby Zone L sample 037GP014. Metals in general were detected in both FDS samples and Zone L samples.



- LEGEND:**
- FDS07B FUEL DISTRIBUTION SYSTEM MONITORING WELL W/ ID NUMBER
 - FDSC0401 SOIL BORING W/ ID NUMBER
 - 037GP024 DPT GROUNDWATER SAMPLE W/ ID NUMBER
 - 037SP014 DPT SOIL SAMPLE W/ ID NUMBER
 - ⊕ SEWER MANHOLE
 - SANS — SANITARY SEWER LINE
 - STHS — STORM SEWER LINE
 - FUEL — FUEL DISTRIBUTION LINE
 - ⊙ 38 STORMWATER DISCHARGE OUTFALL NUMBER

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 CHARLESTON, SC

FIGURE 10.11.1
 FUEL DISTRIBUTION SYSTEM (FDS)
 SAMPLING LOCATIONS
 SUBZONES E, F & G

REVISIONS		
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Table 10.11.1
Comparison of FDS Samples and Zone L Samples in
Subzone E

SUBZONE E

<u><i>FDS Samples</i></u>		
	FDSSC095	FDS17B
<i>Cyanide (CN)</i>	0.15	2.1
<i>Metals - In General</i>	YES	YES
<i>Volatiles:</i>		ND
<i>Acetone</i>	280	
<i>2-Butanone (MEK)</i>	ND	
<i>Carbon disulfide</i>	ND	
<i>Methylene chloride</i>	12	
<u><i>Adjacent Zone L Samples</i></u>		
	504SB001	
<i>Cyanide (CN)</i>	0.15	
<i>Metals - In General</i>	YES	
<i>Volatiles:</i>		
<i>Acetone</i>	ND	
<i>Carbon disulfide</i>	2	
<i>2-Butanone (MEK)</i>	7	



Table 10.11.2
Comparison of FDS Samples and Zone L Samples in Subzone F

SUBZONE F

FDS Samples

	FDS11A	FDS11B	FDS11C	FDSSC051	FDSSH024	FDSSC094	FDS16A	FDSSC097				
<i>Cyanide (CN) (mg/kg)</i>	ND	3.2	2.2	ND	0.24	0.15	4.9	0.24				
<i>Metals (mg/kg) - In General</i>	YES	YES	YES	YES	YES	YES	YES	YES				
<i>Volatiles (ug/kg):</i>	ND	ND					ND					
<i>Acetone</i>			ND	94	69	34		190				
<i>2-Butanone (MEK)</i>			ND	ND	13	ND		5				
<i>Chloroform</i>			ND	ND	ND	2		ND				
<i>Methylene chloride</i>			ND	ND	2	10		9				
<i>4-Methyl-2-Pentanone</i>			ND	ND	ND	2		ND				
<i>Toluene</i>			1	ND	ND	ND		ND				
<i>Xylene (Total)</i>			ND	ND	ND	ND		2				
<u>Adjacent Zone L Samples</u>												
	037GP043				037SP025	037SP026	037GP031	037SP014	037GP015	037SP012	037SP013	037GP014
<i>Cyanide (CN) (mg/kg)</i>	ND				ND							
<i>Metals (mg/kg) - In General</i>	YES				YES							
<i>Volatiles (ug/kg):</i>	ND						ND		ND	ND		ND
<i>Acetone</i>					142	211		5.37			77.1	
<i>Carbon disulfide</i>					ND	6.1		ND			ND	
<i>2-Butanone (MEK)</i>					28.4	52.5		ND			ND	

Table 10.11.3

Comparison of FDS Samples and Zone L Samples in Subzone G

SUBZONE G

FDS Samples

	FDS01E	FDSSC012	FDS02A	FDSSC014	FDS03C	FDS05B	FDS07A
Cyanide (CN) (mg/kg)	3.9	0.75	ND	0.19	2.7	3	2.5
Metals (mg/kg) - In General	YES	YES	YES	YES	YES	YES	YES
Volatiles (ug/kg):	ND		ND		ND	ND	ND
Acetone		65		900			
Carbon disulfide		ND		5			
2-Butanone (MEK)		ND		99			
Methylene chloride		32		17			
Benzene		100		ND			
Toluene		430		17			
Ethylbenzene		740		ND			
Xylene (Total)		3700		ND			

Adjacent Zone L Samples

	037SB009	037SB010	037SB014	037GP025	037GP024	037GP024	037GP020	037GP021	037GP022	037SP014	037SP015	037GP013	037GP014
Cyanide (CN) (mg/kg)	ND	2	ND	5.7									
Metals (mg/kg) - In General	YES												
Volatiles (ug/kg):	ND		ND		ND								
Acetone										26.1		ND	
Carbon disulfide										5.61		7.04	
2-Butanone (MEK)										ND		ND	

10.12 Catch Basin Study

Throughout Zones E, F, and G, catch basins associated with the storm sewer system were sampled to identify areas of contamination within this system that may lead to impacts to aquatic receptors in the Cooper River ecosystem. The results from these samples were used to better focus the Zone J investigation of the water bodies associated with CNC. The samples collected were addressed with each Zone investigated to date and are therefore identified with the specific AOCs and SWMUs which may have contributed contamination to the catch basins and as such are addressed on a site-specific basis. The results for the samples collected from the catch basins are summarized in Appendix C of this document. Figure 10.12.1 shows locations of catch basins near the storm sewer system investigated in Zone L.

10.12.1 Zone E

SWMU 25 Catch Basin

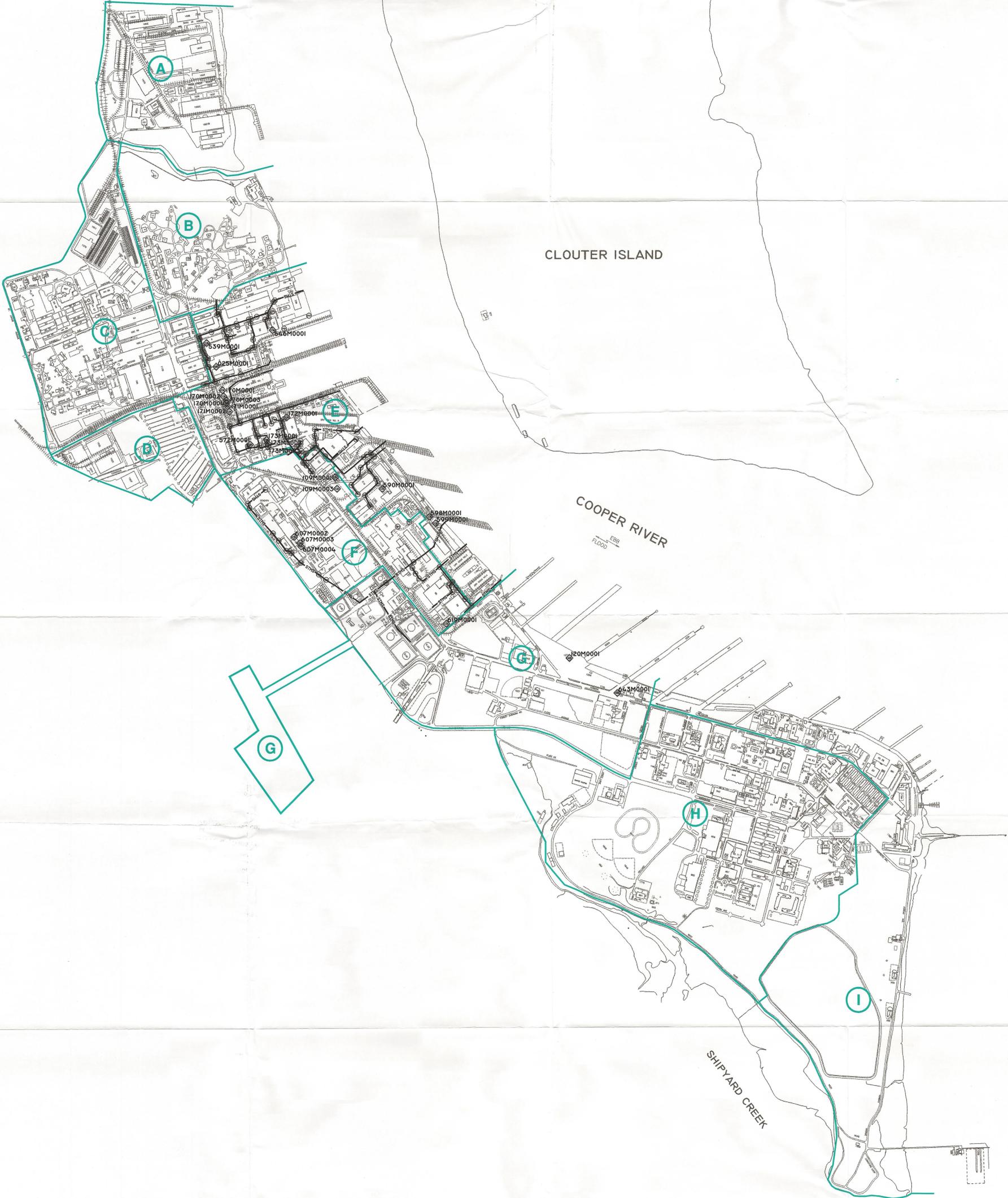
One catch basin was sampled near SWMU 25 in Zone E and analyzed for VOCs, SVOCs, pest/PCBs, metals, cyanide, and organotins. While no Zone L-related samples were collected from the area proximal to this catch basin, Section 10 of the Zone E RFI Report (EnSafe, November 1997) contains the results of SWMU 25 samples collected in the vicinity of this site.

SWMUs 170 and 171 Catch Basins

Four catch basins are located in the vicinity of SWMU 170 and two near SWMU 171 where samples were collected and analyzed for PCBs. No Zone L-related samples were collected. The results SWMUs 170 and 171 samples collected in the vicinity of these catch basins are summarized in Section 10 of the Zone E RFI Report (EnSafe, November 1997).

SWMU 173 Catch Basins

Three catch basins are located in the vicinity of SWMU 173. Samples were collected for each of these and analyzed for VOCs, SVOCs, Pest/PCBs, metals, cyanide, and organotins. While no



CLOUTER ISLAND

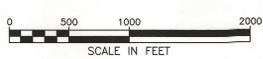
COOPER RIVER
EBB
FLOOD

SHIPYARD CREEK

LEGEND:

- SWS — STORM SEWER LINE
- ⊙ SEWER MANHOLE
- 109M0003 STORMWATER CATCHBASIN W/ ID NUMBER

E BOUNDARY OF STUDY ZONE
W/ LETTER DESIGNATION



REVISIONS		
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		ZONE I RCRA FACILITY INVESTIGATION REPORT NAVAL BASE CHARLESTON CHARLESTON, SC		
		FIGURE 10.12.1 STORMWATER CATCH BASINS		
Dr by: W. FAULK	Tr by: —	Date: 11/30/98	DWG Name: 2912C108	Sheet 1 of 1
Ck by: C. VERNY	Appr by: T. HAVERKOST			

Zone L-related samples were collected in the vicinity of these catch basins, the results for Zone E 1
samples from SWMUs 173 and 083 as well as AOC 572 were collected in the vicinity of these 2
catch basins and are summarized in Section 10 of Zone E RFI Report (EnSafe, November 1997). 3
4

AOC 539 Catch Basin 5

One catch basin is located in the vicinity of AOC 539. From this, one sediment sample was 6
collected and analyzed for VOCs, SVOCs, Pest/PCBs, and metals. While no Zone L-related 7
samples were collected in the vicinity of this catch basin, samples were collected for AOC 539 as 8
part of the Zone E RFI. The results for these samples are presented in Section 10 of the Zone E 9
RFI Report (EnSafe, November 1997). 10
11

AOC 546 Catch Basin 12

One catch basin is located in the vicinity of AOC 546. From this, one sediment sample was 13
collected and analyzed for VOCs, SVOCs, pest/PCBs, metals, cyanide, and organotins. The 14
results for samples collected proximal to this catch basin are presented in Section 10 of the Zone E 15
RFI Report. 16
17

AOC 572 Catch Basin 18

One catch basin is located in the vicinity of AOC 572. From this, one sediment sample was 19
collected and analyzed for VOCs, SVOCs, and metals. The results for samples collected proximal 20
to this catch basin are presented in Figure 10.5.72 of the Zone L RFI Report and Section 10 of 21
the Zone E RFI Report. 22
23

AOC 590 Catch Basin 24

One catch basin is located in the vicinity of AOC 590. From this, one sediment sample was 25
collected and analyzed for VOCs, SVOCs, and metals. The results for samples collected proximal 26
to this catch basin are presented in Section 10 of the Zone E RFI Report (EnSafe November 1997) 27

AOC 598 Catch Basin

One catch basin is located in the vicinity of AOC 598. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, and metals. The results for samples collected proximal to this catch basin are presented in Section 10 of the Zone E RFI Report.

AOC 599 Catch Basin

One catch basin is located in the vicinity of AOC 599. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, and metals. The results for a sample with an elevated arsenic concentration collected near this catch basin are presented in Figure 10.5.82 of the Zone L RFI Report. The results for samples associated with the Zone E RFI collected in the vicinity of this catch basin are summarized in Section 10 of the Zone E RFI Report.

10.12.2 Zone F

AOC 619 Catch Basin

One catch basin is located in the vicinity of AOC 619. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, pest/PCBs, metals, and cyanide. The locations and results for samples near this catch basin with concentrations of benzo(a)pyrene, arsenic, manganese, and thallium in excess of RBCs and/or SSLs are presented in Figures 10.6.30, 10.6.44, 10.6.59, and 10.6.66 of the Zone L RFI Report, respectively. The results for samples collected in association with the Zone E RFI for AOCs 619 and 620 as well as SWMUs 004 and 036, locations proximal to this catch basin, are presented in Section 10 of the Zone F RFI Report.

SWMU 109 Catch Basins

Two catch basins are located in the vicinity of SWMU 109. One sediment sample was collected from each of these locations and analyzed for SVOCs, metals and cyanide. Figures 10.6.37 and 10.6.53 of the Zone L RFI Report present the locations and concentrations of samples collected near these locations with concentrations of arsenic and manganese, respectively, that exceed RBCs

and/or SSLs. The results for samples from SWMU 109 collected in association with the Zone F RFI are presented in Section 10 of the Zone F RFI Report.

AOC 607 Catch Basins

Three catch basins are located in the vicinity of AOC 607. One sediment sample was collected from each of these locations and analyzed for VOCs, SVOCs, metals, and cyanide. Concentrations of cis-1,2-dichloroethene, tetrachloroethene, trichloroethene, vinyl chloride, and arsenic in excess of RBCs and/or SSLs are presented in the Zone L RFI Report in Figures 10.6.19, 10.6.21, 10.6.24, 10.6.26, and 10.6.35, respectively. Section 10 of the Zone F RFI Report presents the results of AOC 607 samples collected in association with the Zone F RFI Report.

10.12.3 Zone G

SWMU 120 Catch Basin

One catch basin is located in the vicinity of SWMU 120. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, pest/PCBs and metals. The results for samples associated with the Zone E RFI collected in the vicinity of this catch basin are summarized in Section 10 of the Zone E RFI Report.

AOC 643 Catch Basin

One catch basin is located in the vicinity of AOC 643. From this, one sediment sample was collected and analyzed for VOCs, SVOCs, and pest/PCBs. The results and locations of samples with elevated concentrations of benzo(a)pyrene, arsenic, copper, manganese, and vanadium are presented in Figures 10.7.12, 10.7.27, 10.7.31, 10.7.38, and 10.7.44, respectively in the Zone L RFI Report. In addition, samples collected in association with the Zone E RFI in the vicinity of this catch basin are presented in the Section 10 of the Zone E RFI Report (EnSafe, November 1997).