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CNC CHARLESTON
5090.3a

CORRECTIVE MEASURES STUDY TECHNICAL MEMORANDUM ZONE A SOLID WASTE MANAGEMENT UNIT 39 (SWMU 39) VOLUME II OF II CNC CHARLESTON SC
12/22/1999
ENSAFE

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY
CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

ZONE A, SWMU 39
CORRECTIVE MEASURES STUDY
TECHNICAL MEMORANDUM
Volume II of II

CTO-029
Contract Number: N62467-89-D-0318

Prepared for:

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Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

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December 22, 1999
Revision: 0

Release of this document requires prior notification of the Commanding Officer of the Southern Division, Naval Facilities Engineering Command, North Charleston, South Carolina.

ATTACHMENT G-1

GENERAL AQUIFER TESTING PROTOCOL

G.1 Aquifer Testing Procedures

After an initial round of water levels were collected, the pump, transducers, data loggers, rain gauge, and any other necessary equipment, were installed and set up. Next, operation of the pump and data loggers were tested; the data loggers were programmed and transducers and water level indicators were calibrated.

To improve measurement accuracy and reduce manpower requirements, water levels in the pumping well, and several nearby observation wells, were measured using pressure transducers and automatic data loggers. Clocks on the data loggers were synchronized with each other before testing began. Water levels in many of the other site wells were monitored intermittently by hand.

The effects of barometric pressure change on the aquifer were investigated during each phase of the test. Pressure changes were monitored with a barometric pressure transducer connected to a data logger.

After testing, the transducers were removed and decontaminated. The data loggers were taken to the office and the data was downloaded to a PC.

Equipment Decontamination

To prevent cross-contamination, water level indicators, pressure transducers, and other equipment that came in contact with contaminated groundwater was decontaminated before and after each use.

Decontamination Steps:

1. Equipment was washed with soap and water.
2. Equipment was rinsed with potable water.
3. Equipment was rinsed with deionized water.

ATTACHMENT G-2

SPECIFIC CAPACITY TEST RESULTS

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 004

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	5.57
DEPTH TO WATER DURING TEST (FT OR M).....=	7.01
DURATION OF THE TEST (HRS).....=	.1
PUMPING RATE (GPM OR CUB.M/S).....=	.3
THICKNESS OF AQUIFER (FT OR M).....=	10
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.22
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.2083334
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.652019E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.652019E-05
NUMBER OF ITERATIONS.....=	5

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

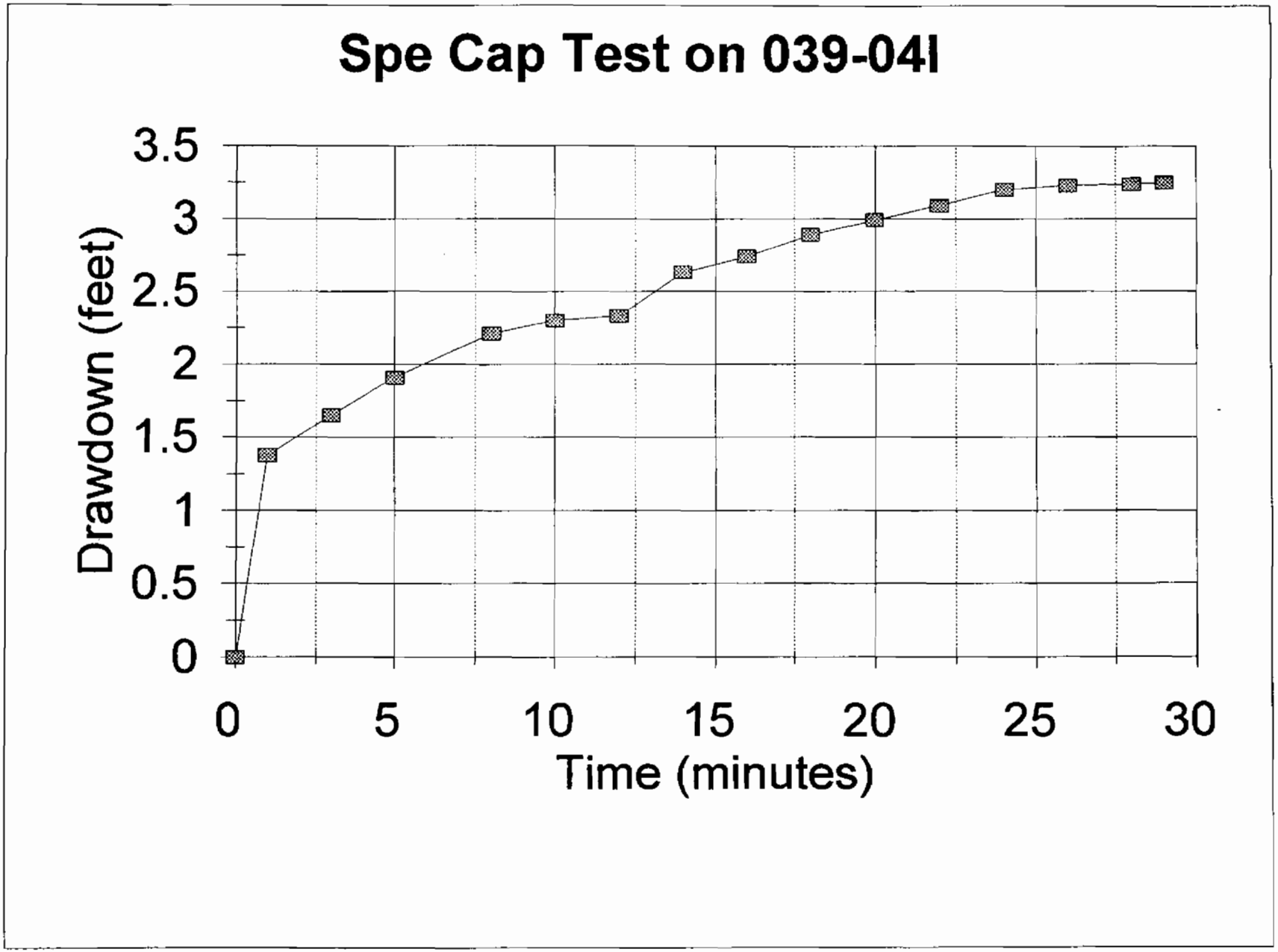
WELL NUMBER.....= 1 04 I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	3.23
DURATION OF THE TEST (HRS).....=	.4333
PUMPING RATE (GPM OR CUB.M/S).....=	2.5
THICKNESS OF AQUIFER (FT OR M).....=	8
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	8
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.7740012
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	.0022273
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	2.784125E-04
NUMBER OF ITERATIONS.....=	4


Spe Cap Test on 039-04I
Drawdown (feet)
3.5
3
2.5
2
1.5
1
0.5
0
0
5
10
15
20
25
30
Time (minutes)

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

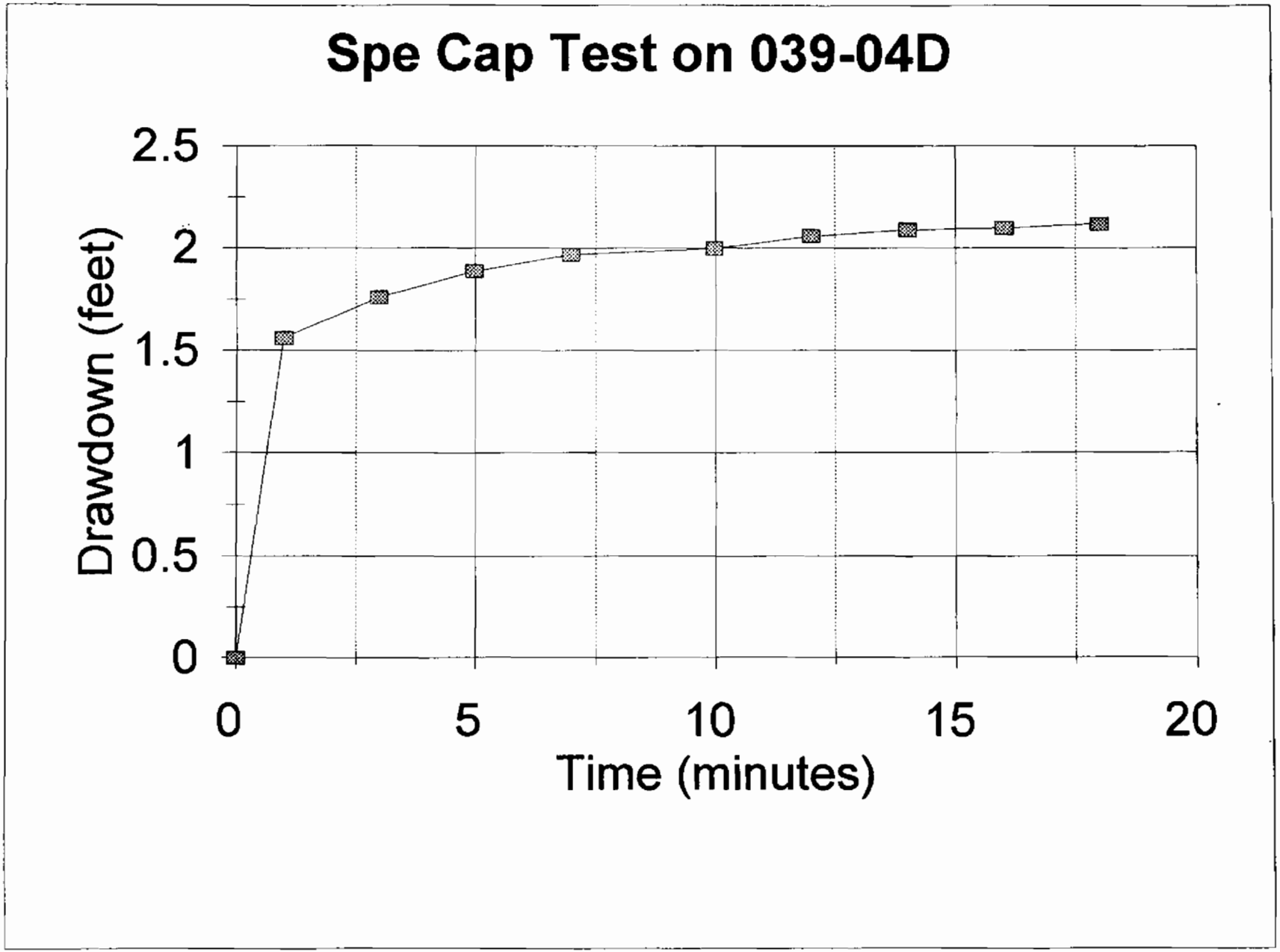
WELL NUMBER.....= 1 04D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	2.1
DURATION OF THE TEST (HRS).....=	.2666
PUMPING RATE (GPM OR CUB.M/S).....=	2.3
THICKNESS OF AQUIFER (FT OR M).....=	8
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	8
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.095252
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	3.123083E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.903853E-04
NUMBER OF ITERATIONS.....=	4


Spe Cap Test on 039-04D
Drawdown (feet)
2.5
2
1.5
1
0.5
0
0
5
10
15
20
Time (minutes)

WELL NUMBER.....= 3 009

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	4.96
DEPTH TO WATER DURING TEST (FT OR M).....=	8.75
DURATION OF THE TEST (HRS).....=	.5
PUMPING RATE (GPM OR CUB.M/S).....=	.55
THICKNESS OF AQUIFER (FT OR M).....=	5.3
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	5.3
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.1451188
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	3.7543E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	7.083583E-05
NUMBER OF ITERATIONS.....=	2

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 09I

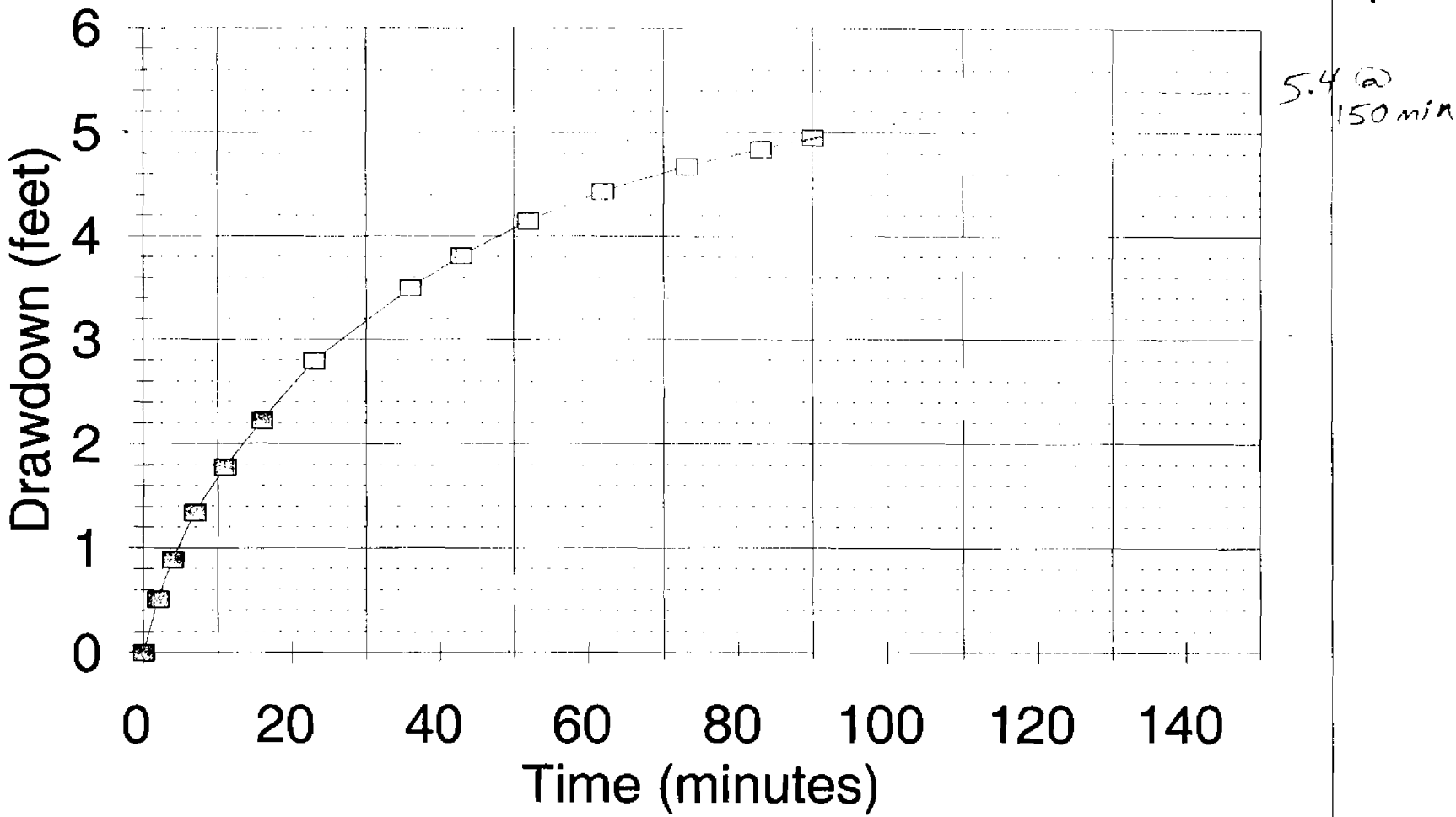
INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	5.4
DURATION OF THE TEST (HRS).....=	2.5
PUMPING RATE (GPM OR CUB.M/S).....=	.058
THICKNESS OF AQUIFER (FT OR M).....=	10
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.074074E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.582016E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	2.582016E-06
NUMBER OF ITERATIONS.....=	2

Spe Cap Test on 039-09I



TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 09D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.56
DURATION OF THE TEST (HRS).....=	.8166
PUMPING RATE (GPM OR CUB.M/S).....=	.055
THICKNESS OF AQUIFER (FT OR M).....=	10
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	3.525641E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	8.502223E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	8.502224E-06
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 010

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	4.75
DURATION OF THE TEST (HRS).....=	.2166
PUMPING RATE (GPM OR CUB.M/S).....=	.24
THICKNESS OF AQUIFER (FT OR M).....=	6.5
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	6.5
STORAGE COEFFICIENT.....=	.1
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	5.052632E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	4.178445E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	6.428377E-06
NUMBER OF ITERATIONS.....=	4

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 10 I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.03
DURATION OF THE TEST (HRS).....=	.2833
PUMPING RATE (GPM OR CUB.M/S).....=	.28
THICKNESS OF AQUIFER (FT OR M).....=	2
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	2
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.2718448
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	7.065391E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.532695E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 10D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.43
DURATION OF THE TEST (HRS).....=	.2833
PUMPING RATE (GPM OR CUB.M/S).....=	.087
THICKNESS OF AQUIFER (FT OR M).....=	3
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	3
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	6.083916E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.407365E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	4.691216E-05
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 012

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.34
DURATION OF THE TEST (HRS).....=	.18333
PUMPING RATE (GPM OR CUB.M/S).....=	1.25
THICKNESS OF AQUIFER (FT OR M).....=	10
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.22
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.9328412
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.162246E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.162246E-04
NUMBER OF ITERATIONS.....=	5

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

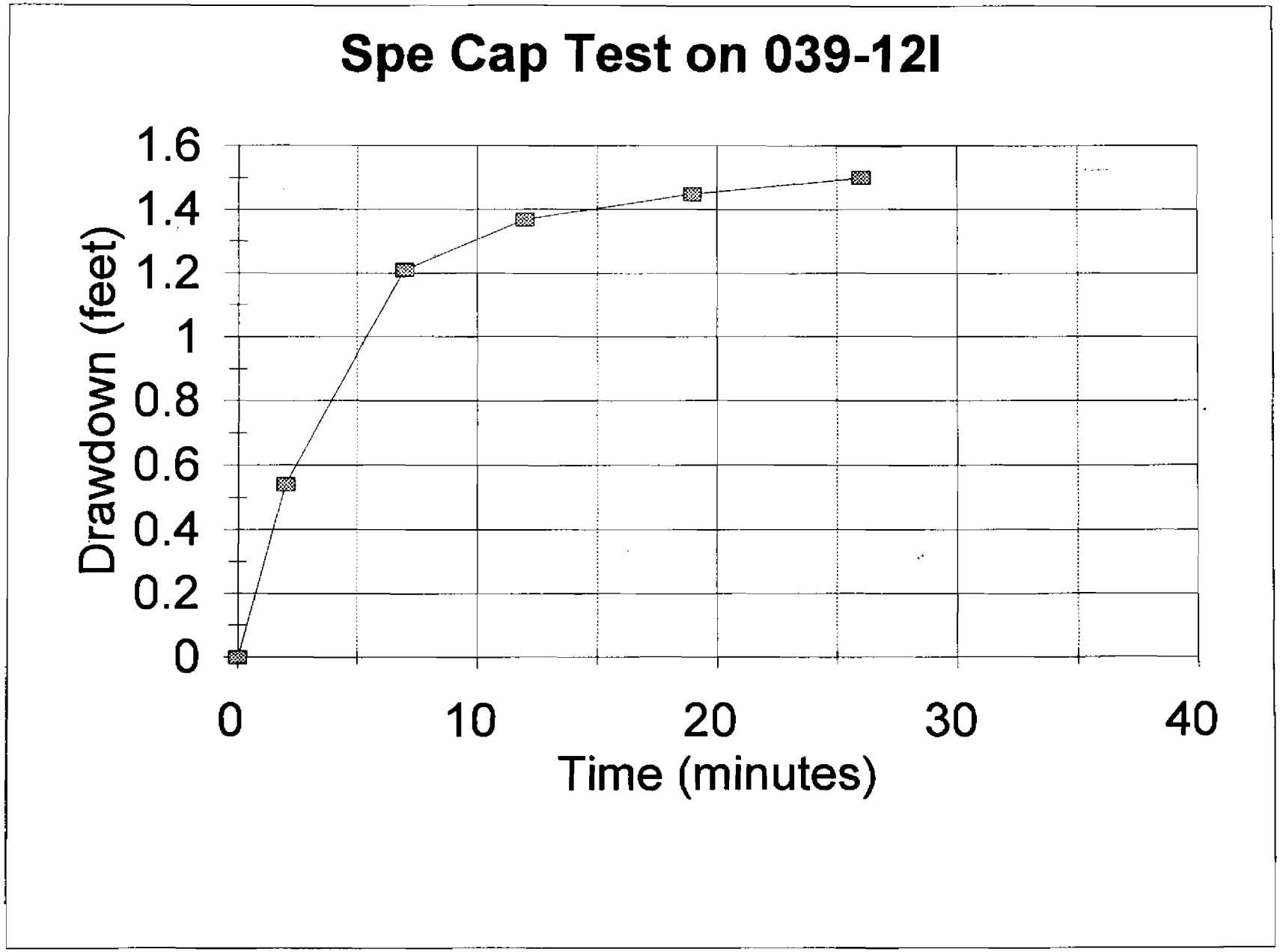
WELL NUMBER.....= 1 12 I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.6
DURATION OF THE TEST (HRS).....=	.58333
PUMPING RATE (GPM OR CUB.M/S).....=	.052
THICKNESS OF AQUIFER (FT OR M).....=	6
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	6
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.0325
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	7.577548E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.262925E-05
NUMBER OF ITERATIONS.....=	3


Spe Cap Test on 039-12I
Drawdown (feet)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
10
20
30
40
Time (minutes)

1.6' @ 35 min

```
TGUESS -- Version 1.2
*********************************************************************
AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES
*********************************************************************
WELL NUMBER........= 1          12D
-----------------------
INPUT DATA  (English units):
   WELL DIAMETER (IN OR M)....................=  2
   STATIC WATER LEVEL (FT OR M)...............=  0
   DEPTH TO WATER DURING TEST (FT OR M)......=  .97
   DURATION OF THE TEST (HRS).................=  .2
   PUMPING RATE (GPM OR CUB.M/S)..............=  .79
   THICKNESS OF AQUIFER (FT OR M)............=  13.5
   OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=  10
   STORAGE COEFFICIENT........................=  .0001
   WELL LOSS COEFFICIENT......................=  1

RESULTS:
   SPECIFIC CAPACITY (GPM/FT OR SQ.M/S)......=  .8144356
   TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S)......=  2.577784E-03
   HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=  1.909469E-04
   NUMBER OF ITERATIONS.......................=  4
```

TGUESS -- Version 1.2

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AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

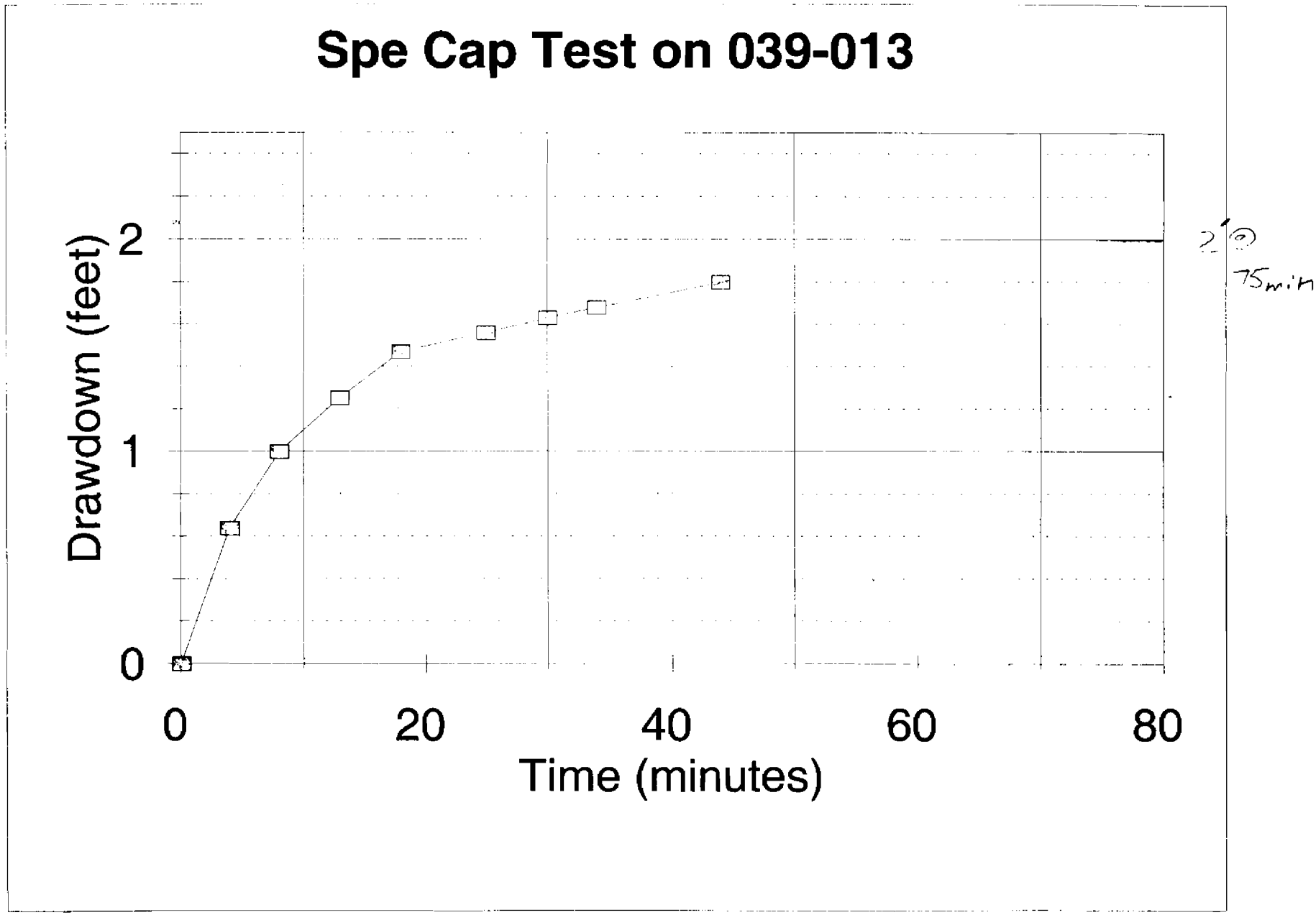
WELL NUMBER.....= 1 013

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	2
DURATION OF THE TEST (HRS).....=	1.25
PUMPING RATE (GPM OR CUB.M/S).....=	.14
THICKNESS OF AQUIFER (FT OR M).....=	9
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	9
STORAGE COEFFICIENT.....=	.02
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	7.000001E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.118028E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.242253E-05
NUMBER OF ITERATIONS.....=	3


Spe Cap Test on 039-013
Drawdown (feet)
0
1
2
0
20
40
60
80
Time (minutes)
2' @
75min

```
TGUESS -- Version 1.2
**********************************************************************
AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES
**********************************************************************
WELL NUMBER........= 1    13I
-----------------------
INPUT DATA  (English units):
   WELL DIAMETER (IN OR M)....................=  2
   STATIC WATER LEVEL (FT OR M)...............=  0
   DEPTH TO WATER DURING TEST (FT OR M)......=  1.08
   DURATION OF THE TEST (HRS).................=  .25
   PUMPING RATE (GPM OR CUB.M/S)..............=  .9
   THICKNESS OF AQUIFER (FT OR M).............=  3
   OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=  3
   STORAGE COEFFICIENT........................=  .0001
   WELL LOSS COEFFICIENT......................=  1

RESULTS:
   SPECIFIC CAPACITY (GPM/FT OR SQ.M/S)......=  .8333364
   TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S)......=  2.323034E-03
   HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=  7.743447E-04
   NUMBER OF ITERATIONS.......................=  4
```

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TGUESS -- Version 1.2
*********************************************************************
AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES
*********************************************************************
WELL NUMBER........= 1     13D
-----------------------
INPUT DATA  (English units):
   WELL DIAMETER (IN OR M)....................=  2
   STATIC WATER LEVEL (FT OR M)...............=  8.11
   DEPTH TO WATER DURING TEST (FT OR M)......=  8.94
   DURATION OF THE TEST (HRS)................=  .1
   PUMPING RATE (GPM OR CUB.M/S)..............=  2.4
   THICKNESS OF AQUIFER (FT OR M)............=  13
   OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=  10
   STORAGE COEFFICIENT.......................=  .0001
   WELL LOSS COEFFICIENT.....................=  1

RESULTS:
   SPECIFIC CAPACITY (GPM/FT OR SQ.M/S)......=  2.891666
   TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S)......=  9.259416E-03
   HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=  7.122628E-04
   NUMBER OF ITERATIONS......................=  4
```

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 13D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.64
DURATION OF THE TEST (HRS).....=	.333
PUMPING RATE (GPM OR CUB.M/S).....=	5.66
THICKNESS OF AQUIFER (FT OR M).....=	13
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	3.451554
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.194385E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	9.18758E-04
NUMBER OF ITERATIONS.....=	4

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

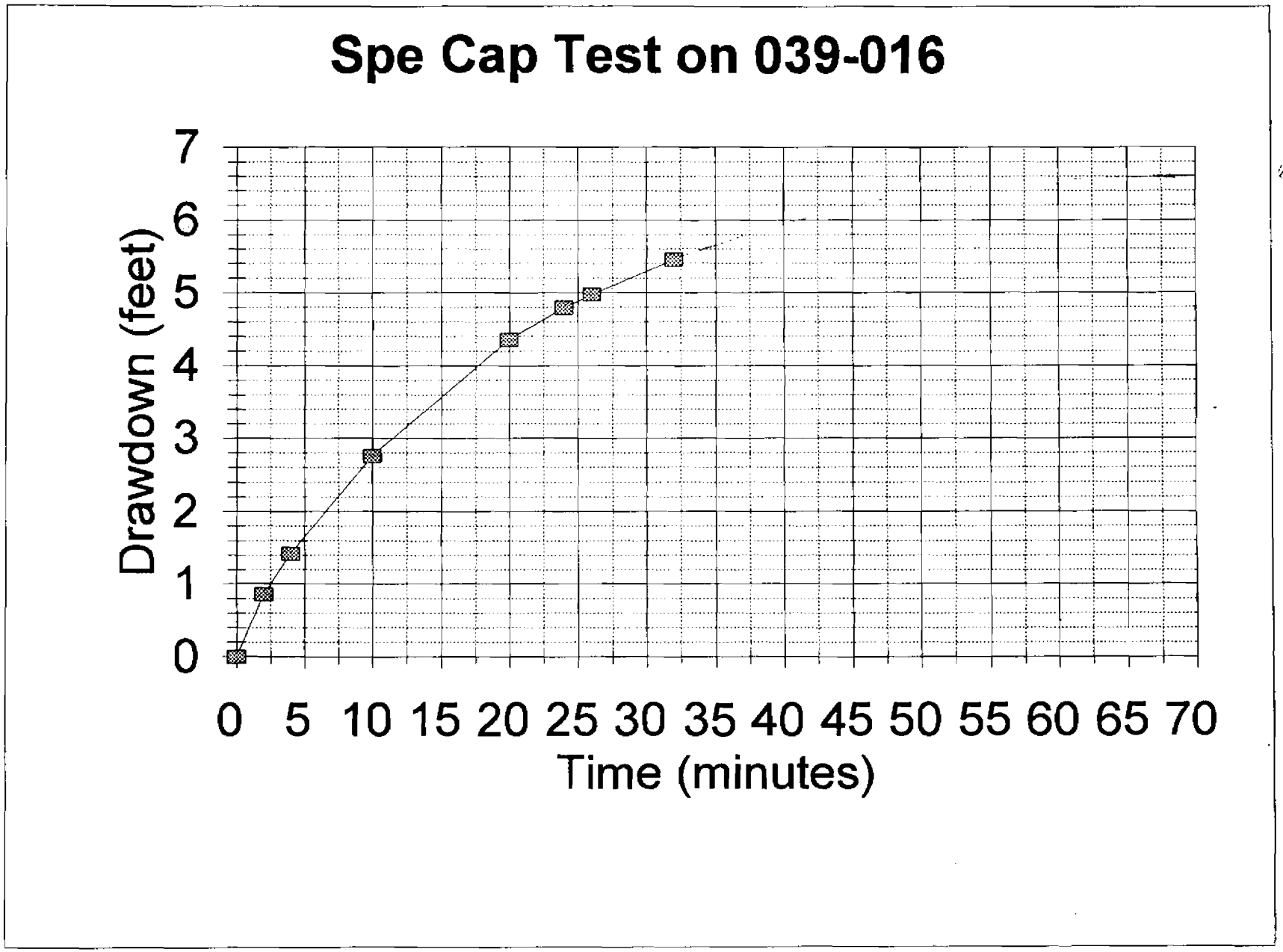
WELL NUMBER.....= 1 016

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	6.6
DURATION OF THE TEST (HRS).....=	1.0833
PUMPING RATE (GPM OR CUB.M/S).....=	.15
THICKNESS OF AQUIFER (FT OR M).....=	8
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	8
STORAGE COEFFICIENT.....=	.22
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	2.272727E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.90436E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	2.38045E-06
NUMBER OF ITERATIONS.....=	3


Spe Cap Test on 039-016
Drawdown (feet)
0
1
2
3
4
5
6
7
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70
Time (minutes)

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 16 I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	5.41
DEPTH TO WATER DURING TEST (FT OR M).....=	6.53
DURATION OF THE TEST (HRS).....=	.116666
PUMPING RATE (GPM OR CUB.M/S).....=	.88
THICKNESS OF AQUIFER (FT OR M).....=	7
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	7
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.7857167
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.067961E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	2.95423E-04
NUMBER OF ITERATIONS.....=	4

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 16 D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	5.49
DEPTH TO WATER DURING TEST (FT OR M).....=	6.13
DURATION OF THE TEST (HRS).....=	.25
PUMPING RATE (GPM OR CUB.M/S).....=	1.88
THICKNESS OF AQUIFER (FT OR M).....=	16
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	2.937579
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.124747E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	7.029668E-04
NUMBER OF ITERATIONS.....=	4

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 017

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	.7
DURATION OF THE TEST (HRS).....=	.3833
PUMPING RATE (GPM OR CUB.M/S).....=	.067
THICKNESS OF AQUIFER (FT OR M).....=	5.5
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	5.5
STORAGE COEFFICIENT.....=	.1
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	9.571429E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.042787E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.895976E-05
NUMBER OF ITERATIONS.....=	4

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 17 I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	.56
DURATION OF THE TEST (HRS).....=	.1
PUMPING RATE (GPM OR CUB.M/S).....=	2
THICKNESS OF AQUIFER (FT OR M).....=	37
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	3.571555
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.592243E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	7.006063E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 17D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.09
DURATION OF THE TEST (HRS).....=	.1666
PUMPING RATE (GPM OR CUB.M/S).....=	2
THICKNESS OF AQUIFER (FT OR M).....=	37
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.834896
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.326585E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.585366E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 17D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.99
DURATION OF THE TEST (HRS).....=	.333
PUMPING RATE (GPM OR CUB.M/S).....=	3.5
THICKNESS OF AQUIFER (FT OR M).....=	37
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.758848
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.292379E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.492915E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 17D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	3.02
DURATION OF THE TEST (HRS).....=	.333
PUMPING RATE (GPM OR CUB.M/S).....=	4.75
THICKNESS OF AQUIFER (FT OR M).....=	37
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.572906
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.152559E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.115025E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 17D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	4.15
DURATION OF THE TEST (HRS).....=	.333
PUMPING RATE (GPM OR CUB.M/S).....=	6.66
THICKNESS OF AQUIFER (FT OR M).....=	37
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.604904
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.176593E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.179981E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 18 I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.02
DURATION OF THE TEST (HRS).....=	.08333
PUMPING RATE (GPM OR CUB.M/S).....=	2.6
THICKNESS OF AQUIFER (FT OR M).....=	28
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	2.549103
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.434713E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	5.123976E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 18D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	.77
DURATION OF THE TEST (HRS).....=	.1
PUMPING RATE (GPM OR CUB.M/S).....=	2.7
THICKNESS OF AQUIFER (FT OR M).....=	28
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	3.506658
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.005813E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	7.163617E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 18 D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.2
DURATION OF THE TEST (HRS).....=	.333
PUMPING RATE (GPM OR CUB.M/S).....=	4.48
THICKNESS OF AQUIFER (FT OR M).....=	28
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	3.733643
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.222025E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	7.935804E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 019

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	6.15
DURATION OF THE TEST (HRS).....=	.5333
PUMPING RATE (GPM OR CUB.M/S).....=	.25
THICKNESS OF AQUIFER (FT OR M).....=	4
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	4
STORAGE COEFFICIENT.....=	.1
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	4.065041E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	3.988162E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	9.970404E-06
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 19I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	4.04
DURATION OF THE TEST (HRS).....=	.38333
PUMPING RATE (GPM OR CUB.M/S).....=	1.3
THICKNESS OF AQUIFER (FT OR M).....=	10
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.3217829
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	8.651154E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	8.651154E-05
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 19D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	5.24
DURATION OF THE TEST (HRS).....=	.16666
PUMPING RATE (GPM OR CUB.M/S).....=	.73
THICKNESS OF AQUIFER (FT OR M).....=	9
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	9
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.1393131
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	3.302157E-04
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.669064E-05
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 020

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	.85
DURATION OF THE TEST (HRS).....=	.5
PUMPING RATE (GPM OR CUB.M/S).....=	.87
THICKNESS OF AQUIFER (FT OR M).....=	17
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.22
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.023534
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.536427E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.492016E-04
NUMBER OF ITERATIONS.....=	4

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 20

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	4.29
DURATION OF THE TEST (HRS).....=	.333
PUMPING RATE (GPM OR CUB.M/S).....=	5.36
THICKNESS OF AQUIFER (FT OR M).....=	17
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.22
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.249459
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	3.04689E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.792288E-04
NUMBER OF ITERATIONS.....=	4

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 20 I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	.73
DURATION OF THE TEST (HRS).....=	.26666
PUMPING RATE (GPM OR CUB.M/S).....=	.53
THICKNESS OF AQUIFER (FT OR M).....=	23.5
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.22
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	.7260287
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	2.479774E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	1.055223E-04
NUMBER OF ITERATIONS.....=	4

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

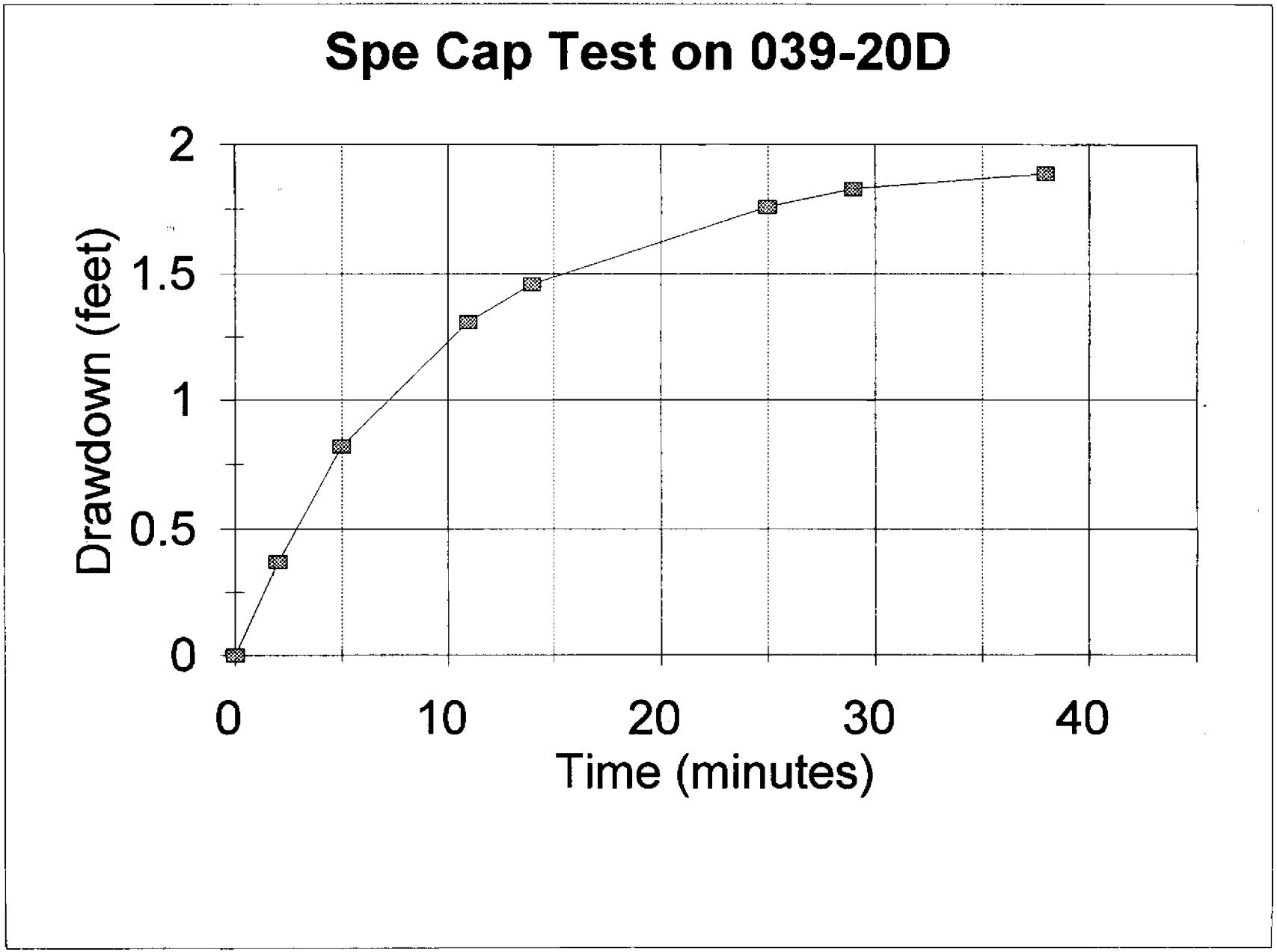
WELL NUMBER.....= 1 20D

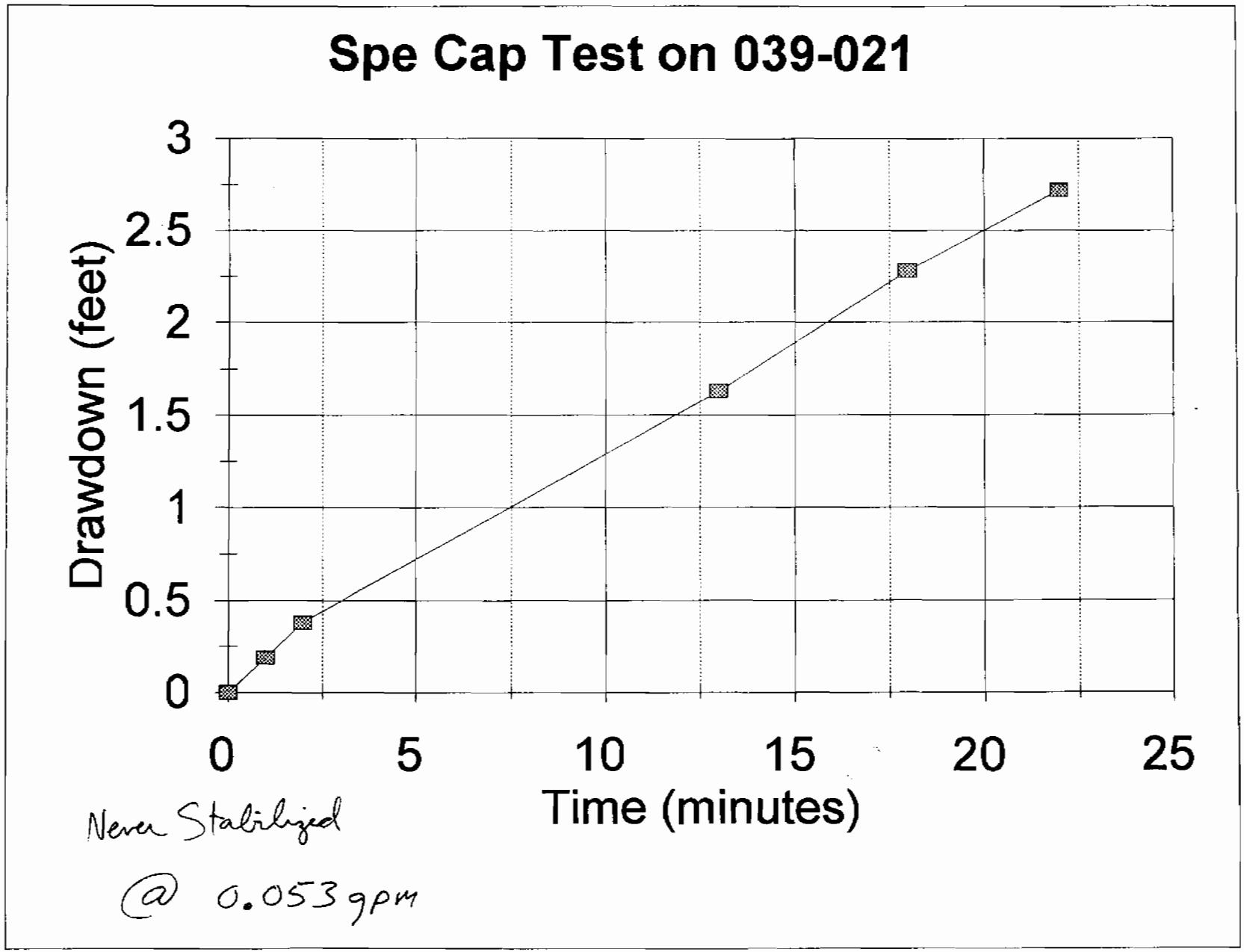
INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	0
DEPTH TO WATER DURING TEST (FT OR M).....=	1.89
DURATION OF THE TEST (HRS).....=	.6333
PUMPING RATE (GPM OR CUB.M/S).....=	.048
THICKNESS OF AQUIFER (FT OR M).....=	10
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	2.539683E-02
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	5.841336E-05
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	5.841336E-06
NUMBER OF ITERATIONS.....=	3


Spe Cap Test on 039-20D
Drawdown (feet)
2
1.5
1
0.5
0
0
10
20
30
40
Time (minutes)


Spe Cap Test on 039-021
Drawdown (feet)
3
2.5
2
1.5
1
0.5
0
0
5
10
15
20
25
Time (minutes)
Never Stabilized
@ 0.053 gpm

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 21 I

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	5.64
DEPTH TO WATER DURING TEST (FT OR M).....=	7.13
DURATION OF THE TEST (HRS).....=	.1
PUMPING RATE (GPM OR CUB.M/S).....=	2.8
THICKNESS OF AQUIFER (FT OR M).....=	28
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.879243
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	1.053483E-02
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.762438E-04
NUMBER OF ITERATIONS.....=	3

TGUESS -- Version 1.2

****

AQUIFER PROPERTIES AS DETERMINED BY ANALYSIS OF SPECIFIC CAPACITIES

****

WELL NUMBER.....= 1 21 D

INPUT DATA (English units):

WELL DIAMETER (IN OR M).....=	2
STATIC WATER LEVEL (FT OR M).....=	5.53
DEPTH TO WATER DURING TEST (FT OR M).....=	7.24
DURATION OF THE TEST (HRS).....=	.1
PUMPING RATE (GPM OR CUB.M/S).....=	2.6
THICKNESS OF AQUIFER (FT OR M).....=	28
OPEN INTERVAL (SCREEN LENGTH; FT OR M)....=	10
STORAGE COEFFICIENT.....=	.0001
WELL LOSS COEFFICIENT.....=	1

RESULTS:

SPECIFIC CAPACITY (GPM/FT OR SQ.M/S).....=	1.520498
TRANSMISSIVITY (SQ FT/SEC OR SQ.M/S).....=	8.464787E-03
HYDRAULIC CONDUCTIVITY (FT/SEC OR M/S)....=	3.023138E-04
NUMBER OF ITERATIONS.....=	3

ATTACHMENT G-3

PUMPING TEST VOC DATA

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 13, 1999

Sample ID	: 039GW020EF2
Lab ID	: 9909333-01
Matrix	: GroundH2O
Date Collected	: 09/09/99
Date Received	: 09/10/99
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Volatile Organics											
GCMS Library Search-VOA							TCL	09/10/99	1318	158167	1
Target Compound List Volatiles - 34 items											
1,1,1-Trichloroethane	U	ND	0.200	1	ug/l	1.0					
1,1,2,2-Tetrachloroethane	U	ND	0.500	1	ug/l	1.0					
1,1,2-Trichloroethane	U	ND	0.400	1	ug/l	1.0					
1,1-Dichloroethane	U	ND	0.400	1	ug/l	1.0					
1,1-Dichloroethylene	U	ND	0.700	1	ug/l	1.0					
1,2-Dichloroethane	U	ND	0.200	1	ug/l	1.0					
1,2-Dichloroethylene		3.84	1.00	2	ug/l	1.0					
1,2-Dichloropropane	U	ND	0.200	1	ug/l	1.0					
2-Butanone	U	ND	5.90	10	ug/l	1.0					
2-Hexanone	U	ND	3.20	5	ug/l	1.0					
4-Methyl-2-pentanone	U	ND	1.60	5	ug/l	1.0					
Acetone	U	ND	3.70	5	ug/l	1.0					
Benzene	U	ND	0.300	1	ug/l	1.0					
Bromoform	U	ND	0.400	1	ug/l	1.0					
Carbon Disulfide	U	ND	1.80	5	ug/l	1.0					
Carbon Tetrachloride	U	ND	0.200	1	ug/l	1.0					
Chlorobenzene	U	ND	0.300	1	ug/l	1.0					
Chlorodibromomethane	U	ND	0.300	1	ug/l	1.0					
Chloroethane	U	ND	0.300	1	ug/l	1.0					
Chloroform	U	ND	0.700	1	ug/l	1.0					
Dichlorobromomethane	U	ND	0.400	1	ug/l	1.0					
Ethylbenzene	U	ND	0.300	1	ug/l	1.0					
Methyl Bromide	U	ND	0.300	1	ug/l	1.0					
Methyl Chloride	U	ND	0.200	1	ug/l	1.0					
Methylene Chloride	U	ND	1.20	5	ug/l	1.0					
Styrene	U	ND	0.200	1	ug/l	1.0					

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 13, 1999

Sample ID : 039GW020EF2

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Tetrachloroethylene	J	0.960	0.700	1	ug/l	1.0					
Toluene	U	ND	0.500	1	ug/l	1.0	TCL	09/10/99	1318	158167	1
Trichloroethylene	J	0.940	0.600	1	ug/l	1.0					
Vinyl Acetate	U	ND	1.80	5	ug/l	1.0					
Vinyl chloride	U	ND	0.400	1	ug/l	1.0					
Xylenes (TOTAL)	U	ND	1.10	2	ug/l	1.0					
cis-1,3-Dichloropropylene	U	ND	0.300	1	ug/l	1.0					
trans-1,3-Dichloropropylene	U	ND	0.300	1	ug/l	1.0					

Surrogate Recovery	Test	Percent%	Acceptable Limits
Bromofluorobenzene	TCLVOA-8260B	90.2	(73.0 - 129.)
Dibromofluoromethane	TCLVOA-8260B	108.	(66.0 - 117.)
Toluene-d8	TCLVOA-8260B	111.	(73.0 - 122.)

M = Method	Method-Description
M 1	EPA 8260B

P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407
(843) 556-8171 • Fax (843) 766-1178

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client:	Environmental & Safety Designs, Inc 935 Houston Northcutt Boulevard Suite 113 Mount Pleasant, South Carolina 29464
Contact:	Mr. Todd Haverkost
Project Description:	Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 13, 1999

Sample ID : 039GW020EF2

M = Method **Method-Description**

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Tom Seabrook at (843) 556-8171.

James M. Seabrook

Reviewed By

P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407

(843) 556-8171 • Fax (843) 766-1178

9909333-01

General Engineering Laboratories, Inc.
Volatile Organics Analysis Data Sheet
Tentatively Identified Compounds

Sample ID: 9909333-01

Date of Analysis: 9-10-99

Dilution: 1

Number TICs Found: 1

Concentration Units: (ug/L or ug/Kg)

CAS Number	Compound Name	Estimated Conc.	Q
1490-04-6	Menthol	11.68	91

9/10/99

Reviewed by: JEB

Date: 9/13/99

ENSAFE

800-588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC; CINCINNATI,OH; DALLAS,TX; JACKSON,TN; KNOXVILLE,TN; LANCASTER,PA; NASHVILLE,TN; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL; RALEIGH,NC; COLOGNE, GERMANY

ENSA0079

CHAIN OF CUSTODY RECORD

9909333%

PAGE 1 OF 1

PROJECT/JOB NO: 2915-00 1-811-00

COC NO:

PO NO: 3189

REL NO: Ø

LAB NAME: GEL

CLIENT

PROJECT MANAGER Todd Kafka

LOCATION SWMU 39 Pumping Tests

TELE/FAX NO. 843.884.0029 / 856.0107

SAMPLERS: (SIGNATURE) TKKafka

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOAS									REMARKS
Ø39GWØ2ØEF2	2315	9/9/99	H_2O	40mL VIAL	4°C	HCL	2	X									Q= [redacted] 42215

TKKafka 9/10/99

RELINQUISHER: TKKafka	DATE	RECEIVER: [signature]	DATE 9/10/99	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Todd Kafka	TIME	PRINTED: P.Y. Jiles	TIME 1210	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Deliver

SHIPMENT NO. N/A

SEND RESULTS TO: Todd Kafka 935 Houston Northcutt Blvd, Ste 113, Mt. Pleasant SC 29464

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE) [signature] 9/10/99

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 02, 1999

Sample ID	: A39Z18DEFF
Lab ID	: 9909024-02
Matrix	: GroundH2O
Date Collected	: 08/31/99
Date Received	: 09/01/99
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Volatile Organics								
GCMS Library Search-VOA				EPA 8260B	TCL	09/01/99	1557	157554
Target Compound List Volatiles - 34 items								
1,1,1-Trichloroethane	<	1.00	ug/l	EPA 8260B				
1,1,2,2-Tetrachloroethane	<	1.00	ug/l	EPA 8260B				
1,1,2-Trichloroethane	<	1.00	ug/l	EPA 8260B				
1,1-Dichloroethane		3.81	ug/l	EPA 8260B				
1,1-Dichloroethylene		10.7	ug/l	EPA 8260B				
1,2-Dichloroethane	<	1.00	ug/l	EPA 8260B				
1,2-Dichloroethylene		356	ug/l	EPA 8260B	TCL	09/01/99	1725	157554
1,2-Dichloropropane	<	1.00	ug/l	EPA 8260B	TCL	09/01/99	1557	157554
2-Butanone	<	10.0	ug/l	EPA 8260B				
2-Hexanone	<	5.00	ug/l	EPA 8260B				
4-Methyl-2-pentanone	<	5.00	ug/l	EPA 8260B				
Acetone	<	5.00	ug/l	EPA 8260B				
Benzene		1.07	ug/l	EPA 8260B				
Bromoform	<	1.00	ug/l	EPA 8260B				
Carbon Disulfide	<	5.00	ug/l	EPA 8260B				
Carbon Tetrachloride	<	1.00	ug/l	EPA 8260B				
Chlorobenzene	<	1.00	ug/l	EPA 8260B				
Chlorodibromomethane	<	1.00	ug/l	EPA 8260B				
Chloroethane	<	1.00	ug/l	EPA 8260B				
Chloroform	<	1.00	ug/l	EPA 8260B				
Dichlorobromomethane	<	1.00	ug/l	EPA 8260B				
Ethylbenzene	<	1.00	ug/l	EPA 8260B				
Methyl Bromide	<	1.00	ug/l	EPA 8260B				
Methyl Chloride	<	1.00	ug/l	EPA 8260B				
Methylene Chloride	<	5.00	ug/l	EPA 8260B				
Styrene	<	1.00	ug/l	EPA 8260B				

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 02, 1999

Sample ID : A39Z18DEFF

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Tetrachloroethylene	<	1.00	ug/l	EPA 8260B				
Toluene	<	1.00	ug/l	EPA 8260B	TCL	09/01/99	1557	157554
Trichloroethylene		290	ug/l	EPA 8260B	TCL	09/01/99	1725	157554
Vinyl Acetate	<	5.00	ug/l	EPA 8260B	TCL	09/01/99	1557	157554
Vinyl chloride		3.91	ug/l	EPA 8260B				
Xylenes (TOTAL)	<	3.00	ug/l	EPA 8260B				
cis-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				
trans-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Tom Seabrook at (843) 556-8171.

Reviewed By

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9909024-02

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 02, 1999

Sample ID	: A39Z13DEFF
Lab ID	: 9909024-01
Matrix	: GroundH2O
Date Collected	: 08/30/99
Date Received	: 09/01/99
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Volatile Organics								
GCMS Library Search-VOA				EPA 8260B	TCL	09/01/99	1528	157554
Target Compound List Volatiles - 34 items								
1,1,1-Trichloroethane	<	1.00	ug/l	EPA 8260B				
1,1,2,2-Tetrachloroethane	<	1.00	ug/l	EPA 8260B				
1,1,2-Trichloroethane	<	1.00	ug/l	EPA 8260B				
1,1-Dichloroethane	<	1.00	ug/l	EPA 8260B				
1,1-Dichloroethylene		2.65	ug/l	EPA 8260B				
1,2-Dichloroethane	<	1.00	ug/l	EPA 8260B				
1,2-Dichloroethylene		121	ug/l	EPA 8260B	TCL	09/01/99	1656	157554
1,2-Dichloropropane	<	1.00	ug/l	EPA 8260B	TCL	09/01/99	1528	157554
2-Butanone	<	10.0	ug/l	EPA 8260B				
2-Hexanone	<	5.00	ug/l	EPA 8260B				
4-Methyl-2-pentanone	<	5.00	ug/l	EPA 8260B				
Acetone	<	5.00	ug/l	EPA 8260B				
Benzene	<	1.00	ug/l	EPA 8260B				
Bromoform	<	1.00	ug/l	EPA 8260B				
Carbon Disulfide	<	5.00	ug/l	EPA 8260B				
Carbon Tetrachloride	<	1.00	ug/l	EPA 8260B				
Chlorobenzene	<	1.00	ug/l	EPA 8260B				
Chlorodibromomethane	<	1.00	ug/l	EPA 8260B				
Chloroethane	<	1.00	ug/l	EPA 8260B				
Chloroform	<	1.00	ug/l	EPA 8260B				
Dichlorobromomethane	<	1.00	ug/l	EPA 8260B				
Ethylbenzene	<	1.00	ug/l	EPA 8260B				
Methyl Bromide	<	1.00	ug/l	EPA 8260B				
Methyl Chloride	<	1.00	ug/l	EPA 8260B				
Methylene Chloride	<	5.00	ug/l	EPA 8260B				
Styrene	<	1.00	ug/l	EPA 8260B				

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 02, 1999

Sample ID : A39Z13DEFF

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Tetrachloroethylene		22.3	ug/l	EPA 8260B				
Toluene	<	1.00	ug/l	EPA 8260B	TCL	09/01/99	1528	157554
Trichloroethylene		44.6	ug/l	EPA 8260B				
Vinyl Acetate	<	5.00	ug/l	EPA 8260B				
Vinyl chloride		4.81	ug/l	EPA 8260B				
Xylenes (TOTAL)	<	3.00	ug/l	EPA 8260B				
cis-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				
trans-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Tom Seabrook at (843) 556-8171.

Reviewed By

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9909024.01

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 02, 1999

Sample ID	: A39Z020EFF
Lab ID	: 9909024-03
Matrix	: GroundH2O
Date Collected	: 08/31/99
Date Received	: 09/01/99
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Volatile Organics								
GCMS Library Search-VOA				EPA 8260B	TCL	09/01/99	1627	157554
Target Compound List Volatiles - 34 items								
1,1,1-Trichloroethane	<	1.00	ug/l	EPA 8260B				
1,1,2,2-Tetrachloroethane	<	1.00	ug/l	EPA 8260B				
1,1,2-Trichloroethane	<	1.00	ug/l	EPA 8260B				
1,1-Dichloroethane	<	1.00	ug/l	EPA 8260B				
1,1-Dichloroethylene	<	1.00	ug/l	EPA 8260B				
1,2-Dichloroethane	<	1.00	ug/l	EPA 8260B				
1,2-Dichloroethylene	<	2.00	ug/l	EPA 8260B				
1,2-Dichloropropane	<	1.00	ug/l	EPA 8260B				
2-Butanone	<	10.0	ug/l	EPA 8260B				
2-Hexanone	<	5.00	ug/l	EPA 8260B				
4-Methyl-2-pentanone	<	5.00	ug/l	EPA 8260B				
Acetone	<	5.00	ug/l	EPA 8260B				
Benzene	<	1.00	ug/l	EPA 8260B				
Bromoform	<	1.00	ug/l	EPA 8260B				
Carbon Disulfide	<	5.00	ug/l	EPA 8260B				
Carbon Tetrachloride	<	1.00	ug/l	EPA 8260B				
Chlorobenzene	<	1.00	ug/l	EPA 8260B				
Chlorodibromomethane	<	1.00	ug/l	EPA 8260B				
Chloroethane	<	1.00	ug/l	EPA 8260B				
Chloroform	<	1.00	ug/l	EPA 8260B				
Dichlorobromomethane	<	1.00	ug/l	EPA 8260B				
Ethylbenzene	<	1.00	ug/l	EPA 8260B				
Methyl Bromide	<	1.00	ug/l	EPA 8260B				
Methyl Chloride	<	1.00	ug/l	EPA 8260B				
Methylene Chloride	<	5.00	ug/l	EPA 8260B				
Styrene	<	1.00	ug/l	EPA 8260B				

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: September 02, 1999

Sample ID : A39Z020EFF

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Tetrachloroethylene	<	1.00	ug/l	EPA 8260B				
Toluene	<	1.00	ug/l	EPA 8260B	TCL	09/01/99	1627	157554
Trichloroethylene	<	1.00	ug/l	EPA 8260B				
Vinyl Acetate	<	5.00	ug/l	EPA 8260B				
Vinyl chloride	<	1.00	ug/l	EPA 8260B				
Xylenes (TOTAL)	<	3.00	ug/l	EPA 8260B				
cis-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				
trans-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Tom Seabrook at (843) 556-8171.

Reviewed By

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8909024-02

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: August 31, 1999

Sample ID	: A39Z17DINF
Lab ID	: 9908E2A-01
Matrix	: GroundH2O
Date Collected	: 08/28/99
Date Received	: 08/30/99
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Volatile Organics								
Target Compound List Volatiles - 34 items								
1,1,1-Trichloroethane	<	1.00	ug/l	EPA 8260B	JEB	08/31/99	1025	157292
1,1,2,2-Tetrachloroethane	<	1.00	ug/l	EPA 8260B				
1,1,2-Trichloroethane	<	1.00	ug/l	EPA 8260B				
1,1-Dichloroethane		3.00	ug/l	EPA 8260B				
1,1-Dichloroethylene		3.71	ug/l	EPA 8260B				
1,2-Dichloroethane	<	1.00	ug/l	EPA 8260B				
1,2-Dichloroethylene		222	ug/l	EPA 8260B	JEB	08/31/99	1148	157292
1,2-Dichloropropane	<	1.00	ug/l	EPA 8260B	JEB	08/31/99	1025	157292
2-Butanone	<	10.0	ug/l	EPA 8260B				
2-Hexanone	<	5.00	ug/l	EPA 8260B				
4-Methyl-2-pentanone	<	5.00	ug/l	EPA 8260B				
Acetone	<	5.00	ug/l	EPA 8260B				
Benzene	<	1.00	ug/l	EPA 8260B				
Bromoform	<	1.00	ug/l	EPA 8260B				
Carbon Disulfide	<	5.00	ug/l	EPA 8260B				
Carbon Tetrachloride	<	1.00	ug/l	EPA 8260B				
Chlorobenzene	<	1.00	ug/l	EPA 8260B				
Chlorodibromomethane	<	1.00	ug/l	EPA 8260B				
Chloroethane	<	1.00	ug/l	EPA 8260B				
Chloroform	<	1.00	ug/l	EPA 8260B				
Dichlorobromomethane	<	1.00	ug/l	EPA 8260B				
Ethylbenzene	<	1.00	ug/l	EPA 8260B				
Methyl Bromide	<	1.00	ug/l	EPA 8260B				
Methyl Chloride	<	1.00	ug/l	EPA 8260B				
Methylene Chloride	<	5.00	ug/l	EPA 8260B				
Styrene	<	1.00	ug/l	EPA 8260B				
Tetrachloroethylene		16.6	ug/l	EPA 8260B				

GENERAL ENGINEERING LABORATORIES

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Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: August 31, 1999

Sample ID : A39Z17DINF

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Toluene	<	1.00	ug/l	EPA 8260B				
Trichloroethylene		101	ug/l	EPA 8260B	JEB	08/31/99	1025	157292
Vinyl Acetate	<	5.00	ug/l	EPA 8260B				
Vinyl chloride		5.50	ug/l	EPA 8260B				
Xylenes (TOTAL)	<	2.00	ug/l	EPA 8260B				
cis-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				
trans-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Tom Seabrook at (843) 556-8171.

Reviewed By

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0008F2A-01

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: August 31, 1999

Sample ID	: A39Z17DEFF
Lab ID	: 9908E2A-02
Matrix	: GroundH2O
Date Collected	: 08/28/99
Date Received	: 08/30/99
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Volatile Organics								
Target Compound List Volatiles - 34 items								
1,1,1-Trichloroethane	<	1.00	ug/l	EPA 8260B	JEB	08/31/99	1053	157292
1,1,2,2-Tetrachloroethane	<	1.00	ug/l	EPA 8260B				
1,1,2-Trichloroethane	<	1.00	ug/l	EPA 8260B				
1,1-Dichloroethane		1.95	ug/l	EPA 8260B				
1,1-Dichloroethylene		2.13	ug/l	EPA 8260B				
1,2-Dichloroethane	<	1.00	ug/l	EPA 8260B				
1,2-Dichloroethylene		145	ug/l	EPA 8260B	JEB	08/31/99	1216	157292
1,2-Dichloropropane	<	1.00	ug/l	EPA 8260B	JEB	08/31/99	1053	157292
2-Butanone	<	10.0	ug/l	EPA 8260B				
2-Hexanone	<	5.00	ug/l	EPA 8260B				
4-Methyl-2-pentanone	<	5.00	ug/l	EPA 8260B				
Acetone	<	5.00	ug/l	EPA 8260B				
Benzene	<	1.00	ug/l	EPA 8260B				
Bromoform	<	1.00	ug/l	EPA 8260B				
Carbon Disulfide	<	5.00	ug/l	EPA 8260B				
Carbon Tetrachloride	<	1.00	ug/l	EPA 8260B				
Chlorobenzene	<	1.00	ug/l	EPA 8260B				
Chlorodibromomethane	<	1.00	ug/l	EPA 8260B				
Chloroethane	<	1.00	ug/l	EPA 8260B				
Chloroform	<	1.00	ug/l	EPA 8260B				
Dichlorobromomethane	<	1.00	ug/l	EPA 8260B				
Ethylbenzene	<	1.00	ug/l	EPA 8260B				
Methyl Bromide	<	1.00	ug/l	EPA 8260B				
Methyl Chloride	<	1.00	ug/l	EPA 8260B				
Methylene Chloride	<	5.00	ug/l	EPA 8260B				
Styrene	<	1.00	ug/l	EPA 8260B				
Tetrachloroethylene		9.95	ug/l	EPA 8260B				

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Environmental & Safety Designs, Inc
935 Houston Northcutt Boulevard
Suite 113
Mount Pleasant, South Carolina 29464
Contact: Mr. Todd Haverkost
Project Description: Pump Test Sampling and Analysis

cc: ENSA00199 Report Date: August 31, 1999

Sample ID : A39Z17DEFF

Parameter	Qualifier	Result	Units	Method	Analyst	Date	Time	Batch
Toluene	<	1.00	ug/l	EPA 8260B				
Trichloroethylene		63.8	ug/l	EPA 8260B	JEB	08/31/99	1053	157292
Vinyl Acetate	<	5.00	ug/l	EPA 8260B				
Vinyl chloride	<	1.00	ug/l	EPA 8260B				
Xylenes (TOTAL)	<	2.00	ug/l	EPA 8260B				
cis-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				
trans-1,3-Dichloropropylene	<	1.00	ug/l	EPA 8260B				

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Tom Seabrook at (843) 556-8171.

Reviewed By

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9908E2A-02

General Engineering Laboratories, Inc.
Volatile Organics Analysis Data Sheet
Tentatively Identified Compounds

Sample ID: 9908E2A-01

Date of Analysis: 8/31/99

Dilution: 1X

Number TICs Found: 0

Concentration Units: (ug/L or ug/Kg)

CAS Number	Compound Name	Estimated Conc.	Q

JCB 8/31/99

Reviewed by: TCL

Date: 8/31/99

General Engineering Laboratories, Inc.
Volatile Organics Analysis Data Sheet
Tentatively Identified Compounds

Sample ID: 9908E2A-02

Date of Analysis: 8/31/99

Dilution: 1X

Number TICs Found: 0

Concentration Units: (ug/L or ug/Kg)

CAS Number	Compound Name	Estimated Conc.	Q

JEB 8/31/99

Reviewed by: JU

Date: 8/31/99

ENSAFE

800-588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC; CINCINNATI,OH; DALLAS,TX; JACKSON,TN; KNOXVILLE,TN; LANCASTER,PA; NASHVILLE,TN; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL; RALEIGH,NC; COLOGNE, GERMANY

9908EZA1

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 291 01-14-811-00
COC NO:
PO NO: 3189
REL NO:
LAB NAME: GEL

Quote # 42215

CLIENT Navy Clean
PROJECT MANAGER Bart Douglas
LOCATION Zone A, SWMU 39, MW 17D
TELE/FAX NO.
SAMPLERS: (SIGNATURE) Bart Douglas

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	8260 VOCs	REMARKS
1 A39 Z17DINF	8/28/99	22:50	GW	40ml VOA	4°C	HCL	3		Rush 24-hour Turnaround
2 A39 Z17DEFF	"	22:50	"	"	"	"	3		

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Bart Douglas	8/30	Teresa Thompson	8/30				
PRINTED: Bart Douglas	TIME 1:30	PRINTED:	TIME 1:30	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Hand Delivered
SHIPMENT NO.
SEND RESULTS TO: Charlie Vernoy

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE) 9/1/00

ENSCOC2

ATTACHMENT G-4

AMBIENT DATA TRENDS

G.4.1 Tidal Influence

During the entire testing period at SWMU 39, a data logger and two transducers were installed to monitor water level changes at wells 21I and 21D. Additional water level trend data was obtained at other site wells using data loggers and/or hand monitoring during the constant rate tests. All ambient water level data are presented in Figures G-1 through G-19.

Table G-1 presents the maximum tidal change for each well observed during testing.

Table G-1
SWMU 39 Tidal Influence

Well	Tidal Fluctuation (ft)
008	Negligible
08D	0.57
009	None
09I	Not Discernible
09D	0.16
010	Negligible
10I	None
10D	0.17
013	Negligible
13I	0.63
13D	0.69
017	0.52
17I	0.53
17D	0.54
18I	0.71
18D	0.72
019	None
19I	None
19D	0.55
020	0.11

Table G-1
SWMU 39 Tidal Influence

Well	Tidal Fluctuation (ft)
20I	0.13
20D	0.61
021	None
21I	0.7
21D	0.68

Figure G-1

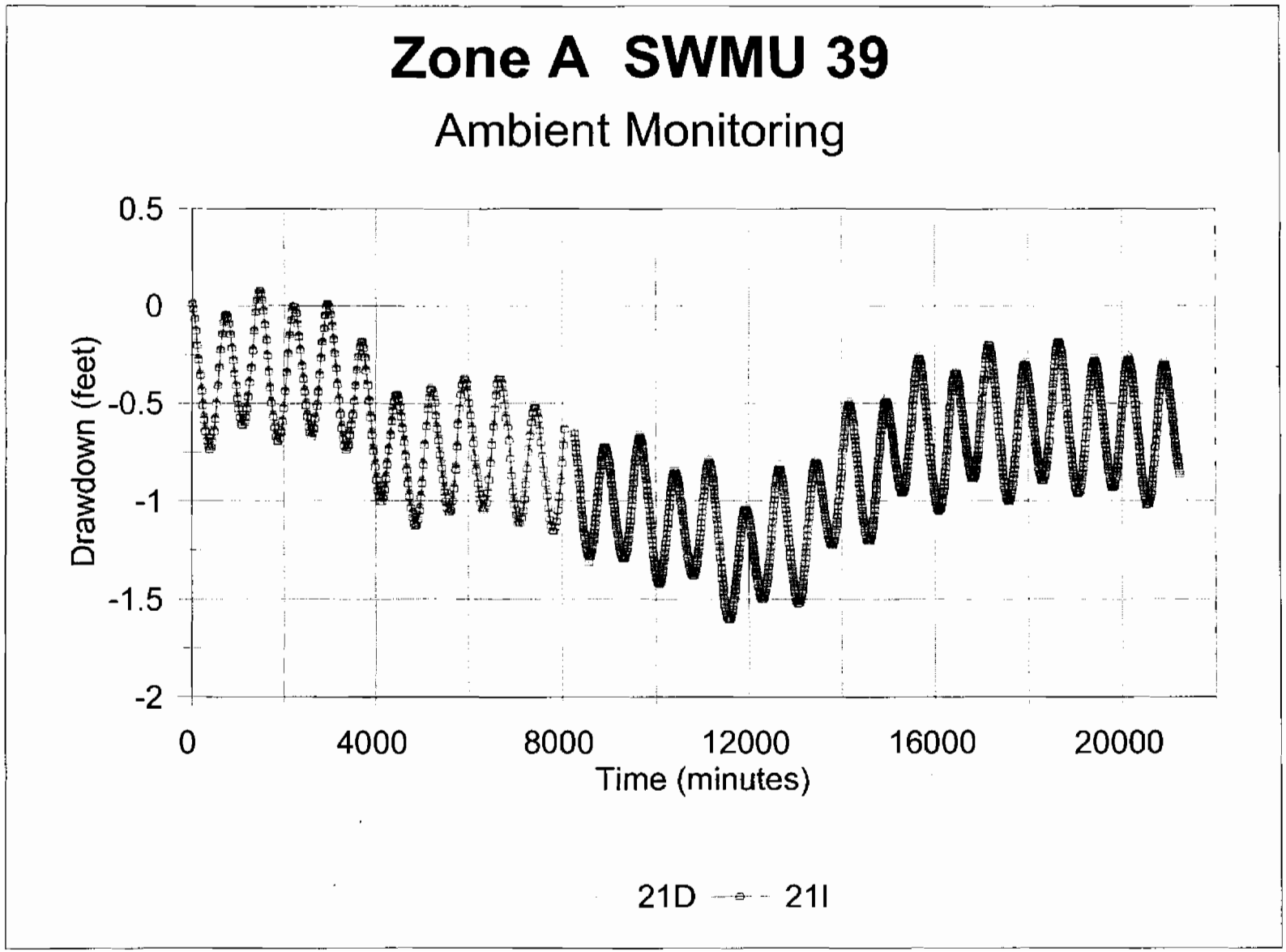

Zone A SWMU 39
Ambient Monitoring
0.5
0
-0.5
-1
-1.5
-2
Drawdown (feet)
0
4000
8000
12000
16000
20000
Time (minutes)
21D
21I

Figure G-2

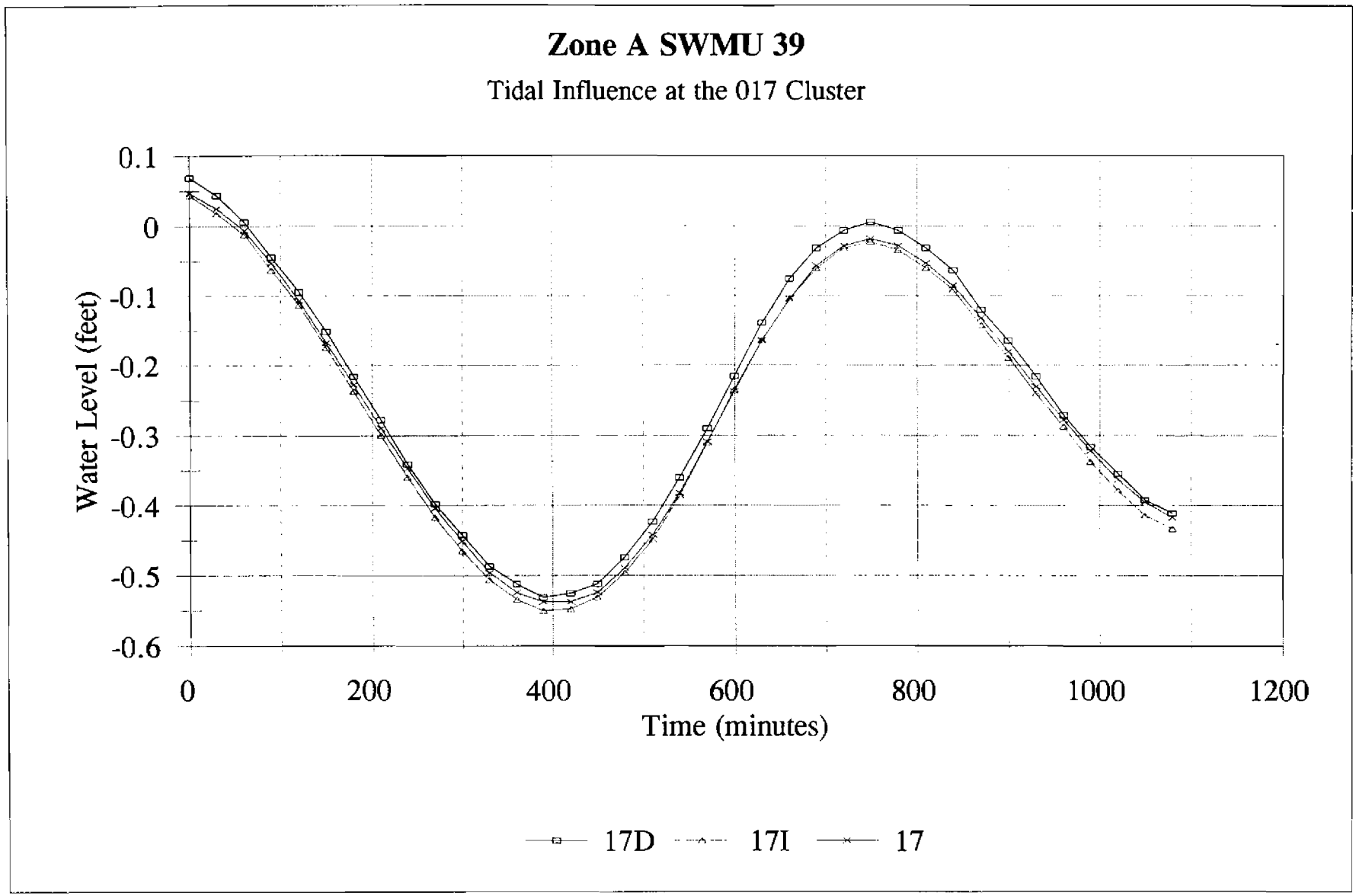

Zone A SWMU 39
Tidal Influence at the 017 Cluster
Water Level (feet)
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
0
200
400
600
800
1000
1200
Time (minutes)
17D
17I
17

Figure G-3

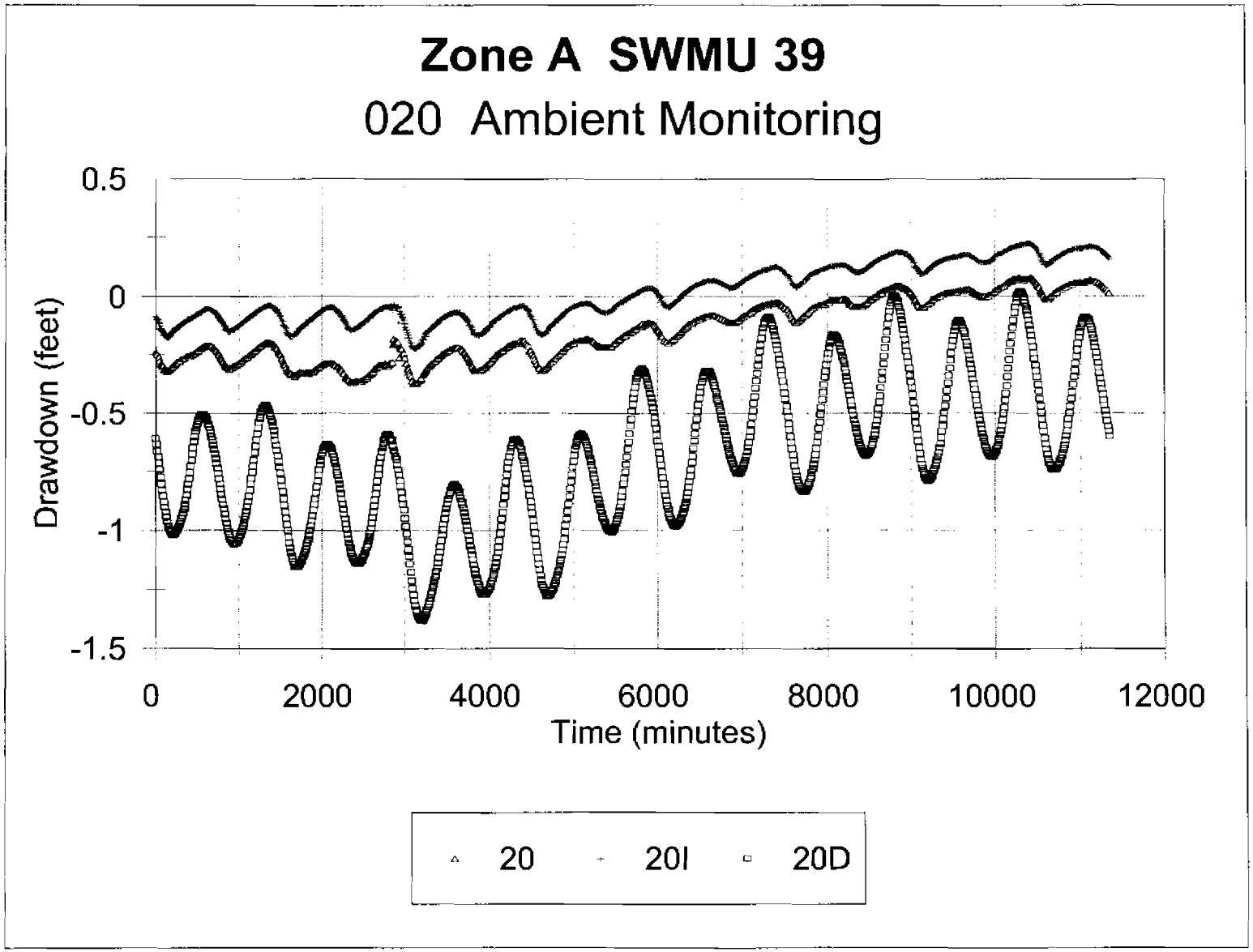

Zone A SWMU 39
020 Ambient Monitoring
0.5
0
-0.5
-1
-1.5
Drawdown (feet)
0
2000
4000
6000
8000
10000
12000
Time (minutes)
20
20I
20D

Figure G-4

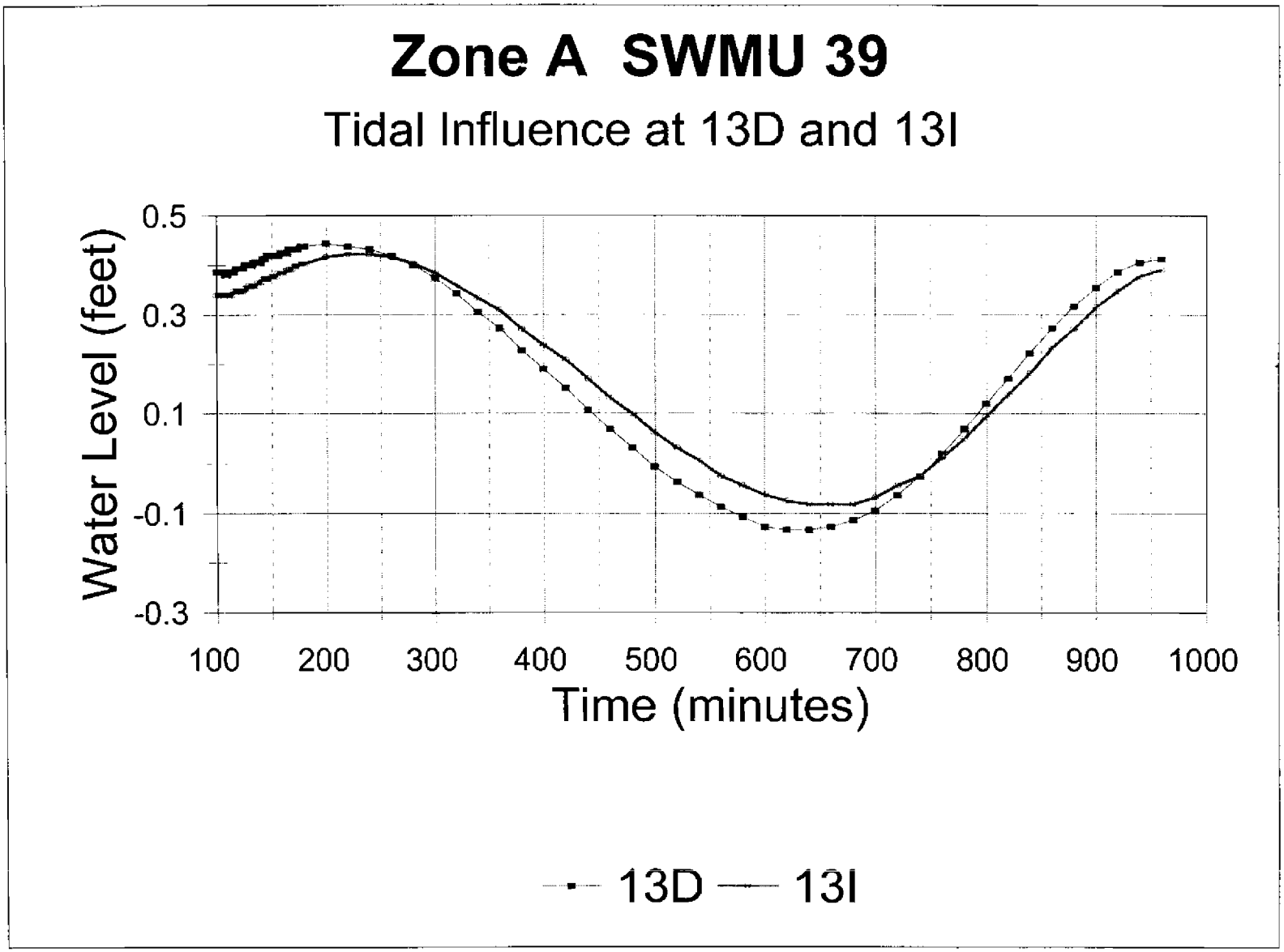

Zone A SWMU 39
Tidal Influence at 13D and 13I
Water Level (feet)
0.5
0.3
0.1
-0.1
-0.3
100
200
300
400
500
600
700
800
900
1000
Time (minutes)
13D
13I

Figure G-5

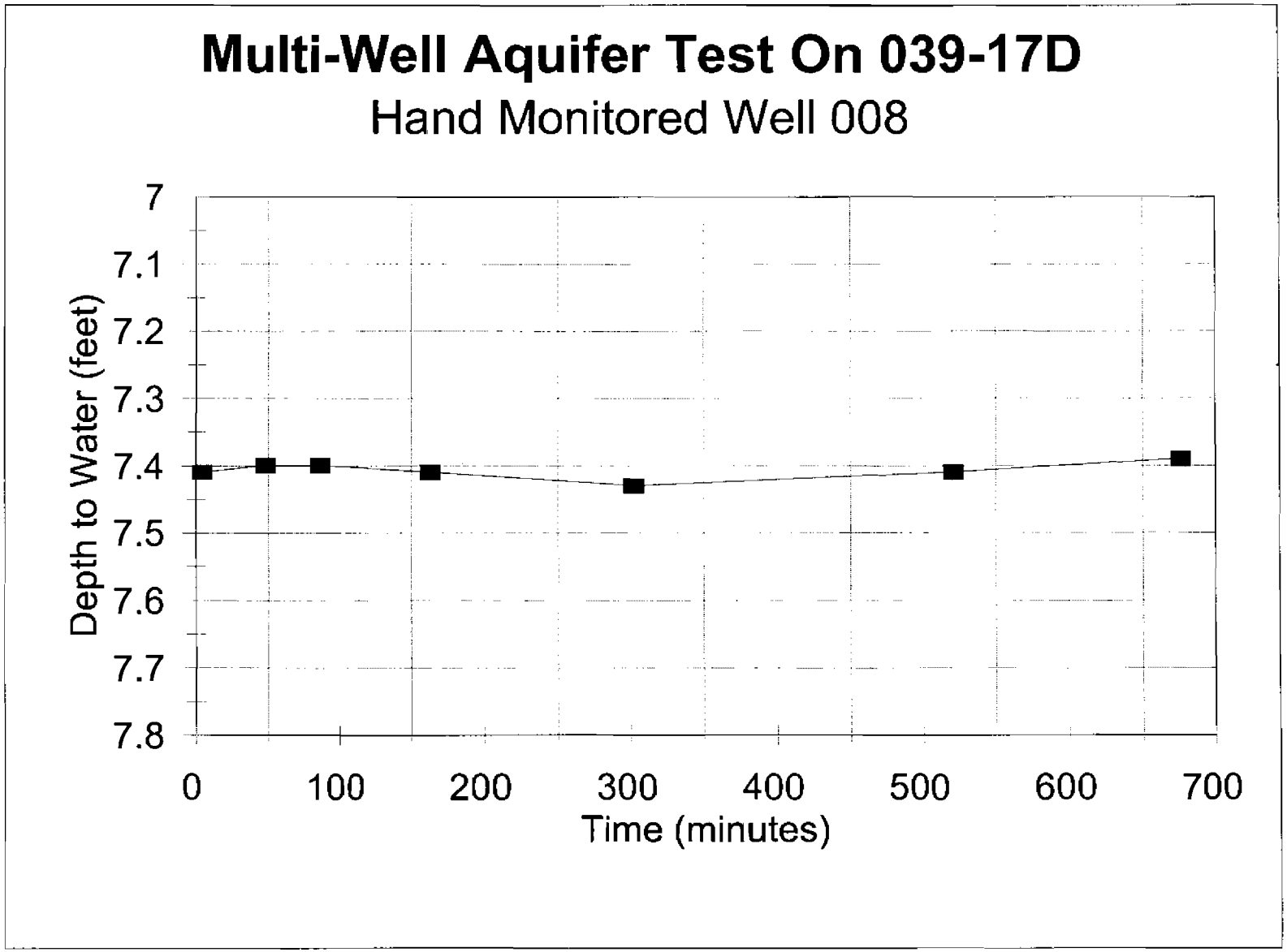

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 008
Depth to Water (feet)
7
7.1
7.2
7.3
7.4
7.5
7.6
7.7
7.8
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-6

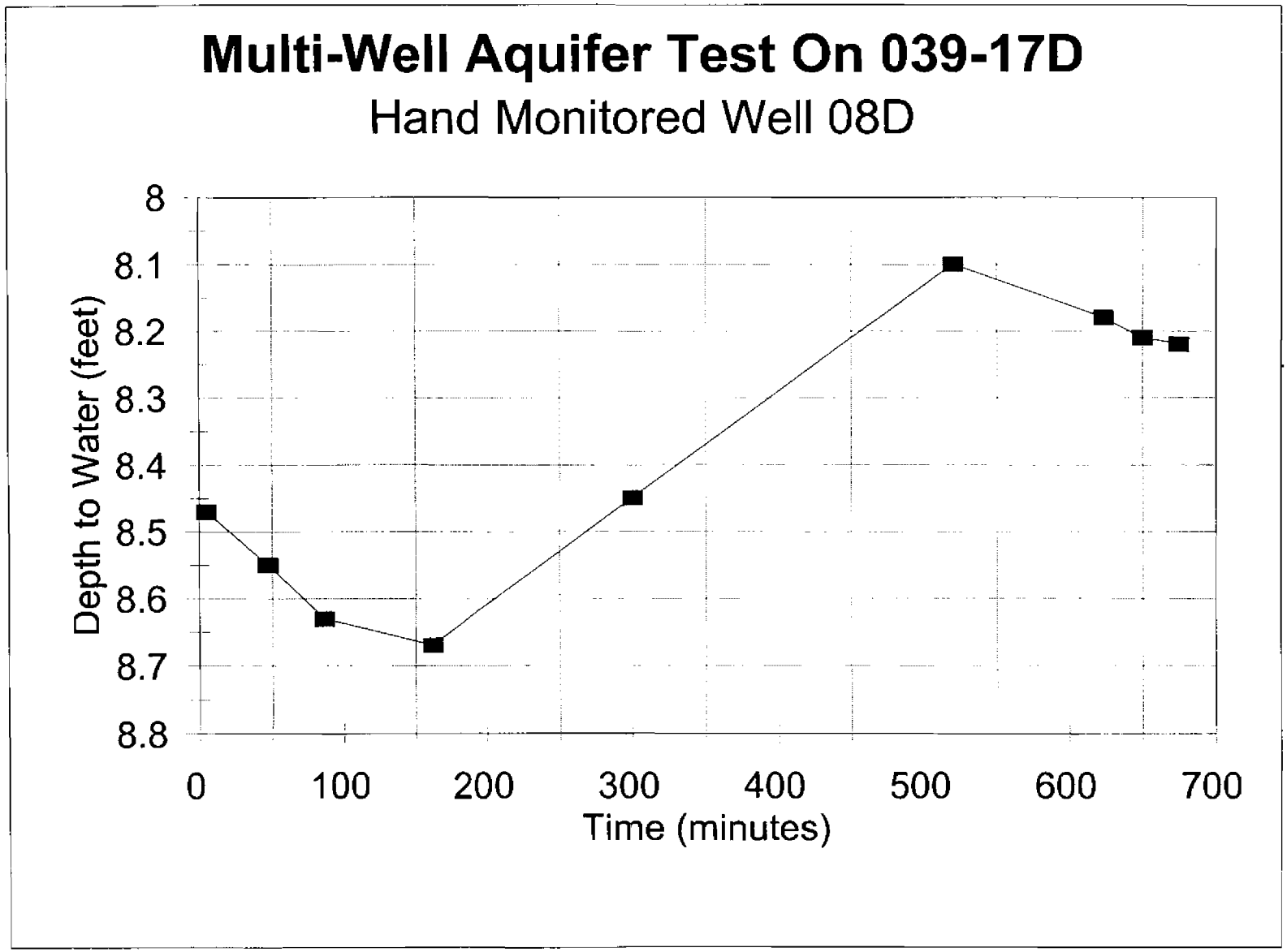

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 08D
Depth to Water (feet)
8
8.1
8.2
8.3
8.4
8.5
8.6
8.7
8.8
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-7

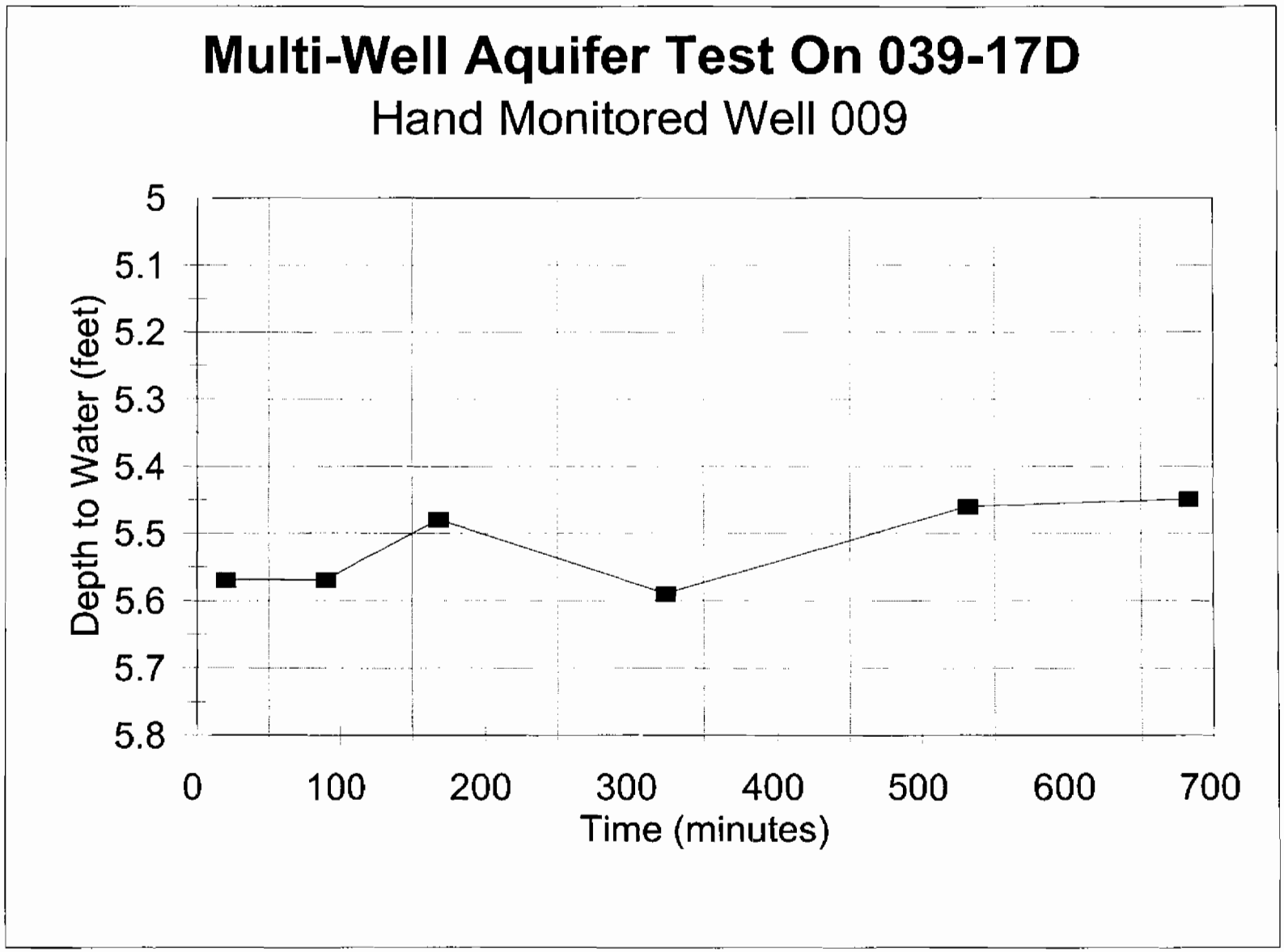

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 009
Depth to Water (feet)
5
5.1
5.2
5.3
5.4
5.5
5.6
5.7
5.8
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-8

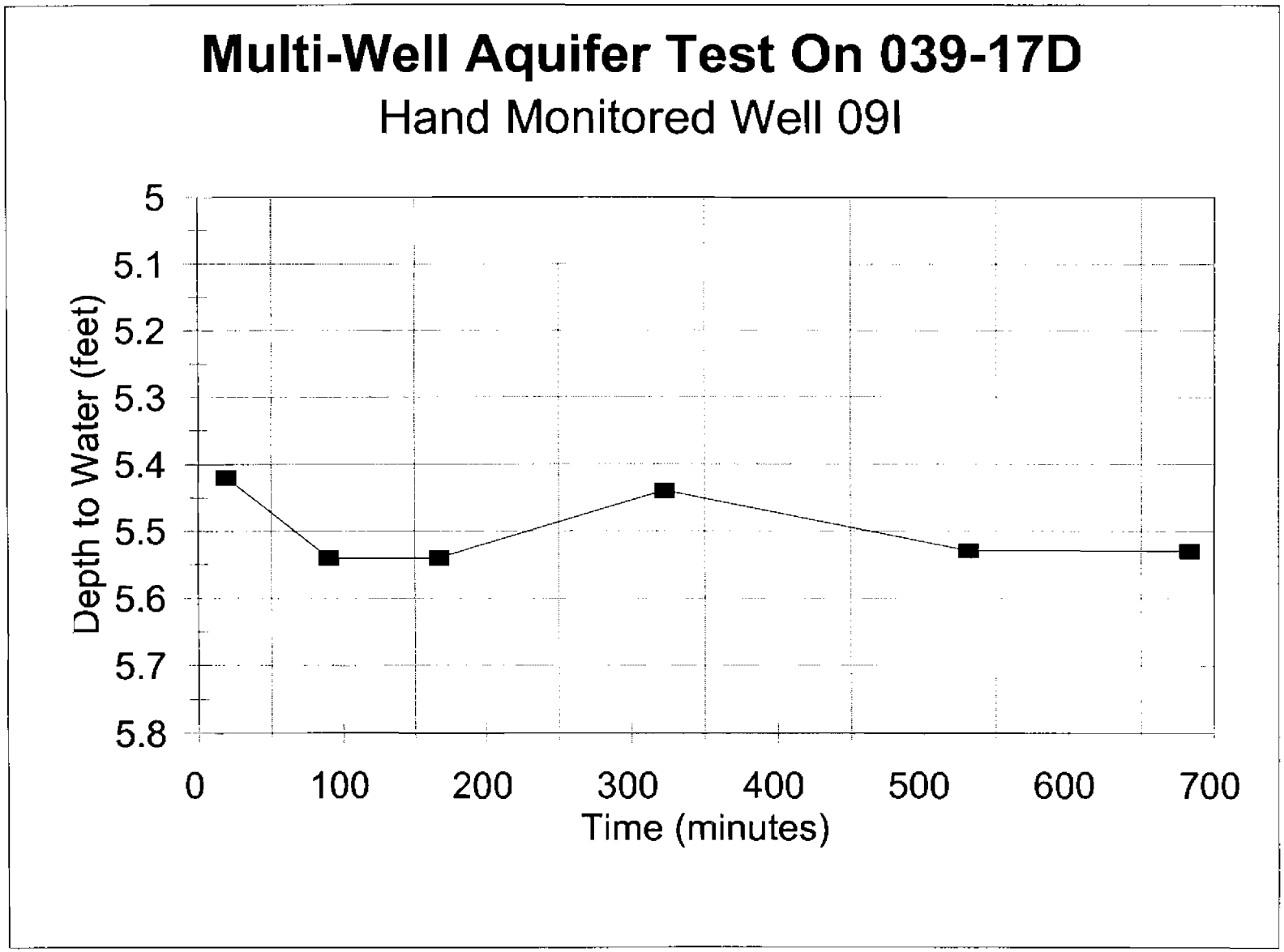

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 09I
Depth to Water (feet)
5
5.1
5.2
5.3
5.4
5.5
5.6
5.7
5.8
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-9

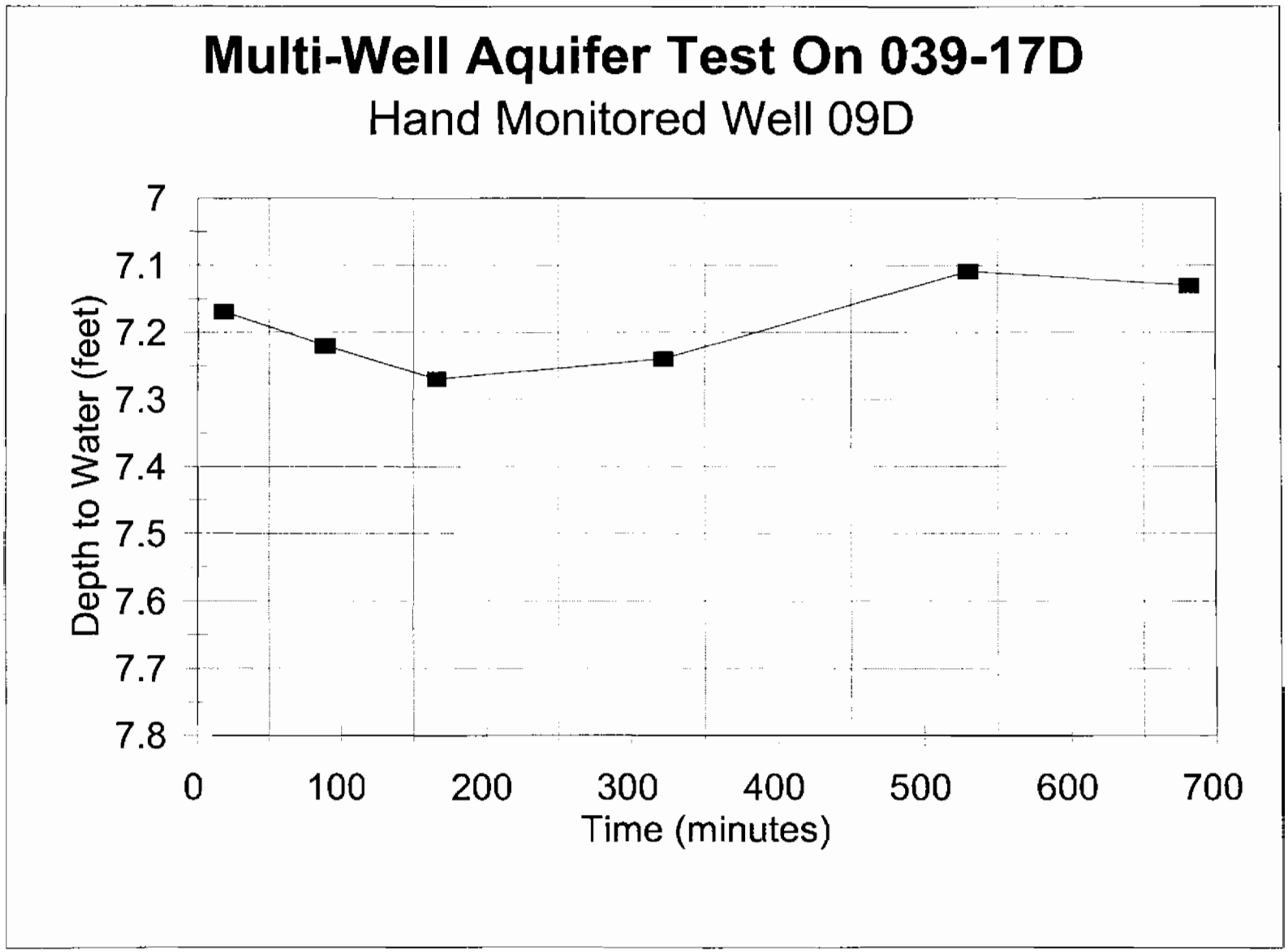

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 09D
Depth to Water (feet)
7
7.1
7.2
7.3
7.4
7.5
7.6
7.7
7.8
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-10

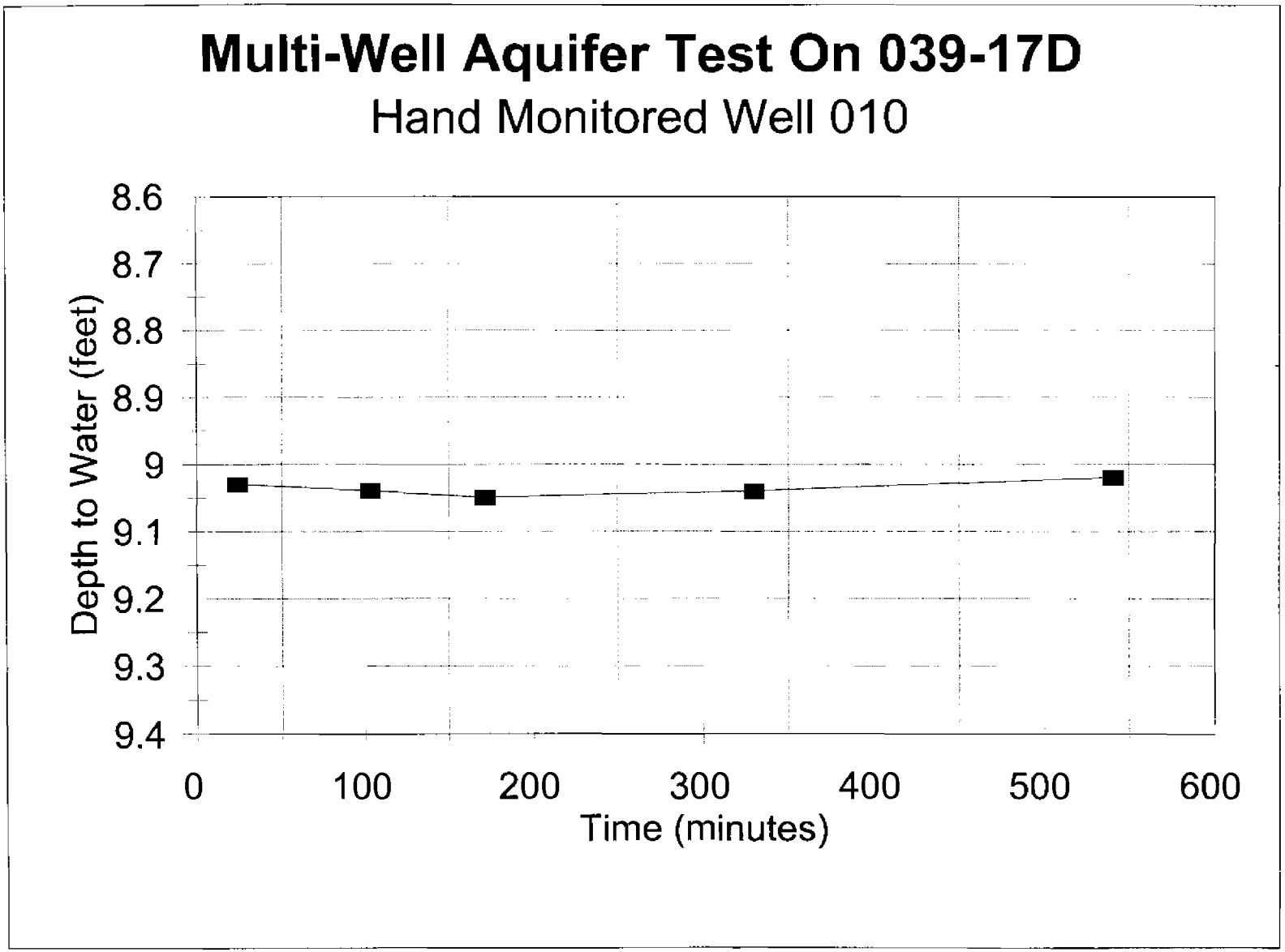

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 010
Depth to Water (feet)
8.6
8.7
8.8
8.9
9
9.1
9.2
9.3
9.4
0
100
200
300
400
500
600
Time (minutes)

Figure G-11

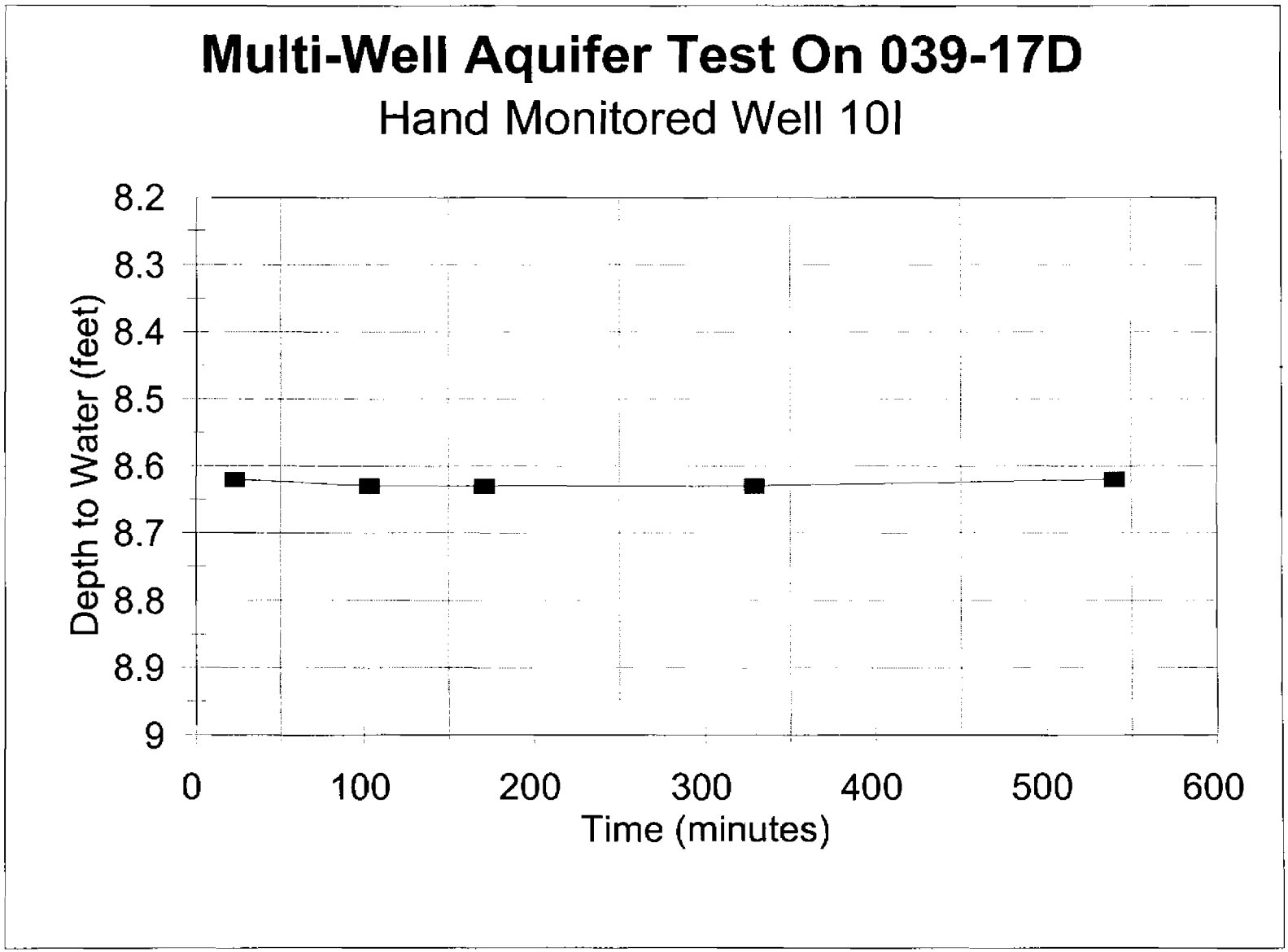

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 10I
Depth to Water (feet)
8.2
8.3
8.4
8.5
8.6
8.7
8.8
8.9
9
0
100
200
300
400
500
600
Time (minutes)

Figure G-12

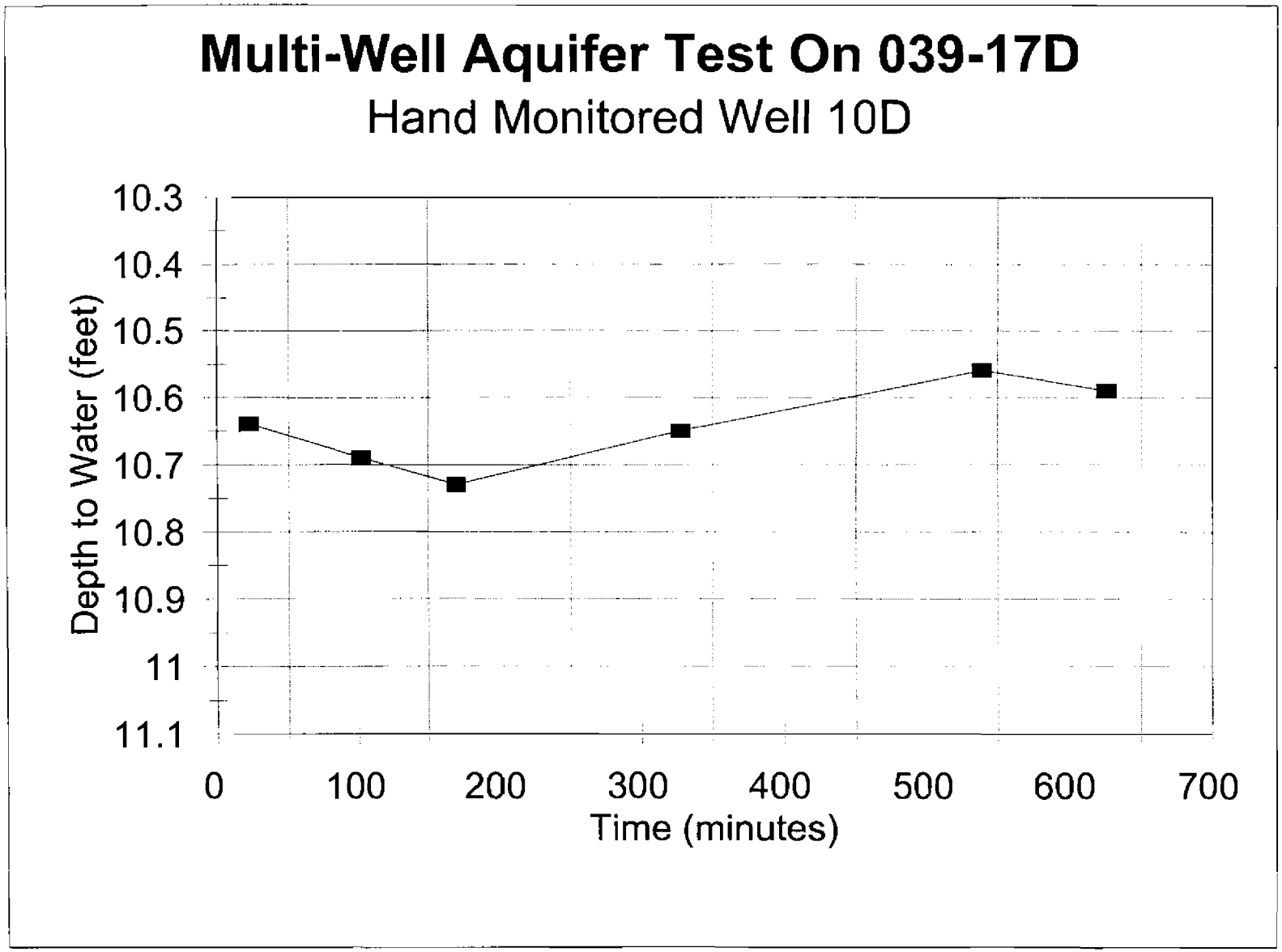

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 10D
Depth to Water (feet)
10.3
10.4
10.5
10.6
10.7
10.8
10.9
11
11.1
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-13

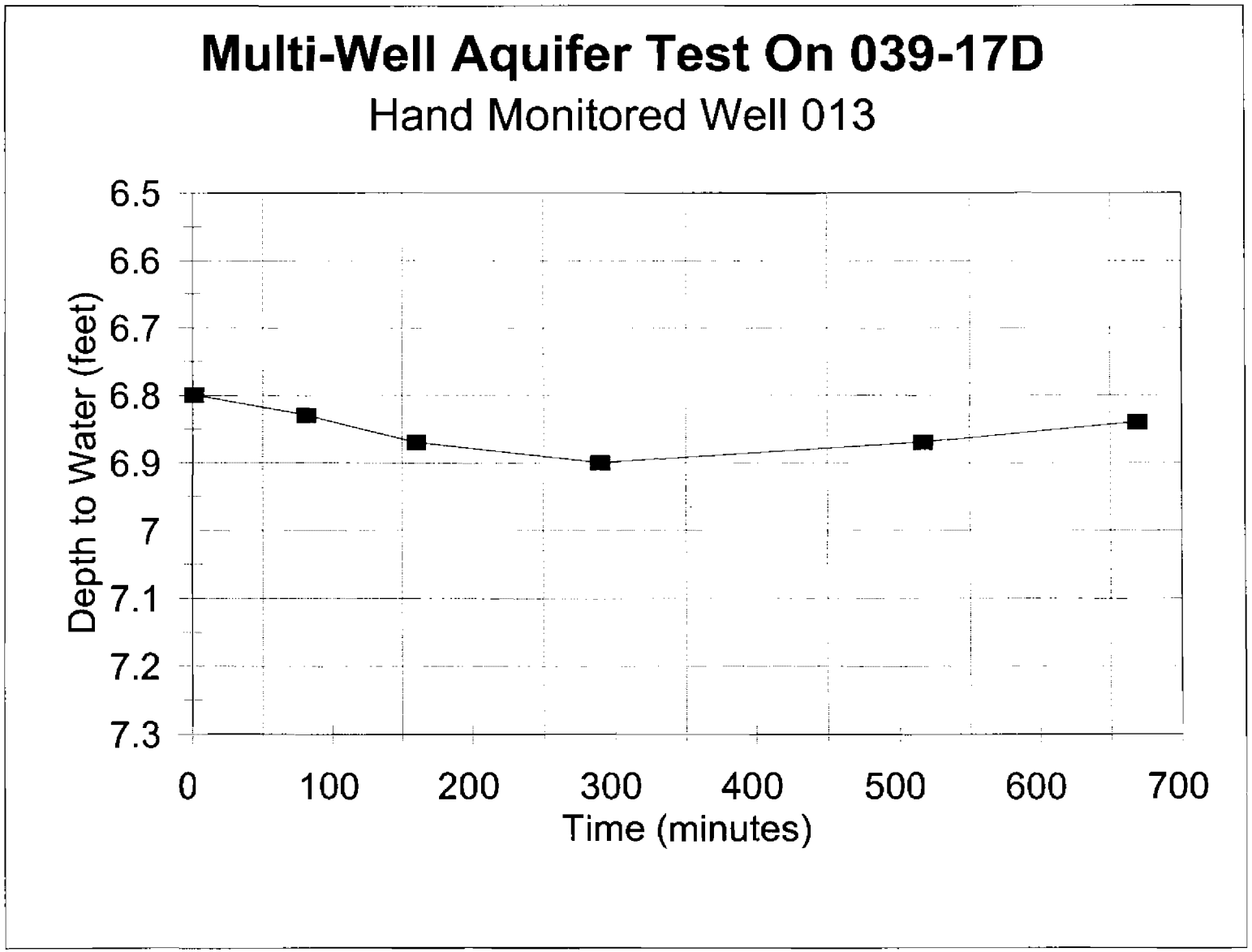

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 013
Depth to Water (feet)
6.5
6.6
6.7
6.8
6.9
7
7.1
7.2
7.3
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-14

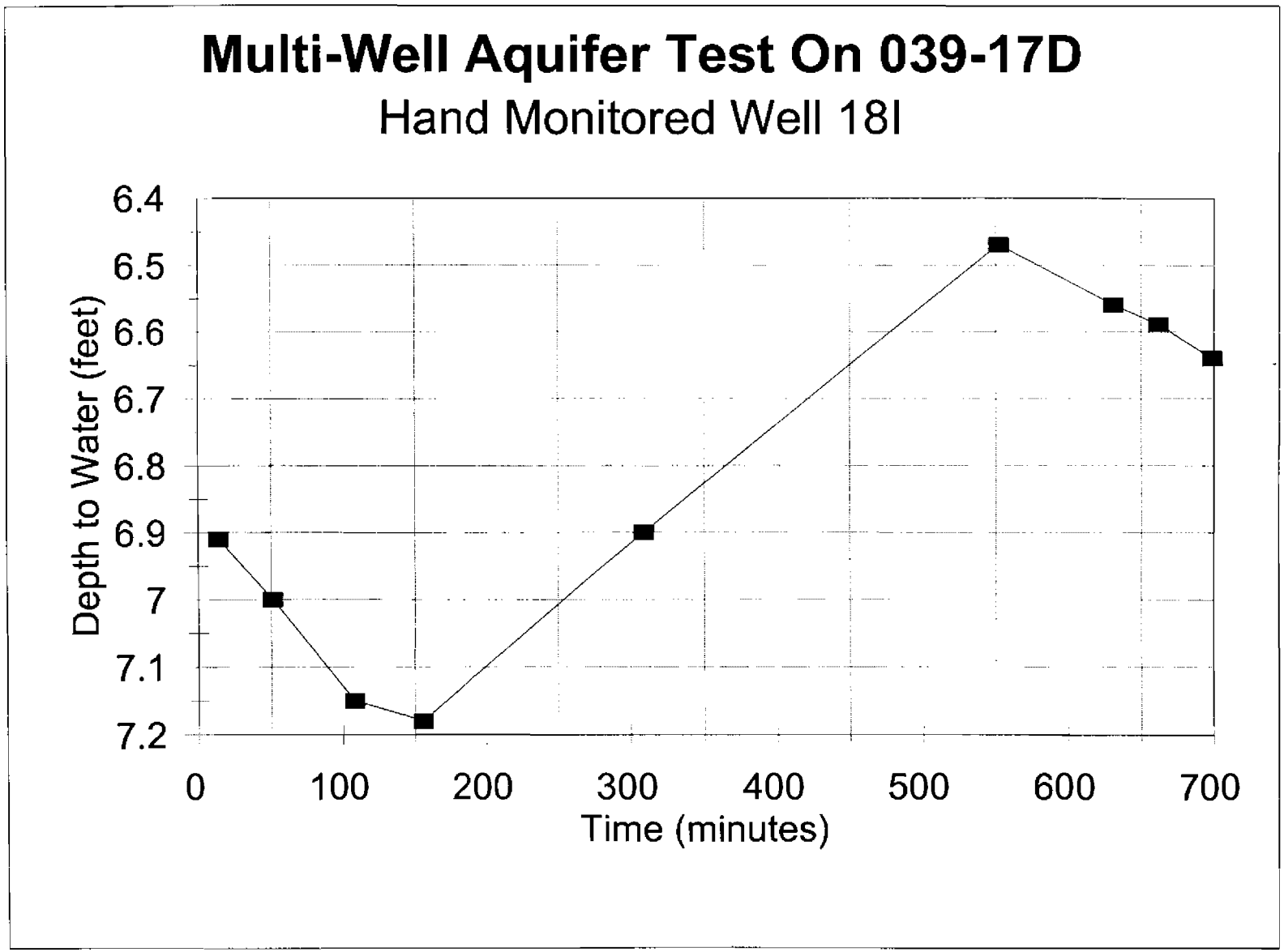

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 18I
Depth to Water (feet)
6.4
6.5
6.6
6.7
6.8
6.9
7
7.1
7.2
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-15

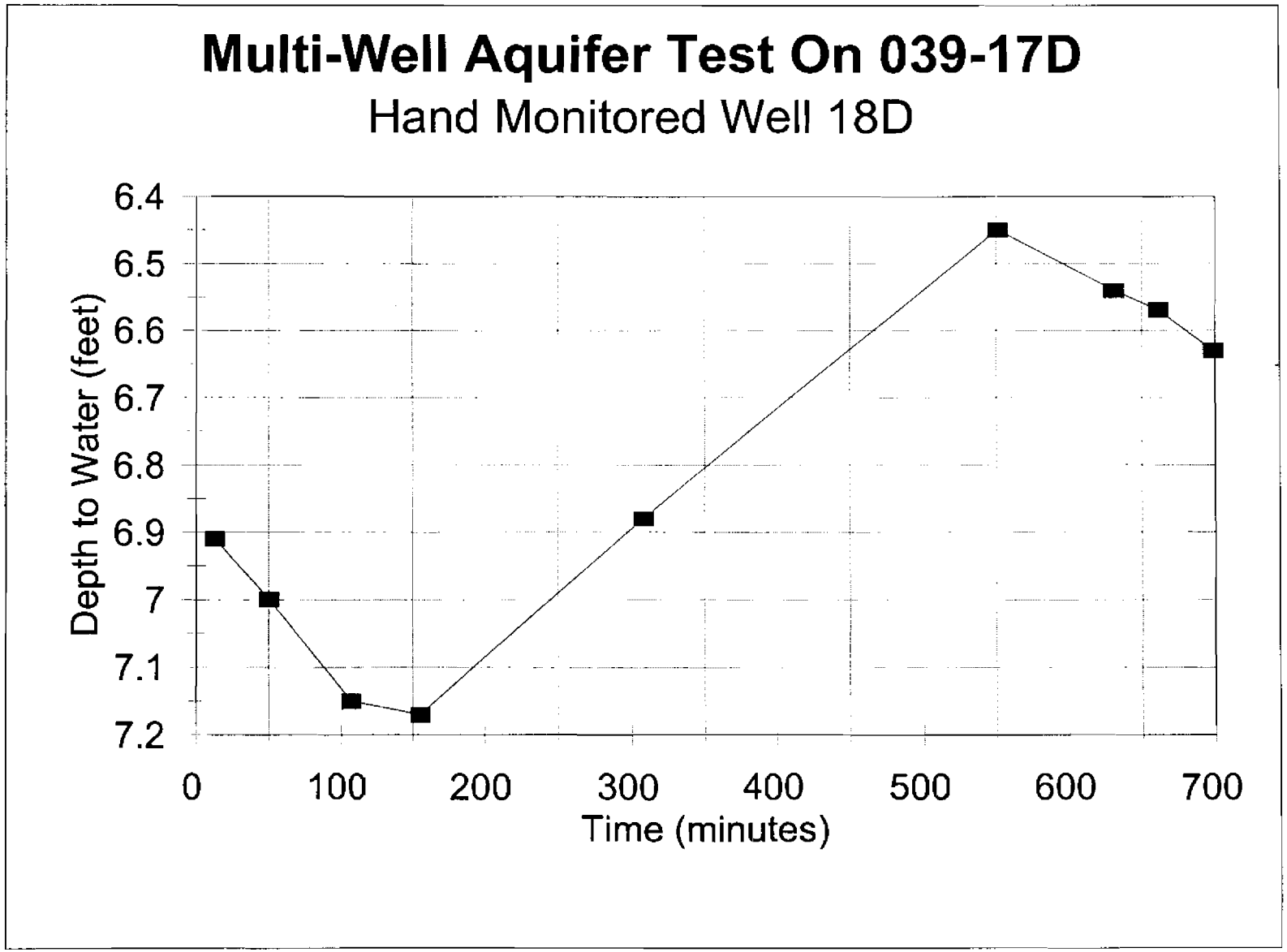

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 18D
Depth to Water (feet)
6.4
6.5
6.6
6.7
6.8
6.9
7
7.1
7.2
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-16

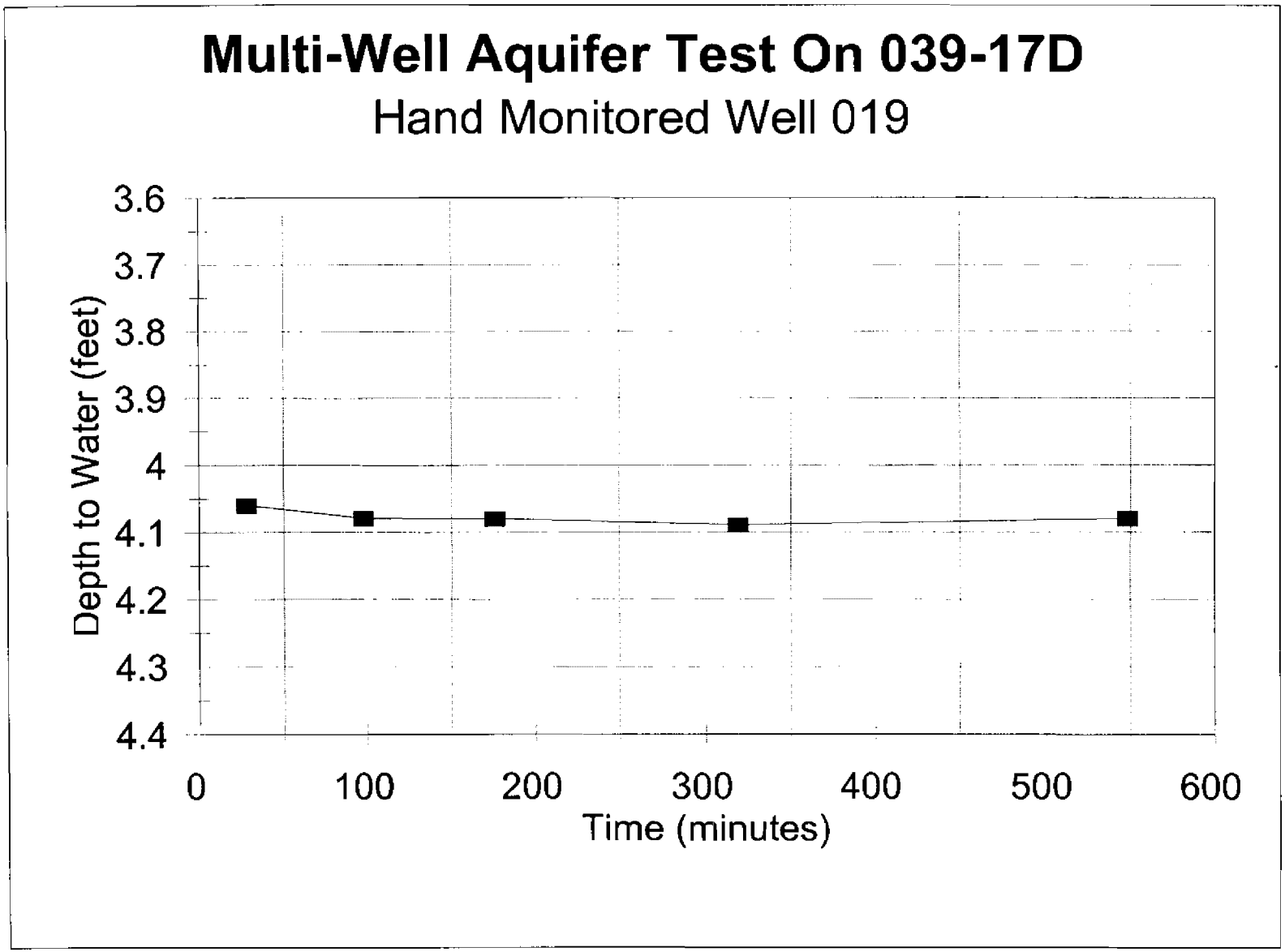

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 019
Depth to Water (feet)
3.6
3.7
3.8
3.9
4
4.1
4.2
4.3
4.4
0
100
200
300
400
500
600
Time (minutes)

Figure G-17

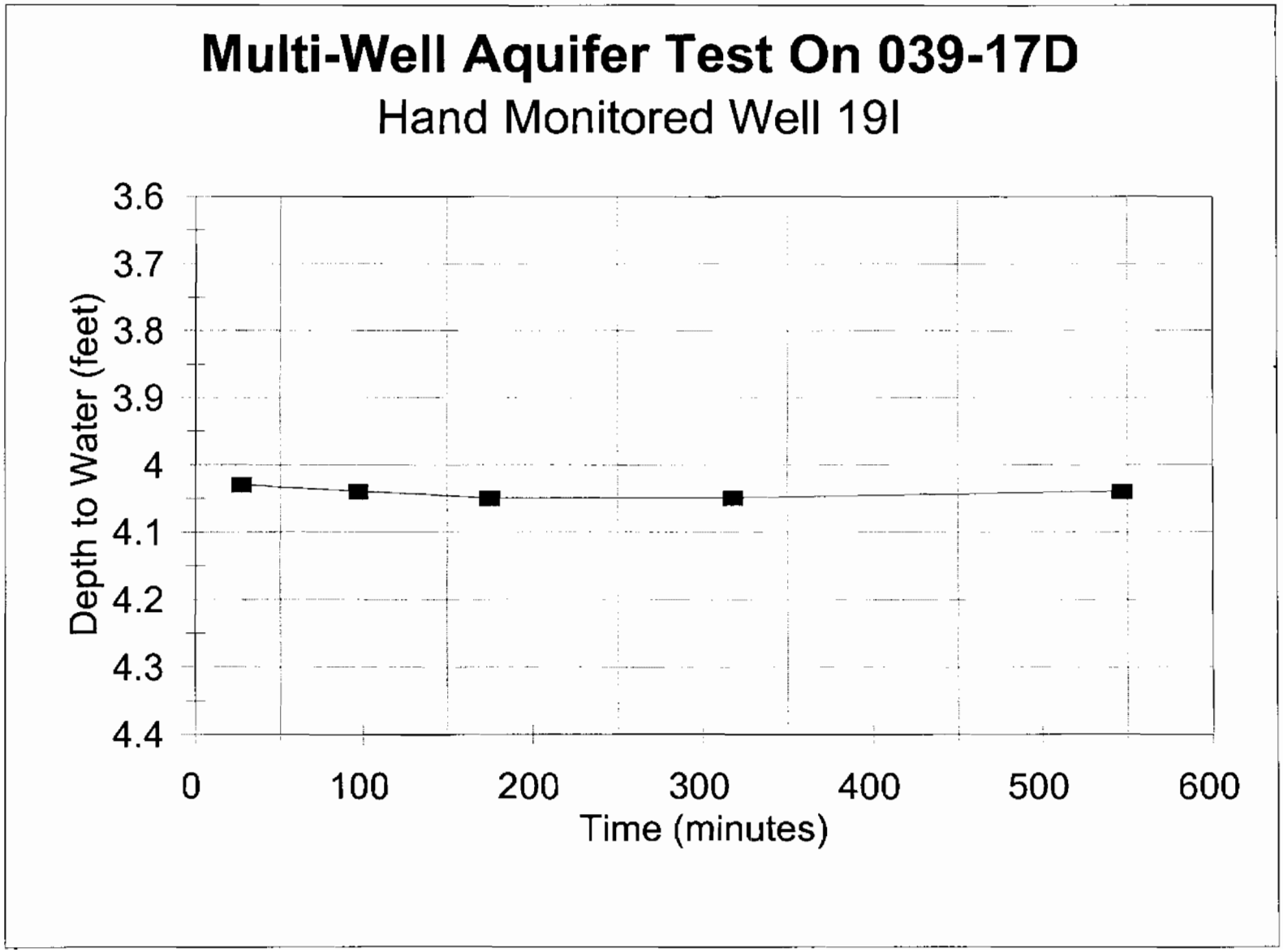

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 19I
Depth to Water (feet)
3.6
3.7
3.8
3.9
4
4.1
4.2
4.3
4.4
0
100
200
300
400
500
600
Time (minutes)

Figure G-18

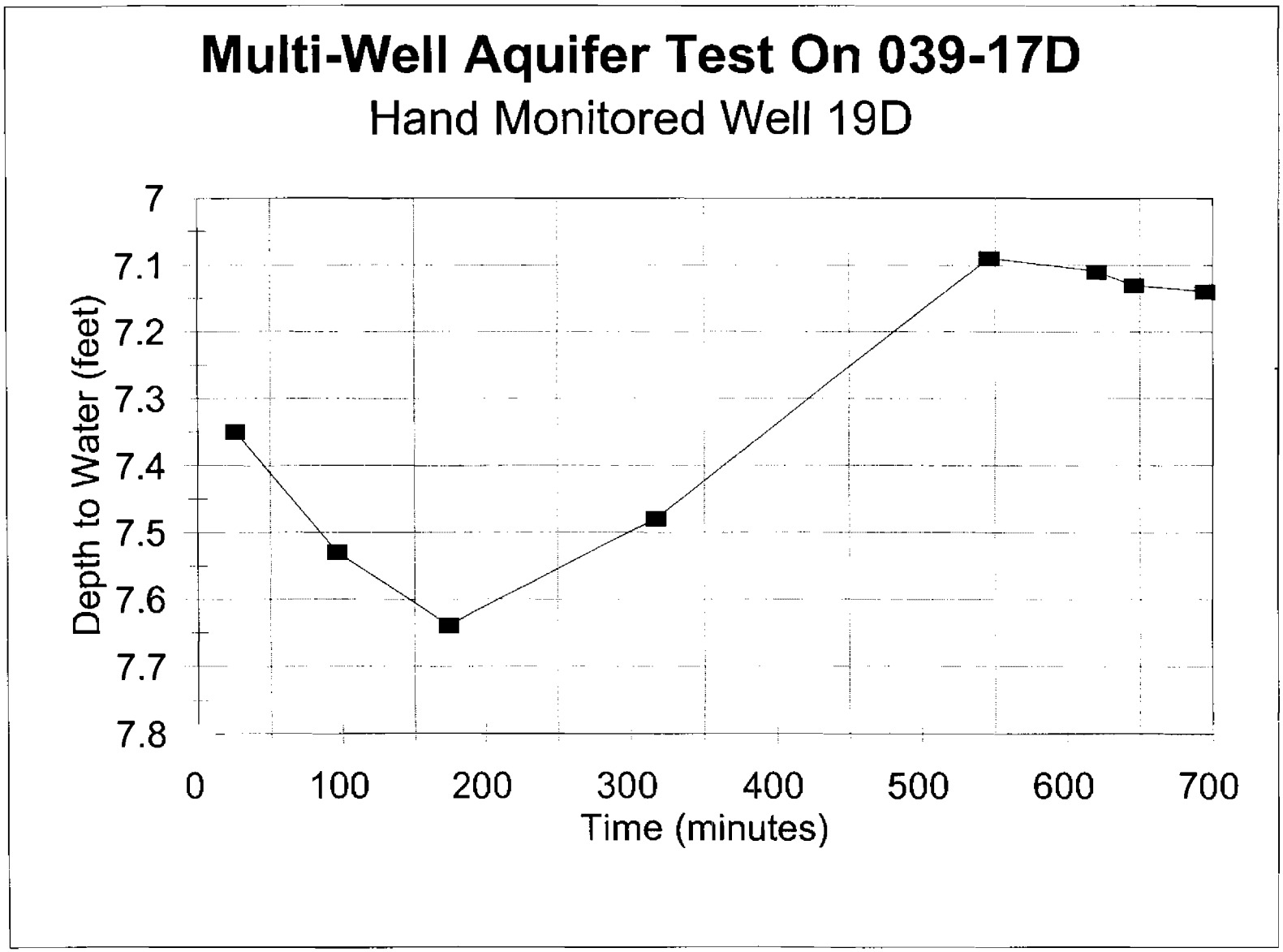
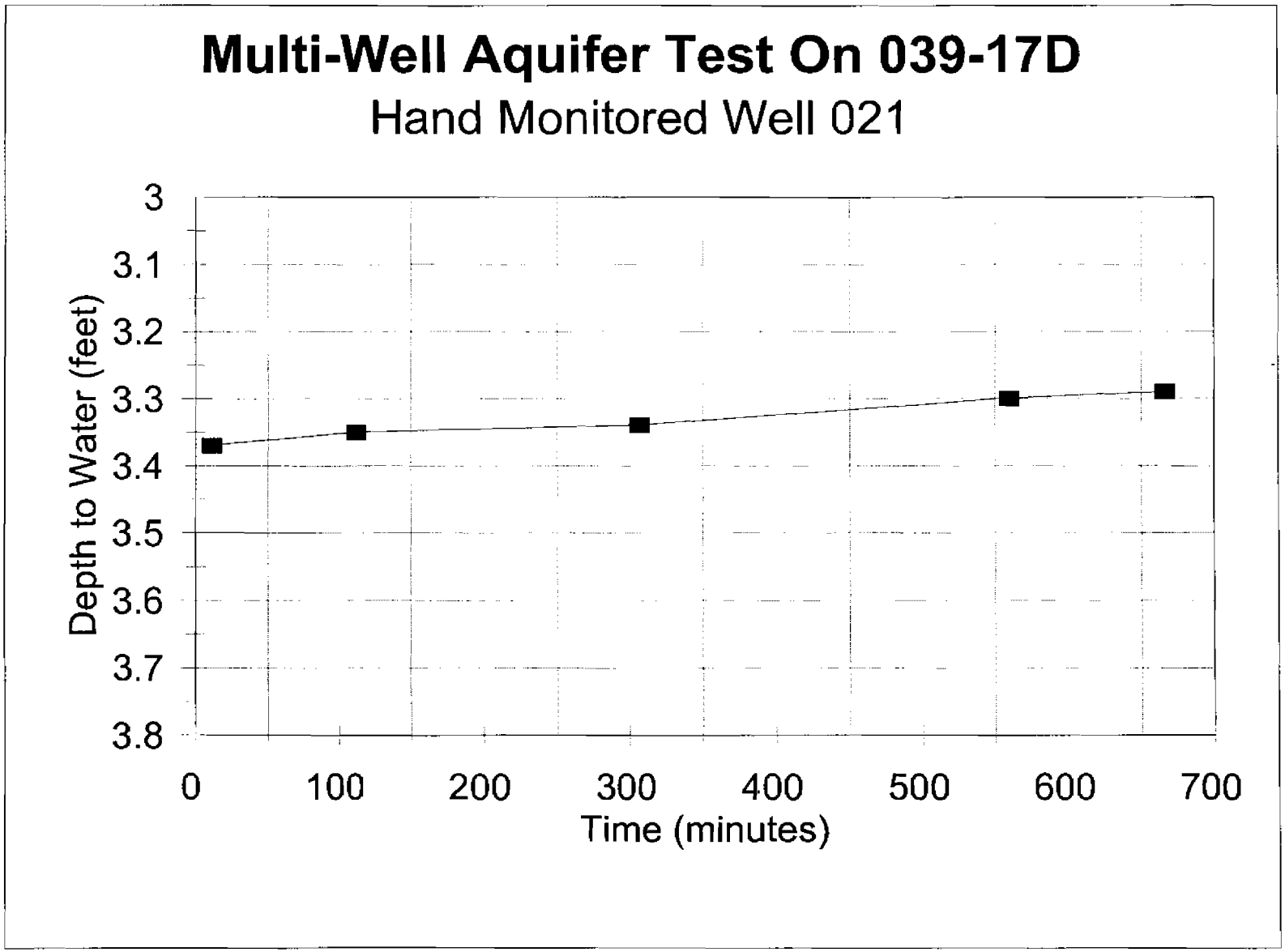

Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 19D
Depth to Water (feet)
7
7.1
7.2
7.3
7.4
7.5
7.6
7.7
7.8
0
100
200
300
400
500
600
700
Time (minutes)

Figure G-19


Multi-Well Aquifer Test On 039-17D
Hand Monitored Well 021
Depth to Water (feet)
3
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
0
100
200
300
400
500
600
700
Time (minutes)

ATTACHMENT G-5

STEP TEST RESULTS

Figure G-20

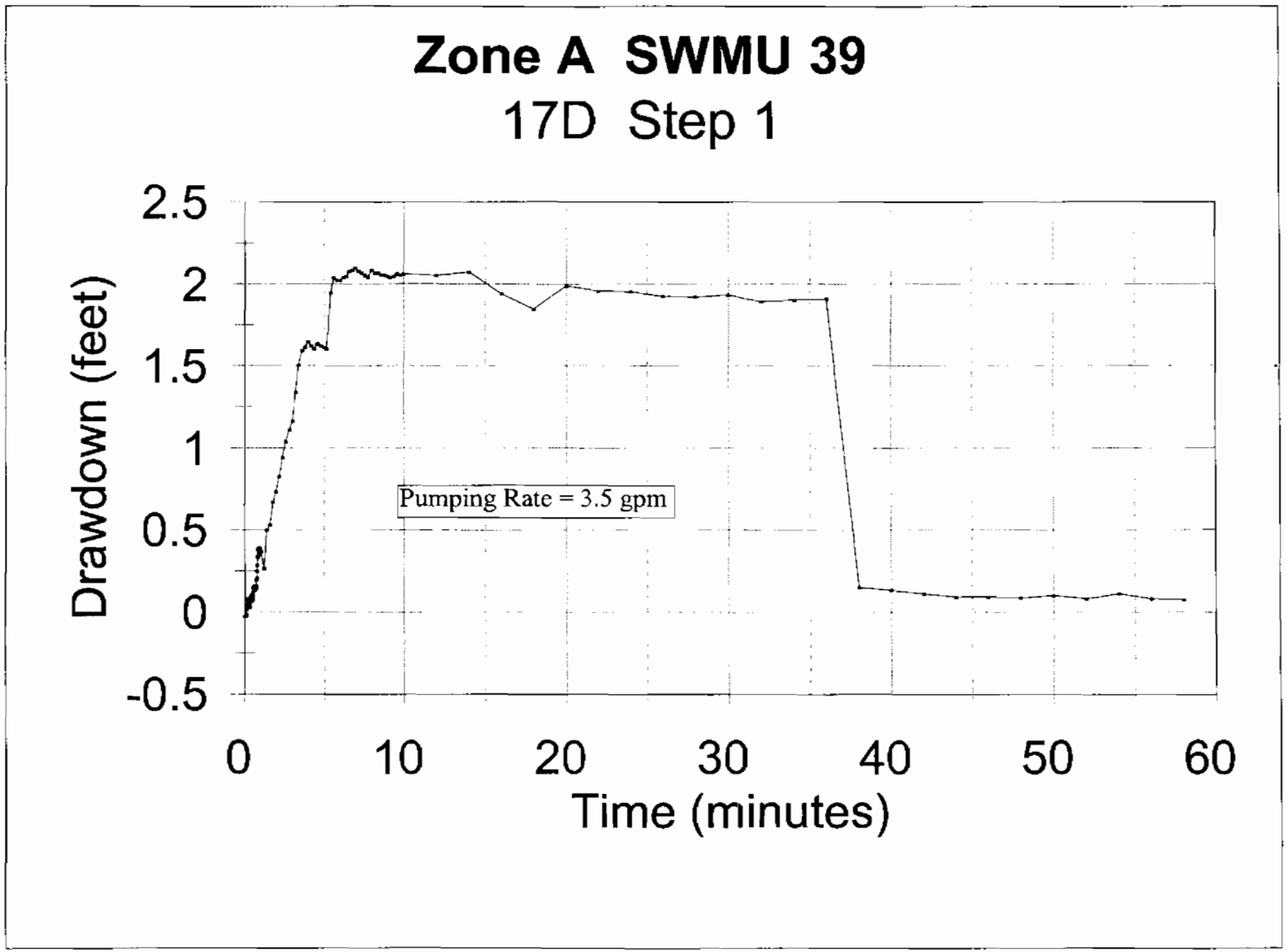

Zone A SWMU 39
17D Step 1
Drawdown (feet)
2.5
2
1.5
1
0.5
0
-0.5
Pumping Rate = 3.5 gpm
0
10
20
30
40
50
60
Time (minutes)

Figure G-21

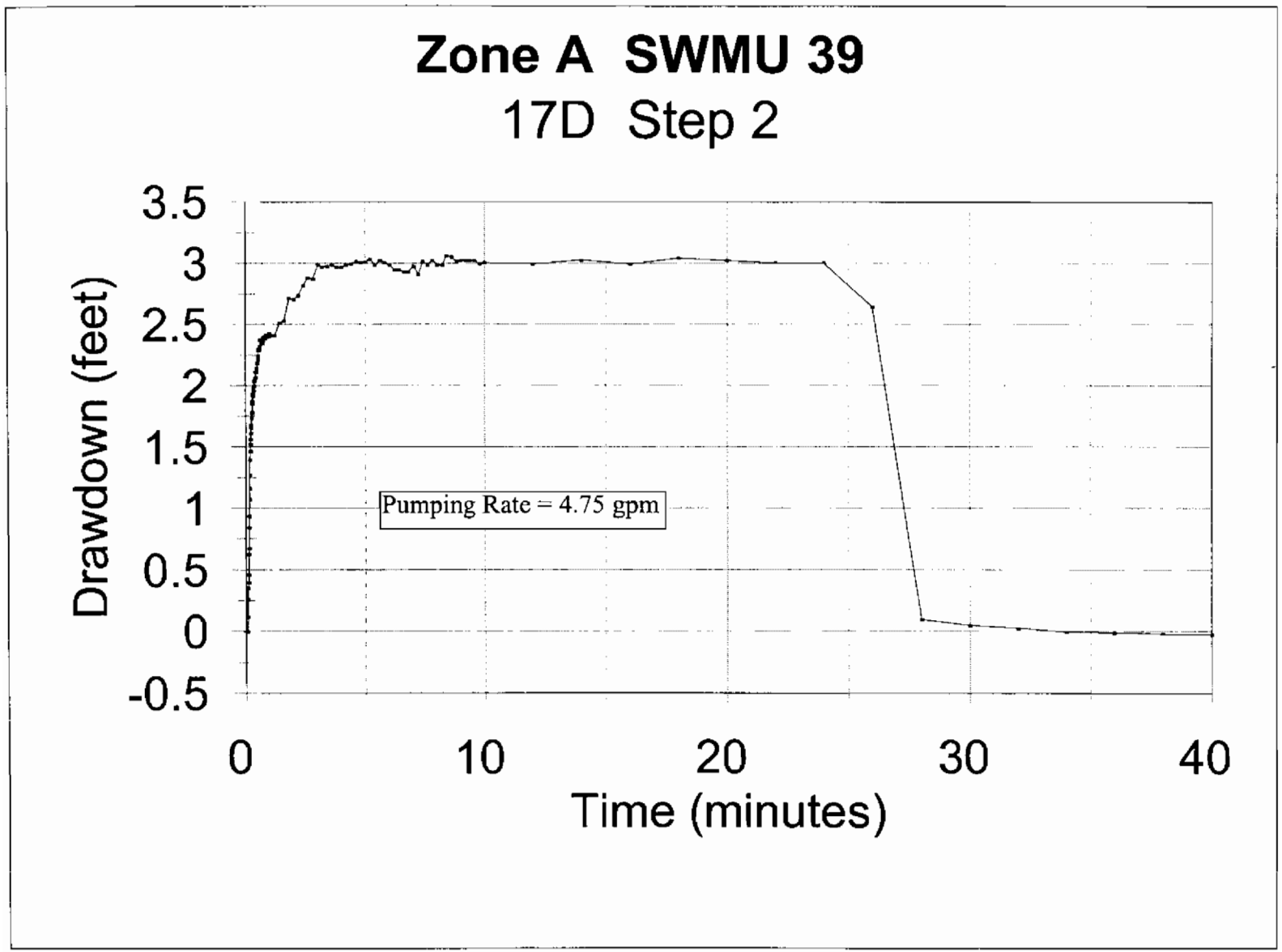

Zone A SWMU 39
17D Step 2
Drawdown (feet)
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
Pumping Rate = 4.75 gpm
0
10
20
30
40
Time (minutes)

Figure G-22

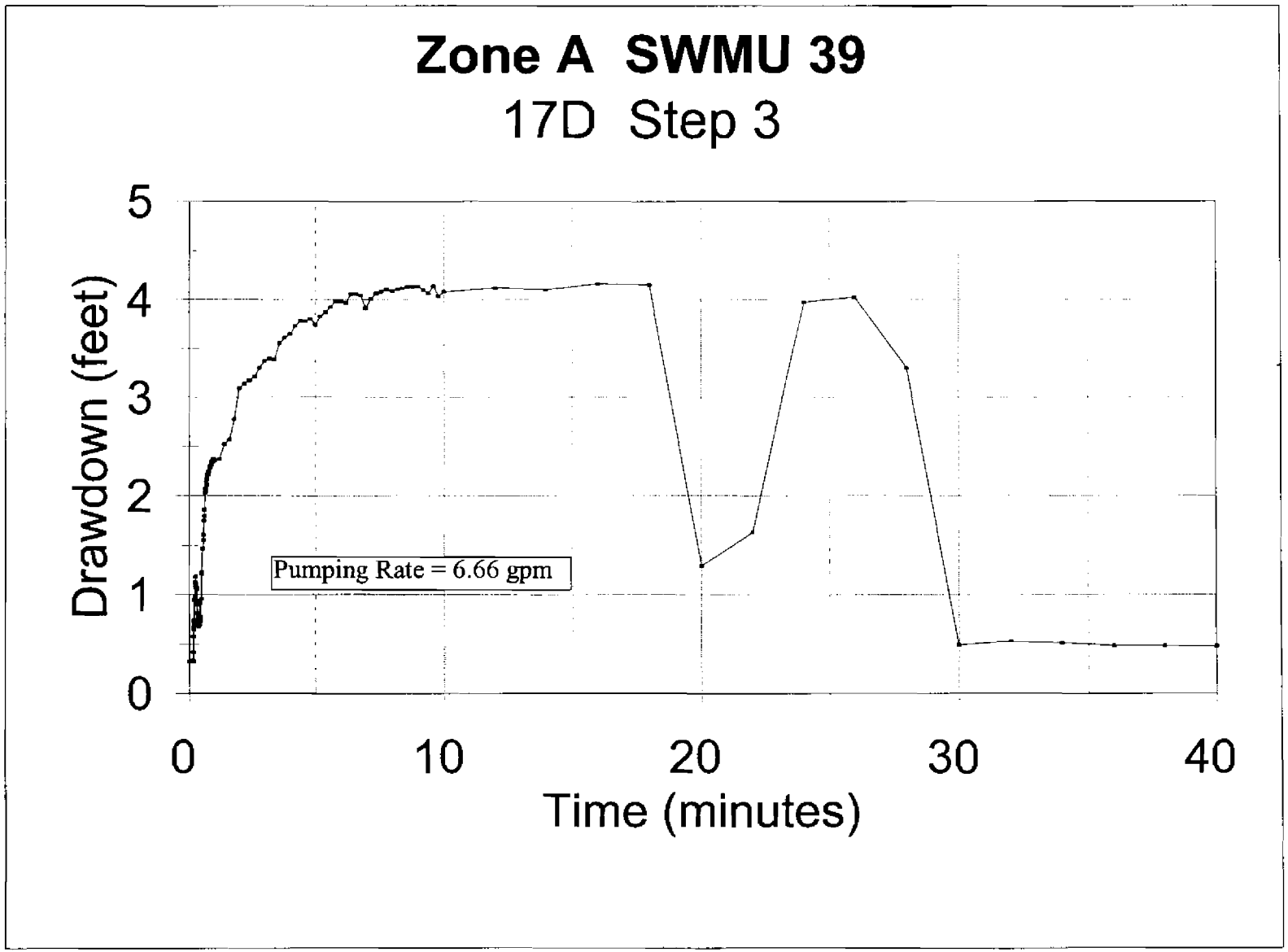

Zone A SWMU 39
17D Step 3
Drawdown (feet)
5
4
3
2
1
0
Pumping Rate = 6.66 gpm
0
10
20
30
40
Time (minutes)

Figure G-23

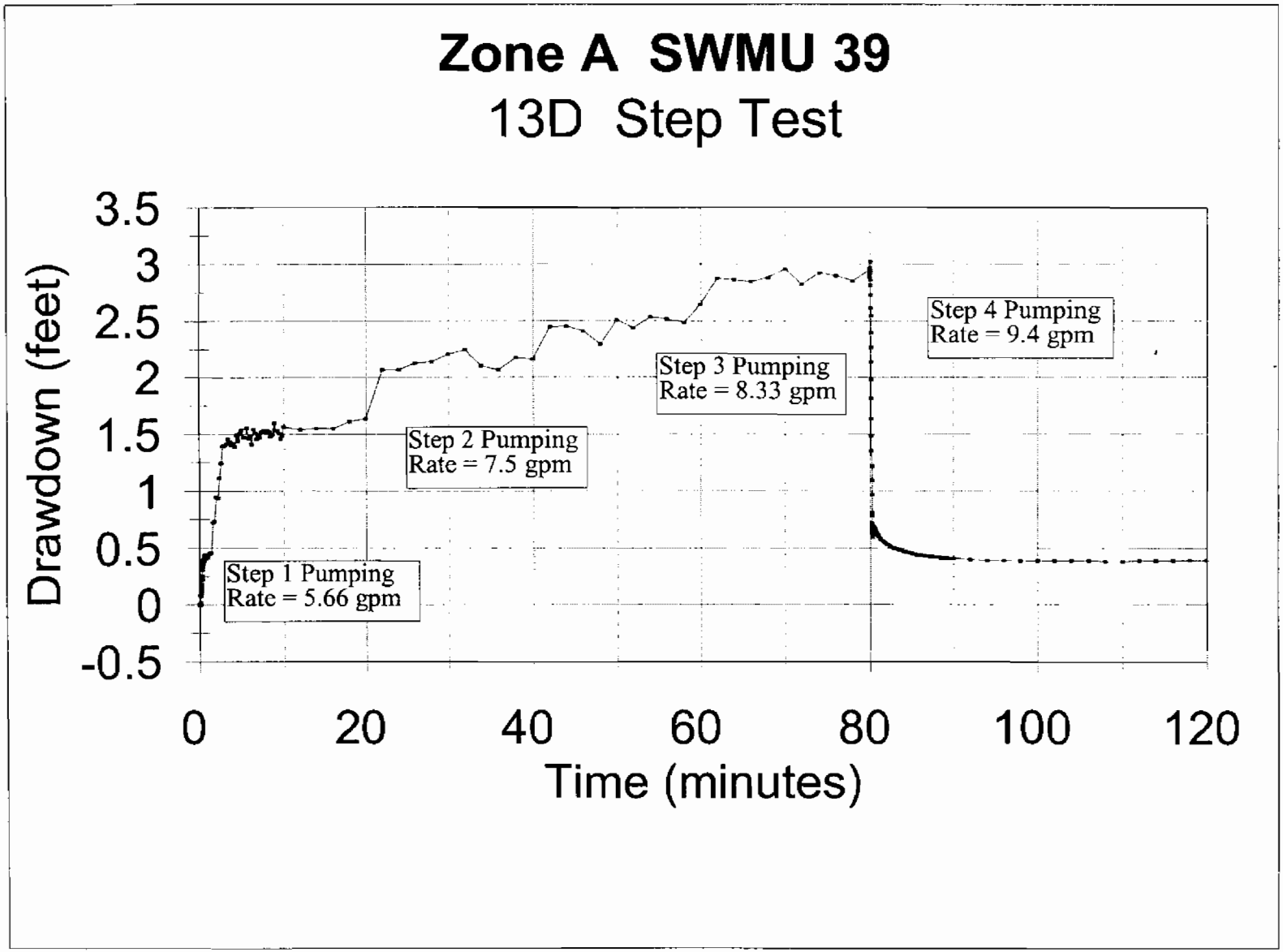

Zone A SWMU 39
13D Step Test
Drawdown (feet)
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
0
20
40
60
80
100
120
Time (minutes)
Step 1 Pumping
Rate = 5.66 gpm
Step 2 Pumping
Rate = 7.5 gpm
Step 3 Pumping
Rate = 8.33 gpm
Step 4 Pumping
Rate = 9.4 gpm

Figure G-24

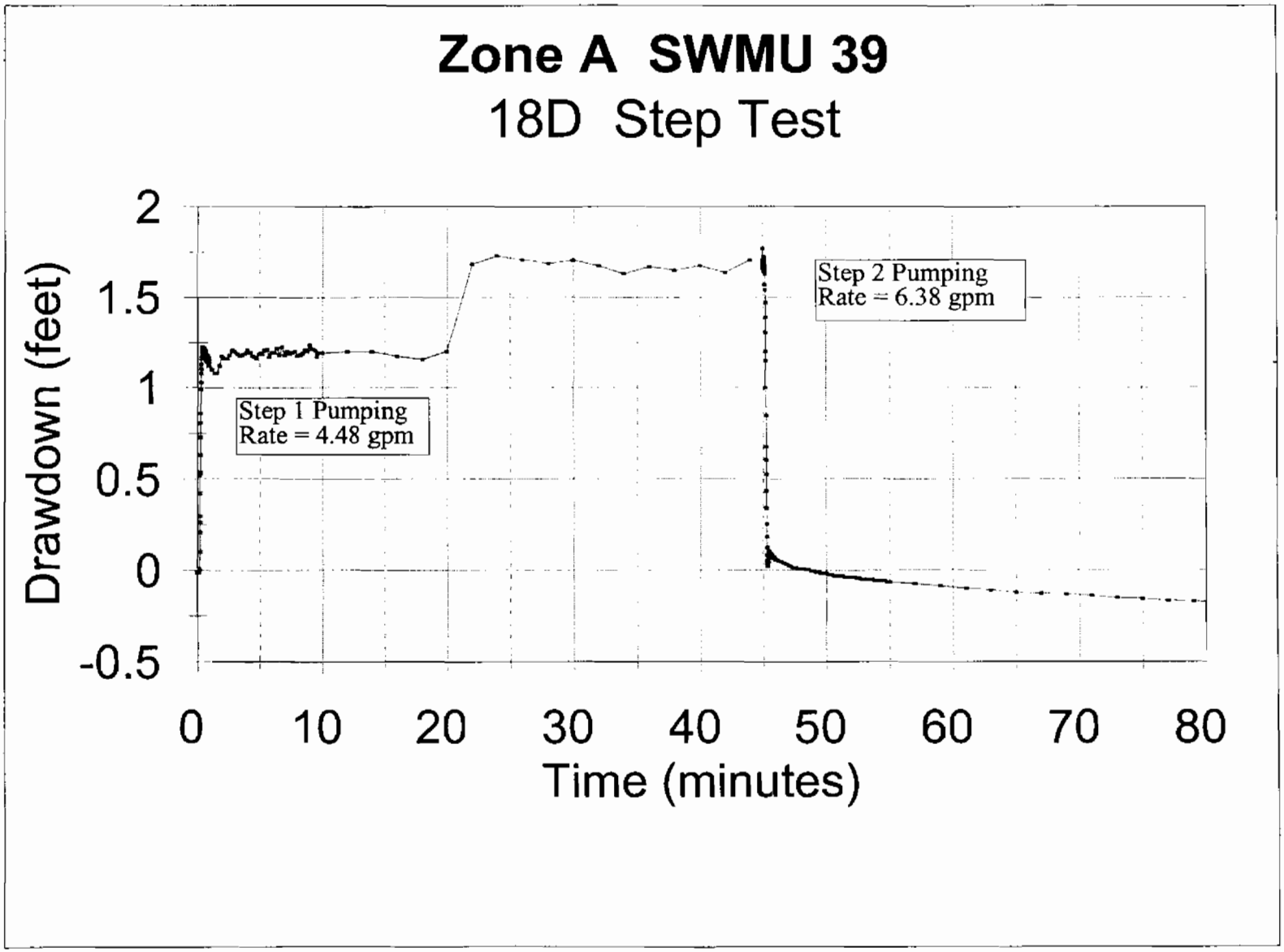
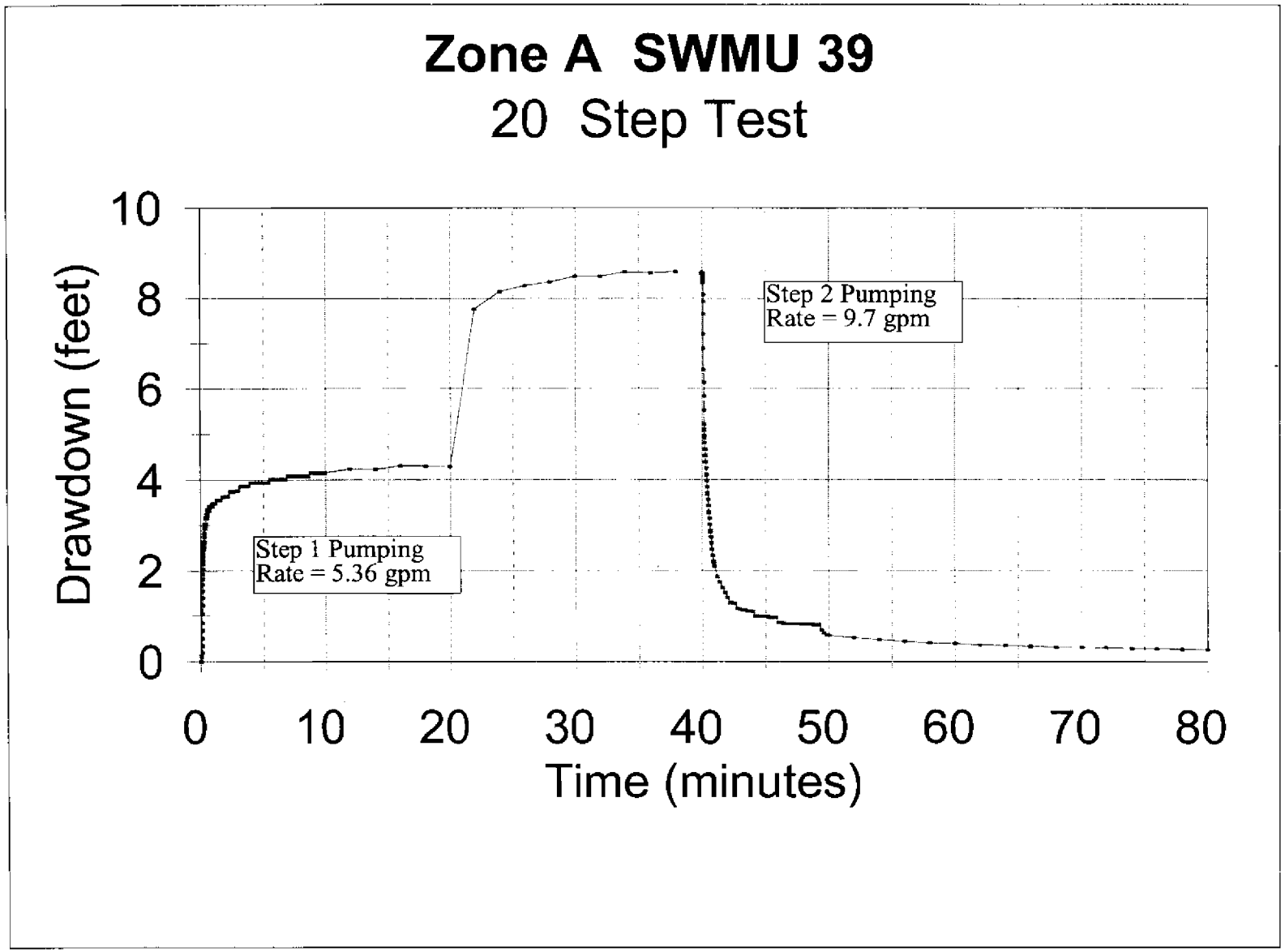
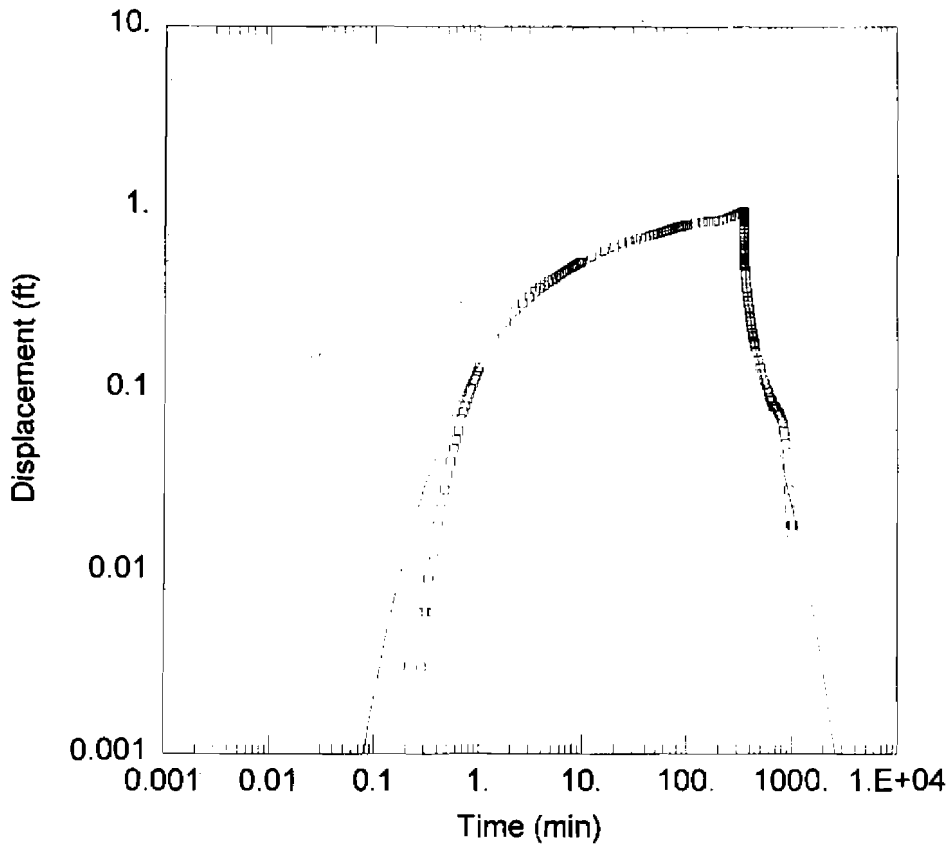

Zone A SWMU 39
18D Step Test
Drawdown (feet)
2
1.5
1
0.5
0
-0.5
0
10
20
30
40
50
60
70
80
Time (minutes)
Step 1 Pumping
Rate = 4.48 gpm
Step 2 Pumping
Rate = 6.38 gpm

Figure G-25


Zone A SWMU 39
20 Step Test
Drawdown (feet)
10
8
6
4
2
0
0
10
20
30
40
50
60
70
80
Time (minutes)
Step 1 Pumping
Rate = 5.36 gpm
Step 2 Pumping
Rate = 9.7 gpm

ATTACHMENT G-6

CONSTANT-RATE TEST RESULTS



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\20I.AQT
Date: 09/28/99 Time: 16:50:42

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob
T = 0.258 ft^2/min
S = 0.001445
r/B = 0.0176

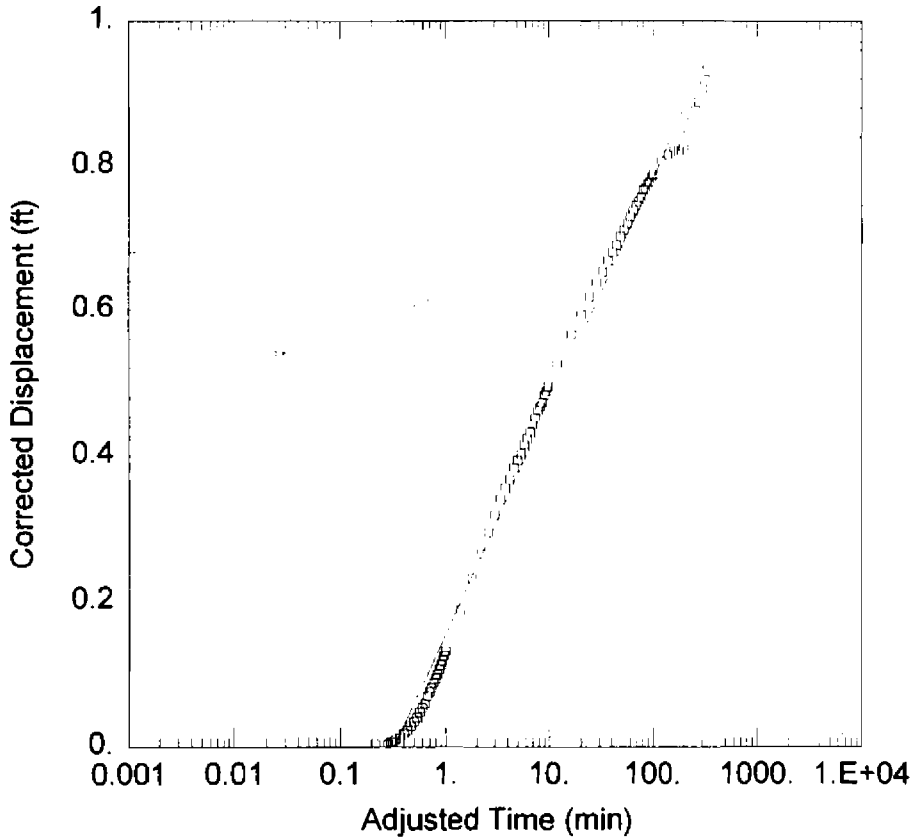
AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
020	0	0	20I	6.6	0



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\20I.AQT
Date: 09/28/99 Time: 16:52:04

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Unconfined
Solution Method: Cooper-Jacob
T = 0.2876 ft^2/min
S = 0.004808

AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

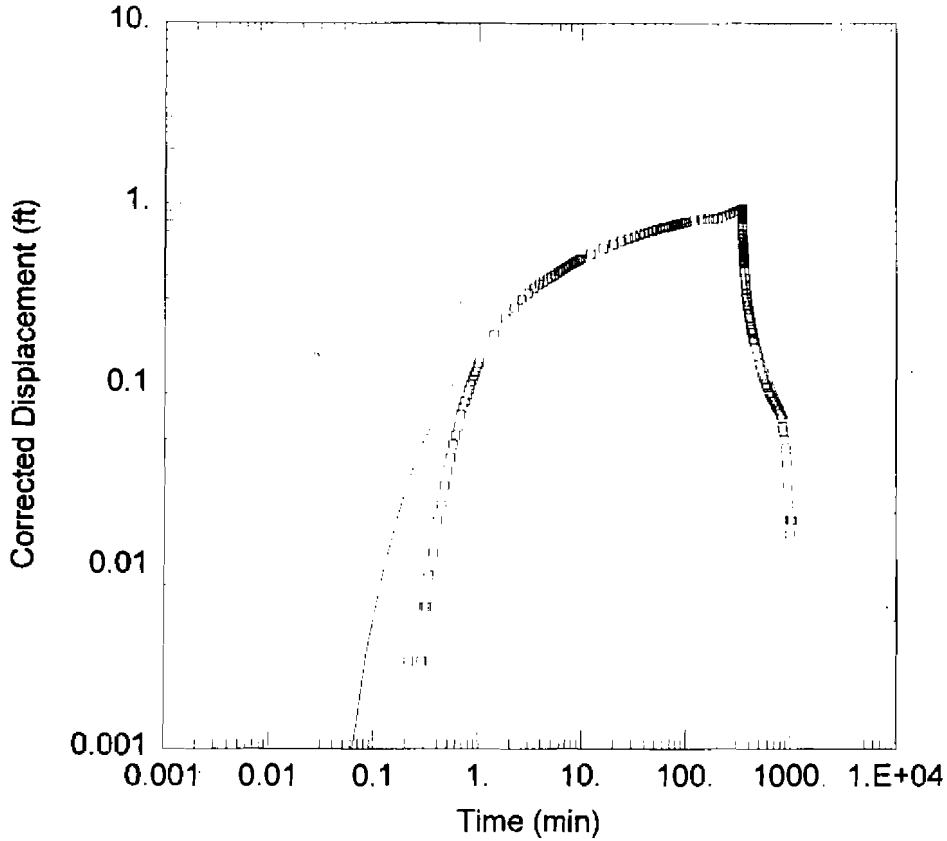
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
020	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
20I	6.6	0



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\20I.AQT
Date: 09/28/99 Time: 16:38:05

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis
T = 0.2804 ft^2/min
S = 0.005562

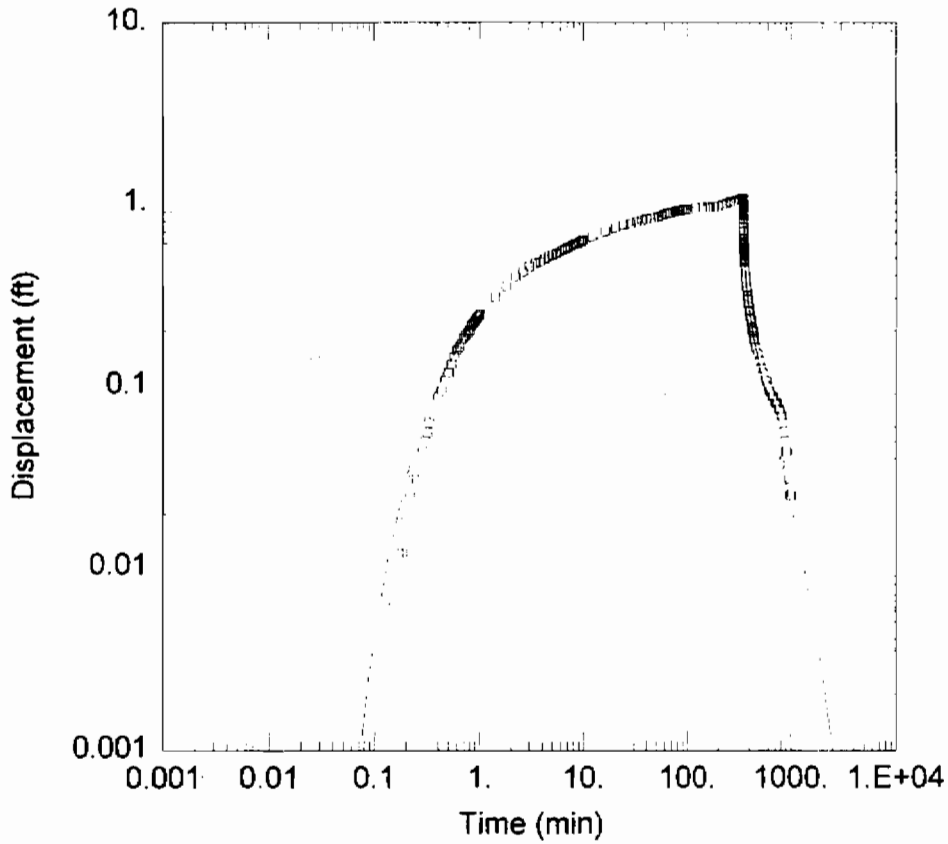
AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
020	0	0	20I	6.6	0



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\PZ6.AQT
Date: 09/28/99 Time: 17:02:48

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 0.253 ft^2/min
S = 0.003368
r/B = 0.04063

AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

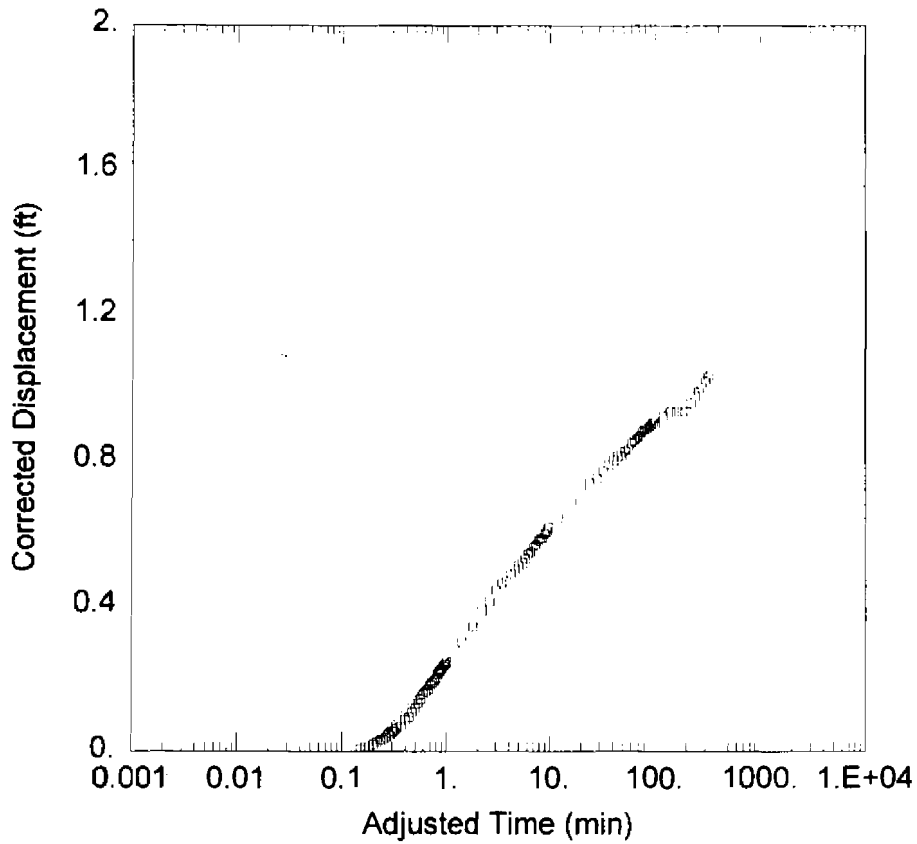
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
020	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
PZ6	9.65	0



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\PZ6.AQT
Date: 09/28/99 Time: 17:01:47

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Unconfined
Solution Method: Cooper-Jacob
T = 0.277 ft^2/min
S = 0.001152

AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

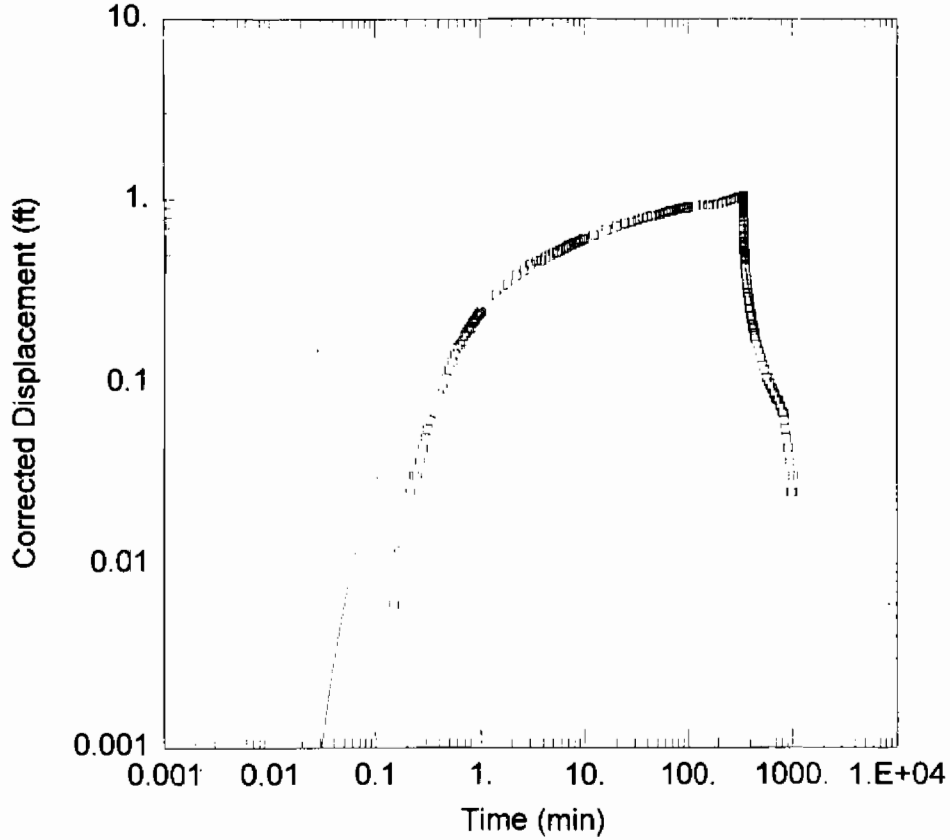
WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
020	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
PZ6	9.65	0



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\PZ6.AQT
Date: 09/28/99 Time: 17:01:05

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis
T = 0.2758 ft^2/min
S = 0.001251

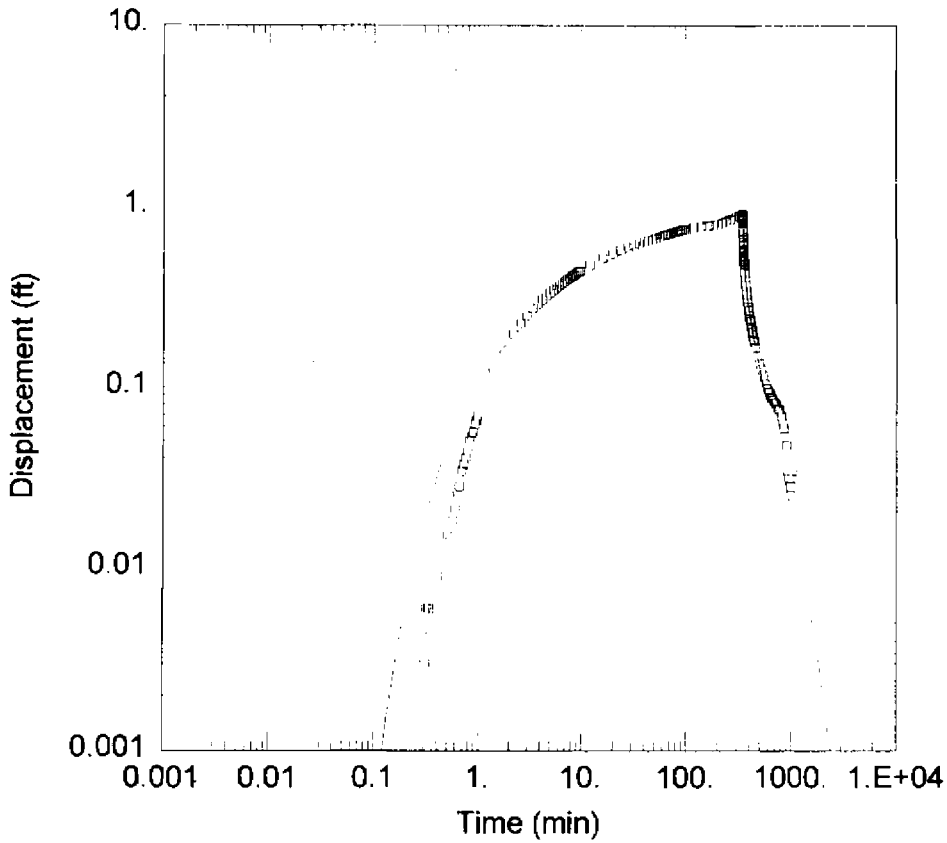
AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
020	0	0	PZ6	9.65	0



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\PZ7.AQT
Date: 09/29/99 Time: 08:40:51

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob
T = 0.2427 ft^2/min
S = 0.0005983
r/B = 0.05306

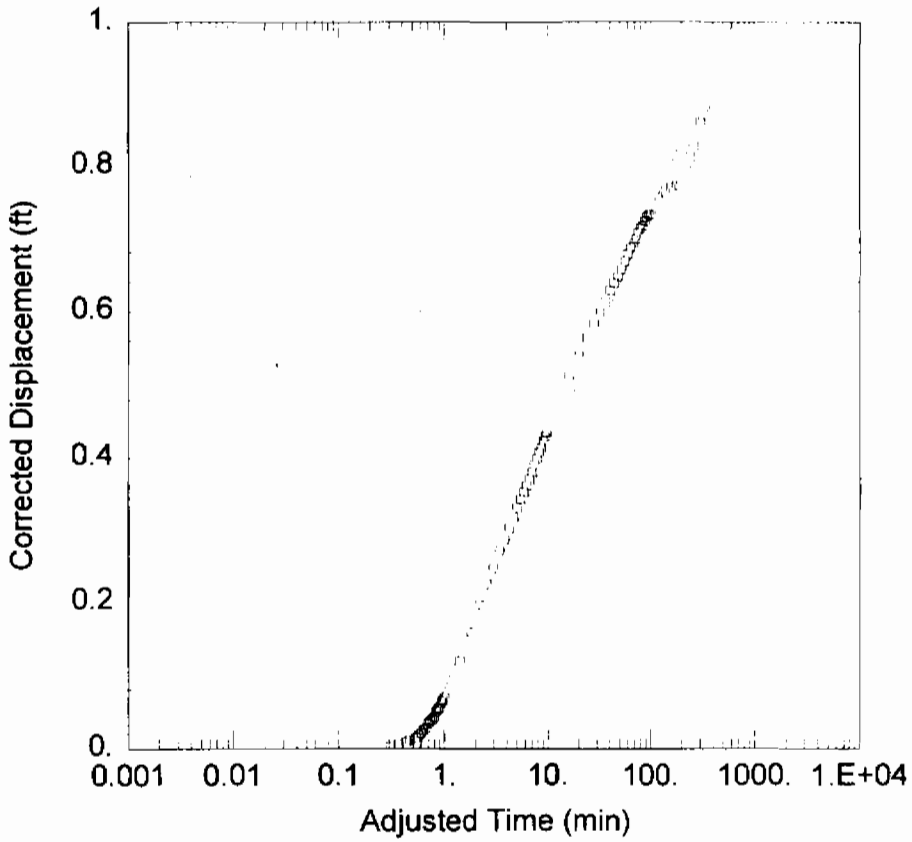
AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
020	0	0	PZ7	28.1	0



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\PZ7.AQT
Date: 09/29/99 Time: 08:52:23

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Unconfined
Solution Method: Cooper-Jacob
T = 0.2757 ft^2/min
S = 0.0004462

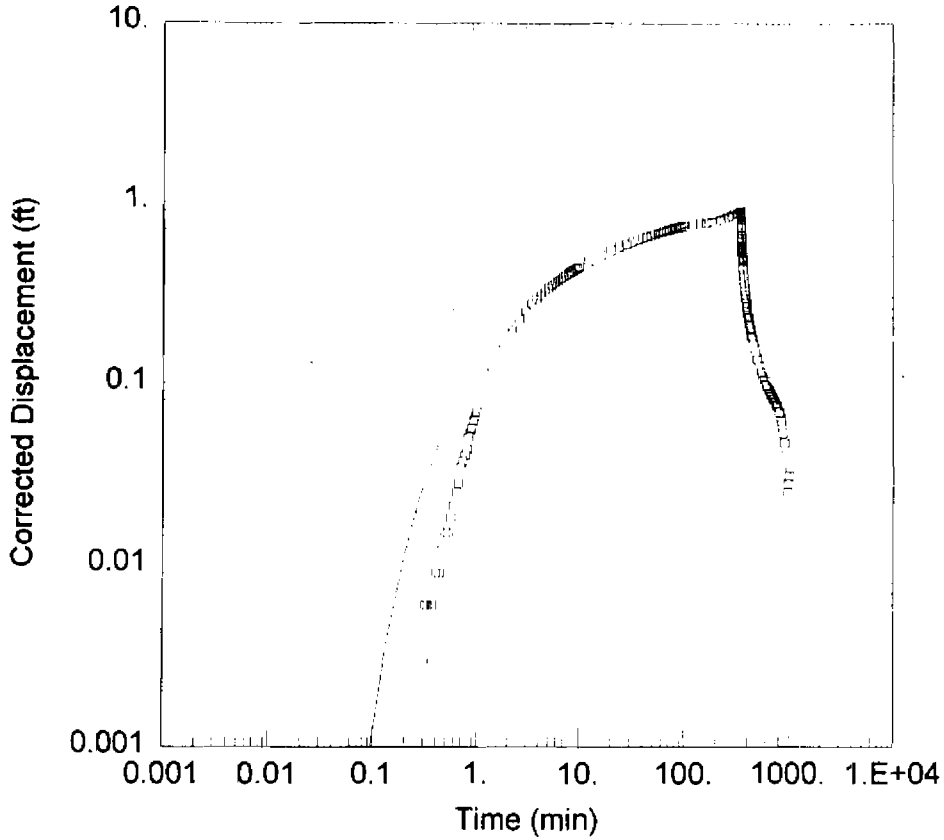
AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
020	0	0	PZ7	28.1	0



CONSTANT RATE PUMPING TEST ON 039020

Data Set: G:\BDOUGLAS\NASCHARL\ZONE_A~1\PZ7.AQT
Date: 09/29/99 Time: 08:42:16

PROJECT INFORMATION

Company: EnSafe Inc.
Client: Navy Clean
Project: 2915-001-14-811-00
Test Location: Zone A SWMU 39
Test Well: 020
Test Date: 9/9/99

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis
T = 0.278 ft^2/min
S = 0.0004647

AQUIFER DATA

Saturated Thickness: 26. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells			Observation Wells		
Well Name	X (ft)	Y (ft)	Well Name	X (ft)	Y (ft)
020	0	0	PZ7	28.1	0

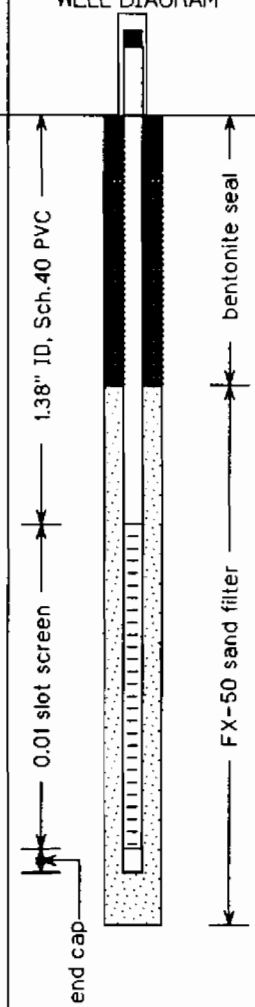
ENSAFE

Monitoring Well NBCA039PZ6

Project: *ZONE A - Charleston Naval Complex*	Coordinates: *E, N*
Location: *Charleston, SC*	Surface Elevation: *feet msl*
Started at *1110 on 9/3/99*	TOC Elevation: *feet msl*
Completed at *1205 on 9/3/99*	Depth to Groundwater: *6.70 feet TOC* Measured: *9/3/99*
Drilling Method: *DPT w/ 3.0" OD casing*	Groundwater Elevation: *feet msl*
Drilling Company: *Alliance Environmental (SC Cert. #1435)*	Total Depth: *11.2 feet*
Geologist: *T. Kafka*	Well Screen: *6.05 to 10.85 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	OVA (ppm)	% RECOVERY	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML	Silt: blk w/ vf/f sand; rootzone	
							SM	Sand: brn to gy-brn; vf/f; sty; loose; tr. cly top 6"; grades to org- brn @ 2.2'.	
			1		100		CL	Clay: org-brn to med brn; FeOx top 0.3'; tr f sd; sty; soft; mst.	
5							SC CL	Clay: bl-grn w/ FeOx; w/ sm f/m sd; firm; inc sd last 0.3'.	
							SP	Sand: gy to bl-gy; vf/f; clean w/ tr cly; wet.	
			2		88		SM	Sand: org; f/m; sty; wet; grades to vf/f w/ sty @ 8.4'; runny.	
10									
			3		25				
15									
20									

WELL DIAGRAM



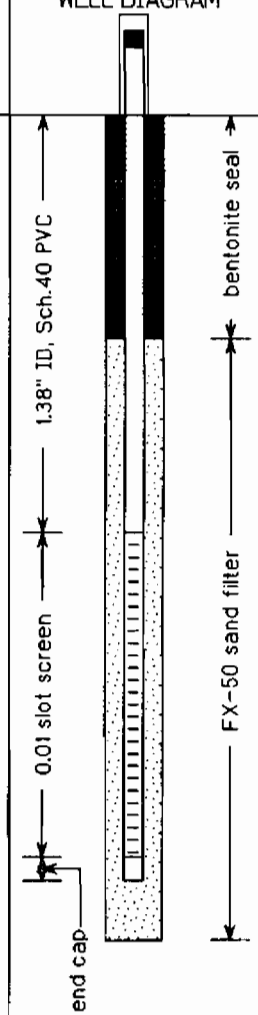
ENSAFE

Monitoring Well NBCA039PZ7

Project: *ZONE A – Charleston Naval Complex*	Coordinates: *E, N*
Location: *Charleston, SC*	Surface Elevation: *feet msl*
Started at *1225 on 9/3/99*	TOC Elevation: *feet msl*
Completed at *1315 on 9/3/99*	Depth to Groundwater: *6.45 feet TOC* Measured: *9/3/99*
Drilling Method: *DPT w/ 3.0" OD casing*	Groundwater Elevation: *feet msl*
Drilling Company: *Alliance Environmental (SC Cert. #1435)*	Total Depth: *11.3 feet*
Geologist: *T. Kafka*	Well Screen: *6.15 to 10.95 feet*

DEPTH IN FEET	LITHOLOGIC SAMPLE	ANALYTICAL SAMPLE	SAMPLE NO.	OVA (ppm)	% RECOVERY	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION	ELEV. (ft-msl)
							ML	Silt: dk brn; tr vf/f sd; roots; friable.	
							SM	Sand: org; vf/f; tr-sm sty; loose; mst.	
							OL CL	Clay: med brn to ol-brn; soft-firm; sty; sticky; mst.	
			1		75		OL CL	Clay: as above.	
5							SC CL	Sand: bl-grn; f/m; sty; cly; firm; mst.	
							SC	Sand: gy to bl-gy; f/m w/ tr crs; occ. FeOx pits; cly; tr-sm sty; inc sd w/ depth.	
			2		95		SP	Sand: org; vf/f; runny.	
10							CL OL	Clay: gy-brn; soft; sty; sticky.	
			3		55				
15									
20									

WELL DIAGRAM



ATTACHMENT H

MONITORED NATURAL ATTENUATION INTERIM REPORT

H.1 MNA GROUNDWATER SAMPLING PROTOCOL

H.1.1 Groundwater Sampling Procedures for Onsite and Offsite Laboratory Analyses

The MNA investigation involved using both onsite and offsite laboratories which required separate sampling techniques for the analytical parameters. It was determined that the onsite laboratory contractor, a joint venture between Target Environmental Services, Inc., (renamed Columbia Environmental Technologies, LLC in 1999) and Microseeps, Inc., would be designated as the first crew to purge and sample the designated wells for the onsite parameters and dissolved gases; and EnSafe personnel would then sample the purged wells within 24 hours for the offsite parameters. The offsite parameters were sampled according to Section 3.2.4.2 of the *Zone A RFI Report (EnSafe, 1997)*. The onsite sampling procedures for hydrogen, fixed gases, and anions and cations adhered to the following steps:

1. Record well number, date, time, diameter, screen length, and total depth.
2. Calibrate water quality meters (done at start of each day).
3. Record the depth to water using a resistive-type water level indicator.
4. Insert a new piece of Teflon tubing into the well until the inlet was directly at the center of the screened interval.
5. Connect the Teflon sampling tube to the silicone tubing around the peristaltic pump head.
6. Cut a one to two foot section of the Teflon tubing to connect the outlet of the peristaltic to the inlet of the flow-through cell and meter.
7. Place the outlet tube from the flow cell into a drum to catch the water.
8. Turn on the pump and adjust the flow rate to 300-600 ml/min. Flow rate was determined by measuring the time required to collect a known volume of water.
9. Monitor the water level within the well during purging with the water level indicator. Flow rates were adjusted to insure that groundwater level did not fall below the top of the well screen.

10. Record groundwater measurements once the flow rate had been established including temperature, pH, oxidation-reduction potential, conductivity, and ground water level for every one to three liters of groundwater purged. Groundwater was be considered stable and ready for sampling when three consecutive measurements of the above listed parameters were within 10% of each other.
11. Prepare appropriate sample containers and labels while purging was being conducted. Prepare three syringes for dissolved gas sampling by purging each syringe three to four times with laboratory grade helium. One syringe was used to inject the initial bubble and the other two were used to collect the dissolved gas samples.
12. Turn off the pump once groundwater had stabilized and disconnect flow through cell and meter.
13. Connect the outlet tube of the pump to the inlet of the dissolved gas sampling bulb (Chapelle-type). Turn on pump and fill bulb with water while making sure that all air was removed from the bulb.
14. Position the sampling bulb at a 45 degree angle with the inlet side higher than the outlet.
15. Inject 30 ml of laboratory grade helium into the bulb.
16. Allow groundwater to flow through the sampling bulb for 30 minutes prior to sampling.
17. Collect the first sample after the appropriate amount of bubbling time, using a gas tight syringe with a stopcock.
18. Purge the helium from the syringe into the atmosphere.
19. Pierce the septum with the needle and extracting 1-2 ml of gas from the bubble.
20. Remove the syringe and expelling the gas into the atmosphere.
21. Reinsert the needle through the septum, and collecting a sample from the bubble.
22. Label the syringe with the sample ID and time of collection.
23. Collect a duplicate sample after five minutes using a second gas tight syringe with a stopcock, using the above procedure.

24. Turn off the pump and detach the sample bulb, then allow the water contained inside to drain into the drum.
25. Turn the pump on and fill the remaining sample containers (anions and cations) through the pump outlet; record the sample ID and the time of collection.
26. Transfer the samples to the mobile laboratory for analysis as quickly as possible to maintain sample integrity, and analyze them quickly to provide accurate results.

H.1.2 Groundwater Sample Preparation, Packaging, and Shipment

Section 3.2.4.3 of the *Zone A RFI Report* (EnSafe, 1998) details preparation, packaging, and shipment of groundwater samples collected at CNC and shipped to an offsite laboratory. This procedure was followed during the MNA investigation. The offsite samples (VOCs, sulfate, nitrate, chloride, and TOC) were shipped priority overnight via FedEx to Southwest Laboratory of Oklahoma in Tulsa for all three sampling rounds. For Round 2 samples, the HPC samples were analyzed by General Engineering Laboratories in Charleston, South Carolina and the BTEX and chlorobenzene degraders were analyzed by Retec in Seattle, Washington. Dissolved gas samples were analyzed onsite in the first two rounds by the mobile laboratory joint venture between Target Environmental, Inc./Microseeps, Inc. Round 3 gas samples were collected by EnSafe personnel using a different gas bubbler than that used in the first two rounds. Gas samples were retained in a refrigerator onsite until all had been collected for a single FedEx shipment to Microseeps, Inc., for analysis.

H.1.3 Groundwater Sample Analyses

The offsite groundwater samples were analyzed per USEPA Method SW-846 at Data Quality Objectives (DQO) Level II as follows:

- VOCs — USEPA Method 8260
- Sulfate — USEPA Method 375.1
- Nitrate — USEPA Method 352.1
- Chloride — USEPA Method 325.1
- TOC — USEPA Method 415.1
- HPC
- BTEX and chlorobenzene degraders

The onsite groundwater samples were analyzed as follows:

• Dissolved Oxygen	Gas chromatography with thermal conductivity detector
• Iron II and III	Ion chromatography with absorbance detector
• Methane	Gas chromatography with flame ionization detector
• Ethane	Gas chromatography with flame ionization detector
• Ethene	Gas chromatography with flame ionization detector
• Alkalinity	HACH alkalinity test kit
• Oxidation-reduction potential	Field probe with direct meter reading
• pH	Field probe with direct meter reading
• Temperature	Field probe with direct meter reading
• Conductivity	Field probe with direct meter reading
• Hydrogen	Equilibrium with gas in the field; Gas Chromatography with reducing gas detector
• Carbon dioxide	Gas chromatography with thermal conductivity detector
• Manganese	Ion chromatography with absorbance detector

H.2 PRELIMINARY MNA RANKING

H.2.1 Comparison Between Sampling Rounds

The MNA data results and preliminary rankings for all three sampling rounds were previously shown in Table 4-4. Table H-1 provides a summary of the round by round rankings at each well location. Note that Round 3 rankings are not complete for many well locations since dissolved gases were not collected sitewide; thus, Round 3 rankings represent a minimum value and cannot be compared directly to those from previous rounds.

Table H-1
Summary of MNA Rankings at SWMU 39 Wells

	Round 1		Round 2		Round 3	
Well ID	**Total Pts**	**NA evidence (1)**	**Total Pts**	**NA evidence**	**Total Pts**	**NA evidence**
Shallow Wells						
039001	9	L	10	L	8*	L
039002	9	L	9	L	11*	L
039003	9	L	9	L	12*	L
039004	9	L	11	L	14	L
039005	24	S	10	L	11*	L
039006	8	L	10	L	13*	L
039007	11	L	11	L	12*	L
039008	10	L	10	L	11*	L
039009	15	A	17	A	13*	L
039010	2	I	9	L	10*	L
039011	17	A	11	L	7*	L
039012	15	A	16	A	20	A
039013	6	L	2	I	8*	L*
039014	9	L	9	L	14*	L
039015	6	L	NS	NS	NS	NS
039016	NS	NS	17	A	14	L
039017	NS	NS	10	L	14	L
039018	NS	NS	11	L	12	L
039019	NS	NS	11	L	9*	L
039020	NS	NS	NS	NS	9	L
039021	NS	NS	NS	NS	15*	A
039022	NS	NS	NS	NS	7*	L
039023	NS	NS	NS	NS	11*	L
038002	NS	NS	6	L	7*	L
042001	NS	NS	3	I	NS	NS
042002	NS	NS	5	I	8*	L
505001	NS	NS	8	L	NS	NS
002004	NS	NS	8	L	11*	L
002006	NS	NS	-1	N	1*	I
Intermediate Wells						
039041	7	L	4	I	10	L
039091	15	A	11	L	13*	L
039101	13	L	14	L	17*	A

Table H-1
Summary of MNA Rankings at SWMU 39 Wells

	Round 1		Round 2		Round 3	
Well ID	**Total Pts**	**NA evidence (1)**	**Total Pts**	**NA evidence**	**Total Pts**	**NA evidence**
03912I	13	L	16	A	17	A
03913I	17	A	14	L	17*	A
03916I	NS	NS	12	L	21	S
03917I	NS	NS	13	L	11	L
03918I	NS	NS	15	A	13	L
03919I	NS	NS	19	S	12*	L
03920I	NS	NS	NS	NS	19	A
03921I	NS	NS	NS	NS	8*	L
Deep Wells						
03801D	NS	NS	11	L	11*	L
03904D	10	L	6	L	12	L
03908D	11	L	7	L	11	L
03909D	8	L	14	L	13*	L
03910D	10	L	7	L	8*	L
03912D	7	L	9	L	15	A
03913D	15	A	12	L	16*	A
03914D	8	L	5	I	8*	L
03915D	8	L	NS	NS	NS	NS
03916D	NS	NS	4	I	14	L
03917D	NS	NS	17	A	14	L
03918D	NS	NS	17	A	13	L
03919D	NS	NS	7	L	13*	L
03920D	NS	NS	NS	NS	16	A
03921D	NS	NS	NS	NS	5	I
03922D	NS	NS	NS	NS	9*	L
03923D	NS	NS	NS	NS	8*	L
04202D	NS	NS	NS	NS	15*	A

Notes:
1 - Ranking results without points awarded for methane concentrations due to natural production from native sediments
N= No evidence
I= Inadequate evidence
L= Limited evidence
A= Adequate evidence
S= Strong evidence
NS= Not Sampled
**= Incomplete ranking results since several gases were not analyzed at these well locations. Therefore, results represent a minimum ranking for Round 3.*

Figures H-1 through H-6 depict the spatial distribution of the rankings for shallow, intermediate, and deep groundwater for Rounds 1 and 2. Round 3 rankings were not presented graphically since the rankings are incomplete. Shallow groundwater predominantly had a limited potential for biodegradation in the first two sampling rounds, though pockets of adequate potential were consistent. The zone of strong potential in Round 1 at 039005 diminished greatly in Round 2 due

to a dramatic decrease in TCE, DCE, and VC. Biodegradation potential in intermediate groundwater became greater in the central part of the site in Round 2, though the southern portion (downgradient) decreased from adequate to limited. Limited potential was predominant in Round 2 deep groundwater as it had been in Round 1, but the zone of adequate potential grew larger and shifted to the east. Two inadequate zones appeared for the first in Round 2 as well.

H.3 MNA DATA EVALUATION AND INTERPRETATION

H.3.1 MNA Process at CNC

As discussed in Section 4.1, the scope of the MNA study throughout CNC has changed frequently due to parallel CMS efforts involving Treatability Studies. This is best exemplified by two memorandums sent to the Project Team (January 29, 1999 and April 14, 1999) in which the status of the evaluation, interpretation, and documentation of the MNA data is dicussed. These memorandums are included at the end of this attachment (after all isopleth figures) for background information.

H.3.1 Scope of MNA Evaluation at SWMU 39

The EPA guidance document entitiled *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater* [EPA/600/R-98/128] (referred to herein as Technical Protocol, 1998) explains in detail the many steps required to demonstrate MNA as a site remedy. In general, MNA investigations are comprised of two main pieces of evidence: qualitative evidence based on empirical data (geochemical and VOC) and quantitative evidence based upon Fate and Transport modeling. Obviously, the qualitative evidence must be present before proceeding with quantification of biodegradation rates and mass balances. As such, the intent of the MNA evaluations at all CNC sites was to collect preliminary geochemical and VOC data to determine qualitatively the potential for biodegradation. A minimum of two sampling events were collected at most CNC sites at a six-month interval in order to establish a geochemical baseline. If the data from these two rounds indicated that biodegradation of VOCs was occurring, then the

investigation would proceed to quantifying biodegradation rates and initiating Fate and Transport modeling, in addition to establishing a monitoring program.

Of the ten CNC sites evaluated, SWMU 39 has shown the greatest potential for MNA based on the geochemical data collected. As such, a third round of data was collected at the site, and an analytical model has been constructed to estimate site-specific biodegradation rates as a preliminary step to more detailed Fate and Transport modeling. This attachment presents and interprets the geochemical data collected from the three sampling rounds. Attachment I discusses the analytical Fate and Transport modeling completed at SWMU 39.

H.3.2 Spatial VOC Distribution

VOC isopleth maps (concentration contours) for PCE, TCE, DCE(tot), VC, and Total BTEX were constructed for shallow, intermediate, and deep groundwater in Rounds 1 and 2. Since BTEX compounds were most prevalent in shallow groundwater, no isopleths were constructed for any other intervals. Although DCE(tot) -- the sum of the cis-1,2-DCE and trans-1,2-DCE isomers– was contoured for ease of presentation, Table 4-4 reveals that the cis-1,2-DCE isomer, which originates solely from biodegradation, comprises nearly all the DCE detected in groundwater.

A confirmation sampling event was conducted on January 18, 1999, to corroborate the results at well cluster 009 from Round 2 and to obtain initial, pre-development VOC samples from the two well clusters, 020 and 021, installed the week prior. These data were not presented graphically due to their limited scope.

An interim MNA sampling event was conducted on February 12-19, 1999, to obtain additional data from all Round 5 and Round 6 monitoring well installation phases (Table 2-2). The well clusters sampled for this effort were 016 through 021; the 009 cluster was added to clarify the discrepancies between the second round MNA sampling and the January 18, 1999 sampling

events. These data were presented graphically in Figure B-19 through B-21 but were not contoured since the full well population was not utilized.

Round 3 was conducted in August 1999 and included the new clusters and wells installed in the seventh monitoring well installation phase (Table 2-2). VOC isopleths were constructed for this event.

Below is a summary of VOC delineation for each MNA sampling event, the confirmation event, and the interim MNA sampling event. Each groundwater interval is discussed separately. It is important to keep in mind the increased resolution available in later sampling events due to the installation of additional wells to address data gaps.

H.3.2.1 Shallow Groundwater

Round 1 (Figures H-7 - H-11)

The Round 1 VOC data indicate that the dissolved chlorinated solvent plume is oriented roughly northwest to southeast across the northern section of the site. The shape of the plume is largely controlled by the high concentrations of TCE and DCE(tot) at shallow wells 005 and 012. PCE was detected at higher concentrations closest to the source area and at one isolated location in the southern portion of the plume. The bulk of the plume is comprised of TCE and DCE(tot) as VC was only encountered in the northern and southern extent similar to PCE. Total BTEX was highest at two separate locations (011 and 001) along the northern boundary. This contamination is the result of a former leaking UST at the Amerada Hess Facility north of the CNC boundary.

Round 2 (Figures H-12 - H-16)

Additional sampling points at the site and the higher concentrations encountered at 039009 revealed two seemingly separate plumes. It is uncertain if this separation is real or merely a function of well location. PCE, DCE(tot), and VC concentrations were highest in the western

plume lobe (009 and 016), whereas, TCE concentrations were greater in the nothern plume lobe (012). Besides the appearance of the western lobe, the other major difference from Round 1 was the disappearance of solvent masses at 005 which resulted in a more circular plume shape in the north centered around 012. Also noteworthy in Round 2 data were the higher concentrations of the degradation products of DCE(tot) and VC. Total BTEX concentrations declined slightly in Round 2, although the BTEX plume morphology was unchanged.

Confirmation Sampling Events

The unusual appearance of high solvent concentrations at 009 warranted confirmation sampling since its sampling history had primarily consisted of only DCE(tot) and VC. The 009 well cluster was sampled on January 18, 1999, in conjunction with pre-development samples taken from newly installed wells at clusters 020 and 021. The VOCs detected in 009, cis-1,2-DCE at 32 μg/L and VC at 8.0 μg/L, were consistent with its sampling history prior to the Round 2 event. No solvents were detected in either of the new shallow wells, 020 and 021.

The 009 well cluster was sampled again with well clusters 016 through 021 on February 19, 1999 (see Figures B-19 for VOC results). Two significant findings were the lack of VOCs detected in 009 and the vertical migration of the solvent mass from 016 during Round 2 to 16I in the February 1999 event. These data clearly indicate that significant solvent masses are transitory along the western property boundary, particularly at the 009 cluster, and that the plume cannot be considered "stable" in that region. This will be discussed in greater detail in conjunction with groundwater flow issues. Trace solvent concentrations were detected in 020 and 021.

Round 3 (Figures H-17 - H-21)

Solvent concentrations were significantly lower and not as pervasive in Round 3 as compared to Rounds 1 and 2. The size and shape of the plume centered around 012 did not change dramatically; however, the contaminants do not appear further downgradient, suggesting in-situ

biodegradation has taken place. The portion of the plume that had been centered around 016 and 009 in Round 2 decreased in concentration and in size in Round 3. Total BTEX concentrations also decreased dramatically with only one well along the Hess property boundary, 011, revealing contamination. This decline is suspected to be the result of an active remediation project on Amerada Hess property that was activated after data collection in Round 2.

H.3.2.2 Intermediate Groundwater

Round 1 (Figures H-22 - H-25)

The VOC plume in intermediate groundwater was found to be centered around two wells, 12I and 13I, during Round 1. PCE was detected only at 13I, whereas, TCE, DCE(tot), and VC were found at 12I and 13I. Benzene was the only BTEX compound detected in intermediate groundwater, but at an estimated concentration of 1.0 μg/L (between the method detection limit and quantitation limit).

Round 2 (Figures H-26 - H-29)

VOC contamination appears more widespread in Round 2 due to the additional sampling points utilized. PCE is still centered around 13I and at a similar concentration as in Round 1. The shapes of the TCE, DCE(tot), and VC plumes were much better defined in Round 2 and shown to have a greater east-west composition. Benzene was again the only BTEX compound detected, but at an estimated value of 1.0 μg/L.

Confirmation sampling events

The January 18, 1999 VOC results revealed trace concentrations of DCE(tot) (1.0 μg/L) at 20I and non-detect at 21I. The TCE and DCE(tot) detections at 09I were similar to those throughout its sampling history.

The February 19, 1999 event revealed the highest total solvent concentrations at 16I; a dramatic increase from its first time sampling results in September 1998 (see Figure B-20). Compared to Round 2 data, TCE decreased while daughter products DCE(tot) and VC increased at 19I. Total solvents declined at 18I and 17I from September 1998. Significant concentrations of PCE through VC appeared for the first time at 20I when compared to its initial pre-development results in January 1999. This data is significant since 20I is the southernmost intermediate well at the site and lies along the western property boundary.

Round 3 (Figures H-30 - H-33)

The plume has a more elongated (southerly) appearance in Round 3 due in part to the disappearance of VOCs at 19I. TCE and DCE(tot) concentrations have declined upgradient at 12I with corresponding increases in DCE (tot) and VC downgradient at 13I and 16I. Well 13I had the most dramatic decrease in PCE, though it appears to have migrated southwesterly toward 16I. While these trends appear encouraging for biodegradation in intermediate groundwater, it is important to realize that some contamination may have merely migrated deeper into the aquifer.

H.3.2.3 Deep Groundwater

Round 1 (Figures H-34 - H-37)

VOCs in deep groundwater were centered around well 13D where PCE through VC were detected. No BTEX compounds were detected in deep groundwater.

Round 2 (Figures H-38 - H-41)

The morphology of the deep groundwater VOC plume was better defined in Round 2 due to additional deep well locations. The PCE plume extended slightly south to 17D while the TCE plume extended northeast toward 18D and south to 17D. The DCE(tot) and VC plumes exhibited the greatest spatial growth reaching the western boundary at 09D and extending northeast to 18D and south to 17D.

Confirmation Sampling Events

The January 18, 1999 confirmation sampling event did not reveal any chlorinated solvent concentrations in the three deep wells sampled (09D, 20D, and 21D) above detection levels. Only toluene was present at an estimated concentration of 1.0 μg/L at 21D.

Chlorinated solvents were detected in four of the seven deep wells sampled in February 1999 (Figure B-21). No solvents were detected in deep groundwater along the western boundary. When compared to the September 1998 event, solvents appeared for the first time at 19D and 16D. Solvent concentrations correlated closely between these two events at 17D, however. TCE concentrations increased slightly in February 1999 at 18D when compared to September 1998.

Round 3 (Figures H-42 - H-45)

PCE and TCE concentrations decreased significantly in Round 3 deep groundwater with the TCE plume changing dramatically in shape. TCE concentrations decreased twofold at 13D and 17D and over two orders of magnitude at 18D. Similarly, DCE(tot) concentrations decreased greatly within the primary plume with 18D showing the greatest decline; however, DCE(tot) was encountered further downgradient at 04202D at surprisingly high concentrations. VC was only detected at low concentrations at two downgradient well locations, 13D and 17D.

The dramatic decrease in mother and daughter products in deep groundwater suggests that significant biodegradation had taken place since Round 2. However, this finding should be cautionary due to the appearance of DCE(tot) further downgradient at 04202D suggesting that a potential migration pathway to the southwest may be the cause for apparent decreases at well locations in the plume.

H.3.3 Daughter Product Analysis

During reductive dechlorination, a chlorinated hydrocarbon is used as an electron acceptor rather than an electron donor as in the biodegradation of fuel hydrocarbons, and a chlorine atom is removed from the hydrocarbon and replaced with a hydrogen atom. Indirect evidence of reductive dechlorination may be provided by analysis of concentrations of the daughter products cis-1,2-DCE, VC, ethene, and ethane. Ethene and ethane are dissolved gases that will be present should VC not be completely oxidized to carbon dioxide, water, and chloride ions.

For Rounds 2 and 3 data, cis-1,2-DCE/1,2-DCE(total) ratios at the majority of wells with detections were 1 or just below 1, indicating that nearly all the 1,2-DCE at the site consists of the cis isomer, the major isomer produced via reductive dechlorination (Figure H-46). Round 1 data were not included since only 1,2-DCE total results were provided by the lab.

Ethene and ethane concentrations from all three rounds are shown in Figures H-47 and H-48, respectively. The 28 wells plotted in this figure were the only SWMU 39 wells with DCE or VC detections in at least one sampling event, and thus, are the most likely locations with potential ethene or ethane production. Twenty-six of the 28 wells had ethene concentrations greater than the 12 ng/L background concentration determined from Round 1 data at an off-base well pair (039015/15D).

Ethene distribution may be seen more clearly in isopleths produced for shallow, intermediate, and deep groundwater using Round 1 and 2 data in Figures H-49 - H-54. Due to limited dissolved gas data collected in Round 3, no isopleths were constructed. In shallow groundwater, ethene production was greatest at 005 in Round 1, coinciding with the high concentrations of solvents found in that well at that time. Ethene was half as great at this well location in Round 2, although there was greater ethene production sitewide, an encouraging sign. Ethene concentrations were significantly greater in Round 2 than Round 1 in intermediate and deep groundwater. The highest

concentrations for each interval were detected at 19I and 17D, reflecting the high concentrations of solvents detected in these wells at that time. These figures indicate that significant degradation is occurring at specific well locations, enough in some cases to reduce VOCs entirely as seen at 005 and 19I.

Ethane concentrations were more difficult to evaluate than ethene due to the high concentration (1,600 ng/L) encountered at the same off-base background well location. This concentration is higher than all, but one well (16I) in SWMU 39 suggests that ethane might be produced naturally at the site as is methane. Due to this ambiguity, no ethane isopleths were constructed.

H.3.4 Geochemical Spatial Distribution

Isopleth maps were constructed for the majority of the geochemical parameters analyzed during Rounds 1 and 2. Round 3 data were not contoured at the time of this report. The following section will focus briefly on the distribution of these parameters with the primary emphasis on redox zonation.

H.3.4.1 Aquifer Redox Processes

Natural attenuation of CAHs via oxidation-reduction (redox) reactions is mediated by microorganisms. The redox potential of groundwater is a measure of the tendency for chemicals in groundwater to transfer their electrons. Microorganisms foster these reactions by utilizing electron transfer to do work.

Many biodegradation processes are carried out in the presence of oxygen, which is the most thermodynamically favorable electron acceptor since it produces the most energy. In an environment without oxygen, microorganisms must seek out new electron acceptors. The next most favorable electron acceptors in decreasing order are nitrate, manganese (IV), iron (III), sulfate, and carbon dioxide. When these chemicals accept electrons from microorganisms, they

become new compounds with different chemistries and reactivities. These new compounds can then be detected in groundwater and attributed to a specific redox process.

Redox zonation is the result of microorganisms using sequentially pairs of redox couples such as O_2/H_2O, NO_3/N_2, Mn(IV)/Mn(II), Fe(III)/Fe(II), SO_4/HS, and CO_2/CH_4 as electron acceptors. The difference between each species in the redox pair is that the first species is oxidized and the second is reduced. The reduction occurs as a result of accepting an electron from a microorganism at the equilibrium redox potential (Eh°), determined under laboratory conditions (25°C and neutral pH), illustrated in the following series of equations:

$$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O \qquad \text{Eh}^\circ = +820 \qquad (1)$$

$$2NO_3 + 12H^+ + 10e^- \rightarrow N_2 + 6H_2O \qquad \text{Eh}^\circ = +740 \qquad (2)$$

$$MnO_2(s) + HCO_3 + 3H^+ + 2e^- \rightarrow MnCO_3(s) + 2H_2O \qquad \text{Eh}^\circ = +520 \qquad (3)$$

$$Fe(OH)_3(s) + 3H^+ + e^- \rightarrow Fe^{2+} + 3H_2O \qquad \text{Eh}^\circ = -50 \qquad (4)$$

$$SO_4^{2-} + 9H^+ + 8e^- \rightarrow HS^- + 4H_2O \qquad \text{Eh}^\circ = -220 \qquad (5)$$

$$CO_2 + 8H^+ + 8e^- \rightarrow CH_4 + 2H_2O \qquad \text{Eh}^\circ = -240 \qquad (6)$$

Microorganisms obtain electrons from organic materials in the aquifer, which can be naturally occurring organic material or anthropogenic material like hydrocarbons. Microorganisms ingest the organic material and utilize it as a carbon source for anabolic processes such as building/repairing cell structures, or catabolic processes by supplying electrons for energy.

Redox reactions involving organic compounds, like reductive dechlorination, only occur under specific redox conditions. Reductive dechlorination is carried out only in an anaerobic, oxygen-deficient environment. Although it can operate under a wide range of redox conditions from +700 millivolts (mV) to -250 mV, its optimal range is approximately -100 mV to -250 mV, which is associated with sulfate and carbon dioxide reduction. Unfortunately, the exact redox state of an aquifer is difficult to measure. Unique redox potentials in groundwater do not exist. Redox reactions typically occur simultaneously among several different redox couples in any given groundwater. The measure of redox potential gives, at best, a broad view of the oxidation-reduction state of an aquifer.

H.3.4.2 ORP – pH Diagrams

Plotting ORP (redox potential) and pH is useful in identifying which samples have the greatest potential for natural attenuation. ORP-pH diagrams are based upon and assist in visualizing acid-base and redox equilibrium relationships between dissolved species. One of the limits associated with ORP-pH diagrams is the potential deviation from equilibrium conditions in groundwater. This is not uncommon and thus must be kept in mind when interpreting ORP-pH plots.

Round 1

Shallow, intermediate, and deep groundwater samples were plotted in Figure H-55. All samples lie within the upper and lower limits of water stability as expected and fall into the ORP-pH region typical of groundwater becoming isolated from the atmosphere (Brownlow, 1979). Plotted on Figure H-55 are the zones of possible and optimal reductive dechlorination based upon ORP and pH values (Technical Document, 1998) for reference.

All but four samples plotted within the range of possible reductive dechlorination with even fewer plotting within the zone of optimal reductive dechlorination. Intermediate samples had the highest percentage plotting within the possible reductive dechlorination field (4 of 5), whereas, deep

samples had the highest percentage in the optimal reductive dechlorination field (3 of 8 samples) primarily due to lower ORPs. As a group, shallow groundwater samples had more outliers with higher ORPs and lower pHs than intermediate or deep groundwater samples. These are likely the result of atmospheric contact with shallow groundwater via gaseous exchange through the unsaturated zone. Low partial pressures of the carbon dioxide in the root zone lead to production of carbonic acid, lowering the groundwater pH. Low alkalinity in groundwater is not enough to buffer the pH.

Round 2

Greater scatter was observed in Round 2 samples with a greater number of wells plotting outside both the possible and optimal zones of reductive dechlorination (Figure H-56). This is not unexpected since many background and downgradient wells were sampled in Round 2 for data gap purposes and thus, are not directly associated with SWMU 39.

The greatest number of outliers belonged to shallow groundwater samples, mainly as a result of a higher percentage of samples with pH values below 6 –. This again may be due to contact with atmospheric or root zone carbon dioxide reservoirs and low to non-detectable alkalinity. Intermediate well samples indicate favorable pH and ORP conditions for reductive dechlorination as seven of nine samples lie within both the possible and optimal zones. Of the twelve deep groundwater samples, six lie within the possible reductive dechlorination zone and four lie within the optimal reductive dechlorination zone. The two outlying well samples had pH values below 6, which may be a function of increased isolation from high carbon dioxide in the root zone and an increase in buffering capacity with depth (i.e., higher alkalinity).

Round 3

Shallow groundwater samples again had the greatest percentage of outliers falling outside the zone of possible reductive dechlorination due to low pHs and elevated ORP values (Figure H-57). Deep groundwater samples had the highest percentage of samples falling within the optimal reductive dechlorination zone. Many samples cluster near the optimal zone boundary.

Overall, reductive dechlorination appears more favorable with depth in the aquifer, deep groundwater being the most favorable. The range of values seen in each depth interval, however, indicates that certain geographic locations are more favorable than others. The spatial relationship of redox zonation will be discussed at greater length in the following section.

H.3.4.3 Redox Zonation

How effective an aquifer environment will be at biodegrading contaminants can be gauged by which redox pair is predominant. In the case of fuel hydrocarbons, an oxygenated environment is always desired. Fuel hydrocarbons are invariably electron donors and favor aerobic conditions. However, CAHs can be electron donors, acceptors, and cometabolites. Highly chlorinated organics such as PCE and TCE can degrade at ORP values indicative of denitrification and Fe(III) reduction, whereas, lightly chlorinated compounds such as 1,2-DCE and VC require either more extremely reducing conditions or oxidizing conditions. Identifying the predominant redox pair will provide an indication as to the biodegradation potential of each portion of the aquifer.

Redox zonation occurs as a result of the depletion of successive electron acceptors by microbial communities as the groundwater moves along a flowpath. The aquifer closest to the contaminant source tends to be the first area depleted with respect to all redox couples. As the groundwater flows through and downgradient of the contaminant source, it becomes less reducing (ORP values increase), thus supporting different microorganisms utilizing different redox couples. The sequence of redox couples is geographically reversed compared to the sequence of favorable

reactions. The shape of redox zones can be effected by groundwater velocity. As groundwater moves faster, the zones will be larger; at slower groundwater velocities, redox zones will occur closer together and may be less distinct.

Three techniques for redox zone delineation were used at SWMU 39: 1) ORP measurement in groundwater samples with a Ag/AgCl electrode, 2) analytical determination of dissolved hydrogen gas concentration in groundwater samples and 3) analytical determination of redox couple concentrations in groundwater, i.e., electron acceptor availability and the presence of metabolic by-products. Each will be discussed separately below.

ORP - DO

Redox measurements using a Ag/AgCl electrode are the simplest means in which to gauge the redox conditions of an aquifer, especially when used in conjunction with DO measurements. Positive ORP values represent more oxidizing environments and thus should coincide with elevated DO concentrations (greater than 1.0 mg/L); similarly, negative ORPs represent more reducing environments and should coincide with little to no DO (<0.5 mg/L). The drawback of this method is that ORP meters are geared for measuring only one of several possible redox couples and requires the assumption that redox in the aquifer is at equilibrium, which is rarely the case. If the ORP electrode is not sensitive to the dominant redox reaction (if there is one) occurring within the aquifer, then redox measurements will be erroneous. The advantage to this method is that data may be collected quickly and provide a gross indication of overall groundwater redox conditions.

In order to meaningfully discuss redox zonation, it is necessary to assume that aquifer redox conditions are in equilibrium. As a result, the spatial zonation of ORP data will be discussed in terms of the equilibrium redox potentials presented in the equations above.

Shallow Groundwater

Round 1

ORP measurements ranged from -150 to 194 mV (Figure H-58) while DO ranged from non-detect (less than 0.15 mg/L) to 1.4 mg/L (Figures H-59). ORP values indicated two oxidizing regions, one centered around well 003 and the other to the southwest between wells 013 and 010. DO concentrations at 010 and 013 correlate well with the elevated ORP, indicating more oxygenated groundwater environments. Despite the non-detect for DO at 003, a high DO area does exist slightly west at 004 indicating nearby oxygenated groundwater, the southern extent of which is not well-defined. More reducing regions occurred along the northern boundary and to the southwest and southeast. DO concentrations tended to be lower in these areas as well with the exception of 006. In general, shallow groundwater appears to vary between oxygenated and suboxygenated zones.

Round 2

ORPs ranged between -189 to 300 mV (Figure H-60) and DO ranged between 0.5 to 6.1 mg/L (Figure H-61). The high ORP located at 010 and 013 in Round 1 merged into a centralized oxidizing region around 002006 (300 mV) in Round 2. This region is coincident with high DO, indicating an oxygenated groundwater environment. Much lower ORP values to the southeast (017) and northwest (019) are coincident with DO concentrations less than 1 mg/L, indicating a suboxygenated to anoxygenated aquifer conditions. Although an ORP above 50 mV was measured at 003 again, DO at this well is significantly higher in Round 2 than in Round 1. However, DO concentrations in this area were not as widely scattered in Round 2 as they had been in Round 1, suggesting that slightly more oxygenated conditions prevail in this portion of the aquifer.

Round 3 (no isopleths produced for this document; see Table 4-4 for data)

DO was lower sitewide in Round 3. The high DO zone seen in previous rounds at wells 013, 018, and 002006 diminished in size and slightly shifted north to 019 where the highest Round 3 DO was

measured, and west to 010. This finding contradicts the high ORPs measured at 013, 002006, and 016 which corroborate with the first two rounds of ORP data. ORPs continued to indicate more strongly reducing conditions in the northern portion of the site near the source area and Amerada Hess property boundary.

Intermediate Groundwater

Round 1

ORP values ranged between -112 and 113 mV (Figure H-62) and were lower along the western boundary and the central portion of the site near 12I. DO concentrations ranged between non-detect (less than 0.15 mg/L) and 1.4 mg/L (Figure H-63). DO did not correlate well with ORP with the exception of the non-detect at the lowest ORP location (12I). Most notably, DO concentrations were nearly equal at 09I and 13I despite their significant disparity in ORP. DO was lowest on the eastern portion of the site, indicating anoxygenated conditions in those locales.

Round 2

ORP ranged between -208 and 70 mV in Round 2 (Figure H-64). The additional well locations sampled in Round 2 indicate that the majority of intermediate groundwater is reducing. The elevated ORP, seen at 13I in Round 1, was reproduced forming an isolated oxidizing anomaly in the center of the site. Given the negative ORPs, DO was unexpectedly high, ranging between 0.65 and 1.2 mg/L (Figure H-65). Elevated DO coincided with the oxidizing region; however, the highest DO concentration was measured at 03917I, which had the lowest ORP value. Nonetheless, intermediate groundwater in the central and southern portions of the site remains suboxygenated since no DO concentrations were high enough to indicate oxygenated regions.

Round 3 (no isopleths produced for this document; see Table 4-4 for data)

Conditions were not as strongly reducing as evidenced by higher ORPs at 17I, 18I, and 19I. Elevated ORP was again encountered in the central portion of the site (13I), although DO was less than 0.5 mg/L at that locale. However, contrary to the ORP results, DO concentrations were significantly lower sitewide with the exception of 18I.

Deep Groundwater

Round 1

ORP ranged between -215 and 75 mV (Figure H-66). More reducing conditions were evident in the northern and western portions of the site, whereas, more oxidizing conditions lie to the south. Low DO concentrations in the north and west correlated well with low ORPs; however, DO remained low to the south and east despite less reducing ORPs (Figure H-67).

Round 2

A wider disparity in ORP was evident in Round 2 ranging from -272 and 98 mV (Figure H-68). Low ORP dominates the majority of the deep wells especially at the center of the site at wells 19D, 12D, and 18D where conditions are likely to be very reducing. As in Round 1, more oxidizing conditions were evident to the south. DO was significantly higher and had a greater range in Round 2 (0.5 to 2.1 mg/L) (Figure H-69). Other than the high DO and ORP coinciding at 16D, DO does not correlate well with ORP throughout the remainder of the site. Suboxygenated conditions reside along the western boundary and in the near vicinity of 16D. Conditions become increasingly anoxygenated throughout the remainder of the site.

Round 3 (no isopleths produced for this document; see Table 4-4 for data)

ORP was more strongly reducing in the southwest portion of the site at 09D, 20D, and 04202D; but much more aerobic and completely opposite of Round 2 data in the southeast at 17D and 18D. Low DO correlated well with the reducing area in the southwest, but elevated DO was not

encountered at 17D as would be expected. The high DO measured at 16D in Round 2 was non-detected in Round 3. DO was still low in the northern portion of the site.

Hydrogen Gas

Although more labor intensive, the use of dissolved hydrogen gas for redox measurements is more reliable under most conditions than use of an ORP electrode. Sample acquisition was discussed in Section H.1. The methodology for using hydrogen gas is discussed at length by Chapelle, et al. (1995).

Hydrogen gas concentrations have been linked to aquifer redox conditions because hydrogen gas is constantly produced during the anaerobic decomposition of organic matter. After hydrogen gas has been produced by fermentative microorganisms, respiratory microorganisms consume it. These respiratory microorganisms, as stated earlier, may use iron (III), sulfate, or carbon dioxide as terminal electron acceptors. The microorganisms that use iron (III) have been found to utilize the free hydrogen gas more efficiently than microorganisms that use sulfate, and even more so than those that use carbon dioxide. This efficiency for using hydrogen gas maintains different equilibrium concentrations in solution and can be linked to a specific redox process in the following manner (Chappelle, et al., 1995):

- hydrogen gas concentration < 0.1 nm/L is indicative of denitrification
- hydrogen gas concentration between 0.2 to 0.8 nm/L is indicative of iron(III) reduction
- hydrogen gas concentration between 1 to 4 nm/L is indicative of sulfate reduction
- hydrogen gas concentration between 5 to 20 nm/L is indicative of methanogenesis

The optimal hydrogen gas concentration range for reductive dechlorination is greater than 1.0 nm/L (Technical Protocol, 1998).

Hydrogen results at each well were plotted by Round for shallow, intermediate, and deep groundwater (Figures H-70 - H-72). It is immediately evident that Round 3 hydrogen results are dramatically higher than those measured in Rounds 1 and 2. In general, all shallow, intermediate, and deep samples had hydrogen concentrations indicating denitrification and iron (III) reduction in Rounds 1 and 2; however, in Round 3, the concentrations correlated with the higher end of the iron (III) reduction range and into the sulfate reduction range (note: an anomalously high value of 27 measured at 18I was determined to be erroneous).

Significant ambiguity results when comparing redox zonation using hydrogen gas concentrations and ORP results for all three rounds (Figures H-73 - 75). Redox zones based on H_2 concentrations extend from the x-axis and are in blue while ORP-based redox zones extend from the y-axis and are in red. Overlapping zones are shaded light blue and indicate agreement between the two methods. A high percentage of Round 1 and 2 data fell within the overlapping iron (III) reduction zone, indicating significant agreement between methods. However, no Round 3 samples fell within any overlapping zones, indicating no agreement between methods and suggesting one may be erroneous. Since ORP data was collected with the same field meter in each sampling round, the H_2 results were evaluated more closely for potential error.

It is possible that the high concentrations in Round 3 are the result of significant reductive dechlorination between Rounds 2 and 3. The sizable decrease in Round 3 VOCs would corroborate these results. However, it is not understood why such a dramatic change in redox conditions occurred in this time period. Given the extent to which MNA must be demonstrated, for it to be chosen as a proven site remedy, the possibility of potentially erroneous data may not be overlooked.

Some suggestions were provided by the laboratory that conducted the dissolved gas analyses for all three rounds (Microseeps, Inc). One possibility is the inadvertant dilution of hydrogen in the first two rounds. If this were the case, all dissolved gases would be diluted since they were collected from a single sample vial. One way to determine this possibility is to compare the ratio of $N_{2(gas)}/O_2$ to hydrogen results as a QA/QC check on the accuracy of the GC data. Plots of this ratio against ORP were constructed for Rounds 1 and 2 data (Figures H-76 and H-77). Round 3 ratios could not be calculated since N_2 data was not analyzed and O_2 data was gathered using direct field meters. Samples with a ratio less than 5 plot below the N_2/O_2 warning boundary, suggesting potential errors in the dissolved gas analyses, especially if their corresponding ORP and DO data indicate the samples represent anaerobic conditions. It would be expected that anaerobic samples would have low DO concentrations and elevated N_2 due to nitrogen enrichment from denitrification. As such, anaerobic samples lying below the N_2/O_2 boundary may have been contaminated with ambient air at some point in the sampling process, and thus, would have faulty hydrogen results. Samples with higher ORPs that plot below the boundary may be considered accurate. A higher percentage of Round 1 samples plotted below this limit than Round 2. Shallow wells, as a group, plotted more frequently below the boundary as well despite the greater number of aerobic shallow groundwater outliers. Therefore, it appears that dissolved gas concentrations in the first two rounds may have been compromised by ambient air contamination.

There are three possible explanations for these erroneous hydrogen/dissolved gas results. One is inherent in the method of using hydrogen results to predict redox zones. Errors may occur in the case of small-scale redox zonation when large variations in redox conditions occur over short distances within the aquifer. For example, Fe(III) reduction may dominate a portion of aquifer immediately adjacent to another portion of aquifer in which methanogenesis dominates. If equal amounts of groundwater are drawn from each zone and mixed during purging, the resultant hydrogen gas concentration will be an average of the two zones, or sulfate reduction (Chapelle, et. al., 1996).

Another is based upon sampling methods. While it may be coincidental, it is important to recognize the differences in dissolved gas sampling between the first two rounds and Round 3. Round 1 and 2 dissolved gas samples were collected by the mobile lab subcontractor (Target Environmental Services/Microseeps) using the "Chapelle-type" gas bubbler aparatus and analyzed by an onsite GC. However, Round 3 samples were collected by EnSafe personnel using equipment provided by Microseeps, which included a new type of dissolved gas bubble sampler. It had been determined by hydrogen gas-sampling experts that the Chapelle-type bubbler was commonly susceptible to positive pressure problems (Bob Pirkle, Microseeps Inc., personal communication). The new bubbler is less susceptible to this problem. As a result, some dissolved gas samples during the first two rounds may have been diluted by ambient air. Therefore, Round 3 results would be more typical of hydrogen concentrations in the aquifer. Another sampling round using the new bubbler would be necessary to definitively conclude if this had been the case.

Temporal variability may be another possible explanation for dissolved gas concentration disparities. Permeable aquifers, such as that at SWMU 39, are often influenced by high precipitation events in which electron acceptors are flushed into the aquifer system and depress the redox conditions. In this case, an aquifer would become less reducing. This theory would state that Rounds 1 and 2 followed periods of high aquifer recharge and Round 3 followed a period of limited recharge, or more static conditions.

Precipitation data was gathered from the Charleston International Airport weather station, approximately 12 miles from the site, to verify this possibility. This data was presented previously in Table 3.9 of *the Monitored Natural Attenuation Interim Report (EnSafe, 1999)*. Prior to the first sampling round (February 12-20, 1998), 7.7 inches of rain were recorded over a three week period from January 19th to February 9th. Prior to the second sampling round (October 6-9, 1998), 10.5 inches of rain were recorded two weeks earlier from September 21-27th. However, only 3.2

inches of rain was recorded during the month of July 1999, preceding Round 3 sampling (August 4-10, 1999). (This data was obtained from the NOAA website (www.ncdc.com) and is presented in this attachment after Figure H-138). Furthermore, no precipitation was recorded during the 11 days prior to sampling (July 24th - August 8th) with the most recent recorded precipitation being 0.26 inches on the 23rd. Aquifer recharge was investigated extensively during the Zone K and Zone E RFIs and was determined to usually occur rapidly in similar permeable deposits, depending upon land cover (Zone K RFI Report, EnSafe, 1998; Zone E RFI Report, EnSafe, 1997). Therefore, it is plausible that the precipitation peaks prior to the first two rounds had fully recharged the aquifer prior to sampling, resulting in the measurement of a temporal redox state.

As a result of these potential errors, spatial redox zonation at the site will not be discussed. Isopleths of hydrogen gas concentrations had been constructed for Rounds 1 and 2 for each groundwater interval and are presented merely for future evaluation (Figures H-78 through H-83). Round 3 isopleths were not constructed.

Redox Couples

In order to sustain metabolic processes, microorganisms progress through a series of redox couples as outlined in the beginning of Section H.3.4.1. The second species in each redox couple is formed by accepting an electron from a microorganism, thus being reduced. This reduced species is also known as a metabolic by-product. Because microorganisms progress through a series of redox couples sequentially, it may be possible to assess the redox state and the biodegradation potential of a region of aquifer by tracing metabolic by-products and/or oxidized parents. The presence of oxidized parents such as nitrate, sulfate, manganese(IV), etc., and the absence of metabolic by-products such as nitrogen gas, hydrogen sulfide, or manganese(II) indicate microbial communities have not depleted previous redox pairs further up the sequence. The presence of oxidized parents and metabolic by-products in the groundwater simultaneously indicate active

reduction by microbial communities. If only metabolic by-products are present, microbial communities have already utilized all of the oxidized parent and moved further down the sequence of redox couples. This process is spatially variable giving rise to redox zonation in an aquifer.

Denitrification (NO_3 -> N_2 (gas)

After all the DO is utilized by microbes, nitrate becomes the next electron acceptor to be utilized via denitrification in which nitrate is ultimately reduced to nitrogen gas. Nitrate concentrations greater than 1.0 mg/L (or 0.23 mg/L nitrate-nitrogen) inhibit reductive dechlorination.

Nitrate isopleths were constructed for Round 1 and 2 data, but not for Round 3. Round 3 data will be discussed only as it pertains to trends evident from the first two rounds. Nitrogen gas results were obtained in Rounds 1 and 2, but no isopleths were constructed for this report.

Shallow Groundwater (Figures H-84 and H-85)

Nitrate was encountered within a small region in the center of the site in Rounds 1 and 2. Better definition of this region and higher concentrations were seen in Round 2. Round 3 nitrate was detected at two of the three well locations with detections in Round 2 (039013 and 039018). Denitrification cannot be sustained elsewhere at the site due to no available nitrate.

Intermediate Groundwater (Figures H-86 and H-87)

Nitrate was detected at location 04I in Round 1 and at location 17I in Round 2. Nitrate was more than three times as great in Round 3 at 17I, which remains the only intermediate location where denitrification may be sustained.

Deep Groundwater (Figures H-88 and H-89)

Nitrate was found in the north portion of the site in Round 1 (04D) and Round 2 (03801D) and in the southeast in Round 2 (17D). Nitrate was not seen at 17D in Round 3 but was detected further east at 21D (6.1 mg/L) and beyond the western property boundary at 22D. As such, denitrification in deep groundwater may be possible at these two isolated locations across the site.

Manganese (IV) Reduction (Mn IV -> Mn II)

Manganese (II), the by-product of manganese (IV) reduction, was analyzed in only second round groundwater samples.

Shallow Groundwater (Figure H-91)

Manganese (II) production was isolated to five locations in the northern portion of the site and two to the west and south. These locales coincide with those with no additional denitrification potential, further indicating that redox processes have become more reducing

Intermediate Groundwater (Figure H-92)

Manganese (II) production has occurred at two separate locales at the site: one is a east-west trending zone through the northern portion of the site while the other is at a single downgradient location (16I) to the south. These two zones are separated by a zone with no manganese (II) production.

Deep Groundwater (Figure H-93)

Manganese (II) production was confined to the southeast at 17D and 08D. The presence of nitrate at 17D suggests that redox processes are transitioning between denitrification and manganese (IV) reduction at that location.

Iron (III) Reduction (Fe III -> Fe II)

Iron (II), or ferrous iron, is the by-product of iron (III) (ferric iron) reduction by microorganisms during anaerobic biodegradation. If microorganisms are utilizing iron (III) as an electron acceptor, the concentration of iron (II) will increase in the surrounding groundwater. Microorganism will typically use iron (III) as an electron acceptor only after they have consumed all available DO and nitrate.

Ferrous iron isopleths were constructed for Round 1 and 2 data but not for Round 3. Dissolved iron (III), or ferric iron, was analyzed in only the second round of groundwater samples. The presence of any iron (III) indicates that iron (II) reduction may take place if all other redox conditions (i.e., available nutrients and substrates) are still met. No ferric iron isopleths were produced for this report and, as a result, will not be discussed.

Shallow Groundwater (Figures H-94A and H-94B)

Significant iron (II) production is evident during both rounds particularly to the north-northwest and south-southeast. A southwest-northeast trending zone of no iron (II) production was evident in both rounds. This zone coincides with the nitrate-rich zone seen previously, further indicating that denitrification is the dominant redox process still operating in this portion of the site. The ferrous iron-free zone was larger in Round 3 such that the only significant iron (II) production occurred in three distinct areas: at 039010 and the wells to the north (005, 014, 002, and 011); at 013 (first time in all three rounds) and the wells to the east (007, 021, 018, and 006); and at 023 to the west.

Intermediate Groundwater (Figures H-95 and H-96)

In Rounds 1 and 2, iron (II) production was less significant in intermediate groundwater than in shallow groundwater. A very clear pattern is evident, however, in that production occurred in the northwest and southeast of the site with little to no production trending southwest-northeast across

the center of the site. No iron (II) was encountered in any Round 3 intermediate samples, suggesting that this redox process has ceased at the site.

Deep Groundwater (Figures H-97 and H-98)

Iron (II) production was limited to two isolated locations in Round 1 but was better defined in Round 2 due to the increased well population. Round 2 indicated that iron (II) was prevalent at the downgradient locations in the south, east, and west. Round 3 iron (II) production was limited to two downgradient, but isolated locations, 08D in the south and 18D in the east. The presence of iron (II) downgradient at 08D indicates that enough bioavailable ferric iron should be present to sustain reductive dechlorination should solvents ever migrate to that location.

Sulfate Reduction (SO_4 -> S^-)

Anaerobic microorganisms may begin to use sulfate as an electron acceptor after the DO, nitrate, and iron (III) supplies have been exhausted. Sulfate is reduced to sulfide during the reduction process, although excessive concentrations of sulfate (>20 mg/L) may cause competitive exclusion of dechlorination, thus preventing any potential for biodegradation of chlorinated compounds.

Sulfate isopleths were produced for Rounds 1 and 2 data but not for Round 3. Sulfide analyses were collected in Rounds 2 and 3 but were not contoured for this report due to limited detections.

Shallow Groundwater (Figures H-99 and H-100)

Sulfate concentrations varied between 0.6 and 5,710 mg/L in Round 1, such that most of the site except the extreme NW had excessive sulfate concentrations that deter reductive dechlorination. Round 2 concentrations were significantly lower (range 0.9 - 2,600 mg/L) such that the lower sulfate zone is evident in a similar southwest-northeast trend across the center of the site, as has been evident with other redox couples. However, several locales were still predominantly greater

than 20 mg/L. No sulfide was detected in Round 2 indicating that despite the lower sulfate concentrations, sulfate reduction had yet to commence at the site. Round 3 sulfate concentrations were orders of magnitude lower (range from non-detect (ND) - 92) with high concentrations predominantly confined to the south-southwest and along a southwest-northeast trend from 002006 to 018. Sulfide was detected for the first time in shallow groundwater at four locations (017, 021, 023, and 002004), indicating that sulfate reduction has been initiated at isolated locations at the site.

Intermediate Groundwater (Figures H-101 and H-102)

An area in the northern portion of the site that had shown excessive sulfate in Round 1 was not apparent in Round 2, reflecting the much lower sulfate concentrations detected overall in Round 2. Only isolated locations to the north (04I) and southeast (17I) had concentrations greater than 20 mg/L in Round 2 to suggest possible reductive dechlorination inhibition at these locales. No sulfide was detected in Round 2 indicating that sulfate reduction had yet to commence at the site. Although Round 3 sulfate concentrations were elevated above 20 mg/L in the southwest, southeast, and extreme north, the remainder of the site had concentrations below 20 mg/L. Sulfide was detected at three Round 3 locations (13I, 17I, and 21I), which generally lie at downgradient plume locations, indicating the initiation of sulfate reduction in intermediate groundwater.

Deep Groundwater (Figures H-103 and H-104)

Sulfate concentrations were orders of magnitude lower in Round 2 than Round 1. Concentrations were lower than 20 mg/L along a southwest-northeast trend across the center of the site, indicating the potential for sulfate reduction. However, no sulfide was detected in Round 2, indicating that sulfate reduction had not yet commenced. Round 3 sulfate concentrations were higher in Round 3 than Round 2, but the southwest-northeast trend of low concentrations was still present. Sulfide was detected at 13D and 21D in Round 3, indicating that sulfate reduction had begun at isolated locations.

Methanogenesis (CO_2 -> CH_4)

Carbon dioxide may be used as an electron acceptor once all of the DO, nitrate, iron (III), and sulfate have been used by microorganisms. During this electron transfer, carbon dioxide is reduced to methane gas via methanogenesis. If carbon dioxide is being utilized as an electron acceptor at the site, increases in methane concentrations would indicate sustained biodegradation of chlorinated solvents.

Methane concentrations at the site are greatly influenced by natural methane production due to the prevalence of organic matter in many of the sediments (especially Qm and Qdm). Natural methane production interferes with the methane produced via reductive dechlorination, making it impossible to determine what proportion might be attributed to VOC degradation. While decreases in carbon dioxide concentrations may be used to assist in determining if methanogenesis is operating at the site, no other redox data suggests that the aquifer has approached this highly reductive state. As such, methane and carbon dioxide isopleths were constructed for Rounds 1 and 2 (Figures H-105 - H-116), but will not be discussed. No isopleths were constructed from Round 3 data.

H.3.4.4 Non-Redox Parameters

pH (Figures H-117 - H-122) – No Round 3 Isopleths Constructed

Most microorganisms are very sensitive to the pH of the groundwater and tend to thrive under very specific pH ranges. The optimal pH range for reductive dechlorination is generally between 6 and 8 standard units.

Shallow groundwater pH sitewide has generally ranged between 6-7; however, a small region of more acidic pHs has been consistently centered around wells 013 and 002006. This region was slightly larger in Round 3 as it included 016. Intermediate pHs have tended to be closer to 7 in the north and declined to below 6 to the south. This decline was less significant in Round 3. Deep groundwater has shown the development of an elevated pH zone (pH > 8) centered around

12D and 19D in Round 2 that was evident also in Round 3. In general, deep groundwater pHs decline from the northwest to southeast across the site.

Alkalinity (Figures H-123 - H-128) – No Round 3 Isopleths Constructed

Alkalinity concentrations increase in aquifer regions sustaining large microbial populations. Acids formed during aerobic and anaerobic reactions dissolve the surrounding aquifer materials. The dissolved aquifer materials tend to increase groundwater alkalinity and thus buffer the pH. This buffering is important in sustaining a groundwater pH that supports resident microbial populations.

Shallow groundwater alkalinity was consistently low in the center of the site in Rounds 1 and 2 before increasing significantly to the southeast. Round 3 alkalinity was dramatically higher sitewide, having increased roughly 2-10 times at each location. Despite this increase, alkalinities were still depressed in the center of the site at wells 017, 002006, and 013.

Alkalinity in intermediate groundwater showed no definitive trends in the first two rounds but dramatically increased in Round 3, ranging between 48 and 786 mg/L. Alkalinities were greatest at the westernmost well (20I) and easternmost well (21I) and was lowest to the south (17I).

In the first two rounds deep groundwater alkalinities decreased to the south and east at SWMU 39. As it had in shallow and intermediate groundwater, alkalinities increased dramatically in Round 3, but continued to show a decline to the south at 08D; however, like intermediate groundwater, the greatest values lie to the east at 21D and west at 20D, 09D, and 04202D.

The increase in alkalinity seen between Rounds 2 and 3 indicates a dramatic increase in microbial activity in that timeframe.

Total Organic Carbon (Figures H-129 - H-133) – No Round 3 Isopleths Constructed

Total organic carbon (TOC) is the total concentration of organic materials, both natural and anthropogenic, in groundwater. Because microorganisms use organic carbon for energy and as a substrate, a high TOC concentration in an aquifer encourages the growth of microbial communities and thus maintains the aquifer's capacity to degrade other organic chemical compounds.

First and second round shallow TOCs followed a northwest-southeast trend with the greatest values in the northwest corner of the site (011), the lowest in the center of the site (002006 and 013) , and then elevated values further southeast (007, 008, and 017). Round 3 values followed a similar trend, although concentrations were higher throughout the site.

Intermediate TOC values in the first two rounds ranged from non-detect (< 2.0 mg/L) to 4.7 mg/L and were generally higher across the center of the site, declining to the north and the south. Round 3 values were significantly higher, ranging between 2.1 to 56 mg/L and showed a different trend with the lowest values lying to the north above 19I and 18I.

Deep TOC values have varied greatly through all three rounds. No wells had detectable TOC in Round 1. Round 2 TOCs ranged between non-detect and 7.3 mg/L; were greatest to the west at 09D, and declined to the north and to the south where none was detected at 16D, 17D, and 08D. Conversely, TOC was found in every Round 3 well location, ranging between 1.1 and 56 mg/L, and decreasing from south to north across the site.

Heterotrophic Plate Counts (Figures H-134 - H-136)

Heterotrophic plate counts (HPCs) were used to gauge the size of microbial populations in groundwater. Larger populations of microorganisms may result in greater the potential to biodegrade VOCs. This analysis was only collected at selected Round 2 well locations.

HPCs in shallow groundwater were greatest to the north and east, with the greatest number counted at 018. Intermediate results were similar with the highest populations encountered at 18I and 17I. However, low populations encountered at 12I, 13I, and 19I were discouraging given the high concentrations of VOCs measured at these locations. Deep HPCs were also greatest to the east at 17D and 18D, which is encouraging given the high concentrations of VOCs that existed at those wells at that time. Similarly, high VOC concentrations measured at 13D presumably would persist given the low microbial population encountered.

BTEX Degraders (Figures H-137 - H-139)

Some microbial populations preferentially utilize BTEX compounds for energy requirements. These populations were quantified in selected Round 2 well samples as a means to gauge the availability of microbial populations to degrade the BTEX plume in the northern portion of the site.

Of the shallow wells sampled, BTEX degrader populations were greatest just south of Buildings 1604 and 1605 at wells 012 and 19. Intermediate and deep populations were also greatest at 19I and 19D, respectively. Populations apparently increased with depth in the aquifer.

H.3.4 Summary

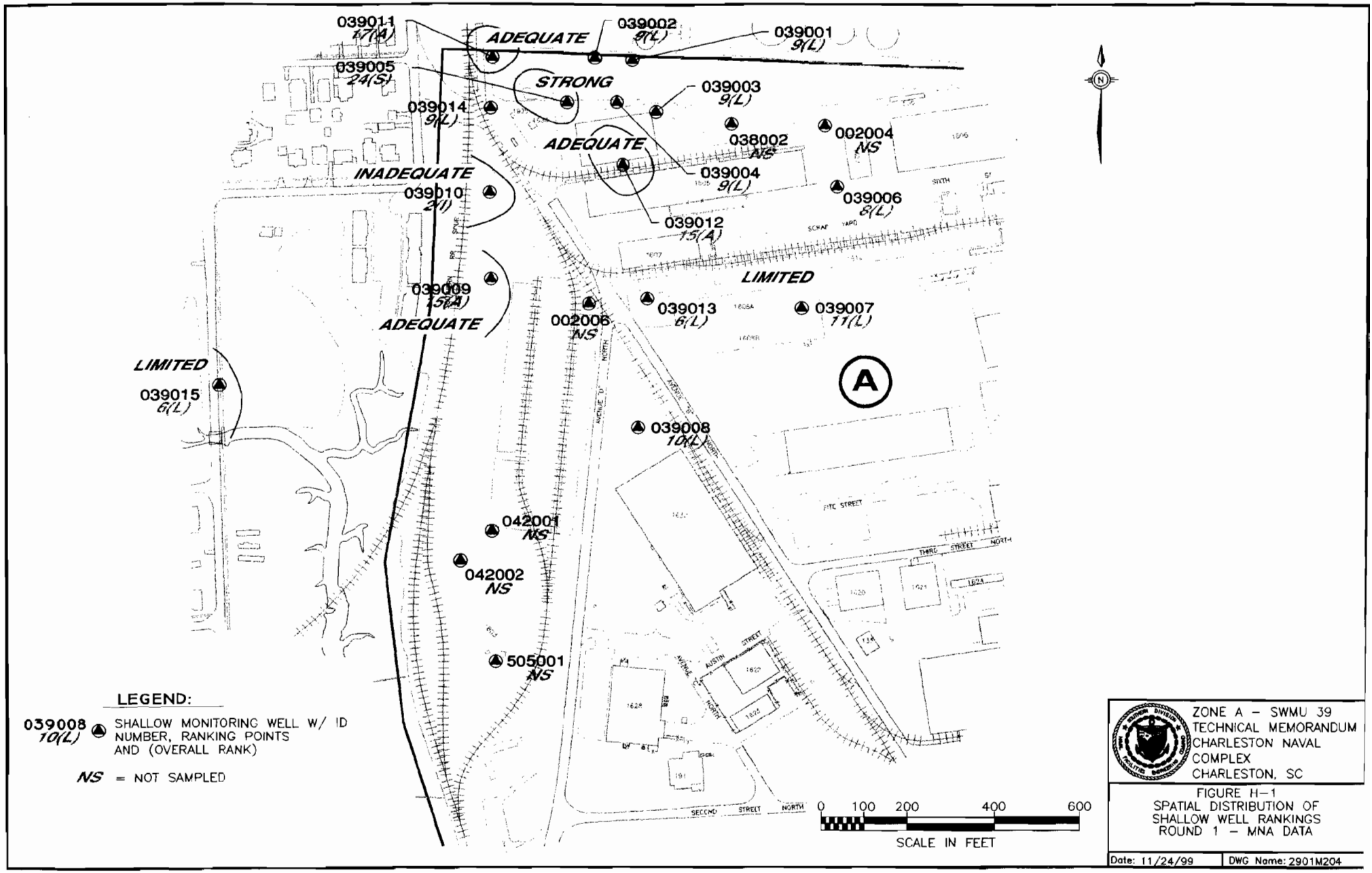
A significant decrease in VOC distribution was seen between Rounds 2 and 3, which correlated with an apparent dramatic change in aquifer redox conditions as well. Although H_2 concentrations in Rounds 1 and 2 may have been compromised by dilution and recent temporal aquifer recharge, the higher Round 3 concentrations suggest that much of the aquifer is advancing through iron (III) reduction to sulfate reduction. Sporadic detections of sulfide were encountered in shallow, intermediate, and deep groundwater for the first time in Round 3, perhaps confirming these findings. Unfortunately, locations with sulfide detections are not the same as those with the high H_2 concentrations that fall within the sulfate reduction range. In fact, only three locations with

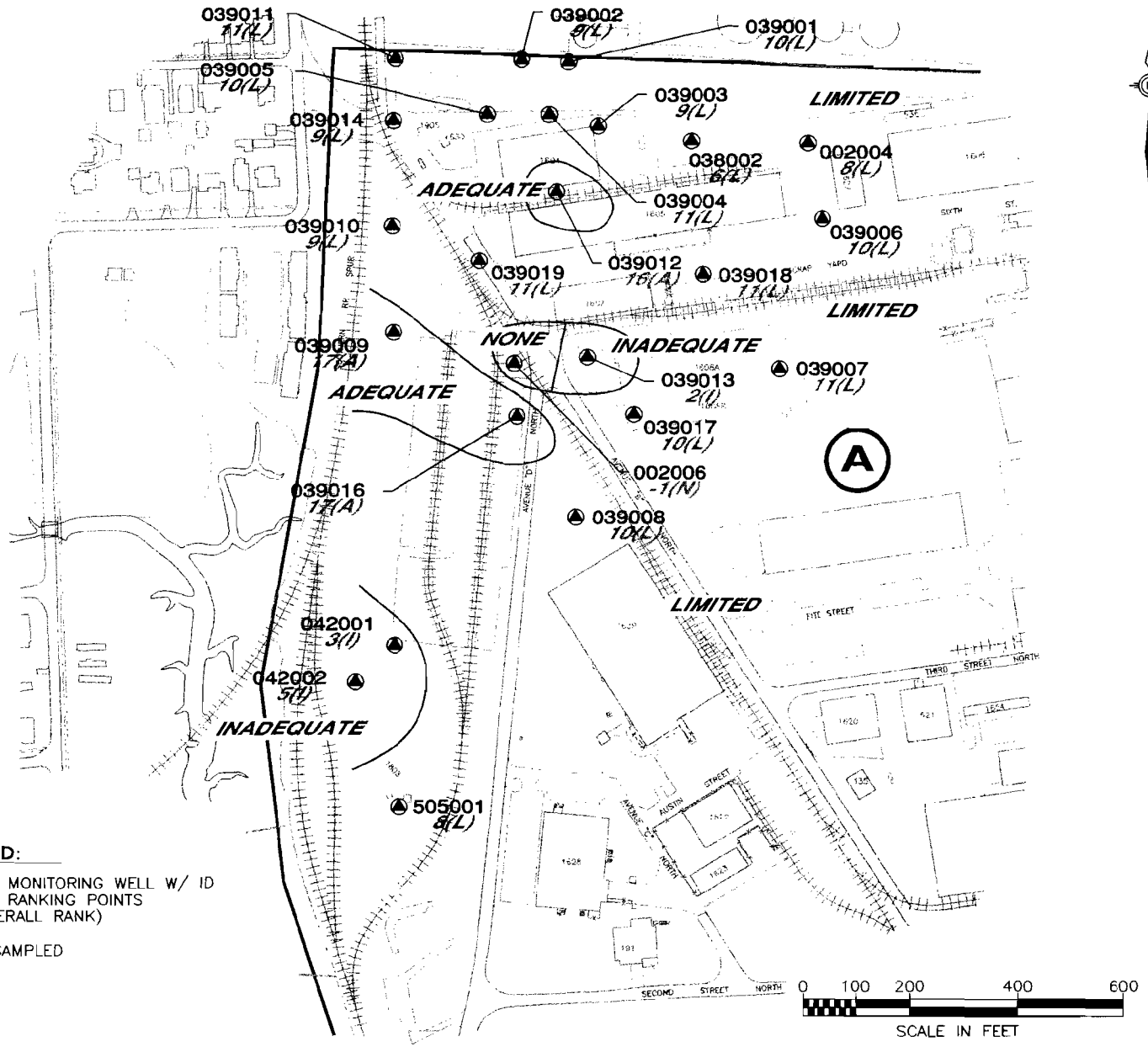
sulfide detections (017, 17I, and 21D) had H_2 analyses performed in Round 3, and each H_2 concentration fell within the iron (III) reduction range.

It is unusual that the more reduced metabolic by-products such as iron (II) and sulfide appear along the edges of the plume, primarily to the southeast and south. This is the reverse of what would be expected, since more oxidizing conditions should be encountered away from the source area/plume center. These findings are encouraging at least, in indicating that the plume is being dechlorinated at its edges, but it is unknown how long those conditions might prevail.

Discrepancies such as these are not be uncommon when considering a dynamic aquifer system. Redox conditions might be the average of the several methods use to fingerprint (H_2 concentrations, ORP-DO measurements, and redox couples) as no single piece of evidence is without contradiction. Overall, it is noteworthy to see that there has been significant ferrous iron produced at specific locations at the site, and that sulfide production has begun, even though not exactly where expected.

Trends in geochemical data coincide with the location of the clay/sand boundary discussed in Section 3. DO and ORP data show more oxygenated conditions close to the boundary, as would be expected if a multi-layered clay/sand aquifer rapidly coalesced into one large unconfined sand body. Nitrate concentrations are highest in this area whereas iron (II) concentrations are low to non-detect, indicating that this zone at the site is more aerobic and less susceptible to reductive dechlorination. Alkalinity and pH values are lower closer to the boundary, indicating a lower buffering capacity in this zone as well. The lack of clay downgradient of the clay/sand boundary also limits the amount of available carbon, which is evident in the low to non-detect TOC concentrations in this region. The presence of CAH daughter products such as cis-1,2-DCE and VC in this area are probably the result of contaminant migration from more reducing areas upgradient. These compounds may oxidize in-situ, but since the more chlorinated compounds PCE and TCE also co-exist there, reductive dechlorination is not likely given the geochemical conditions within this locale.


039011
17(A)
ADEQUATE
039002
9(L)
039001
9(L)
039005
24(S)
STRONG
039003
9(L)
039014
9(L)
ADEQUATE
038002
NS
002004
NS
INADEQUATE
039004
9(L)
039010
2(I)
039006
8(L)
039012
15(A)
LIMITED
039009
15(A)
ADEQUATE
002006
NS
039013
6(L)
039007
11(L)
LIMITED
039015
6(L)
A
039008
10(L)
042001
NS
042002
NS
505001
NS
LEGEND:
039008
10(L)
SHALLOW MONITORING WELL W/ ID NUMBER, RANKING POINTS AND (OVERALL RANK)
NS = NOT SAMPLED
0 100 200 400 600
SCALE IN FEET
ZONE A – SWMU 39
TECHNICAL MEMORANDUM
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H–1
SPATIAL DISTRIBUTION OF SHALLOW WELL RANKINGS
ROUND 1 – MNA DATA
Date: 11/24/99
DWG Name: 2901M204



LEGEND:

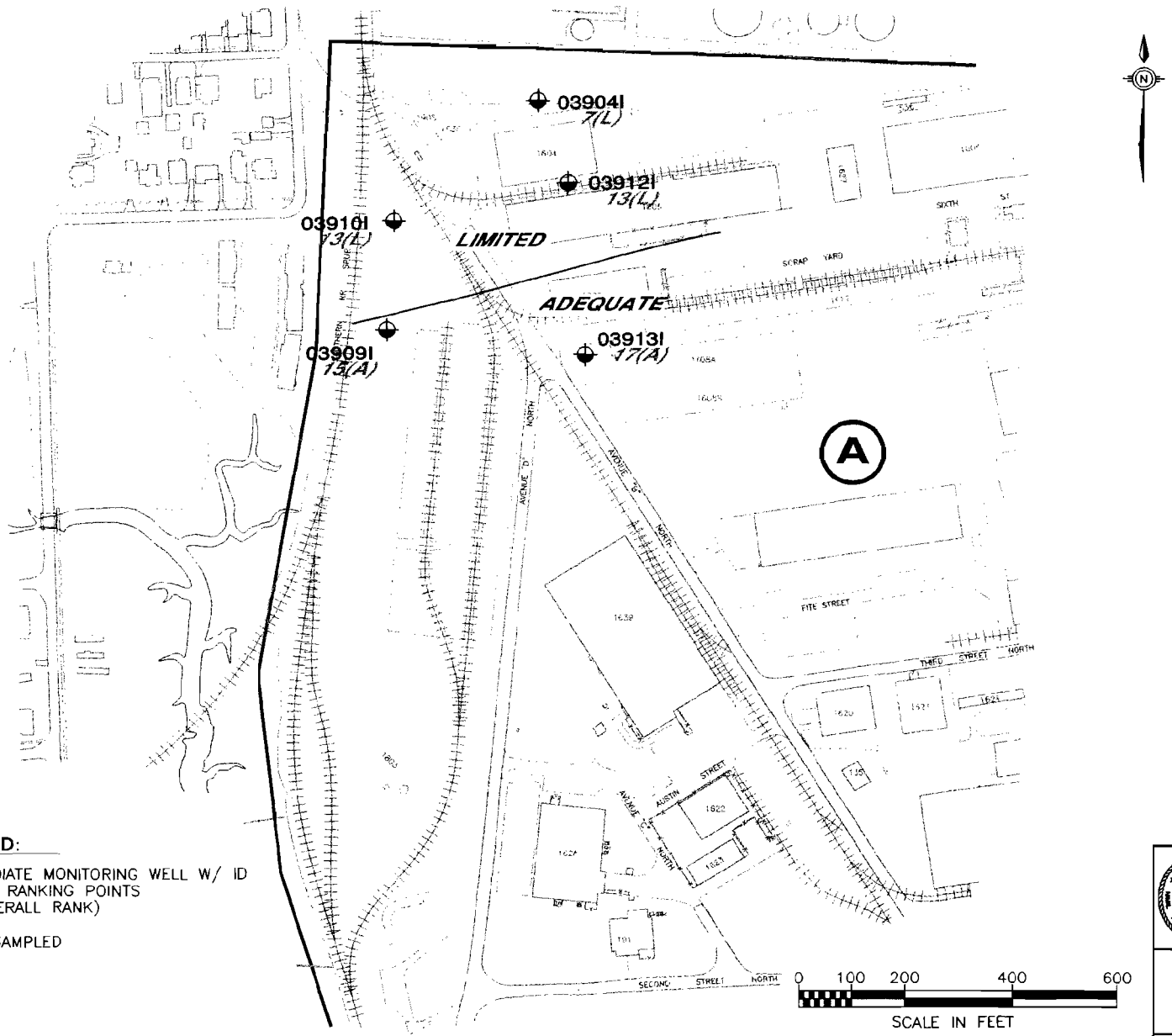
039008 10(L) — SHALLOW MONITORING WELL W/ ID NUMBER, RANKING POINTS AND (OVERALL RANK)

NS = NOT SAMPLED

ZONE A – SWMU 39
TECHNICAL MEMORANDU
CHARLESTON NAVAL
COMPLEX
CHARLESTON, SC

FIGURE H–2
SPATIAL DISTRIBUTION OF
SHALLOW WELL RANKINGS
ROUND 2 – MNA DATA

Date: 11/24/99 | DWG Name: 2901M205



LEGEND:

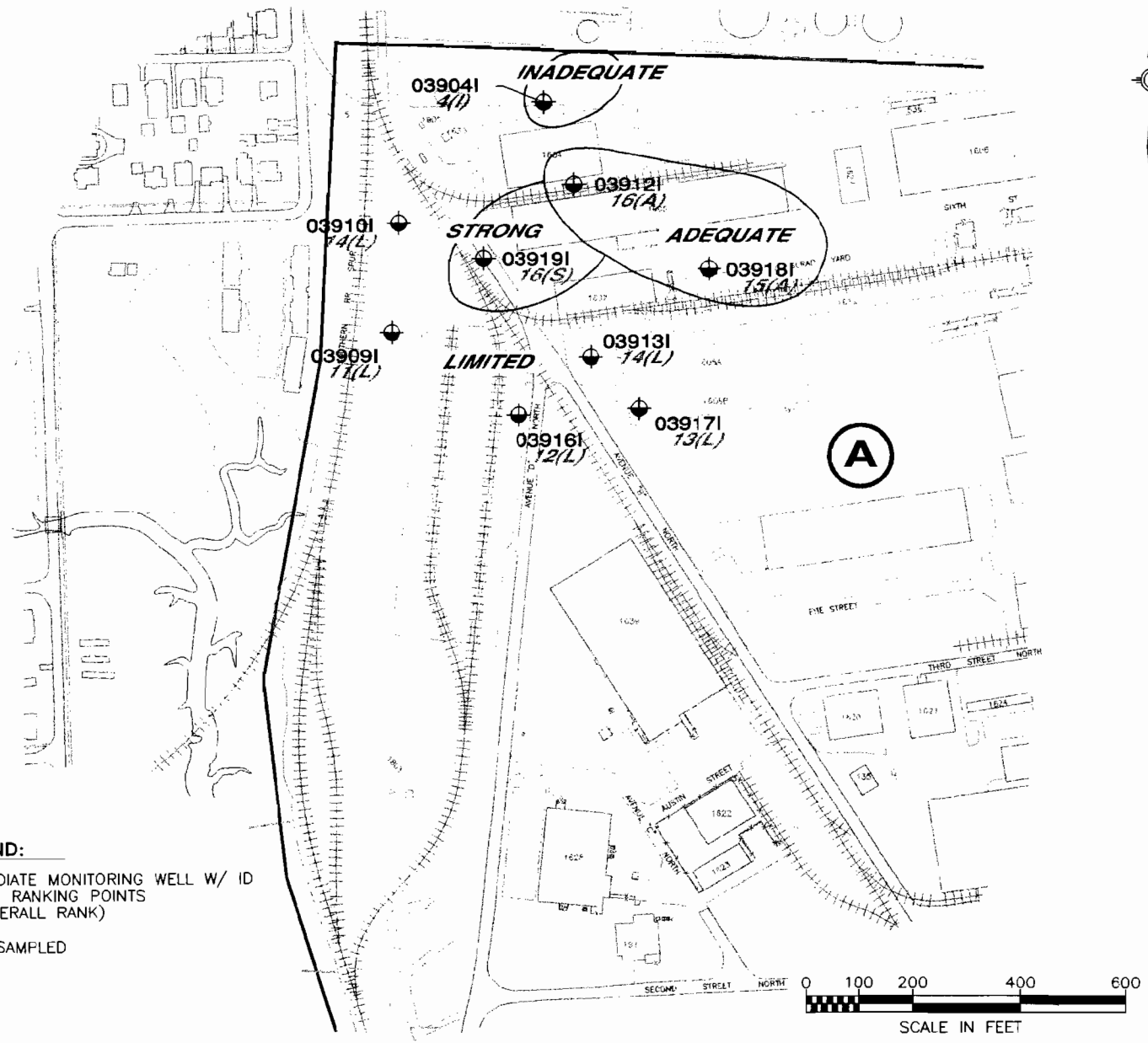
03913I 17(A) ◆ INTERMEDIATE MONITORING WELL W/ ID NUMBER, RANKING POINTS AND (OVERALL RANK)

NS = NOT SAMPLED

ZONE A – SWMU 39
TECHNICAL MEMORANDU
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H–3
SPATIAL DISTRIBUTION OF INTERMEDIATE WELL RANKINGS
ROUND 1 – MNA DATA

Date: 11/24/99 | DWG Name: 2901M202



LEGEND:

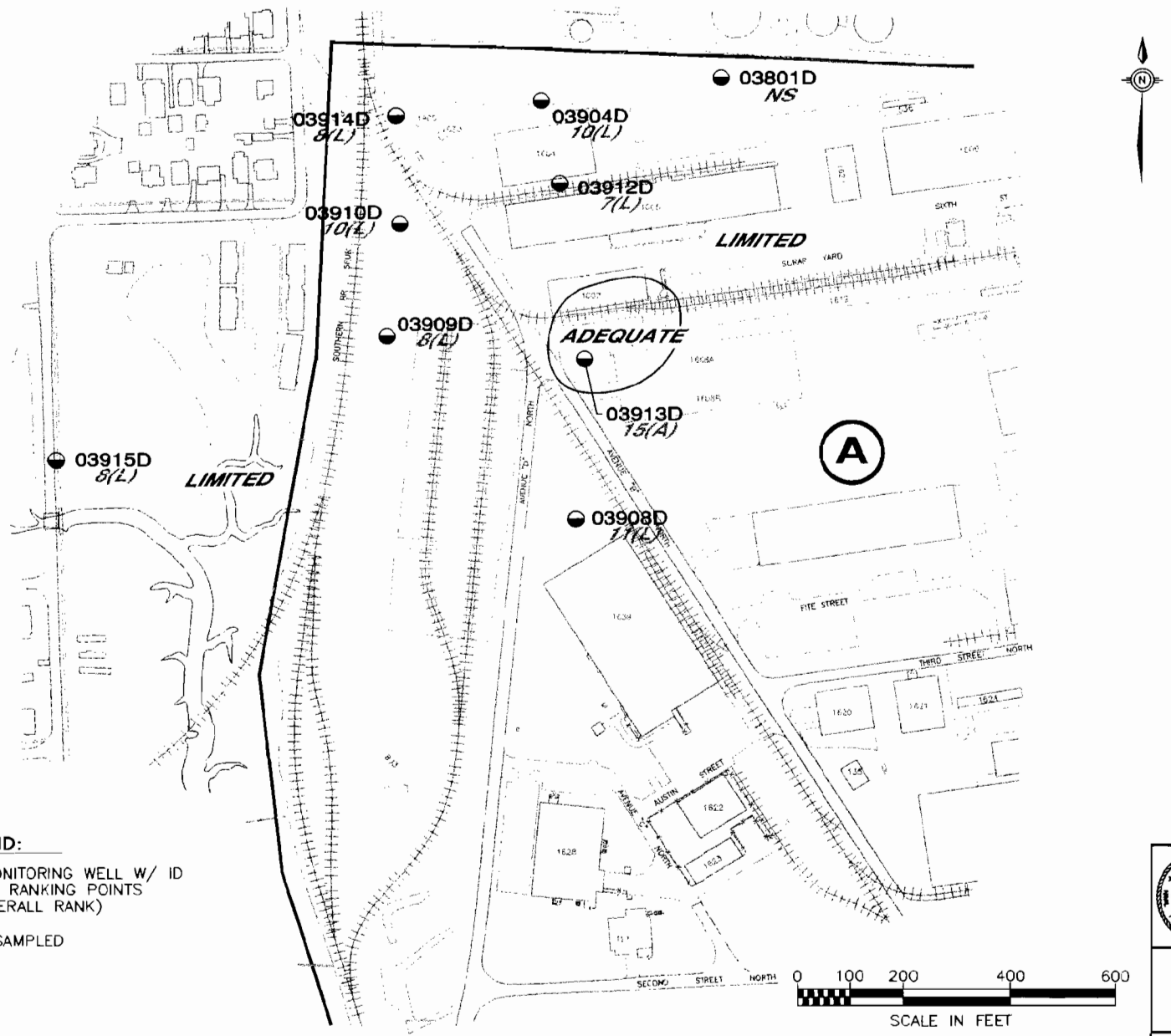
039131 14(L) — INTERMEDIATE MONITORING WELL W/ ID NUMBER, RANKING POINTS AND (OVERALL RANK)

NS = NOT SAMPLED

ZONE A – SWMU 39
TECHNICAL MEMORANDU
CHARLESTON NAVAL
COMPLEX
CHARLESTON, SC

FIGURE H–4
SPATIAL DISTRIBUTION OF
INTERMEDIATE WELL RANKINGS
ROUND 2 – MNA DATA

Date: 11/24/99 | DWG Name: 2901M203



LEGEND:

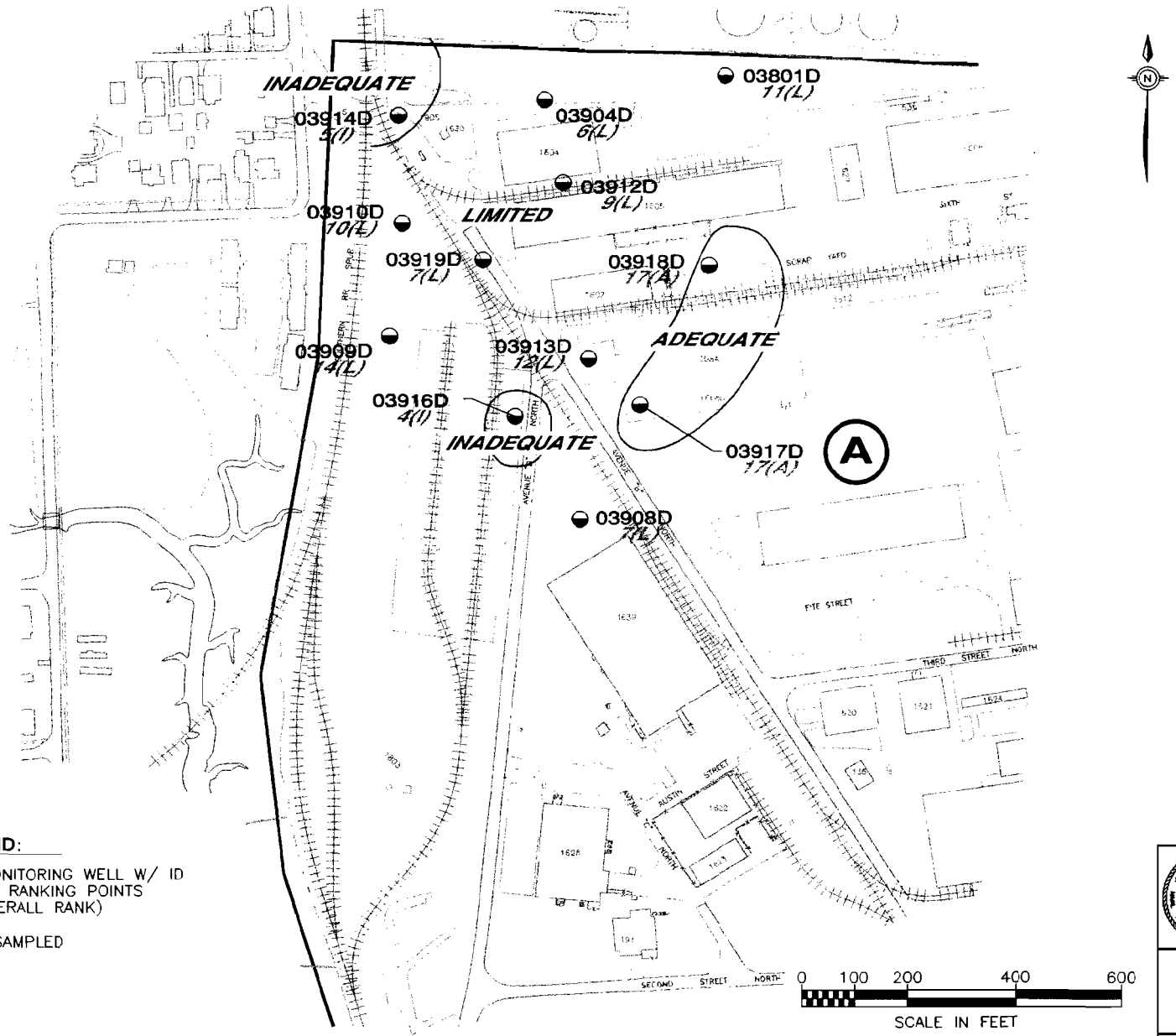
03908D 11(L) — DEEP MONITORING WELL W/ ID NUMBER, RANKING POINTS AND (OVERALL RANK)

NS = NOT SAMPLED

ZONE A – SWMU 39
TECHNICAL MEMORANDUM
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-5
SPATIAL DISTRIBUTION OF DEEP WELL RANKINGS
ROUND 1 – MNA DATA

Date 11/24/99 | DWG Name: 2901M200



LEGEND:

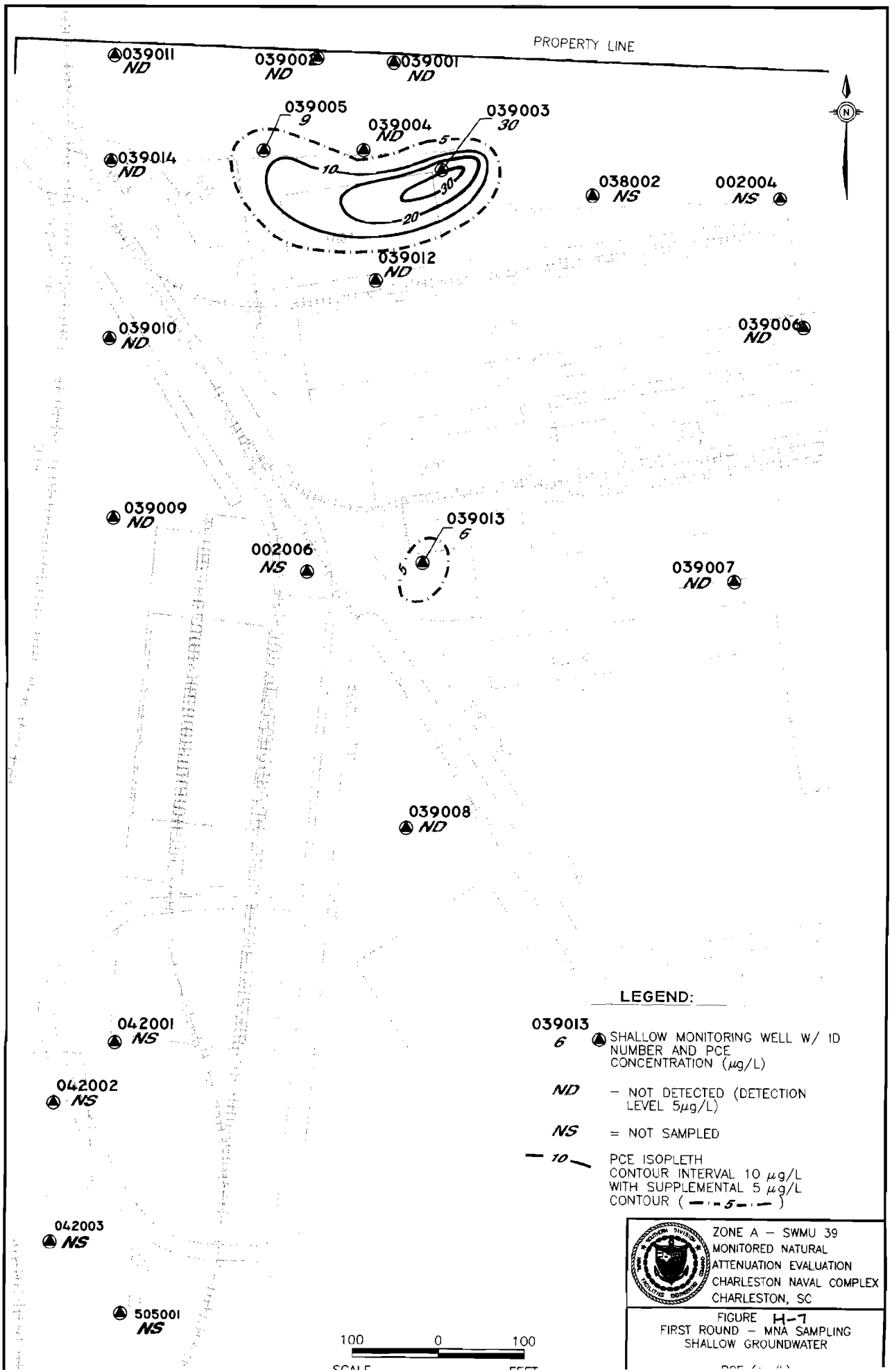
03908D 7(L) — DEEP MONITORING WELL W/ ID NUMBER, RANKING POINTS AND (OVERALL RANK)

NS = NOT SAMPLED

ZONE A – SWMU 39
TECHNICAL MEMORANDUM
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H–6
SPATIAL DISTRIBUTION OF DEEP WELL RANKINGS
ROUND 2 – MNA DATA

Date: 11/24/99 | DWG Name: 2901M2C1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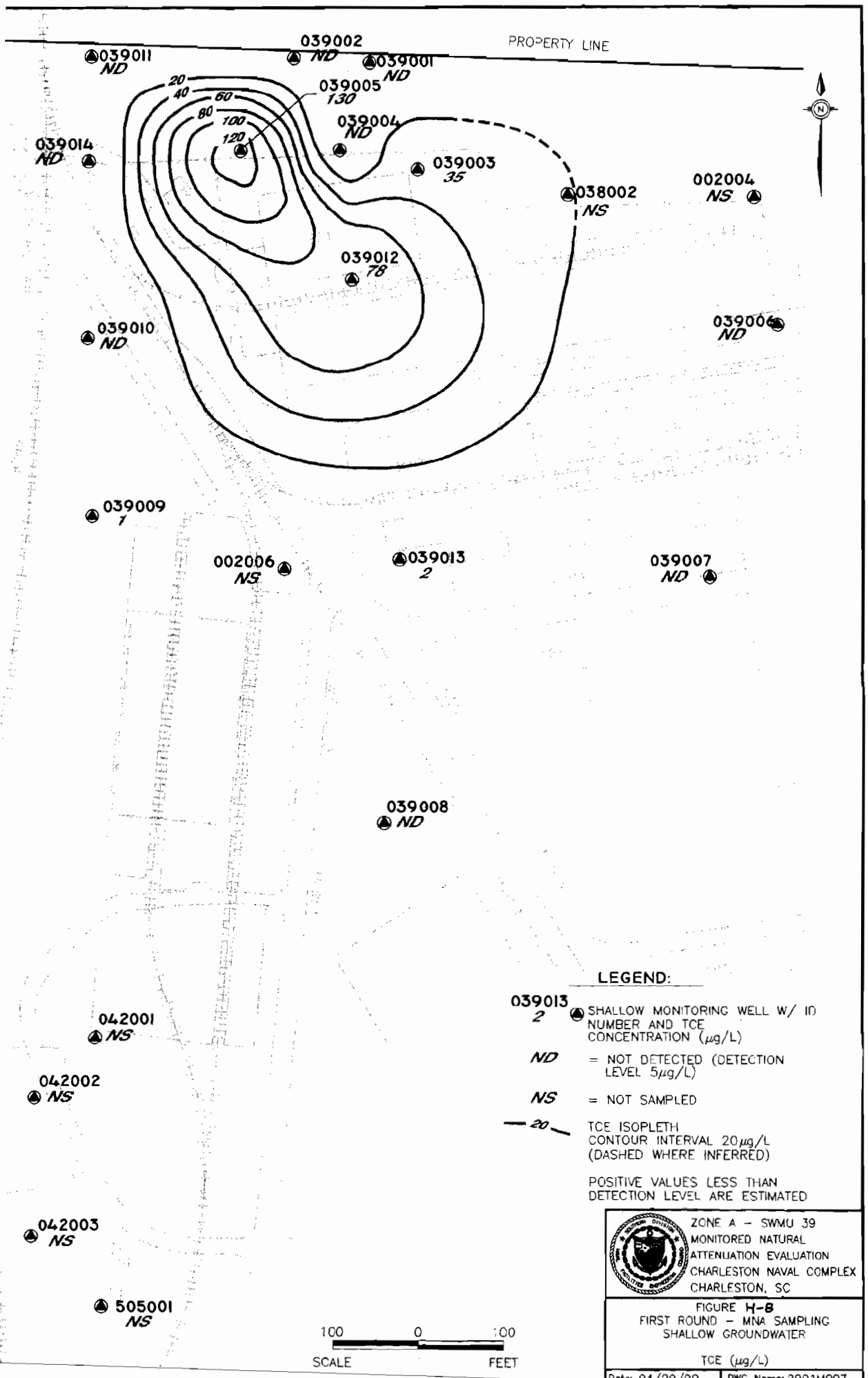
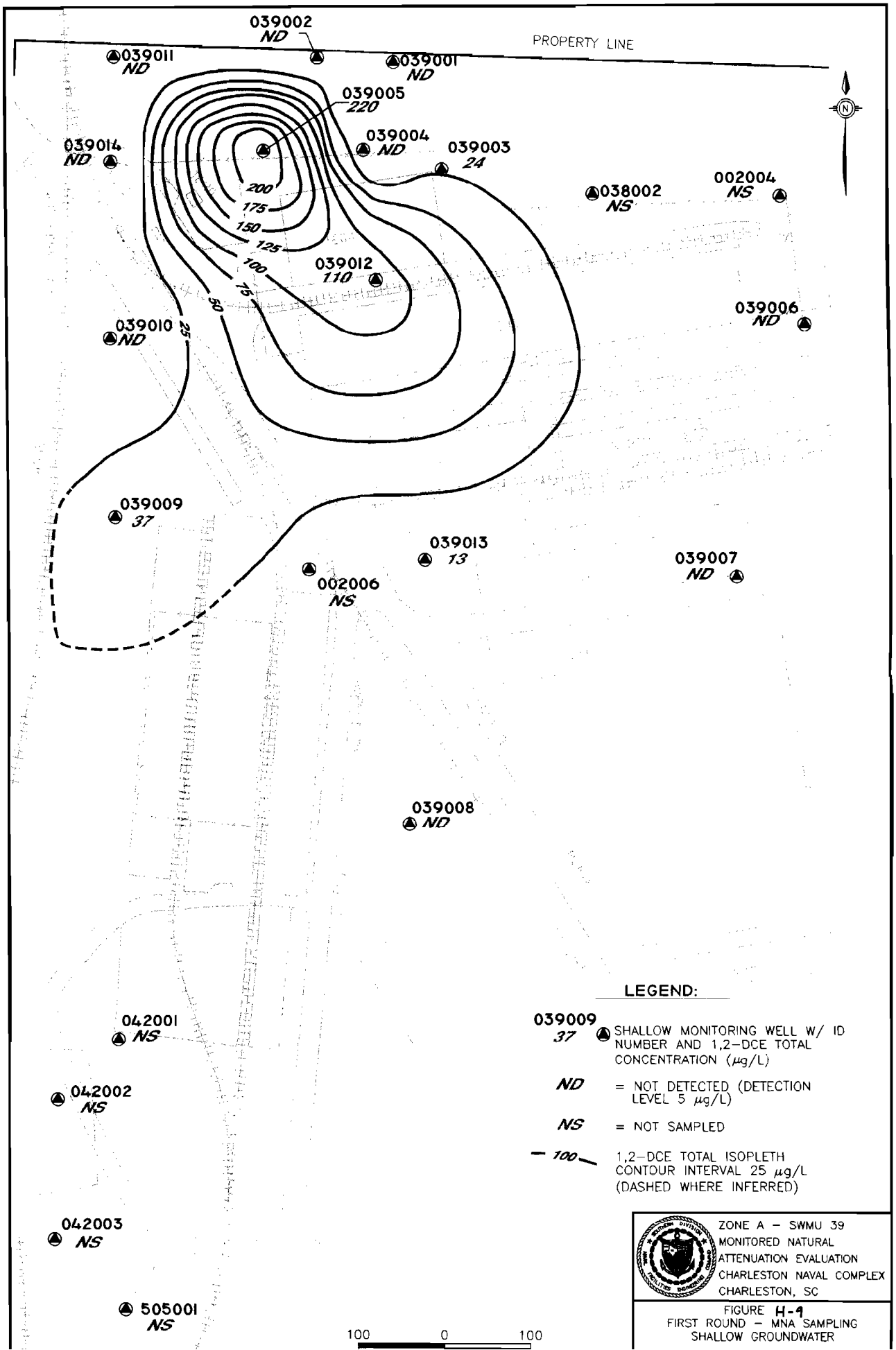
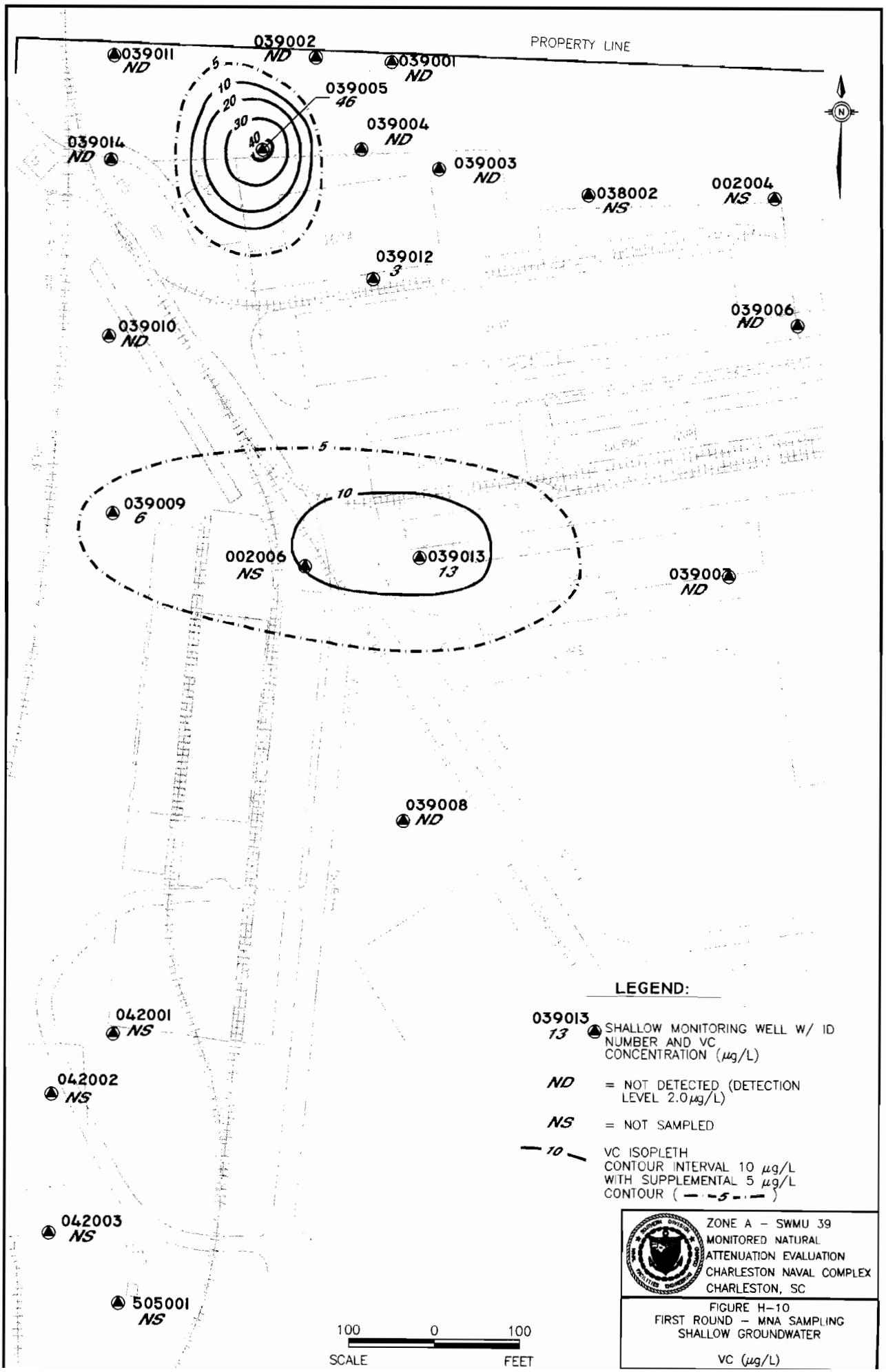
ND
039002
ND
039001
ND
039005
9
039004
ND
039003
30
5
10
30
20
039014
ND
038002
NS
002004
NS
039012
ND
039010
ND
039006
ND
039009
ND
039013
6
5
002006
NS
039007
ND
039008
ND
042001
NS
042002
NS
042003
NS
505001
NS
100
0
100
SCALE
FEET
LEGEND:
039013
6
SHALLOW MONITORING WELL W/ ID NUMBER AND PCE CONCENTRATION (μg/L)
ND
– NOT DETECTED (DETECTION LEVEL 5μg/L)
NS
= NOT SAMPLED
10
PCE ISOPLETH CONTOUR INTERVAL 10 μg/L WITH SUPPLEMENTAL 5 μg/L CONTOUR (5)
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-7
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER


PROPERTY LINE
039002
ND
039011
ND
039001
ND
039005
130
039004
ND
039014
ND
039003
35
038002
NS
002004
NS
039012
78
039010
ND
039006
ND
039009
1
002006
NS
039013
2
039007
ND
039008
ND
042001
NS
042002
NS
042003
NS
505001
NS
20
40
60
80
100
120
N
100
0
100
SCALE
FEET
LEGEND:
039013
2
SHALLOW MONITORING WELL W/ ID NUMBER AND TCE CONCENTRATION (μg/L)
ND = NOT DETECTED (DETECTION LEVEL 5μg/L)
NS = NOT SAMPLED
20
TCE ISOPLETH CONTOUR INTERVAL 20μg/L (DASHED WHERE INFERRED)
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-8
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
TCE (μg/L)
Date: 04/20/99
DWG. Name: 2901M007


PROPERTY LINE
039002
ND
039011
ND
039001
ND
039005
220
039004
ND
039003
24
039014
ND
038002
NS
002004
NS
200
175
150
125
100
75
50
25
039012
110
039006
ND
039010
ND
039009
37
039013
13
039007
ND
002006
NS
039008
ND
042001
NS
042002
NS
042003
NS
505001
NS
100
0
100
LEGEND:
039009
37
SHALLOW MONITORING WELL W/ ID NUMBER AND 1,2-DCE TOTAL CONCENTRATION (μg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 μg/L)
NS
= NOT SAMPLED
100
1,2-DCE TOTAL ISOPLETH CONTOUR INTERVAL 25 μg/L (DASHED WHERE INFERRED)
ZONE A - SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-9
FIRST ROUND - MNA SAMPLING
SHALLOW GROUNDWATER


PROPERTY LINE
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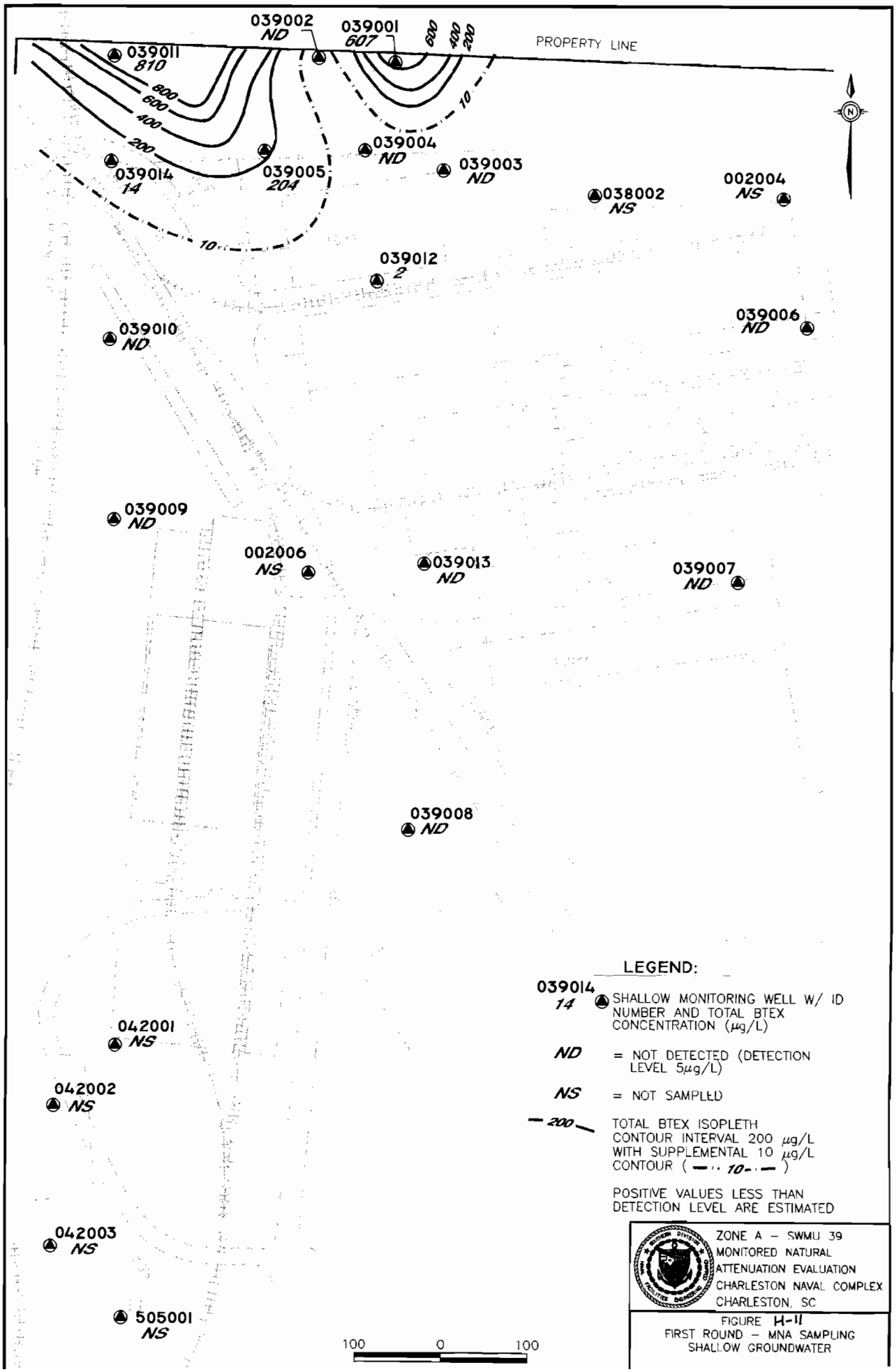
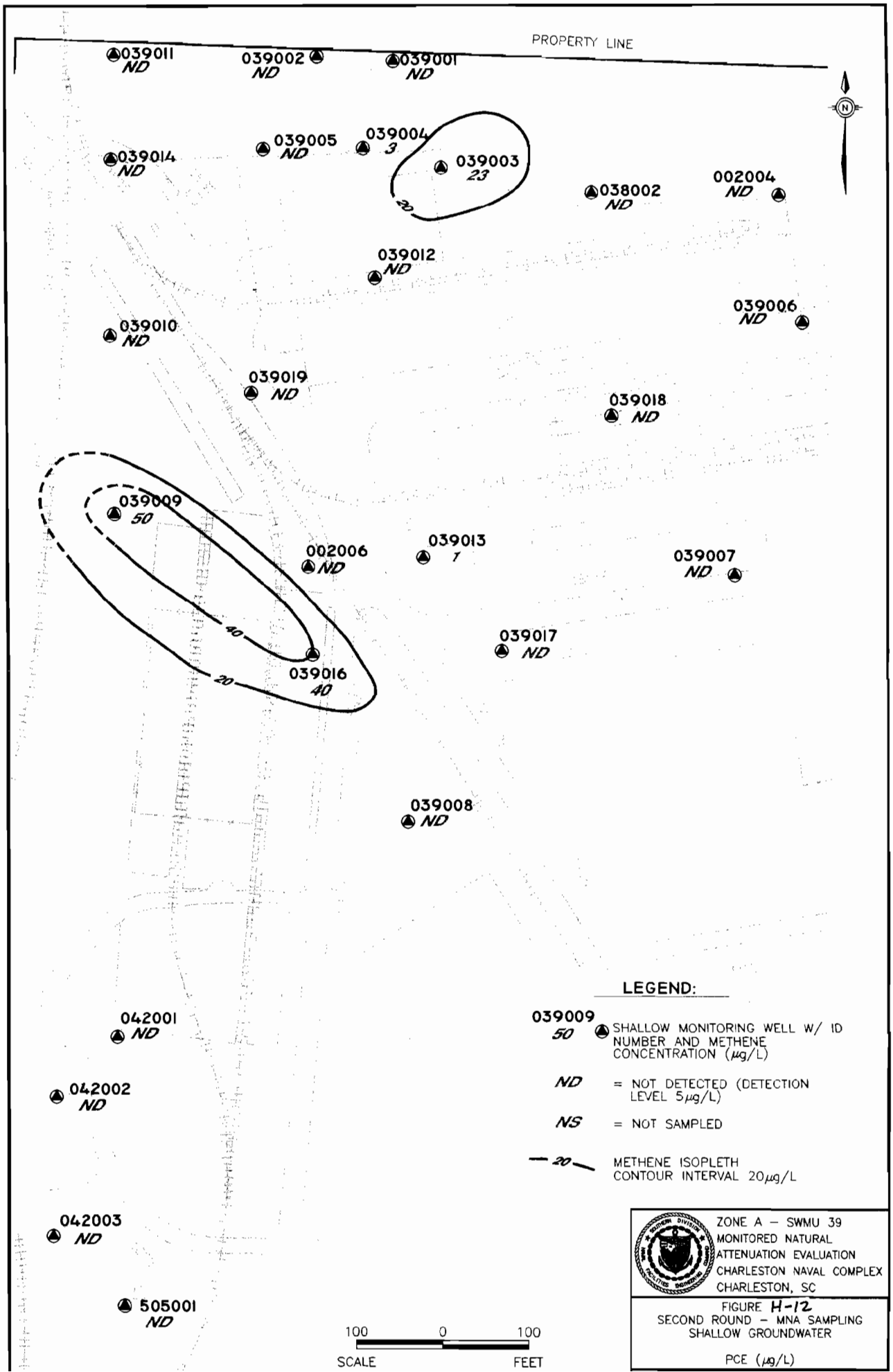
039002
ND
039001
ND
039005
46
039004
ND
039014
ND
039003
ND
038002
NS
002004
NS
039012
3
039006
ND
039010
ND
039009
6
002006
NS
039013
13
039007
ND
039008
ND
042001
NS
042002
NS
042003
NS
505001
NS
5
10
20
30
40
LEGEND:
039013
13
SHALLOW MONITORING WELL W/ ID NUMBER AND VC CONCENTRATION (µg/L)
ND = NOT DETECTED (DETECTION LEVEL 2.0µg/L)
NS = NOT SAMPLED
10
VC ISOPLETH CONTOUR INTERVAL 10 µg/L WITH SUPPLEMENTAL 5 µg/L CONTOUR (5)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-10
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
VC (µg/L)


039002
ND
039001
607
600
400
200
PROPERTY LINE
039011
810
800
600
400
200
10
039004
ND
039003
ND
039014
14
039005
204
038002
NS
002004
NS
10
039012
2
039006
ND
039010
ND
039009
ND
002006
NS
039013
ND
039007
ND
039008
ND
042001
NS
042002
NS
042003
NS
505001
NS
100
0
100
LEGEND:
039014
14
SHALLOW MONITORING WELL W/ ID NUMBER AND TOTAL BTEX CONCENTRATION (μg/L)
ND = NOT DETECTED (DETECTION LEVEL 5μg/L)
NS = NOT SAMPLED
200
TOTAL BTEX ISOPLETH CONTOUR INTERVAL 200 μg/L WITH SUPPLEMENTAL 10 μg/L CONTOUR (10)
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-11
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER


PROPERTY LINE
039011
ND
039002
ND
039001
ND
039014
ND
039005
ND
039004
3
039003
23
20
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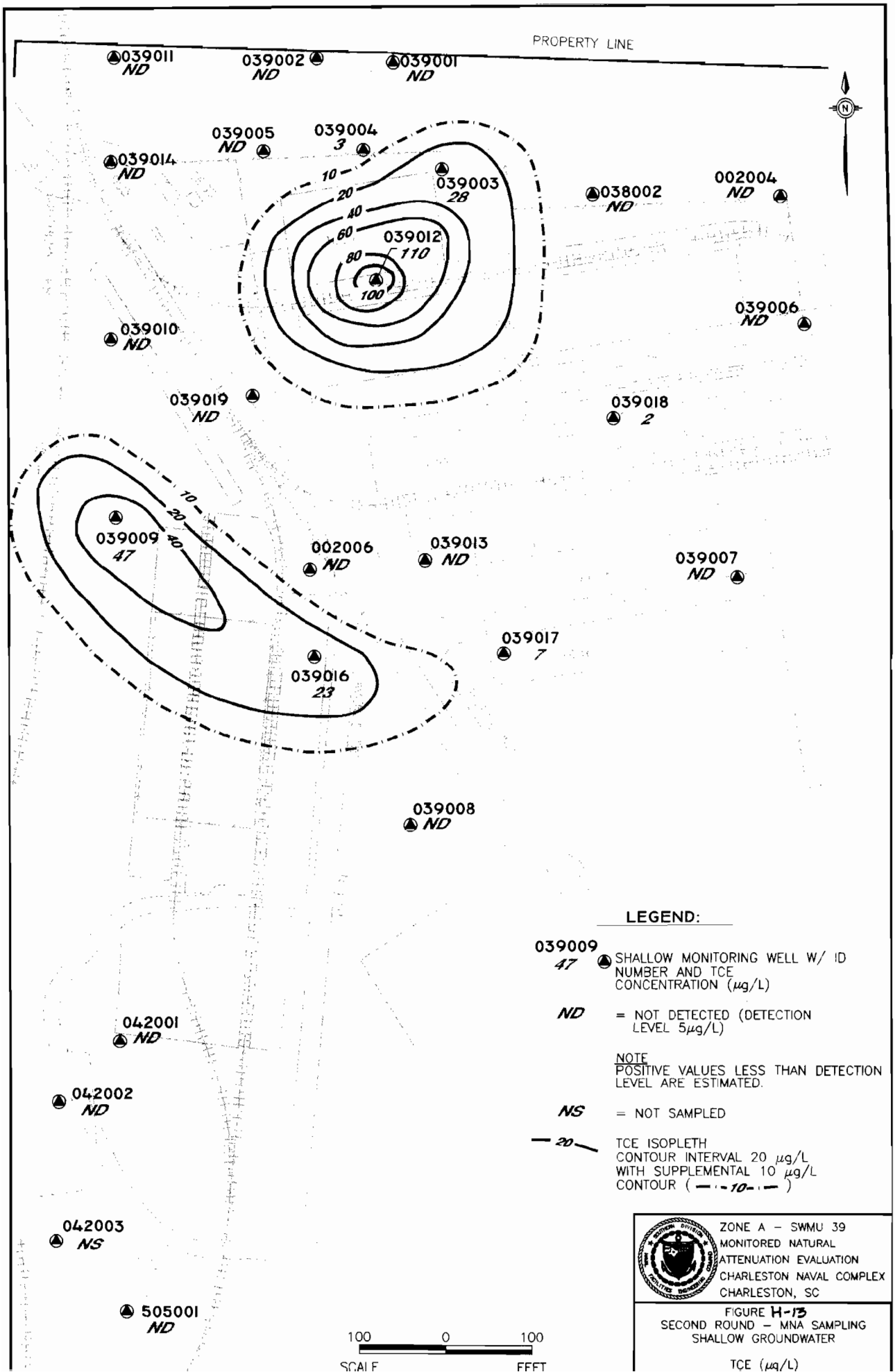
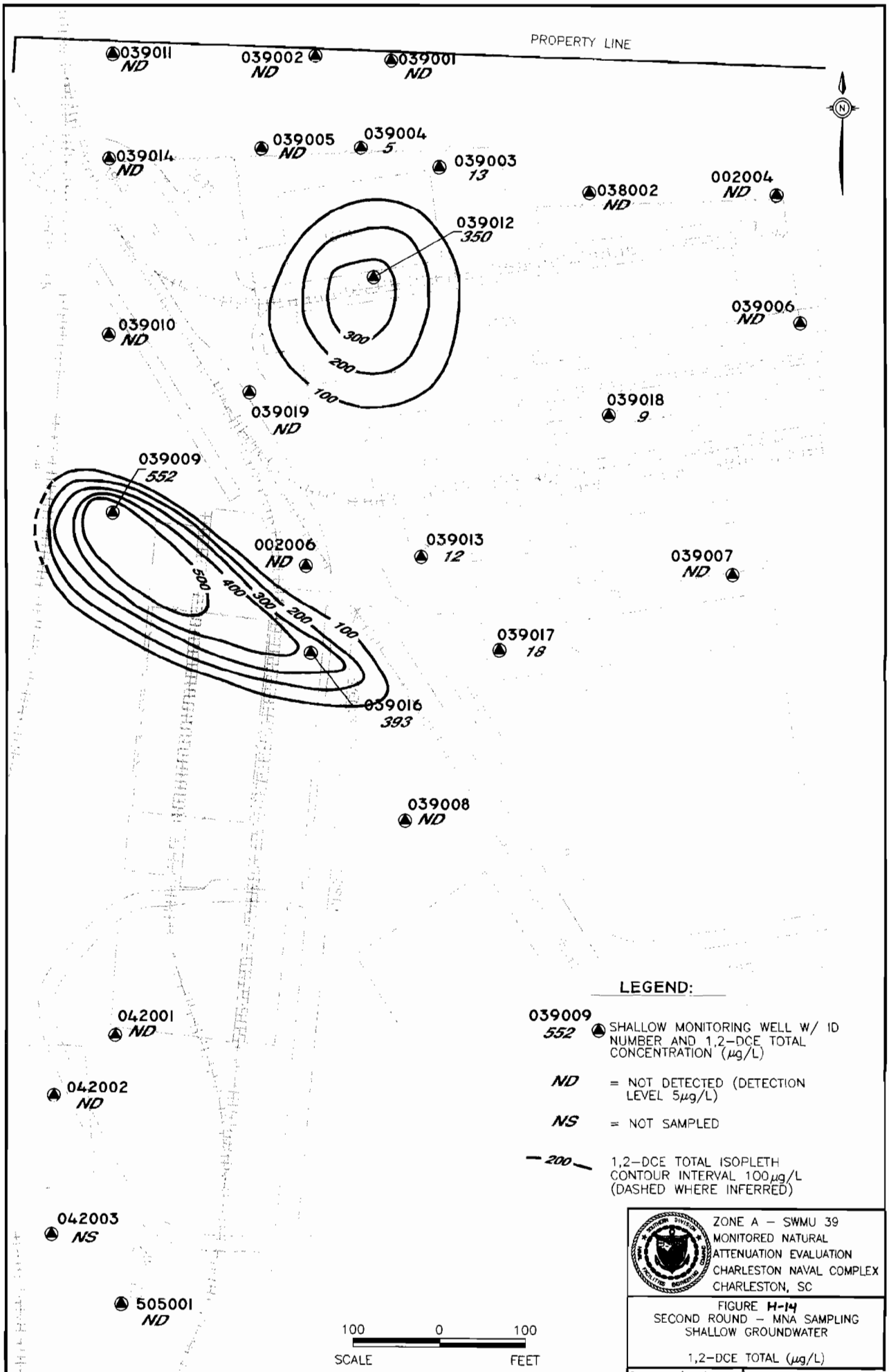
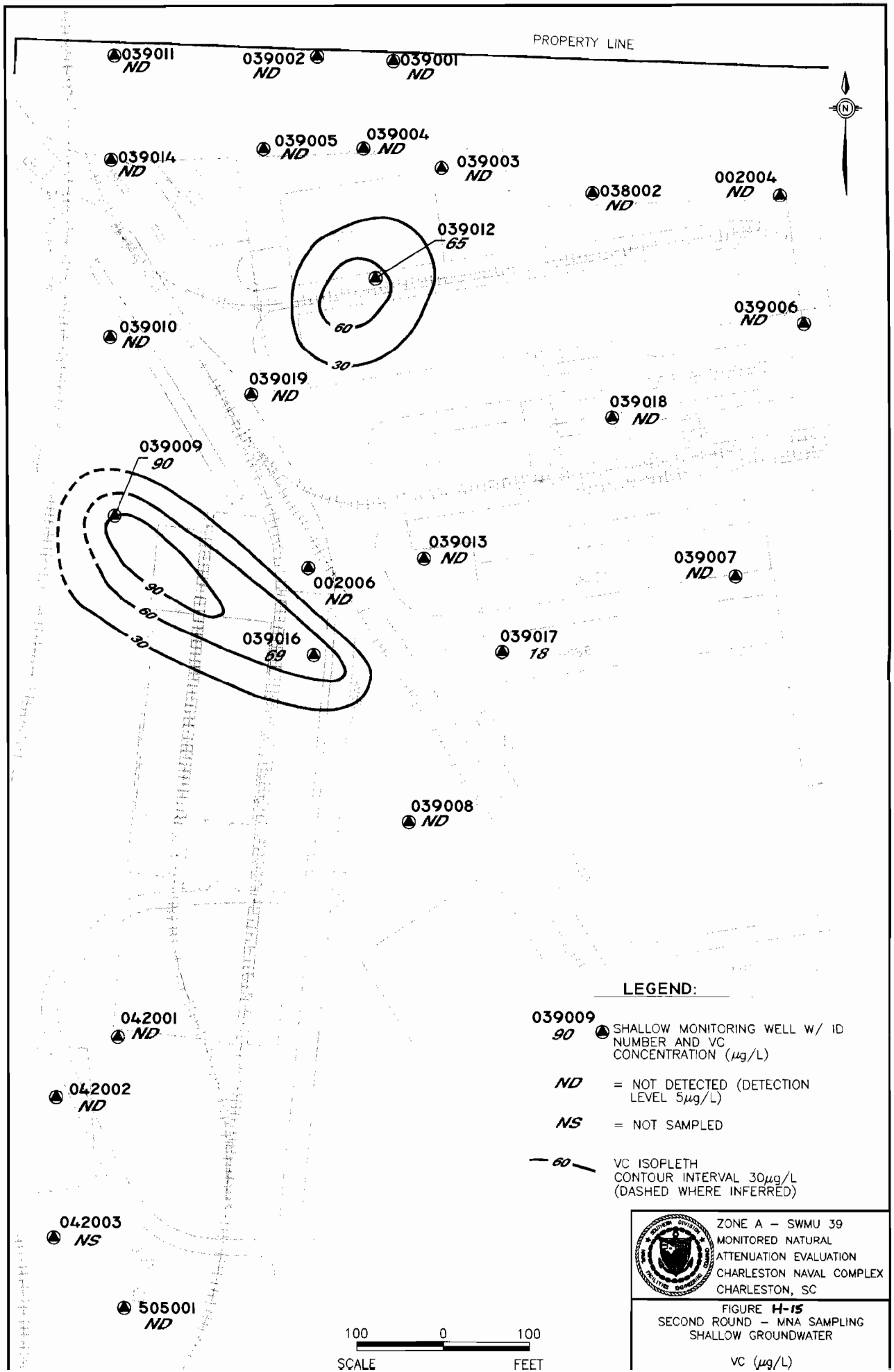
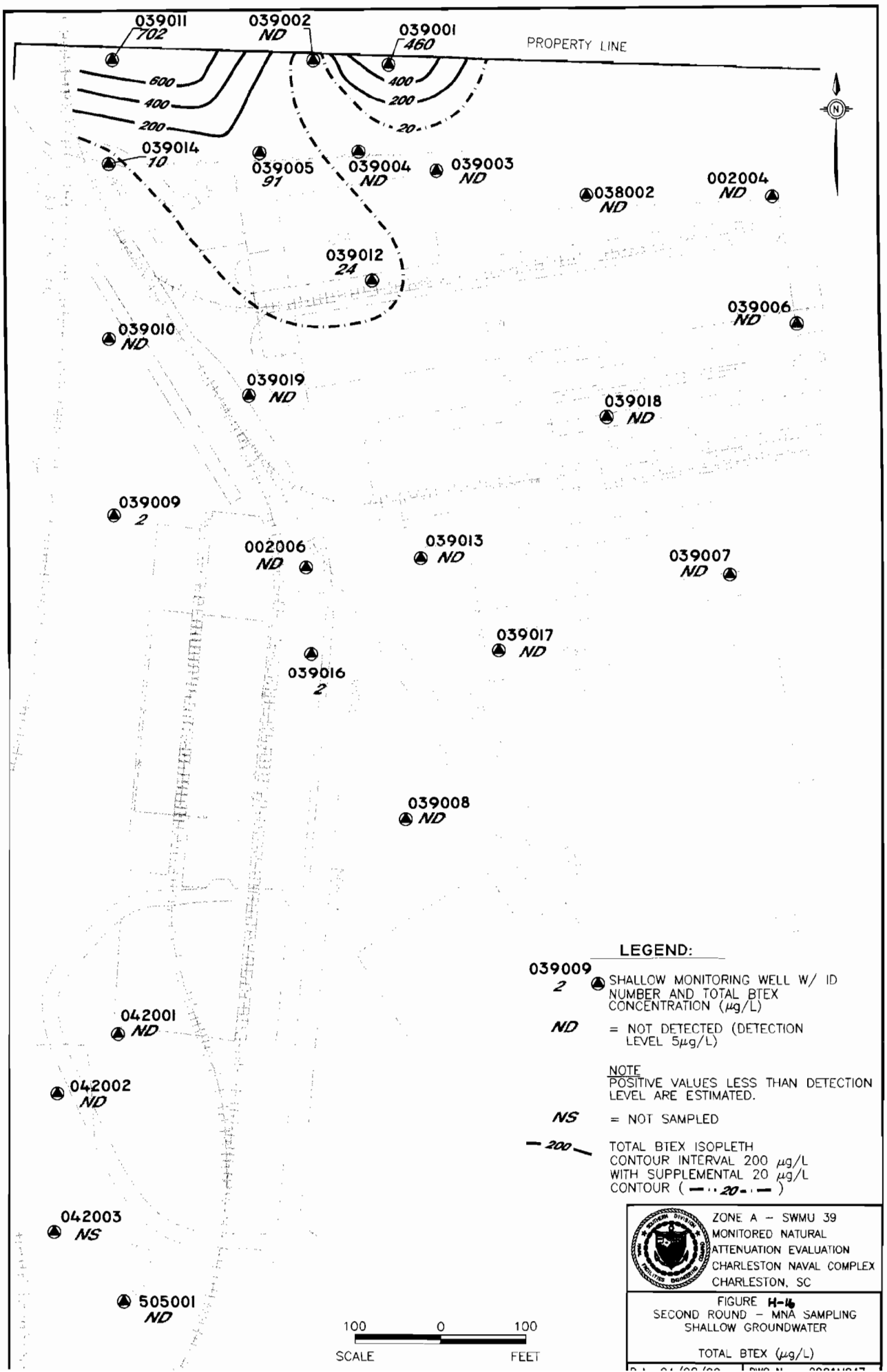
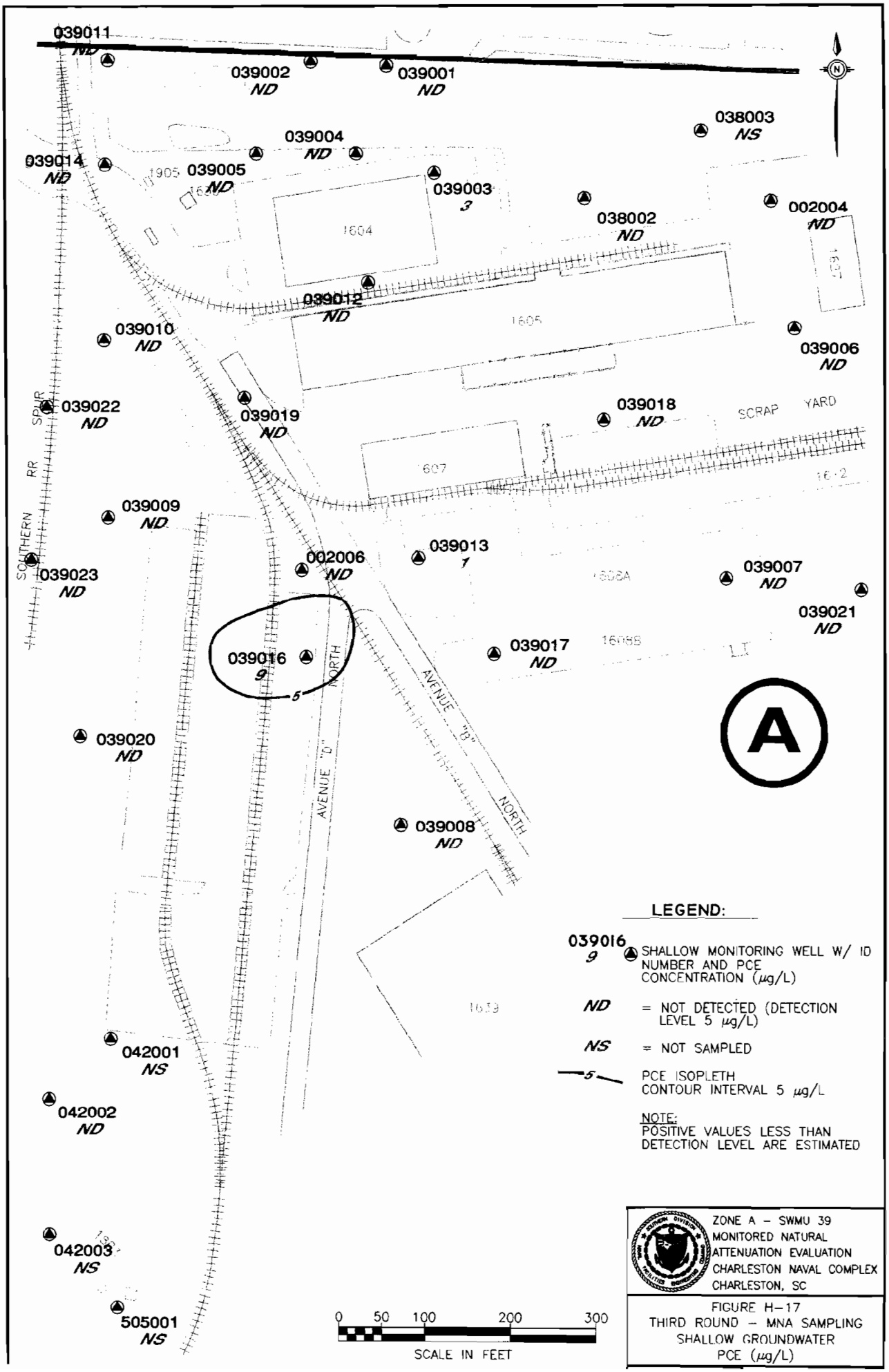
002004
ND
039012
ND
039006
ND
039010
ND
039019
ND
039018
ND
039009
50
002006
ND
039013
1
039007
ND
40
039017
ND
20
039016
40
039008
ND
042001
ND
042002
ND
042003
ND
505001
ND
100
0
100
SCALE
FEET
LEGEND:
039009
50
SHALLOW MONITORING WELL W/ ID NUMBER AND METHENE CONCENTRATION (μg/L)
ND = NOT DETECTED (DETECTION LEVEL 5μg/L)
NS = NOT SAMPLED
20
METHENE ISOPLETH CONTOUR INTERVAL 20μg/L
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-12
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
PCE (μg/L)


PROPERTY LINE
039011
ND
039002
ND
039001
ND
039005
ND
039004
3
039014
ND
039003
28
038002
ND
002004
ND
039012
110
100
80
60
40
20
10
039006
ND
039010
ND
039019
ND
039018
2
039009
47
002006
ND
039013
ND
039007
ND
039017
7
039016
23
039008
ND
042001
ND
042002
ND
042003
NS
505001
ND
100
0
100
SCALE
FEET
LEGEND:
039009
47
SHALLOW MONITORING WELL W/ ID NUMBER AND TCE CONCENTRATION (μg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5μg/L)
NOTE
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED.
NS
= NOT SAMPLED
20
TCE ISOPLETH
CONTOUR INTERVAL 20 μg/L
WITH SUPPLEMENTAL 10 μg/L
CONTOUR (10)
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-13
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
TCE (μg/L)


PROPERTY LINE
039011
ND
039002
ND
039001
ND
039014
ND
039005
ND
039004
5
039003
13
038002
ND
002004
ND
039012
350
039006
ND
039010
ND
300
200
100
039019
ND
039018
9
039009
552
002006
ND
039013
12
039007
ND
500
400
300
200
100
039017
18
039016
393
039008
ND
042001
ND
042002
ND
042003
NS
505001
ND
LEGEND:
039009
552
SHALLOW MONITORING WELL W/ ID NUMBER AND 1,2-DCE TOTAL CONCENTRATION (μg/L)
ND = NOT DETECTED (DETECTION LEVEL 5μg/L)
NS = NOT SAMPLED
200
1,2-DCE TOTAL ISOPLETH CONTOUR INTERVAL 100μg/L (DASHED WHERE INFERRED)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-14
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
1,2-DCE TOTAL (μg/L)


PROPERTY LINE
039011
ND
039002
ND
039001
ND
039005
ND
039004
ND
039014
ND
039003
ND
038002
ND
002004
ND
039012
65
60
30
039006
ND
039010
ND
039019
ND
039018
ND
039009
90
039013
ND
039007
ND
002006
ND
90
60
30
039016
69
039017
18
039008
ND
042001
ND
042002
ND
042003
NS
505001
ND
100
0
100
SCALE
FEET
LEGEND:
039009
90
SHALLOW MONITORING WELL W/ ID NUMBER AND VC CONCENTRATION (μg/L)
ND = NOT DETECTED (DETECTION LEVEL 5μg/L)
NS = NOT SAMPLED
60
VC ISOPLETH
CONTOUR INTERVAL 30μg/L
(DASHED WHERE INFERRED)
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-15
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
VC (μg/L)


039011
702
039002
ND
039001
460
PROPERTY LINE
600
400
200
400
200
20
039014
10
039005
91
039004
ND
039003
ND
038002
ND
002004
ND
039012
24
039006
ND
039010
ND
039019
ND
039018
ND
039009
2
002006
ND
039013
ND
039007
ND
039017
ND
039016
2
039008
ND
042001
ND
042002
ND
042003
NS
505001
ND
100
0
100
SCALE
FEET
LEGEND:
039009
2
SHALLOW MONITORING WELL W/ ID NUMBER AND TOTAL BTEX CONCENTRATION (µg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5µg/L)
NOTE
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED.
NS
= NOT SAMPLED
200
TOTAL BTEX ISOPLETH CONTOUR INTERVAL 200 µg/L WITH SUPPLEMENTAL 20 µg/L CONTOUR (20)
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-14
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
TOTAL BTEX (µg/L)


039011
ND
039002
ND
039001
ND
038003
NS
039004
ND
039014
ND
039005
ND
039003
3
038002
ND
002004
ND
1604
039012
ND
1605
039010
ND
039006
ND
039022
ND
039019
ND
039018
ND
SCRAP YARD
1607
SOUTHERN RR SPUR
039009
ND
039013
1
002006
ND
039023
ND
039007
ND
039021
ND
039016
9
5
039017
ND
NORTH AVENUE "D"
AVENUE "B" NORTH
A
039020
ND
039008
ND
LEGEND:
039016
9
SHALLOW MONITORING WELL W/ ID NUMBER AND PCE CONCENTRATION (µg/L)
ND = NOT DETECTED (DETECTION LEVEL 5 µg/L)
NS = NOT SAMPLED
5
PCE ISOPLETH CONTOUR INTERVAL 5 µg/L
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
042001
NS
042002
ND
042003
NS
505001
NS
0 50 100 200 300
SCALE IN FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-17
THIRD ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
PCE (µg/L)

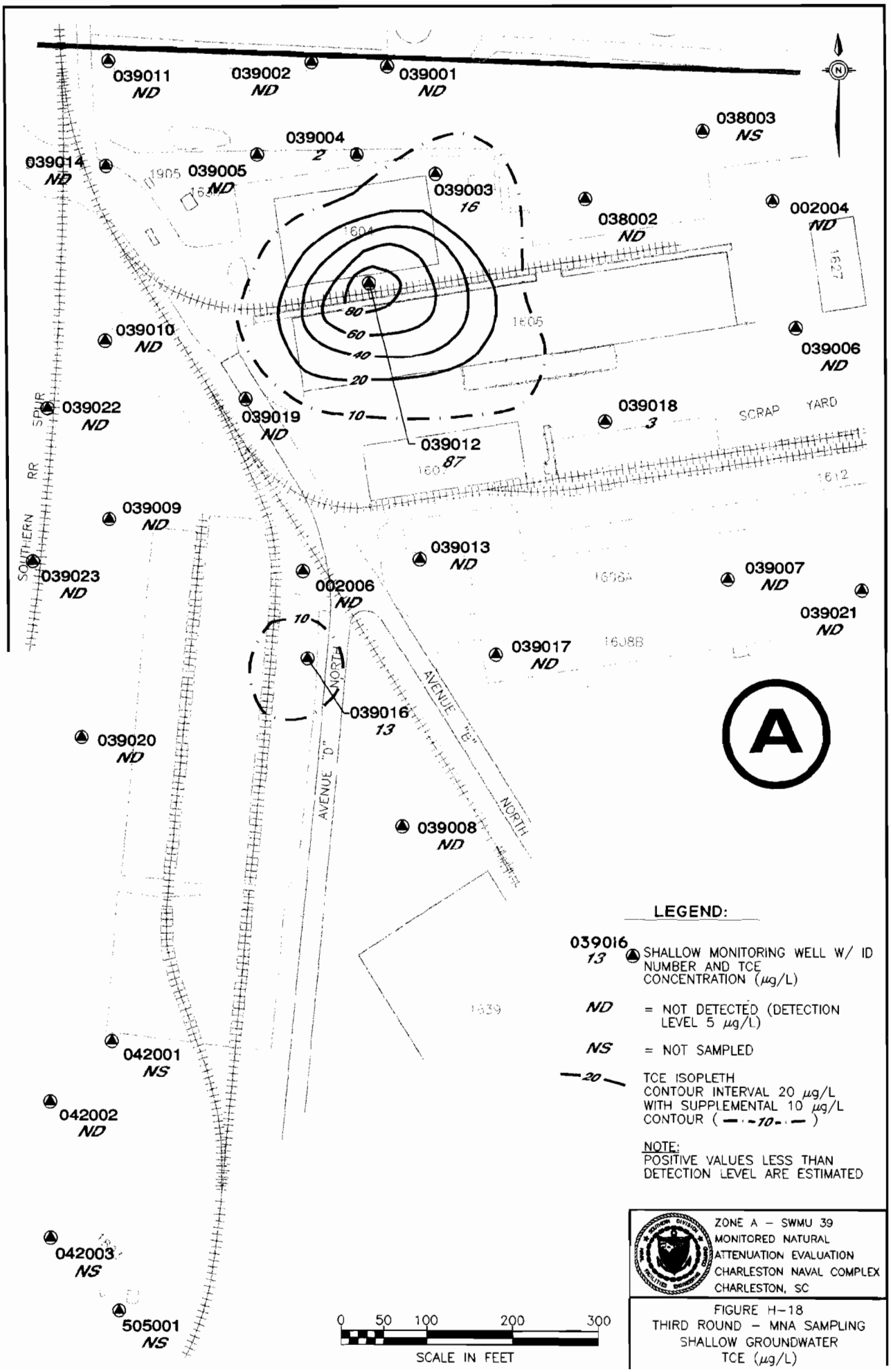
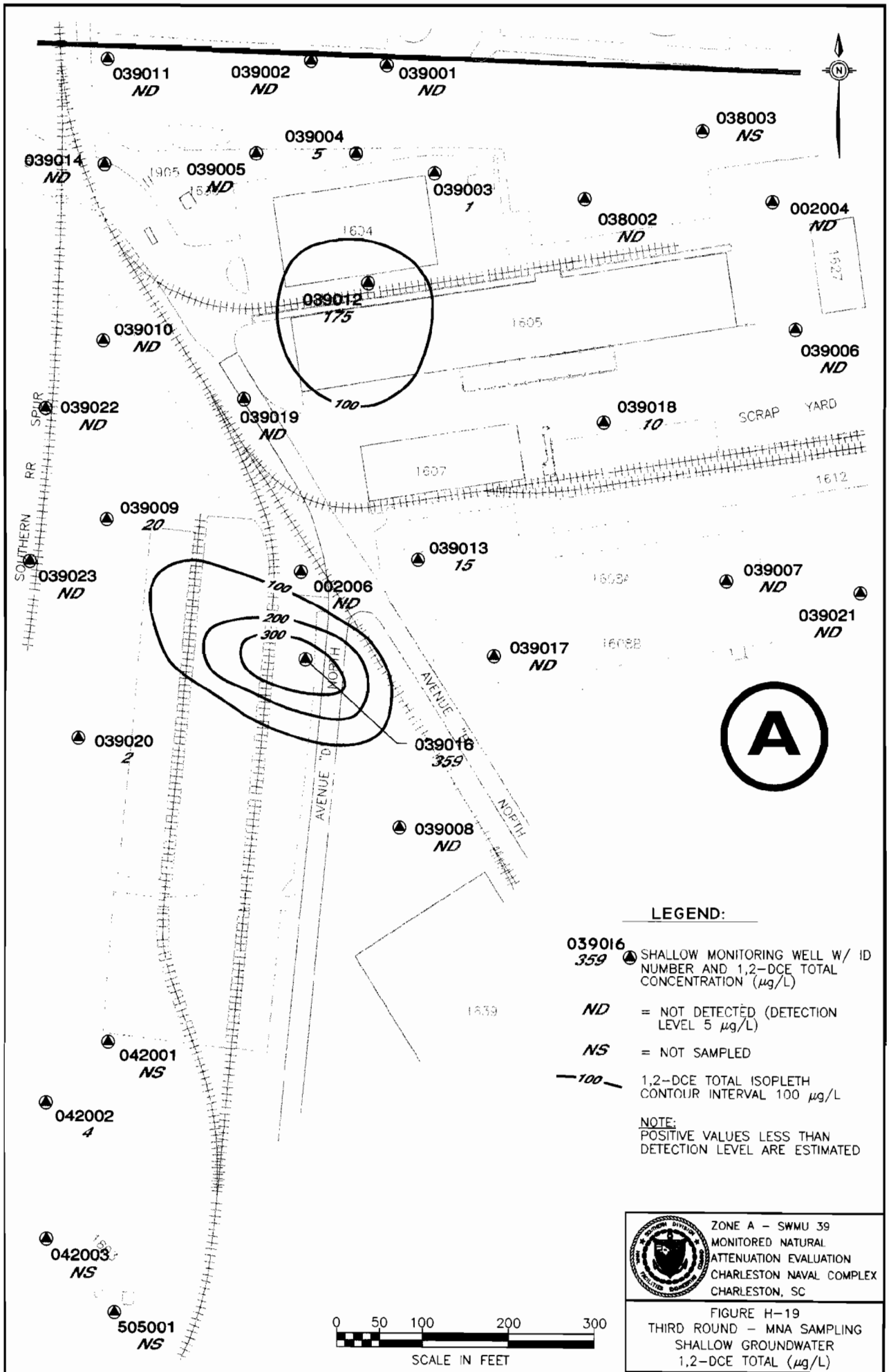
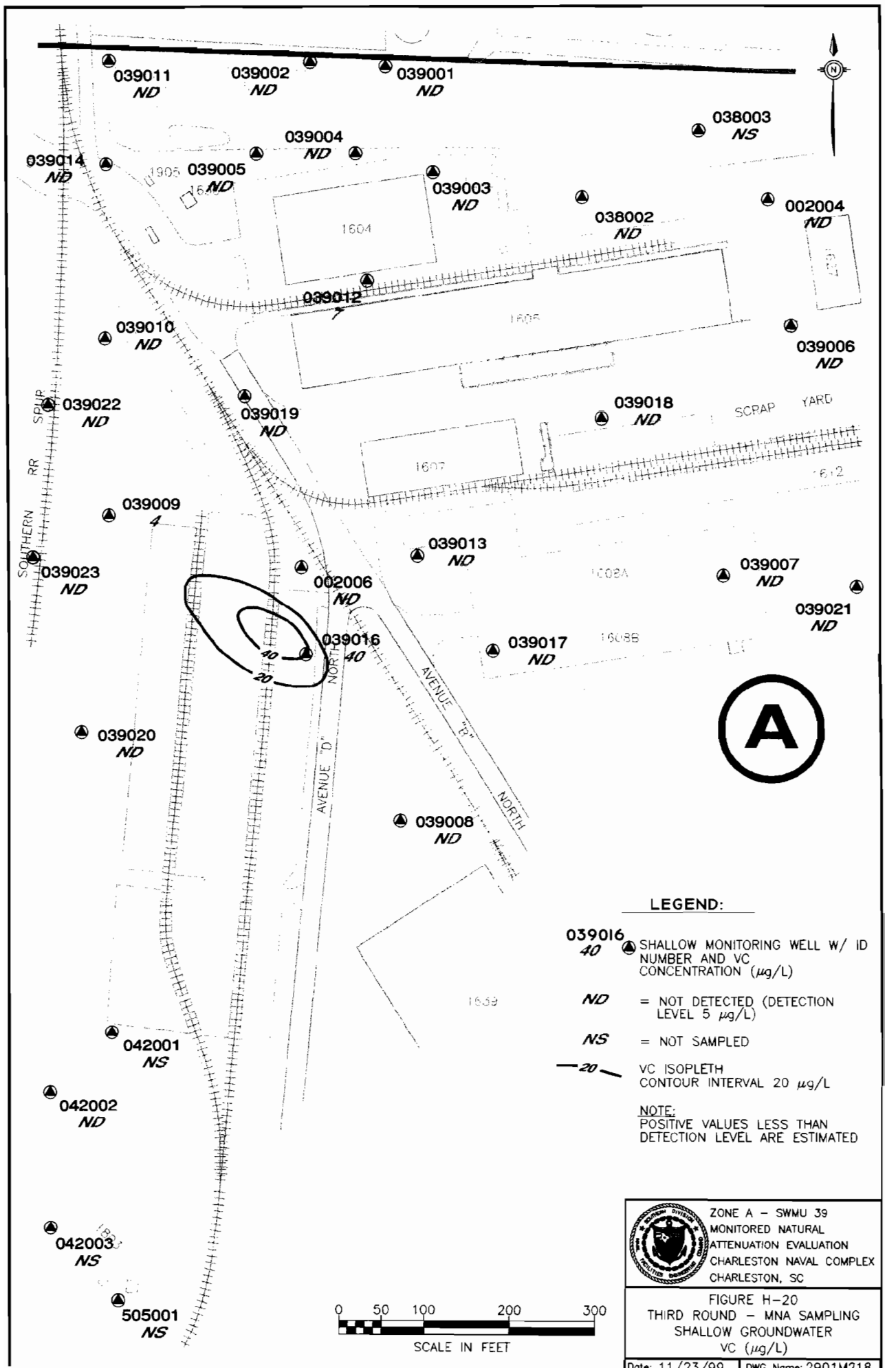
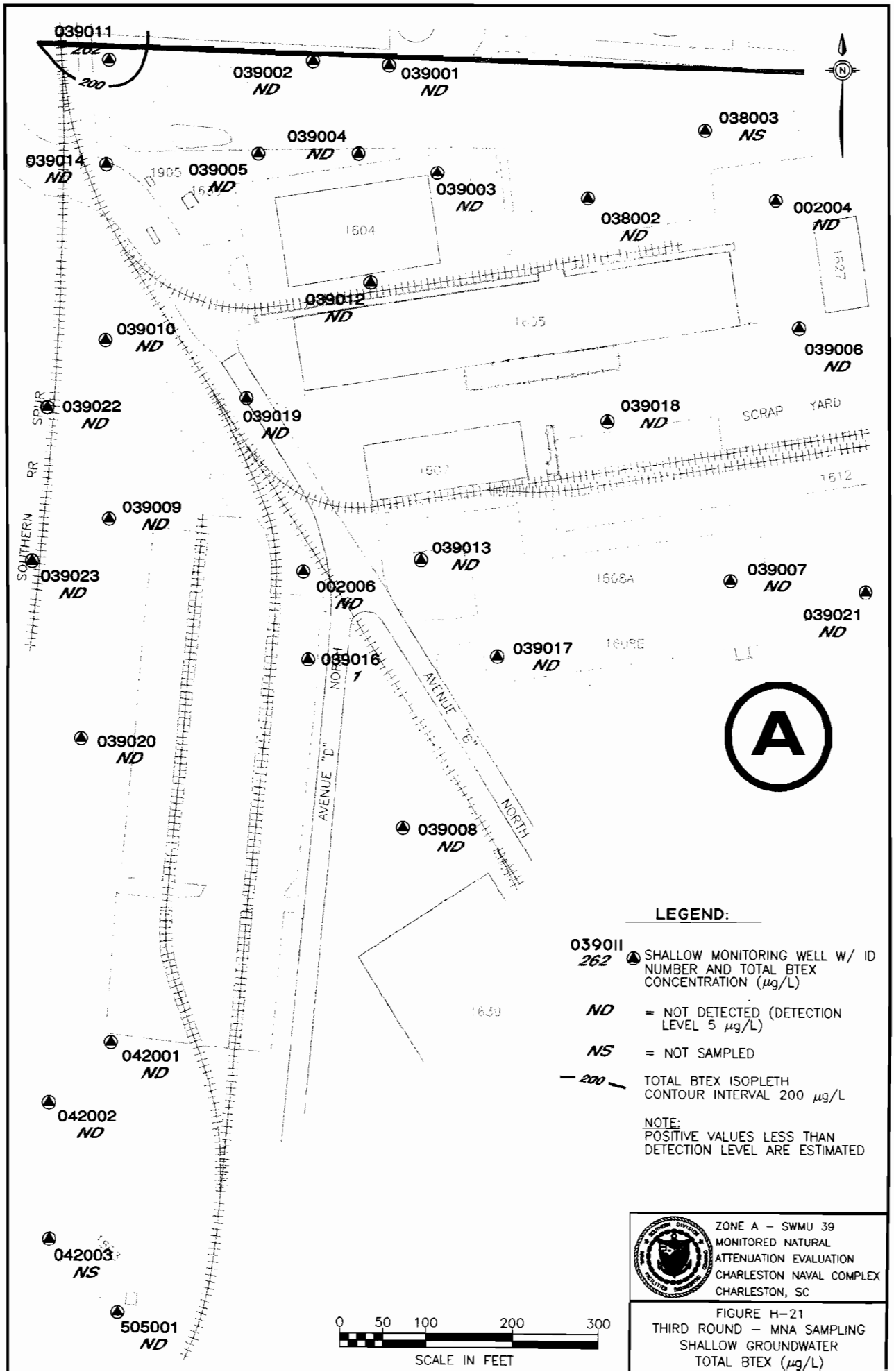
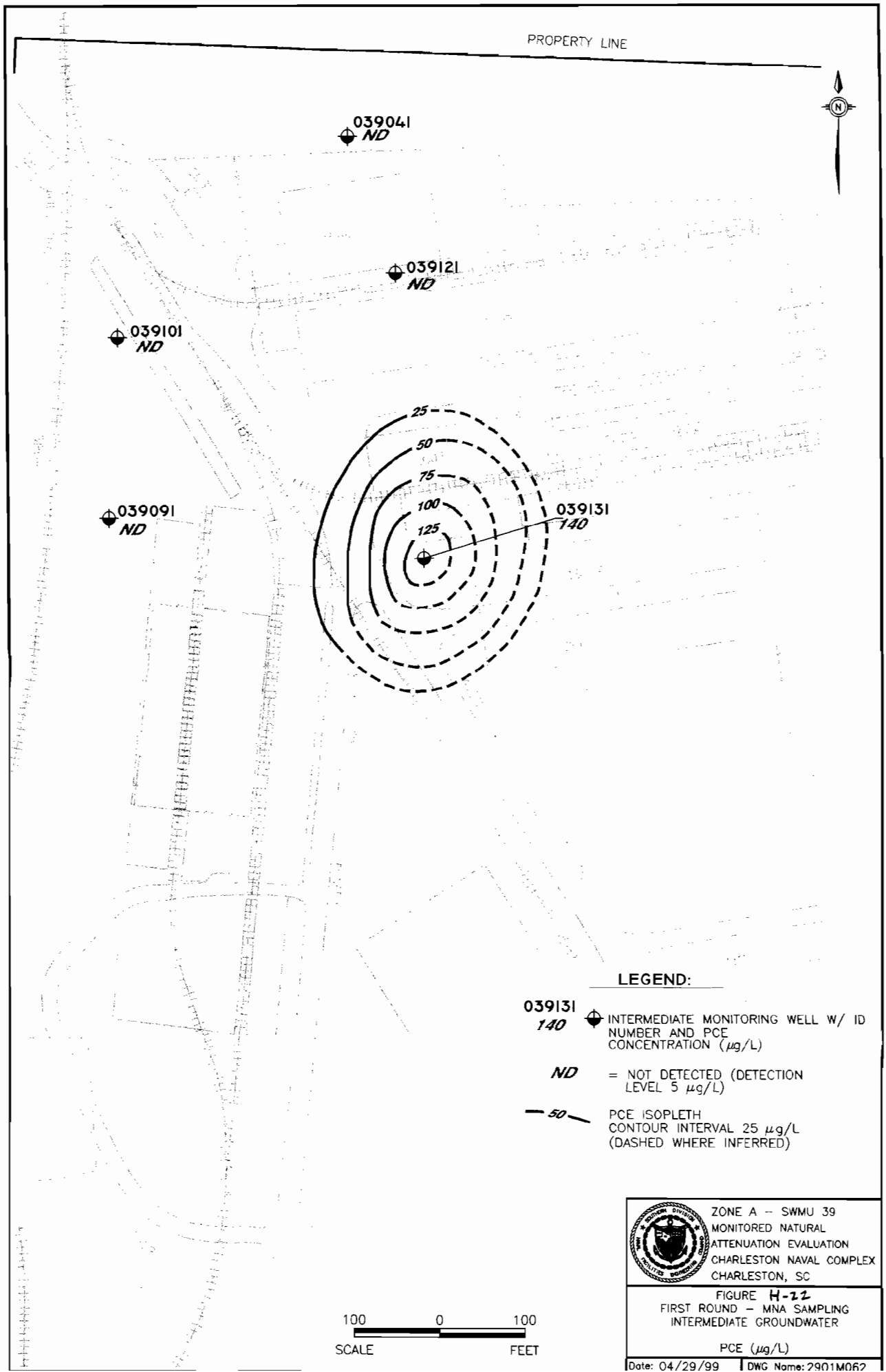


FIGURE H-18
THIRD ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
TCE (µg/L)


039011
ND
039002
ND
039001
ND
038003
NS
039004
5
039014
ND
039005
ND
039003
1
038002
ND
002004
ND
039012
175
039010
ND
039006
ND
039022
ND
039019
ND
039018
10
SCRAP YARD
SOUTHERN RR SPUR
039009
20
039013
15
039023
ND
002006
ND
039007
ND
039021
ND
039017
ND
039020
2
039016
359
AVENUE "D" NORTH
AVENUE "D" NORTH
039008
ND
042001
NS
042002
4
042003
NS
505001
NS
100
200
300
A
LEGEND:
039016
359
SHALLOW MONITORING WELL W/ ID NUMBER AND 1,2-DCE TOTAL CONCENTRATION (µg/L)
ND = NOT DETECTED (DETECTION LEVEL 5 µg/L)
NS = NOT SAMPLED
100
1,2-DCE TOTAL ISOPLETH CONTOUR INTERVAL 100 µg/L
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
0 50 100 200 300
SCALE IN FEET
ZONE A - SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-19
THIRD ROUND - MNA SAMPLING
SHALLOW GROUNDWATER
1,2-DCE TOTAL (µg/L)


039011
ND
039002
ND
039001
ND
038003
NS
039004
ND
039014
ND
039005
ND
039003
ND
038002
ND
002004
ND
1604
039012
7
039010
ND
039006
ND
039022
ND
039019
ND
039018
ND
SCRAP YARD
SOUTHERN RR SPUR
039009
4
039013
ND
039023
ND
002006
ND
039007
ND
039021
ND
039016
40
40
20
039017
ND
NORTH
AVENUE "B"
NORTH
AVENUE "D"
039020
ND
039008
ND
A
LEGEND:
039016
40
SHALLOW MONITORING WELL W/ ID NUMBER AND VC CONCENTRATION (µg/L)
ND = NOT DETECTED (DETECTION LEVEL 5 µg/L)
NS = NOT SAMPLED
20
VC ISOPLETH CONTOUR INTERVAL 20 µg/L
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
042001
NS
042002
ND
042003
NS
505001
NS
0 50 100 200 300
SCALE IN FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-20
THIRD ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
VC (µg/L)
Date: 11/23/99
DWG Name: 2901M218


039011
262
200
039002
ND
039001
ND
038003
NS
039004
ND
039014
ND
039005
ND
039003
ND
038002
ND
002004
ND
1604
039012
ND
039010
ND
039006
ND
039022
ND
039019
ND
039018
ND
SCRAP YARD
SOUTHERN RR SPUR
039009
ND
039013
ND
039023
ND
002006
ND
039007
ND
039021
ND
039016
1
039017
ND
AVENUE "B"
AVENUE "D"
NORTH
A
039020
ND
039008
ND
042001
ND
042002
ND
042003
NS
505001
ND
0 50 100 200 300
SCALE IN FEET
LEGEND:
039011
262
SHALLOW MONITORING WELL W/ ID NUMBER AND TOTAL BTEX CONCENTRATION (µg/L)
ND = NOT DETECTED (DETECTION LEVEL 5 µg/L)
NS = NOT SAMPLED
200
TOTAL BTEX ISOPLETH CONTOUR INTERVAL 200 µg/L
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-21
THIRD ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
TOTAL BTEX (µg/L)

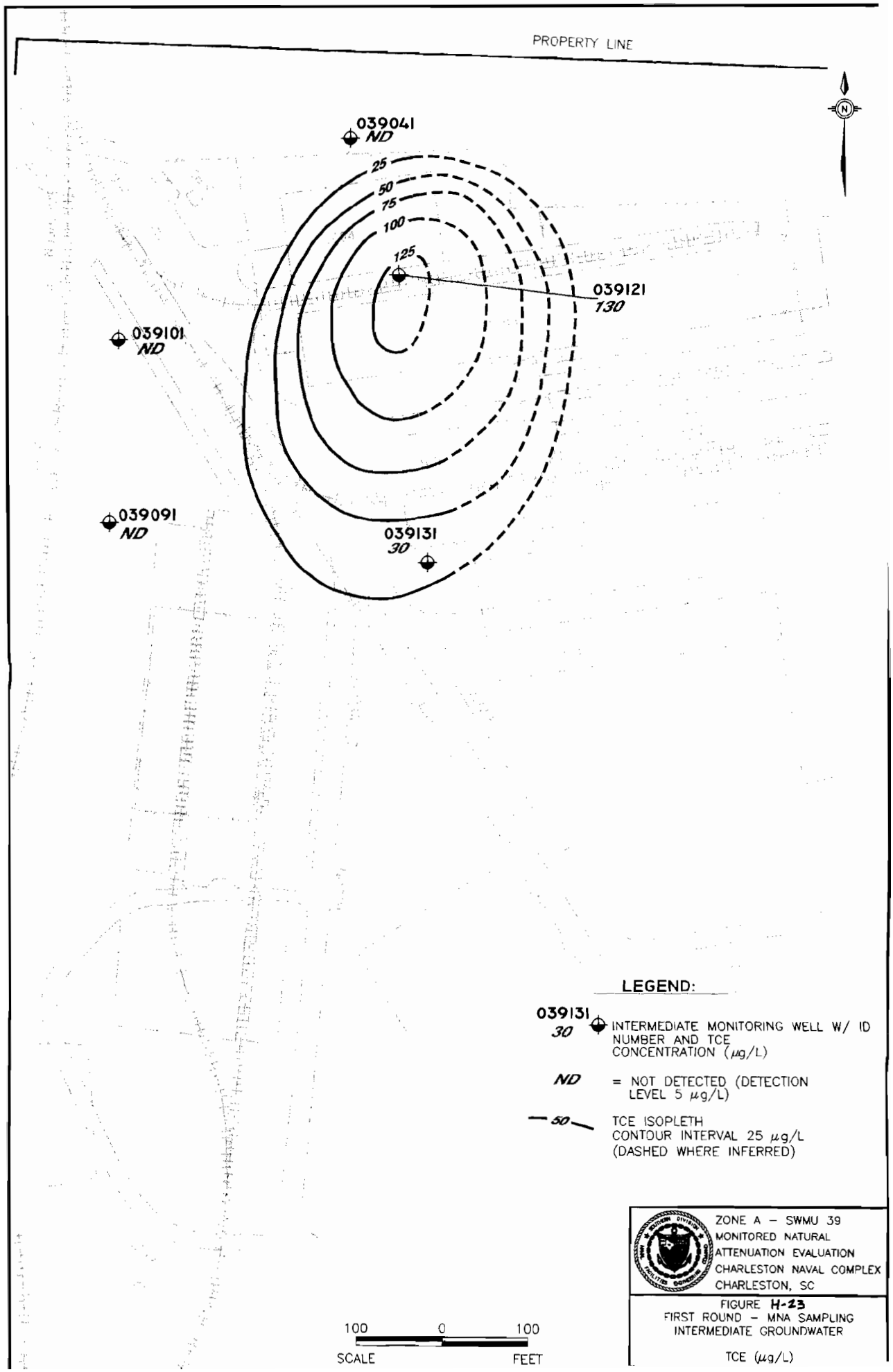


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-22
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

PCE (µg/L)

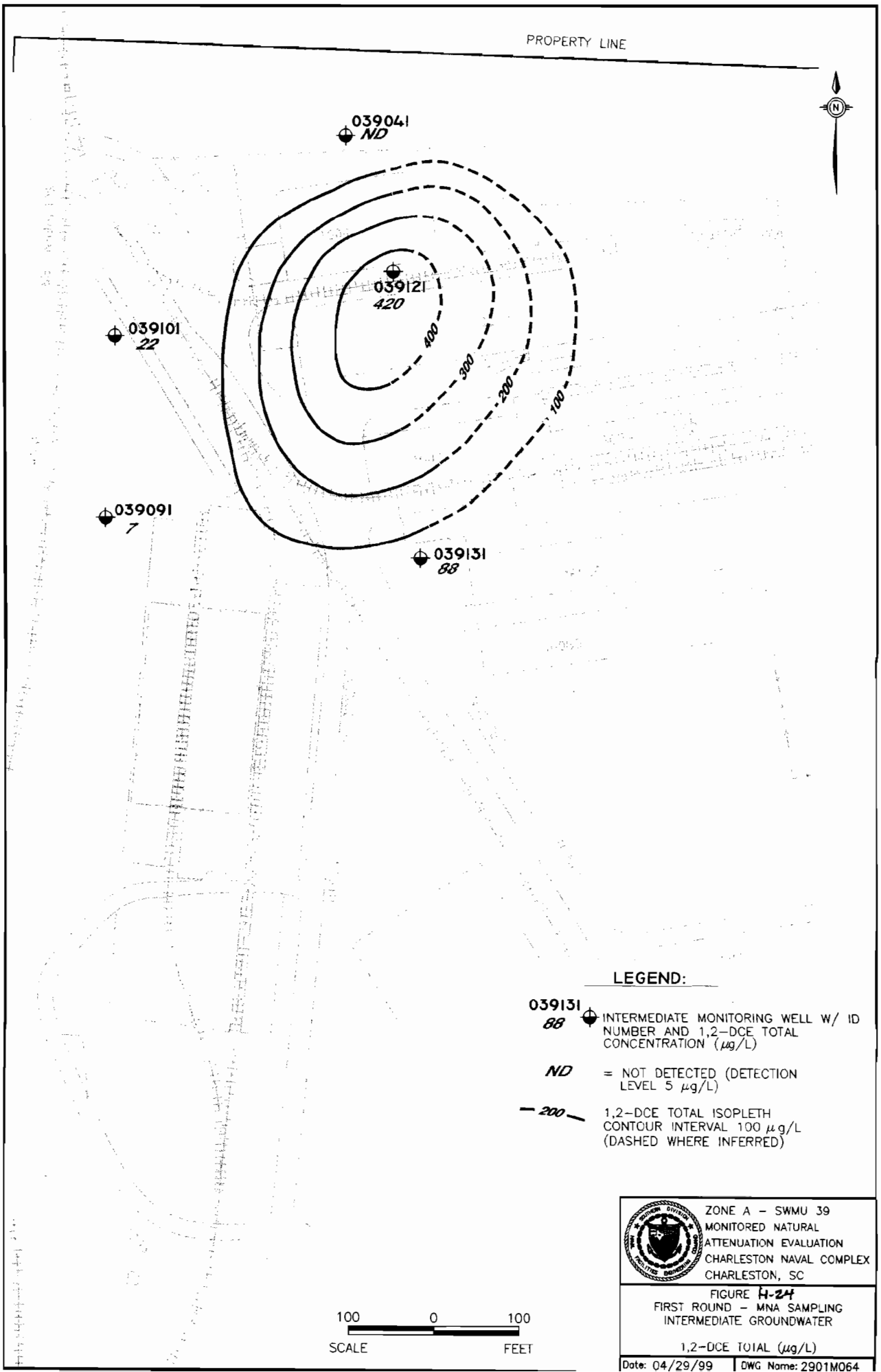
Date: 04/29/99 | DWG Name: 2901M062



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-23
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

TCE (μg/L)

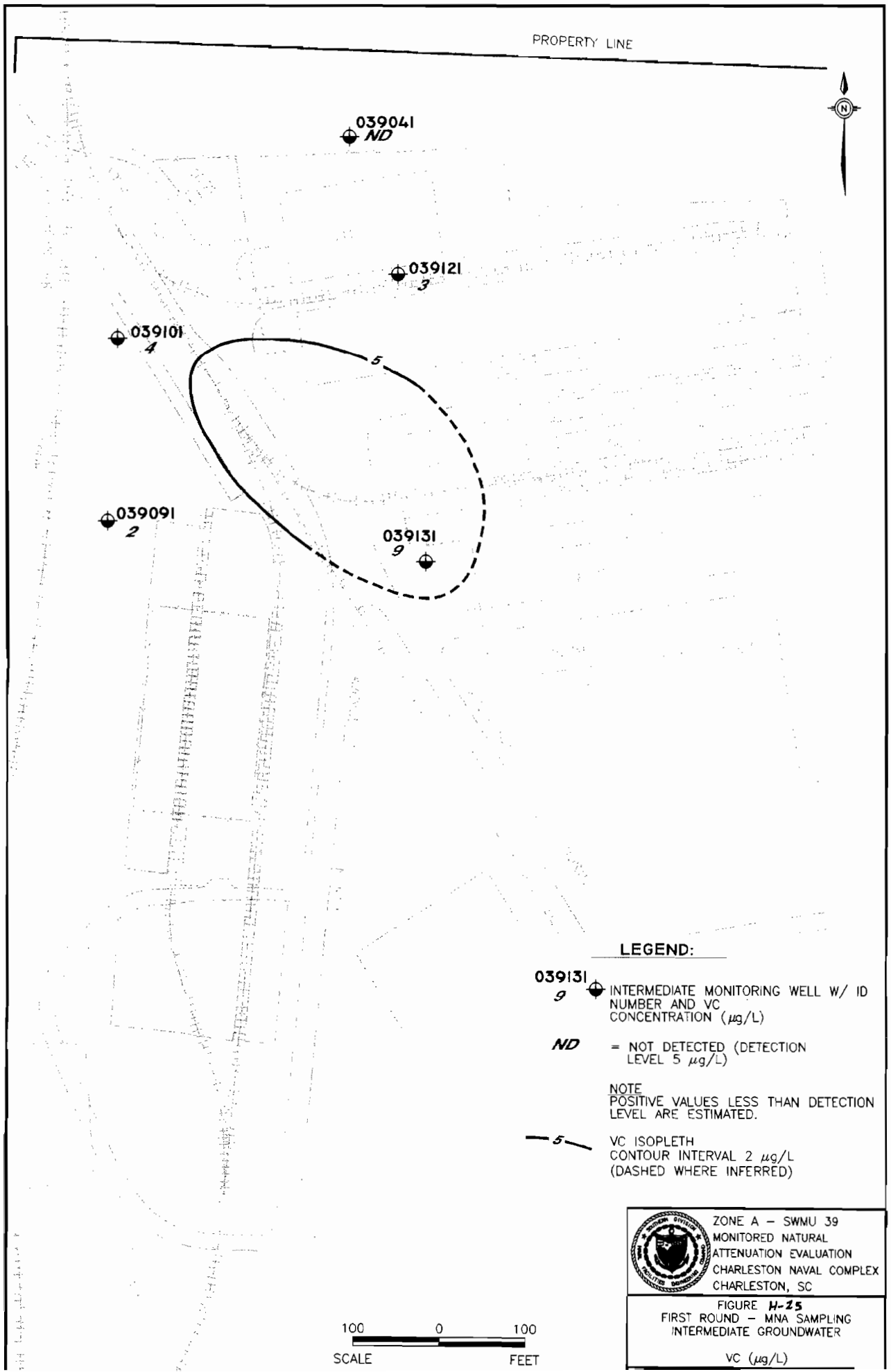


ZONE A - SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-24
FIRST ROUND - MNA SAMPLING
INTERMEDIATE GROUNDWATER

1,2-DCE TOTAL (μg/L)

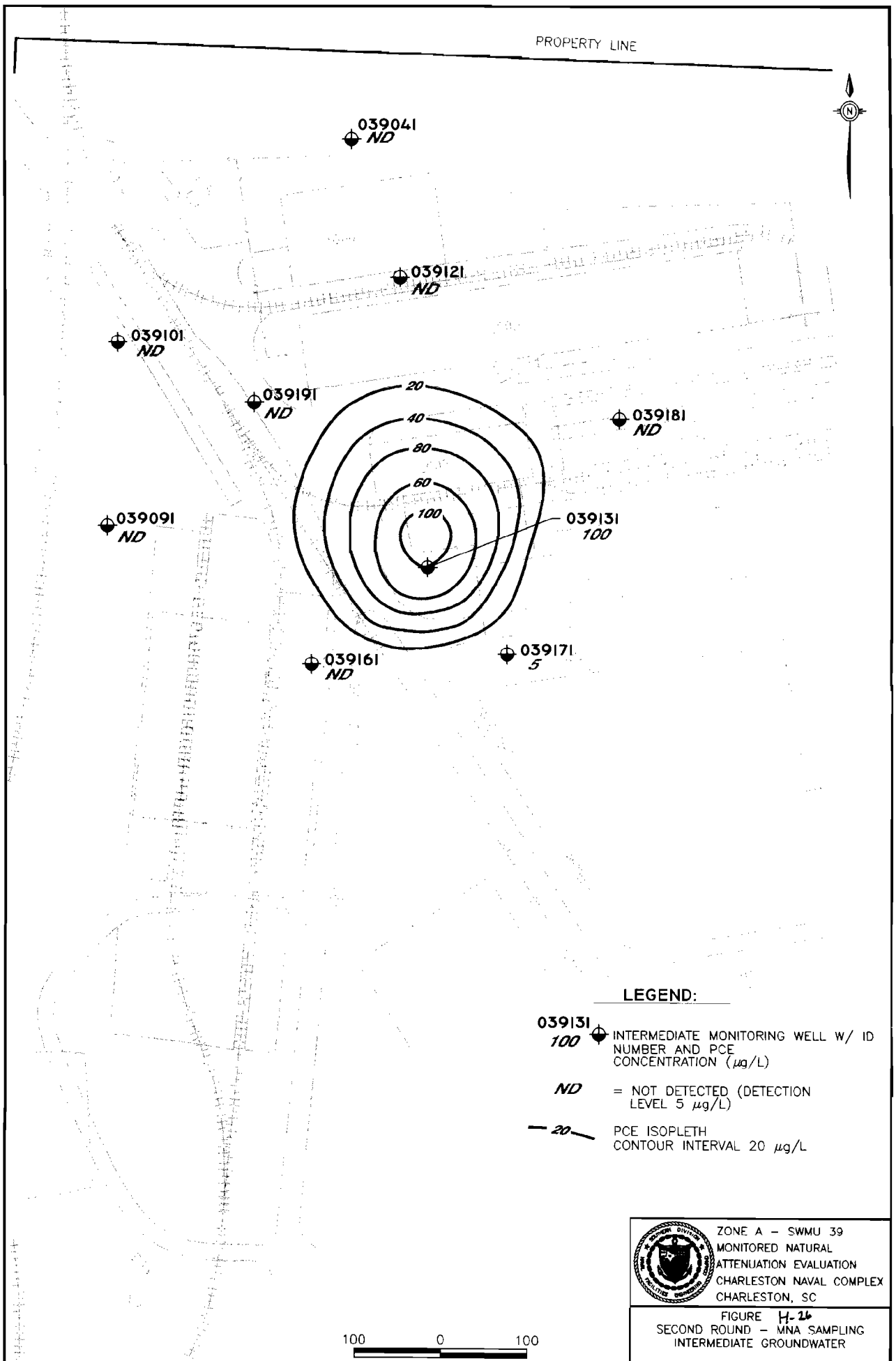
Date: 04/29/99 | DWG Name: 2901M064



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

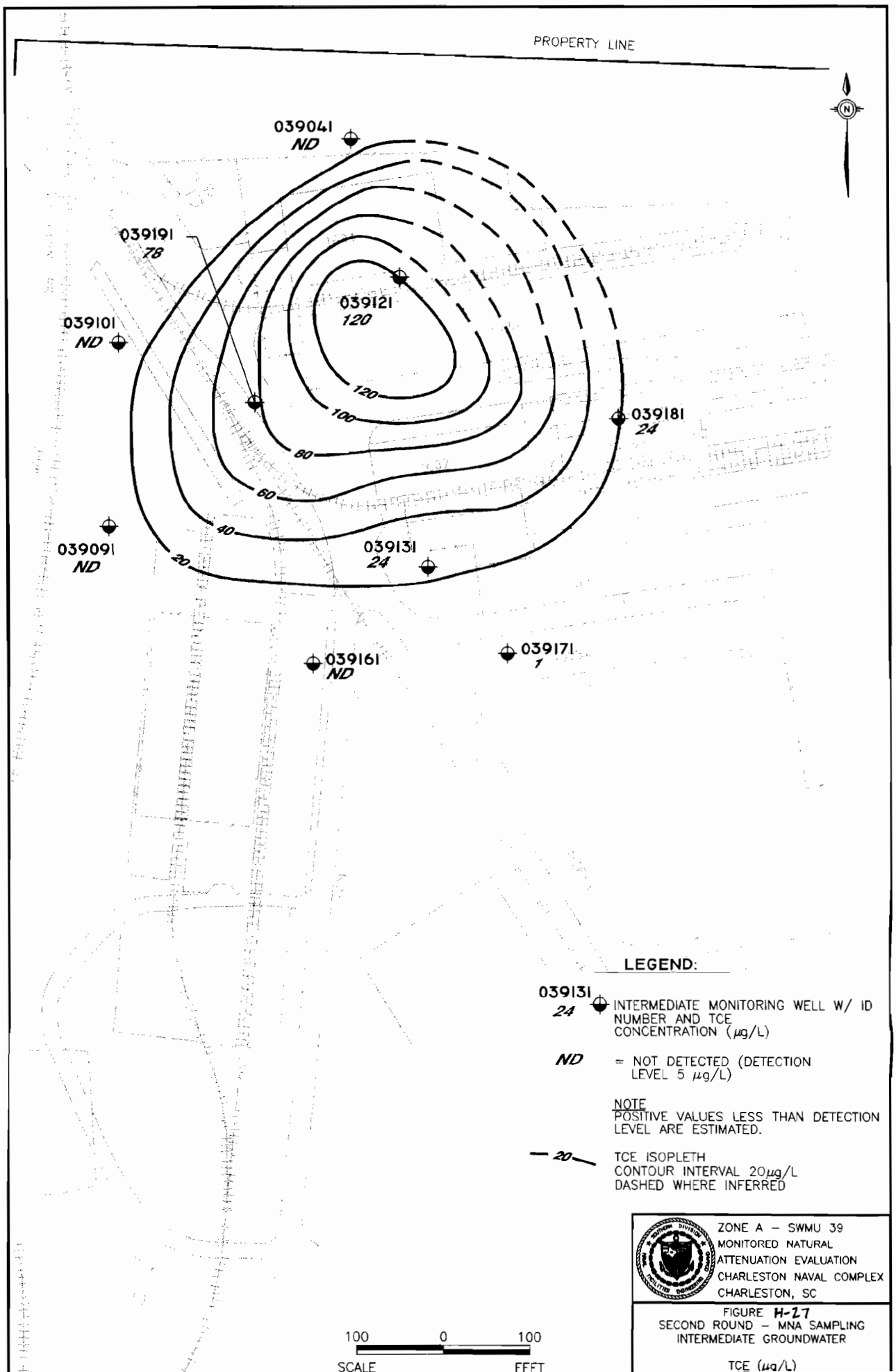
FIGURE H-25
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

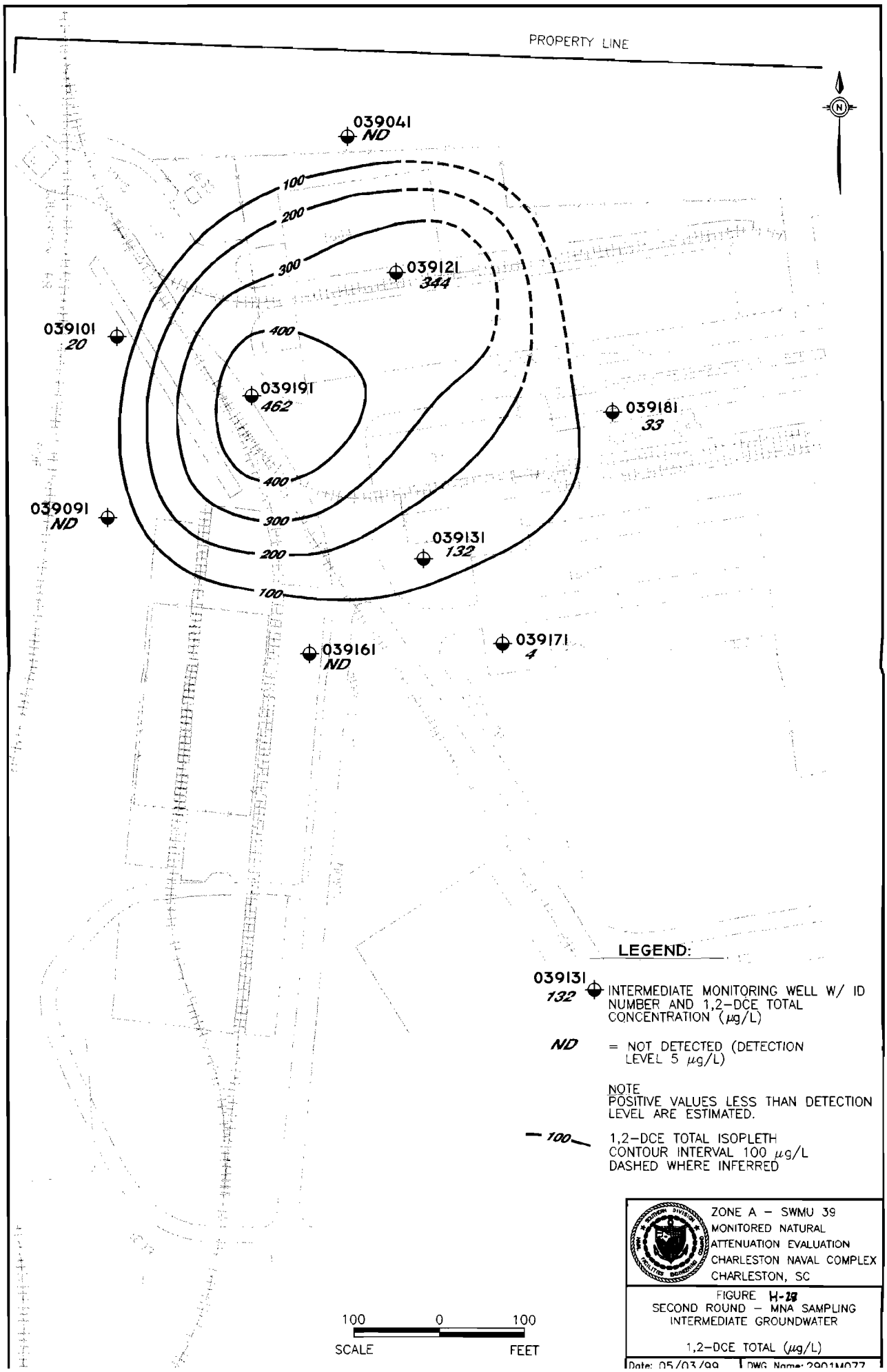
VC (µg/L)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-26
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER


PROPERTY LINE
N
039041
ND
039191
78
039121
120
039101
ND
120
100
80
60
40
20
039181
24
039091
ND
039131
24
039161
ND
039171
1
LEGEND:
039131
24
INTERMEDIATE MONITORING WELL W/ ID NUMBER AND TCE CONCENTRATION (µg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 µg/L)
NOTE
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED.
20
TCE ISOPLETH
CONTOUR INTERVAL 20µg/L
DASHED WHERE INFERRED
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-27
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER
TCE (µg/L)
100
0
100
SCALE
FEET

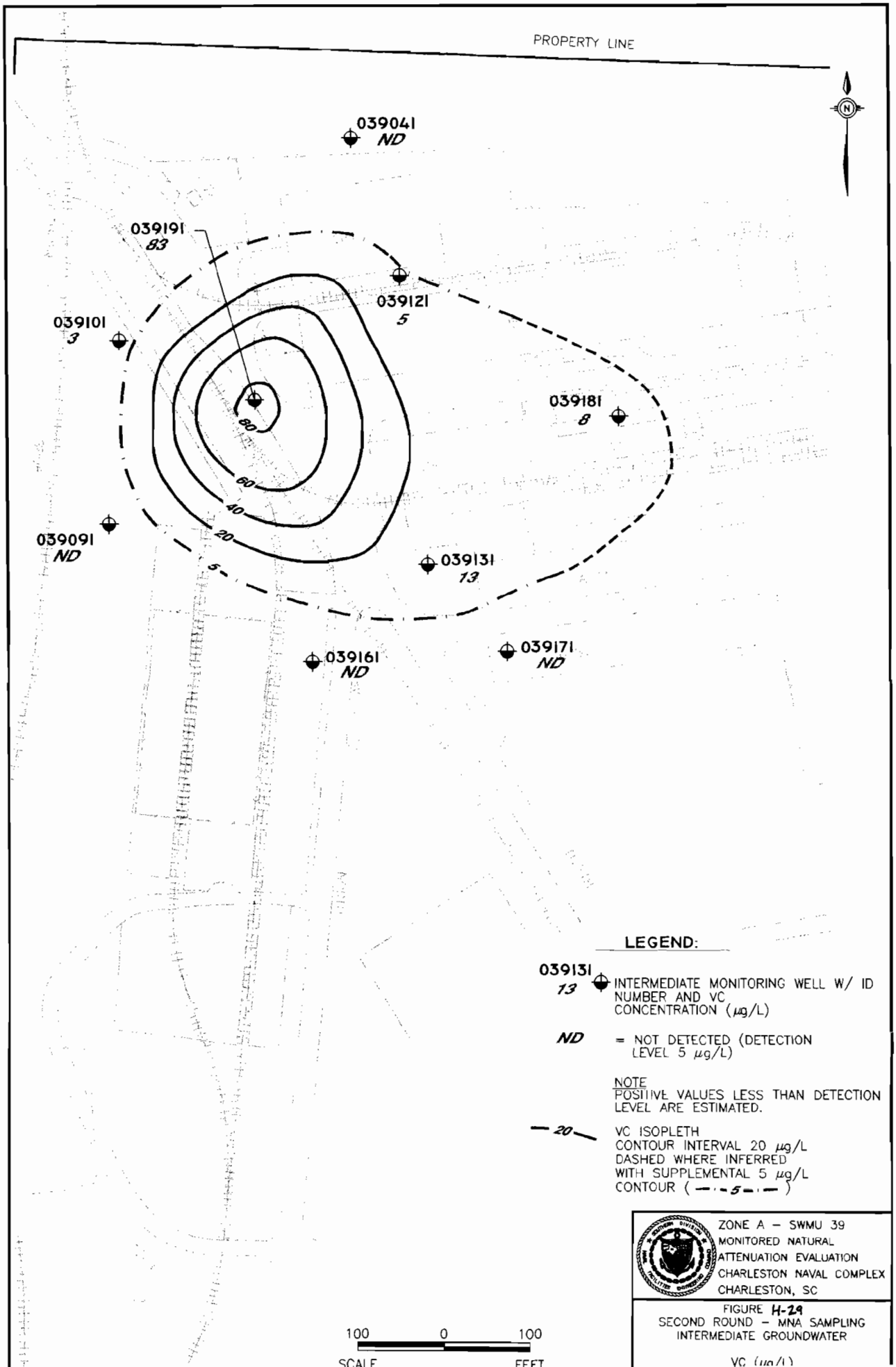


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-28
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

1,2-DCE TOTAL (μg/L)

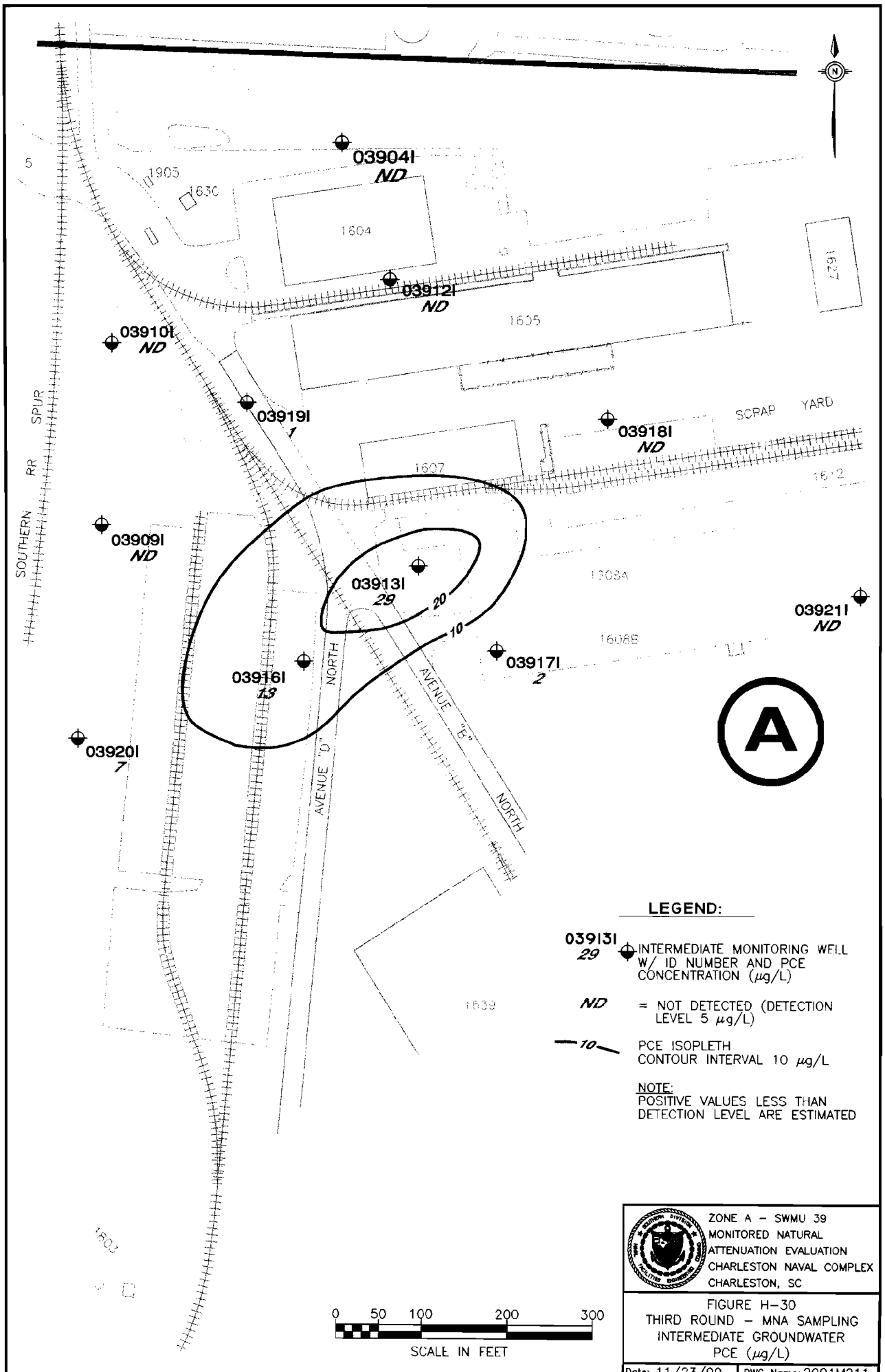
Date: 05/03/99 | DWG Name: 2901M077

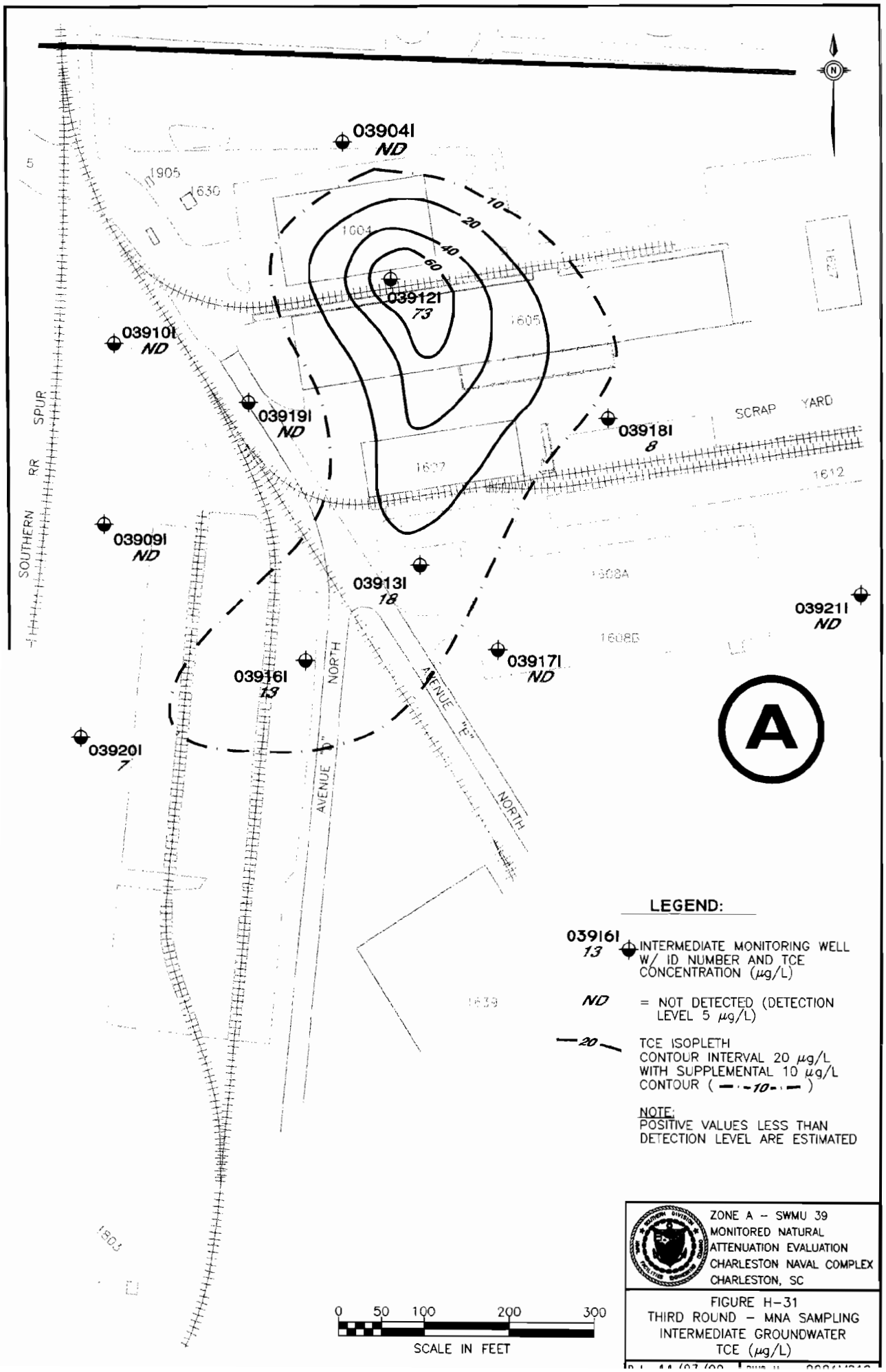


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-29
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

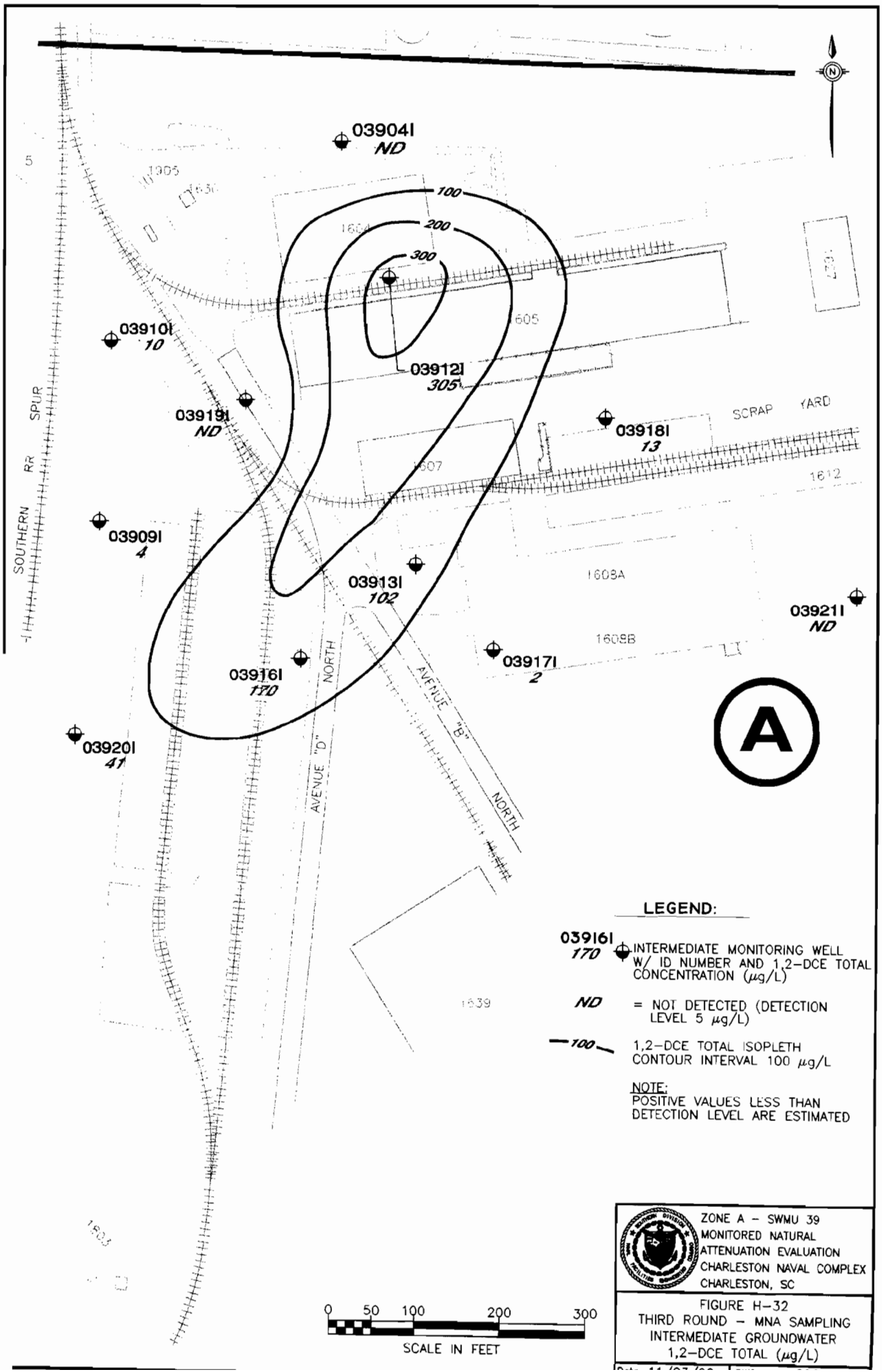
VC (µg/L)


039041
ND
039121
ND
039101
ND
039191
1
039181
ND
039091
ND
039131
29
039161
13
039171
2
039211
ND
039201
7
1905
1630
1604
1605
1627
1607
1608A
1608B
1639
SCRAP YARD
SOUTHERN RR SPUR
AVENUE "D" NORTH
AVENUE "B" NORTH
20
10
A
LEGEND:
039131
29
INTERMEDIATE MONITORING WELL W/ ID NUMBER AND PCE CONCENTRATION (μg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 μg/L)
10
PCE ISOPLETH CONTOUR INTERVAL 10 μg/L
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
0 50 100 200 300
SCALE IN FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-30
THIRD ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER
PCE (μg/L)
Date: 11/23/99
DWG Name: 2901M211



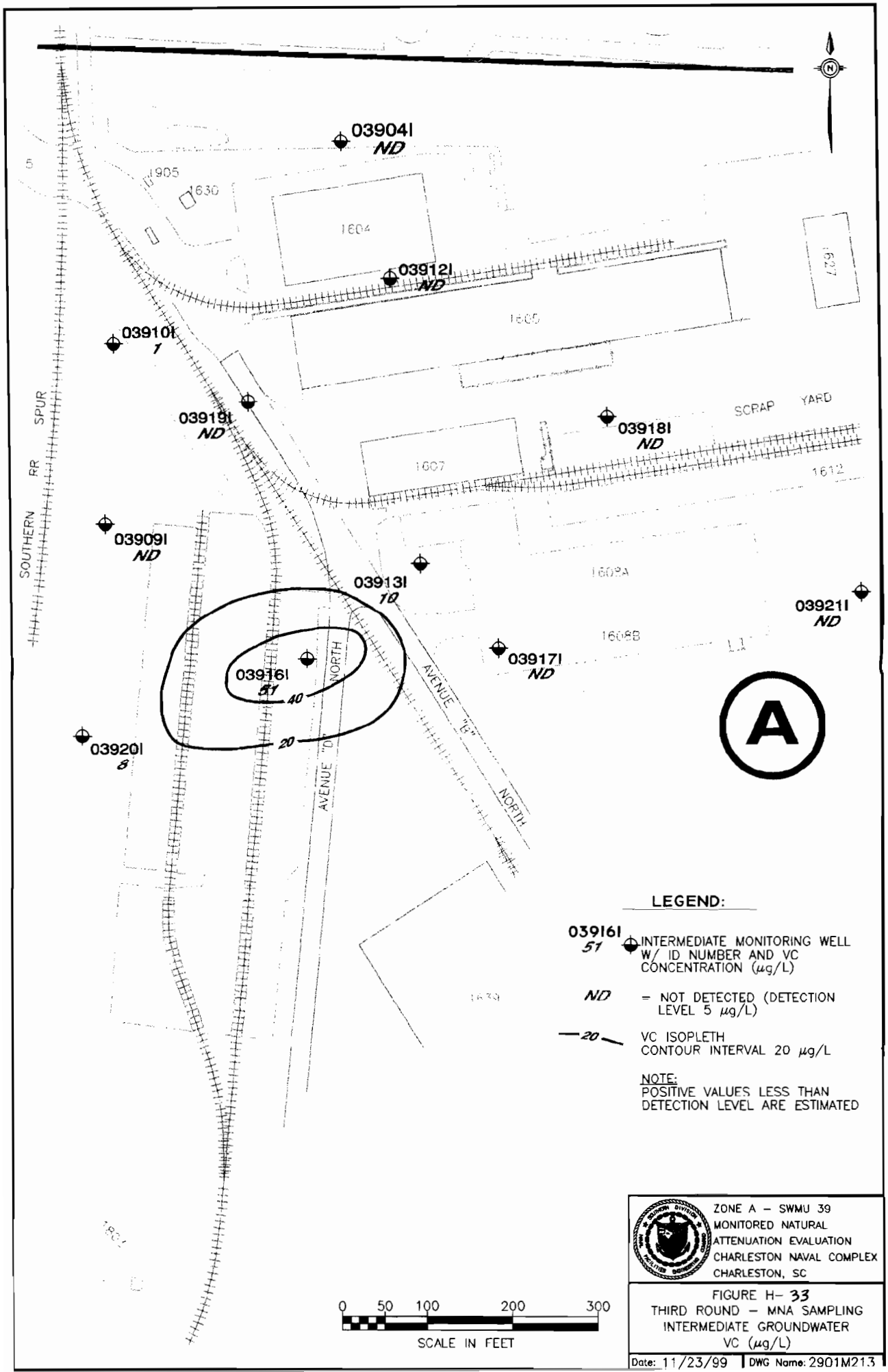
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

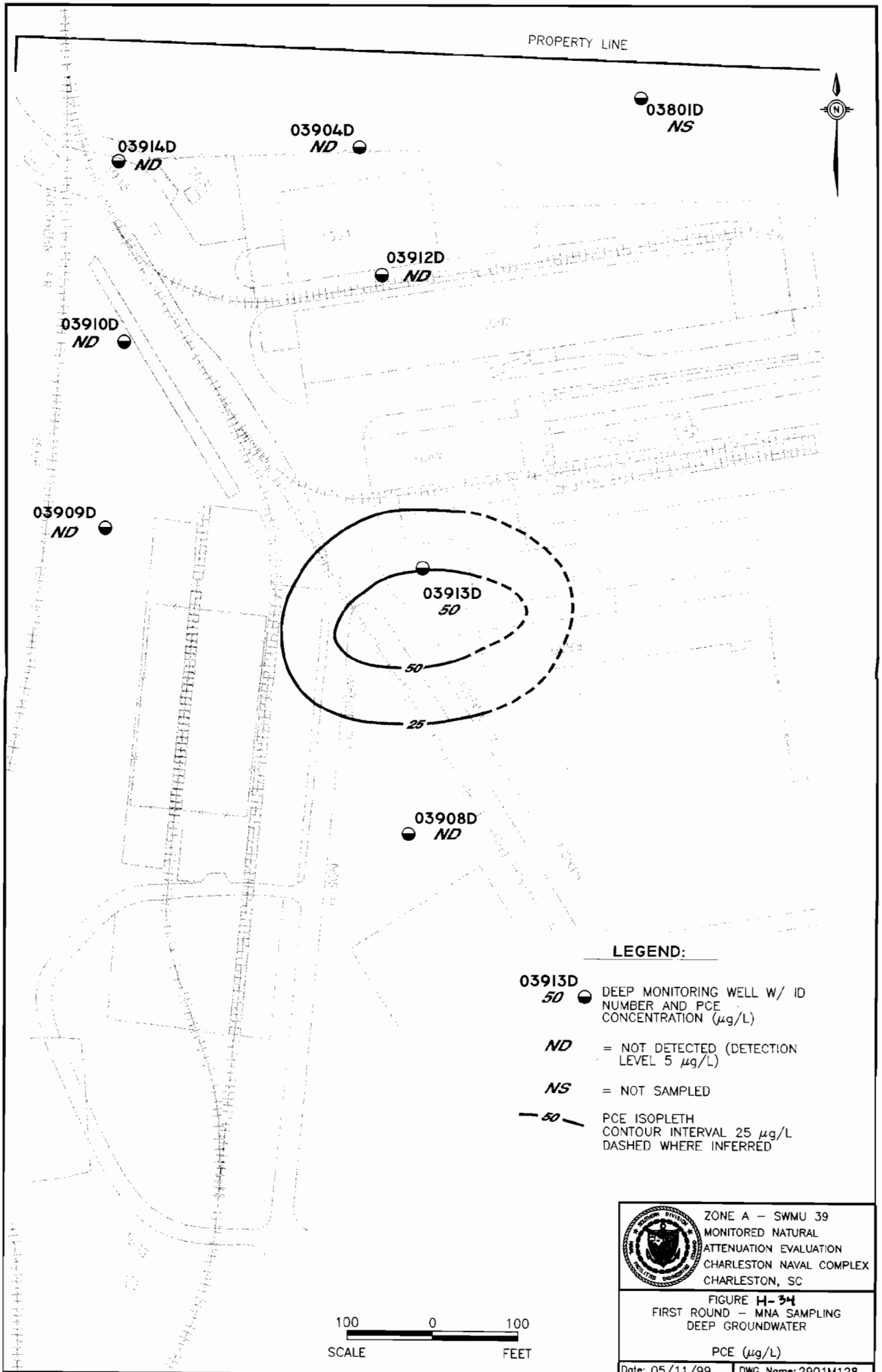
FIGURE H-31
THIRD ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER
TCE (μg/L)



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-32
THIRD ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER
1,2-DCE TOTAL (μg/L)


03904I
ND
1905
1630
1604
03912I
ND
1605
1639
03910I
1
03919I
ND
03918I
ND
SCRAP YARD
1607
1612
SOUTHERN RR SPUR
03909I
ND
1608A
03913I
10
03921I
ND
1608B
03917I
ND
03916I
51
40
20
NORTH AVENUE "D"
AVENUE "E" NORTH
A
03920I
8
LEGEND:
03916I
51
INTERMEDIATE MONITORING WELL W/ ID NUMBER AND VC CONCENTRATION (μg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 μg/L)
20
VC ISOPLETH CONTOUR INTERVAL 20 μg/L
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
0 50 100 200 300
SCALE IN FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H- 33
THIRD ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER
VC (μg/L)
Date: 11/23/99
DWG Name: 2901M213

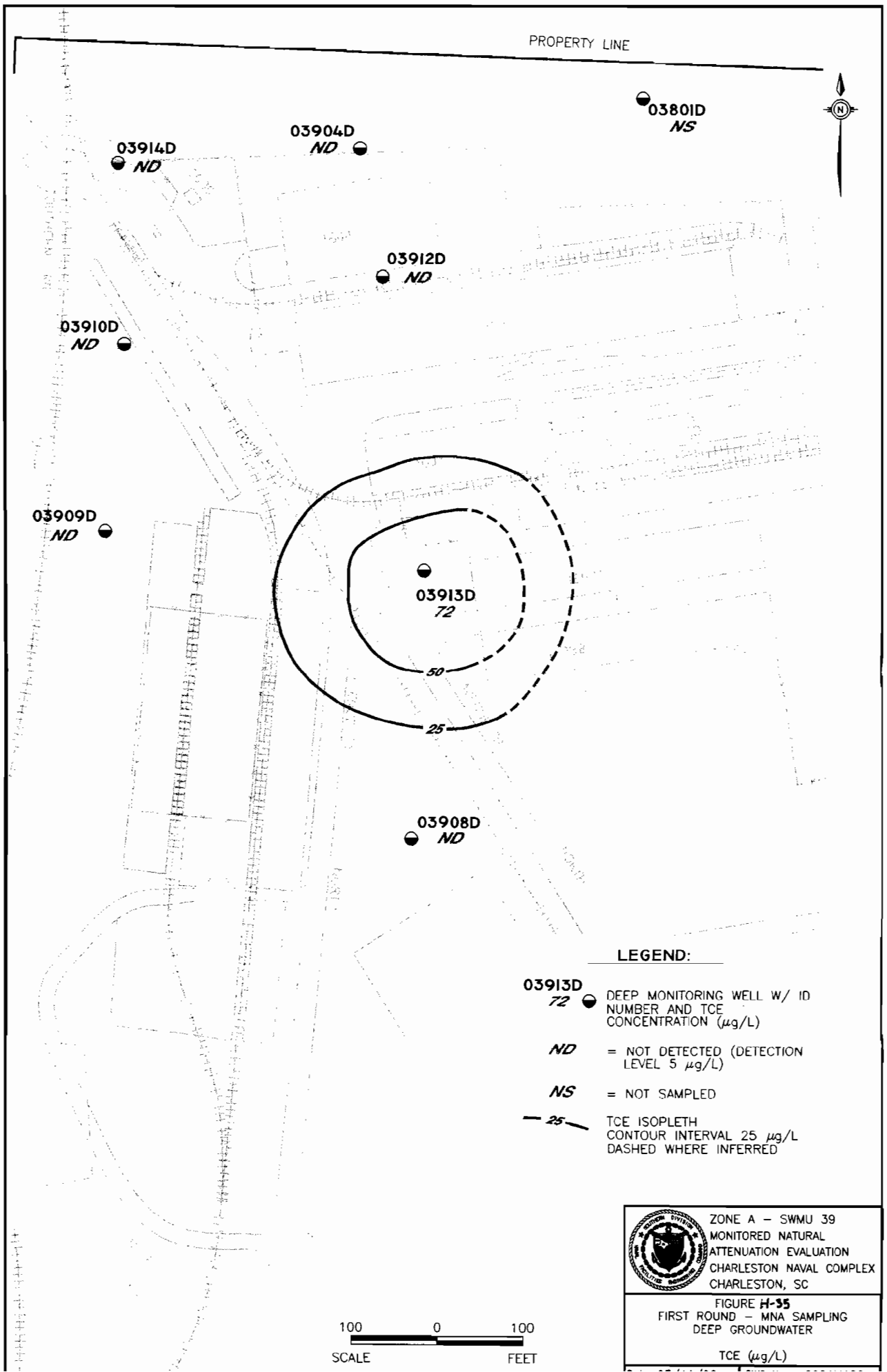


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-34
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

PCE (μg/L)

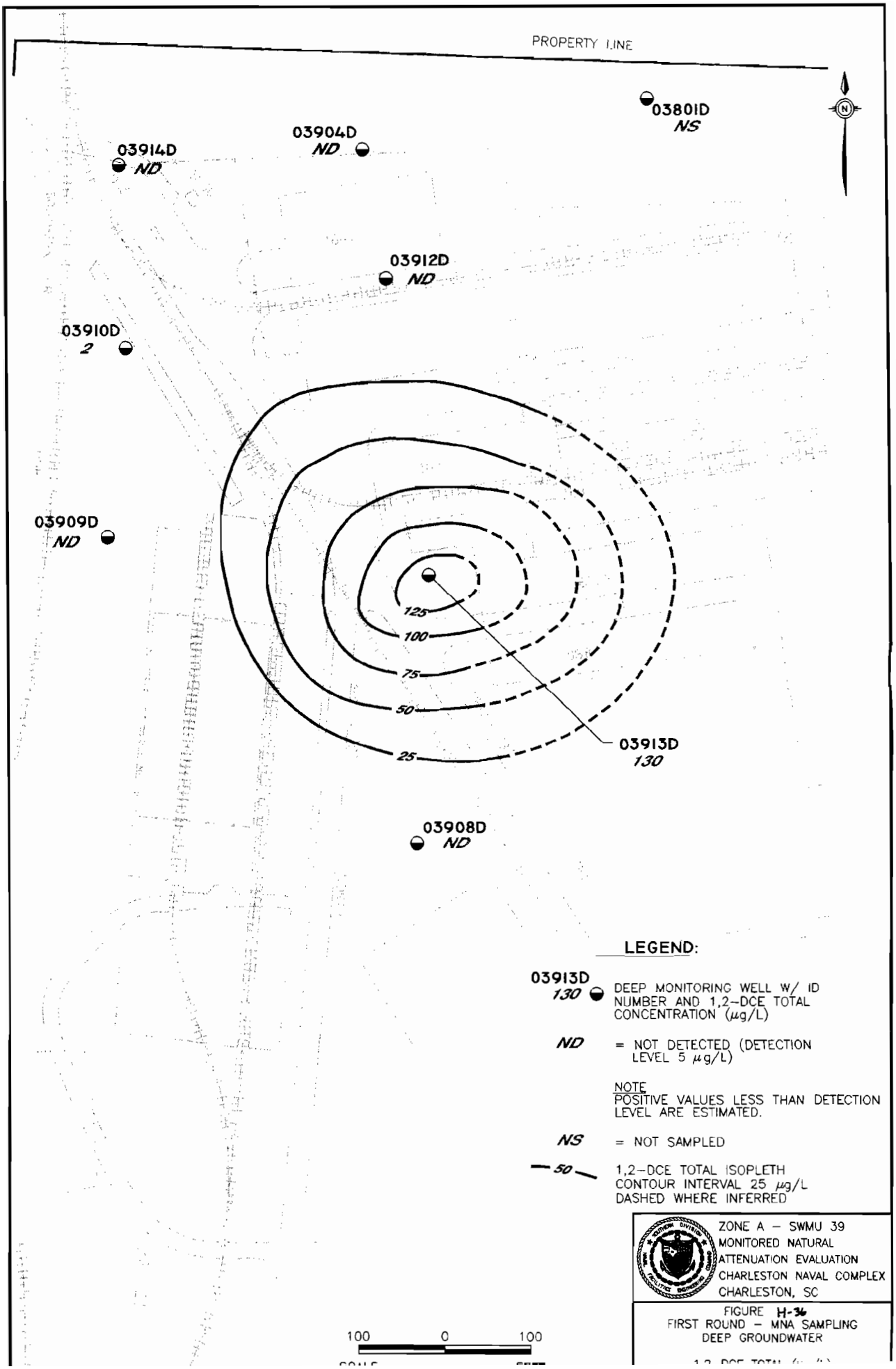
Date: 05/11/99 | DWG Name: 2901M128

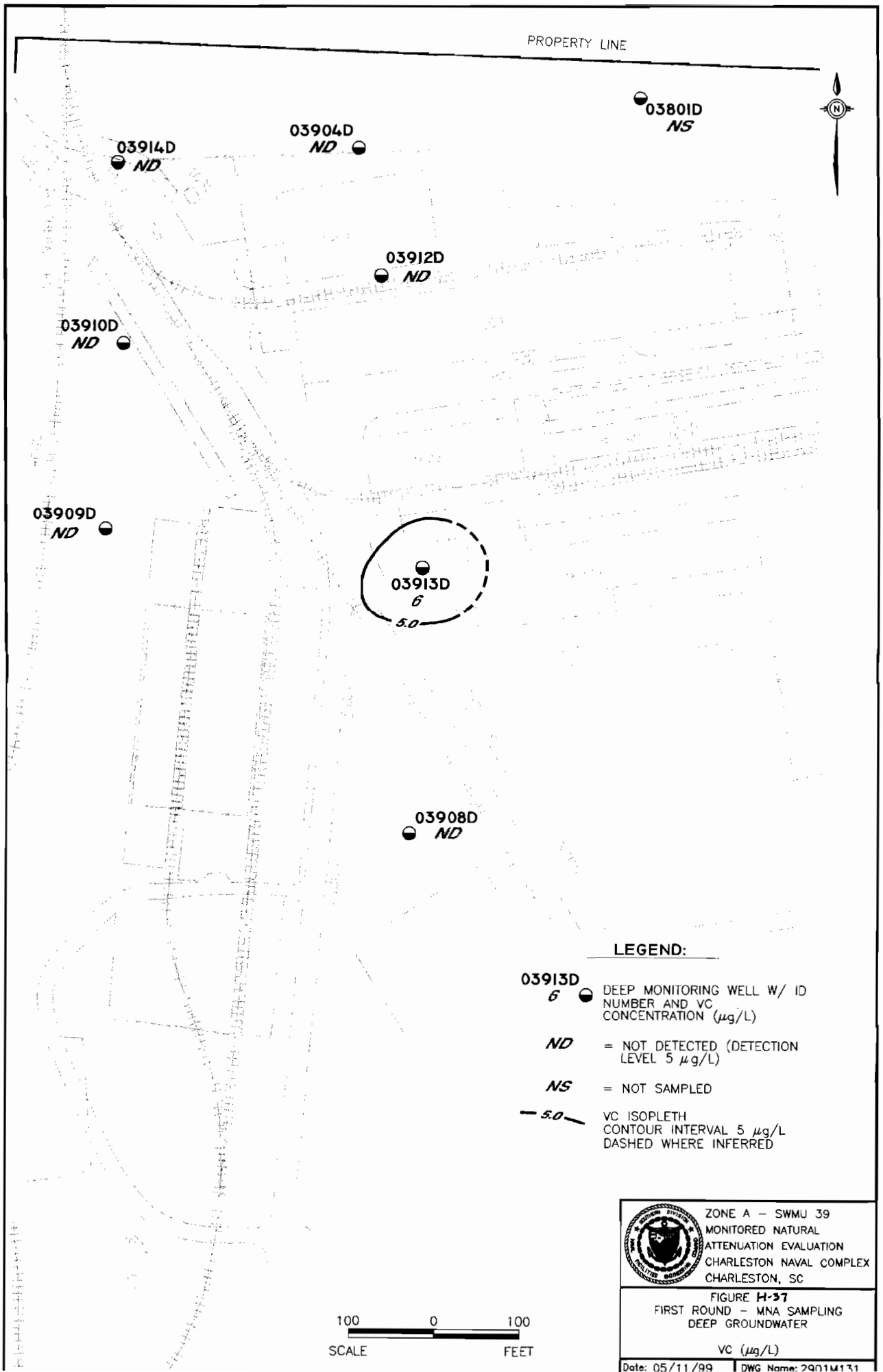


ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-35
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

TCE (μg/L)


PROPERTY LINE
03801D
NS
03904D
ND
03914D
ND
03912D
ND
03910D
2
03909D
ND
125
100
75
50
25
03913D
130
03908D
ND
LEGEND:
03913D
130
DEEP MONITORING WELL W/ ID NUMBER AND 1,2-DCE TOTAL CONCENTRATION (μg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 μg/L)
NOTE
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED.
NS
= NOT SAMPLED
50
1,2-DCE TOTAL ISOPLETH CONTOUR INTERVAL 25 μg/L DASHED WHERE INFERRED
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-36
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER
100
0
100

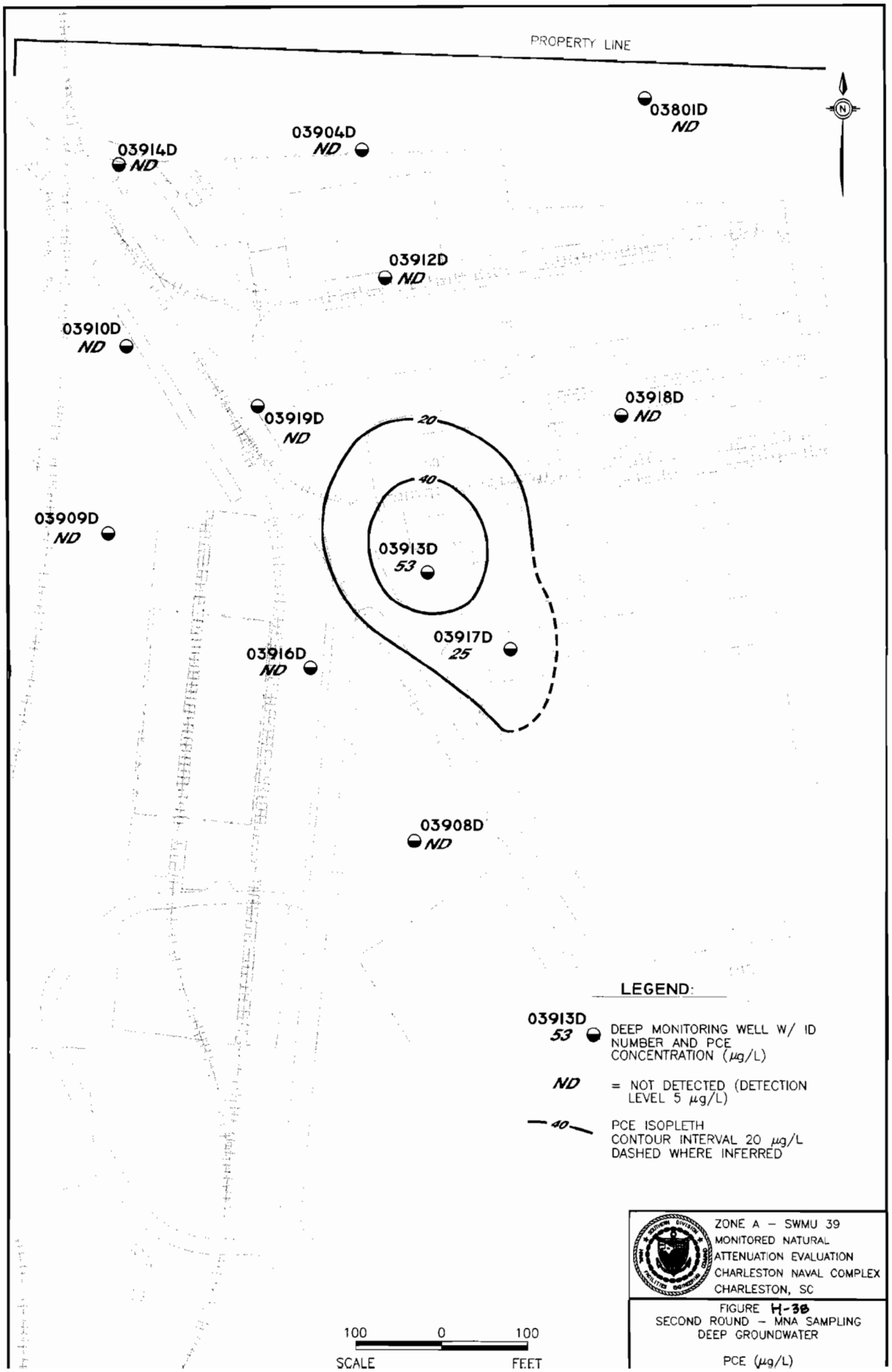


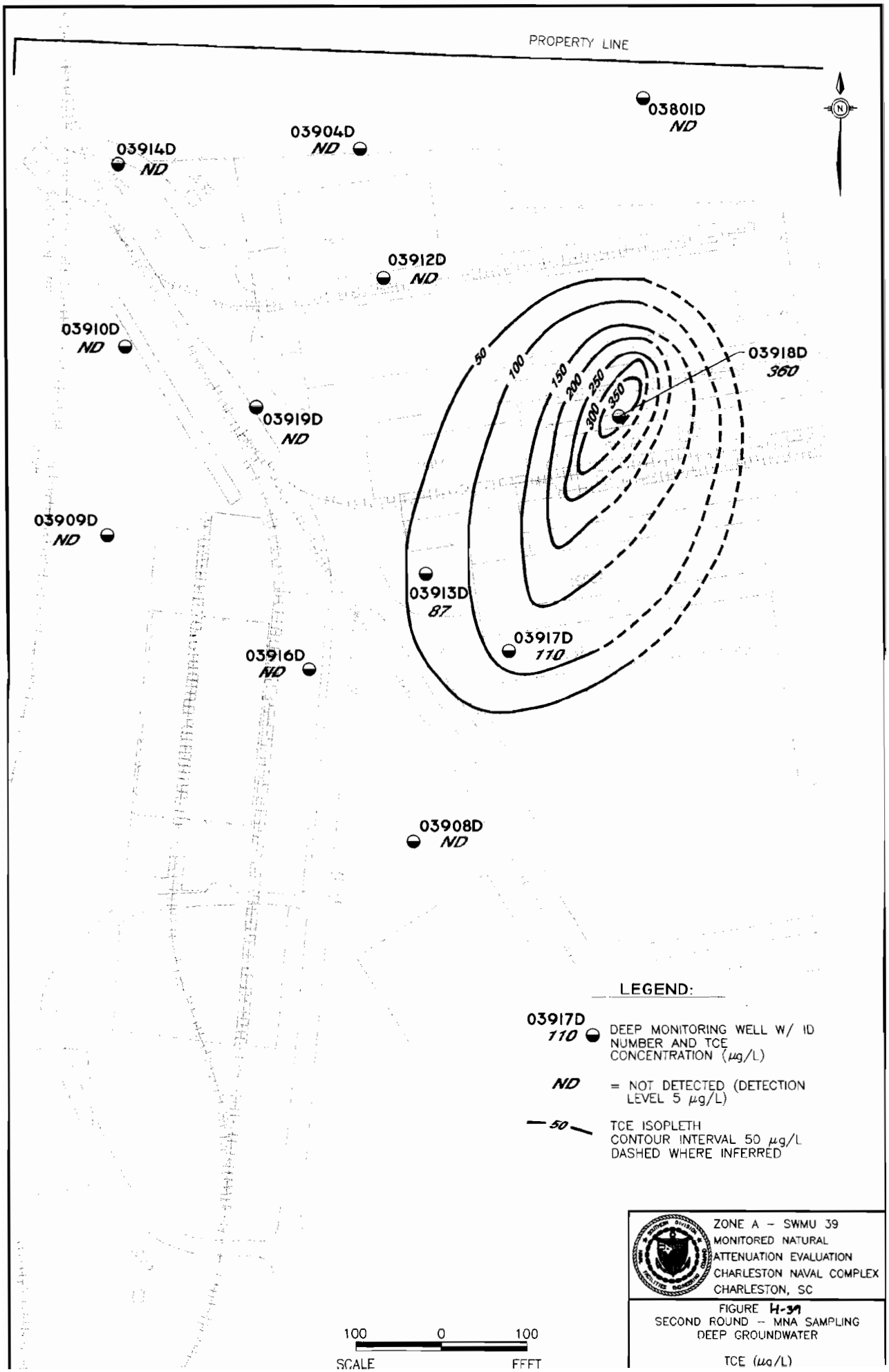
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-37
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

VC (μg/L)

Date: 05/11/99 | DWG Name: 2901M131

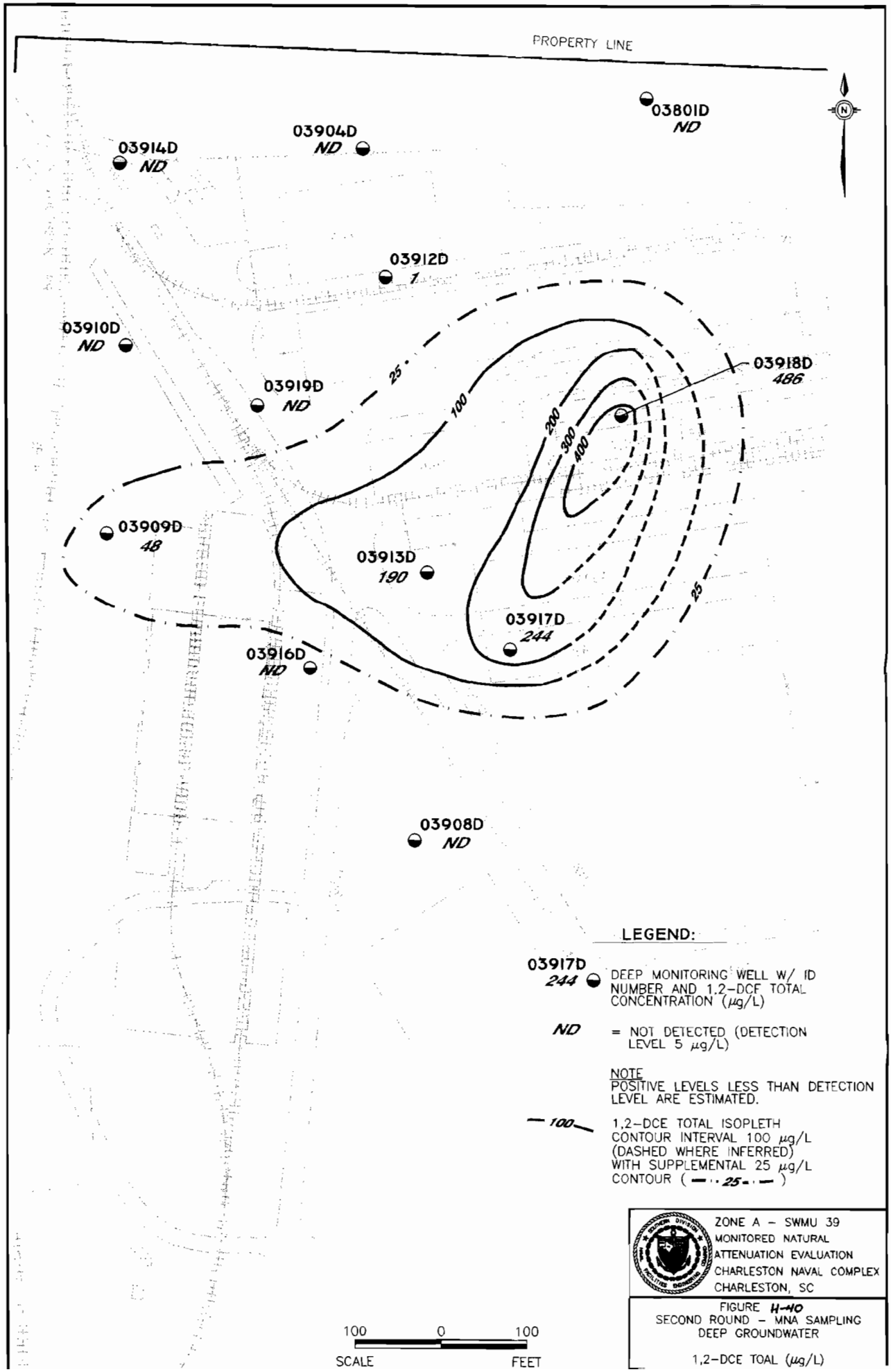

PROPERTY LINE
03801D
ND
03904D
ND
03914D
ND
03912D
ND
03910D
ND
03919D
ND
03918D
ND
20
40
03909D
ND
03913D
53
03917D
25
03916D
ND
03908D
ND
LEGEND:
03913D
53
DEEP MONITORING WELL W/ ID NUMBER AND PCE CONCENTRATION (μg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 μg/L)
40
PCE ISOPLETH CONTOUR INTERVAL 20 μg/L DASHED WHERE INFERRED
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-38
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER
PCE (μg/L)

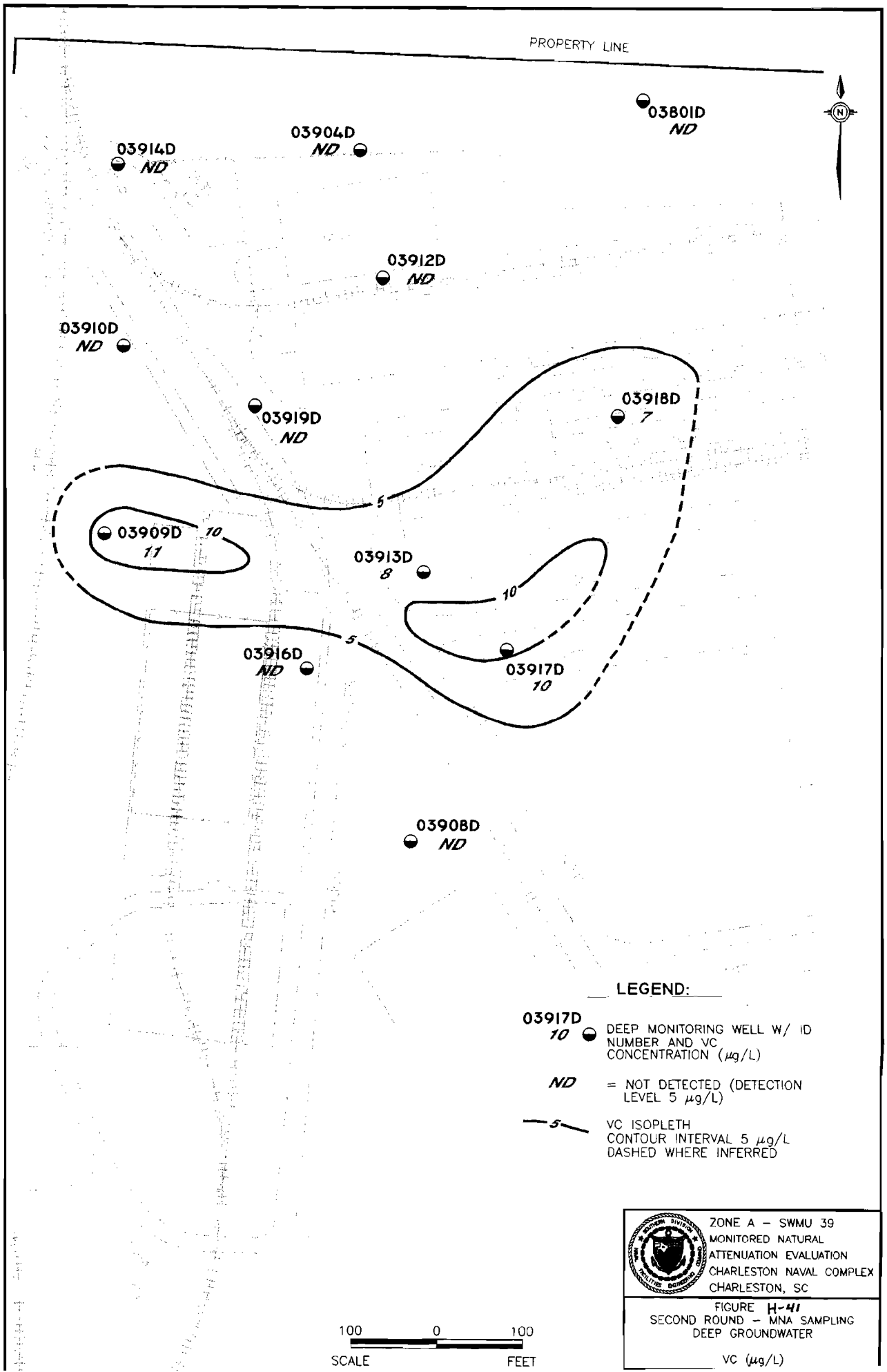


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-39
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

TCE (µg/L)

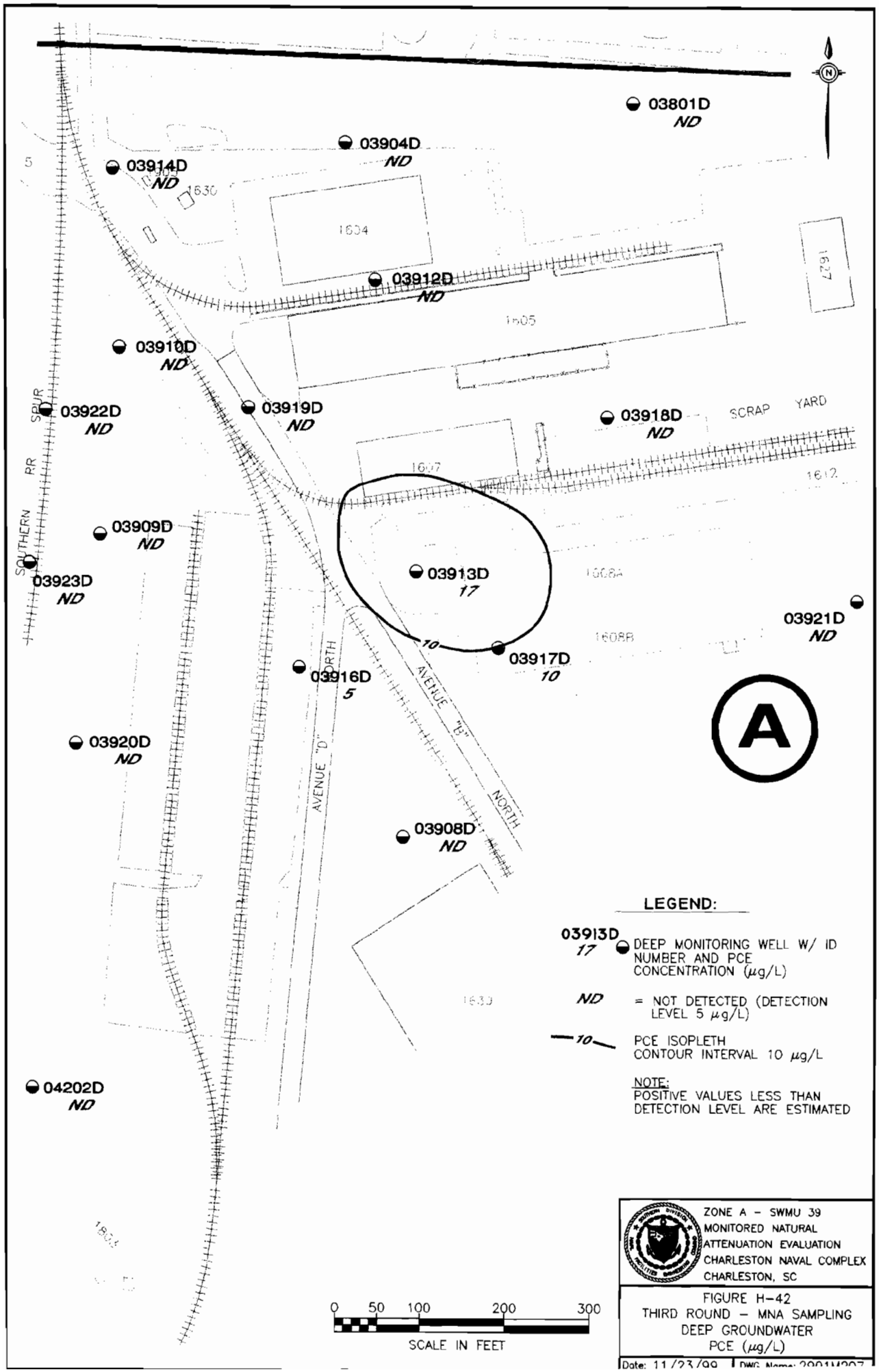

PROPERTY LINE
03801D
ND
03904D
ND
03914D
ND
03912D
1
03910D
ND
03919D
ND
03918D
486
25
100
200
300
400
25
03909D
48
03913D
190
03917D
244
03916D
ND
03908D
ND
LEGEND:
03917D
244
DEEP MONITORING WELL W/ ID NUMBER AND 1,2-DCE TOTAL CONCENTRATION (μg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 μg/L)
NOTE
POSITIVE LEVELS LESS THAN DETECTION LEVEL ARE ESTIMATED.
100
1,2-DCE TOTAL ISOPLETH CONTOUR INTERVAL 100 μg/L (DASHED WHERE INFERRED) WITH SUPPLEMENTAL 25 μg/L CONTOUR (25)
ZONE A - SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-40
SECOND ROUND - MNA SAMPLING
DEEP GROUNDWATER
1,2-DCE TOAL (μg/L)
100
0
100
SCALE
FEET

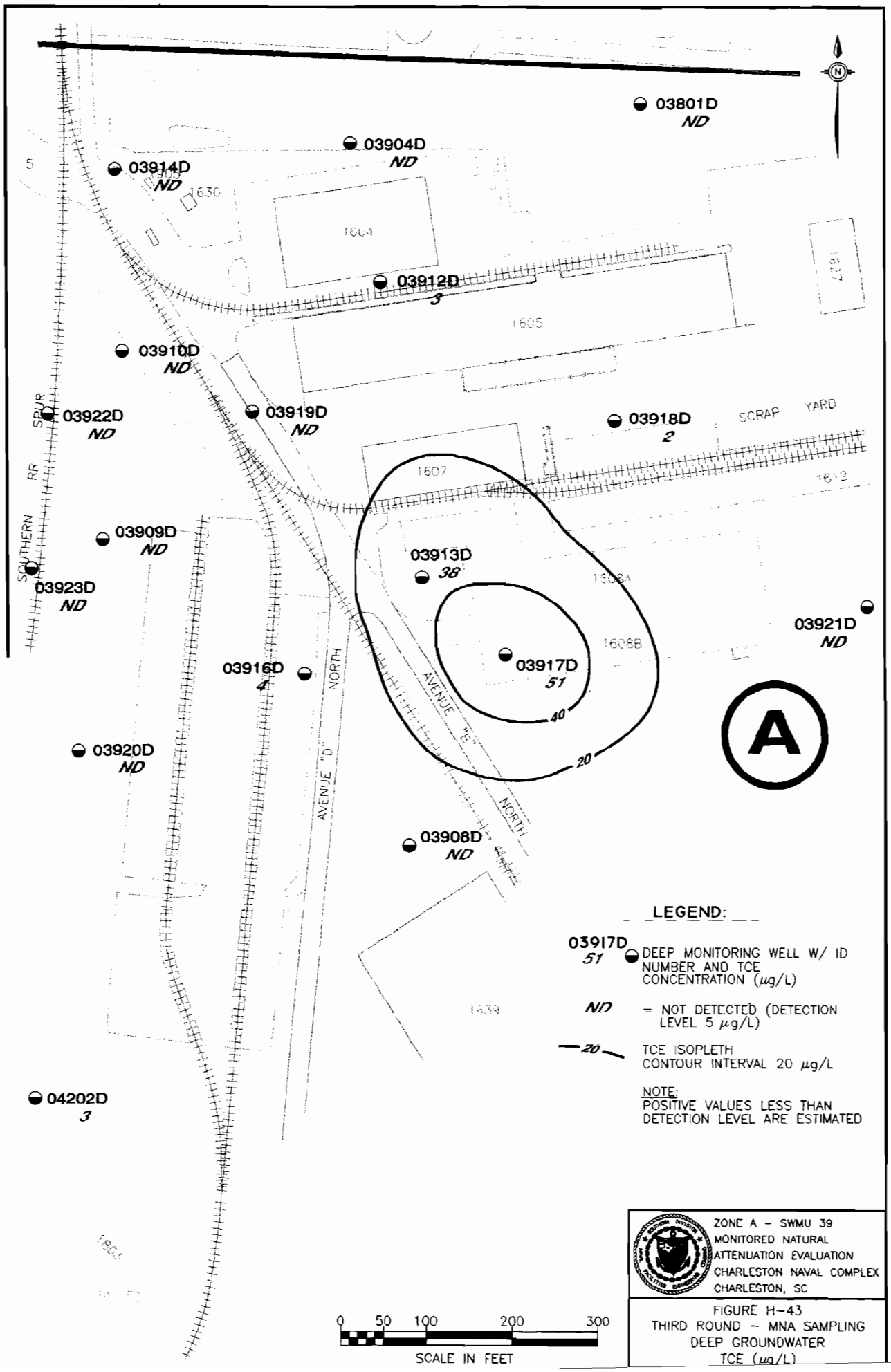


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-41
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

VC (μg/L)


03801D
ND
03904D
ND
03914D
ND
1630
1604
03912D
ND
1627
1605
03910D
ND
03922D
ND
03919D
ND
03918D
ND
SCRAP YARD
1607
1612
SOUTHERN RR SPUR
03909D
ND
03923D
ND
03913D
17
1608A
03921D
ND
1608B
10
03917D
10
03916D
5
AVENUE "D" NORTH
AVENUE "B" NORTH
A
03920D
ND
03908D
ND
LEGEND:
03913D
17
DEEP MONITORING WELL W/ ID NUMBER AND PCE CONCENTRATION (µg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 µg/L)
10
PCE ISOPLETH CONTOUR INTERVAL 10 µg/L
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
04202D
ND
0 50 100 200 300
SCALE IN FEET
ZONE A - SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-42
THIRD ROUND - MNA SAMPLING
DEEP GROUNDWATER
PCE (µg/L)
Date: 11/23/99
DWG Name: 2901M207



LEGEND:

03917D 51 — DEEP MONITORING WELL W/ ID NUMBER AND TCE CONCENTRATION (μg/L)

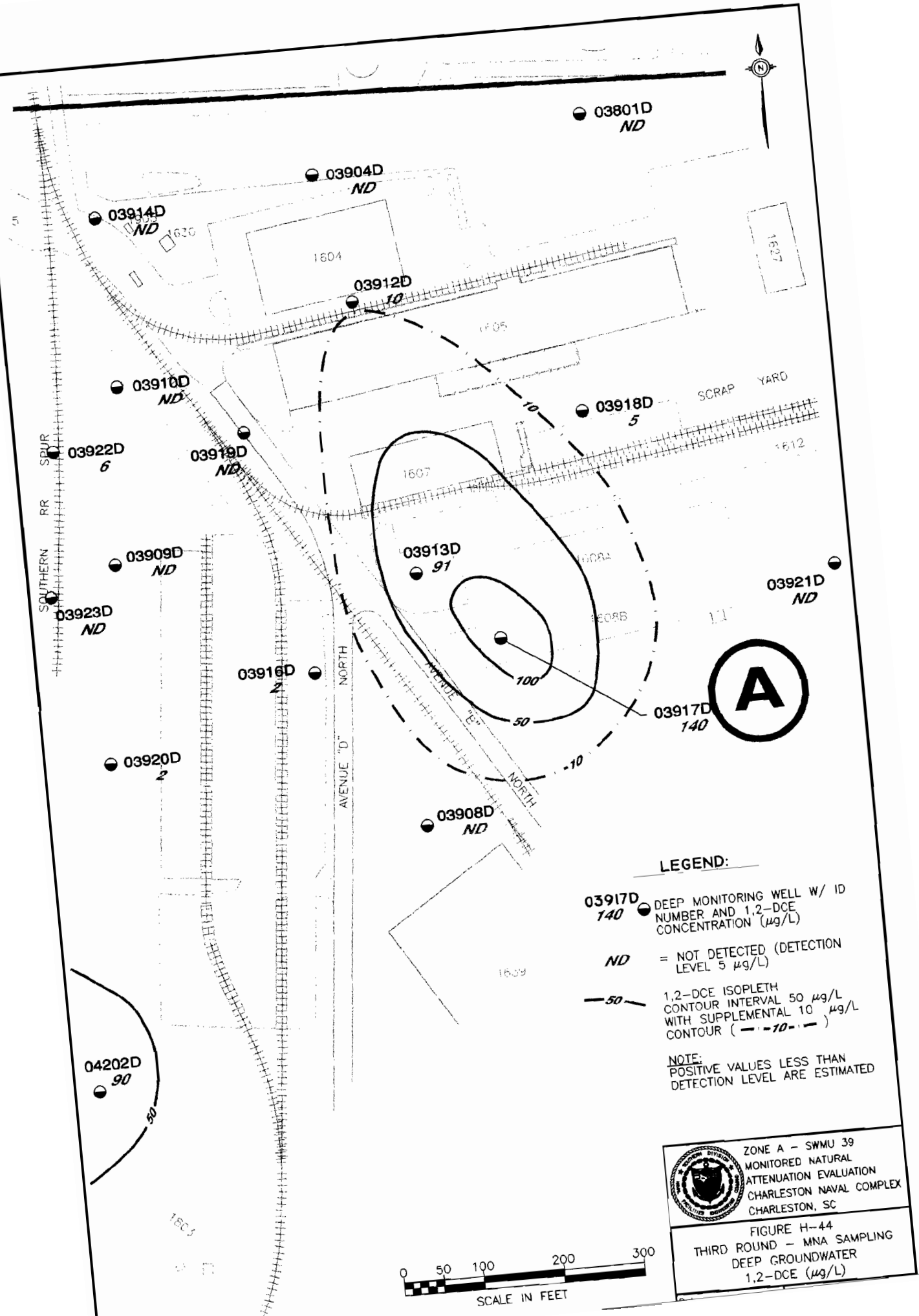
ND = NOT DETECTED (DETECTION LEVEL 5 μg/L)

20 — TCE ISOPLETH CONTOUR INTERVAL 20 μg/L

NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED

ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-43
THIRD ROUND – MNA SAMPLING
DEEP GROUNDWATER
TCE (μg/L)


03801D
ND
03904D
ND
03914D
ND
1630
1604
1627
03912D
10
1605
03910D
ND
03918D
5
SCRAP YARD
10
03922D
6
03919D
ND
1607
1612
SOUTHERN RR SPUR
03909D
ND
03913D
91
1608A
03921D
ND
03923D
ND
1608B
03916D
2
NORTH
AVENUE "D"
100
AVENUE "B"
50
03917D
140
A
03920D
2
10
NORTH
03908D
ND
LEGEND:
03917D
140
DEEP MONITORING WELL W/ ID NUMBER AND 1,2-DCE CONCENTRATION (µg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 µg/L)
50
1,2-DCE ISOPLETH CONTOUR INTERVAL 50 µg/L WITH SUPPLEMENTAL 10 µg/L CONTOUR (10)
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
1639
04202D
90
50
1603
0 50 100 200 300
SCALE IN FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-44
THIRD ROUND – MNA SAMPLING
DEEP GROUNDWATER
1,2-DCE (µg/L)

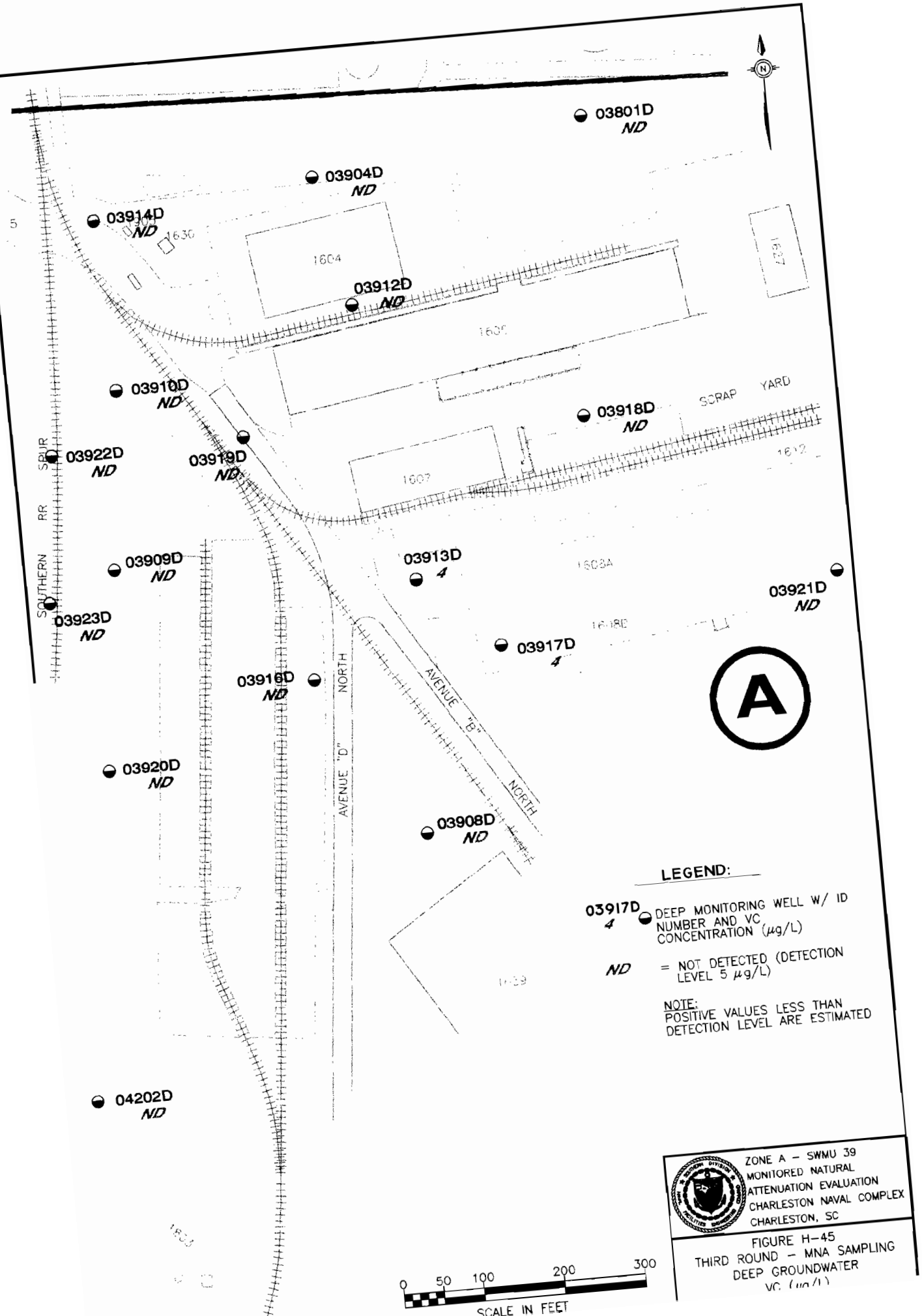

03801D
ND
03904D
ND
03914D
ND
1630
1604
03912D
ND
1605
1627
03910D
ND
03918D
ND
SCRAP YARD
03922D
ND
03919D
ND
1607
1612
SOUTHERN RR SPUR
03909D
ND
03913D
4
1603A
03921D
ND
03923D
ND
1608D
03917D
4
A
03916D
ND
NORTH
AVENUE "B"
AVENUE "D"
NORTH
03920D
ND
03908D
ND
LEGEND:
03917D
4
DEEP MONITORING WELL W/ ID NUMBER AND VC CONCENTRATION (µg/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 µg/L)
NOTE:
POSITIVE VALUES LESS THAN DETECTION LEVEL ARE ESTIMATED
1639
04202D
ND
0
50
100
200
300
SCALE IN FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-45
THIRD ROUND – MNA SAMPLING
DEEP GROUNDWATER
VC (µg/L)

Figure H-46
Evidence of Biodegradation Using Ratio of cis-1,2-DCE to 1,2-DCE total

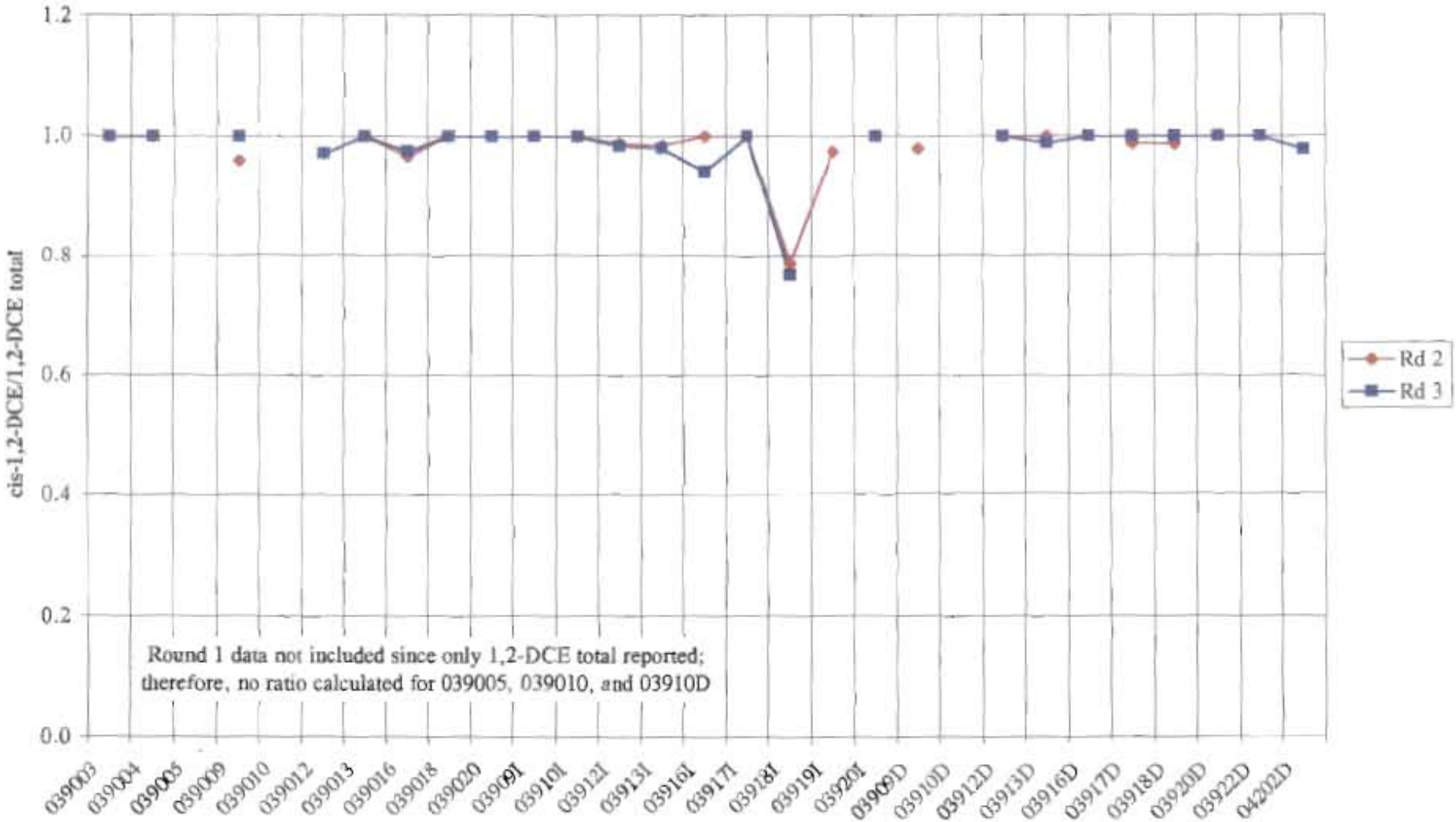


Figure H-47
Ethene in Groundwater

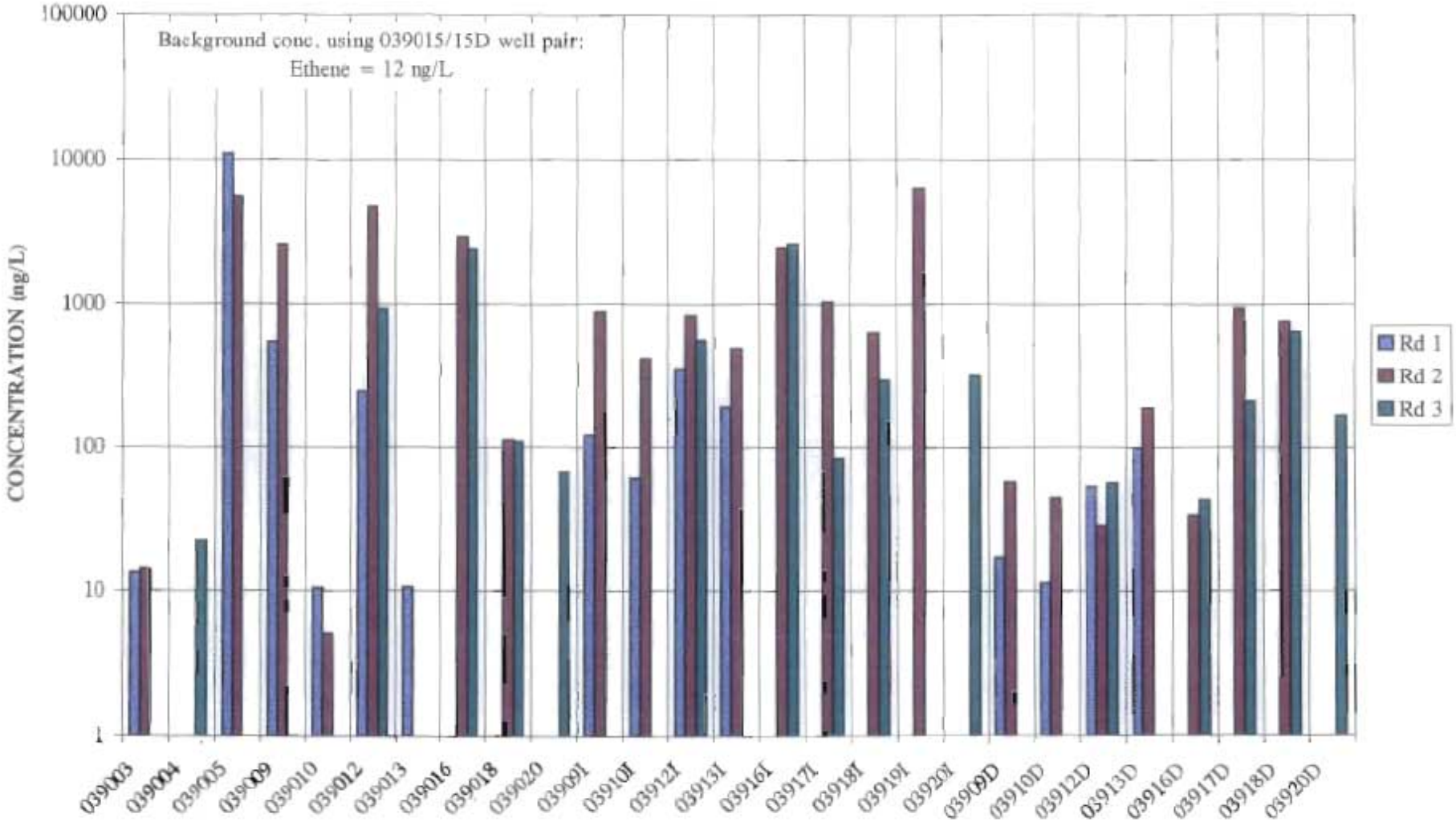
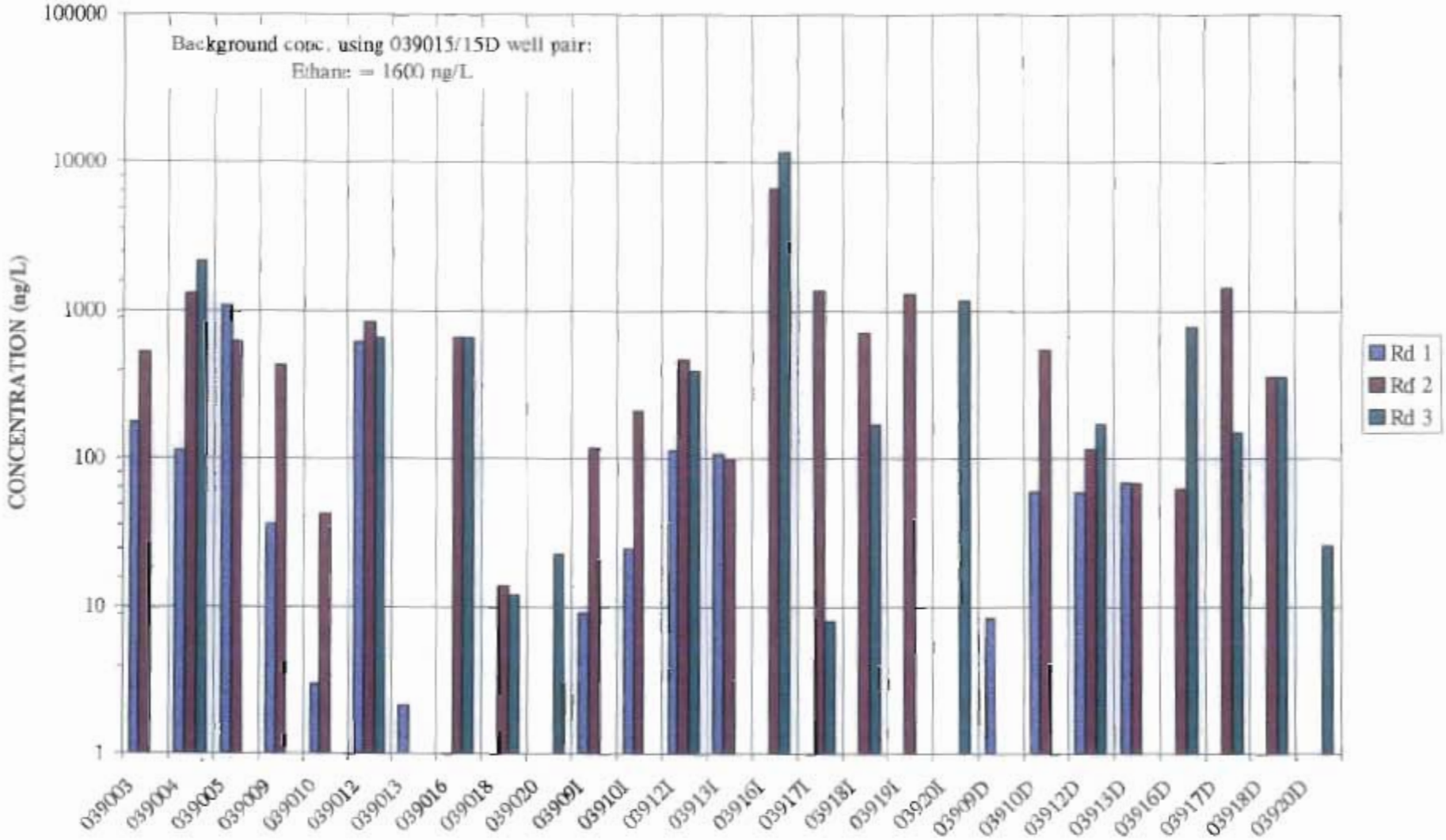
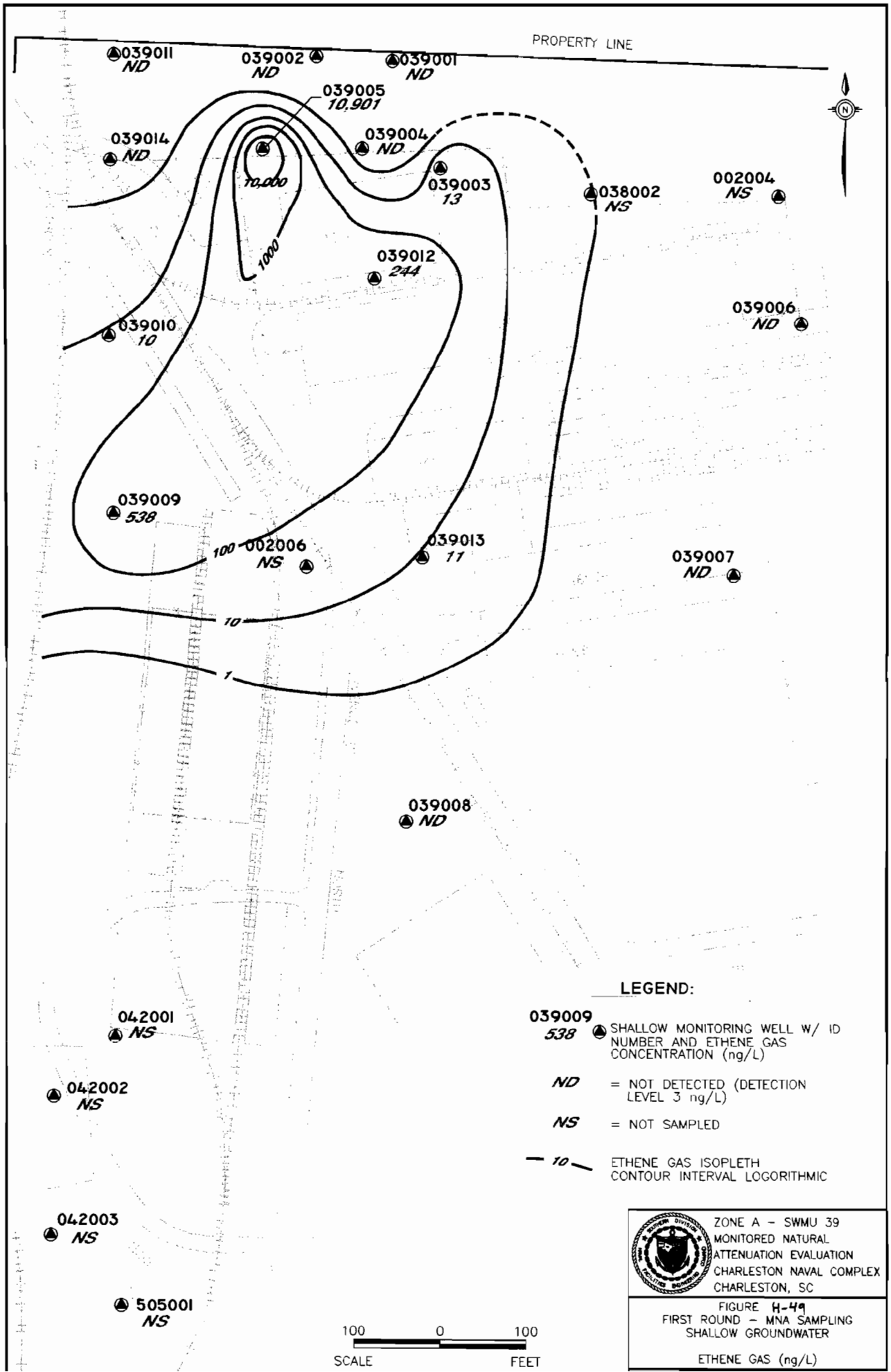
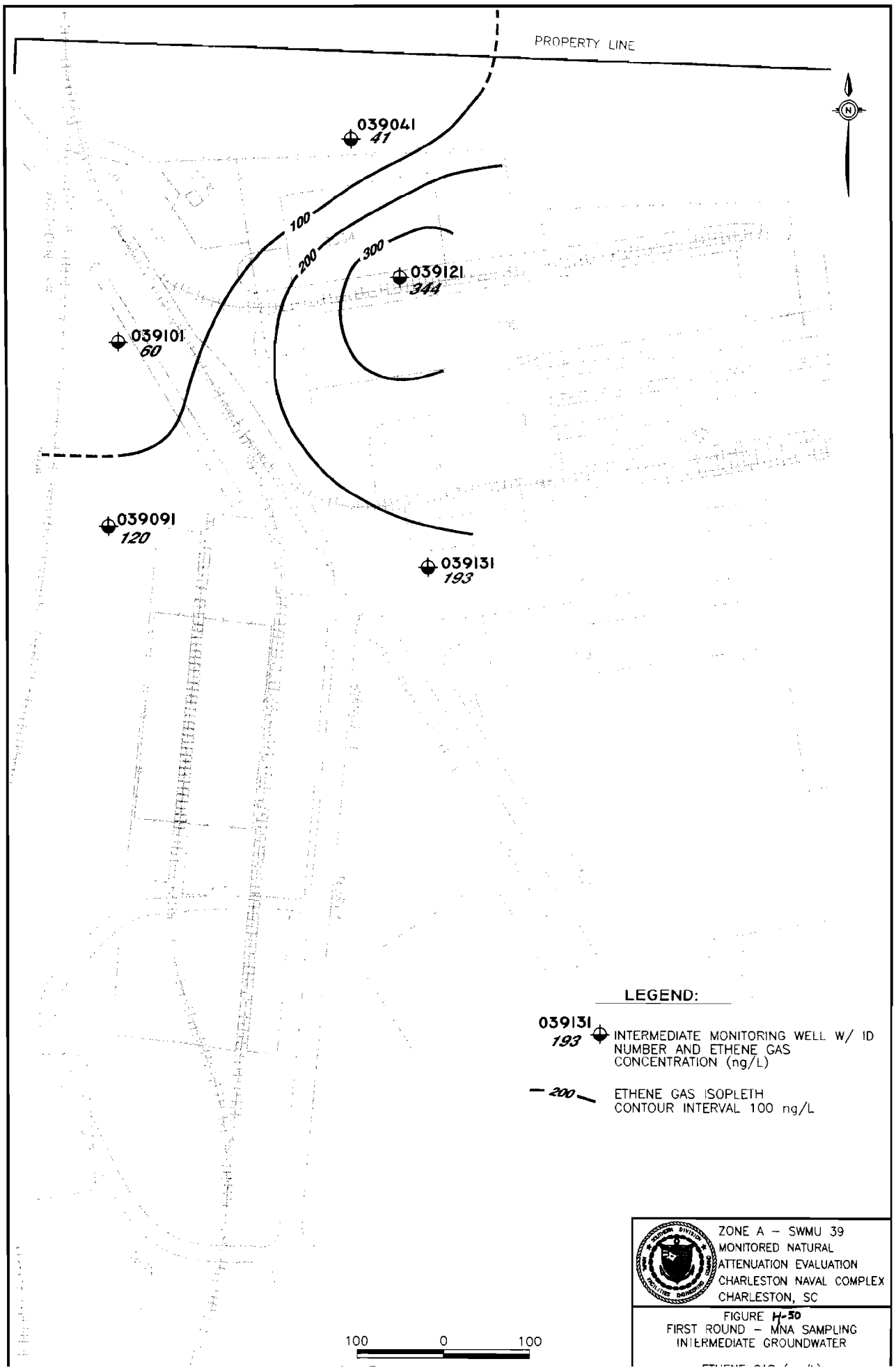


Figure H-48
Ethane in Groundwater



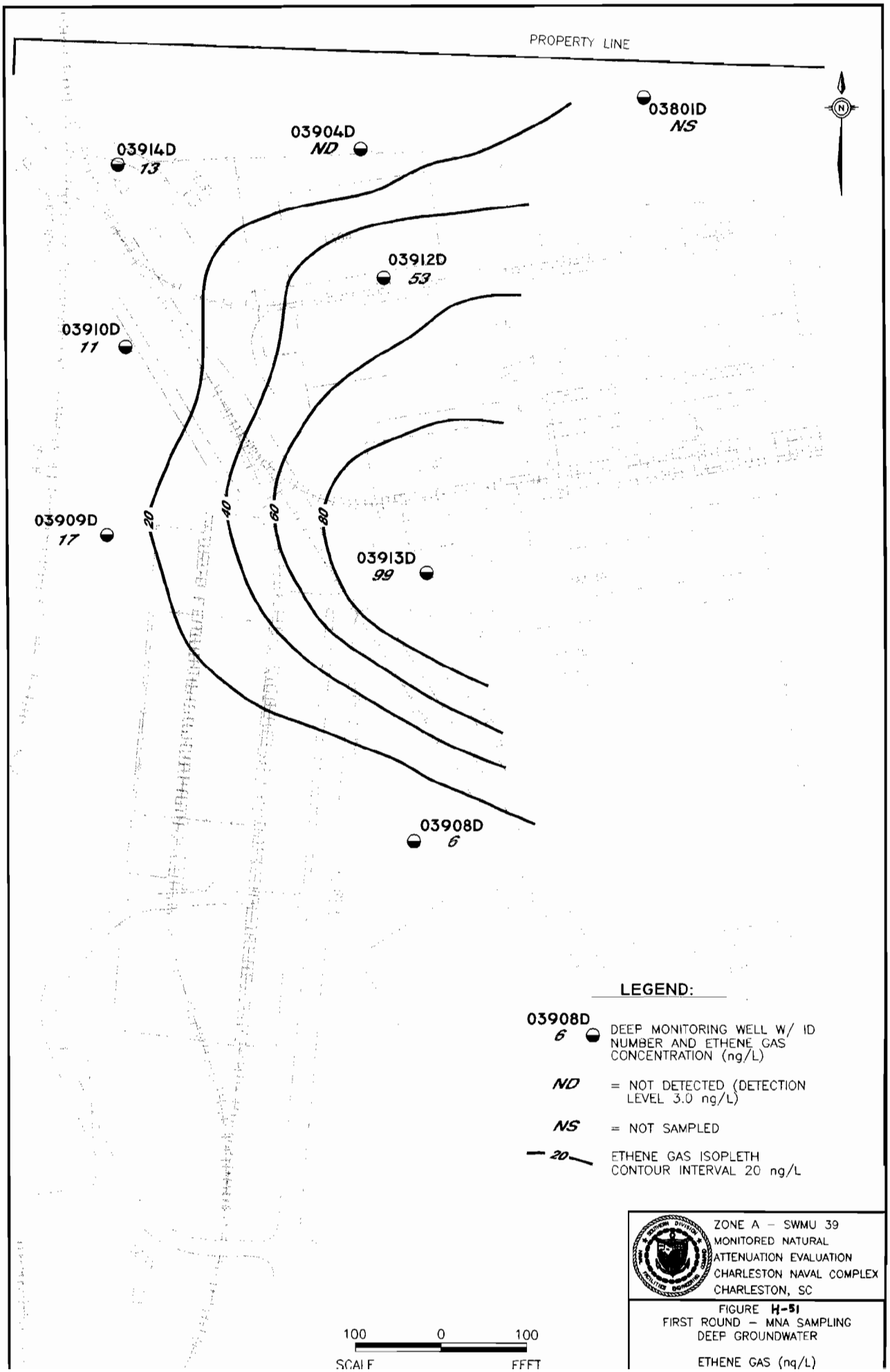

PROPERTY LINE
039011
ND
039002
ND
039001
ND
039005
10,901
039014
ND
039004
ND
039003
13
038002
NS
002004
NS
10,000
1000
039012
244
039006
ND
039010
10
039009
538
100
002006
NS
039013
11
039007
ND
10
1
039008
ND
042001
NS
042002
NS
042003
NS
505001
NS
LEGEND:
039009
538
SHALLOW MONITORING WELL W/ ID NUMBER AND ETHENE GAS CONCENTRATION (ng/L)
ND = NOT DETECTED (DETECTION LEVEL 3 ng/L)
NS = NOT SAMPLED
10
ETHENE GAS ISOPLETH CONTOUR INTERVAL LOGORITHMIC
100 0 100
SCALE FEET
ZONE A - SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-49
FIRST ROUND - MNA SAMPLING
SHALLOW GROUNDWATER
ETHENE GAS (ng/L)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-50
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

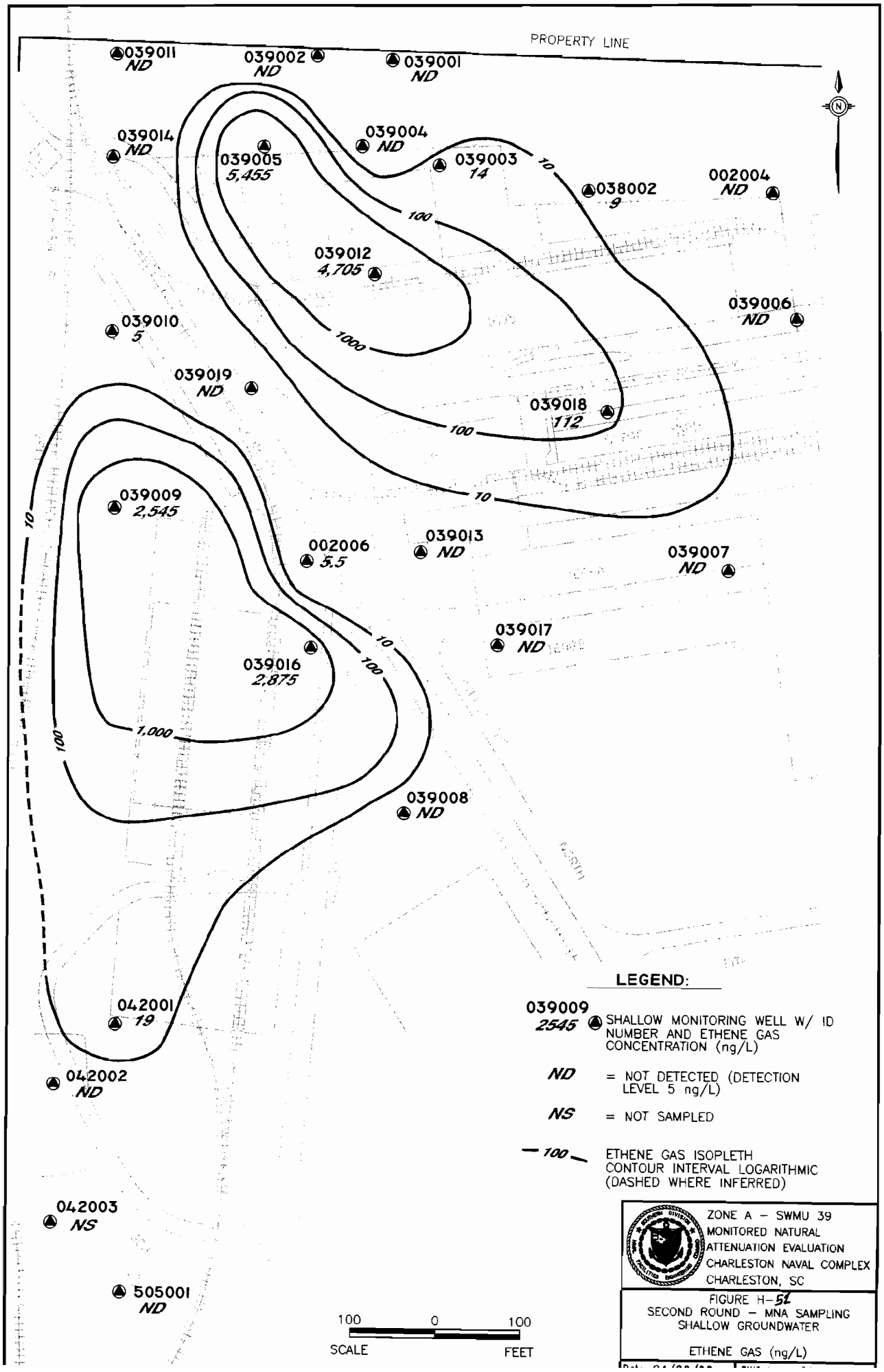
ETHENE GAS (ng/L)

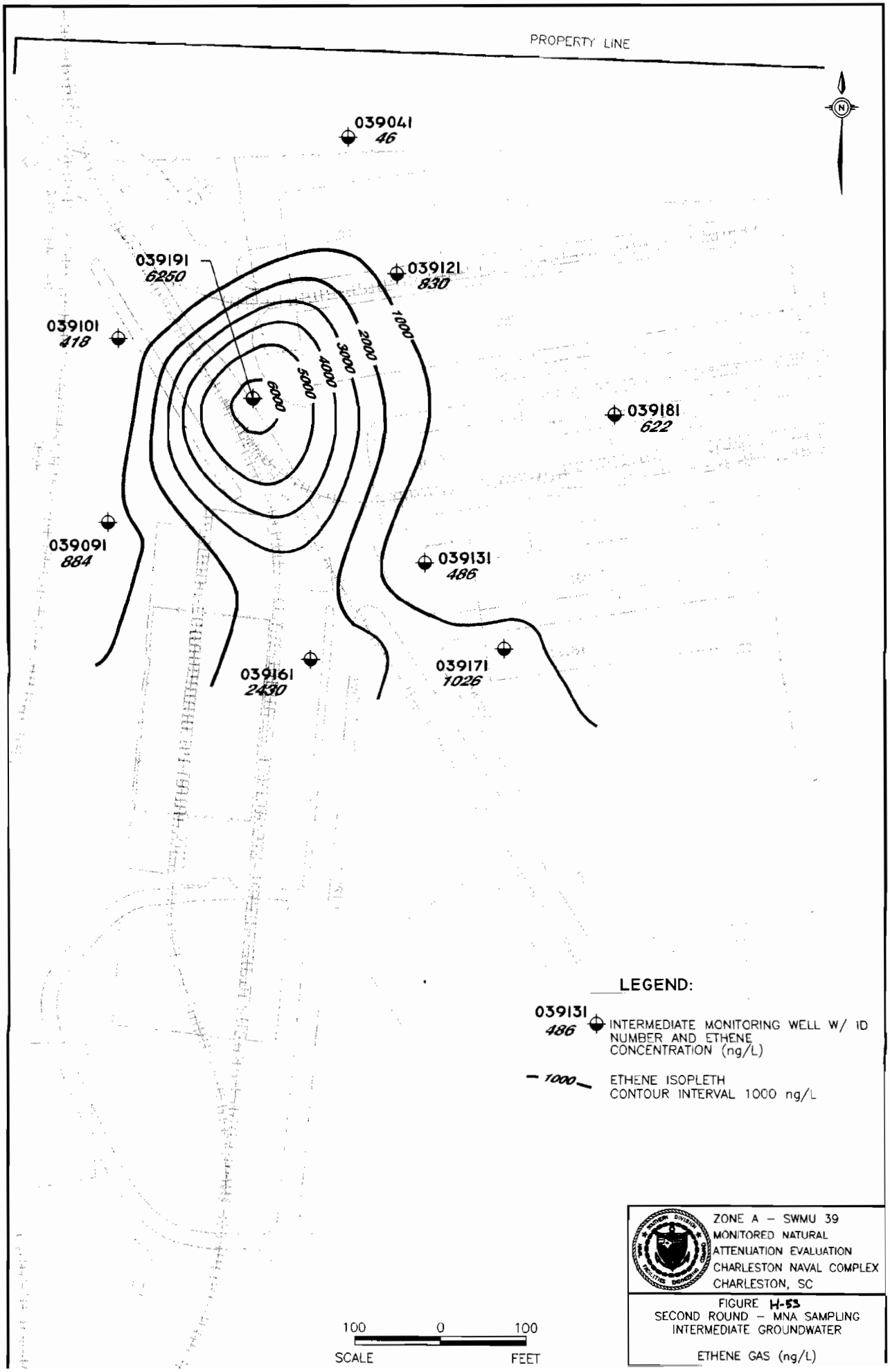


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-51
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

ETHENE GAS (ng/L)

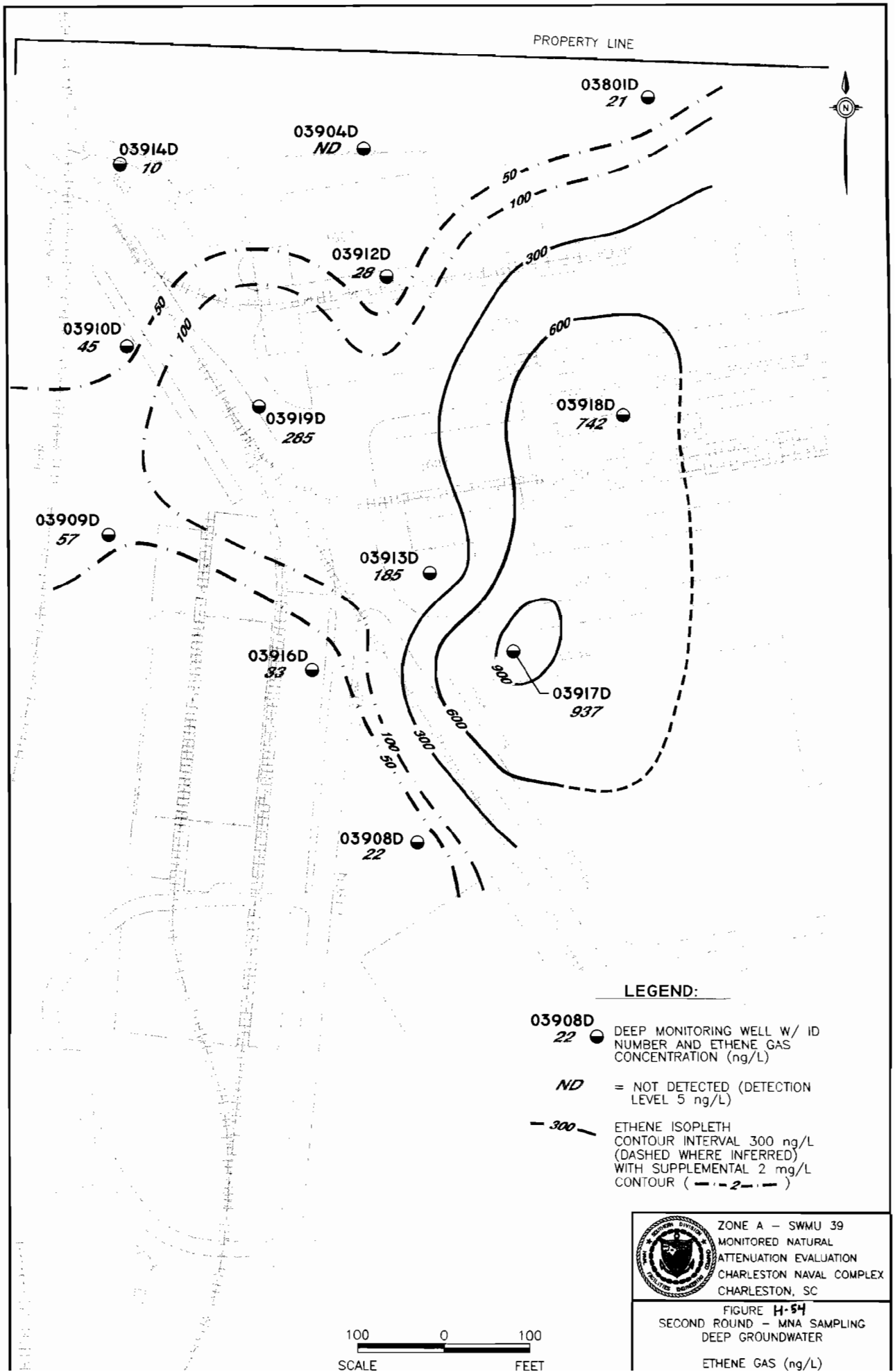

PROPERTY LINE
039011
ND
039002
ND
039001
ND
039014
ND
039005
5,455
039004
ND
039003
14
038002
9
002004
ND
039012
4,705
039006
ND
039010
5
039019
ND
039018
112
039009
2,545
002006
5.5
039013
ND
039007
ND
039017
ND
039016
2,875
039008
ND
042001
19
042002
ND
042003
NS
505001
ND
10
100
1000
1,000
LEGEND:
039009
2545
SHALLOW MONITORING WELL W/ ID NUMBER AND ETHENE GAS CONCENTRATION (ng/L)
ND = NOT DETECTED (DETECTION LEVEL 5 ng/L)
NS = NOT SAMPLED
100
ETHENE GAS ISOPLETH CONTOUR INTERVAL LOGARITHMIC (DASHED WHERE INFERRED)
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-51
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
ETHENE GAS (ng/L)
100 0 100
SCALE
FEET



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-53
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

ETHENE GAS (ng/L)


PROPERTY LINE
03801D
21
03904D
ND
03914D
10
03912D
28
03910D
45
03919D
285
03918D
742
03909D
57
03913D
185
03916D
33
03917D
937
03908D
22
50
100
300
600
900
LEGEND:
03908D
22
DEEP MONITORING WELL W/ ID NUMBER AND ETHENE GAS CONCENTRATION (ng/L)
ND
= NOT DETECTED (DETECTION LEVEL 5 ng/L)
300
ETHENE ISOPLETH CONTOUR INTERVAL 300 ng/L (DASHED WHERE INFERRED) WITH SUPPLEMENTAL 2 mg/L CONTOUR (2)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-54
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER
ETHENE GAS (ng/L)

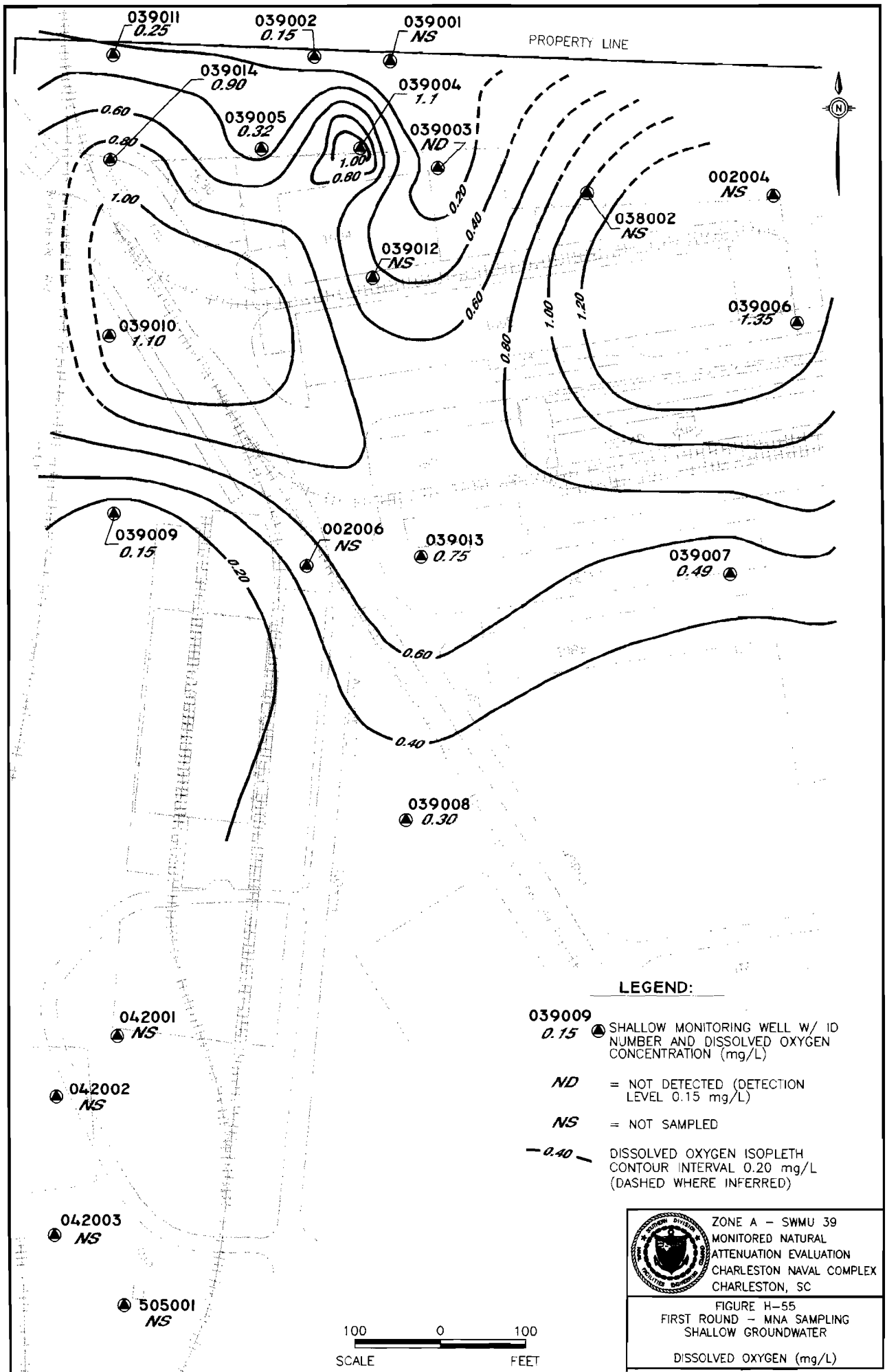

039011
0.25
039002
0.15
039001
NS
PROPERTY LINE
039014
0.90
039004
1.1
039005
0.32
039003
ND
1.00
0.80
0.60
0.80
1.00
0.20
0.40
0.60
0.80
1.00
1.20
002004
NS
038002
NS
039012
NS
039006
1.35
039010
1.10
039009
0.15
002006
NS
039013
0.75
039007
0.49
0.20
0.60
0.40
039008
0.30
042001
NS
042002
NS
042003
NS
505001
NS
LEGEND:
039009
0.15
SHALLOW MONITORING WELL W/ ID NUMBER AND DISSOLVED OXYGEN CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 0.15 mg/L)
NS = NOT SAMPLED
0.40
DISSOLVED OXYGEN ISOPLETH CONTOUR INTERVAL 0.20 mg/L (DASHED WHERE INFERRED)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-55
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
DISSOLVED OXYGEN (mg/L)

Figure H-55
SWMU 39 Round 1 MNA ORP-pH Diagram

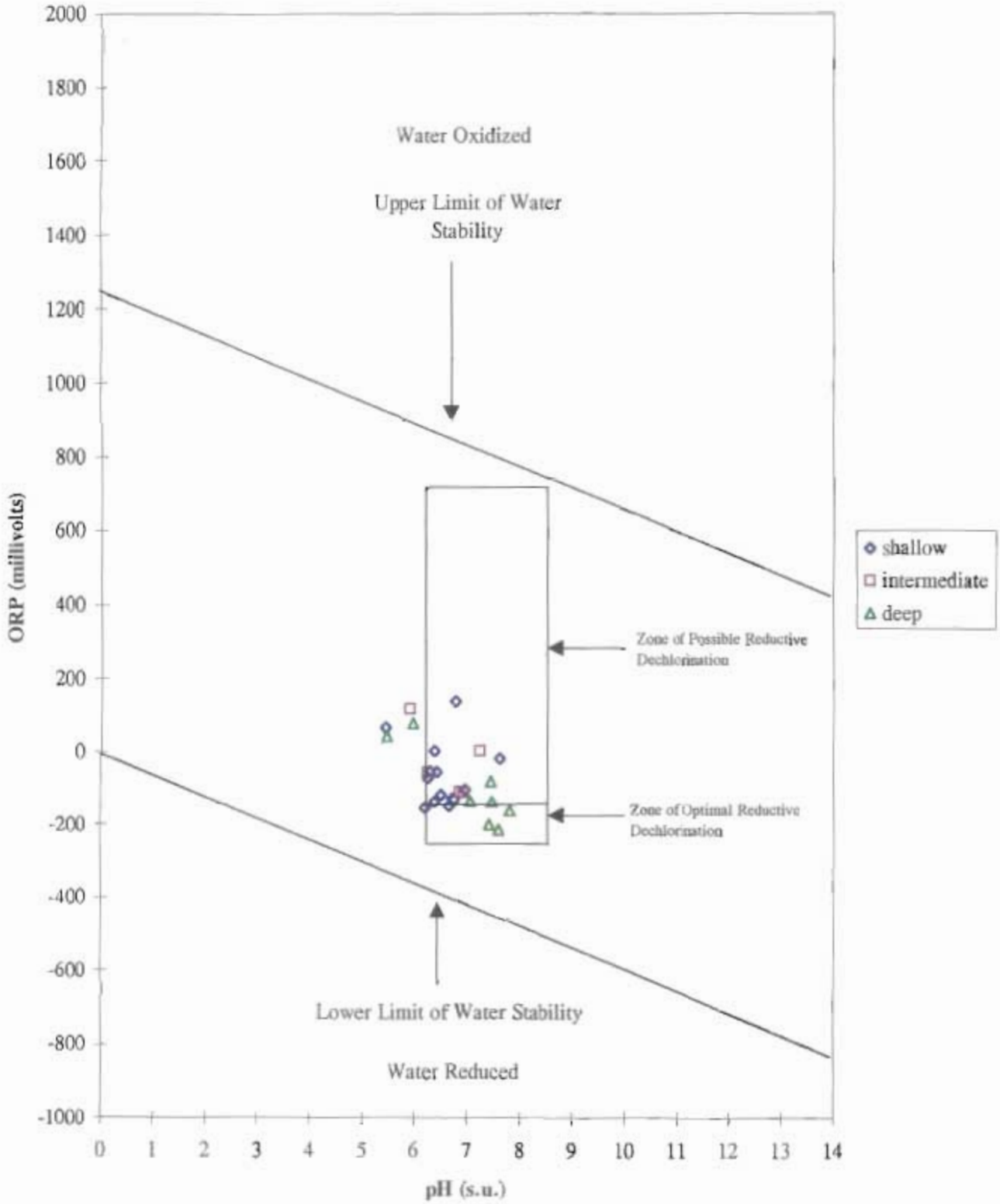


Figure H-56
SWMU 39 Round 2 MNA ORP-pH Diagram

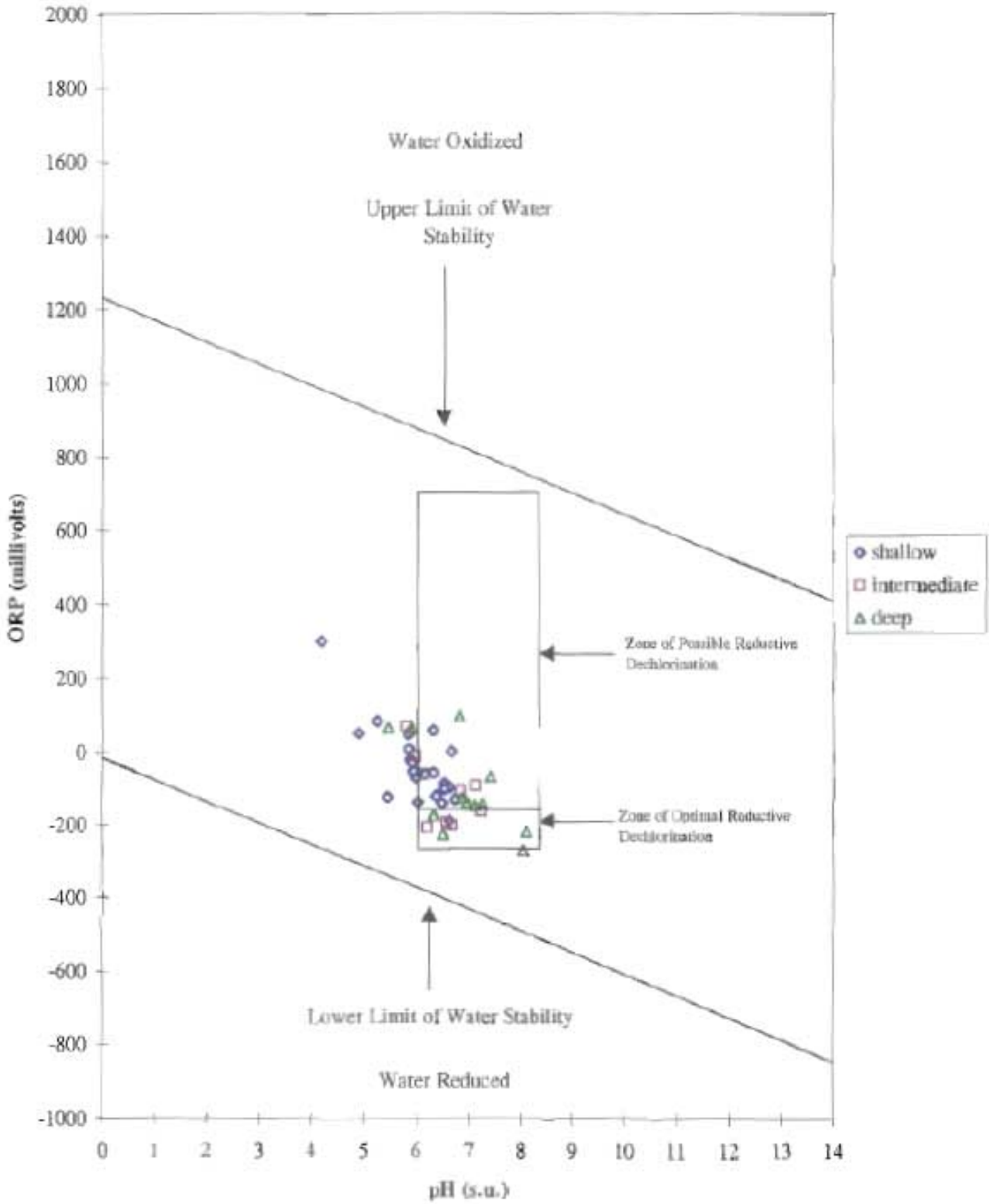
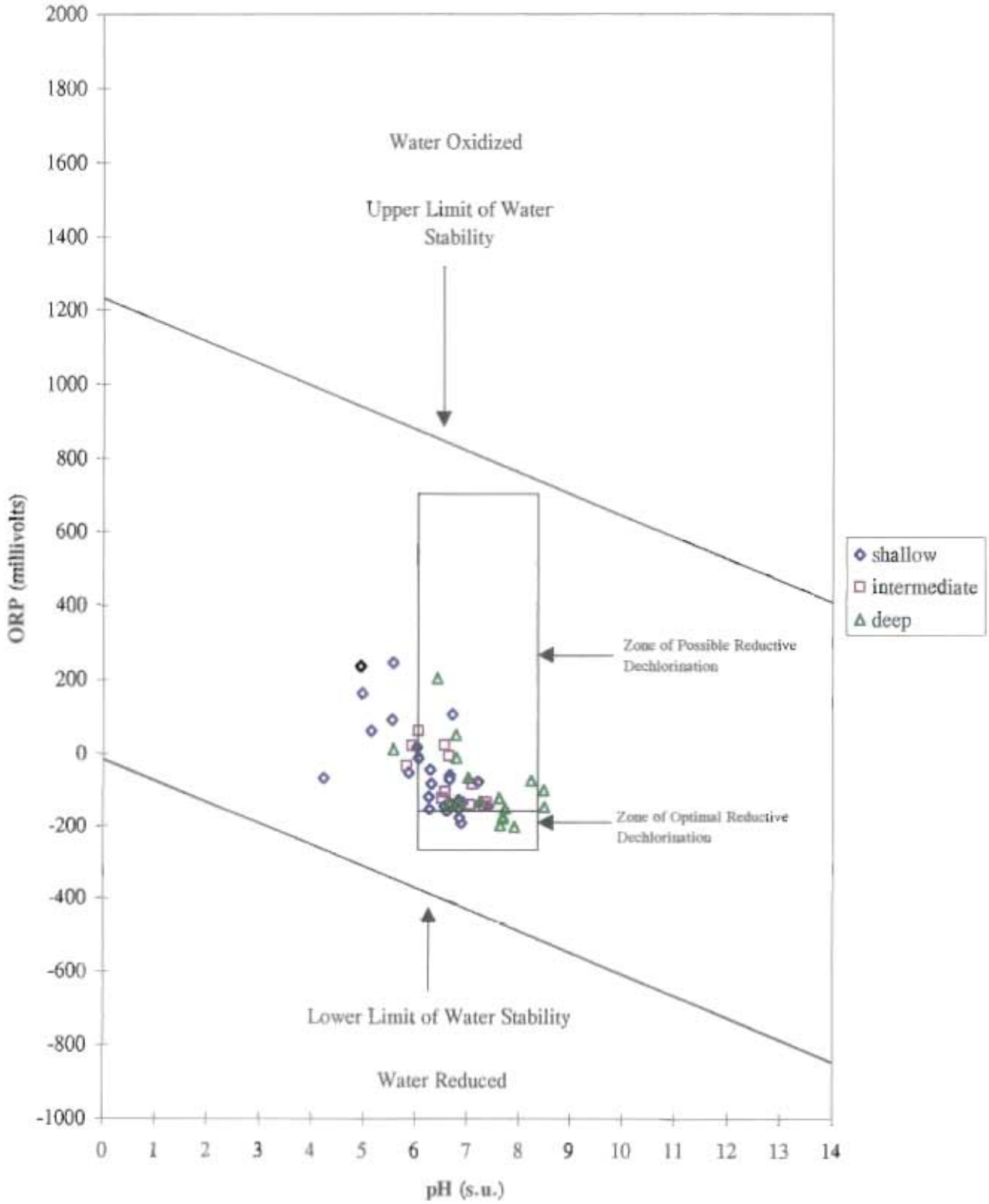
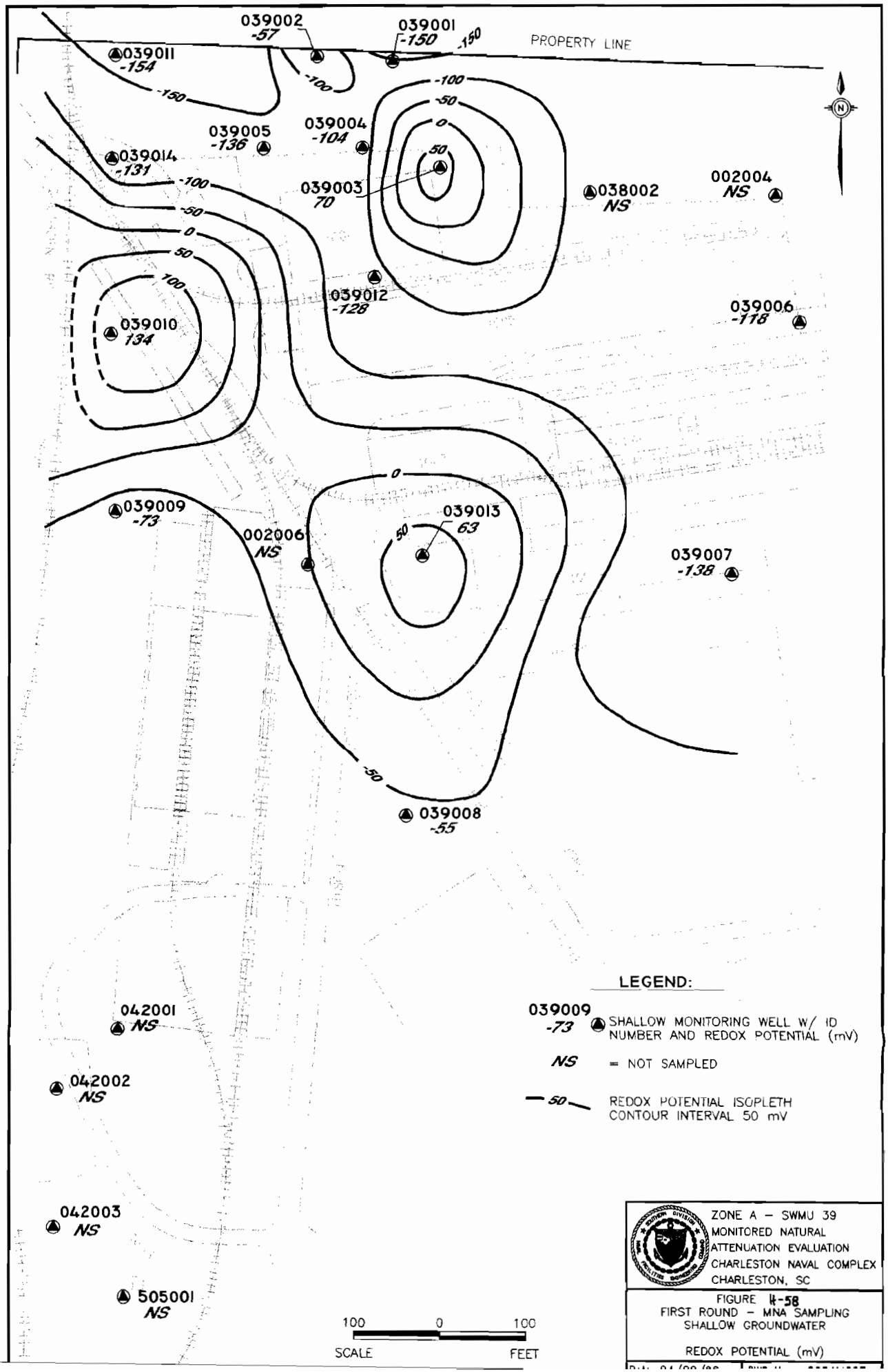
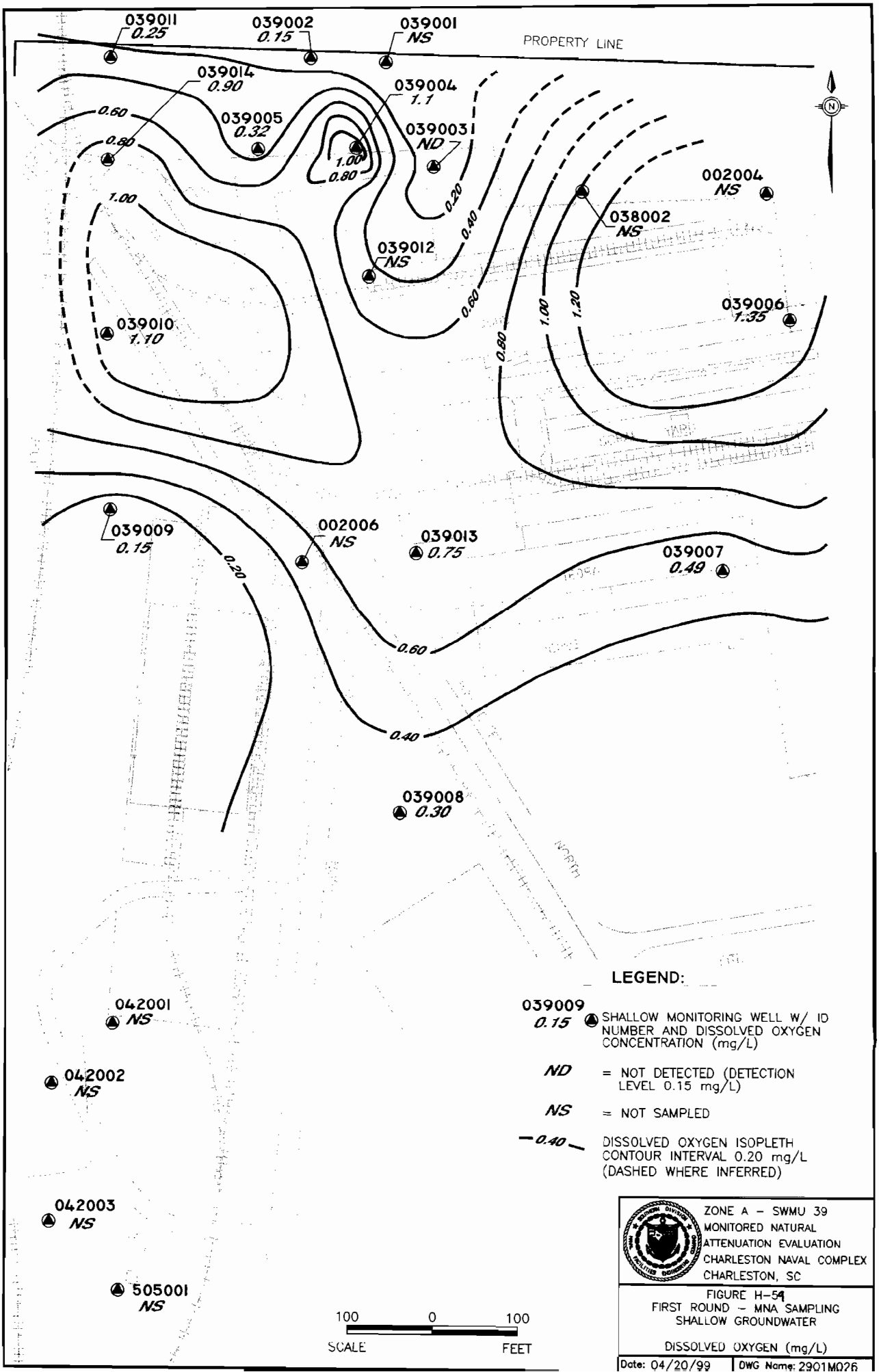
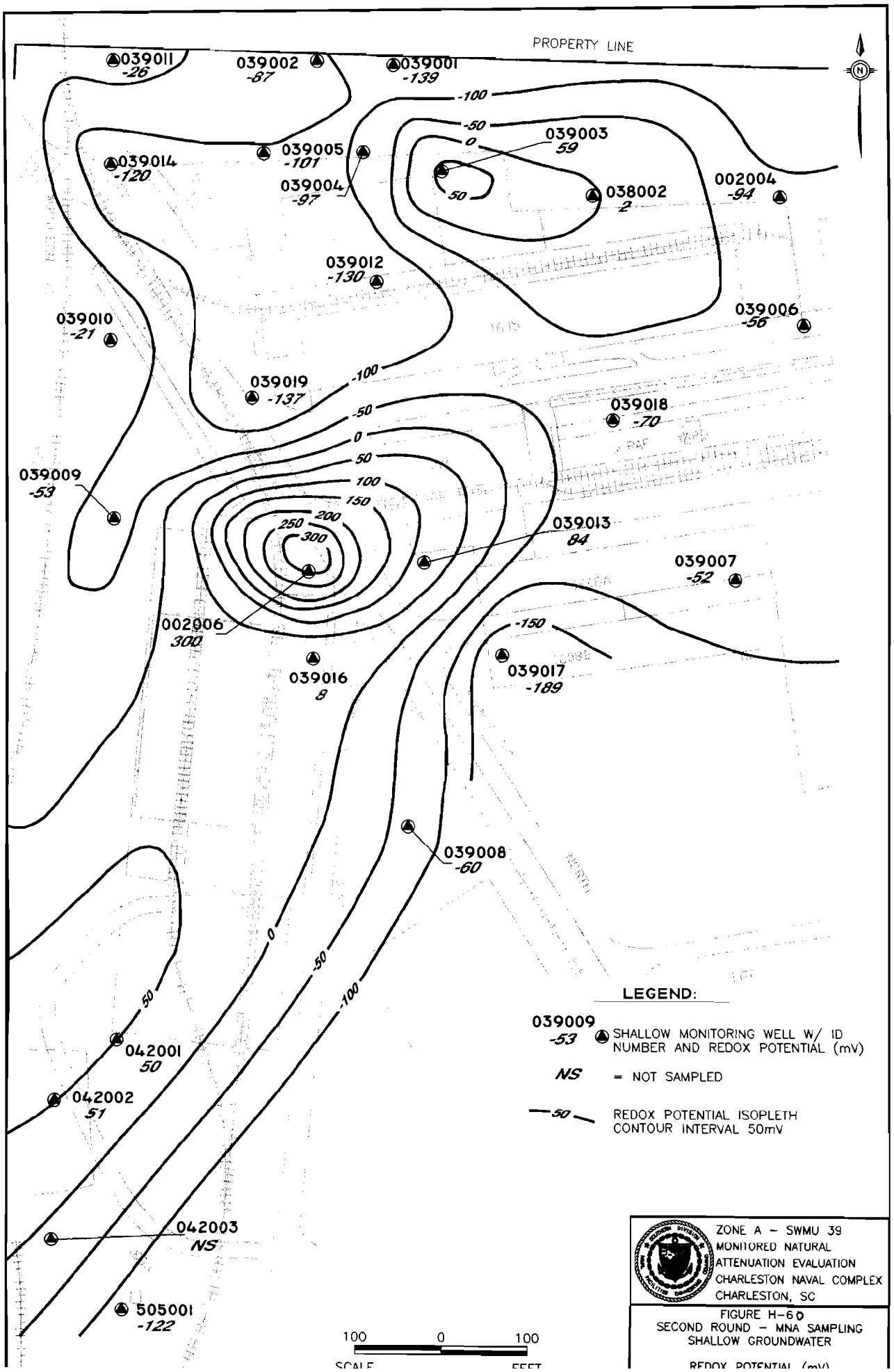


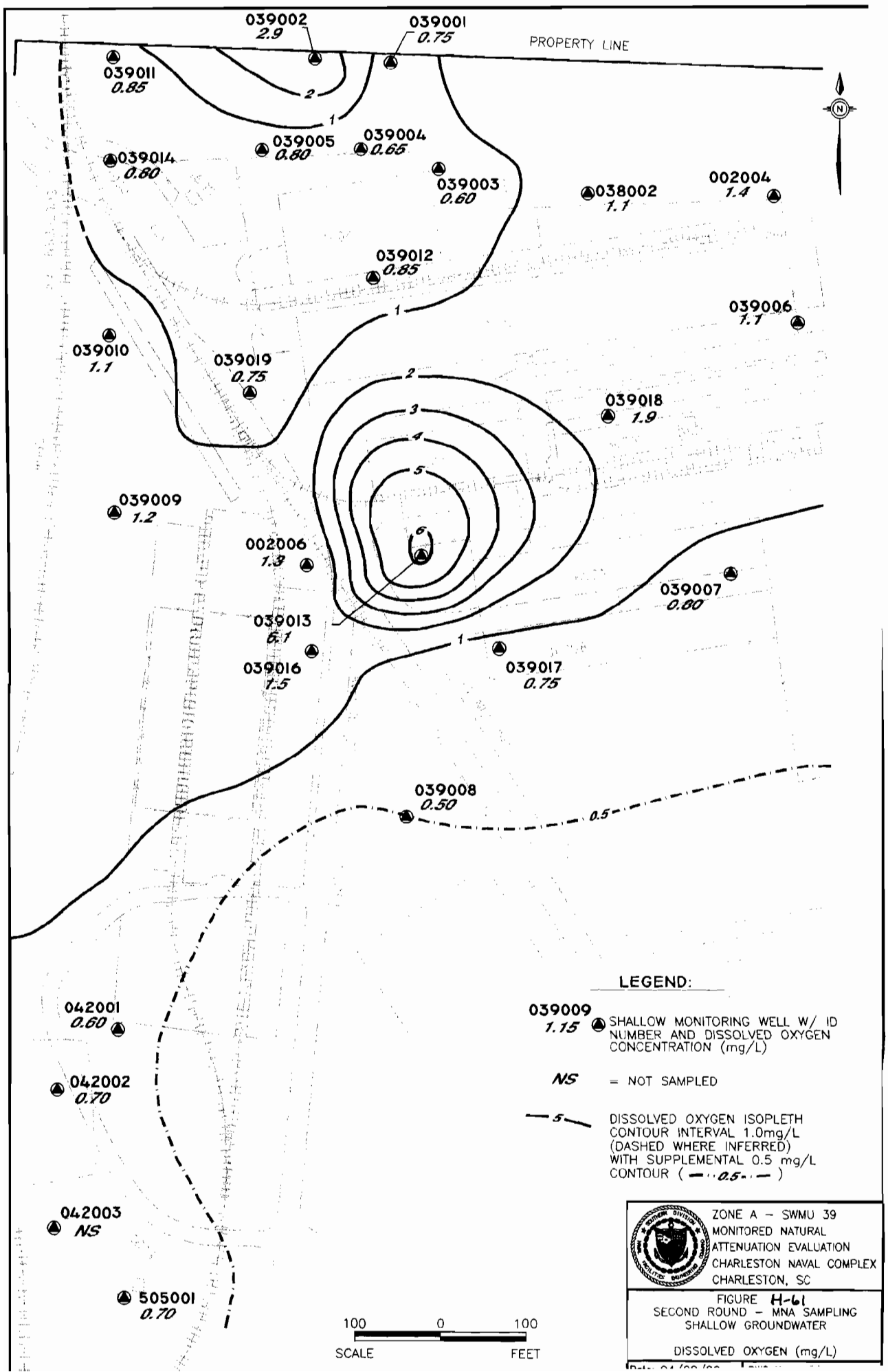
Figure H-57
SWMU 39 Round 3 MNA ORP-pH Diagram

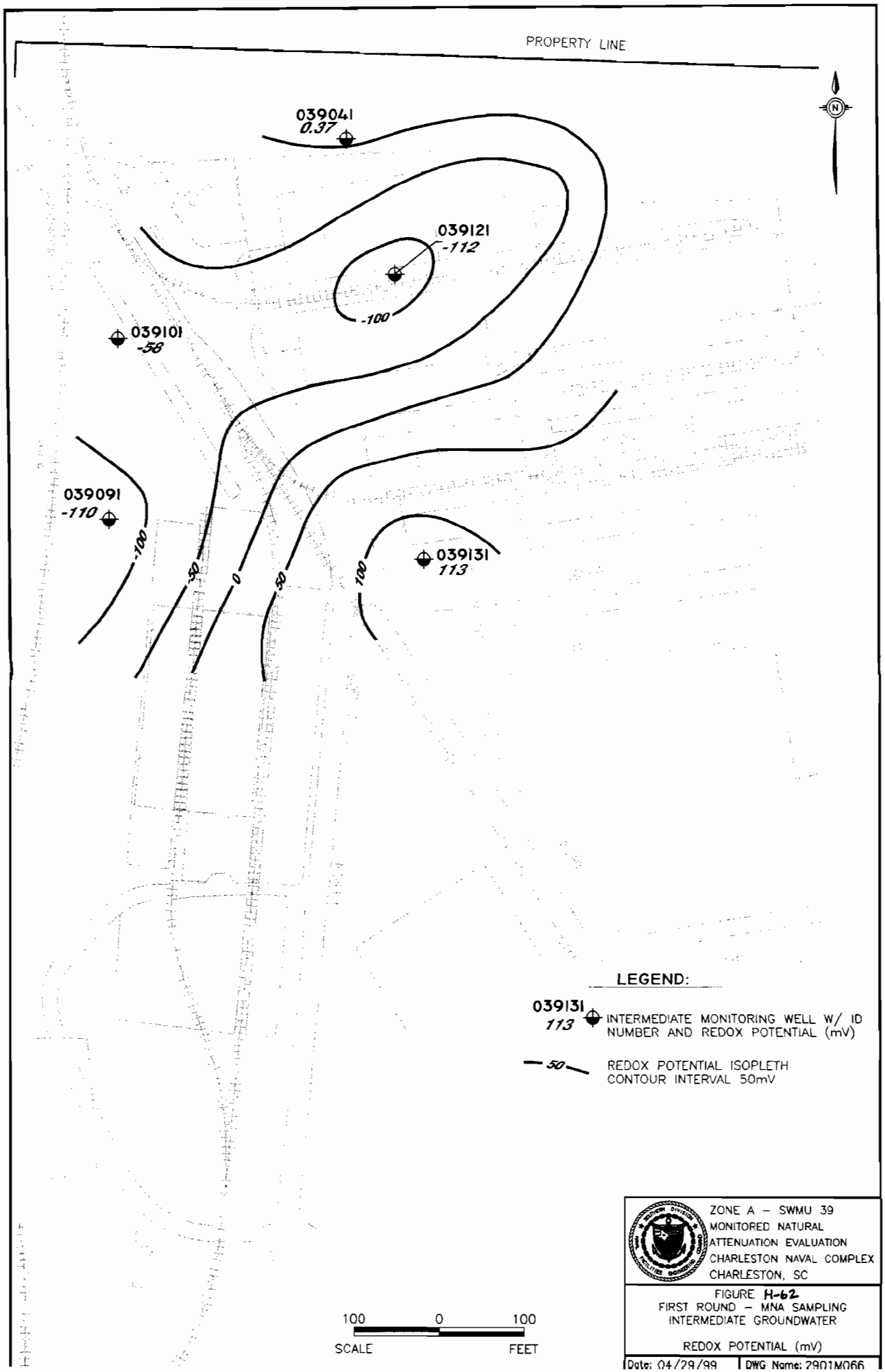



PROPERTY LINE
039002
-57
039001
-150
039011
-154
039005
-136
039004
-104
039014
-131
039003
70
038002
NS
002004
NS
039012
-128
039006
-118
039010
134
039009
-73
002006
NS
039013
63
039007
-138
039008
-55
042001
NS
042002
NS
042003
NS
505001
NS
LEGEND:
039009
-73
SHALLOW MONITORING WELL W/ ID NUMBER AND REDOX POTENTIAL (mV)
NS = NOT SAMPLED
50
REDOX POTENTIAL ISOPLETH CONTOUR INTERVAL 50 mV
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE 4-58
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
REDOX POTENTIAL (mV)


039011
0.25
039002
0.15
039001
NS
PROPERTY LINE
039014
0.90
039004
1.1
039005
0.32
039003
ND
1.00
0.80
0.60
0.80
1.00
0.20
0.40
002004
NS
038002
NS
039012
NS
0.60
1.00
1.20
039006
1.35
039010
1.10
0.80
039009
0.15
002006
NS
039013
0.75
039007
0.49
0.20
0.60
0.40
039008
0.30
042001
NS
042002
NS
042003
NS
505001
NS
100
0
100
SCALE
FEET
LEGEND:
039009
0.15
SHALLOW MONITORING WELL W/ ID NUMBER AND DISSOLVED OXYGEN CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 0.15 mg/L)
NS = NOT SAMPLED
0.40
DISSOLVED OXYGEN ISOPLETH CONTOUR INTERVAL 0.20 mg/L (DASHED WHERE INFERRED)
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-59
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
DISSOLVED OXYGEN (mg/L)
Date: 04/20/99
DWG Name: 2901M026


PROPERTY LINE
039011
-26
039002
-87
039001
-139
-100
-50
0
039003
59
039005
-101
039014
-120
039004
-97
50
038002
2
002004
-94
039012
-130
039010
-21
039006
-56
039019
-137
-100
039018
-70
-50
0
50
100
150
200
250
300
039009
-53
039013
84
039007
-52
002006
300
-150
039016
8
039017
-189
039008
-60
0
-50
-100
50
042001
50
042002
51
042003
NS
505001
-122
100
0
100
SCALE
FEET
LEGEND:
039009
-53
SHALLOW MONITORING WELL W/ ID NUMBER AND REDOX POTENTIAL (mV)
NS
= NOT SAMPLED
50
REDOX POTENTIAL ISOPLETH CONTOUR INTERVAL 50mV
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-60
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
REDOX POTENTIAL (mV)


039002
2.9
039001
0.75
PROPERTY LINE
039011
0.85
039005
0.80
039004
0.65
039014
0.80
039003
0.60
038002
1.1
002004
1.4
039012
0.85
039006
1.7
039010
1.1
039019
0.75
039018
1.9
039009
1.2
002006
1.3
039007
0.80
039013
6.1
039016
1.5
039017
0.75
039008
0.50
042001
0.60
042002
0.70
042003
NS
505001
0.70
LEGEND:
039009
1.15
SHALLOW MONITORING WELL W/ ID NUMBER AND DISSOLVED OXYGEN CONCENTRATION (mg/L)
NS
= NOT SAMPLED
DISSOLVED OXYGEN ISOPLETH CONTOUR INTERVAL 1.0mg/L (DASHED WHERE INFERRED) WITH SUPPLEMENTAL 0.5 mg/L CONTOUR
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-61
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
DISSOLVED OXYGEN (mg/L)

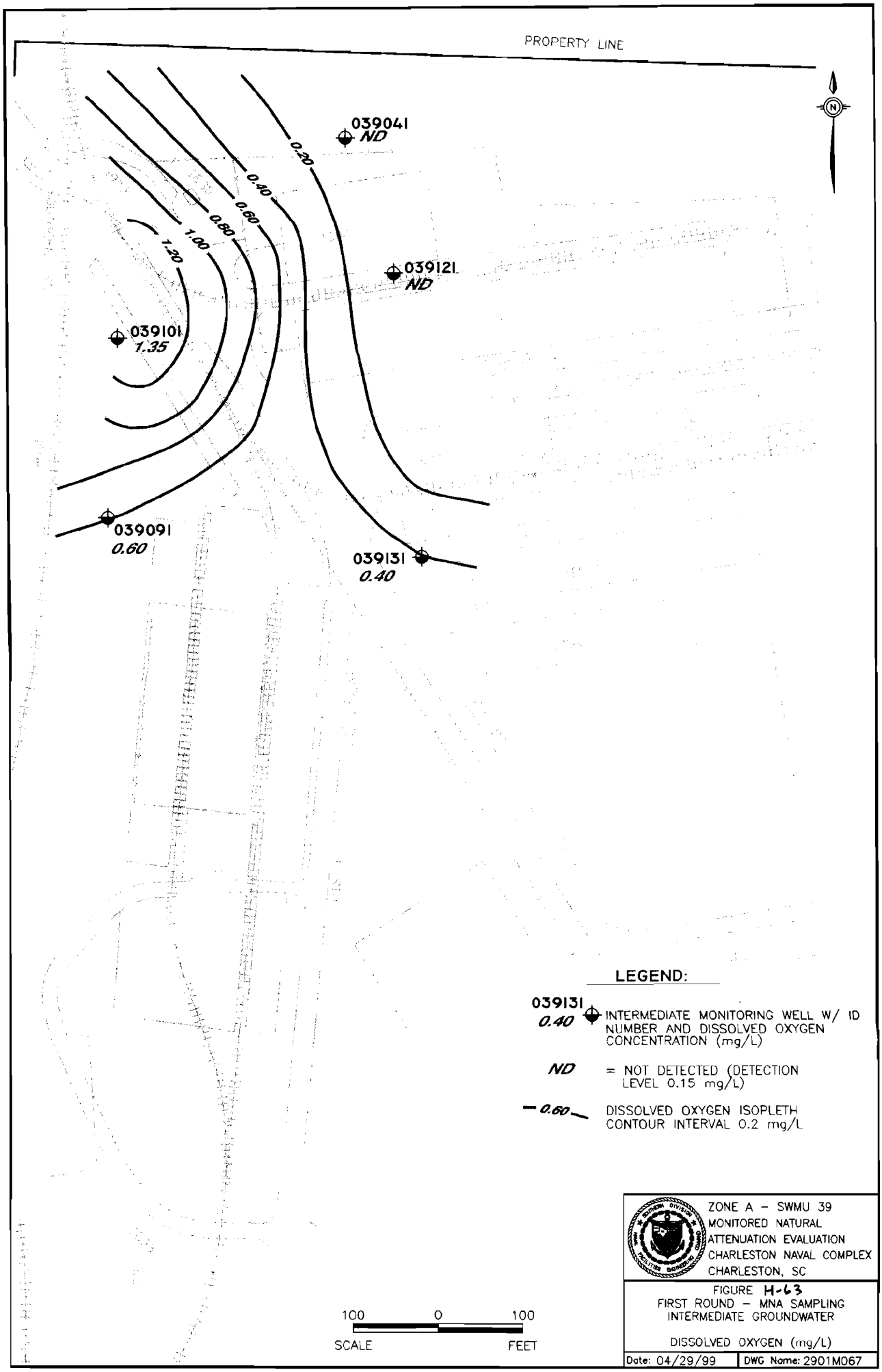


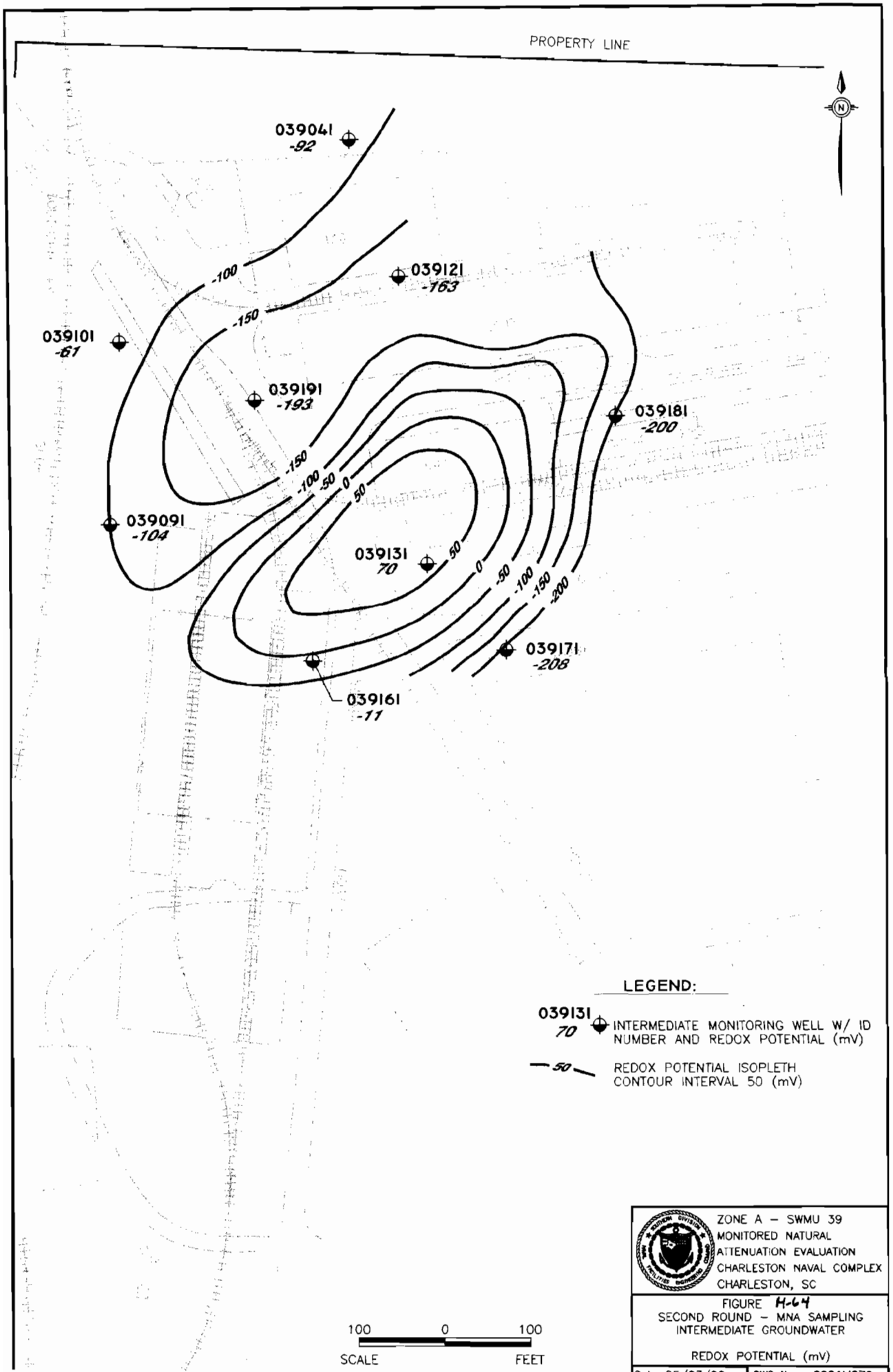
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-62
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

REDOX POTENTIAL (mV)

Date: 04/29/99 | DWG Name: 2901M066

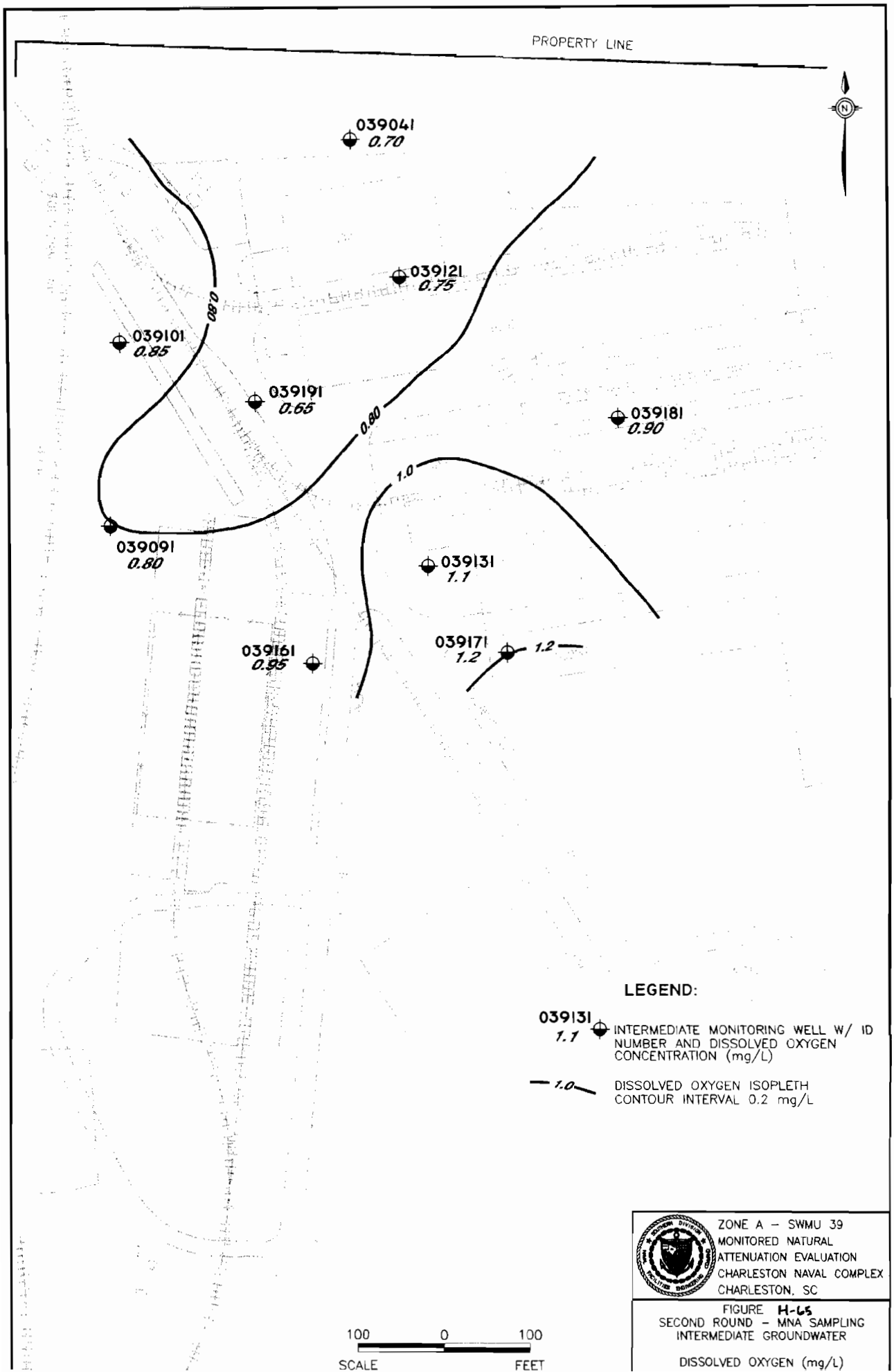

PROPERTY LINE
039041
ND
039121
ND
039101
1.35
039091
0.60
039131
0.40
0.20
0.40
0.60
0.80
1.00
1.20
LEGEND:
039131
0.40
INTERMEDIATE MONITORING WELL W/ ID NUMBER AND DISSOLVED OXYGEN CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 0.15 mg/L)
0.60
DISSOLVED OXYGEN ISOPLETH CONTOUR INTERVAL 0.2 mg/L
100
0
100
SCALE
FEET
ZONE A - SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-63
FIRST ROUND - MNA SAMPLING
INTERMEDIATE GROUNDWATER
DISSOLVED OXYGEN (mg/L)
Date: 04/29/99
DWG Name: 2901M067



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-64
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

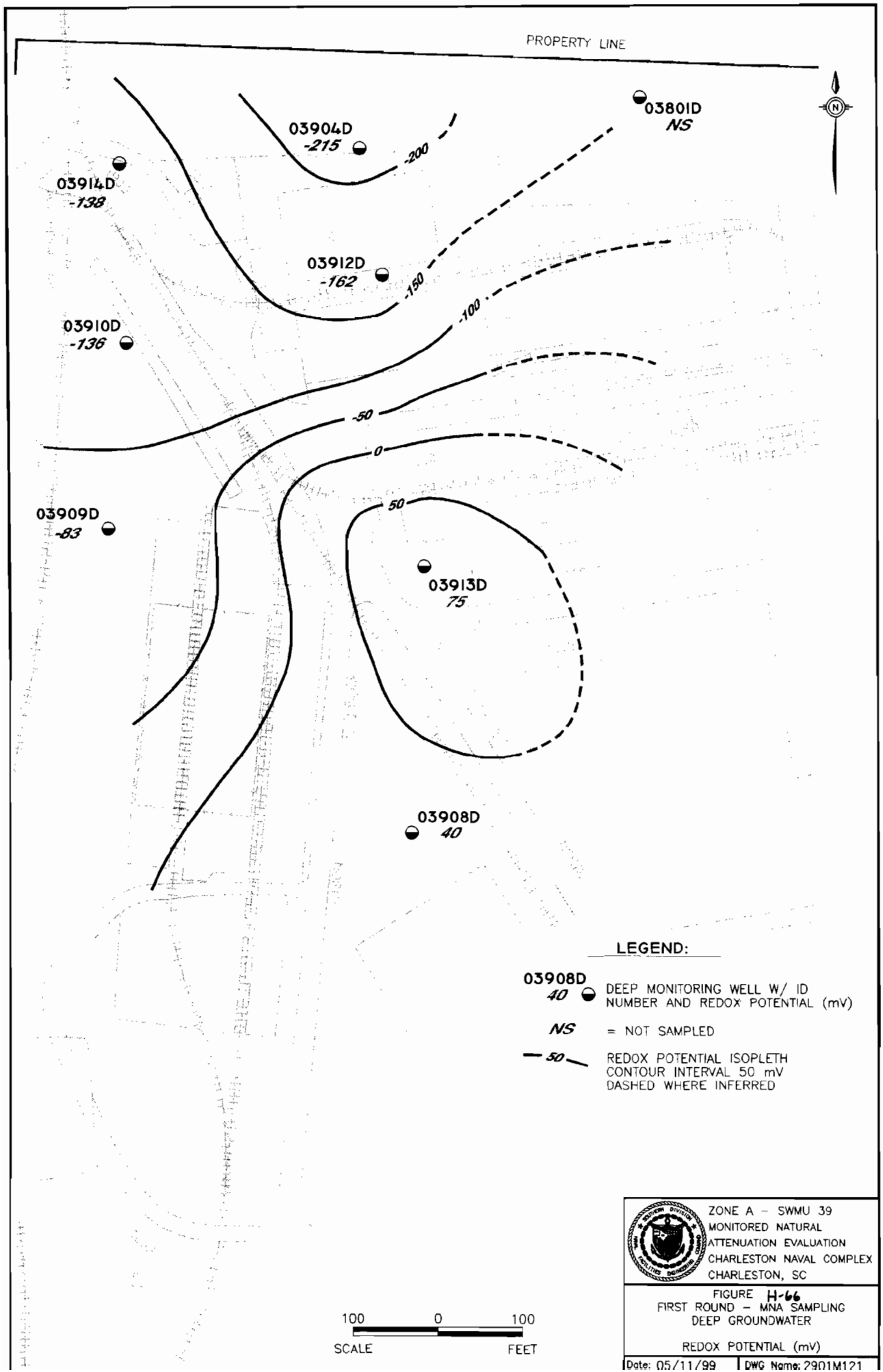
REDOX POTENTIAL (mV)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-65
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

DISSOLVED OXYGEN (mg/L)

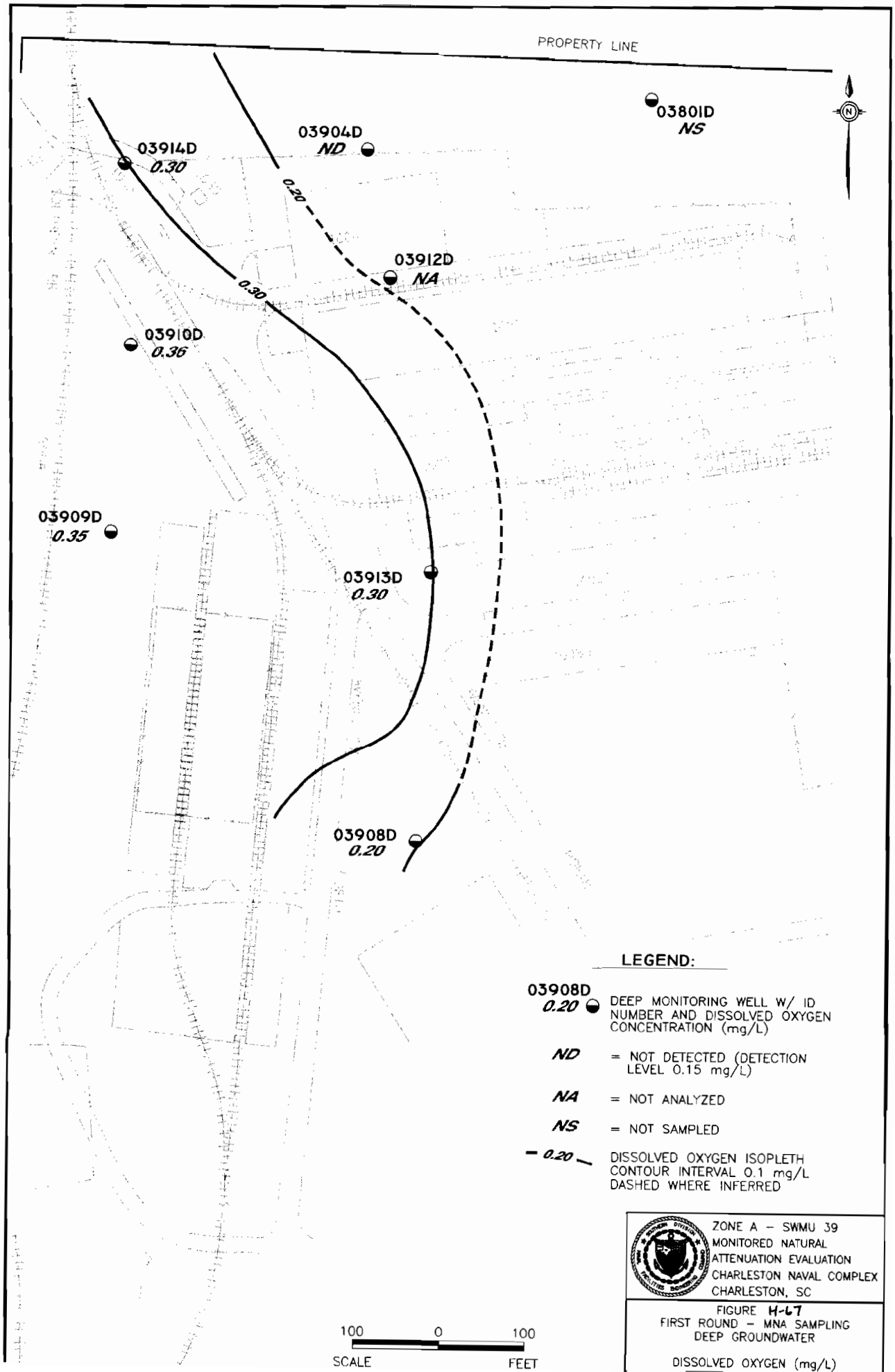


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-66
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

REDOX POTENTIAL (mV)

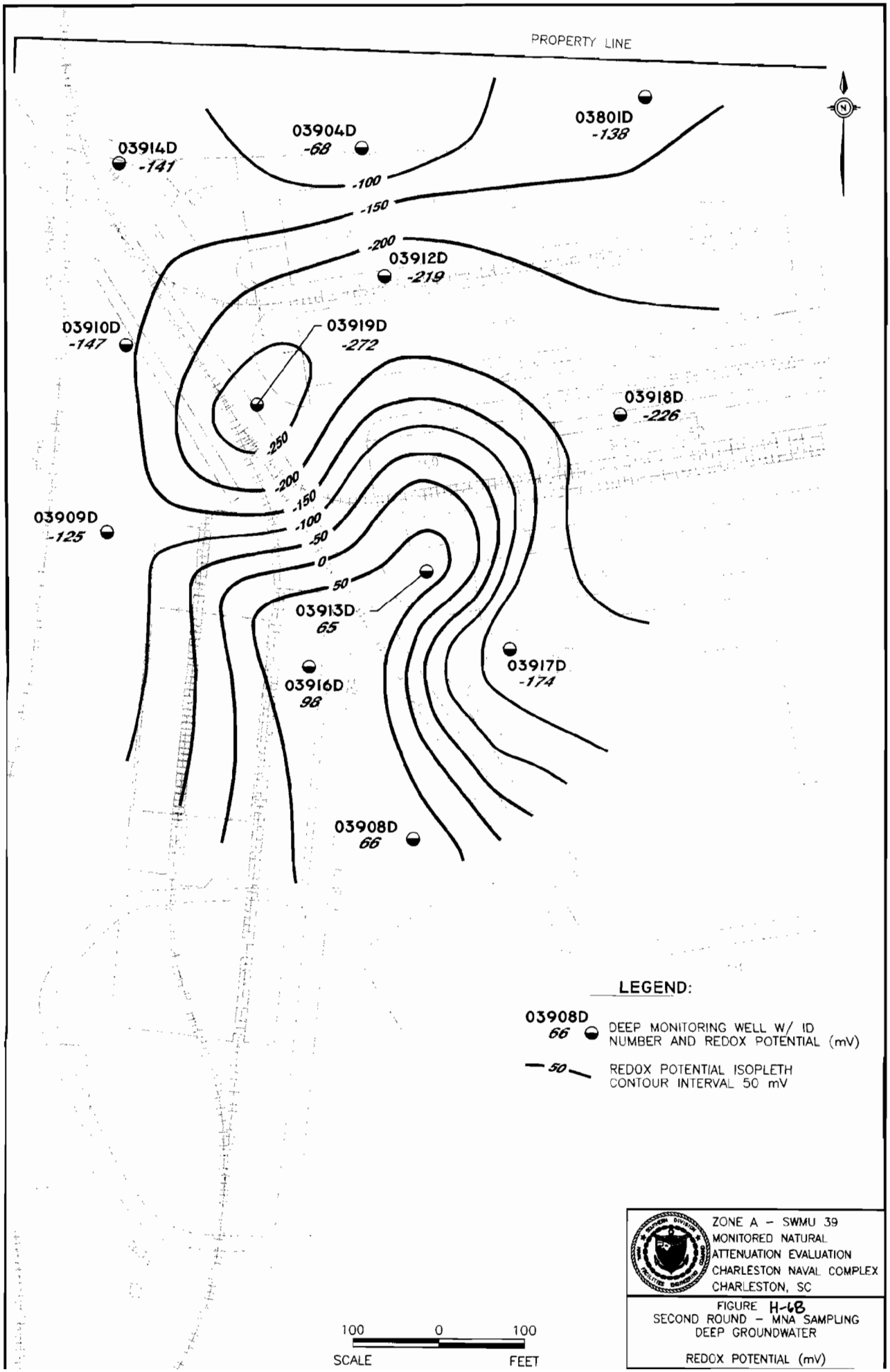
Date: 05/11/99 | DWG Name: 2901M121



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-67
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

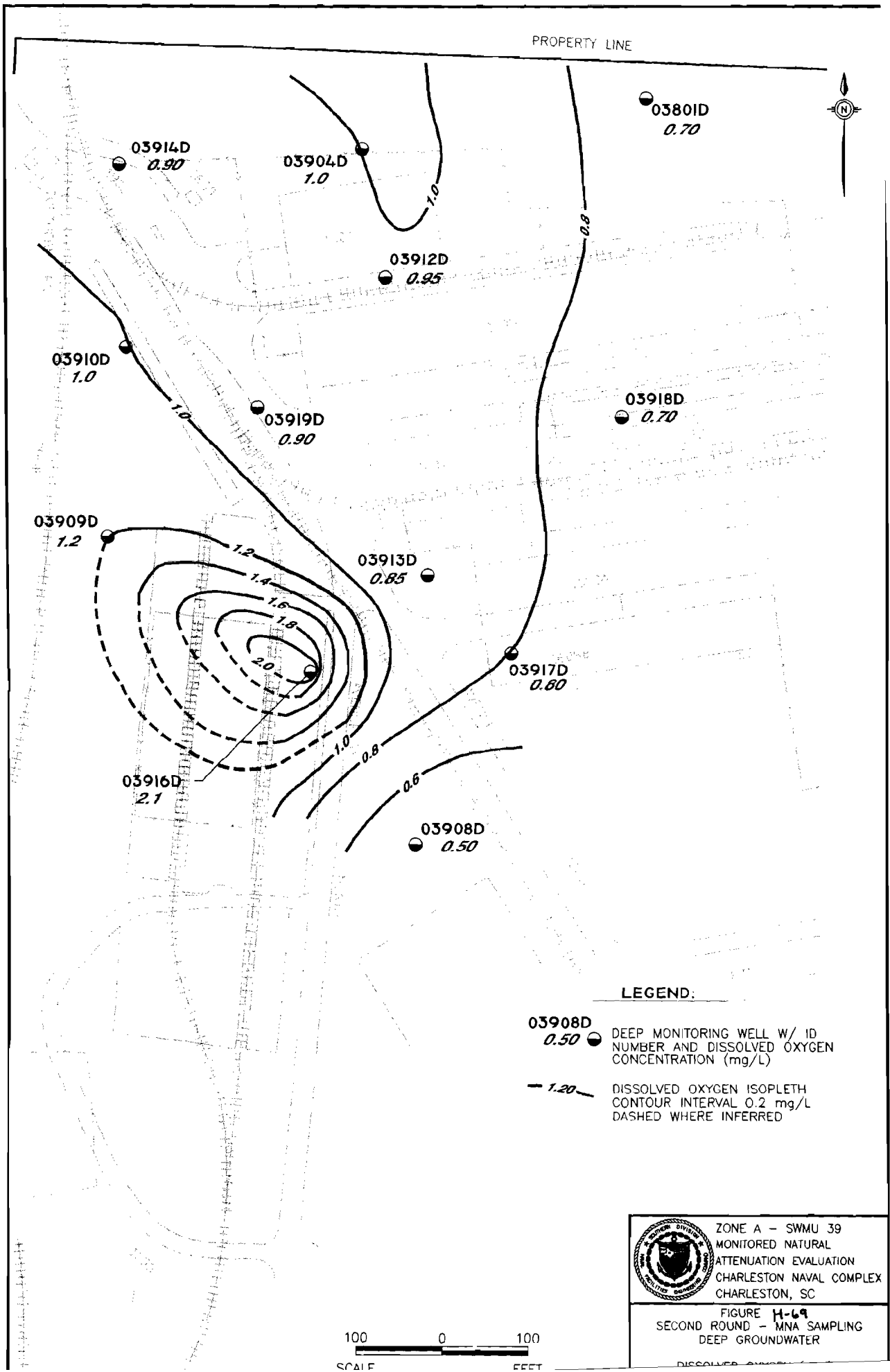
DISSOLVED OXYGEN (mg/L)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-6B
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

REDOX POTENTIAL (mV)



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-69
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

Figure H-70
Shallow Groundwater Hydrogen Concentrations

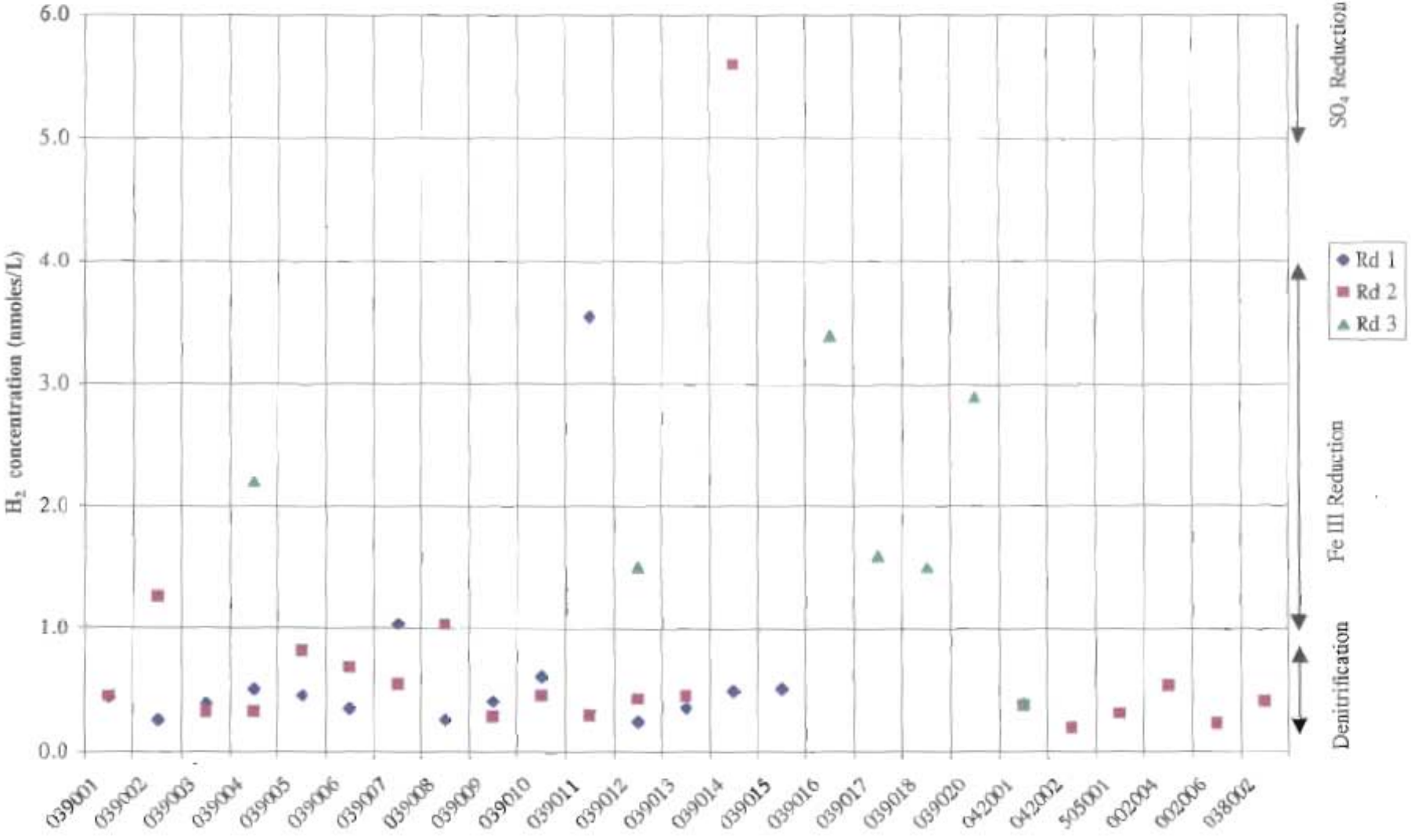


Figure H-71
Intermediate Groundwater Hydrogen Concentrations

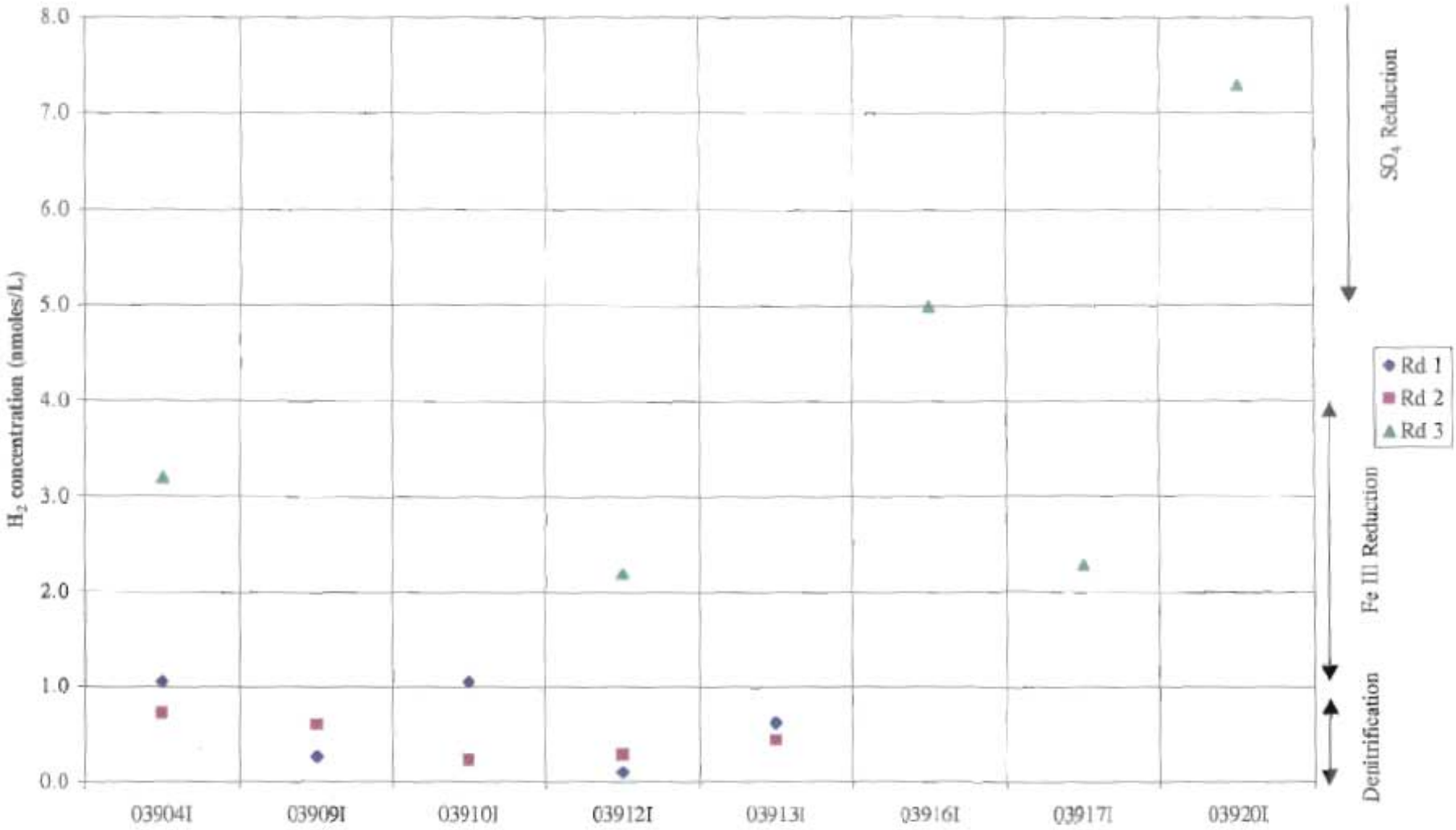


Figure H-72
Deep Groundwater Hydrogen Concentrations

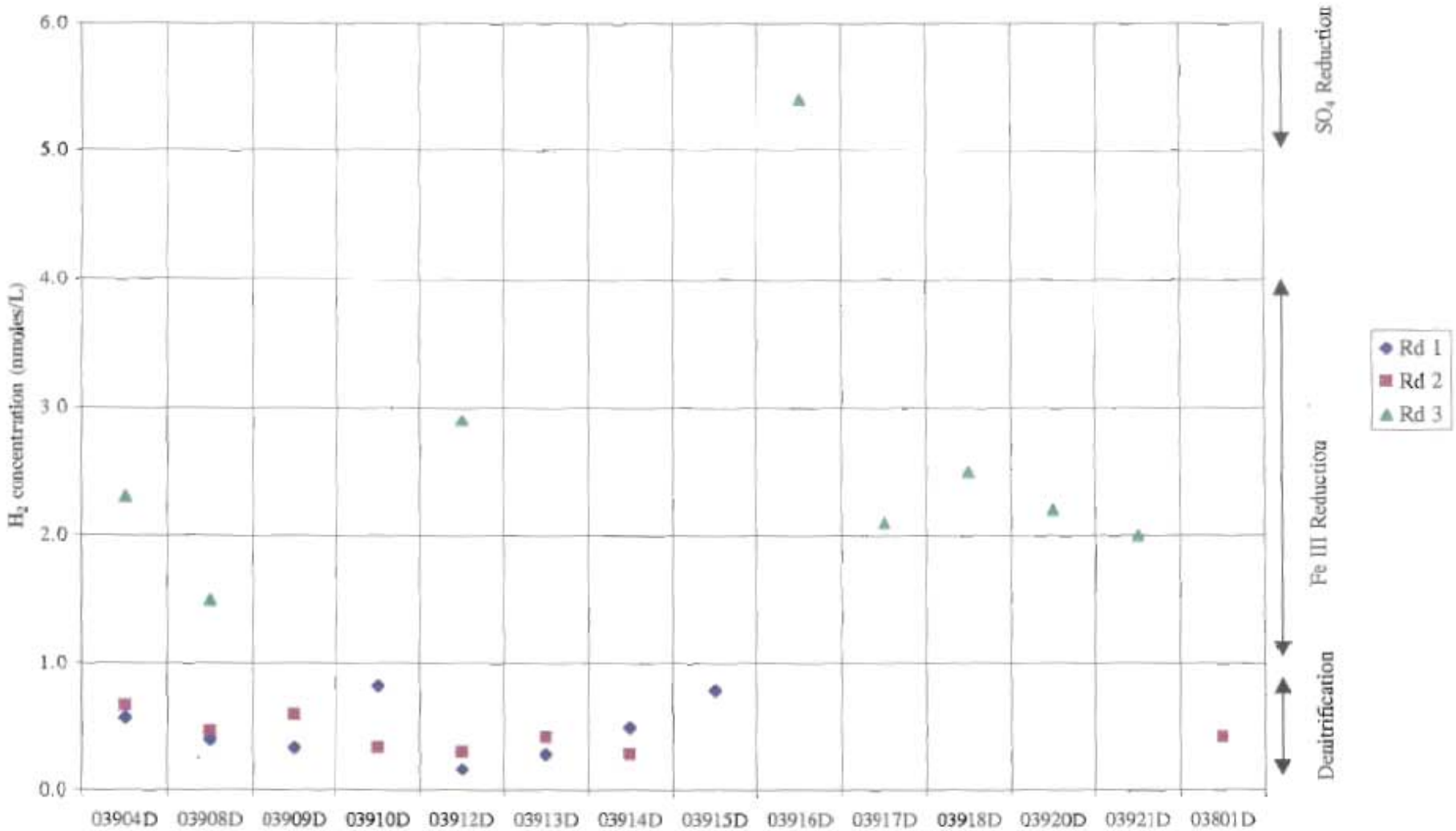


Figure H-73
Round 1 MNA Data

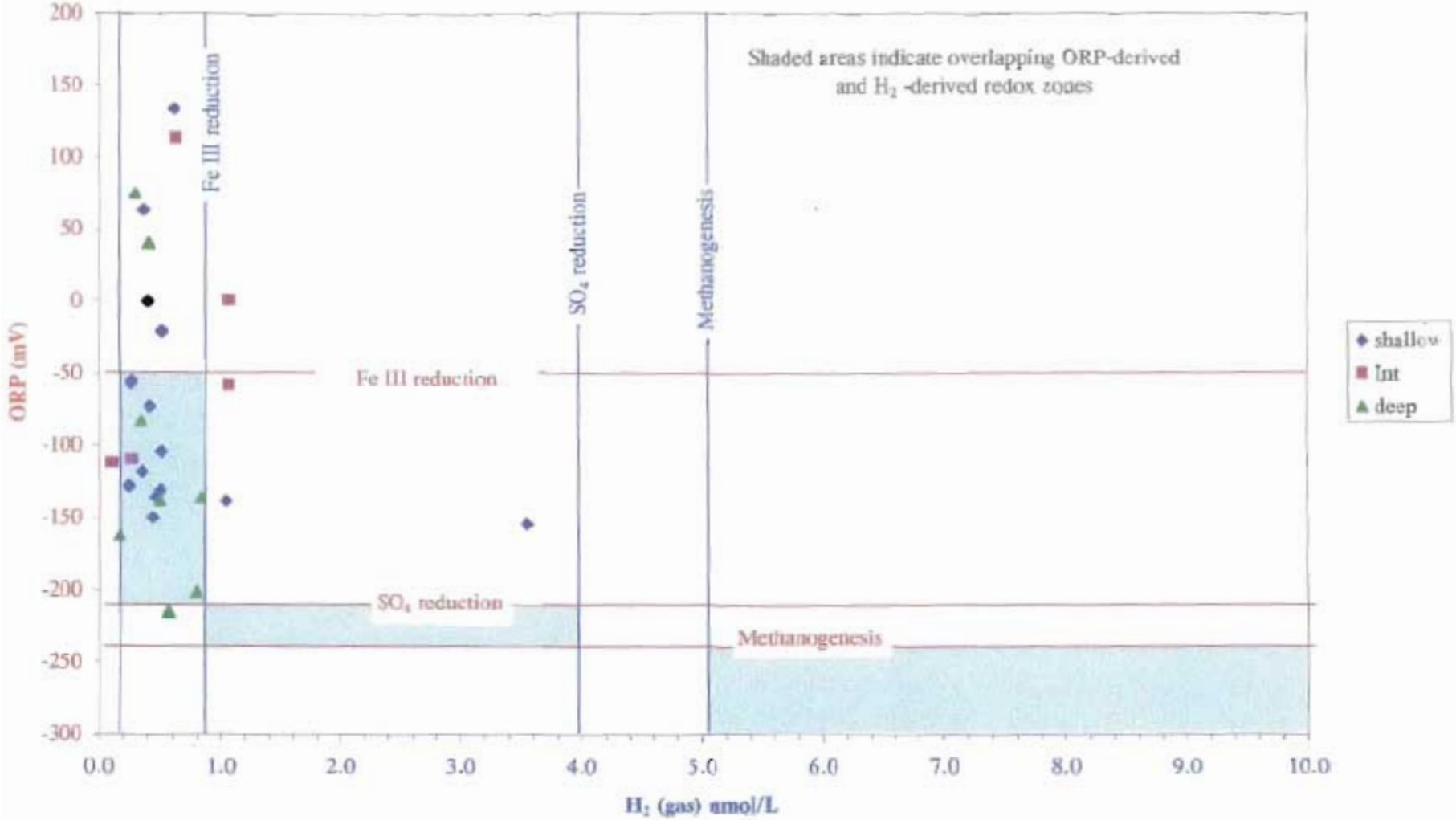


Figure H-74
Round 2 MNA Data

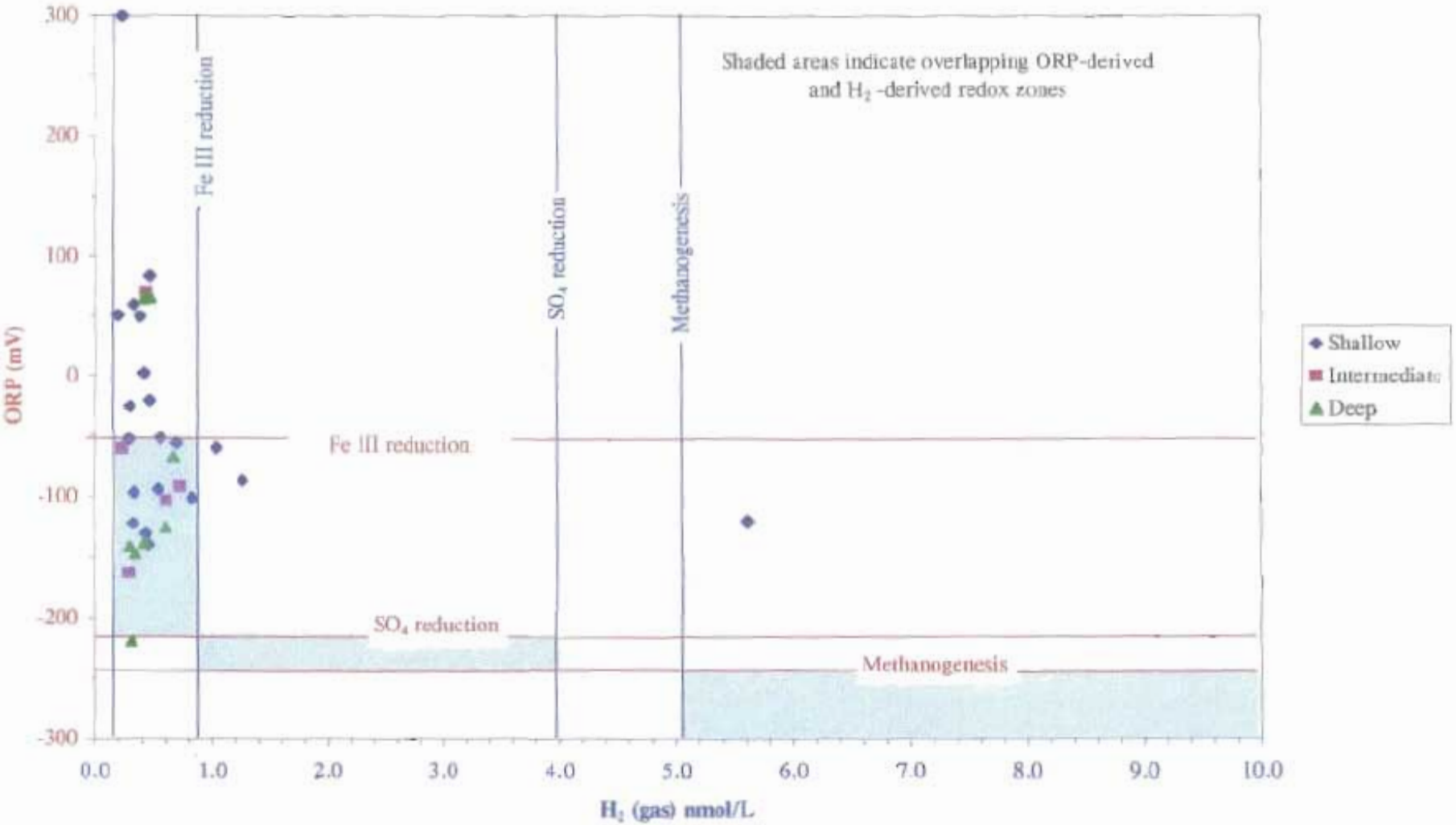


Figure H-75
Round 3 MNA Data

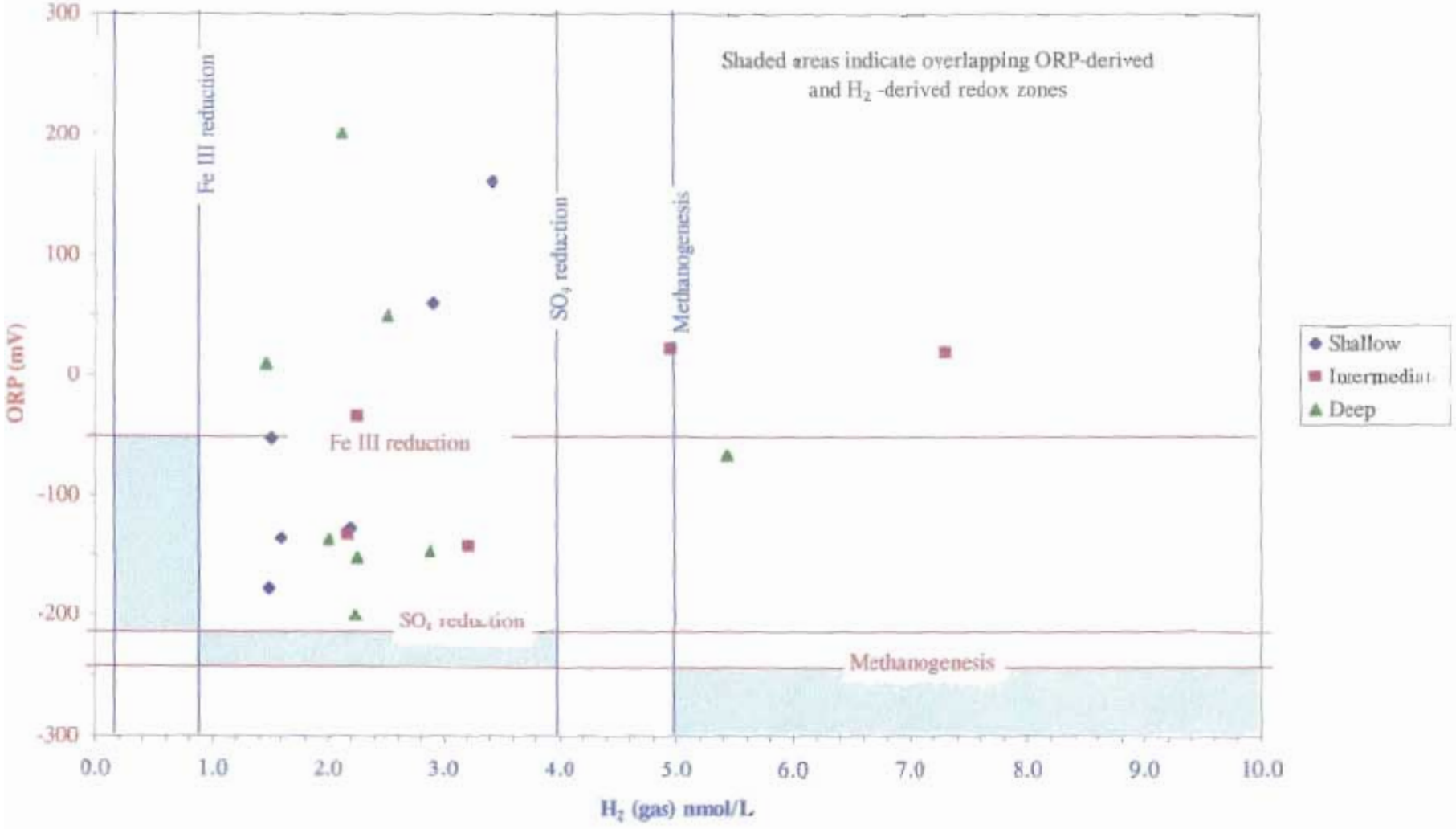


Figure H-76
Round 1 MNA Data

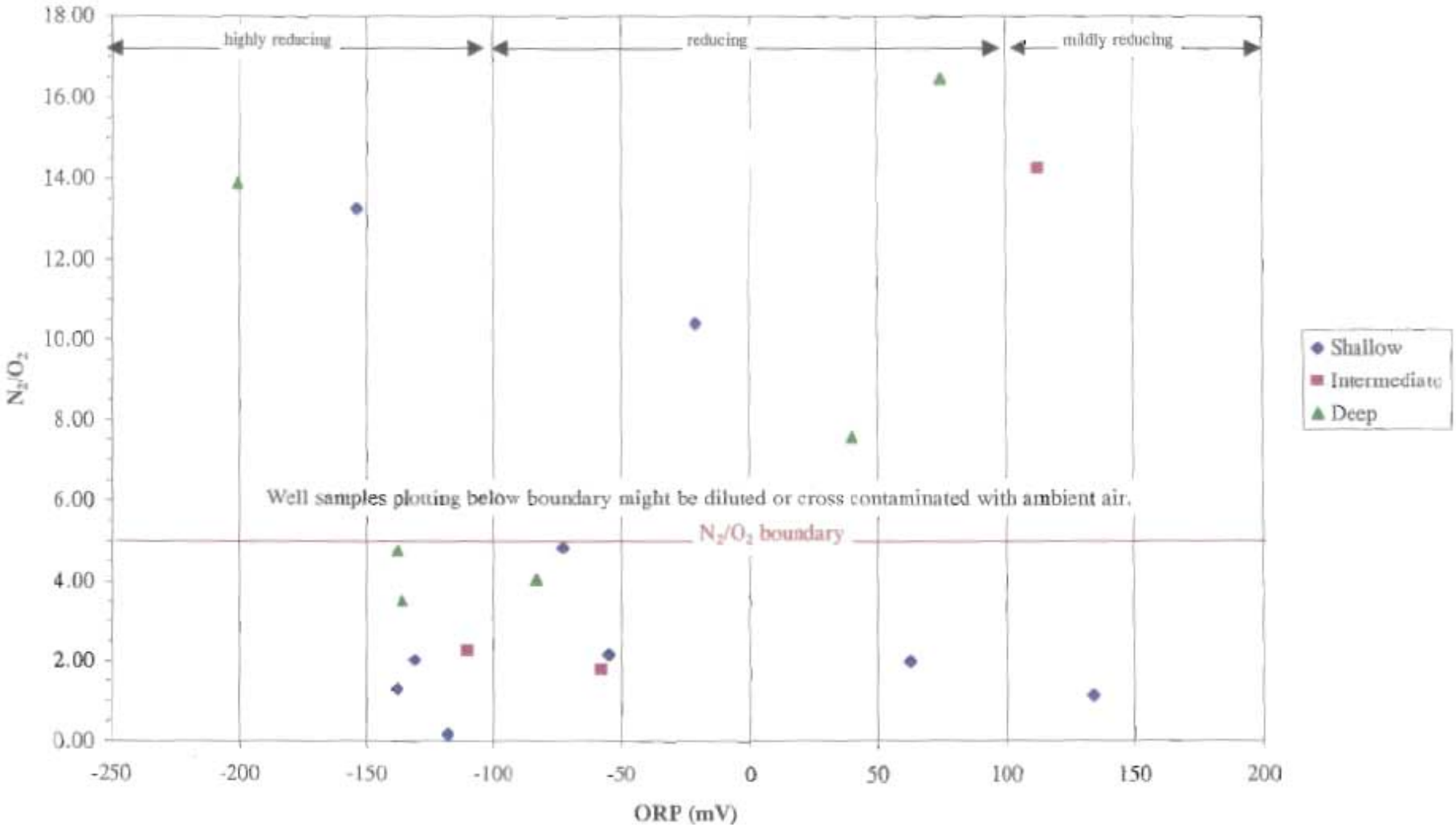
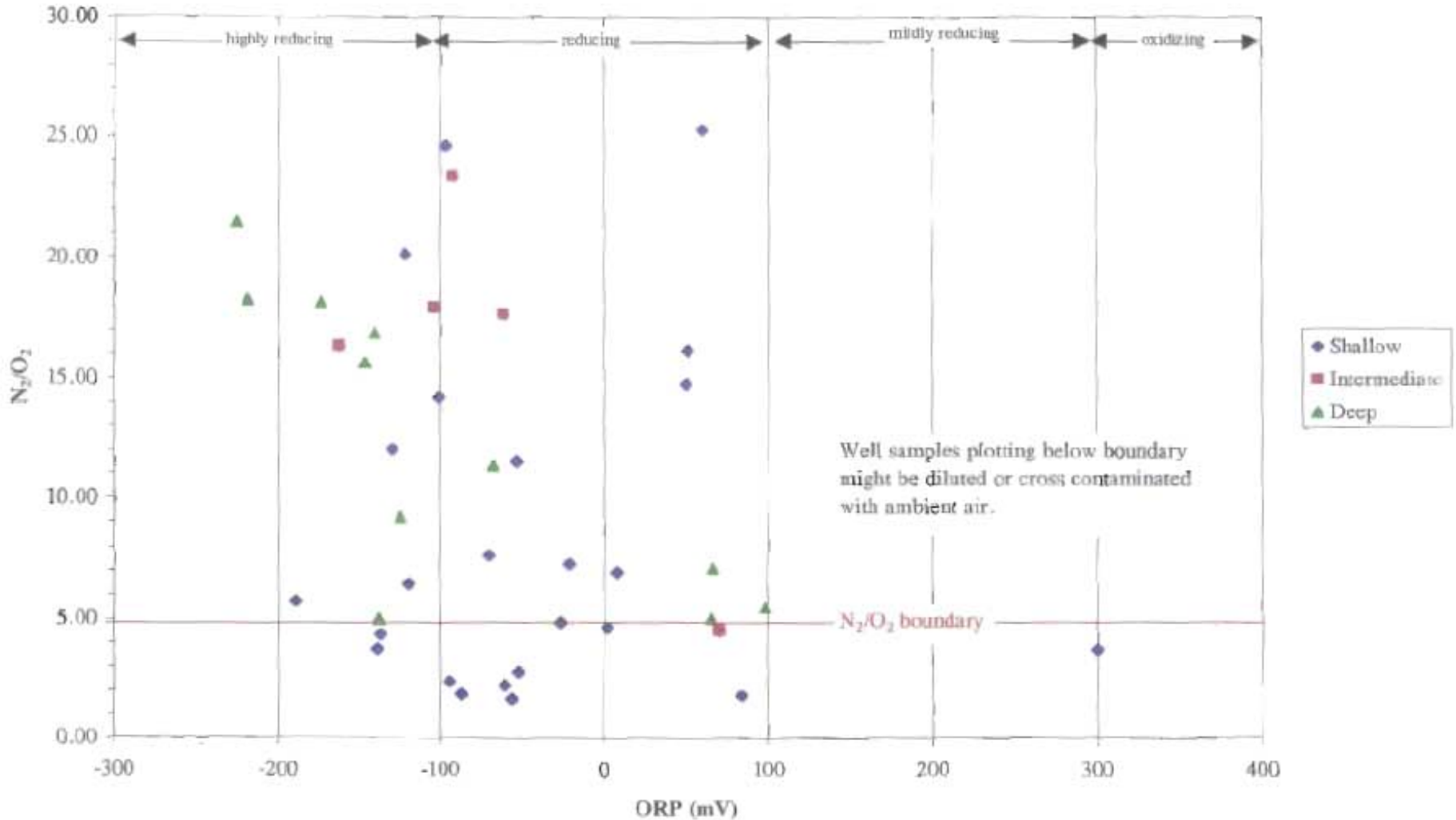
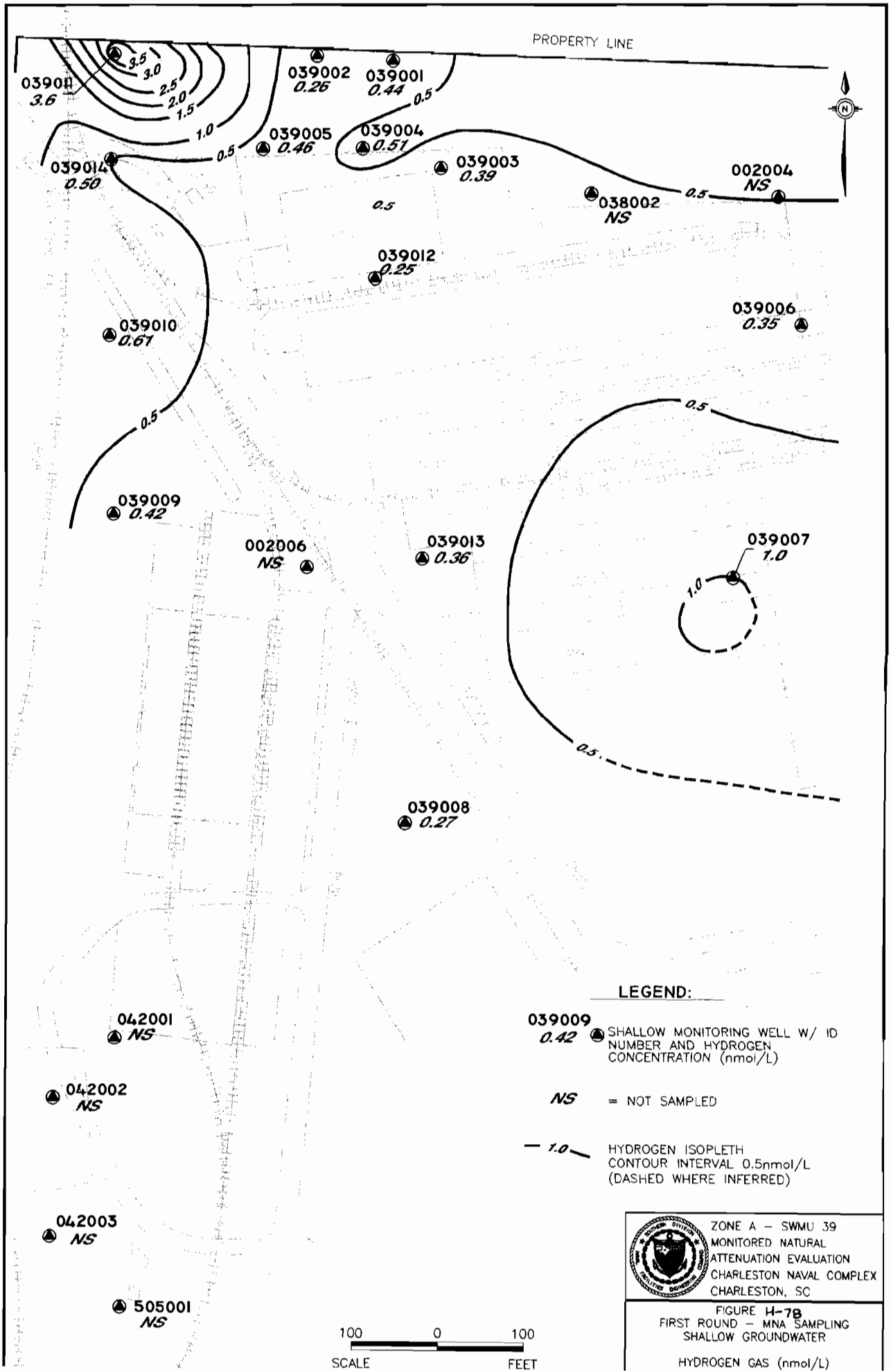
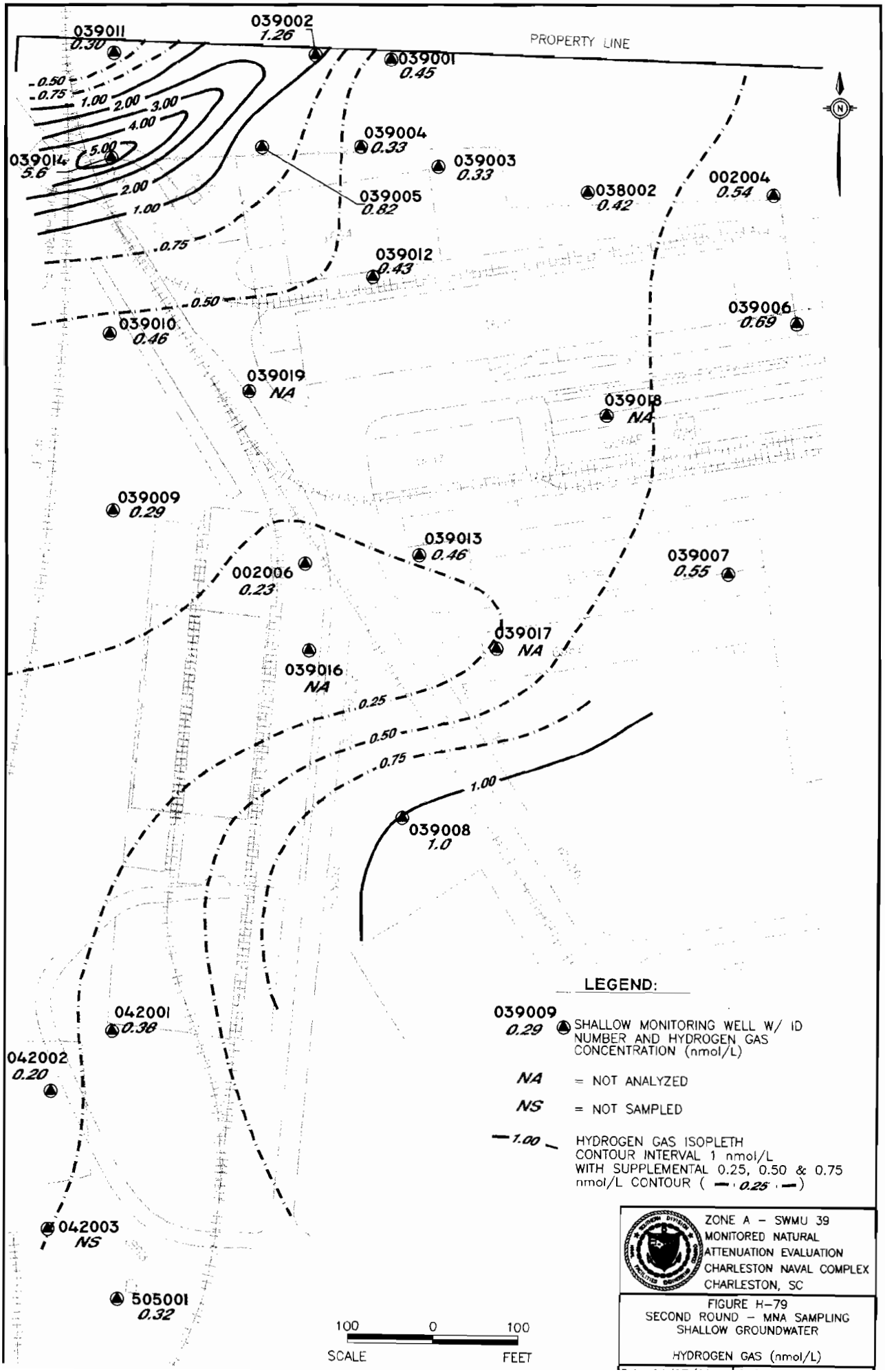
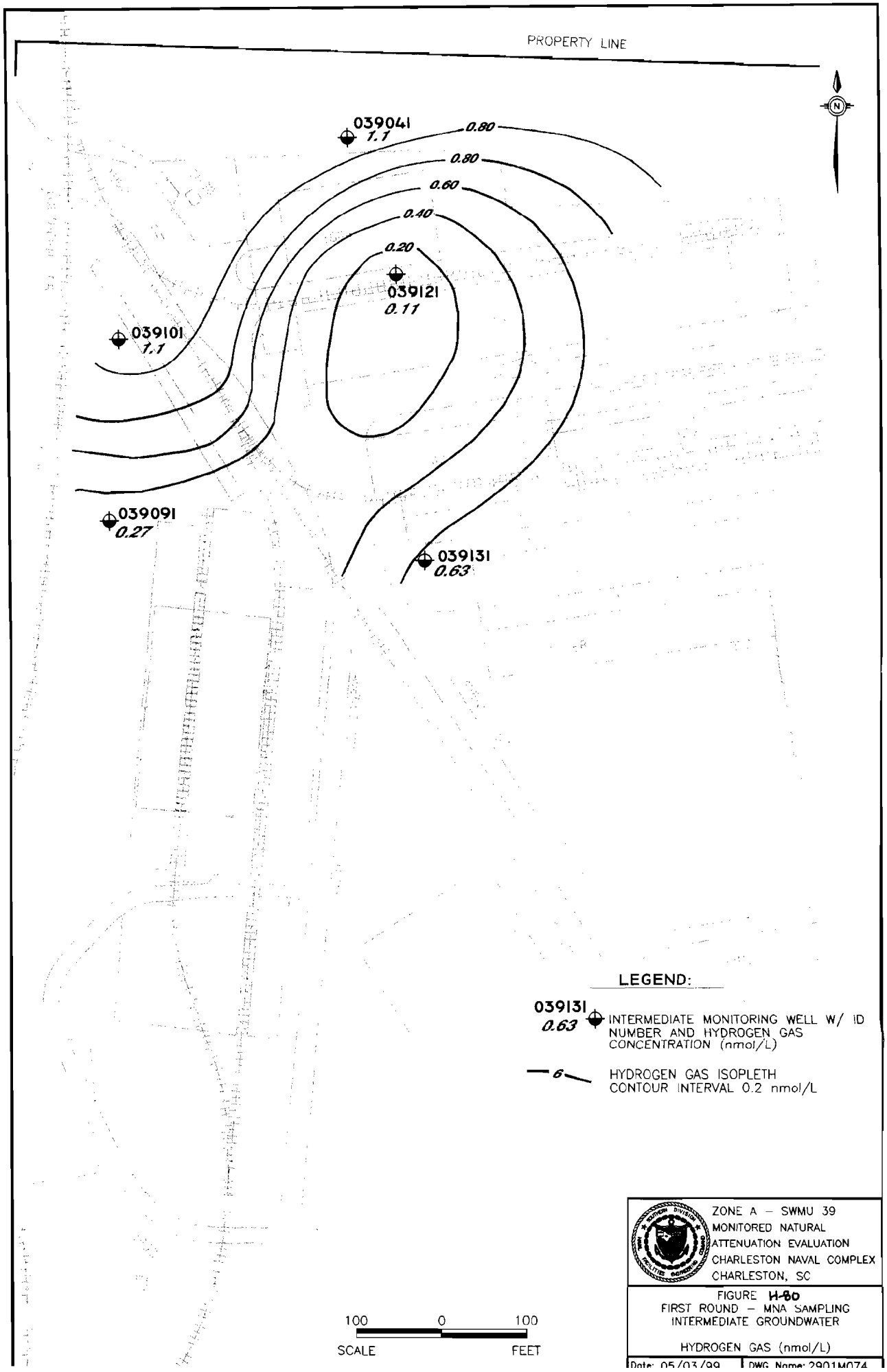


Figure H-77
Round 2 MNA Data




PROPERTY LINE
039011
3.6
3.5
3.0
2.5
2.0
1.5
1.0
0.5
039002
0.26
039001
0.44
039005
0.46
039004
0.51
039014
0.50
039003
0.39
002004
NS
038002
NS
039012
0.25
039006
0.35
039010
0.67
039009
0.42
002006
NS
039013
0.36
039007
1.0
039008
0.27
042001
NS
042002
NS
042003
NS
505001
NS
LEGEND:
039009
0.42
SHALLOW MONITORING WELL W/ ID NUMBER AND HYDROGEN CONCENTRATION (nmol/L)
NS = NOT SAMPLED
1.0
HYDROGEN ISOPLETH CONTOUR INTERVAL 0.5nmol/L (DASHED WHERE INFERRED)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-78
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
HYDROGEN GAS (nmol/L)


PROPERTY LINE
039011
0.30
039002
1.26
039001
0.45
039004
0.33
039003
0.33
039014
5.6
039005
0.82
038002
0.42
002004
0.54
039012
0.43
039006
0.69
039010
0.46
039019
NA
039018
NA
039009
0.29
039013
0.46
039007
0.55
002006
0.23
039017
NA
039016
NA
039008
1.0
042001
0.38
042002
0.20
042003
NS
505001
0.32
0.50
0.75
1.00
2.00
3.00
4.00
5.00
0.25
LEGEND:
039009
0.29
SHALLOW MONITORING WELL W/ ID NUMBER AND HYDROGEN GAS CONCENTRATION (nmol/L)
NA = NOT ANALYZED
NS = NOT SAMPLED
1.00
HYDROGEN GAS ISOPLETH CONTOUR INTERVAL 1 nmol/L WITH SUPPLEMENTAL 0.25, 0.50 & 0.75 nmol/L CONTOUR (0.25)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-79
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
HYDROGEN GAS (nmol/L)

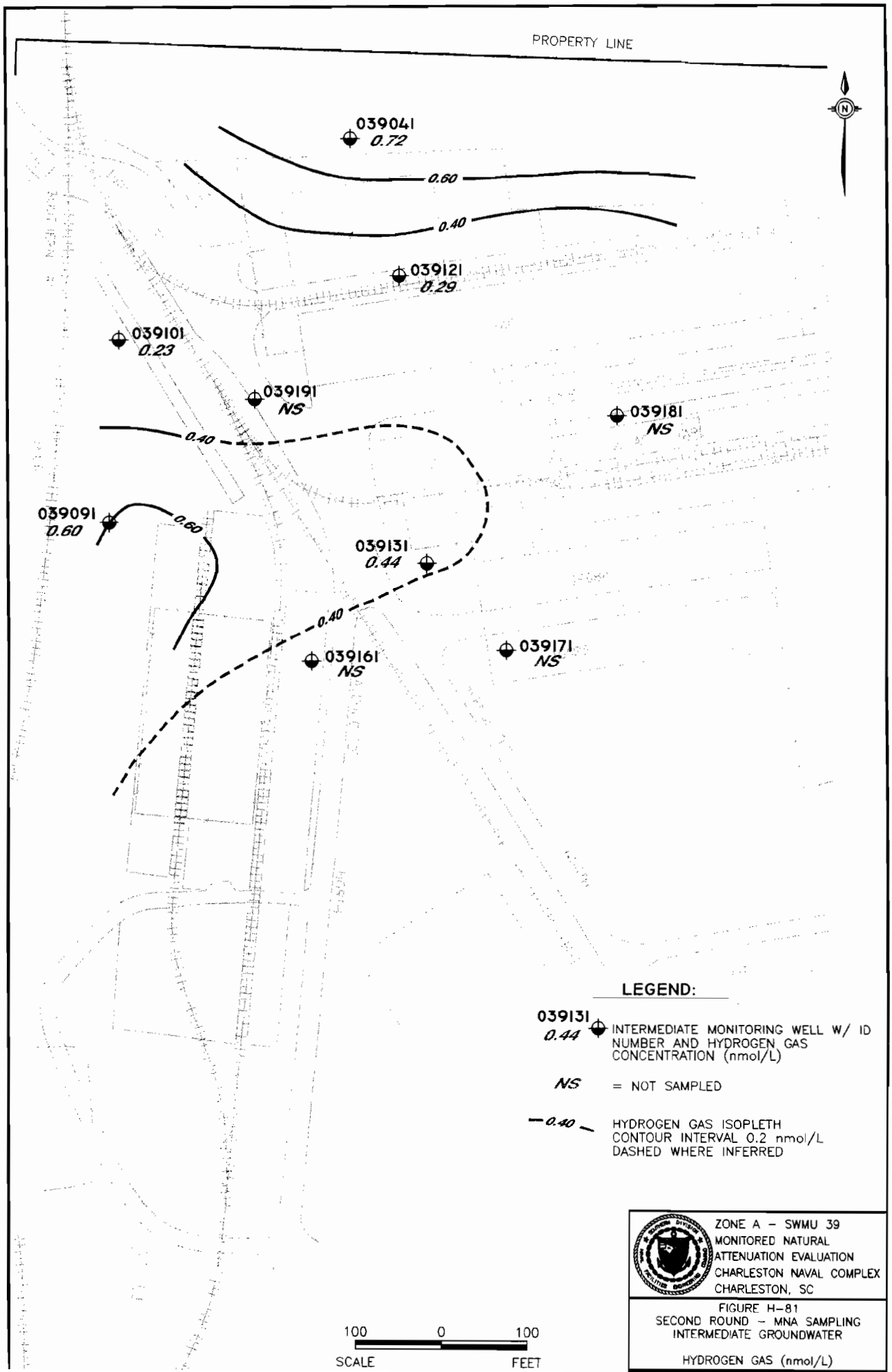


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-80
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

HYDROGEN GAS (nmol/L)

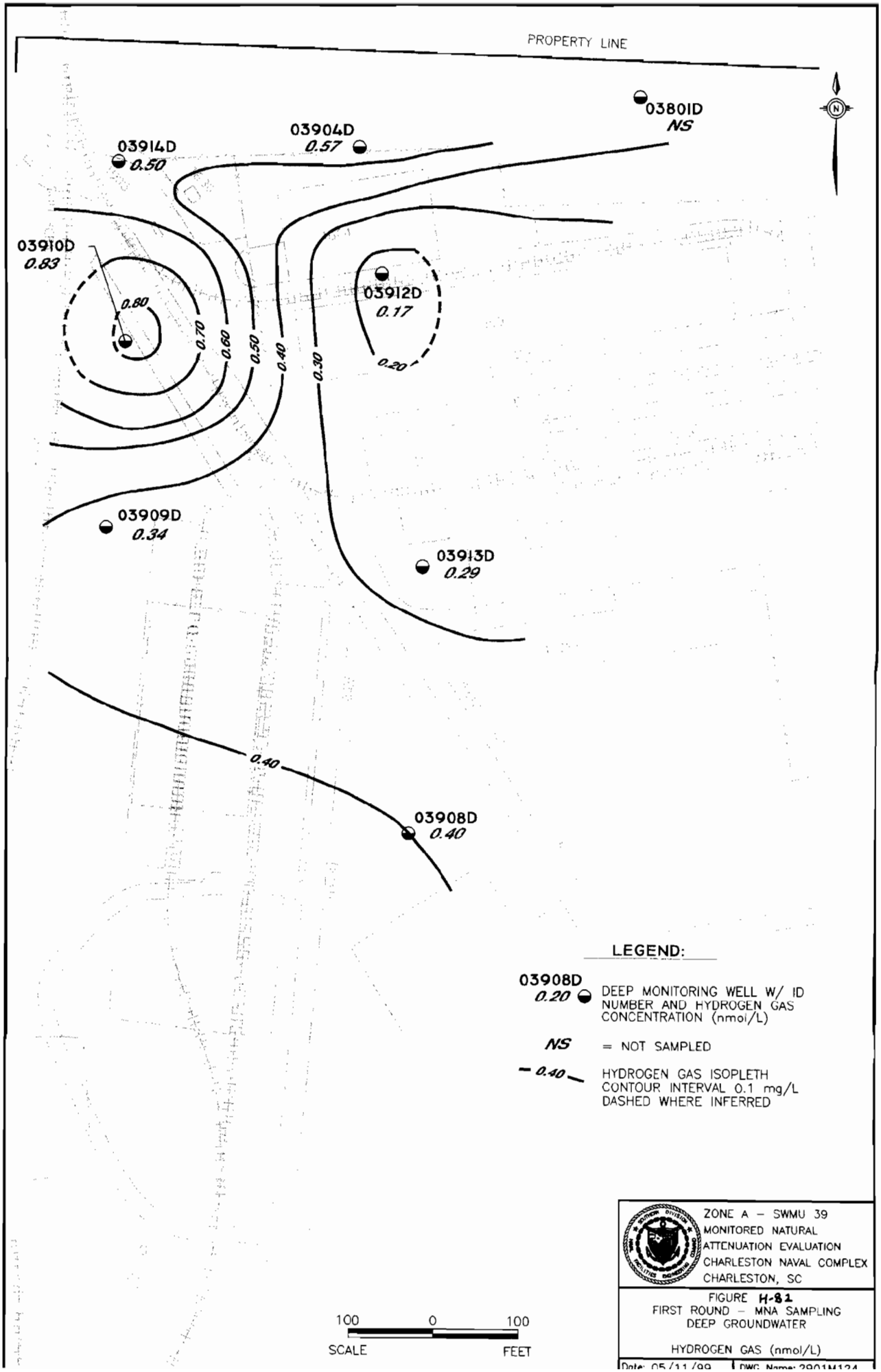
Date: 05/03/99 | DWG Name: 2901M074

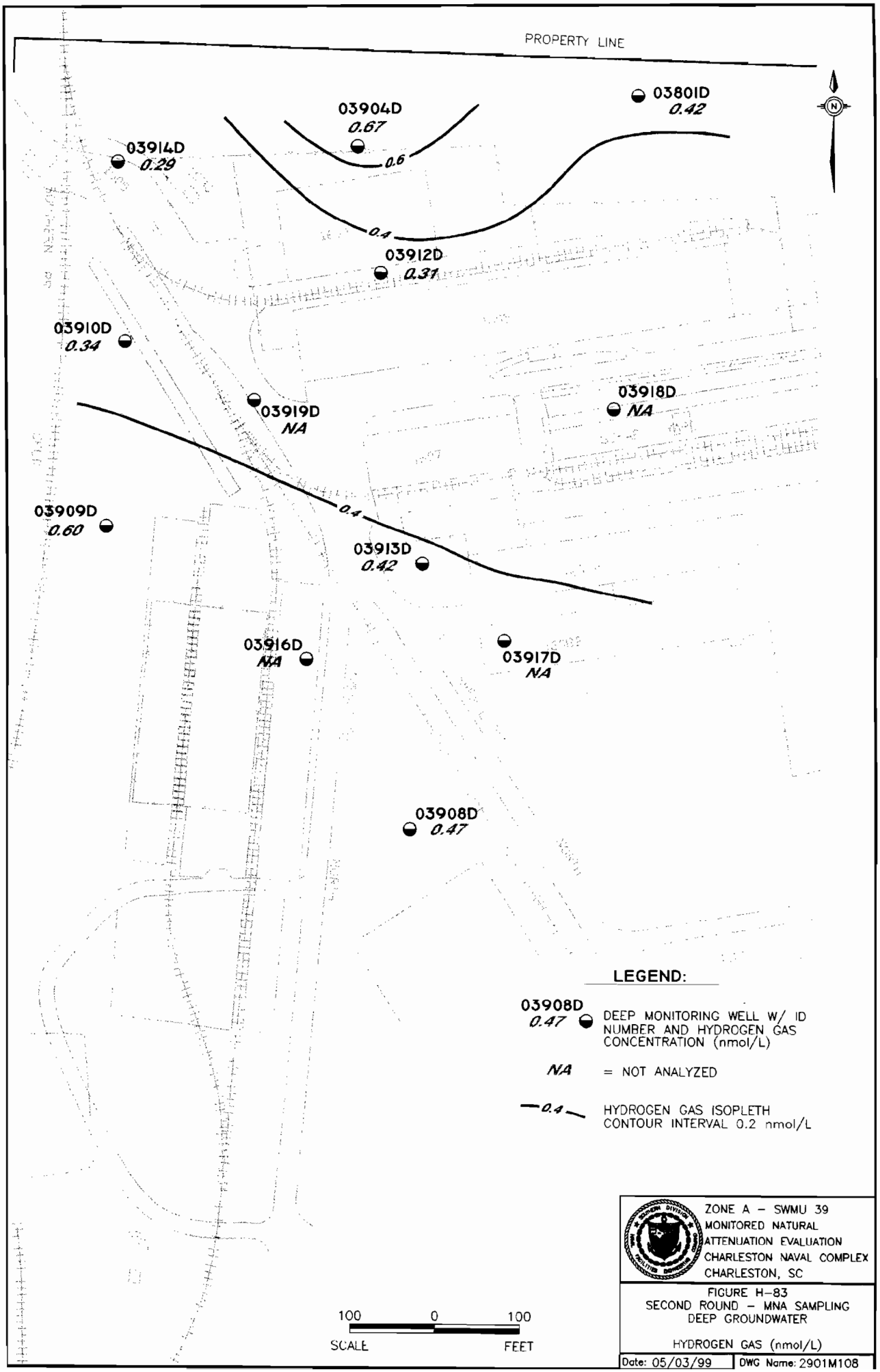


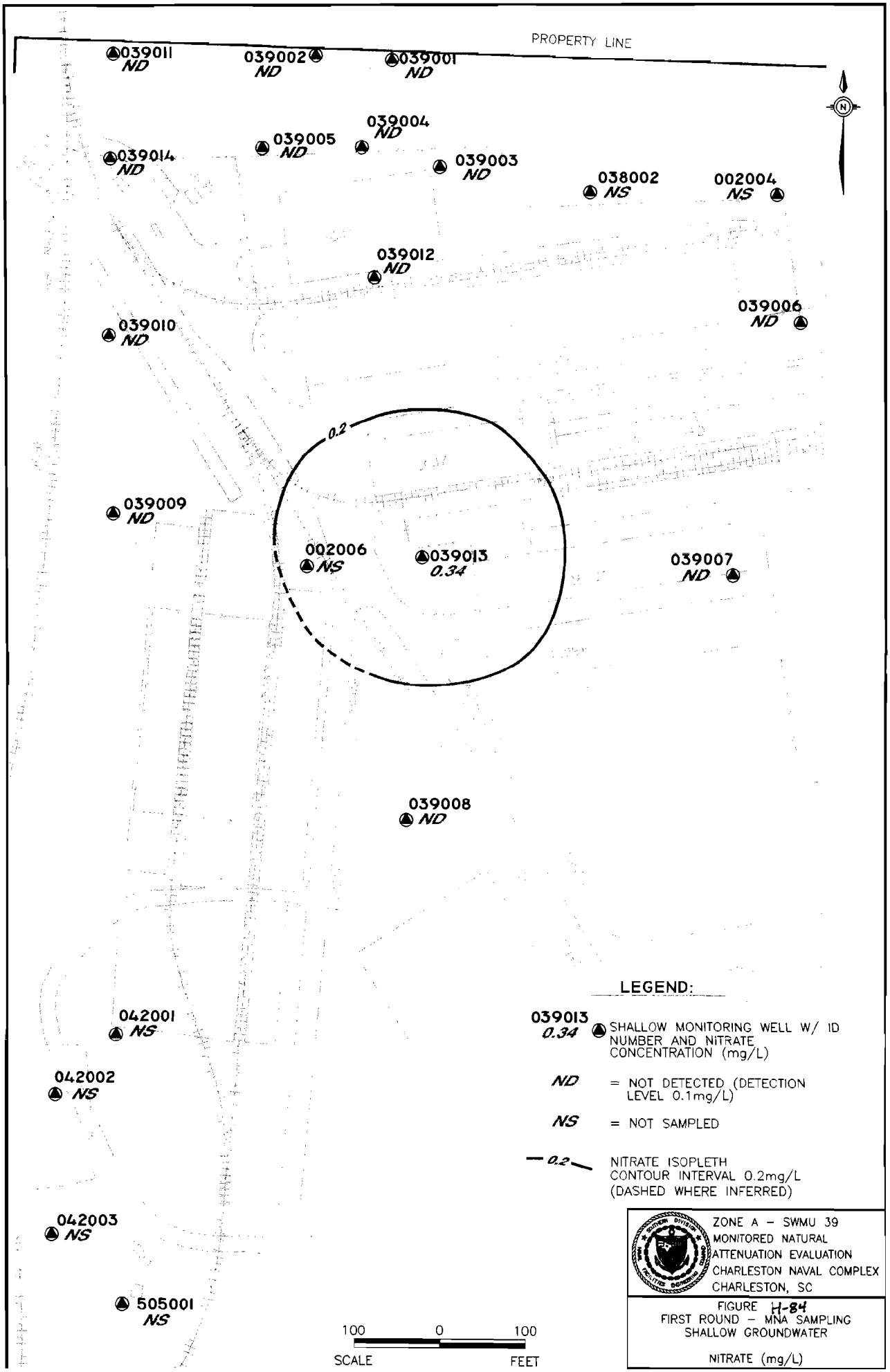
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

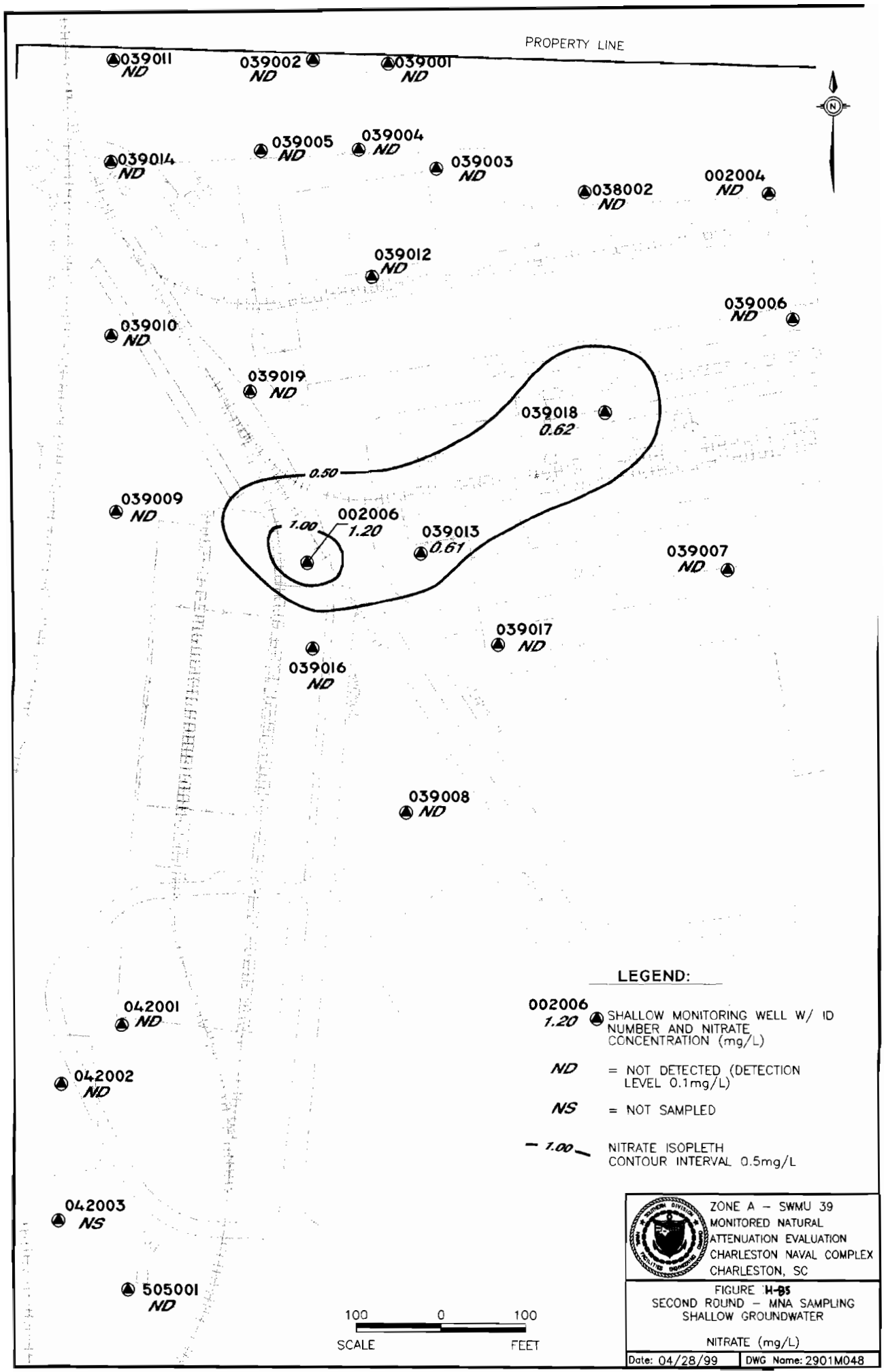
FIGURE H-81
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

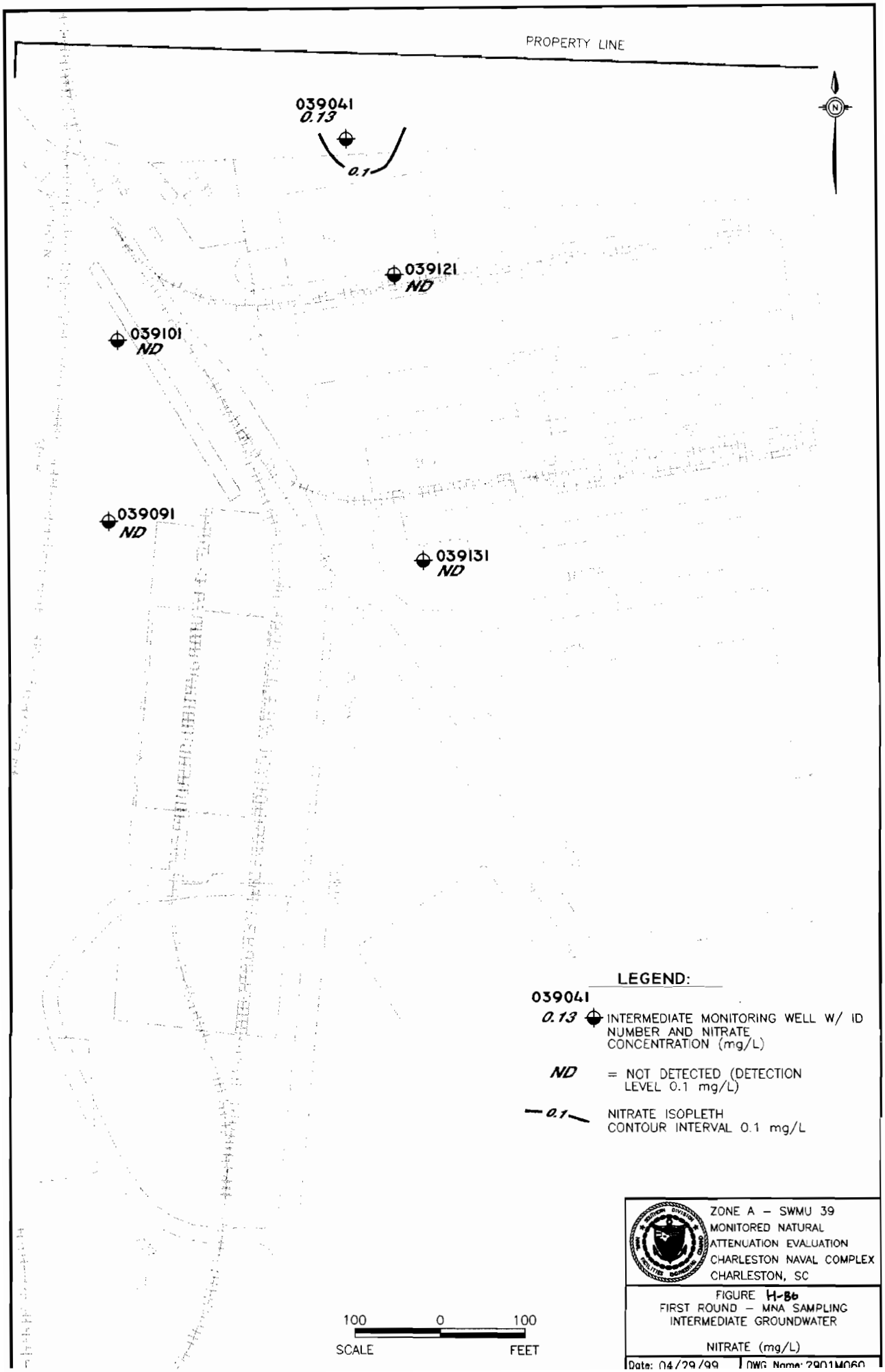
HYDROGEN GAS (nmol/L)

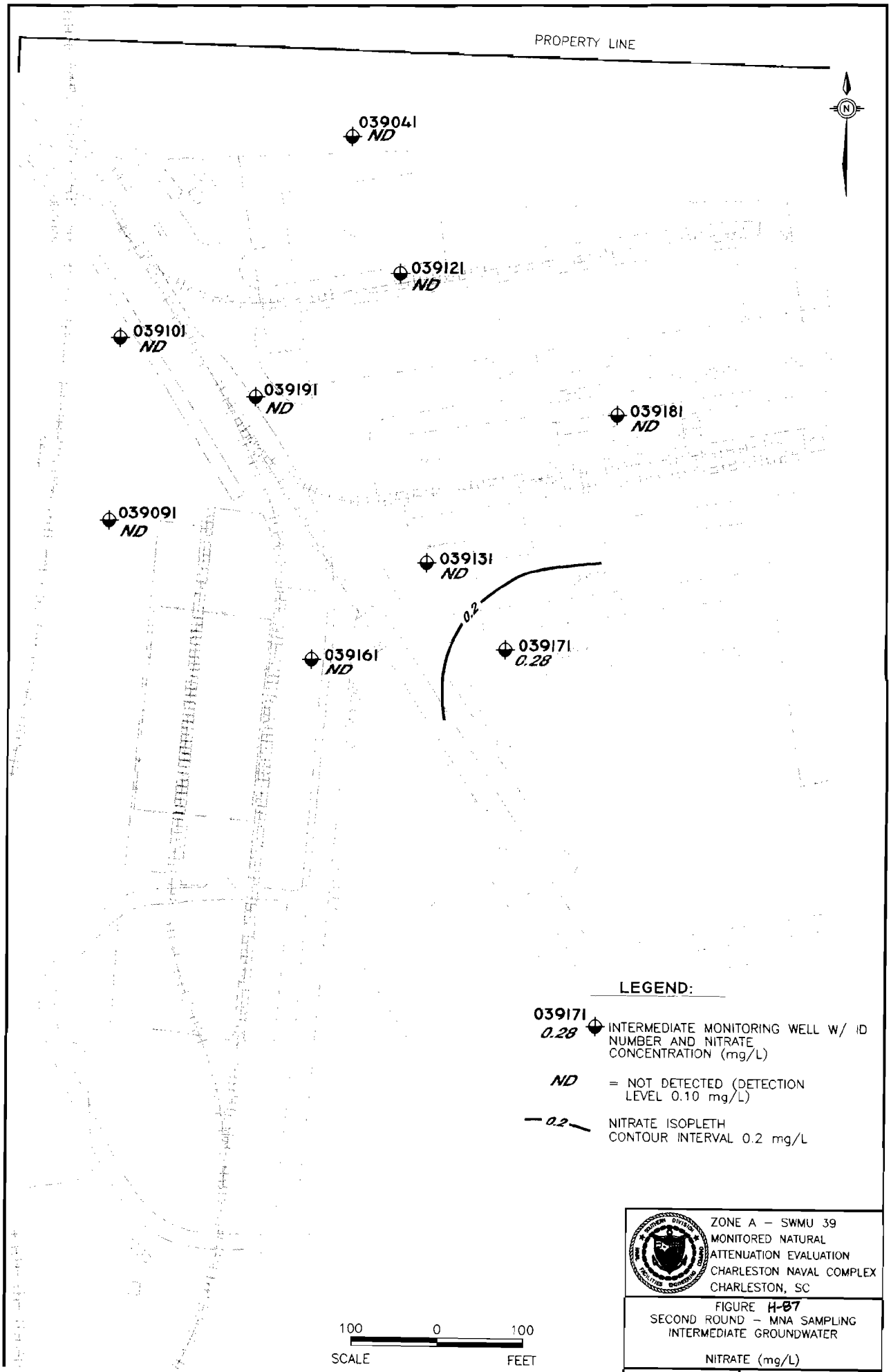

PROPERTY LINE
03801D
NS
03904D
0.57
03914D
0.50
03910D
0.83
0.80
0.70
0.60
0.50
0.40
0.30
03912D
0.17
0.20
03909D
0.34
03913D
0.29
0.40
03908D
0.40
LEGEND:
03908D
0.20
DEEP MONITORING WELL W/ ID NUMBER AND HYDROGEN GAS CONCENTRATION (nmol/L)
NS
= NOT SAMPLED
0.40
HYDROGEN GAS ISOPLETH CONTOUR INTERVAL 0.1 mg/L DASHED WHERE INFERRED
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-82
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER
HYDROGEN GAS (nmol/L)
Date: 05/11/99
DWG. Name: 2901M124


PROPERTY LINE
03801D
0.42
03904D
0.67
03914D
0.29
0.6
0.4
03912D
0.31
03910D
0.34
03919D
NA
03918D
NA
03909D
0.60
0.4
03913D
0.42
03916D
NA
03917D
NA
03908D
0.47
LEGEND:
03908D
0.47
DEEP MONITORING WELL W/ ID NUMBER AND HYDROGEN GAS CONCENTRATION (nmol/L)
NA
= NOT ANALYZED
0.4
HYDROGEN GAS ISOPLETH CONTOUR INTERVAL 0.2 nmol/L
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-83
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER
HYDROGEN GAS (nmol/L)
Date: 05/03/99
DWG Name: 2901M108


PROPERTY LINE
039011
ND
039002
ND
039001
ND
039004
ND
039005
ND
039014
ND
039003
ND
038002
NS
002004
NS
039012
ND
039006
ND
039010
ND
0.2
039009
ND
002006
NS
039013
0.34
039007
ND
039008
ND
042001
NS
042002
NS
042003
NS
505001
NS
LEGEND:
039013
0.34
SHALLOW MONITORING WELL W/ ID NUMBER AND NITRATE CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 0.1mg/L)
NS = NOT SAMPLED
0.2
NITRATE ISOPLETH CONTOUR INTERVAL 0.2mg/L (DASHED WHERE INFERRED)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-84
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
NITRATE (mg/L)


PROPERTY LINE
039011
ND
039002
ND
039001
ND
039005
ND
039004
ND
039014
ND
039003
ND
038002
ND
002004
ND
039012
ND
039006
ND
039010
ND
039019
ND
039018
0.62
0.50
039009
ND
002006
1.20
1.00
039013
0.61
039007
ND
039017
ND
039016
ND
039008
ND
042001
ND
042002
ND
042003
NS
505001
ND
LEGEND:
002006
1.20
SHALLOW MONITORING WELL W/ ID NUMBER AND NITRATE CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 0.1mg/L)
NS = NOT SAMPLED
1.00
NITRATE ISOPLETH CONTOUR INTERVAL 0.5mg/L
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-B5
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
NITRATE (mg/L)
Date: 04/28/99
DWG Name: 2901M048

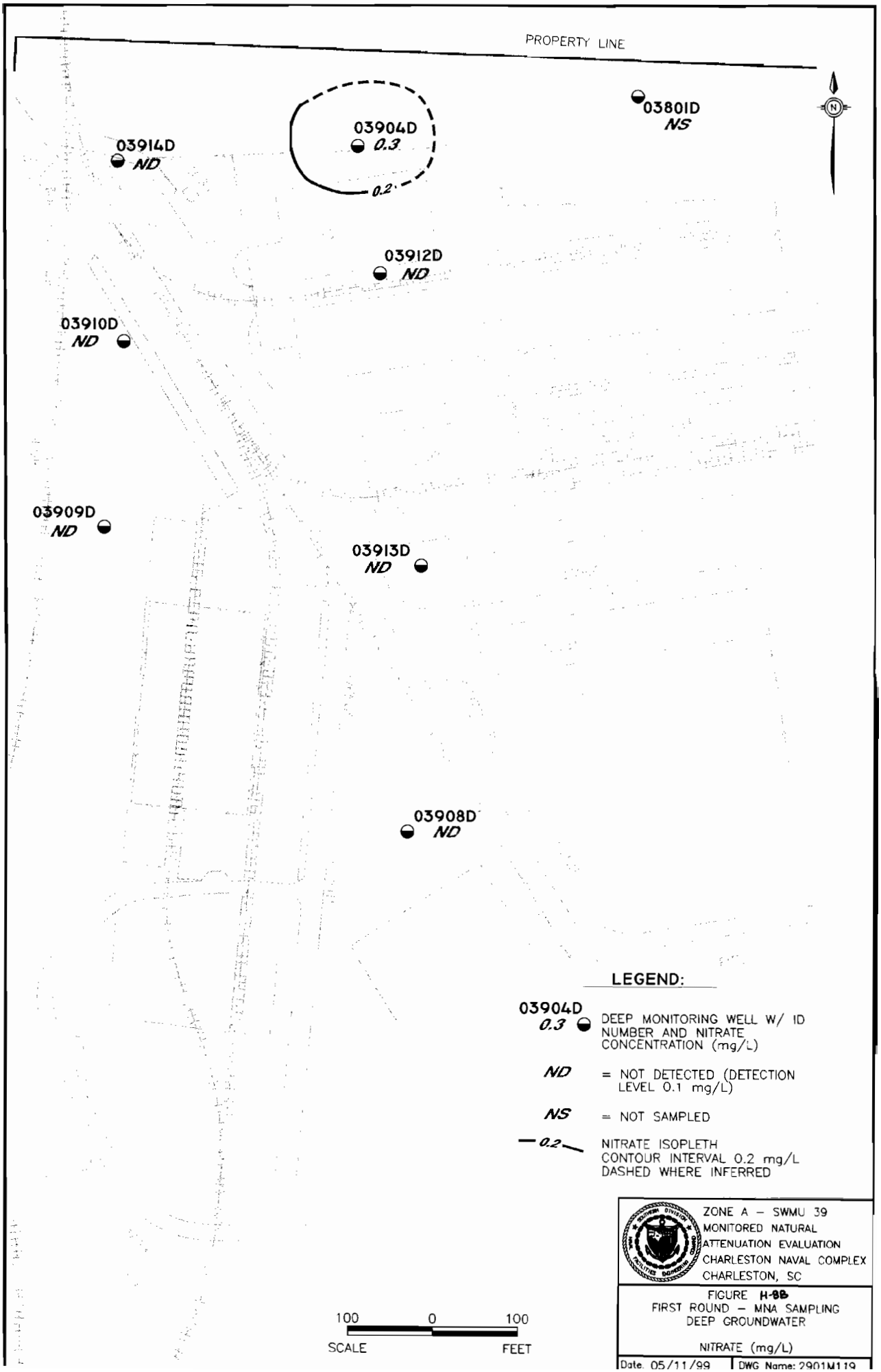

PROPERTY LINE
039041
0.13
0.1
039121
ND
039101
ND
039091
ND
039131
ND
LEGEND:
039041
0.13
INTERMEDIATE MONITORING WELL W/ ID NUMBER AND NITRATE CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 0.1 mg/L)
0.1
NITRATE ISOPLETH CONTOUR INTERVAL 0.1 mg/L
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-B6
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER
NITRATE (mg/L)
Date: 04/29/99
DWG Name: 2901M060



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-87
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

NITRATE (mg/L)

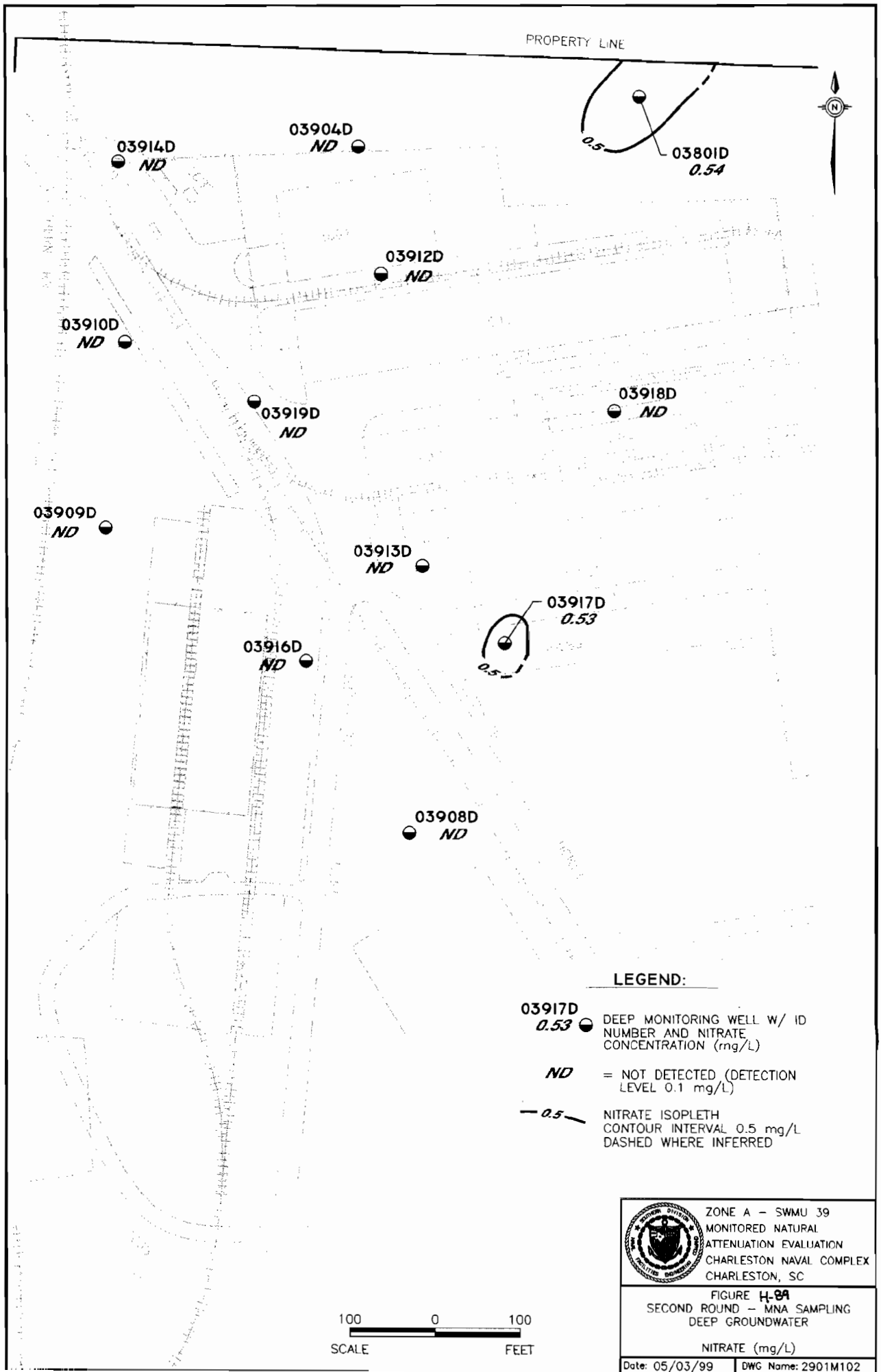


ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-8B
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

NITRATE (mg/L)

Date. 05/11/99 | DWG Name: 2901M119

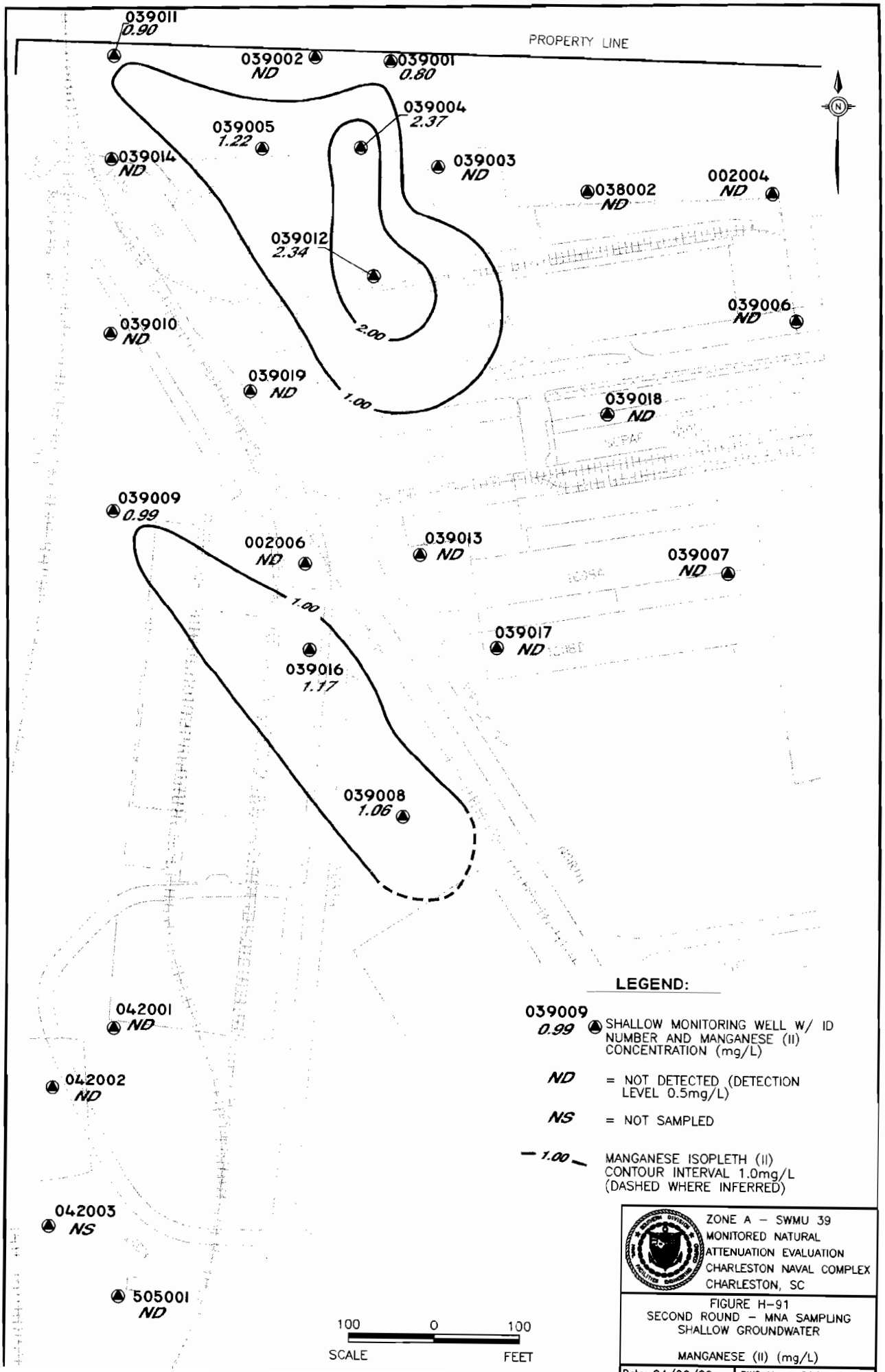


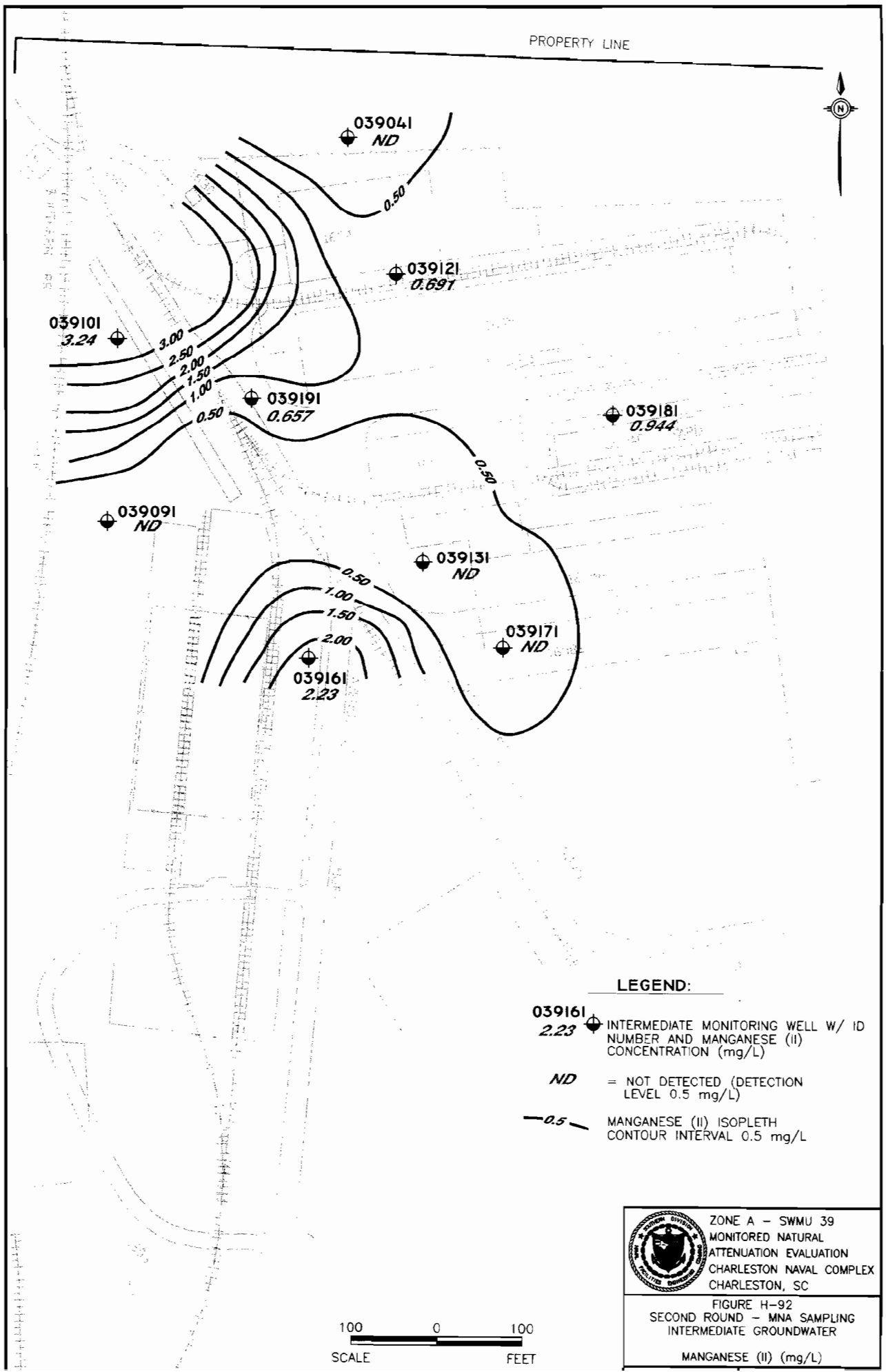
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-8A
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

NITRATE (mg/L)

Date: 05/03/99 | DWG Name: 2901M102

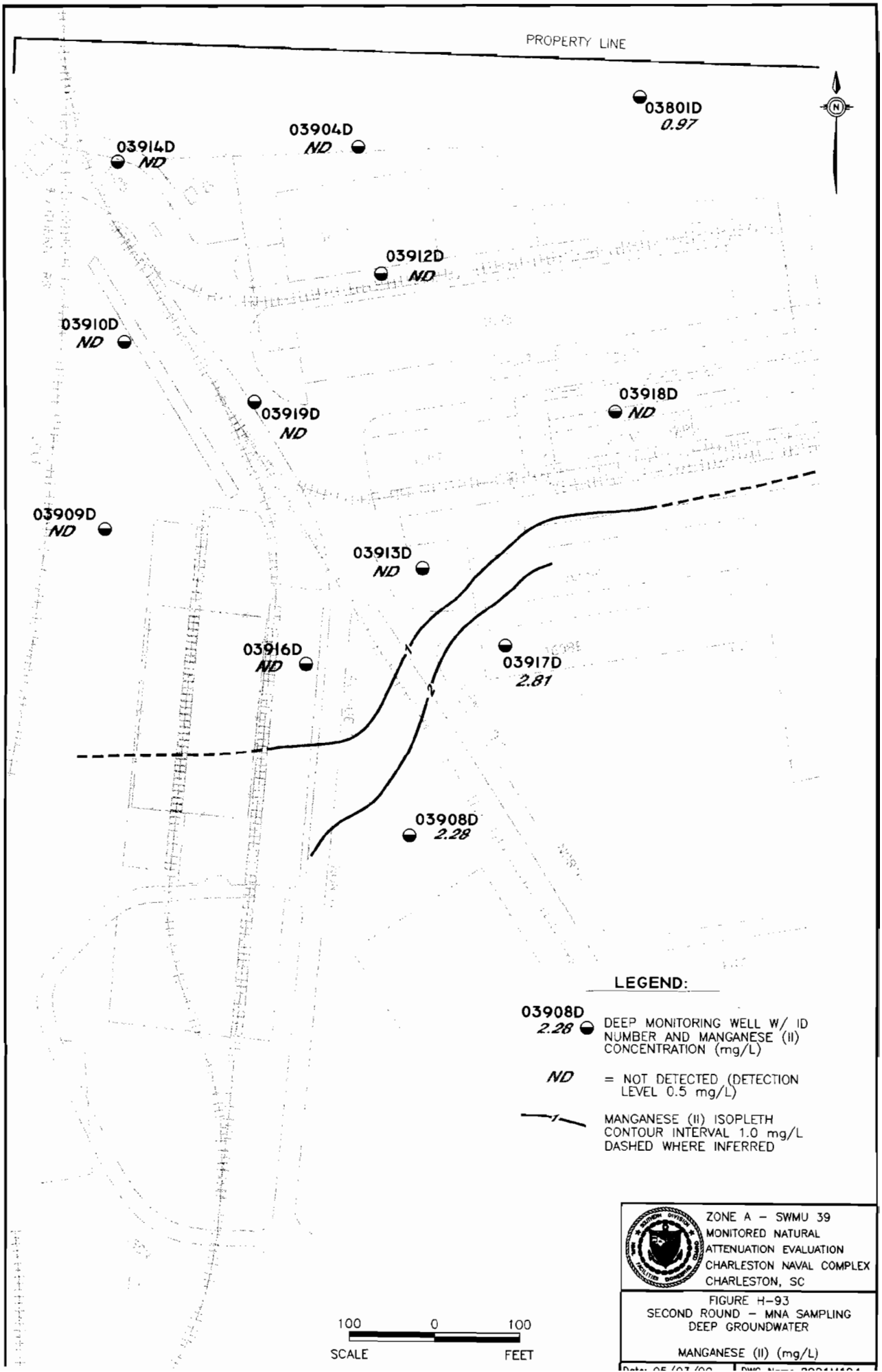

PROPERTY LINE
039011
0.90
039002
ND
039001
0.80
039004
2.37
039005
1.22
039014
ND
039003
ND
038002
ND
002004
ND
039012
2.34
039006
ND
039010
ND
2.00
039019
ND
1.00
039018
ND
039009
0.99
002006
ND
039013
ND
039007
ND
1.00
039017
ND
039016
1.17
039008
1.06
042001
ND
042002
ND
042003
NS
505001
ND
LEGEND:
039009
0.99
SHALLOW MONITORING WELL W/ ID NUMBER AND MANGANESE (II) CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 0.5mg/L)
NS = NOT SAMPLED
1.00
MANGANESE ISOPLETH (II) CONTOUR INTERVAL 1.0mg/L (DASHED WHERE INFERRED)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-91
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
MANGANESE (II) (mg/L)

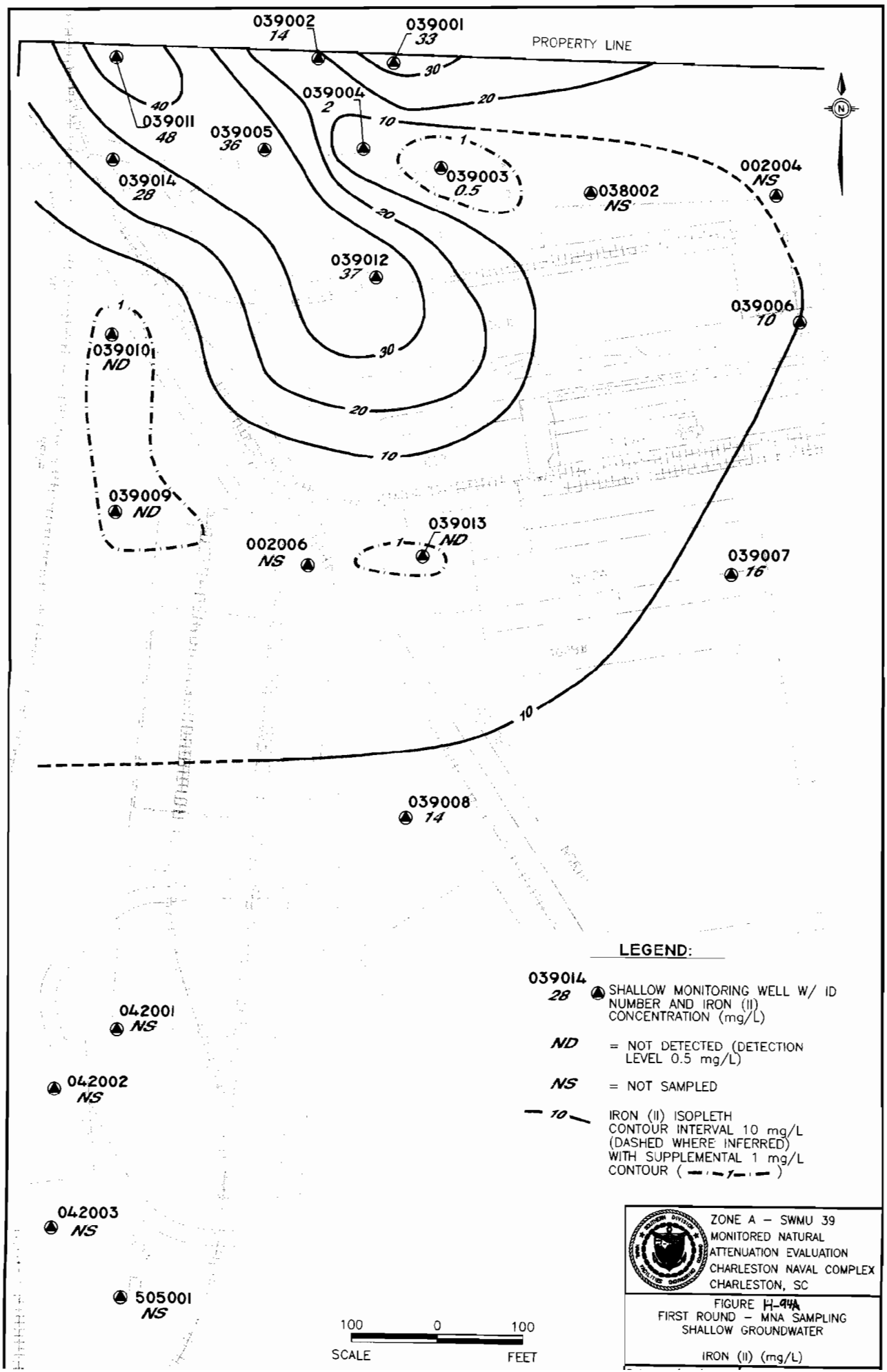


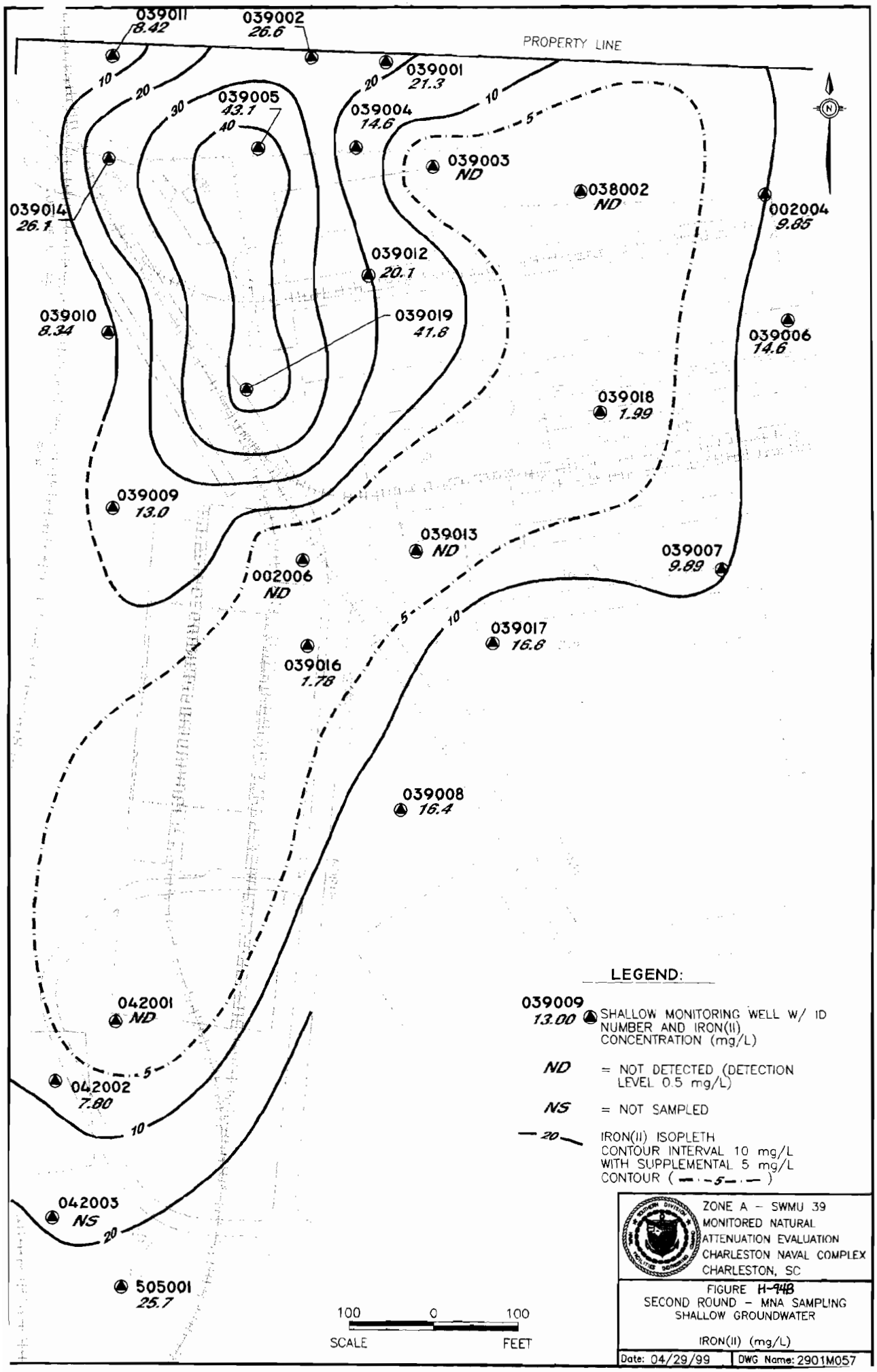
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

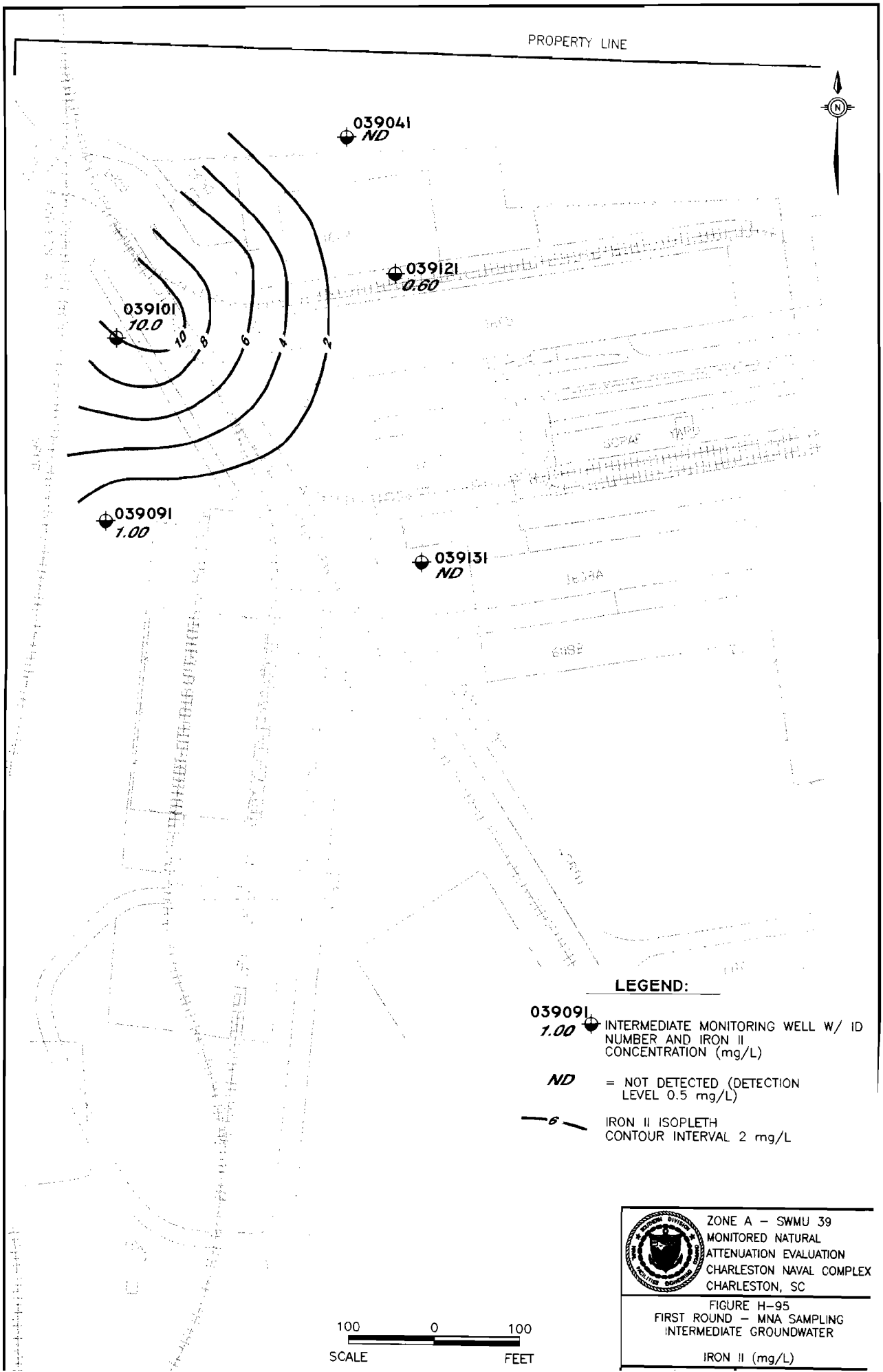
FIGURE H-92
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

MANGANESE (II) (mg/L)


PROPERTY LINE
03801D
0.97
03904D
ND
03914D
ND
03912D
ND
03910D
ND
03919D
ND
03918D
ND
03909D
ND
03913D
ND
03916D
ND
03917D
2.81
03908D
2.28
1
2
LEGEND:
03908D
2.28
DEEP MONITORING WELL W/ ID NUMBER AND MANGANESE (II) CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 0.5 mg/L)
MANGANESE (II) ISOPLETH CONTOUR INTERVAL 1.0 mg/L DASHED WHERE INFERRED
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-93
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER
MANGANESE (II) (mg/L)


PROPERTY LINE
039002
14
039001
33
039004
2
039011
48
039005
36
039014
28
039003
0.5
038002
NS
002004
NS
039012
37
039006
10
039010
ND
039009
ND
039013
ND
002006
NS
039007
16
039008
14
042001
NS
042002
NS
042003
NS
505001
NS
40
30
20
10
1
LEGEND:
039014
28
SHALLOW MONITORING WELL W/ ID NUMBER AND IRON (II) CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 0.5 mg/L)
NS = NOT SAMPLED
10
IRON (II) ISOPLETH CONTOUR INTERVAL 10 mg/L (DASHED WHERE INFERRED) WITH SUPPLEMENTAL 1 mg/L CONTOUR
100 0 100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-94A
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
IRON (II) (mg/L)

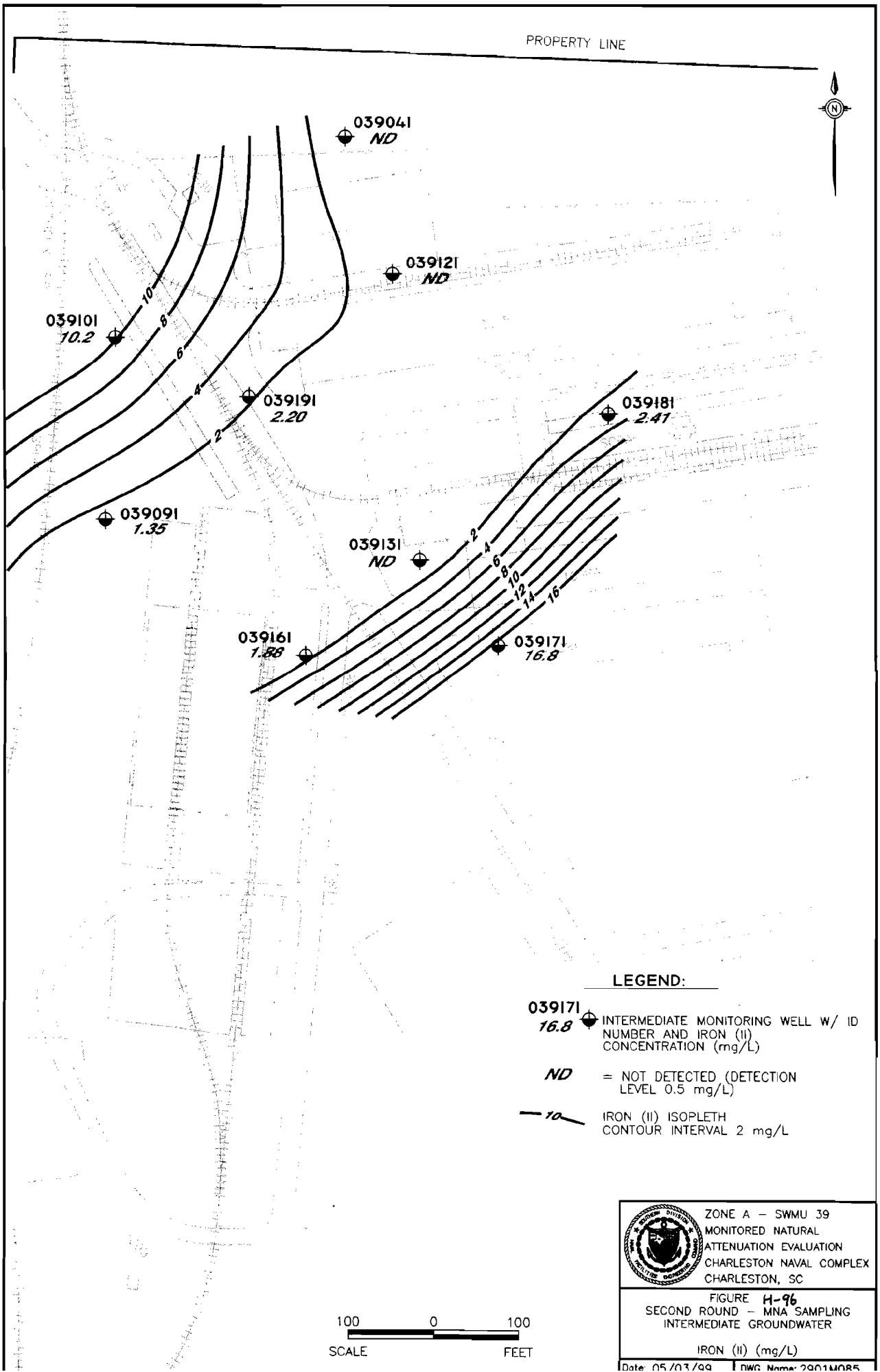

039011
8.42
039002
26.6
PROPERTY LINE
039001
21.3
039005
43.1
039004
14.6
039003
ND
038002
ND
002004
9.85
039014
26.1
039012
20.1
039019
41.6
039010
8.34
039006
14.6
039018
1.99
039009
13.0
039013
ND
039007
9.89
002006
ND
039017
16.6
039016
1.78
039008
16.4
042001
ND
042002
7.80
042003
NS
505001
25.7
10
20
30
40
5
N
100
0
100
SCALE
FEET
LEGEND:
039009
13.00
SHALLOW MONITORING WELL W/ ID NUMBER AND IRON(II) CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 0.5 mg/L)
NS = NOT SAMPLED
20
IRON(II) ISOPLETH CONTOUR INTERVAL 10 mg/L WITH SUPPLEMENTAL 5 mg/L CONTOUR (5)
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-94B
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
IRON(II) (mg/L)
Date: 04/29/99
DWG Name: 2901M057

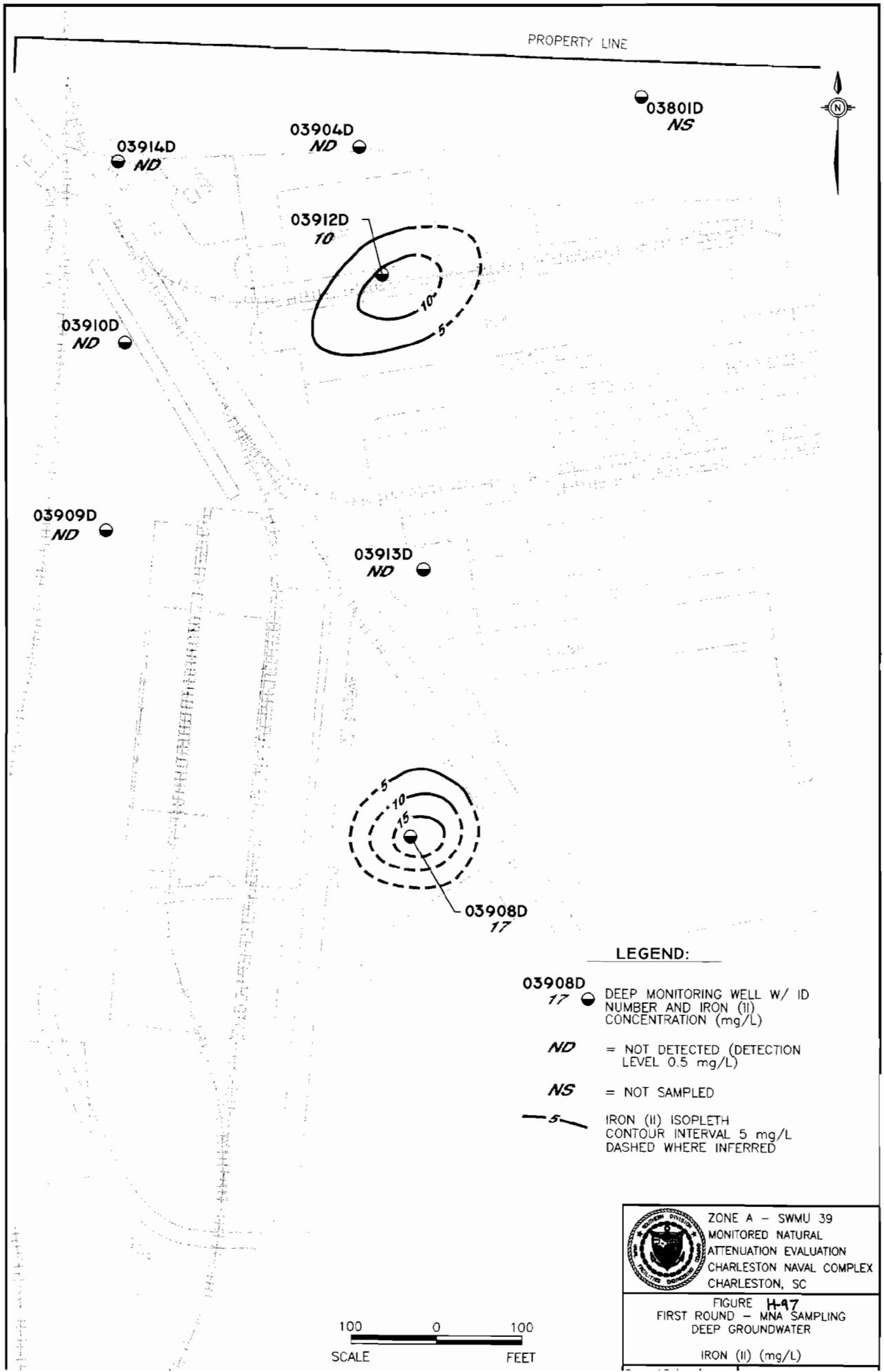


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-95
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

IRON II (mg/L)

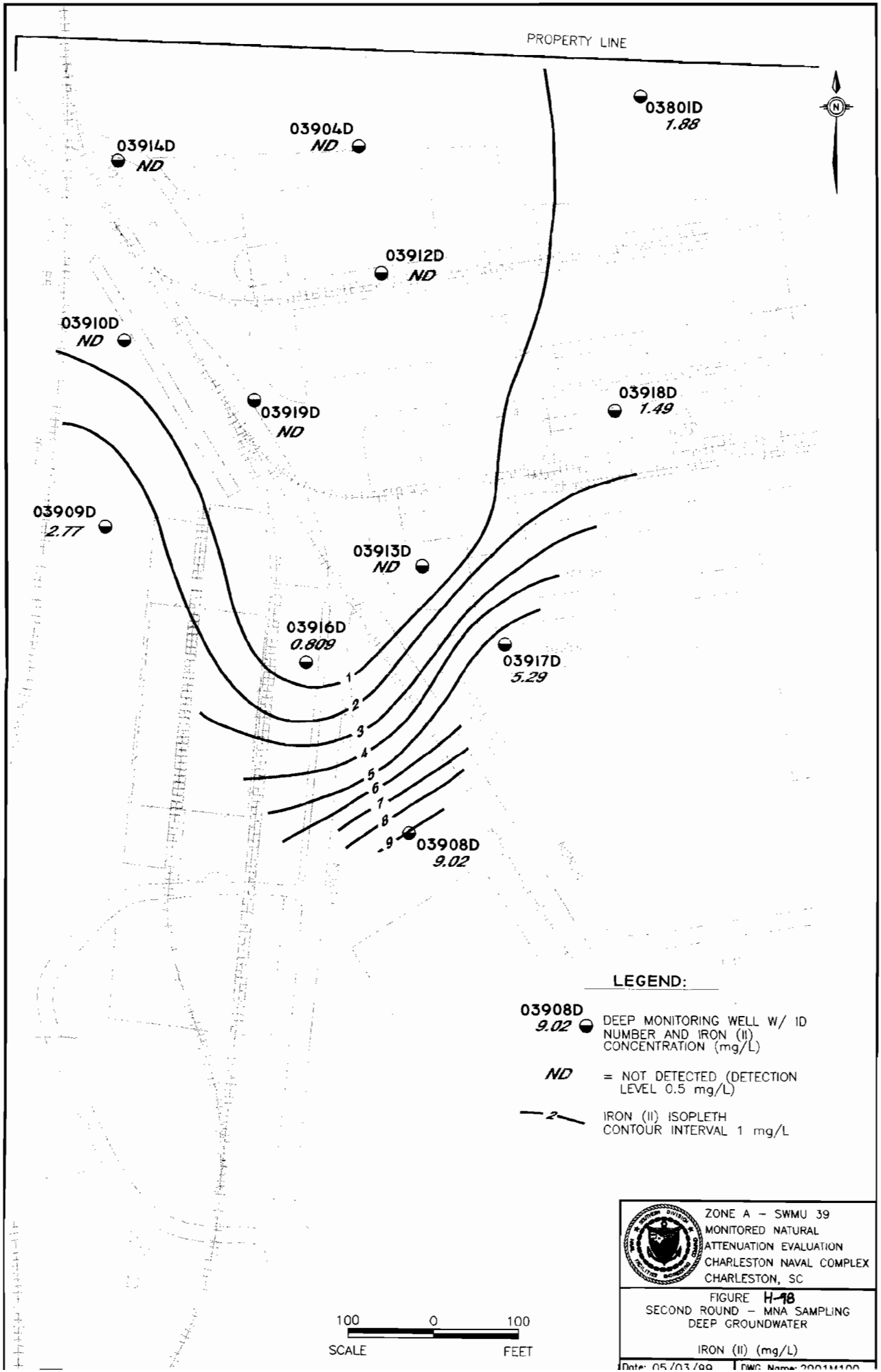

PROPERTY LINE
N
039041
ND
039121
ND
039101
10.2
039191
2.20
039181
2.41
039091
1.35
039131
ND
039161
1.88
039171
16.8
2
4
6
8
10
12
14
16
LEGEND:
039171
16.8
INTERMEDIATE MONITORING WELL W/ ID NUMBER AND IRON (II) CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 0.5 mg/L)
10
IRON (II) ISOPLETH CONTOUR INTERVAL 2 mg/L
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-96
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER
IRON (II) (mg/L)
Date: 05/03/99
DWG Name: 2901M085

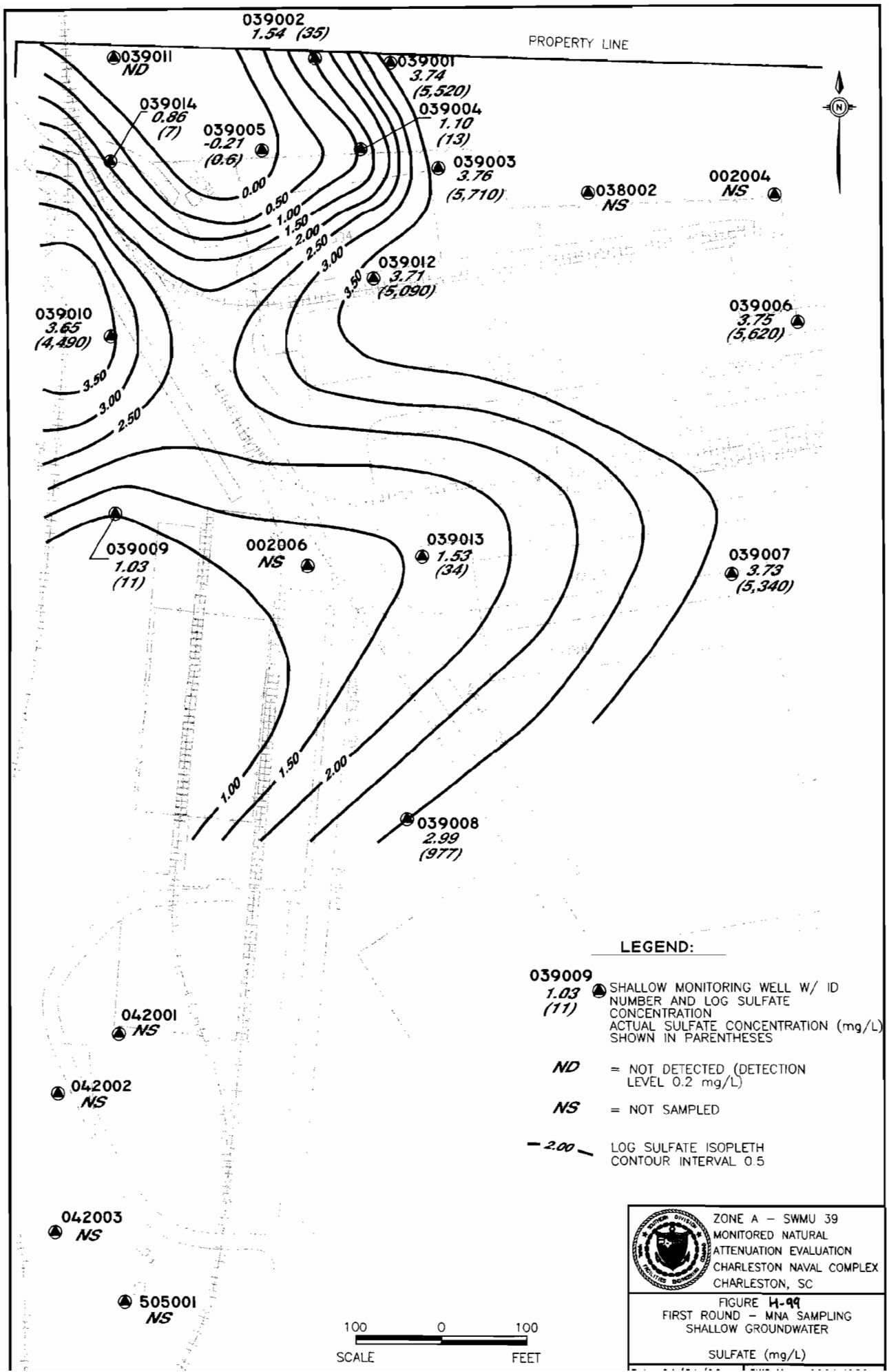


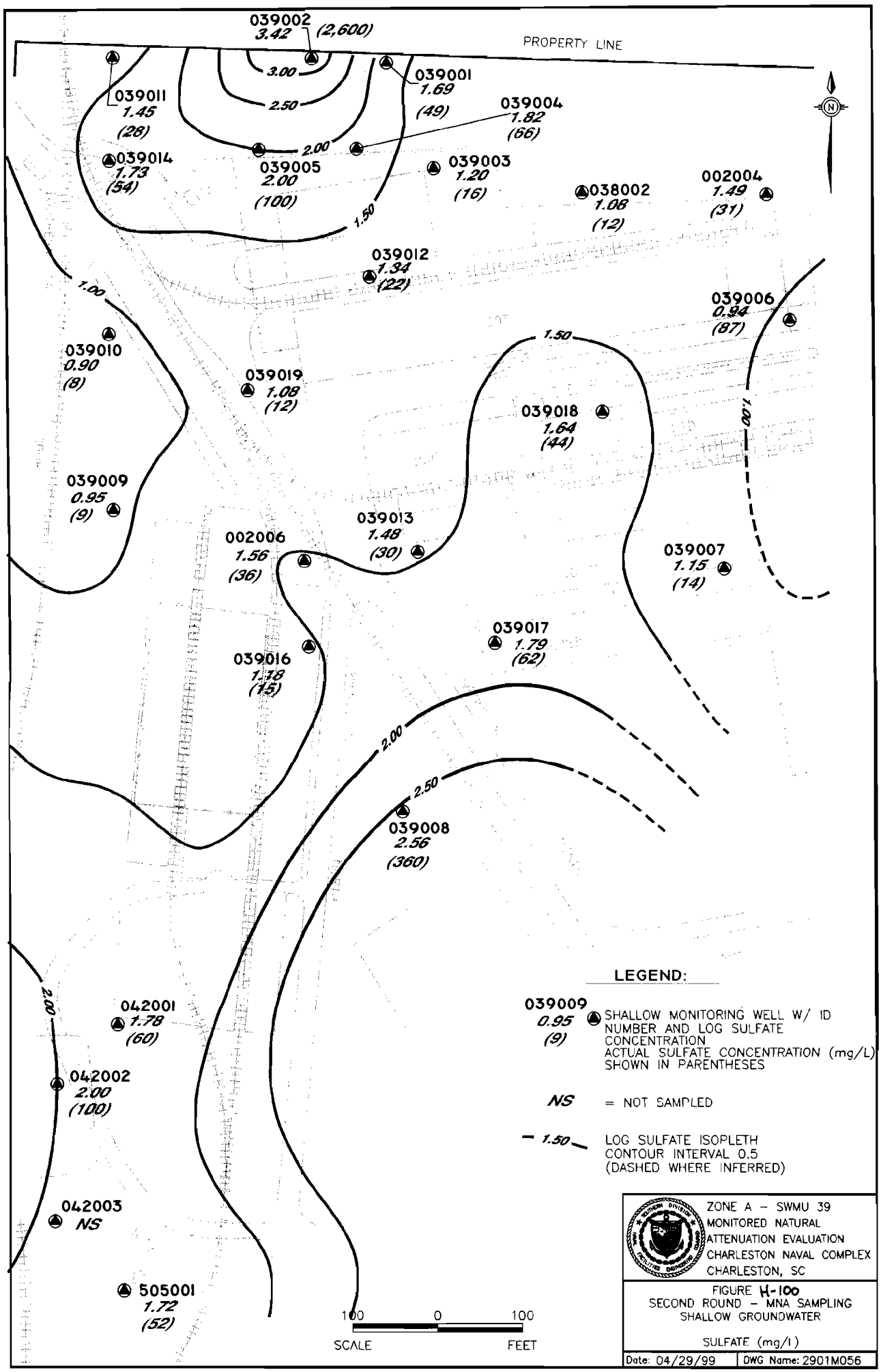
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

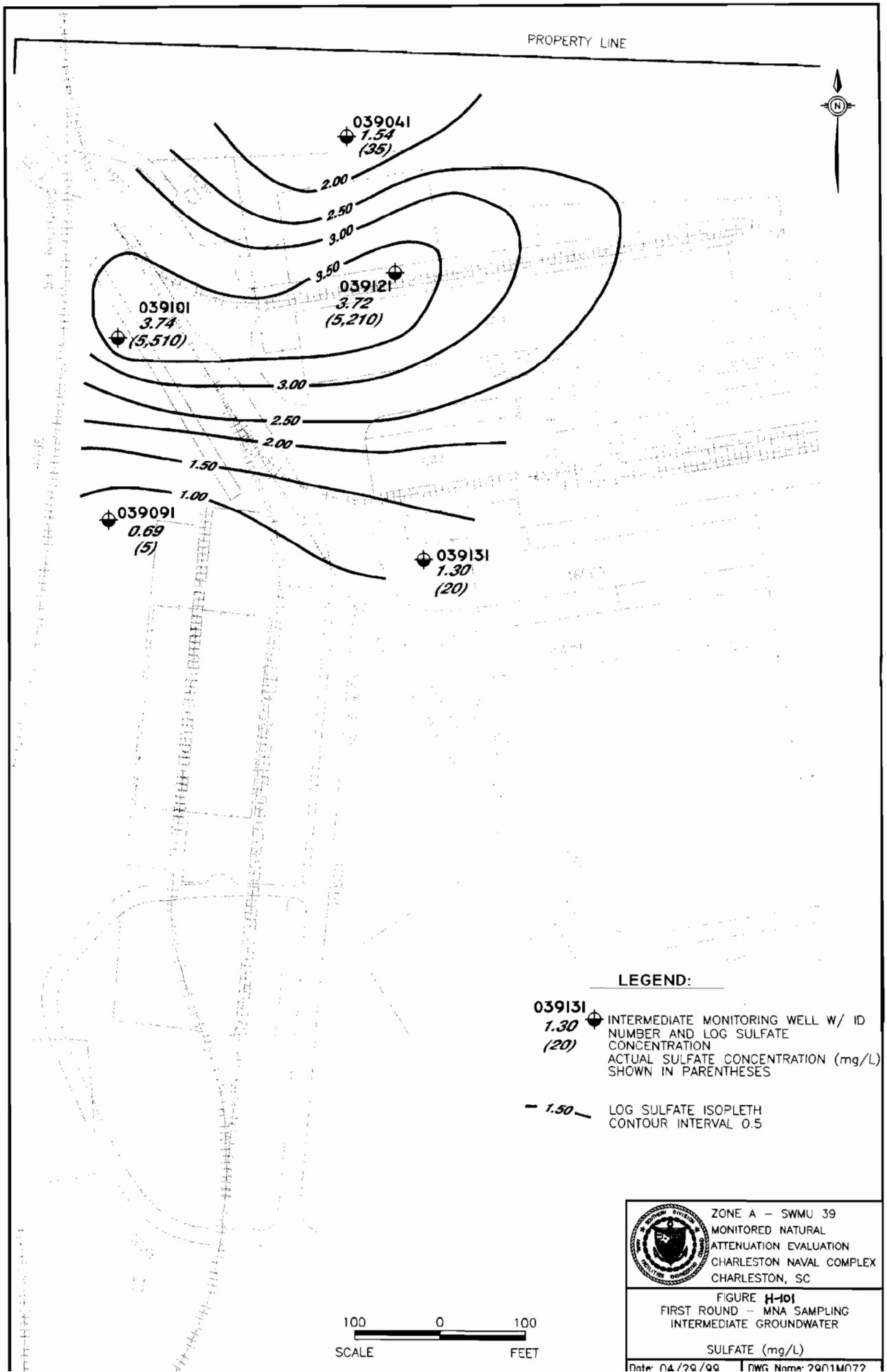
FIGURE H-97
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

IRON (II) (mg/L)


PROPERTY LINE
N
03801D
1.88
03904D
ND
03914D
ND
03912D
ND
03910D
ND
03919D
ND
03918D
1.49
03909D
2.77
03913D
ND
03916D
0.809
03917D
5.29
1
2
3
4
5
6
7
8
9
03908D
9.02
LEGEND:
03908D
9.02
DEEP MONITORING WELL W/ ID NUMBER AND IRON (II) CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 0.5 mg/L)
2
IRON (II) ISOPLETH CONTOUR INTERVAL 1 mg/L
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-18
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER
IRON (II) (mg/L)
Date: 05/03/99
DWG Name: 2001M100


PROPERTY LINE
039002
1.54 (35)
039011
ND
039001
3.74
(5,520)
039014
0.86
(7)
039004
1.10
(13)
039005
-0.21
(0.6)
039003
3.76
(5,710)
038002
NS
002004
NS
039012
3.71
(5,090)
039010
3.65
(4,490)
039006
3.75
(5,620)
039009
1.03
(11)
002006
NS
039013
1.53
(34)
039007
3.73
(5,340)
039008
2.99
(977)
042001
NS
042002
NS
042003
NS
505001
NS
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
100 0 100
SCALE FEET
LEGEND:
039009
1.03
(11)
SHALLOW MONITORING WELL W/ ID NUMBER AND LOG SULFATE CONCENTRATION
ACTUAL SULFATE CONCENTRATION (mg/L) SHOWN IN PARENTHESES
ND = NOT DETECTED (DETECTION LEVEL 0.2 mg/L)
NS = NOT SAMPLED
2.00 LOG SULFATE ISOPLETH CONTOUR INTERVAL 0.5
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-99
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
SULFATE (mg/L)


PROPERTY LINE
039002
3.42
(2,600)
039001
1.69
(49)
039004
1.82
(66)
039011
1.45
(28)
039014
1.73
(54)
039005
2.00
(100)
039003
1.20
(16)
038002
1.08
(12)
002004
1.49
(31)
039012
1.34
(22)
039006
0.94
(87)
039010
0.90
(8)
039019
1.08
(12)
039018
1.64
(44)
039009
0.95
(9)
039013
1.48
(30)
002006
1.56
(36)
039007
1.15
(14)
039017
1.79
(62)
039016
1.18
(15)
039008
2.56
(360)
042001
1.78
(60)
042002
2.00
(100)
042003
NS
505001
1.72
(52)
3.00
2.50
2.00
1.50
1.00
LEGEND:
039009
0.95
(9)
SHALLOW MONITORING WELL W/ ID NUMBER AND LOG SULFATE CONCENTRATION
ACTUAL SULFATE CONCENTRATION (mg/L) SHOWN IN PARENTHESES
NS = NOT SAMPLED
1.50
LOG SULFATE ISOPLETH
CONTOUR INTERVAL 0.5
(DASHED WHERE INFERRED)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-100
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
SULFATE (mg/l)
Date: 04/29/99
DWG Name: 2901M056

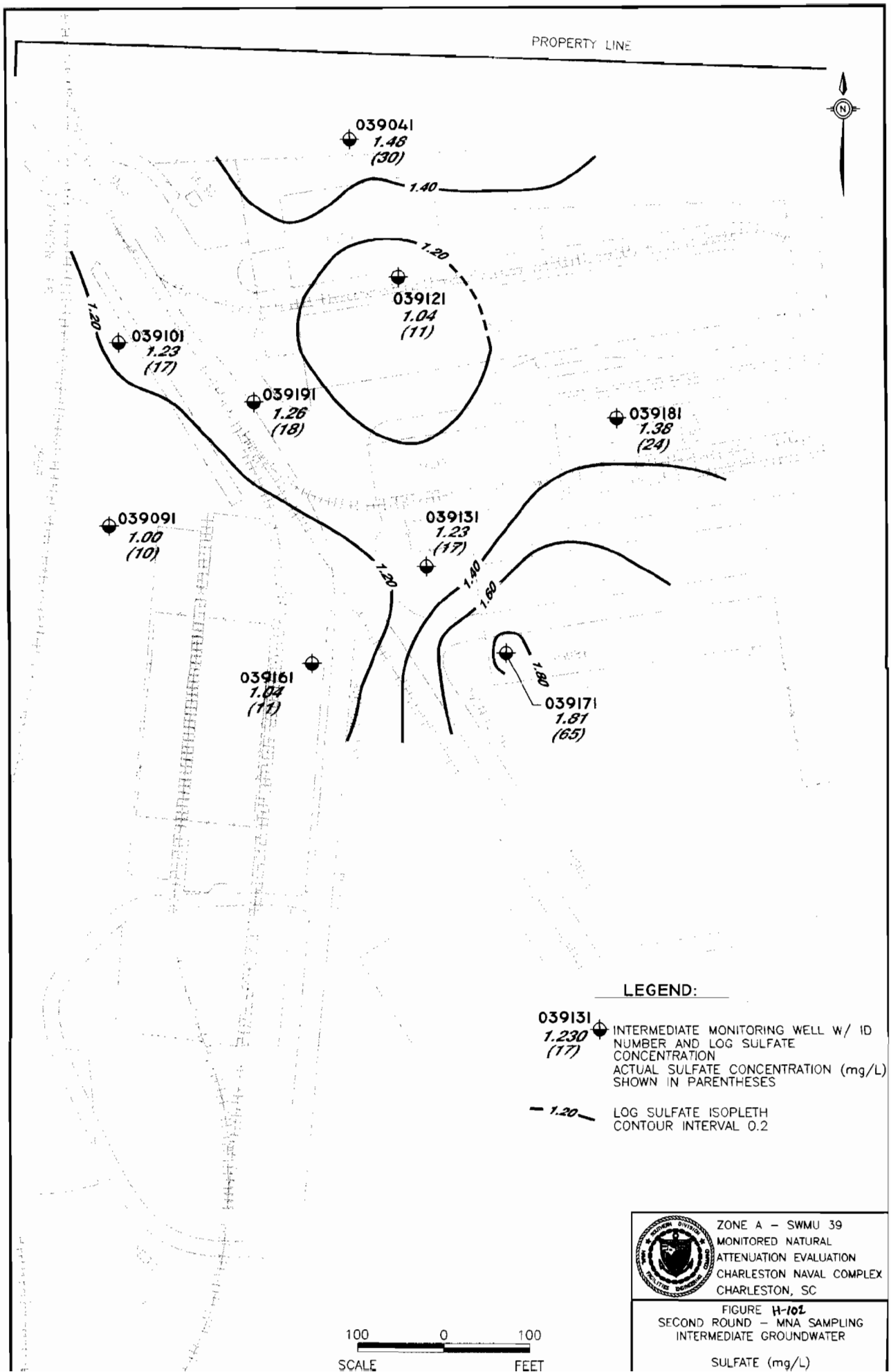


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-101
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

SULFATE (mg/L)

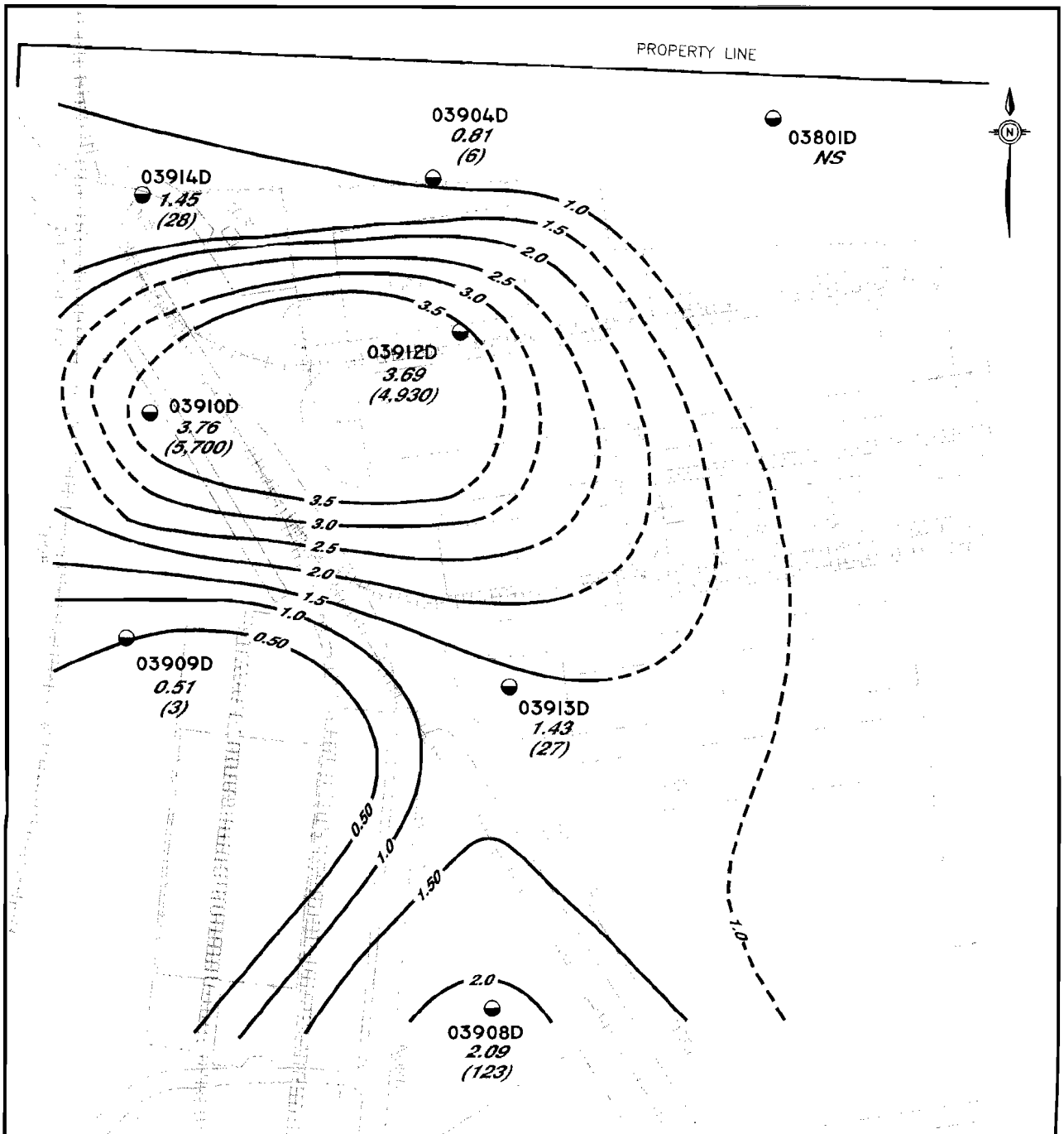
Date: 04/29/99	DWG Name: 2901M072



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-102
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

SULFATE (mg/L)



LEGEND:

03908D
0.20
(123)
DEEP MONITORING WELL W/ ID NUMBER AND LOG SULFATE CONCENTRATION
ACTUAL SULFATE CONCENTRATION (mg/L) SHOWN IN PARENTHESES

NS = NOT SAMPLED

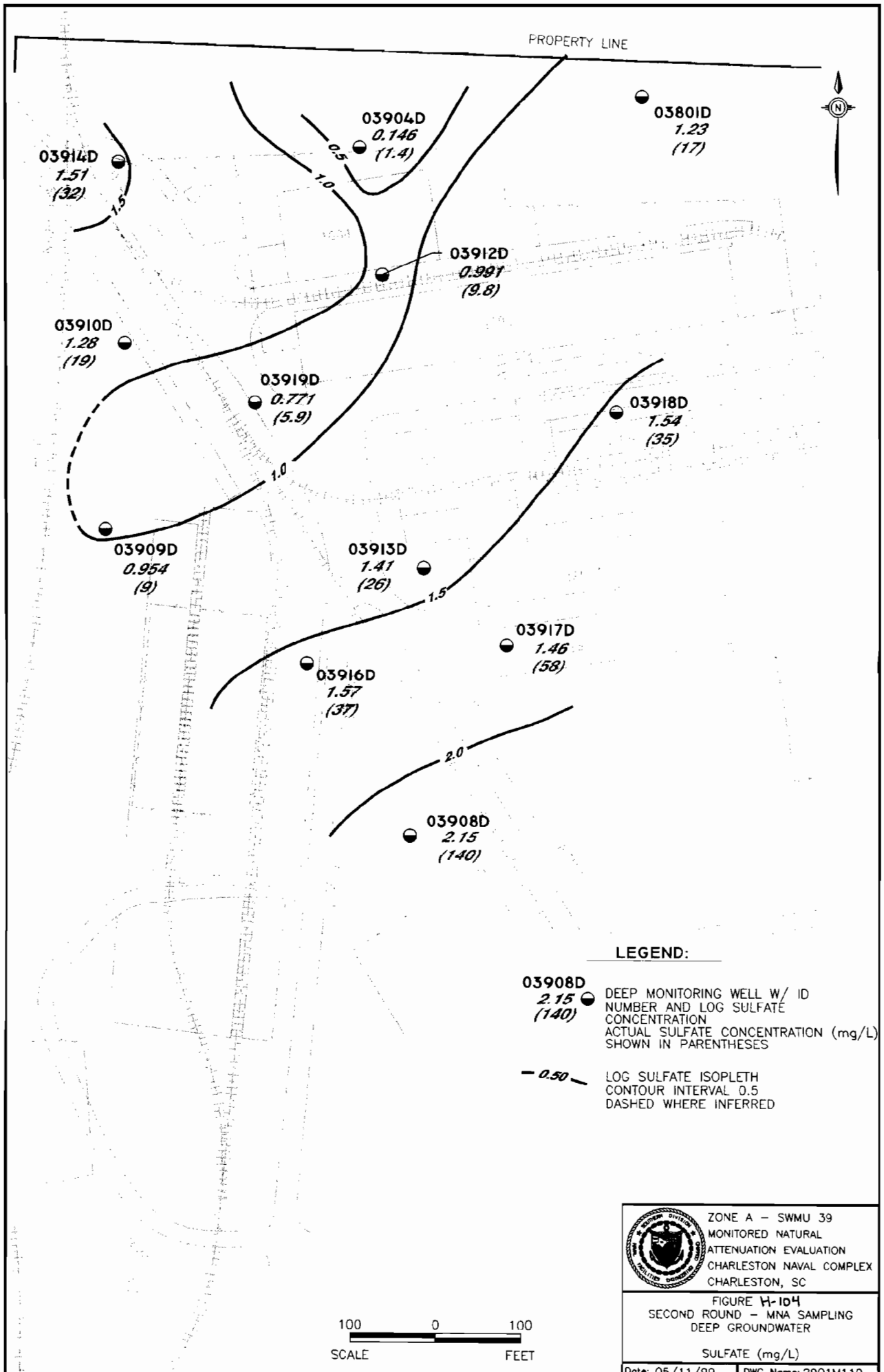
0.50 LOG SULFATE ISOPLETH CONTOUR INTERVAL 0.5 DASHED WHERE INFERRED

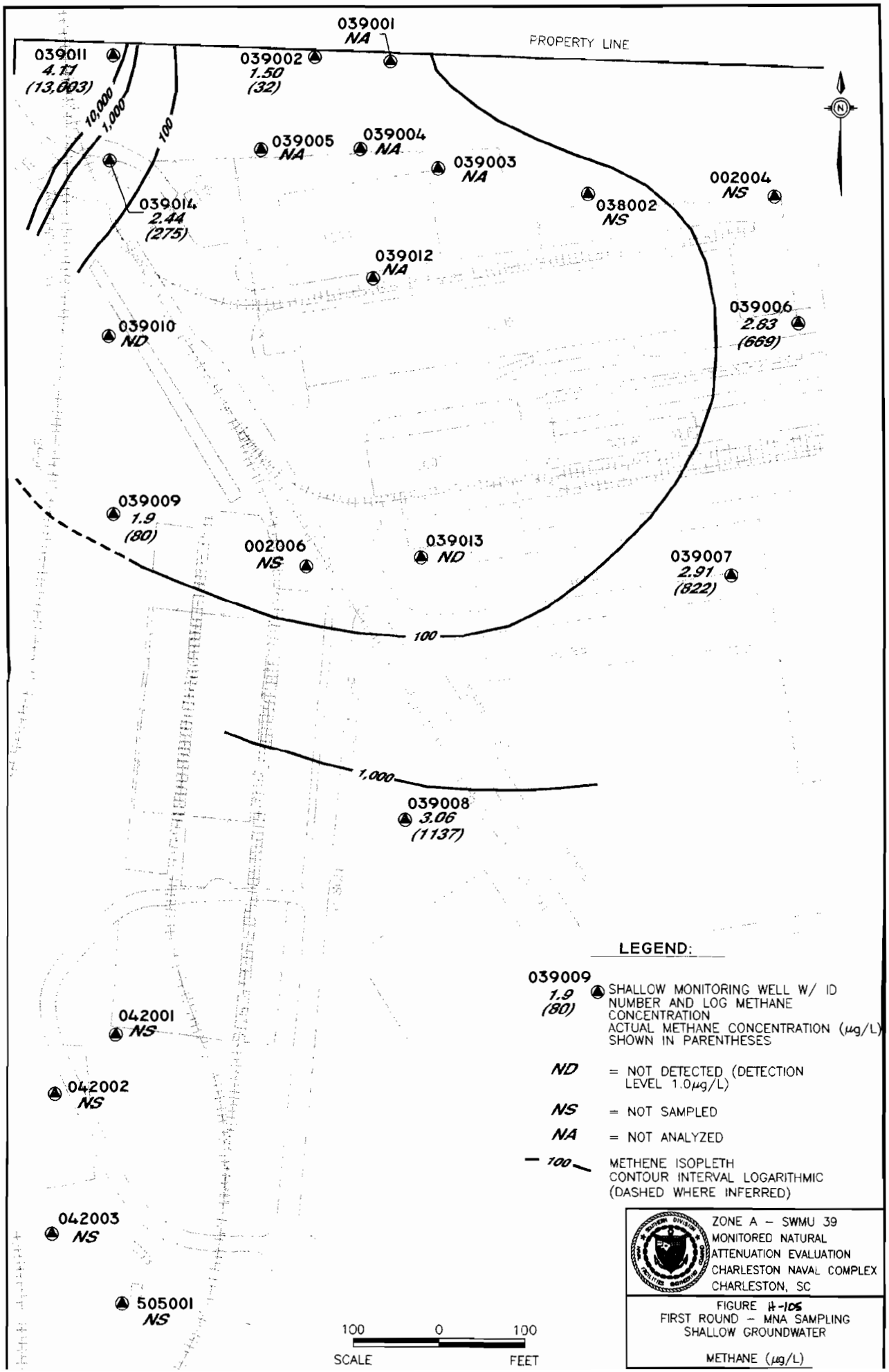
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

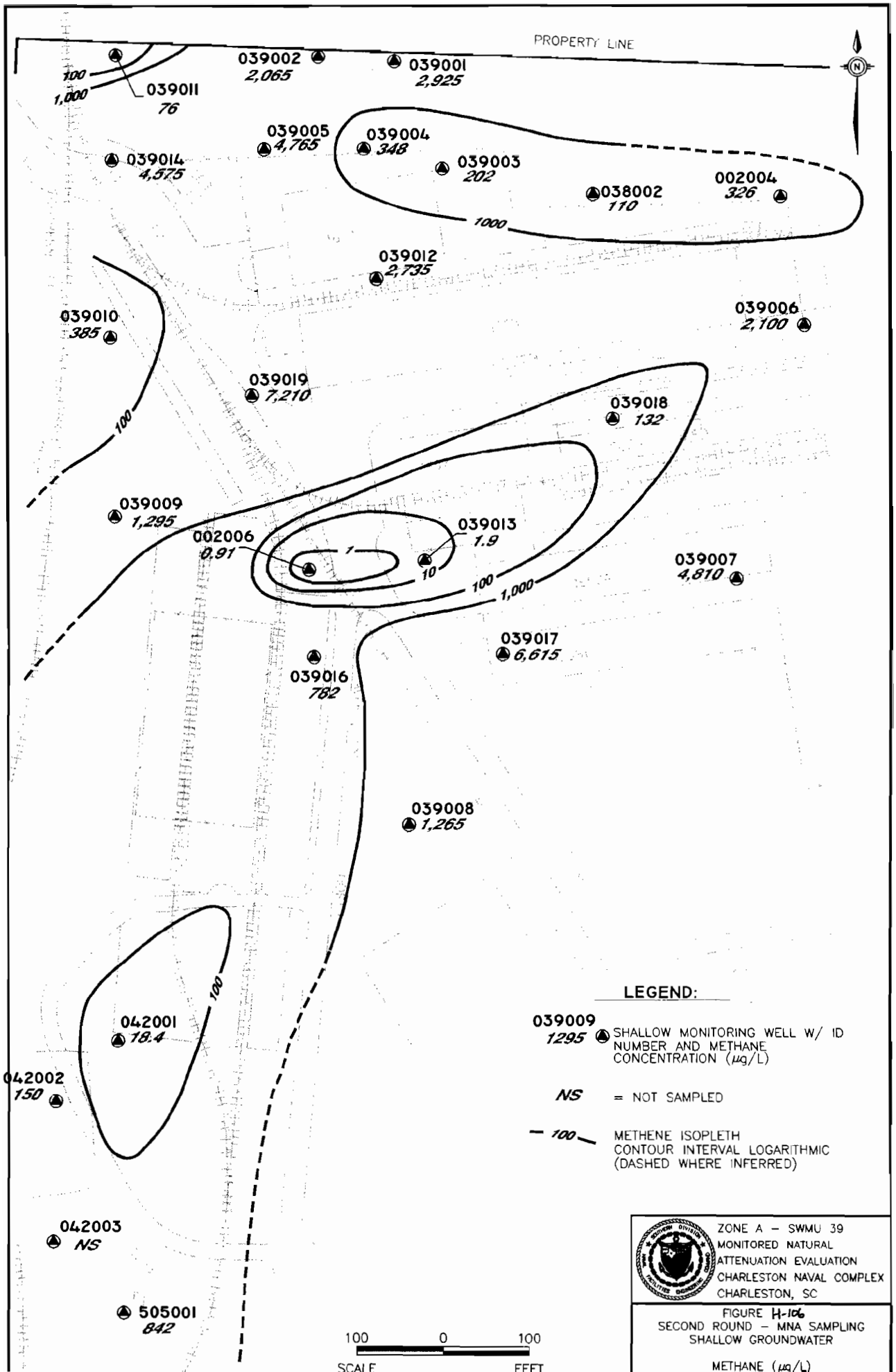
FIGURE H-103
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

SULFATE (mg/L)

100 0 100
SCALE FEET


PROPERTY LINE
N
03904D
0.146
(1.4)
03801D
1.23
(17)
03914D
1.51
(32)
0.5
1.0
1.5
03912D
0.991
(9.8)
03910D
1.28
(19)
03919D
0.771
(5.9)
03918D
1.54
(35)
1.0
03909D
0.954
(9)
03913D
1.41
(26)
1.5
03917D
1.46
(58)
03916D
1.57
(37)
2.0
03908D
2.15
(140)
LEGEND:
03908D
2.15
(140)
DEEP MONITORING WELL W/ ID NUMBER AND LOG SULFATE CONCENTRATION
ACTUAL SULFATE CONCENTRATION (mg/L) SHOWN IN PARENTHESES
0.50
LOG SULFATE ISOPLETH
CONTOUR INTERVAL 0.5
DASHED WHERE INFERRED
100 0 100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-104
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER
SULFATE (mg/L)

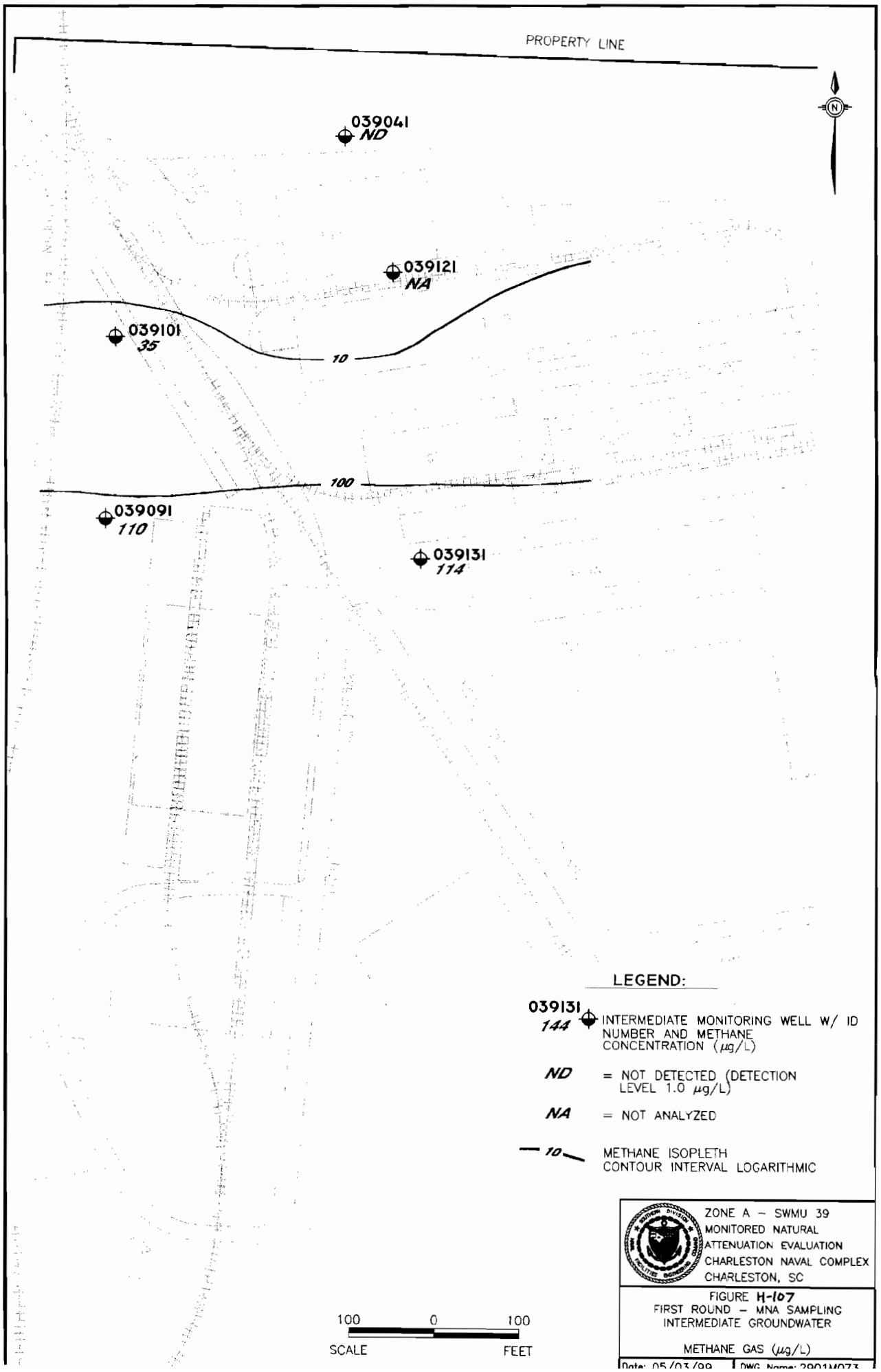

039001
NA
PROPERTY LINE
039011
4.11
(13,003)
039002
1.50
(32)
10,000
1,000
100
039005
NA
039004
NA
039003
NA
002004
NS
038002
NS
039014
2.44
(275)
039012
NA
039006
2.83
(669)
039010
ND
039009
1.9
(80)
002006
NS
039013
ND
039007
2.91
(822)
100
1,000
039008
3.06
(1137)
042001
NS
042002
NS
042003
NS
505001
NS
100 0 100
SCALE FEET
LEGEND:
039009
1.9
(80)
SHALLOW MONITORING WELL W/ ID NUMBER AND LOG METHANE CONCENTRATION
ACTUAL METHANE CONCENTRATION (μg/L) SHOWN IN PARENTHESES
ND = NOT DETECTED (DETECTION LEVEL 1.0μg/L)
NS = NOT SAMPLED
NA = NOT ANALYZED
100
METHENE ISOPLETH
CONTOUR INTERVAL LOGARITHMIC
(DASHED WHERE INFERRED)
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-10S
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
METHANE (μg/L)



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-106
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER

METHANE (µg/L)

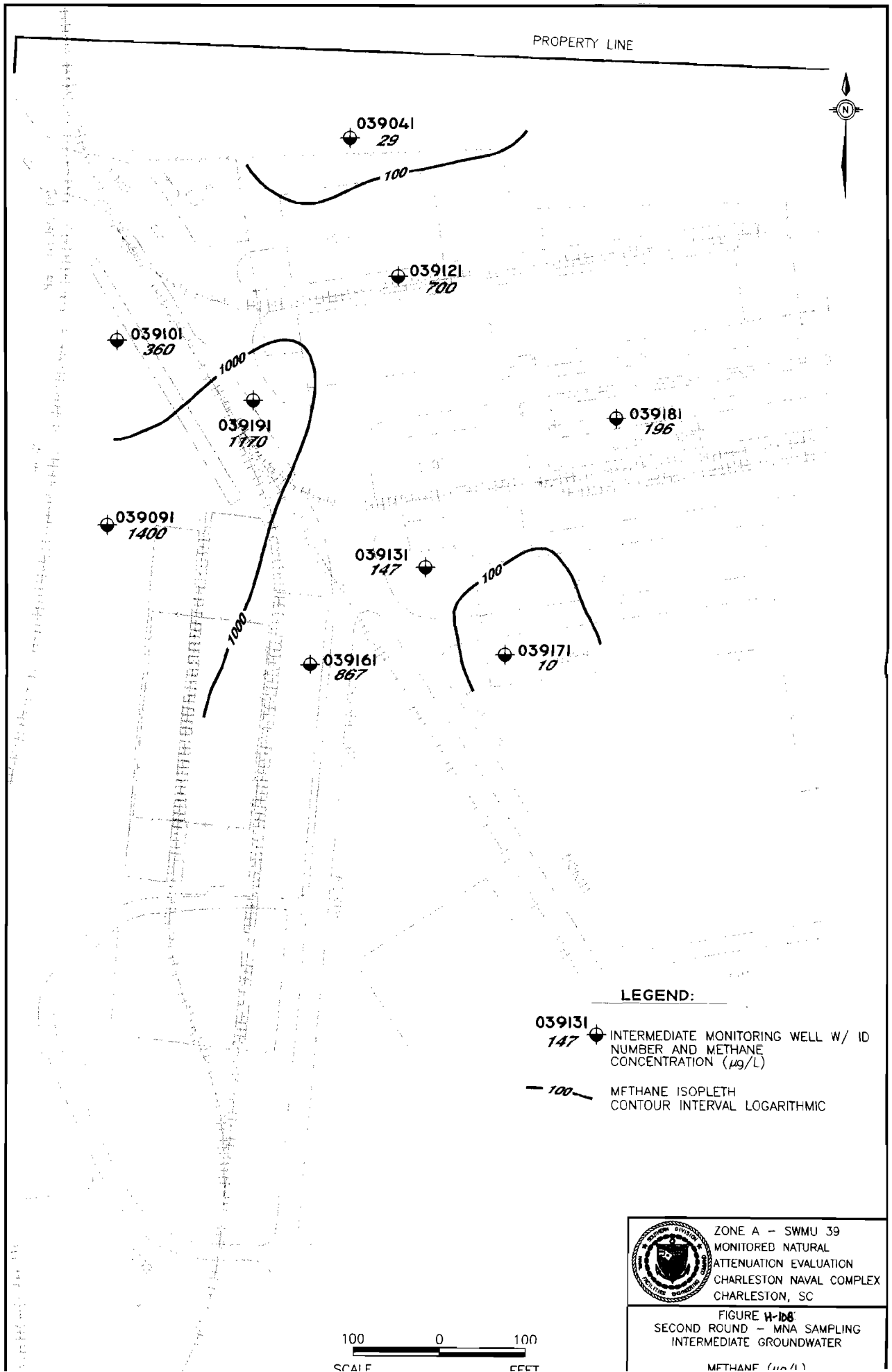


ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-107
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

METHANE GAS (µg/L)

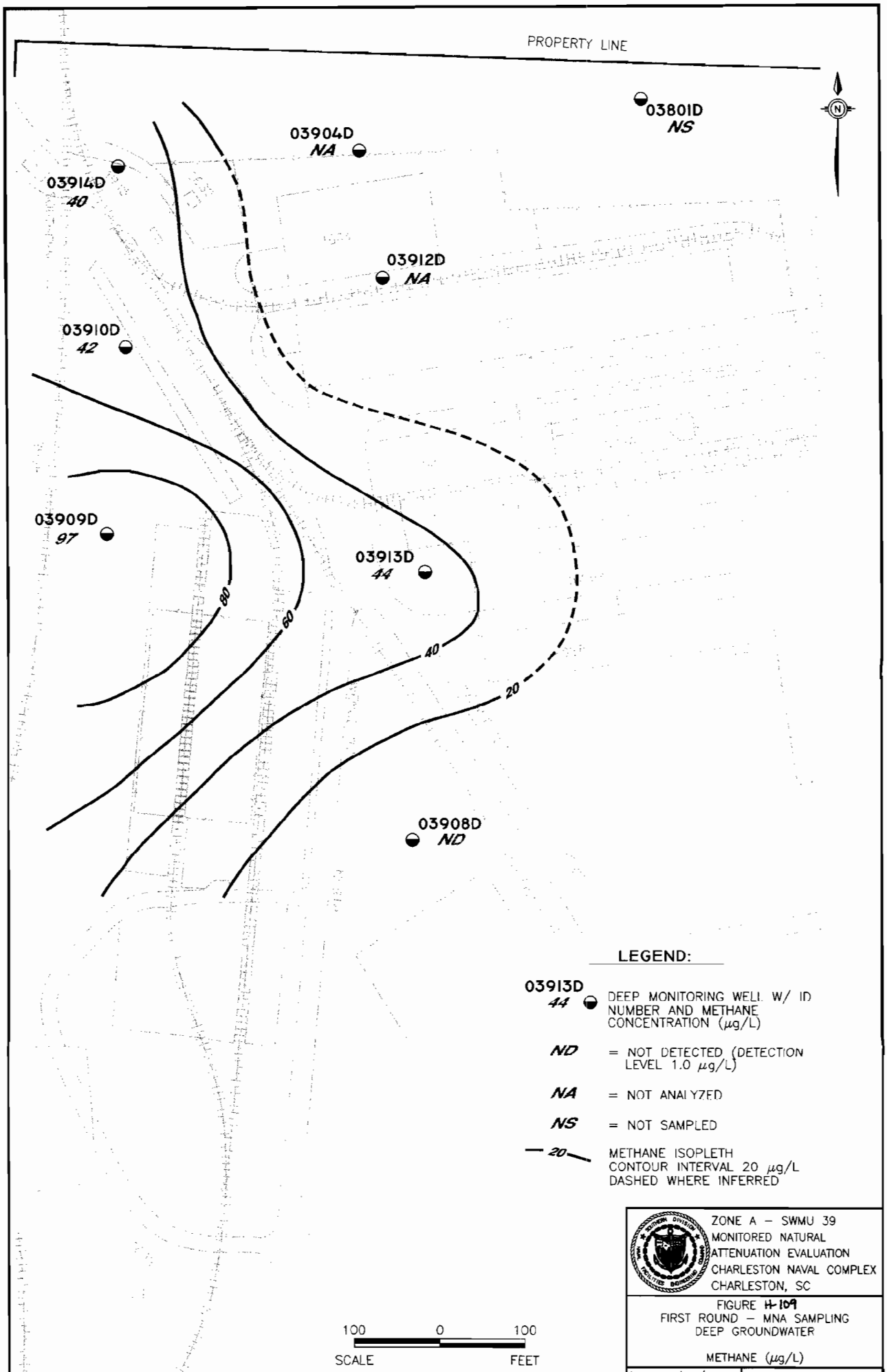
Date: 05/03/99 | DWG Name: 2901M073



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-108
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

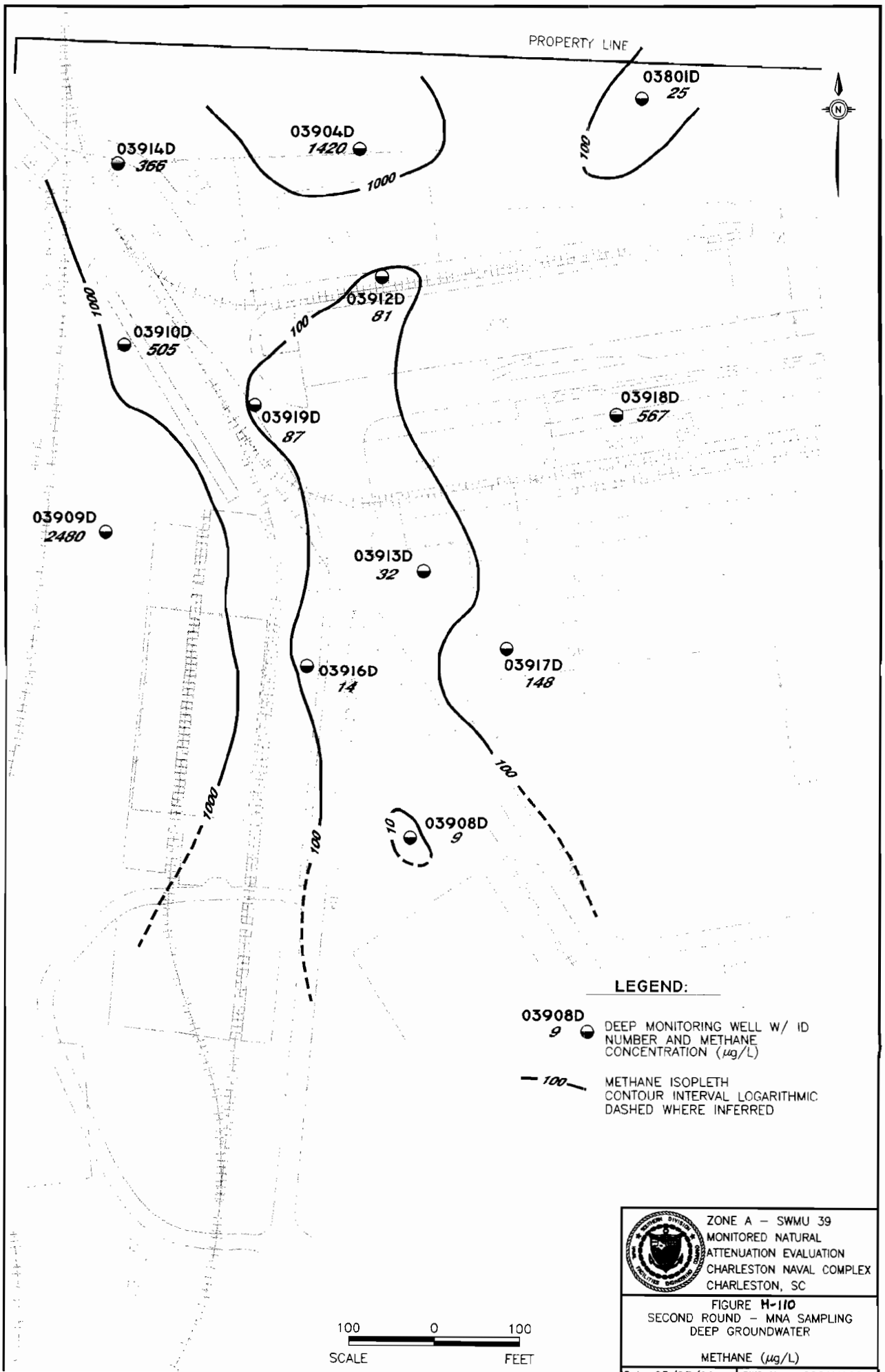
METHANE (µg/L)



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-109
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

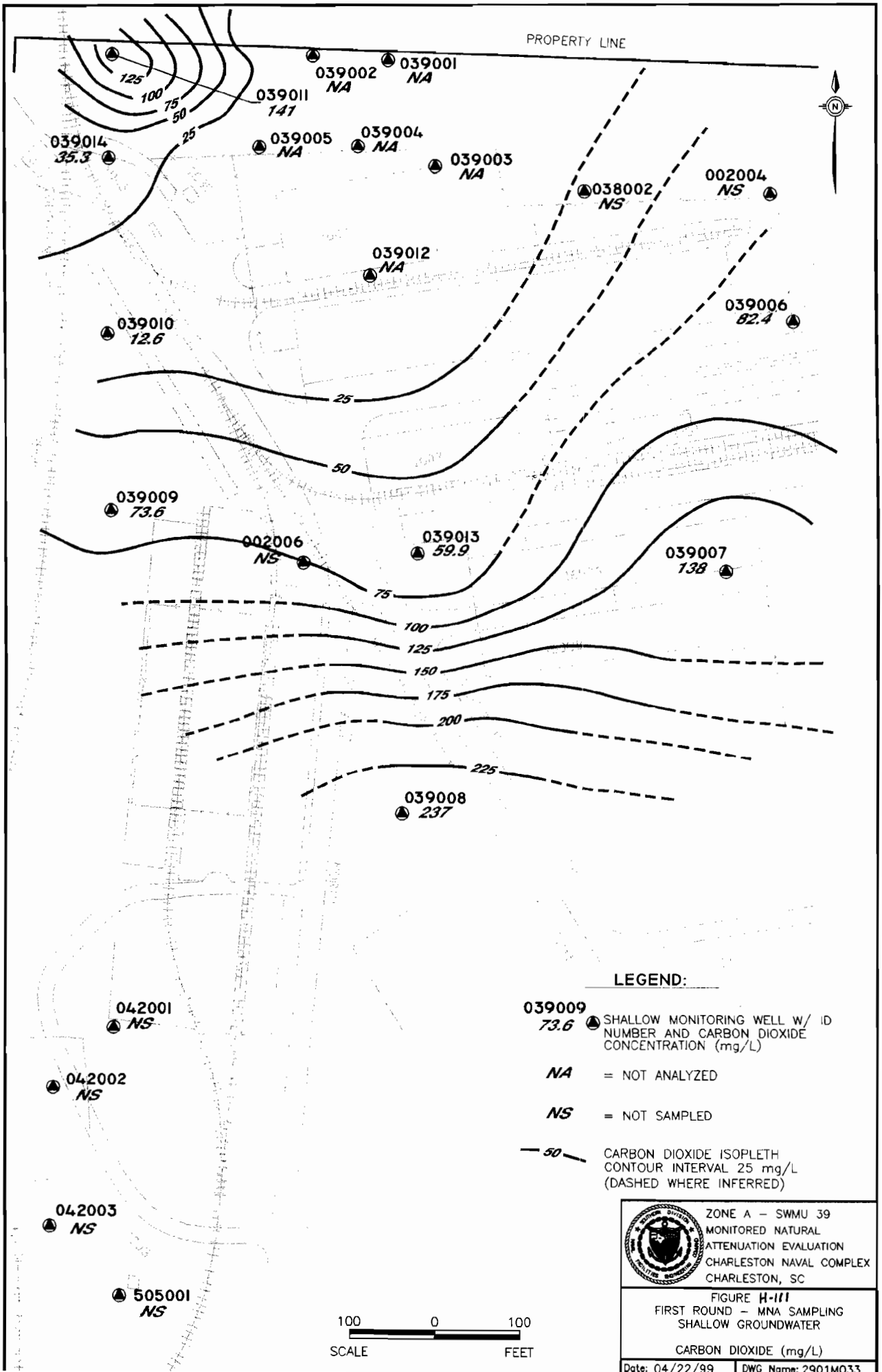
METHANE (μg/L)

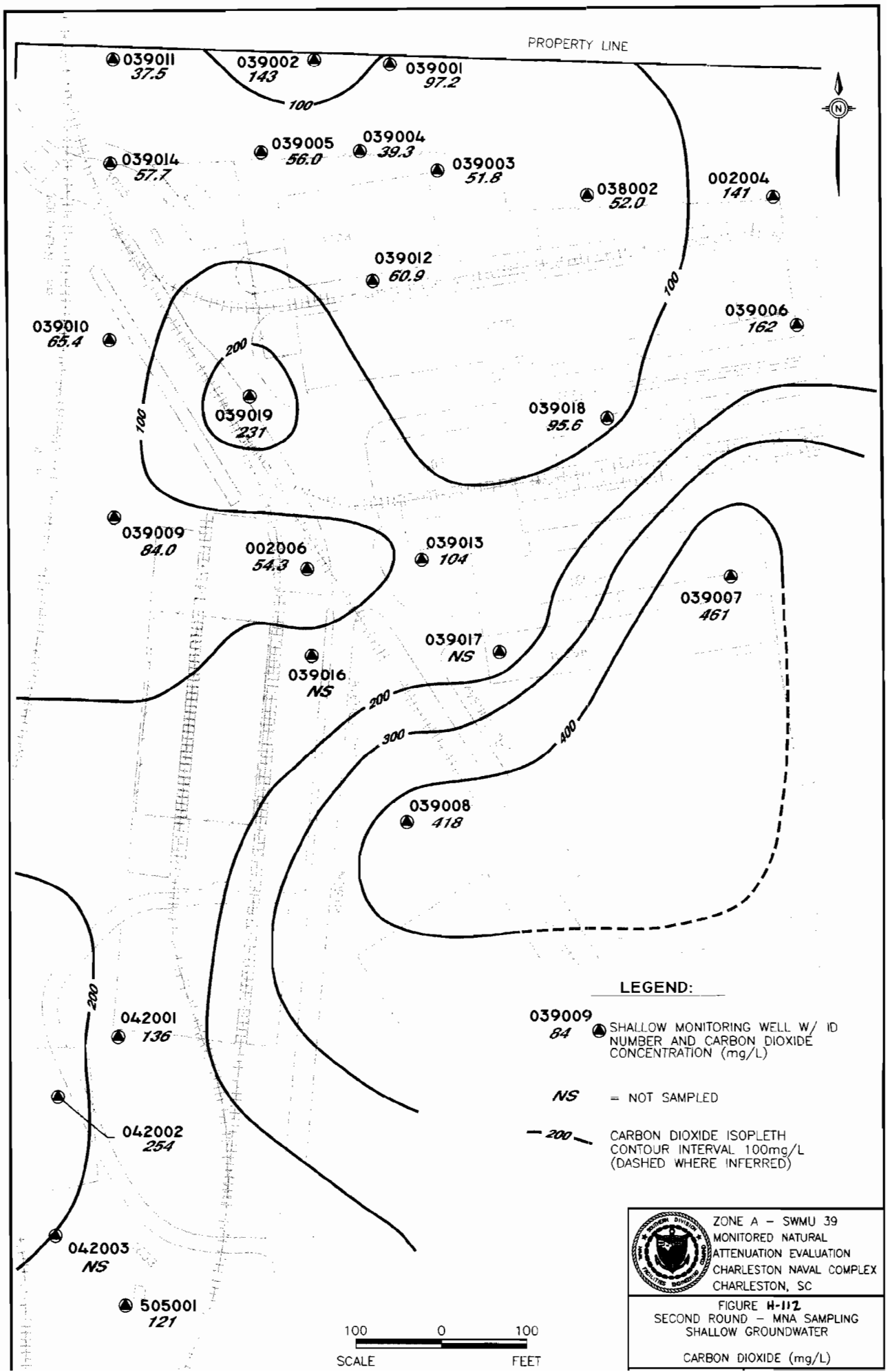


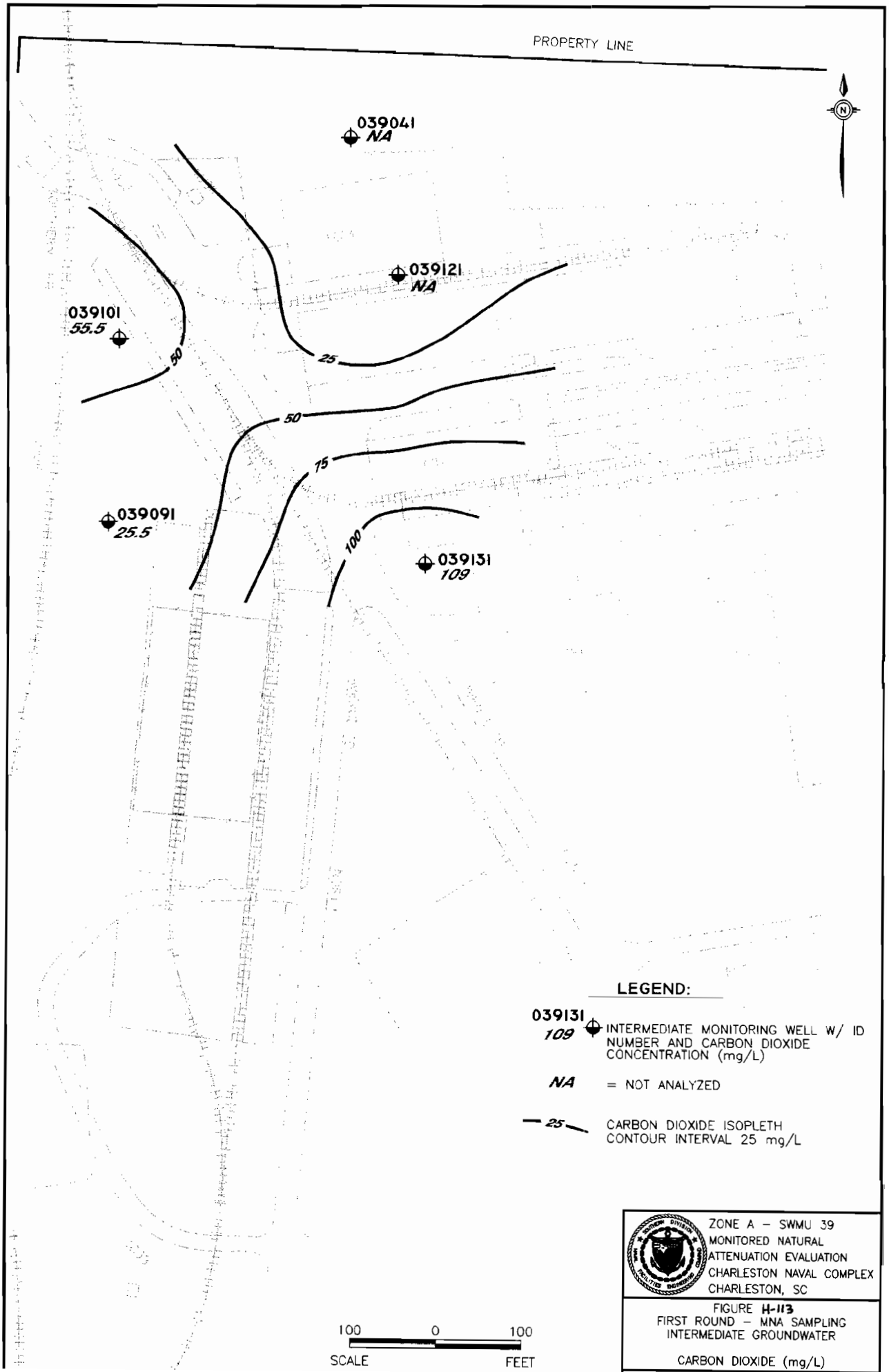
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-110
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

METHANE (μg/L)


PROPERTY LINE
039002
NA
039001
NA
039011
141
039014
35.3
039005
NA
039004
NA
039003
NA
038002
NS
002004
NS
039012
NA
039006
82.4
039010
12.6
039009
73.6
002006
NS
039013
59.9
039007
138
039008
237
042001
NS
042002
NS
042003
NS
505001
NS
125
100
75
50
25
25
50
75
100
125
150
175
200
225
N
LEGEND:
039009
73.6
SHALLOW MONITORING WELL W/ ID NUMBER AND CARBON DIOXIDE CONCENTRATION (mg/L)
NA = NOT ANALYZED
NS = NOT SAMPLED
50
CARBON DIOXIDE ISOPLETH CONTOUR INTERVAL 25 mg/L (DASHED WHERE INFERRED)
100 0 100
SCALE FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-111
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
CARBON DIOXIDE (mg/L)
Date: 04/22/99
DWG Name: 2901M033

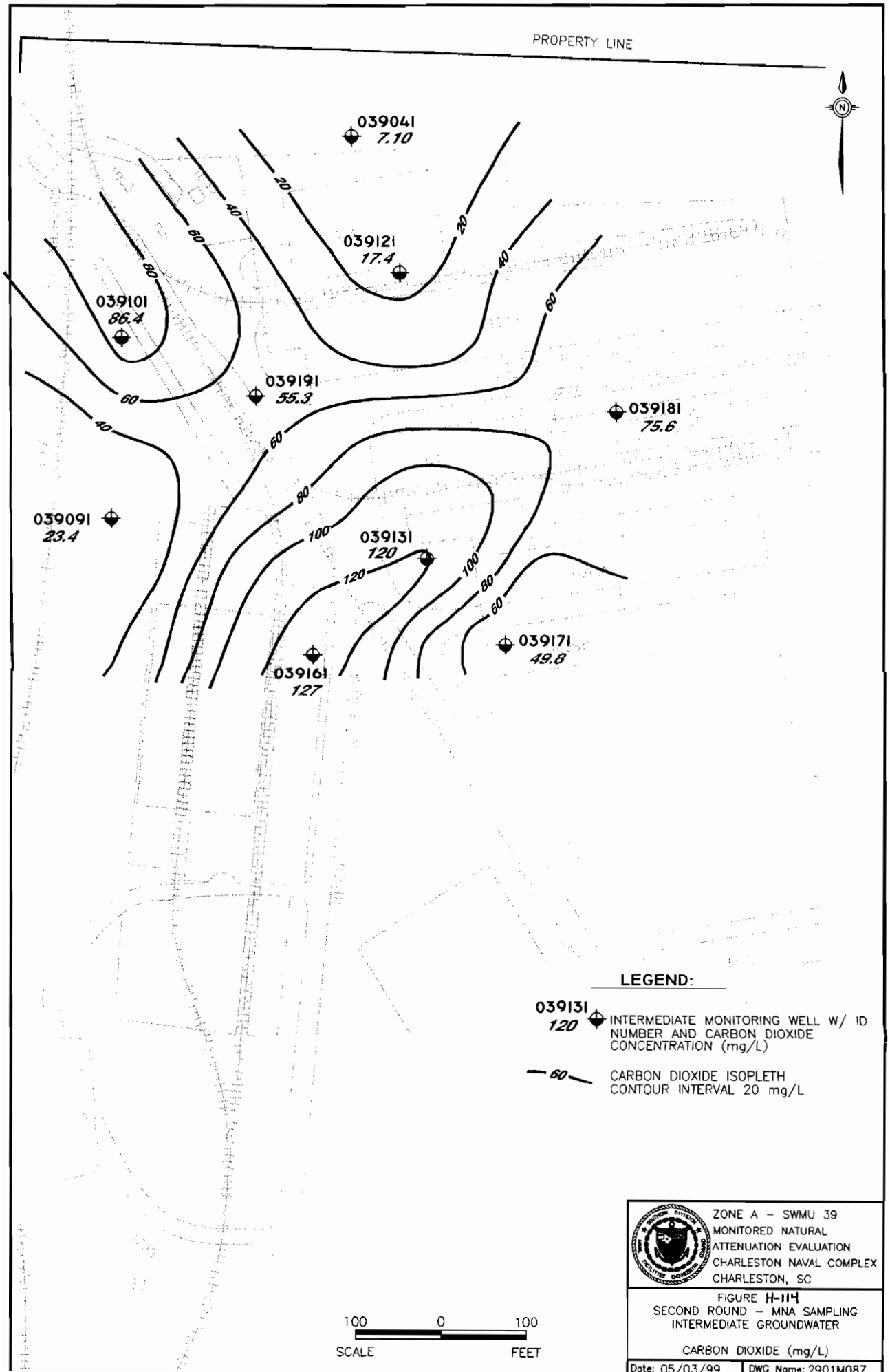

PROPERTY LINE
039011
37.5
039002
143
039001
97.2
100
039014
57.7
039005
56.0
039004
39.3
039003
51.8
038002
52.0
002004
141
039012
60.9
100
039006
162
039010
65.4
200
039019
231
100
039018
95.6
039009
84.0
002006
54.3
039013
104
039007
461
039017
NS
039016
NS
200
300
400
039008
418
200
042001
136
042002
254
042003
NS
505001
121
LEGEND:
039009
84
SHALLOW MONITORING WELL W/ ID NUMBER AND CARBON DIOXIDE CONCENTRATION (mg/L)
NS
= NOT SAMPLED
200
CARBON DIOXIDE ISOPLETH CONTOUR INTERVAL 100mg/L (DASHED WHERE INFERRED)
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-112
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
CARBON DIOXIDE (mg/L)



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-113
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

CARBON DIOXIDE (mg/L)

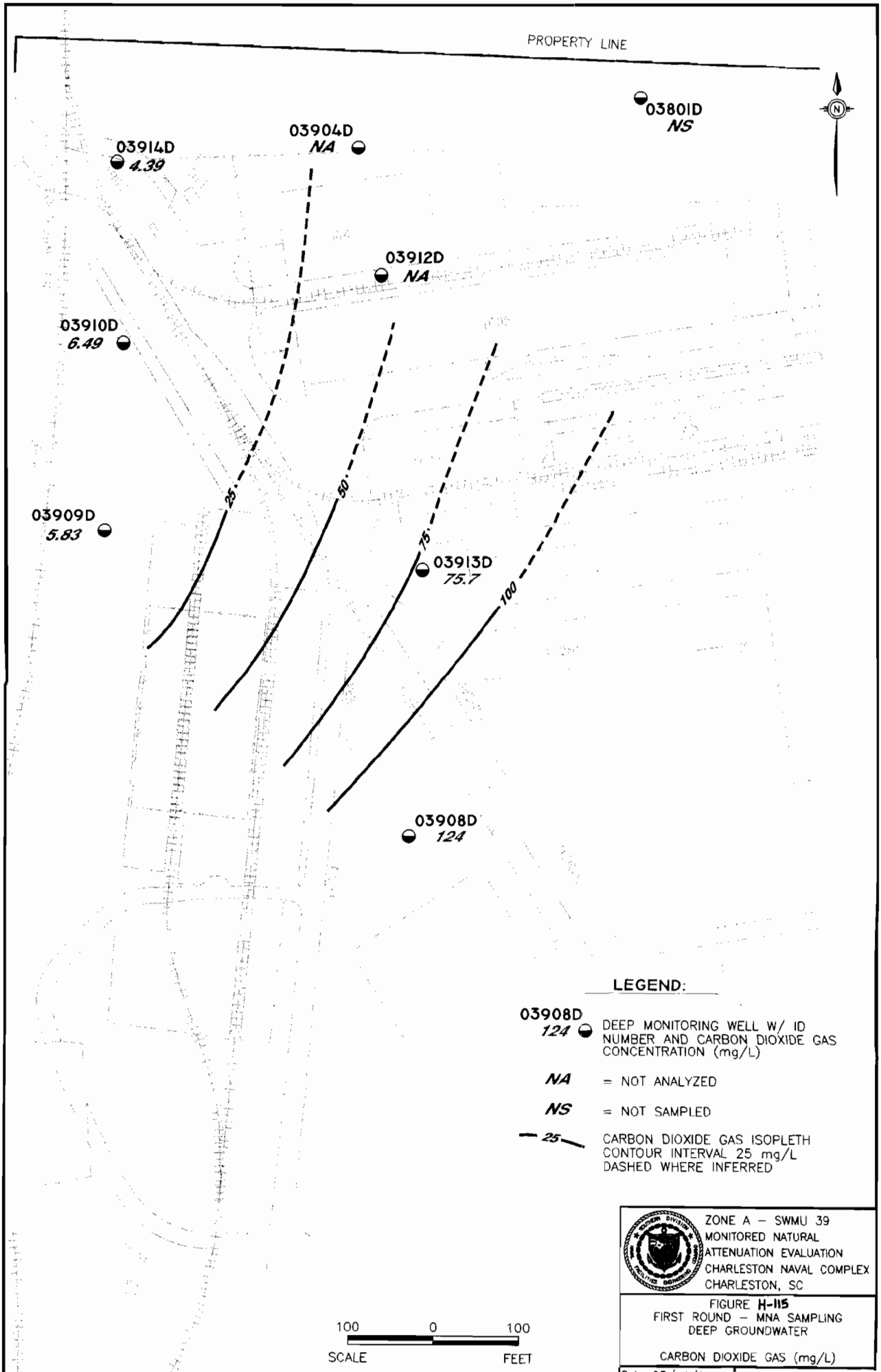


ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-114
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

CARBON DIOXIDE (mg/L)

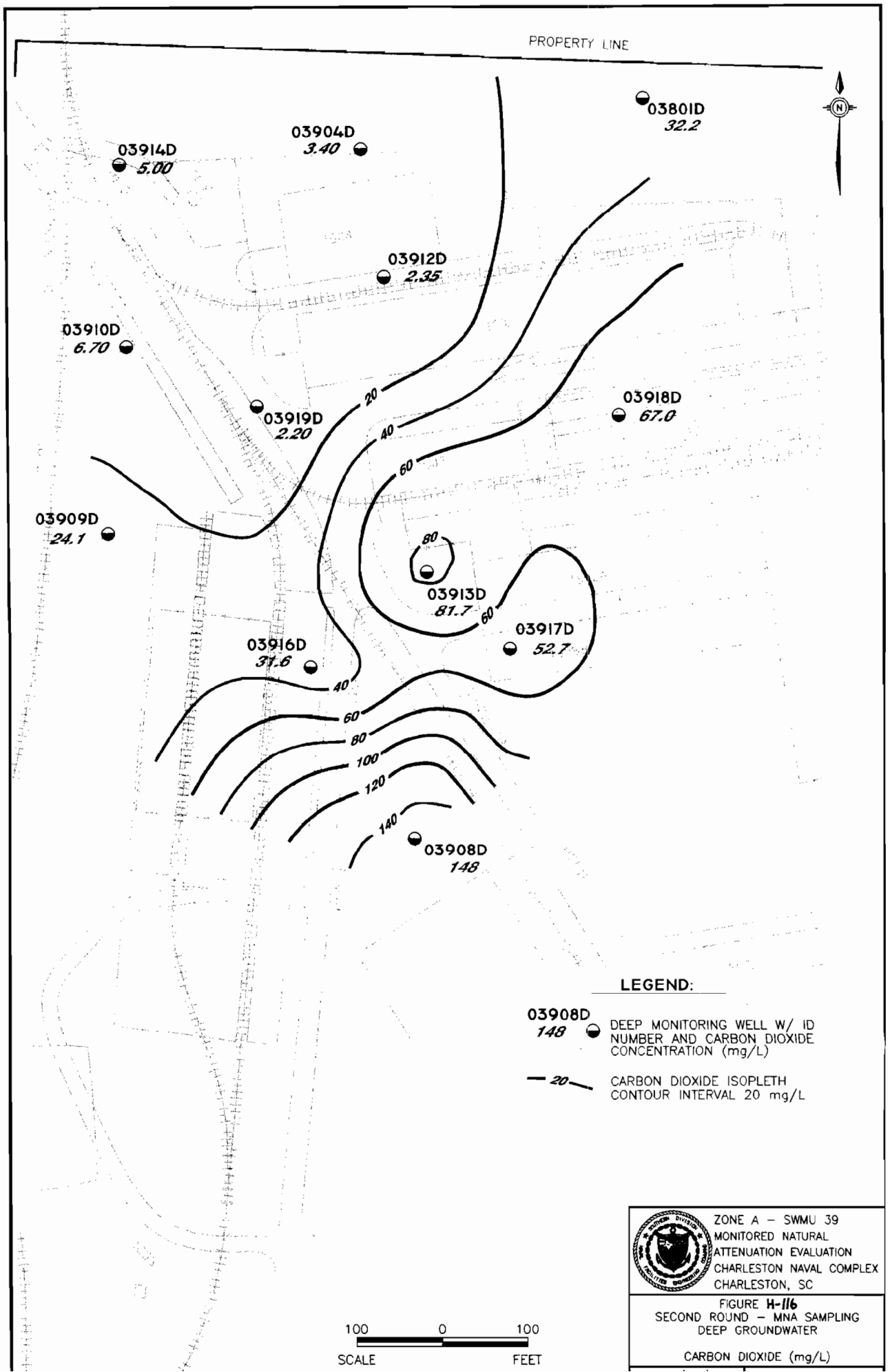
Date: 05/03/99 | DWG Name: 2901M087



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-115
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

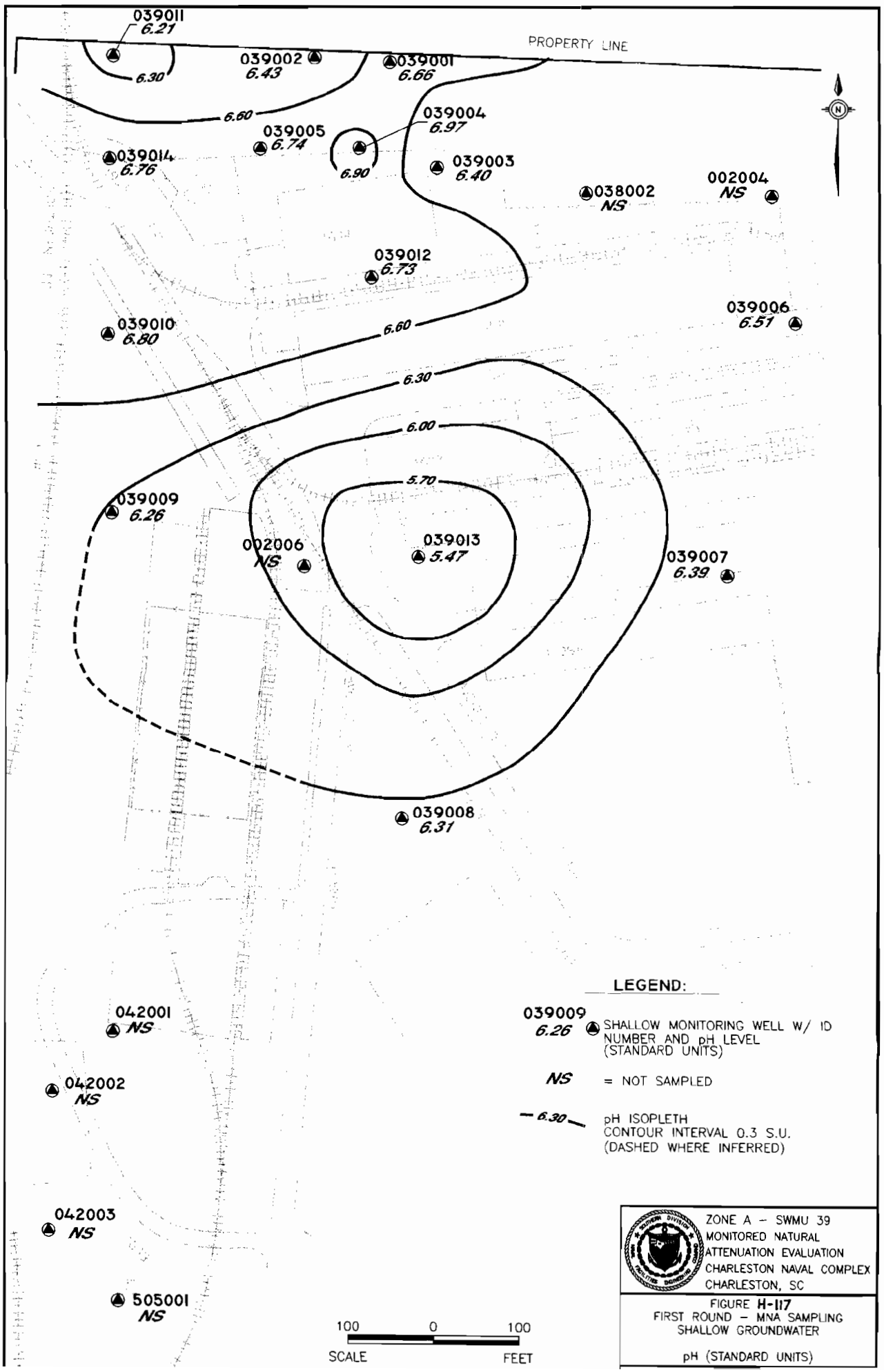
CARBON DIOXIDE GAS (mg/L)

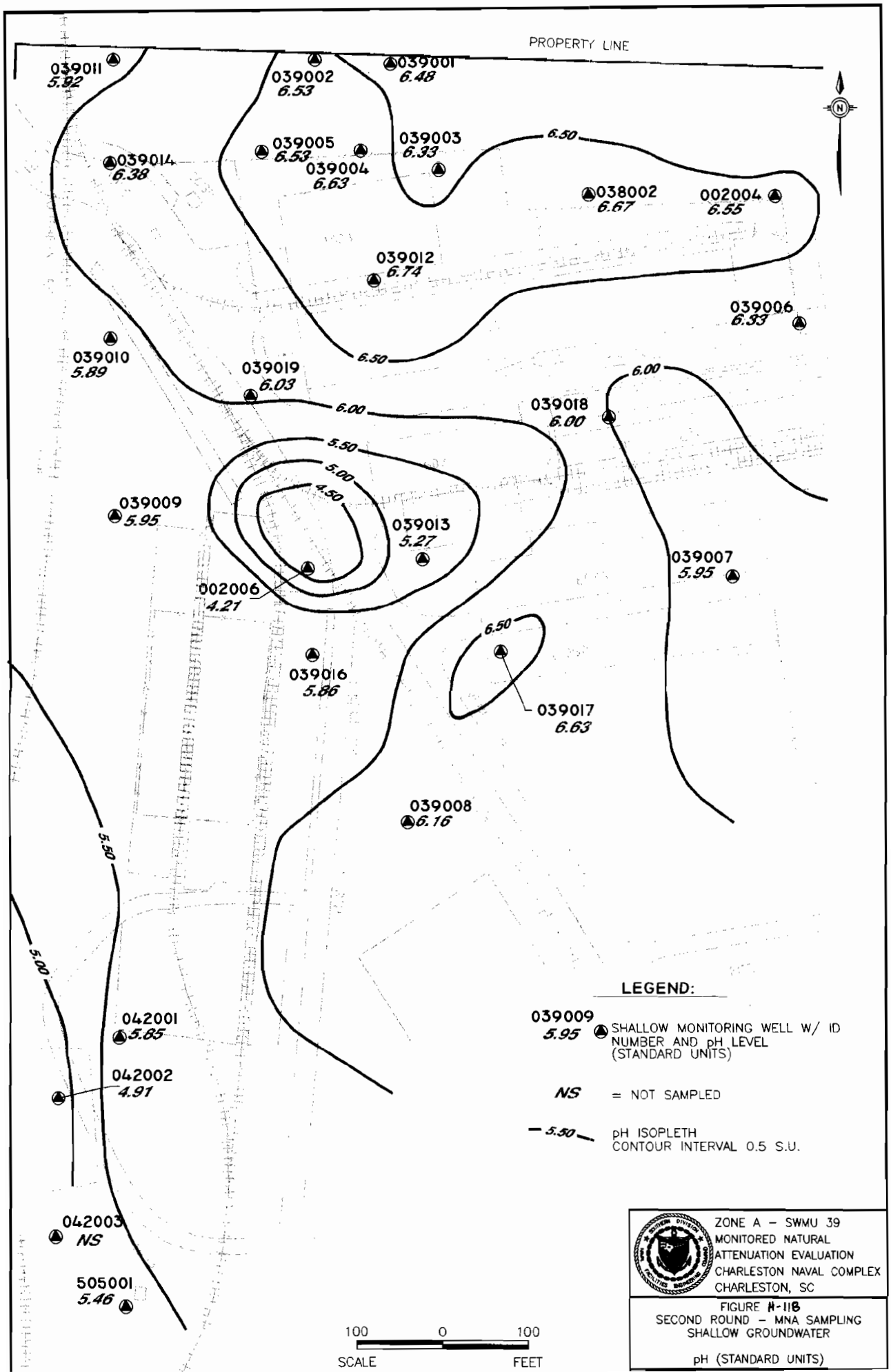


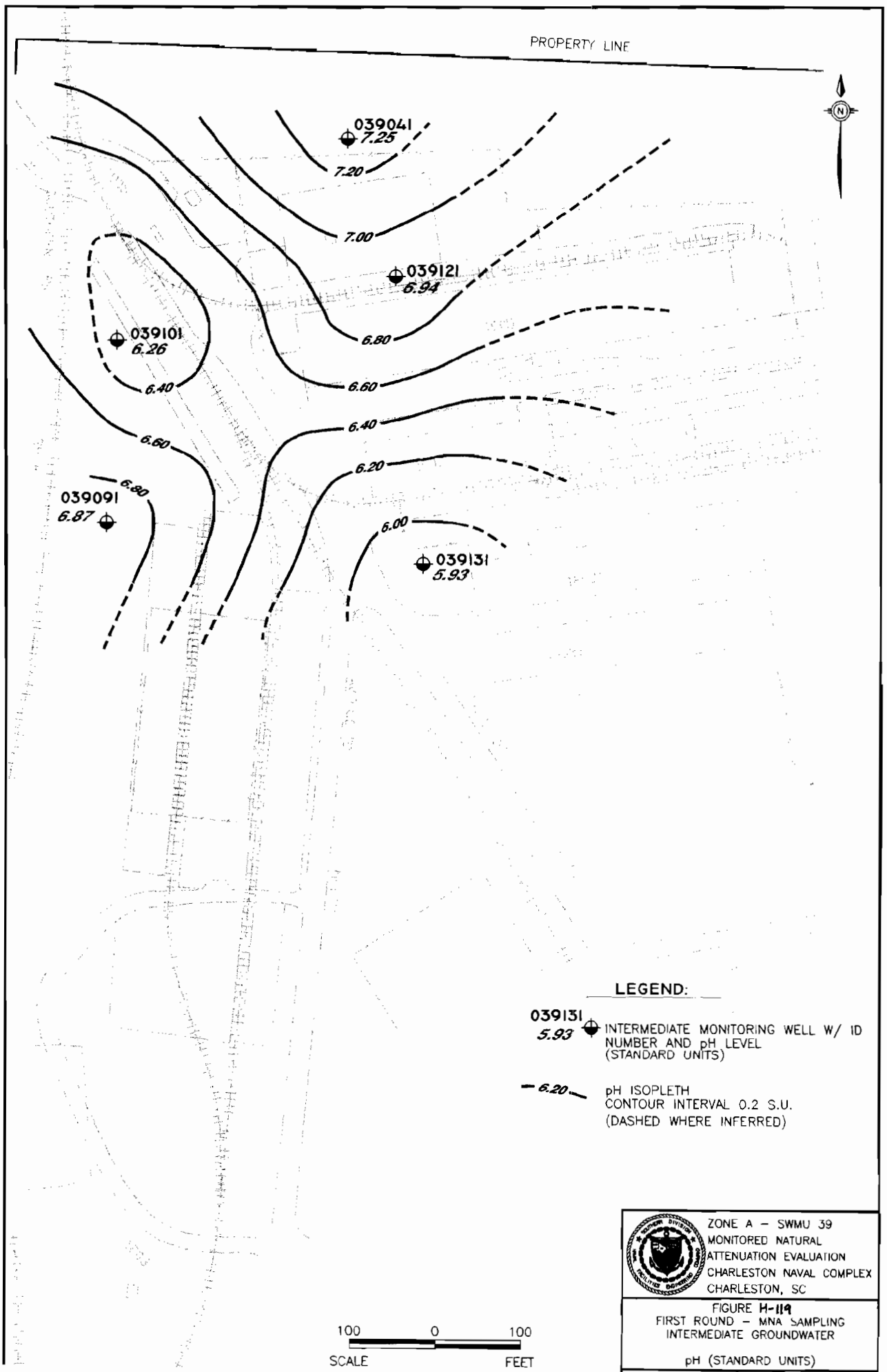
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-116
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

CARBON DIOXIDE (mg/L)


039011
6.21
6.30
039002
6.43
039001
6.66
PROPERTY LINE
6.60
039004
6.97
039005
6.74
039014
6.76
6.90
039003
6.40
038002
NS
002004
NS
039012
6.73
039006
6.51
039010
6.80
6.60
6.30
6.00
5.70
039009
6.26
002006
NS
039013
5.47
039007
6.39
039008
6.31
042001
NS
042002
NS
042003
NS
505001
NS
100
0
100
SCALE
FEET
LEGEND:
039009
6.26
SHALLOW MONITORING WELL W/ ID NUMBER AND pH LEVEL (STANDARD UNITS)
NS
= NOT SAMPLED
6.30
pH ISOPLETH
CONTOUR INTERVAL 0.3 S.U.
(DASHED WHERE INFERRED)
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-117
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
pH (STANDARD UNITS)

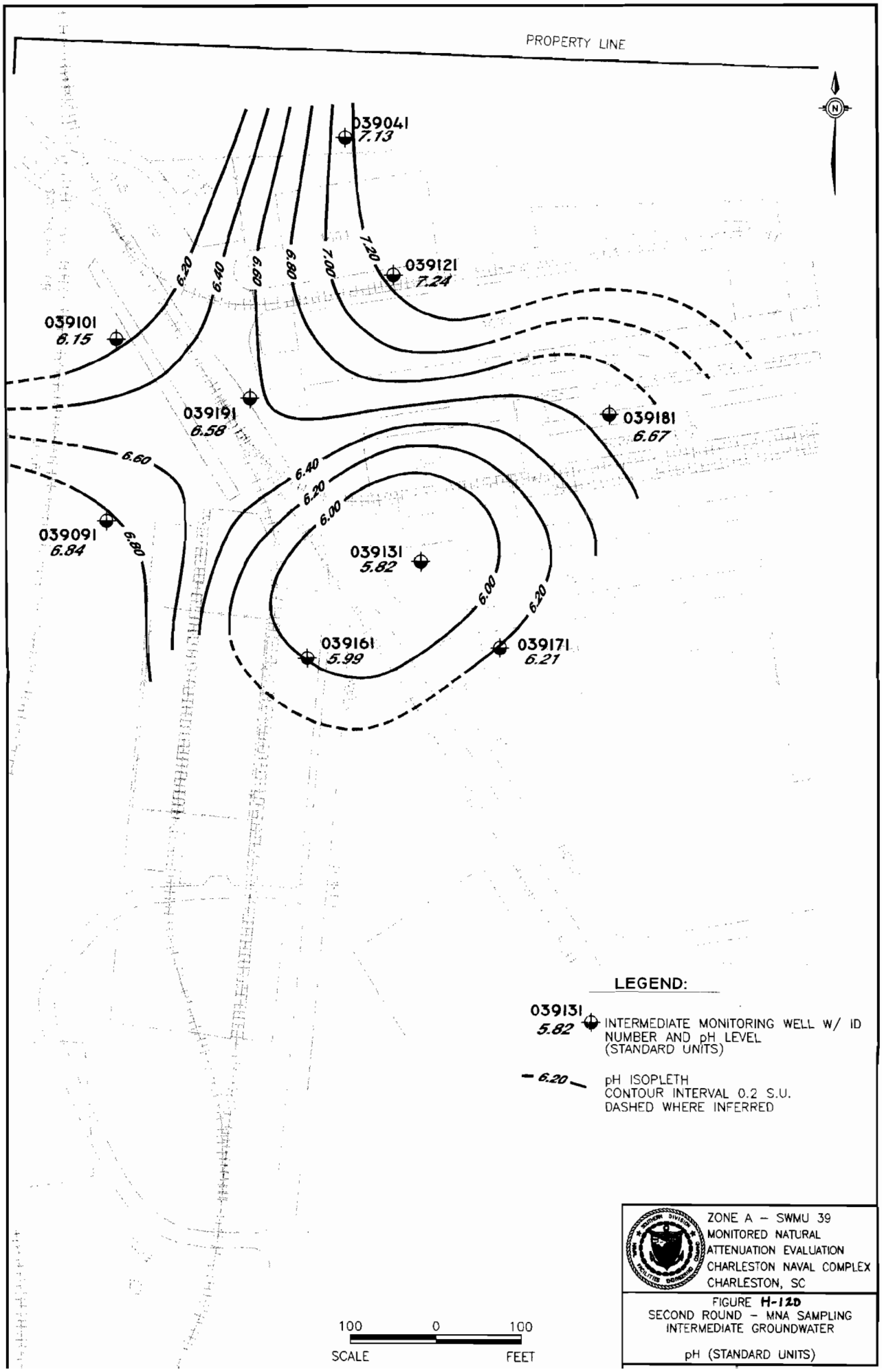

PROPERTY LINE
039011
5.92
039002
6.53
039001
6.48
039014
6.38
039005
6.53
039004
6.63
039003
6.33
6.50
038002
6.67
002004
6.55
039012
6.74
039006
6.33
039010
5.89
039019
6.03
6.50
6.00
039018
6.00
6.00
5.50
5.00
4.50
039009
5.95
039013
5.27
039007
5.95
002006
4.21
6.50
039016
5.86
039017
6.63
039008
6.16
5.50
5.00
042001
5.85
042002
4.91
042003
NS
505001
5.46
LEGEND:
039009
5.95
SHALLOW MONITORING WELL W/ ID NUMBER AND pH LEVEL (STANDARD UNITS)
NS
= NOT SAMPLED
5.50
pH ISOPLETH CONTOUR INTERVAL 0.5 S.U.
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE N-118
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
pH (STANDARD UNITS)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-119
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

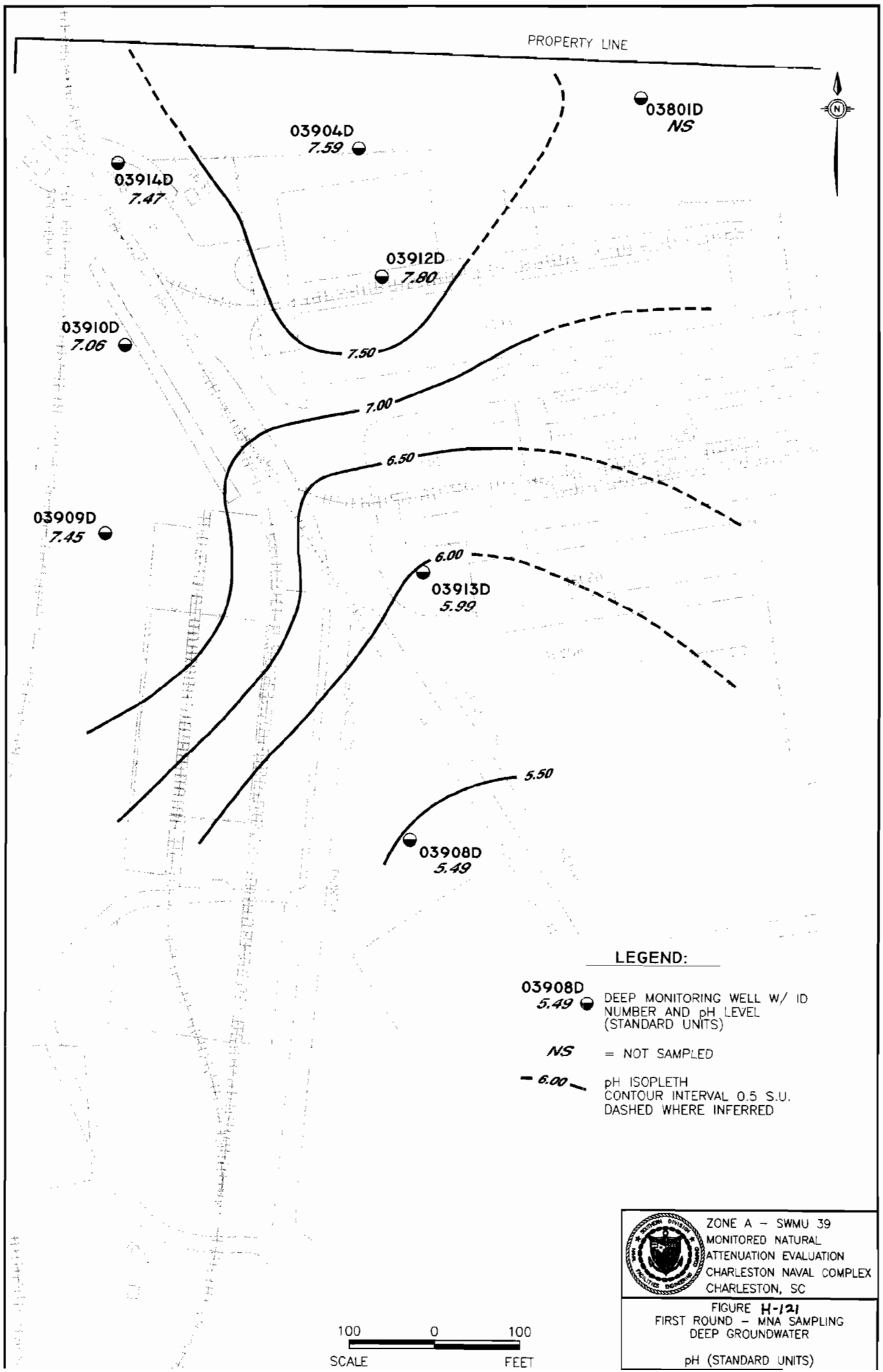
pH (STANDARD UNITS)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-12D
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

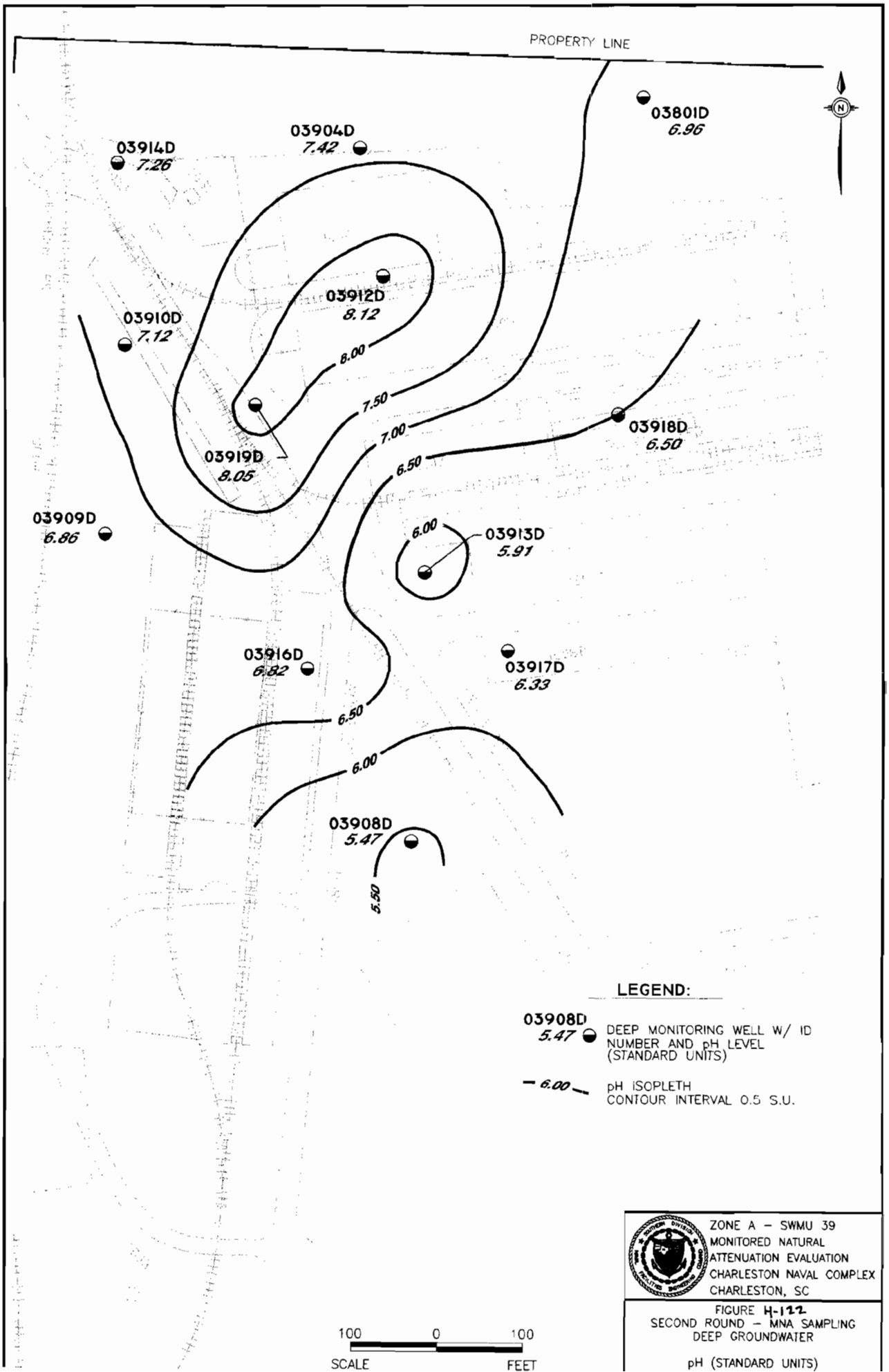
pH (STANDARD UNITS)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-121
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

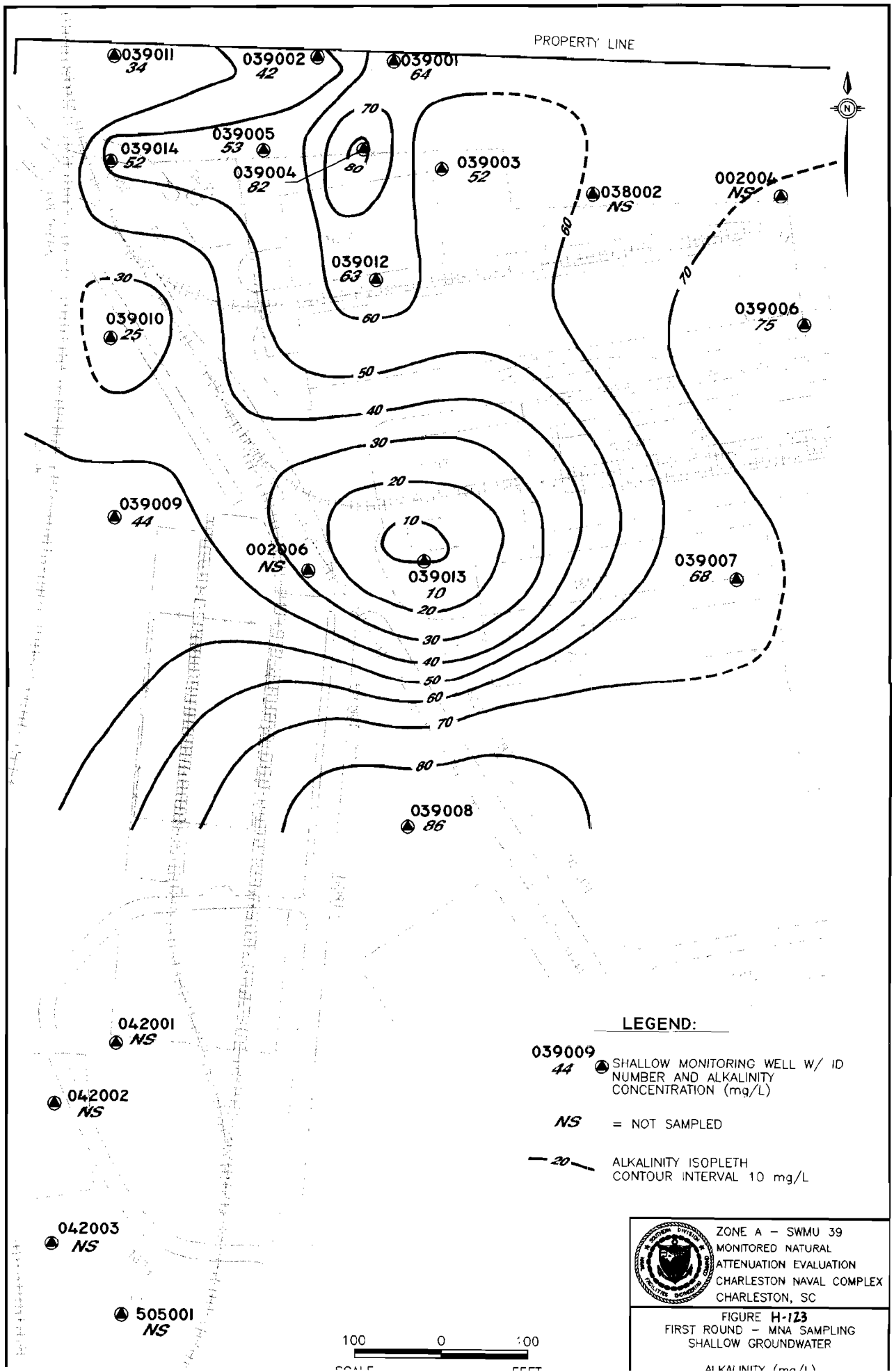
pH (STANDARD UNITS)

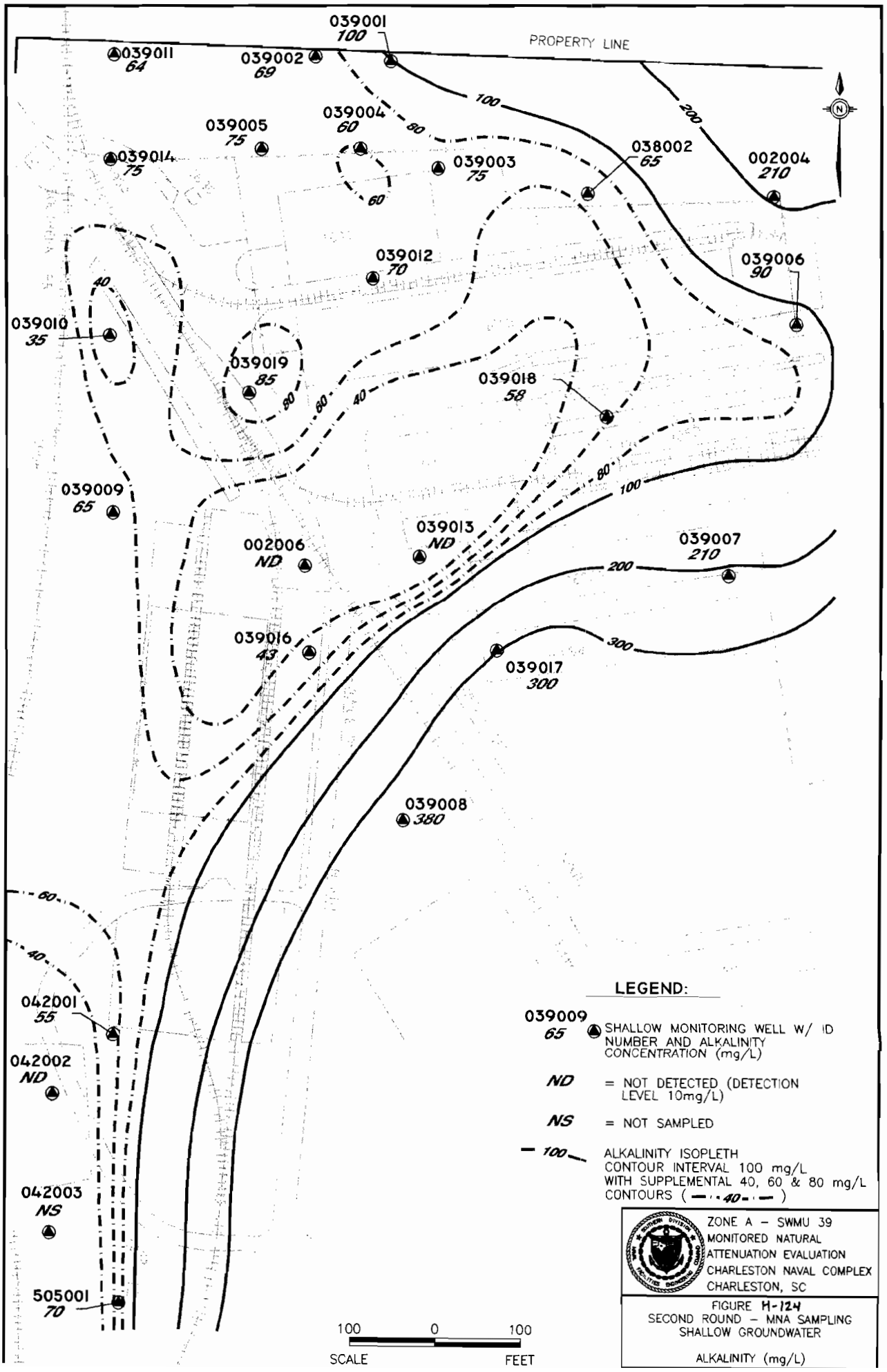


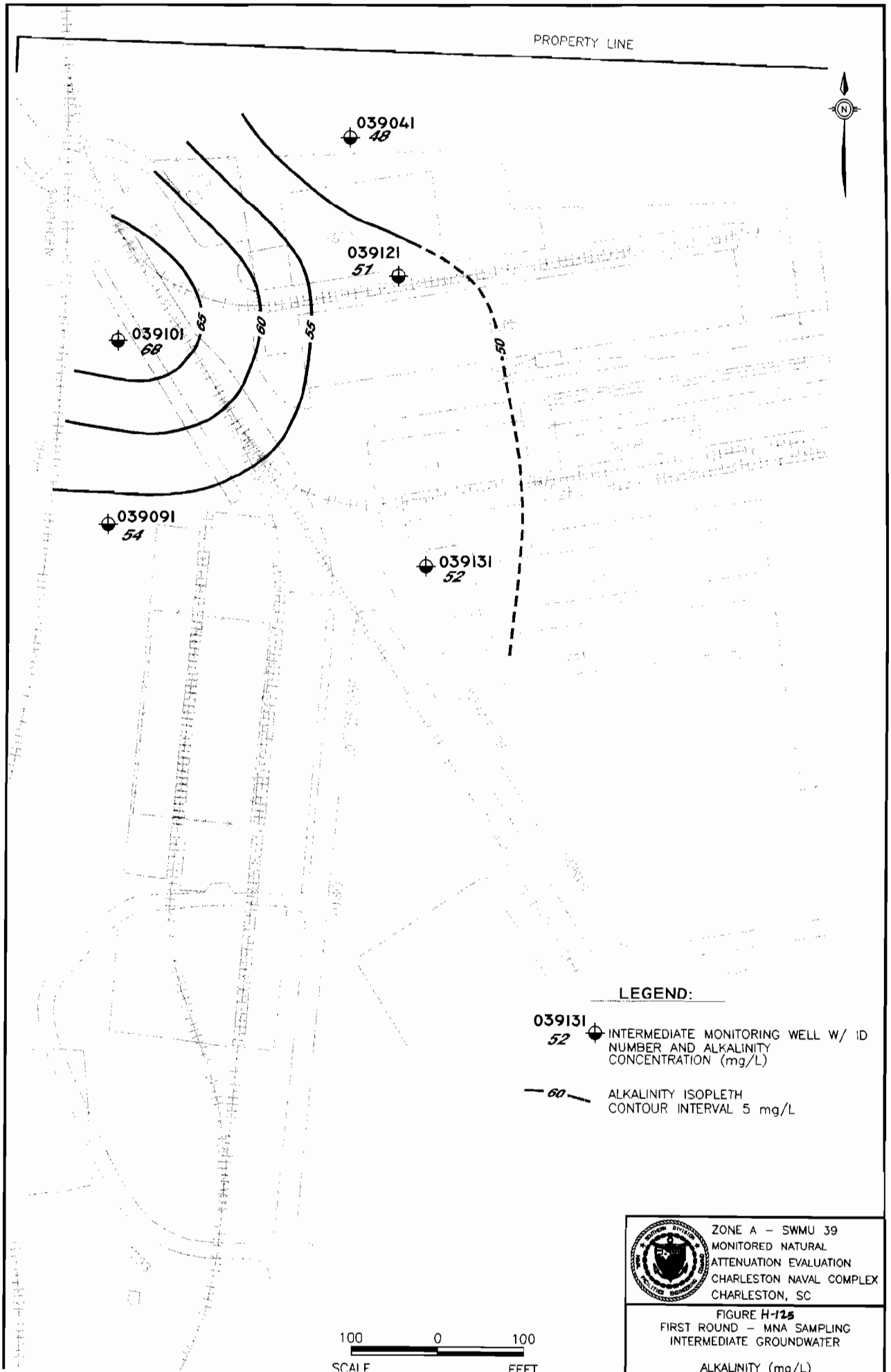
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-122
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

pH (STANDARD UNITS)


PROPERTY LINE
039011
34
039002
42
039001
64
039005
53
039014
52
039004
82
039003
52
038002
NS
002004
NS
039012
63
039010
25
039006
75
039009
44
002006
NS
039013
10
039007
68
039008
86
042001
NS
042002
NS
042003
NS
505001
NS
70
80
60
30
50
40
20
10
LEGEND:
039009
44
SHALLOW MONITORING WELL W/ ID NUMBER AND ALKALINITY CONCENTRATION (mg/L)
NS = NOT SAMPLED
20
ALKALINITY ISOPLETH CONTOUR INTERVAL 10 mg/L
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-123
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
ALKALINITY (mg/L)

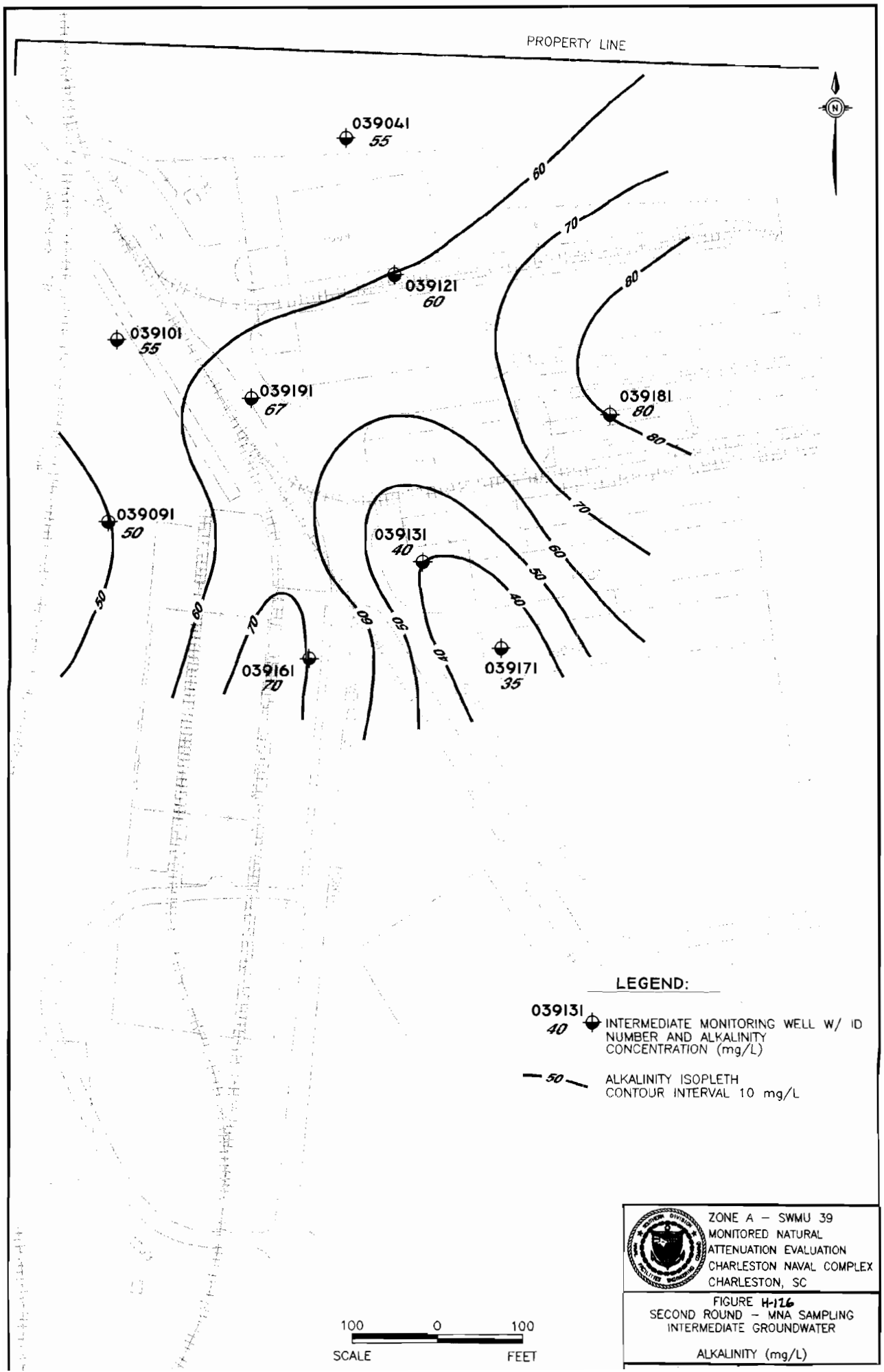

PROPERTY LINE
039001
100
039011
64
039002
69
039004
60
039005
75
039014
75
039003
75
038002
65
002004
210
039012
70
039006
90
039010
35
039019
85
039018
58
039009
65
039013
ND
002006
ND
039007
210
039016
43
039017
300
039008
380
042001
55
042002
ND
042003
NS
505001
70
100
200
300
80
60
40
N
LEGEND:
039009
65
SHALLOW MONITORING WELL W/ ID NUMBER AND ALKALINITY CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 10mg/L)
NS = NOT SAMPLED
100
ALKALINITY ISOPLETH CONTOUR INTERVAL 100 mg/L WITH SUPPLEMENTAL 40, 60 & 80 mg/L CONTOURS (40)
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-124
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
ALKALINITY (mg/L)
100 0 100
SCALE
FEET



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-12b
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

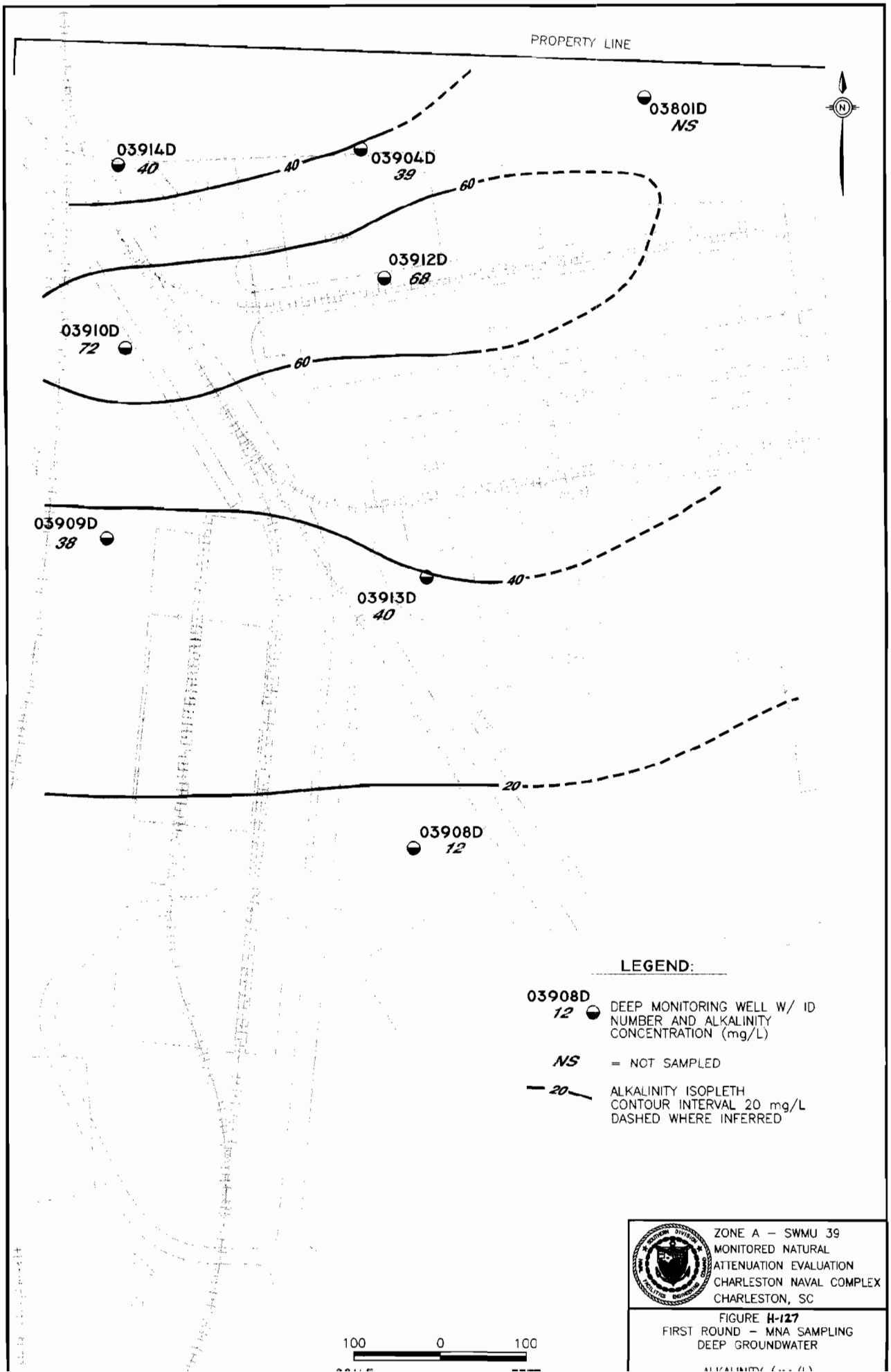
ALKALINITY (mg/L)



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

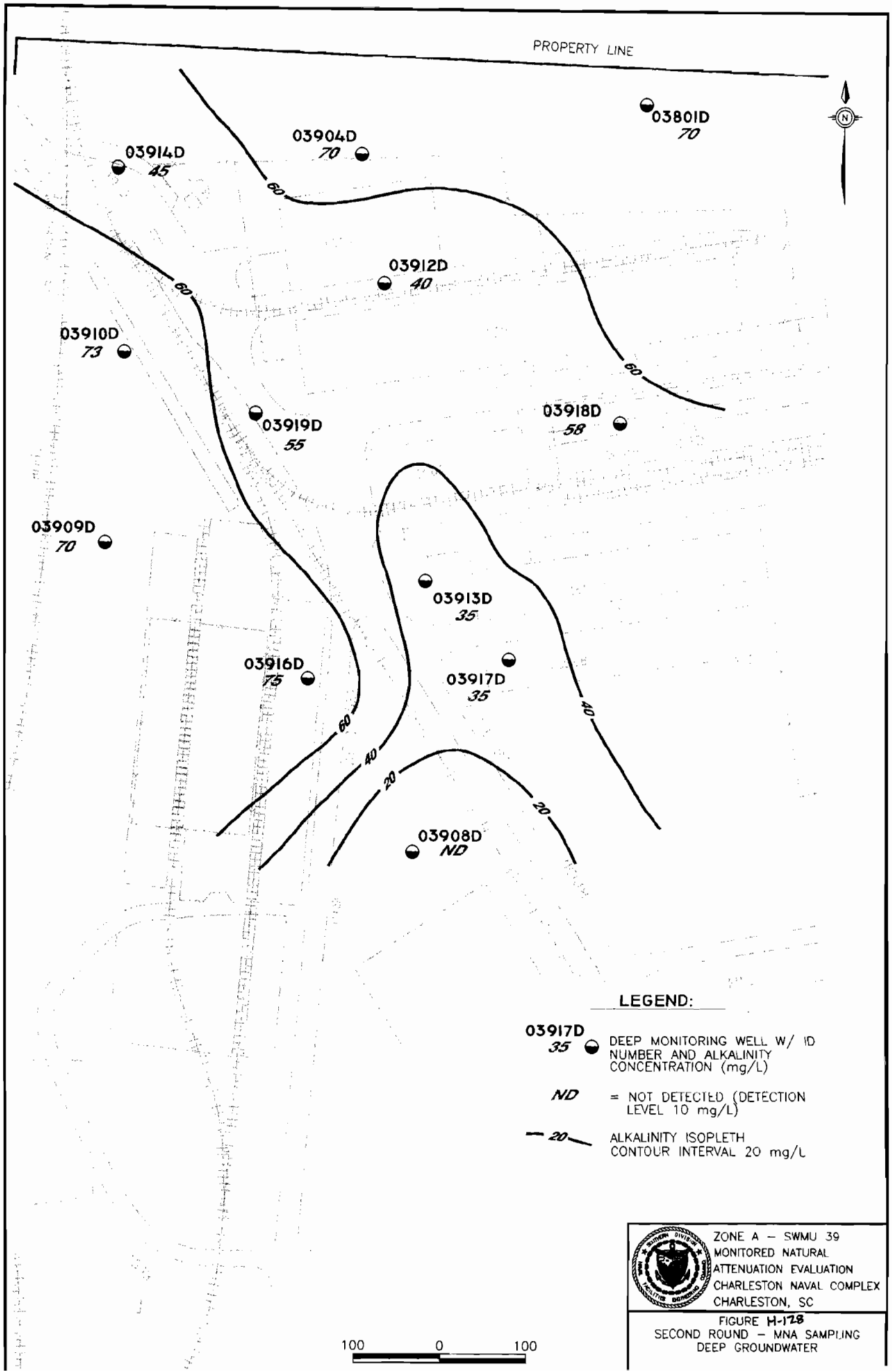
FIGURE H-126
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

ALKALINITY (mg/L)



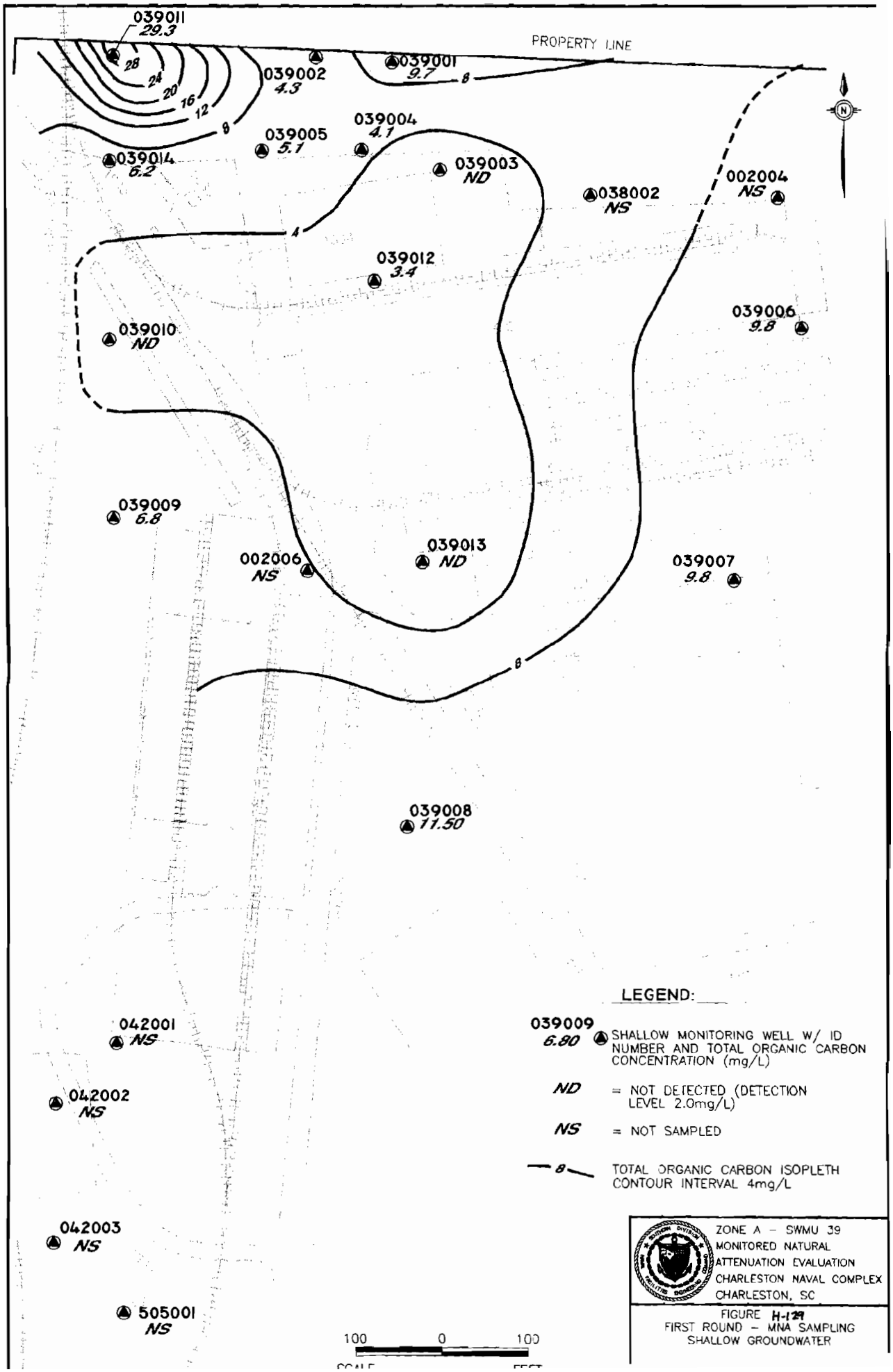
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

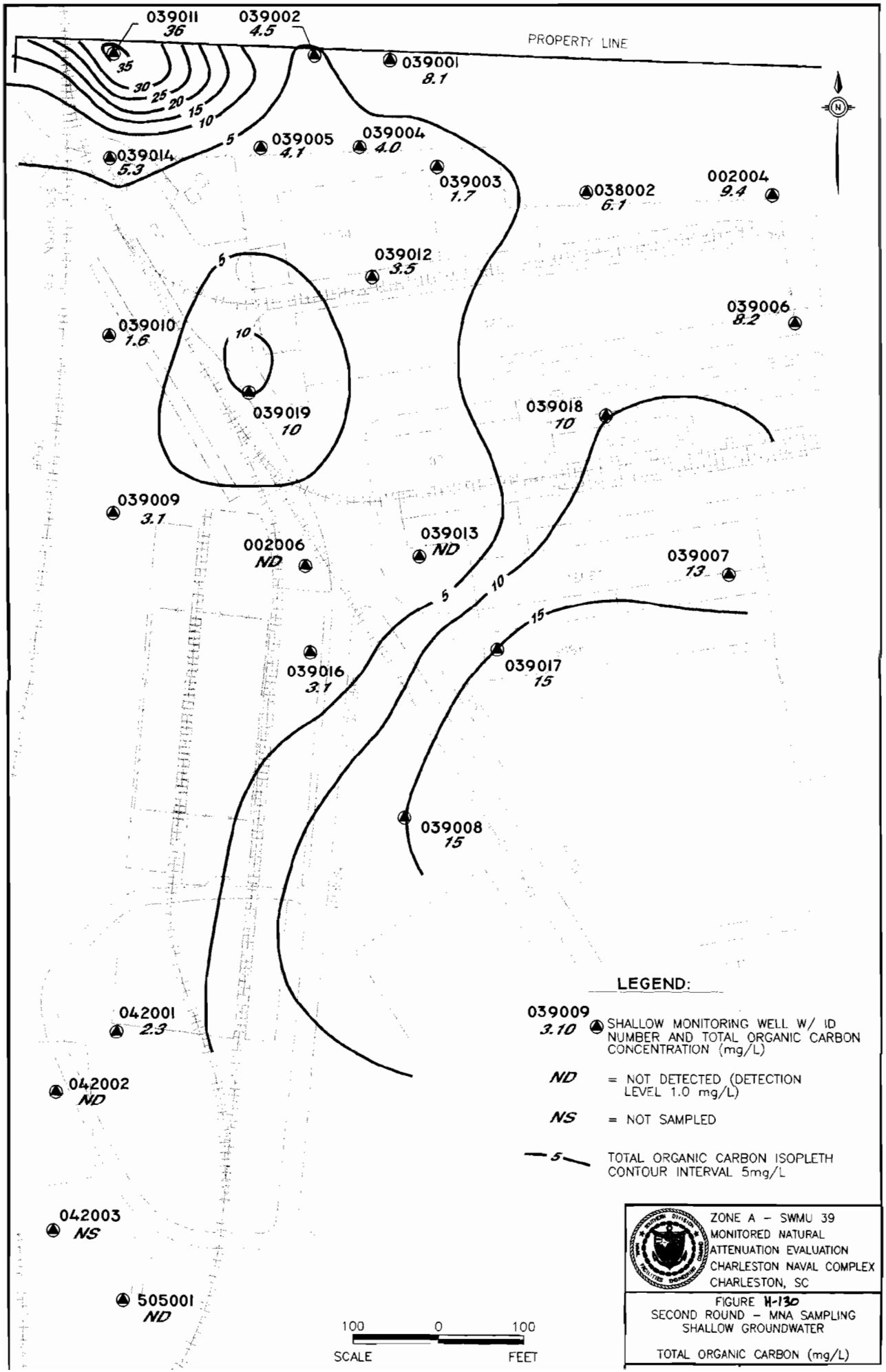
FIGURE H-127
FIRST ROUND – MNA SAMPLING
DEEP GROUNDWATER

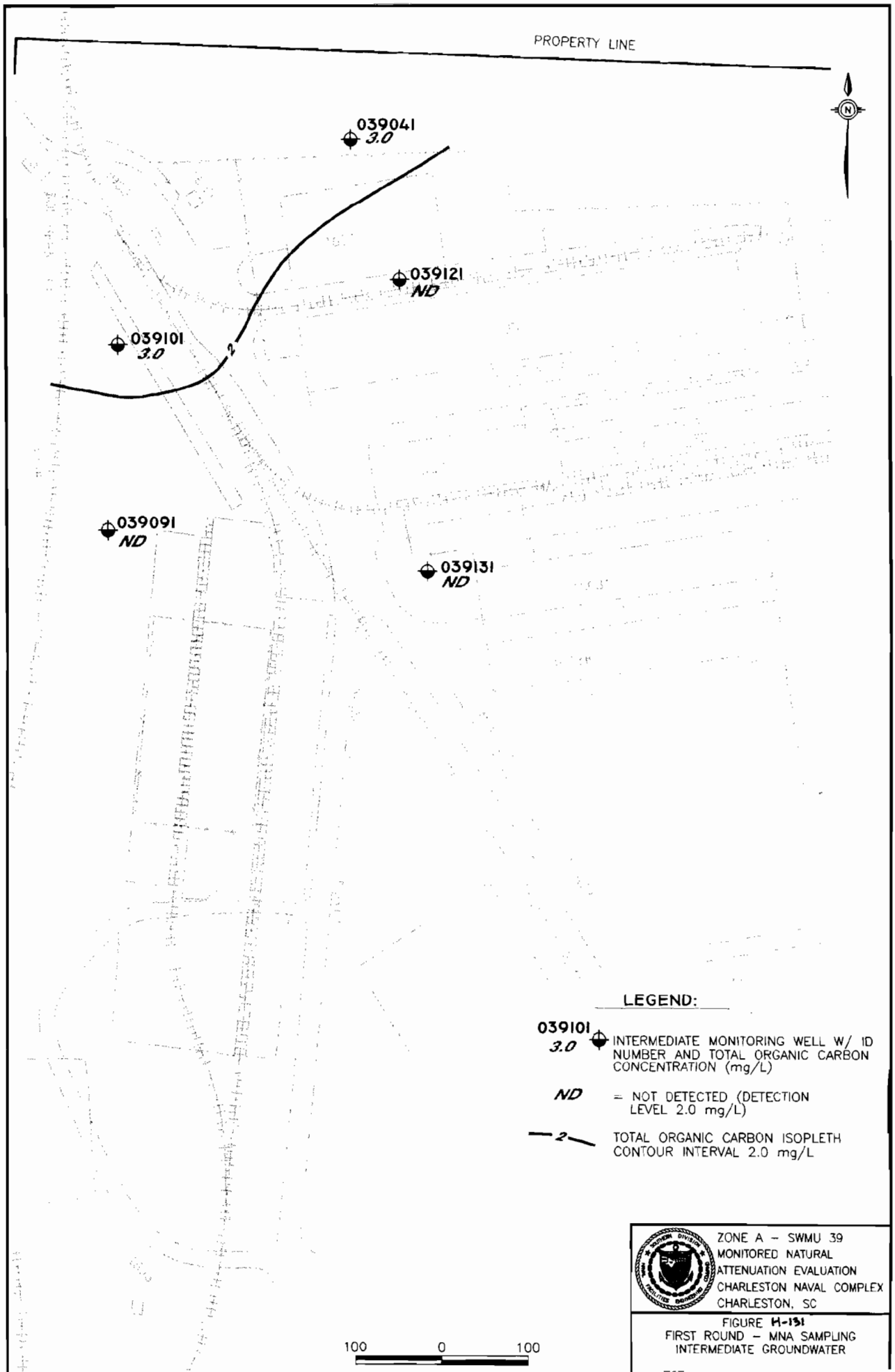


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-128
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

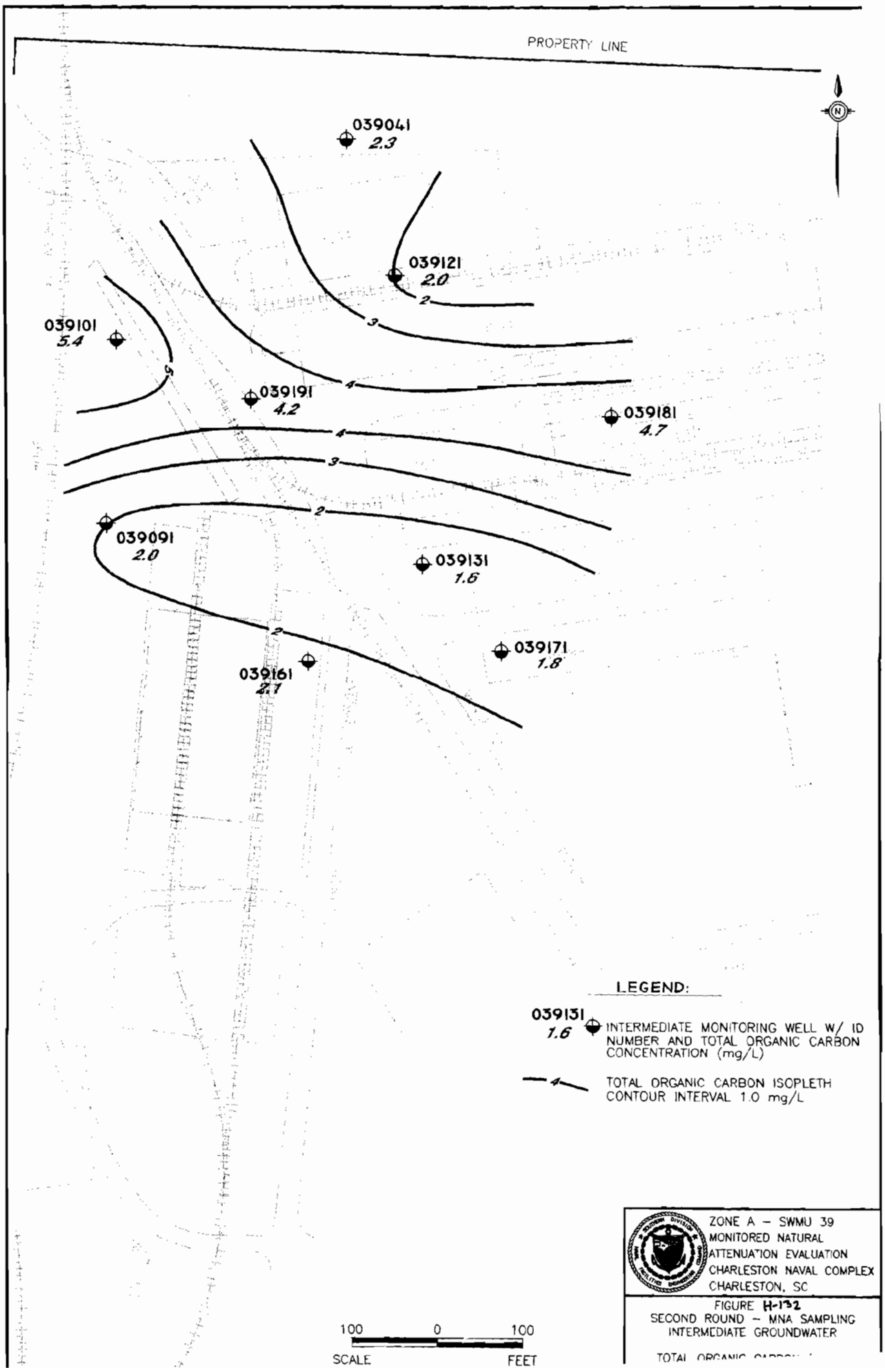

PROPERTY LINE
039011
29.3
28
24
20
16
12
8
039002
4.3
039001
9.7
8
039004
4.1
039005
5.1
039014
6.2
039003
ND
038002
NS
002004
NS
4
039012
3.4
039006
9.8
039010
ND
039009
6.8
039013
ND
002006
NS
039007
9.8
8
039008
11.50
042001
NS
042002
NS
042003
NS
505001
NS
100
0
100
SCALE
FEET
LEGEND:
039009
6.80
SHALLOW MONITORING WELL W/ ID NUMBER AND TOTAL ORGANIC CARBON CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 2.0mg/L)
NS
= NOT SAMPLED
8
TOTAL ORGANIC CARBON ISOPLETH CONTOUR INTERVAL 4mg/L
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-129
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER


039011
36
039002
4.5
PROPERTY LINE
039001
8.1
35
30
25
20
15
10
5
039014
5.3
039005
4.1
039004
4.0
039003
1.7
038002
6.1
002004
9.4
039012
3.5
039006
8.2
039010
1.6
10
039019
10
039018
10
039009
3.1
002006
ND
039013
ND
039007
13
10
15
039016
3.1
039017
15
039008
15
042001
2.3
042002
ND
042003
NS
505001
ND
LEGEND:
039009
3.10
SHALLOW MONITORING WELL W/ ID NUMBER AND TOTAL ORGANIC CARBON CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 1.0 mg/L)
NS = NOT SAMPLED
5
TOTAL ORGANIC CARBON ISOPLETH CONTOUR INTERVAL 5mg/L
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-130
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
TOTAL ORGANIC CARBON (mg/L)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

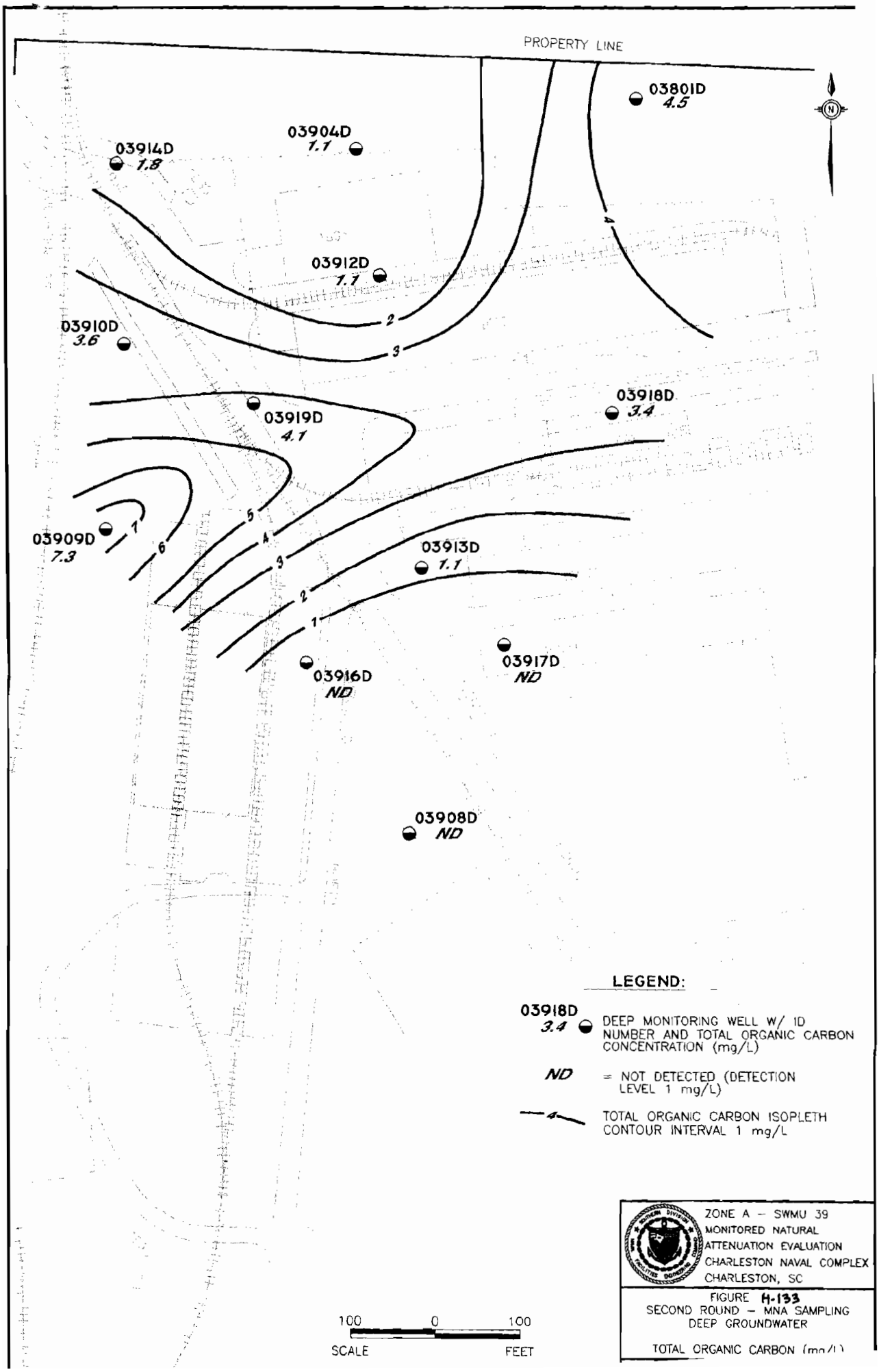
FIGURE H-131
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

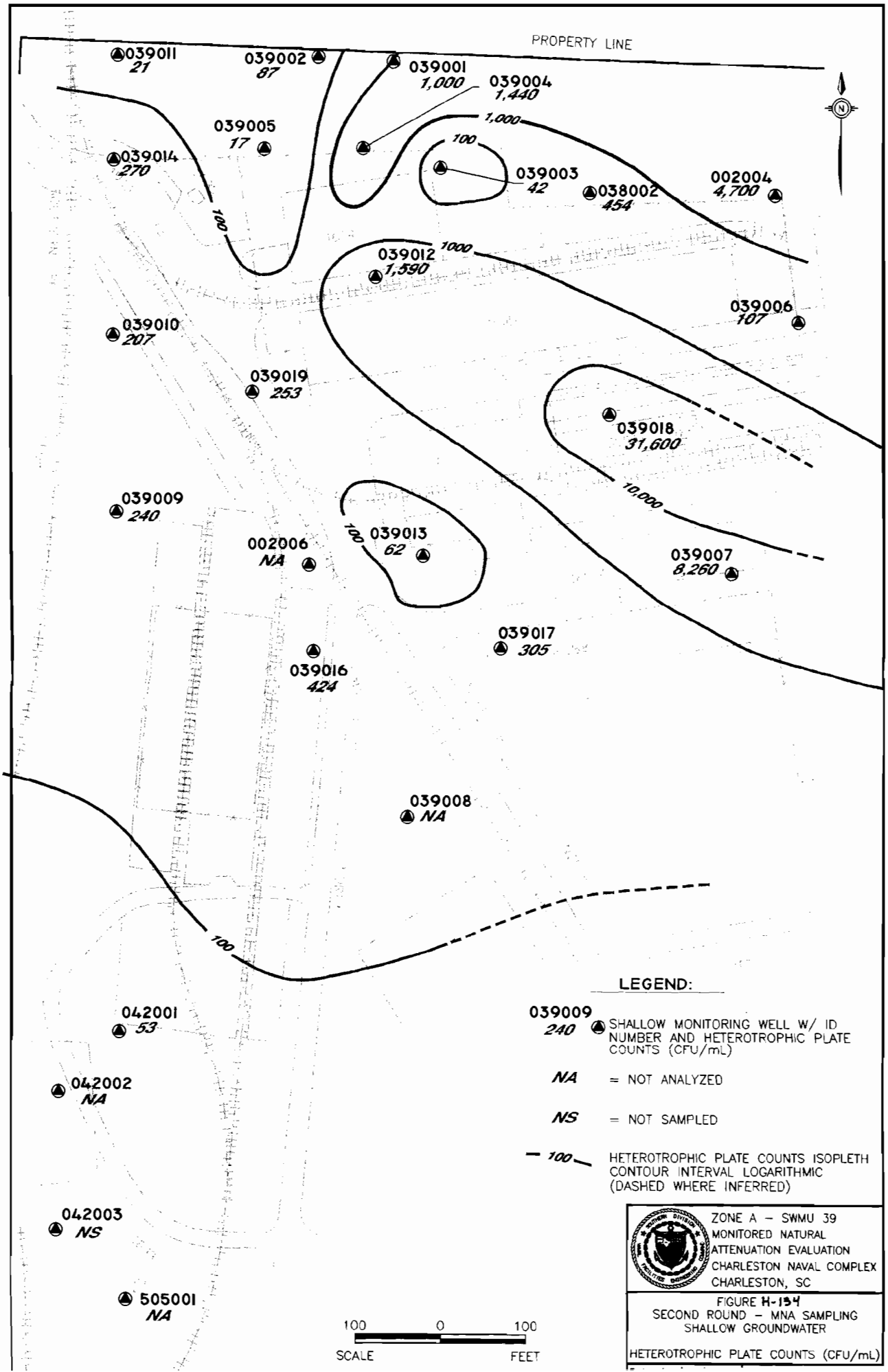


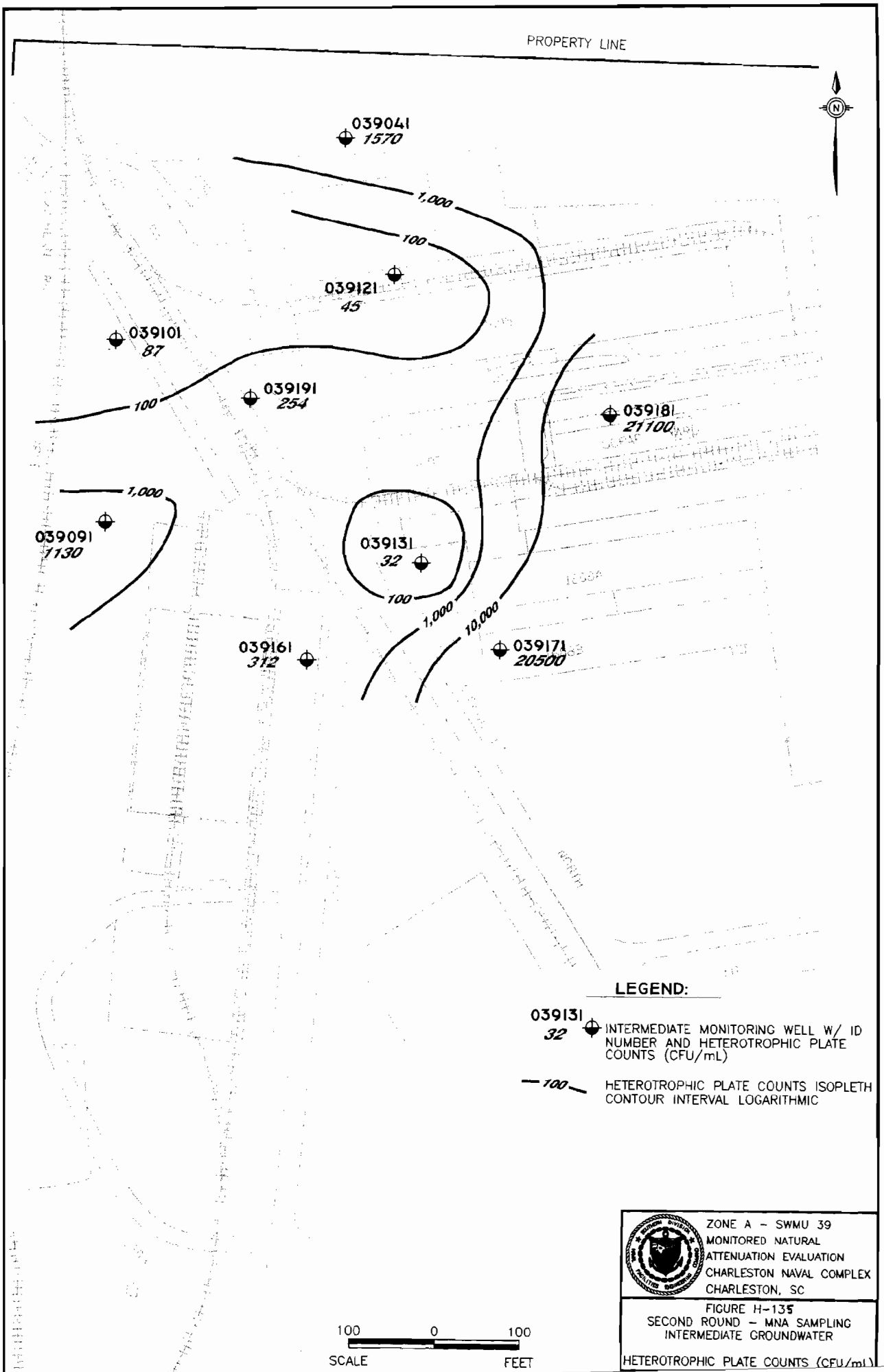
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-132
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

TOTAL ORGANIC CARBON


PROPERTY LINE
03801D
4.5
03904D
1.1
03914D
1.8
03912D
1.1
03910D
3.6
03918D
3.4
03919D
4.1
03909D
7.3
03913D
1.1
03917D
ND
03916D
ND
03908D
ND
N
LEGEND:
03918D
3.4
DEEP MONITORING WELL W/ ID NUMBER AND TOTAL ORGANIC CARBON CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 1 mg/L)
TOTAL ORGANIC CARBON ISOPLETH CONTOUR INTERVAL 1 mg/L
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-133
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER
TOTAL ORGANIC CARBON (mg/L)

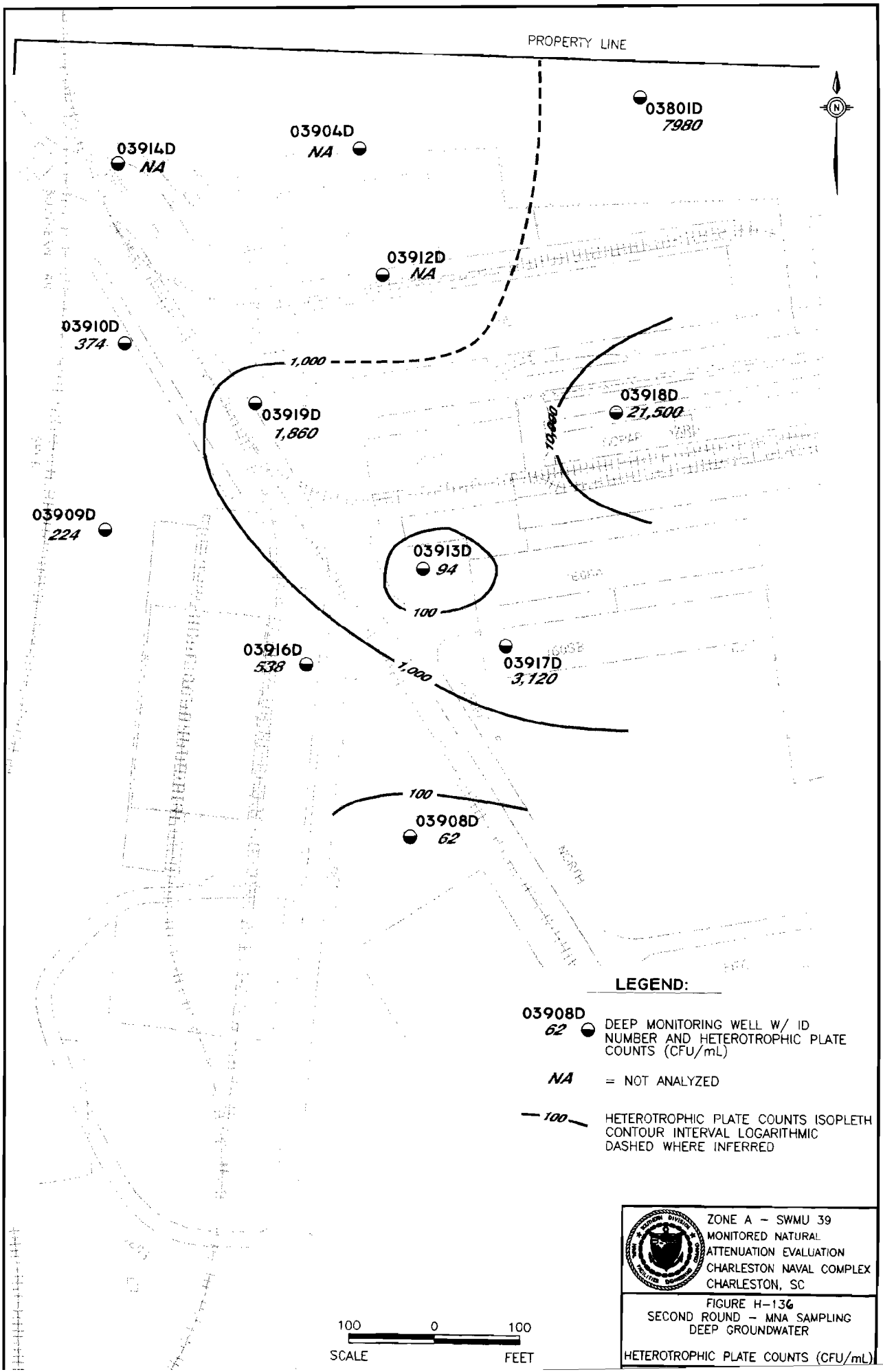

PROPERTY LINE
039011
21
039002
87
039001
1,000
039004
1,440
039005
17
039014
270
1,000
100
039003
42
038002
454
002004
4,700
100
039012
1,590
1000
039006
107
039010
207
039019
253
039018
31,600
10,000
039009
240
039013
62
100
002006
NA
039007
8,260
039017
305
039016
424
039008
NA
100
042001
53
042002
NA
042003
NS
505001
NA
100
0
100
SCALE
FEET
LEGEND:
039009
240
SHALLOW MONITORING WELL W/ ID NUMBER AND HETEROTROPHIC PLATE COUNTS (CFU/mL)
NA = NOT ANALYZED
NS = NOT SAMPLED
100
HETEROTROPHIC PLATE COUNTS ISOPLETH CONTOUR INTERVAL LOGARITHMIC (DASHED WHERE INFERRED)
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-134
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
HETEROTROPHIC PLATE COUNTS (CFU/mL)

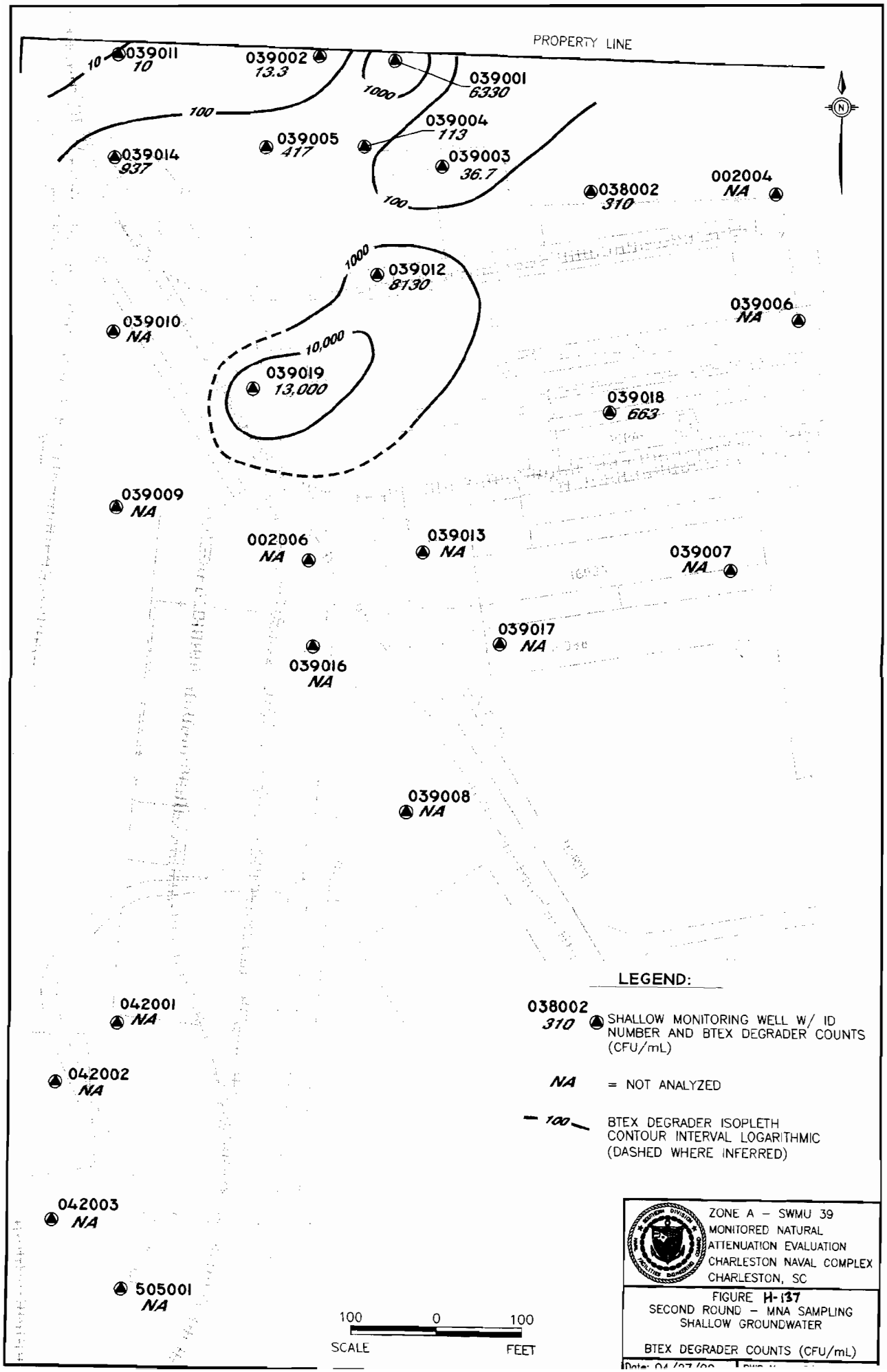


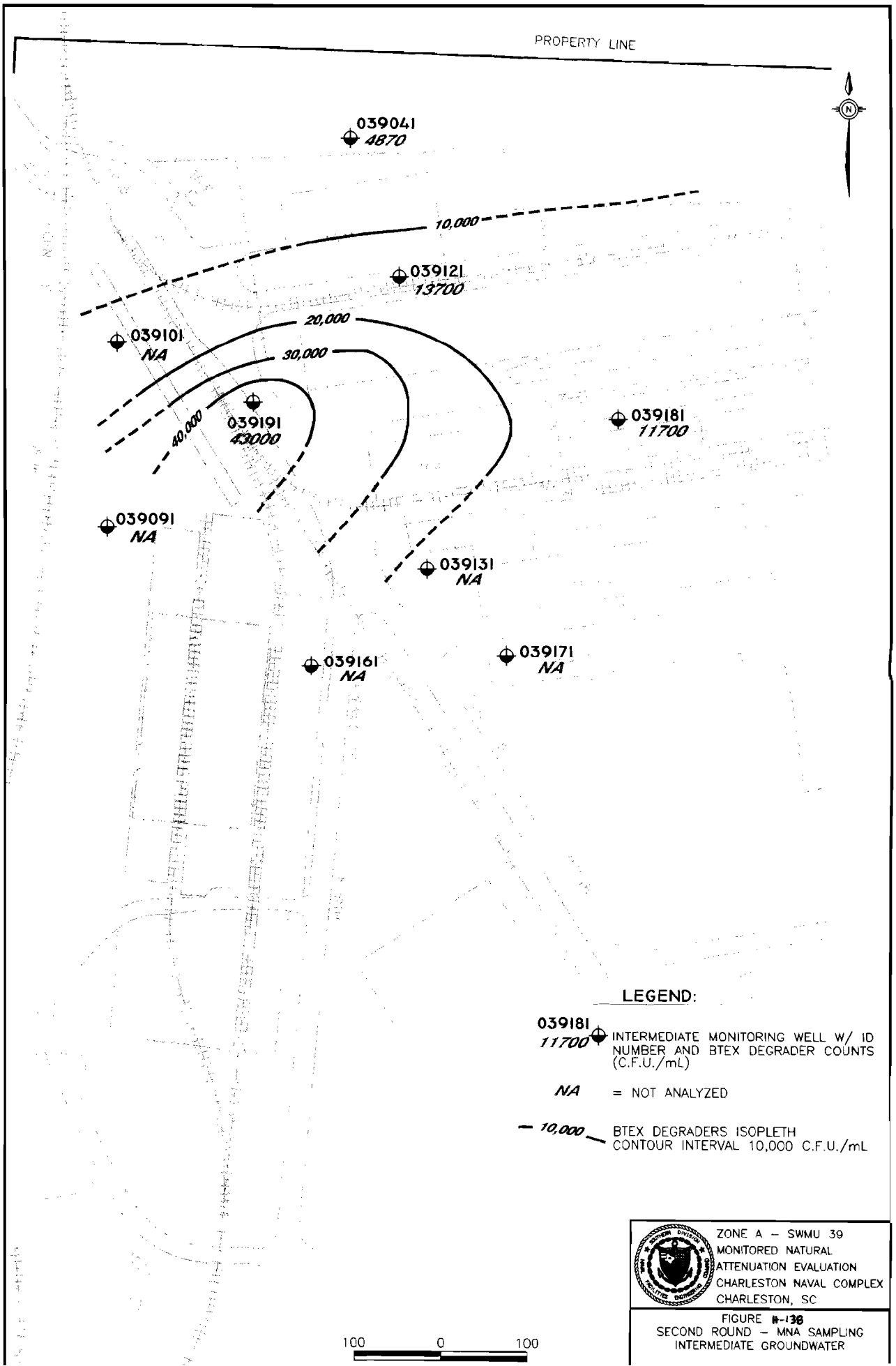
ZONE A - SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-135
SECOND ROUND - MNA SAMPLING
INTERMEDIATE GROUNDWATER

HETEROTROPHIC PLATE COUNTS (CFU/mL)

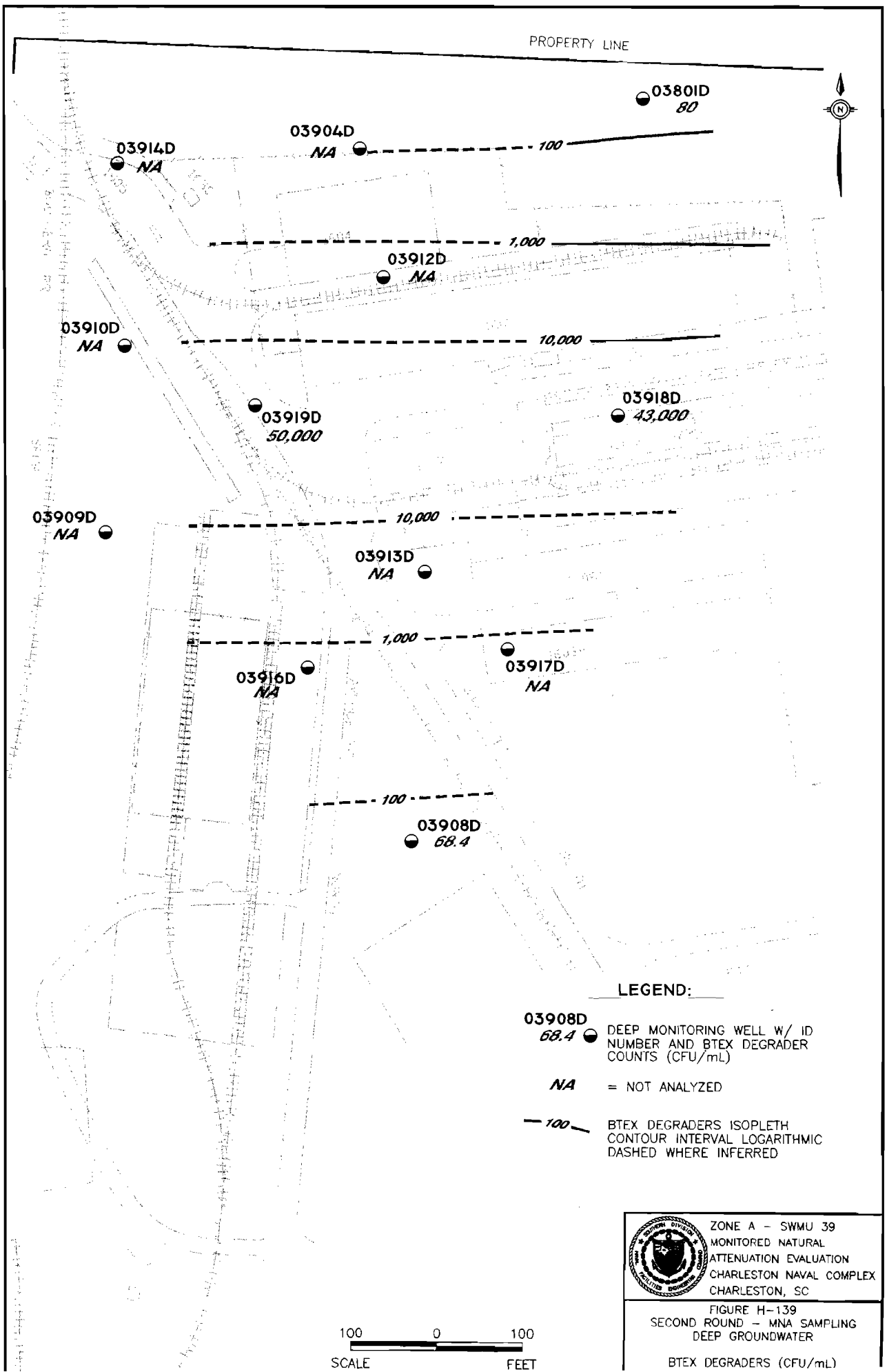

PROPERTY LINE
03801D
7980
03904D
NA
03914D
NA
03912D
NA
03910D
374
1,000
03919D
1,860
03918D
21,500
10,000
03909D
224
03913D
94
100
03916D
538
1,000
03917D
3,120
100
03908D
62
LEGEND:
03908D
62
DEEP MONITORING WELL W/ ID NUMBER AND HETEROTROPHIC PLATE COUNTS (CFU/mL)
NA
= NOT ANALYZED
100
HETEROTROPHIC PLATE COUNTS ISOPLETH CONTOUR INTERVAL LOGARITHMIC DASHED WHERE INFERRED
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-136
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER
HETEROTROPHIC PLATE COUNTS (CFU/mL)

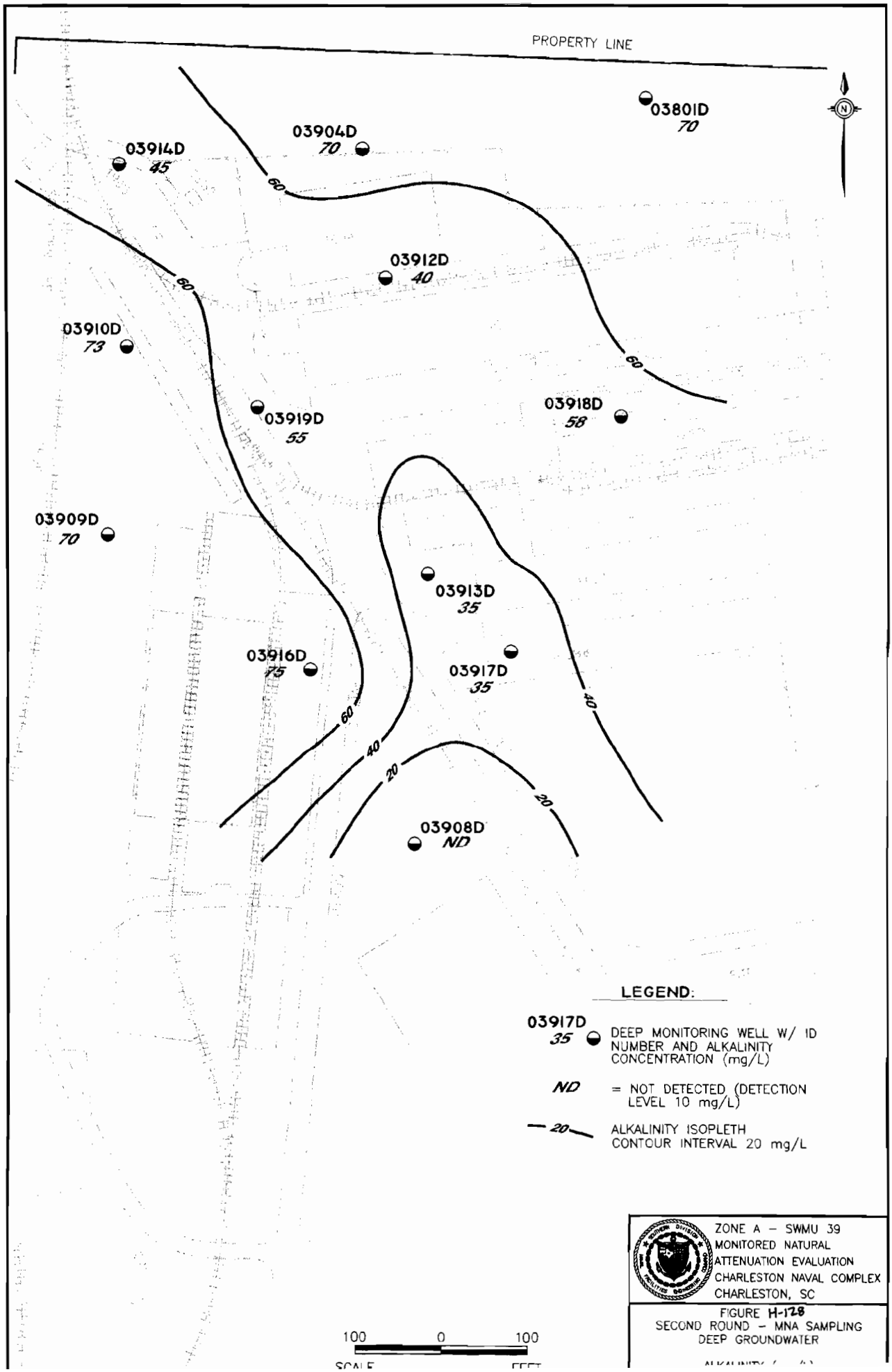

PROPERTY LINE
039011
10
039002
13.3
039001
6330
039004
113
039005
417
039003
36.7
039014
937
038002
310
002004
NA
039012
8130
039006
NA
039010
NA
039019
13,000
039018
663
039009
NA
002006
NA
039013
NA
039007
NA
039017
NA
039016
NA
039008
NA
042001
NA
042002
NA
042003
NA
505001
NA
10
100
1000
10,000
LEGEND:
038002
310
SHALLOW MONITORING WELL W/ ID NUMBER AND BTEX DEGRADER COUNTS (CFU/mL)
NA
= NOT ANALYZED
100
BTEX DEGRADER ISOPLETH CONTOUR INTERVAL LOGARITHMIC (DASHED WHERE INFERRED)
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-137
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
BTEX DEGRADER COUNTS (CFU/mL)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

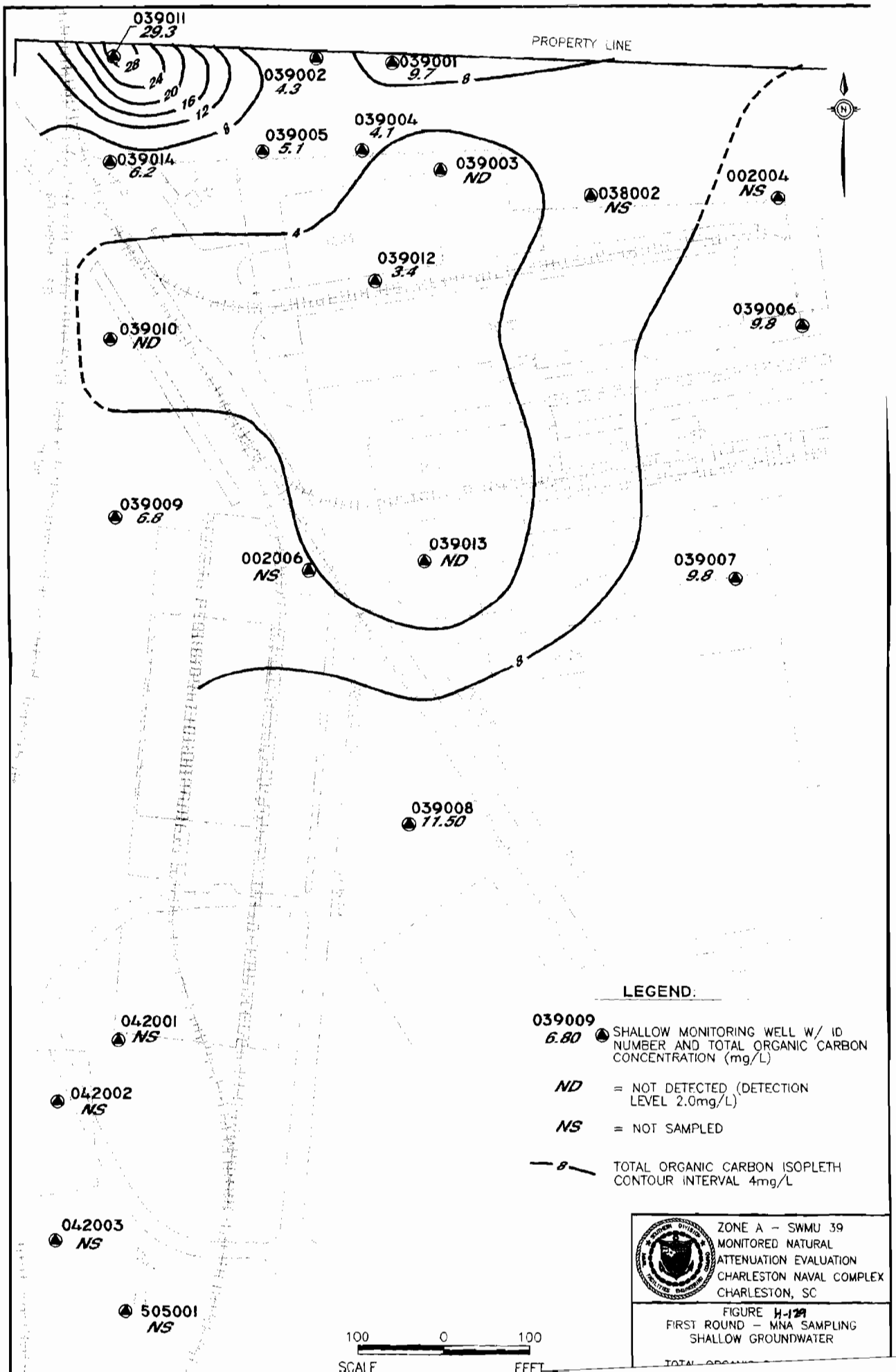
FIGURE 11-138
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

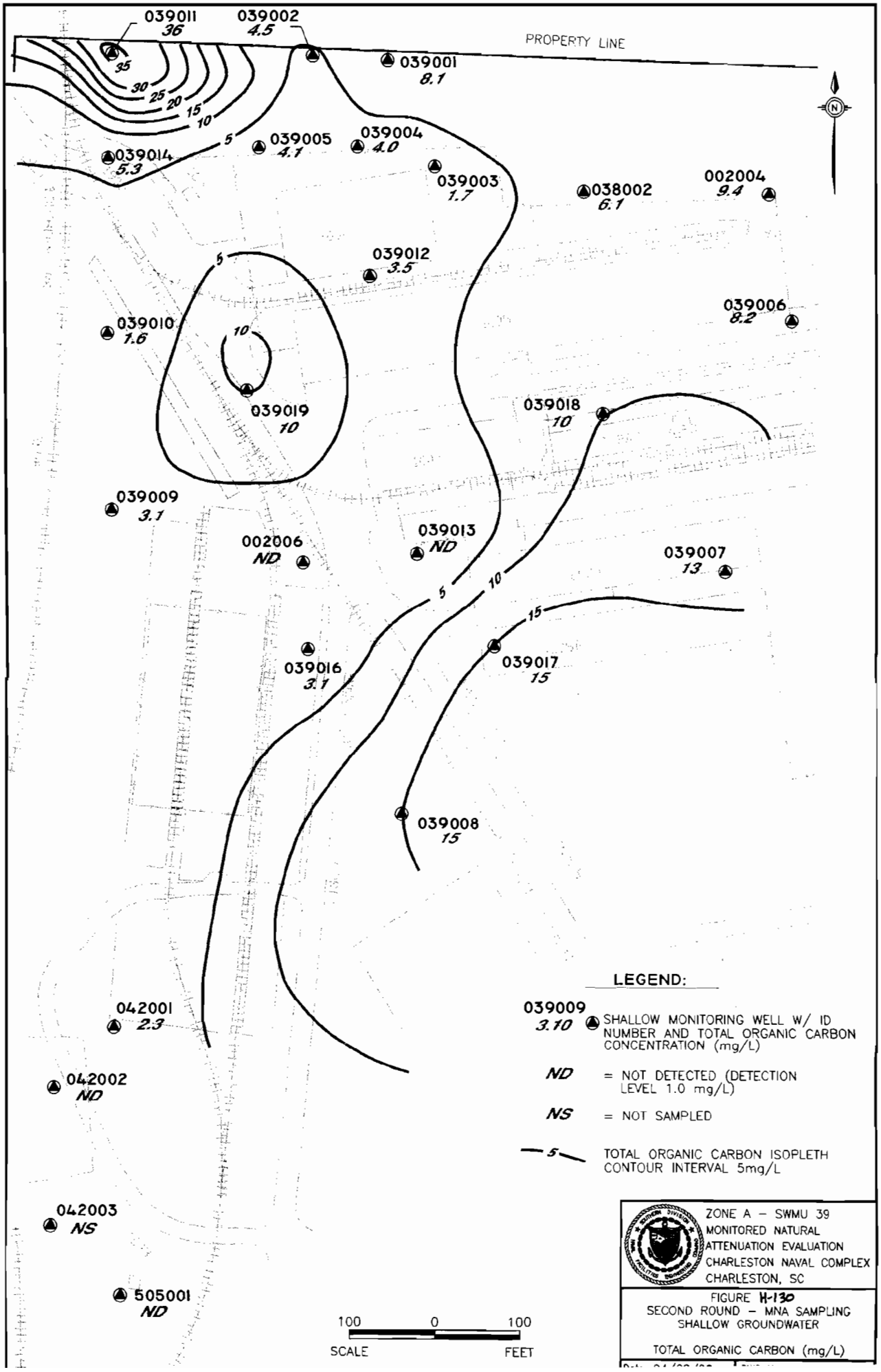

PROPERTY LINE
03801D
80
03904D
NA
100
03914D
NA
1,000
03912D
NA
03910D
NA
10,000
03918D
43,000
03919D
50,000
03909D
NA
10,000
03913D
NA
1,000
03917D
NA
03916D
NA
100
03908D
68.4
LEGEND:
03908D
68.4
DEEP MONITORING WELL W/ ID NUMBER AND BTEX DEGRADER COUNTS (CFU/mL)
NA
= NOT ANALYZED
100
BTEX DEGRADERS ISOPLETH CONTOUR INTERVAL LOGARITHMIC DASHED WHERE INFERRED
100
0
100
SCALE
FEET
ZONE A - SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-139
SECOND ROUND - MNA SAMPLING
DEEP GROUNDWATER
BTEX DEGRADERS (CFU/mL)

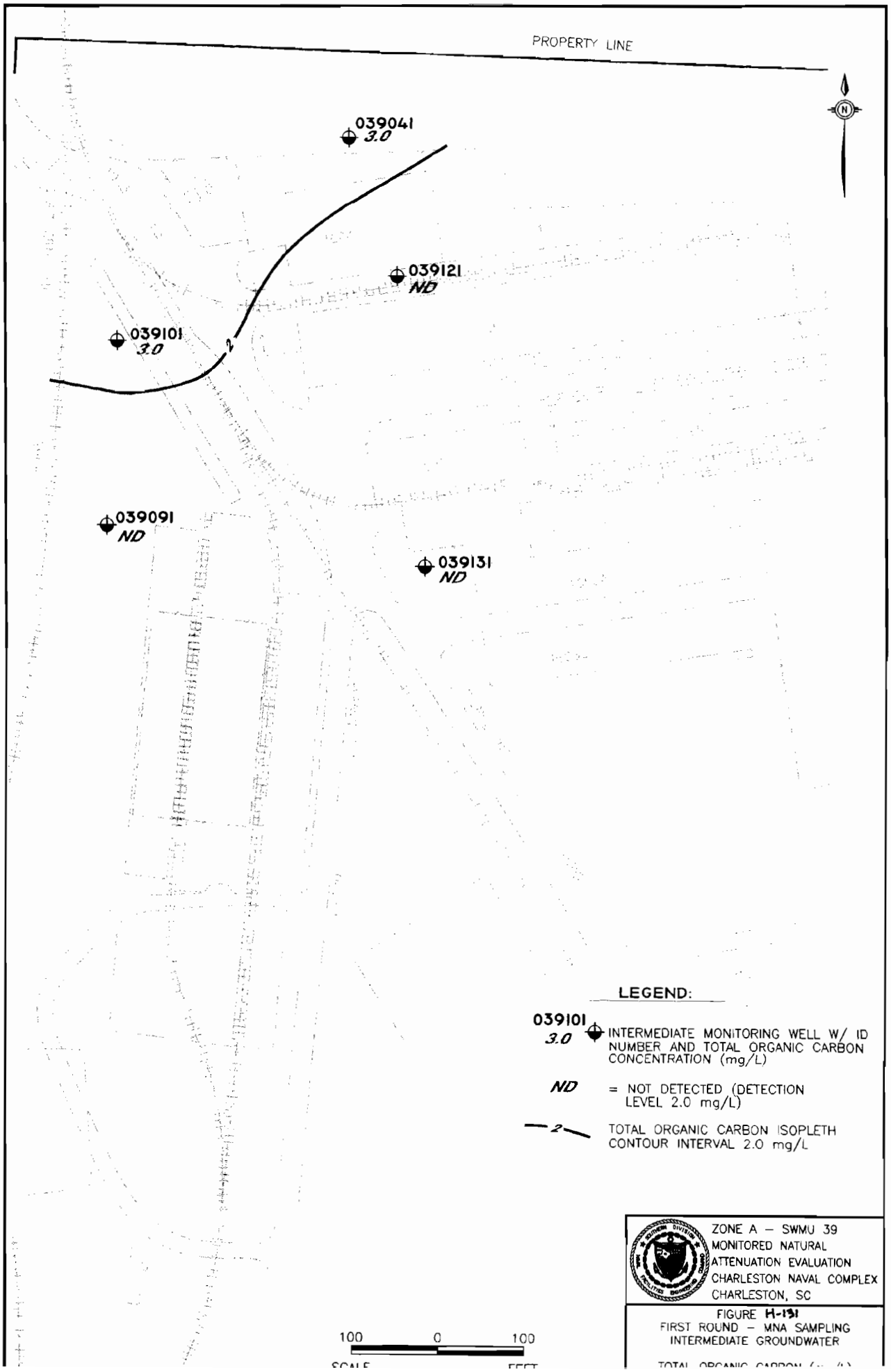


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-128
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER


039011
29.3
28
24
20
16
12
8
PROPERTY LINE
039002
4.3
039001
9.7
8
039004
4.1
039005
5.1
039014
6.2
039003
ND
038002
NS
002004
NS
4
039012
3.4
039006
9.8
039010
ND
039009
6.8
039013
ND
002006
NS
039007
9.8
8
039008
11.50
042001
NS
042002
NS
042003
NS
505001
NS
100
0
100
SCALE
FEET
LEGEND:
039009
6.80
SHALLOW MONITORING WELL W/ ID NUMBER AND TOTAL ORGANIC CARBON CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 2.0mg/L)
NS
= NOT SAMPLED
8
TOTAL ORGANIC CARBON ISOPLETH CONTOUR INTERVAL 4mg/L
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-129
FIRST ROUND – MNA SAMPLING
SHALLOW GROUNDWATER

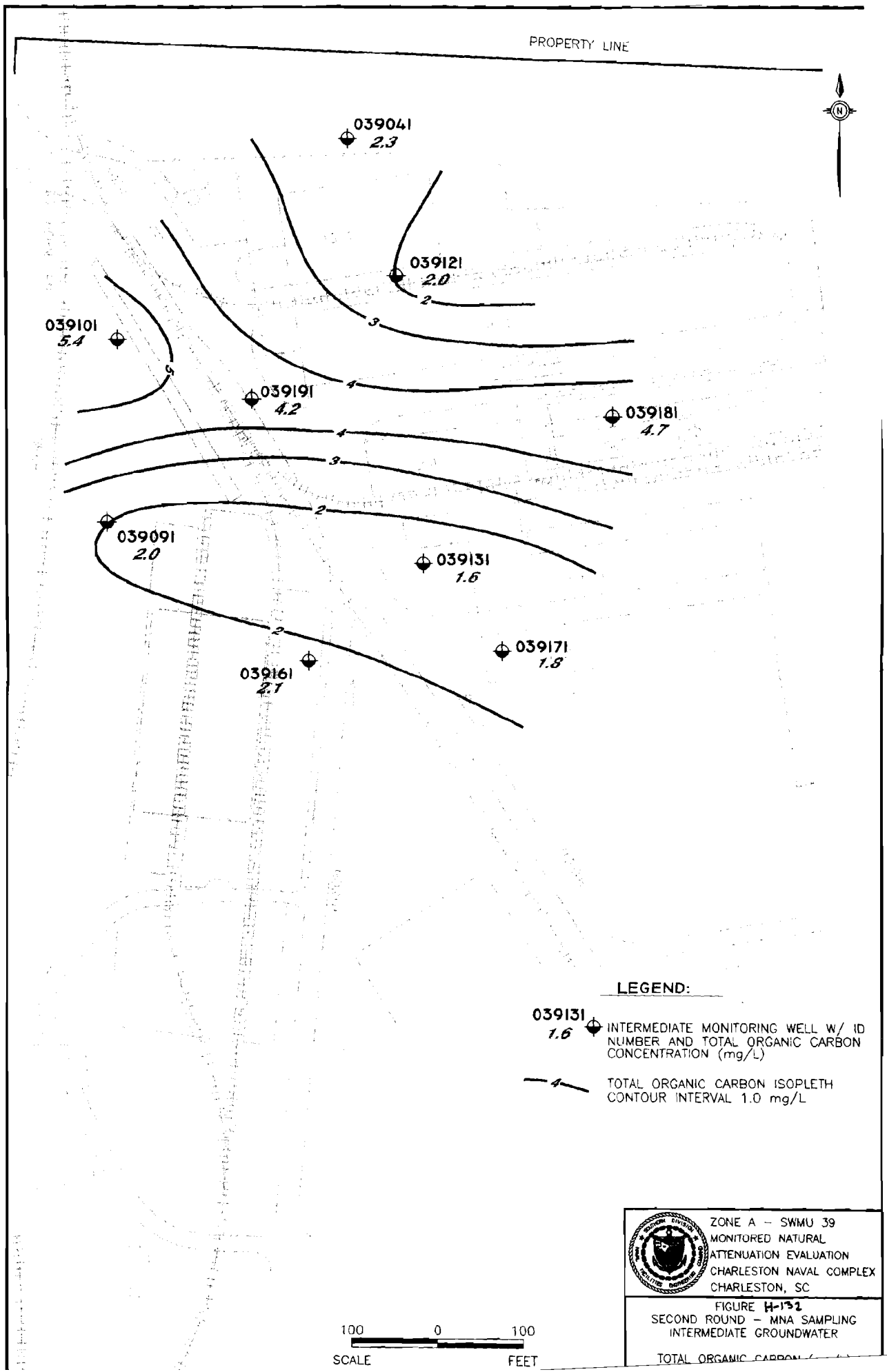

039011
36
039002
4.5
PROPERTY LINE
039001
8.1
35
30
25
20
15
10
5
039005
4.1
039004
4.0
039014
5.3
039003
1.7
038002
6.1
002004
9.4
039012
3.5
039006
8.2
039010
1.6
10
039019
10
039018
10
039009
3.1
002006
ND
039013
ND
039007
13
5
10
15
039016
3.1
039017
15
039008
15
042001
2.3
042002
ND
042003
NS
505001
ND
100
0
100
SCALE
FEET
LEGEND:
039009
3.10
SHALLOW MONITORING WELL W/ ID NUMBER AND TOTAL ORGANIC CARBON CONCENTRATION (mg/L)
ND = NOT DETECTED (DETECTION LEVEL 1.0 mg/L)
NS = NOT SAMPLED
5
TOTAL ORGANIC CARBON ISOPLETH CONTOUR INTERVAL 5mg/L
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-130
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
TOTAL ORGANIC CARBON (mg/L)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-19I
FIRST ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

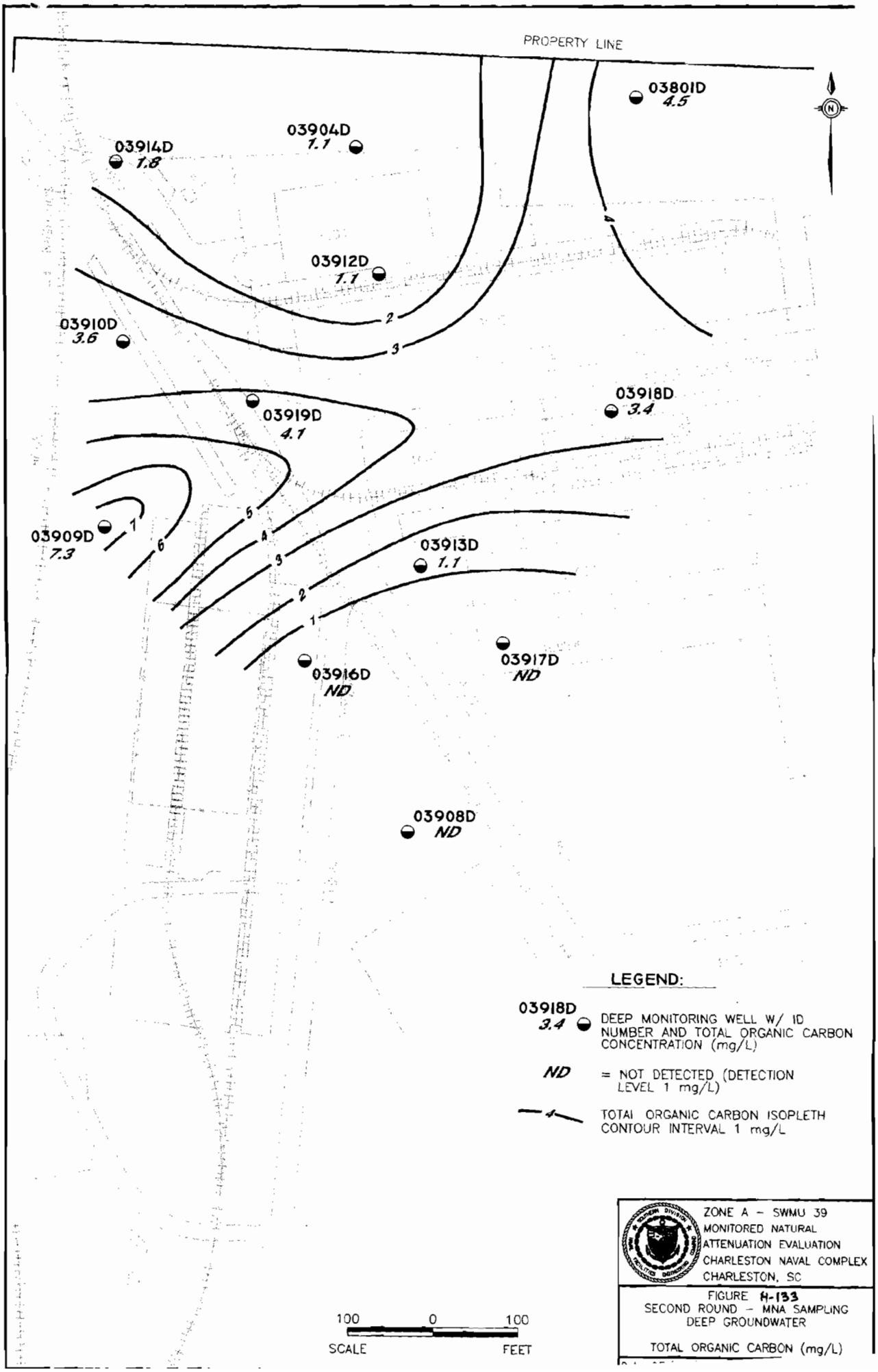
TOTAL ORGANIC CARBON

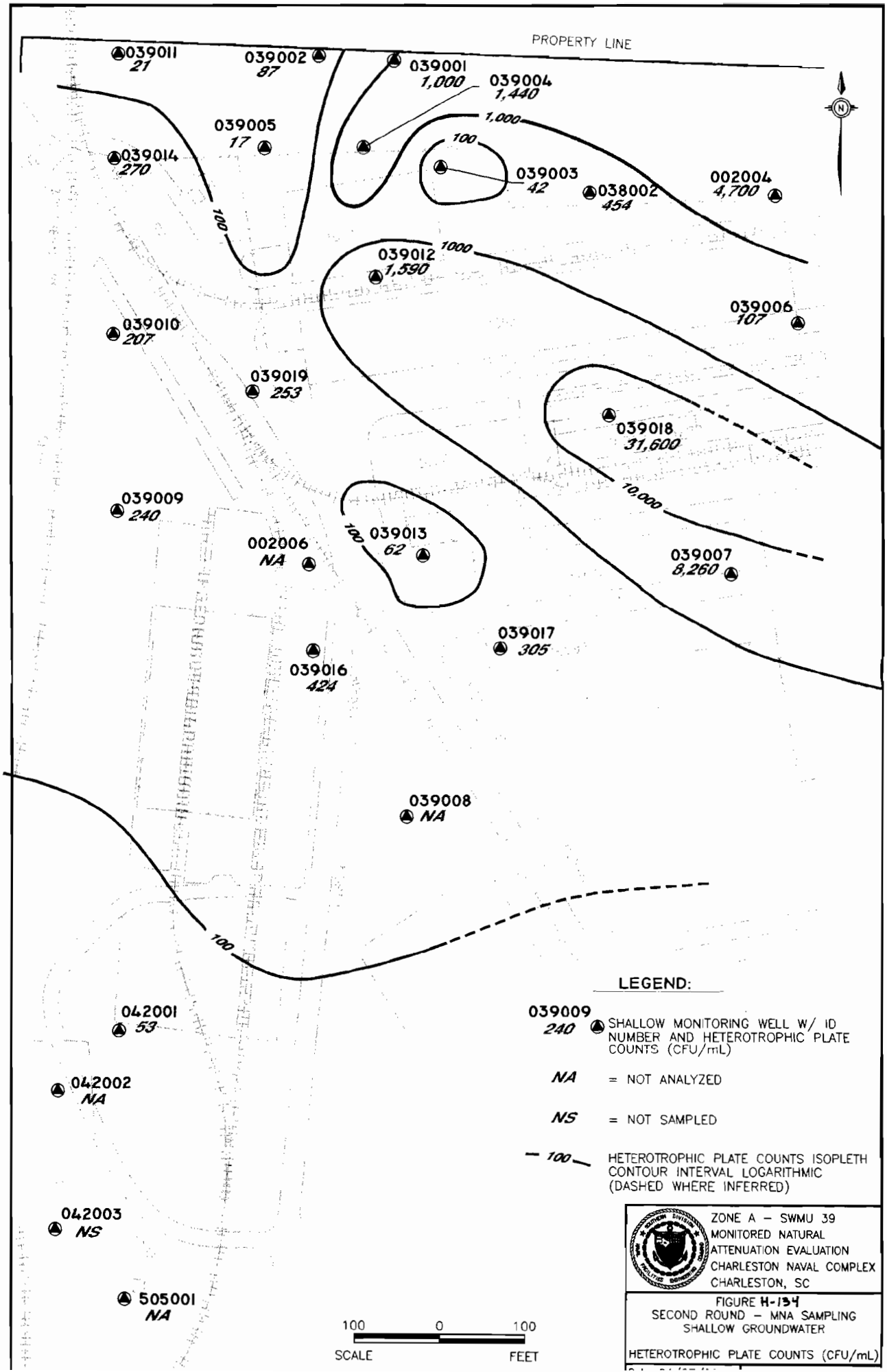


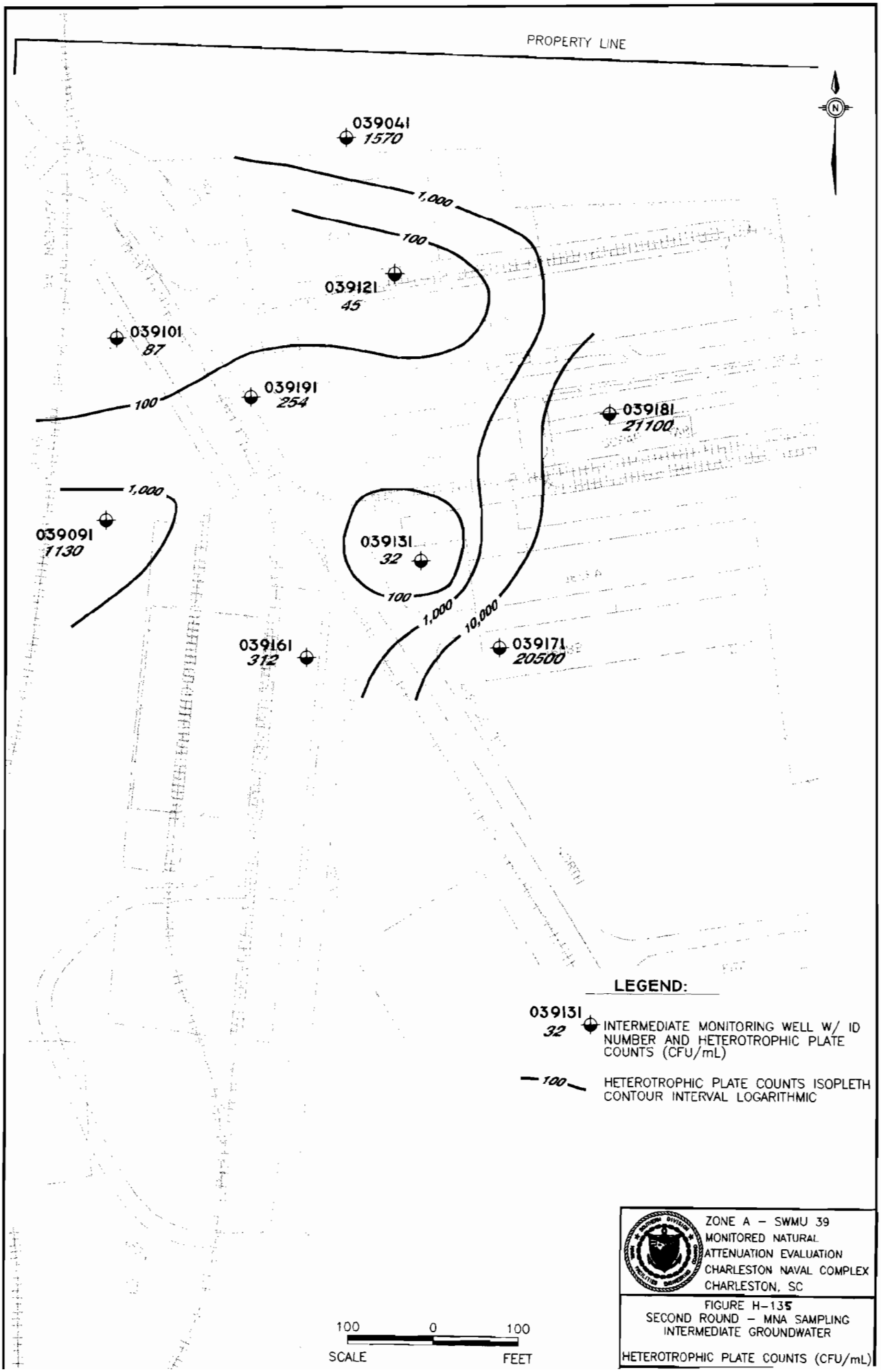
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-132
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

TOTAL ORGANIC CARBON


PROPERTY LINE
03801D
4.5
03904D
1.7
03914D
1.8
03912D
1.1
03910D
3.6
03918D
3.4
03919D
4.1
03909D
7.3
03913D
1.1
03917D
ND
03916D
ND
03908D
ND
2
3
5
4
3
2
1
7
6
LEGEND:
03918D
3.4
DEEP MONITORING WELL W/ ID NUMBER AND TOTAL ORGANIC CARBON CONCENTRATION (mg/L)
ND
= NOT DETECTED (DETECTION LEVEL 1 mg/L)
4
TOTAL ORGANIC CARBON ISOPLETH CONTOUR INTERVAL 1 mg/L
100
0
100
SCALE
FEET
ZONE A - SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-133
SECOND ROUND - MNA SAMPLING
DEEP GROUNDWATER
TOTAL ORGANIC CARBON (mg/L)

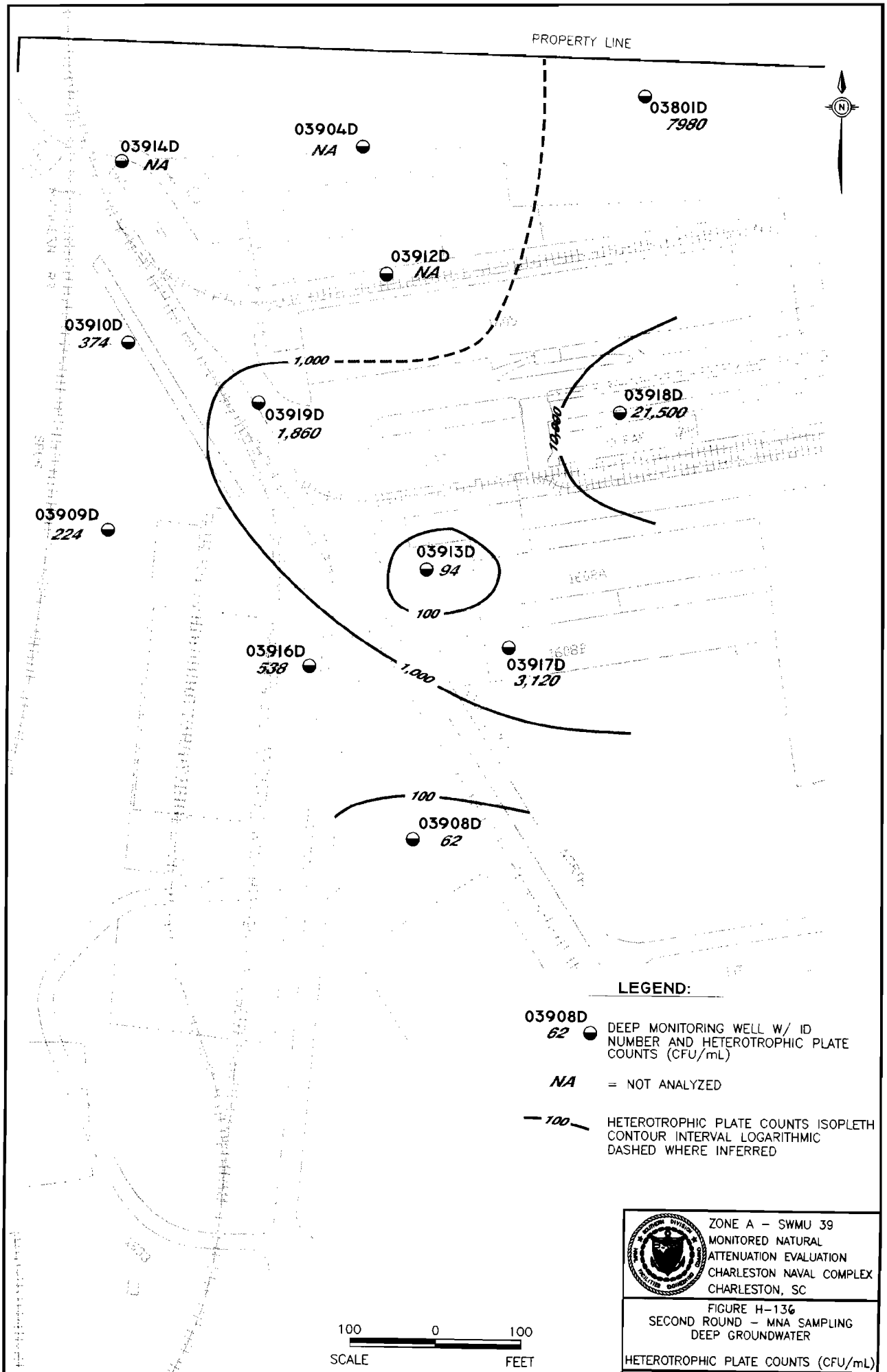

PROPERTY LINE
039011
21
039002
87
039001
1,000
039004
1,440
039005
17
039014
270
1,000
100
039003
42
038002
454
002004
4,700
100
039012
1,590
1000
039006
107
039010
207
039019
253
039018
31,600
10,000
039009
240
100
039013
62
002006
NA
039007
8,260
039017
305
039016
424
039008
NA
100
042001
53
042002
NA
042003
NS
505001
NA
100
0
100
SCALE
FEET
LEGEND:
039009
240
SHALLOW MONITORING WELL W/ ID NUMBER AND HETEROTROPHIC PLATE COUNTS (CFU/mL)
NA = NOT ANALYZED
NS = NOT SAMPLED
100
HETEROTROPHIC PLATE COUNTS ISOPLETH CONTOUR INTERVAL LOGARITHMIC (DASHED WHERE INFERRED)
ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-134
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
HETEROTROPHIC PLATE COUNTS (CFU/mL)



ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-135
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER

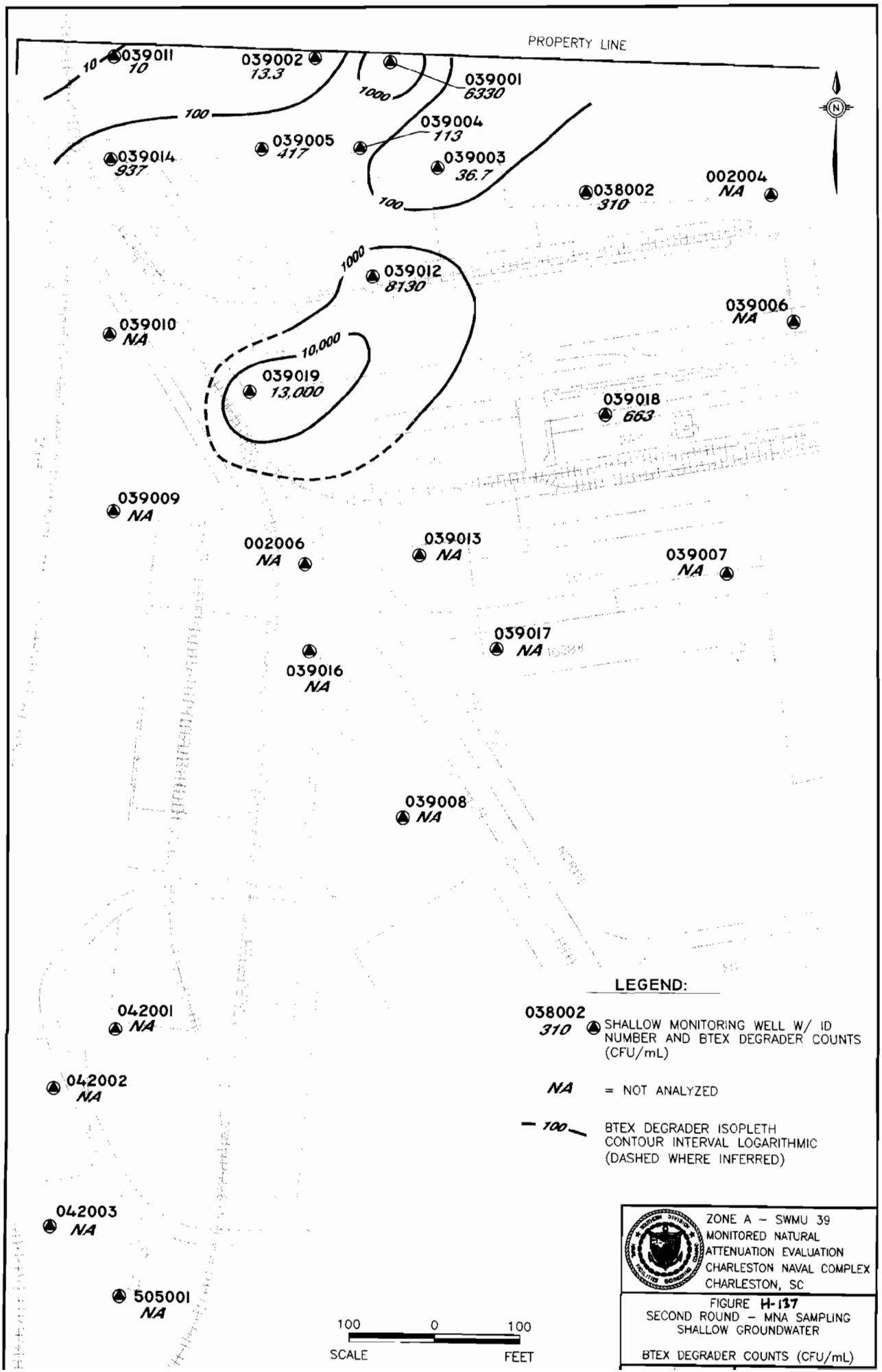
HETEROTROPHIC PLATE COUNTS (CFU/mL)

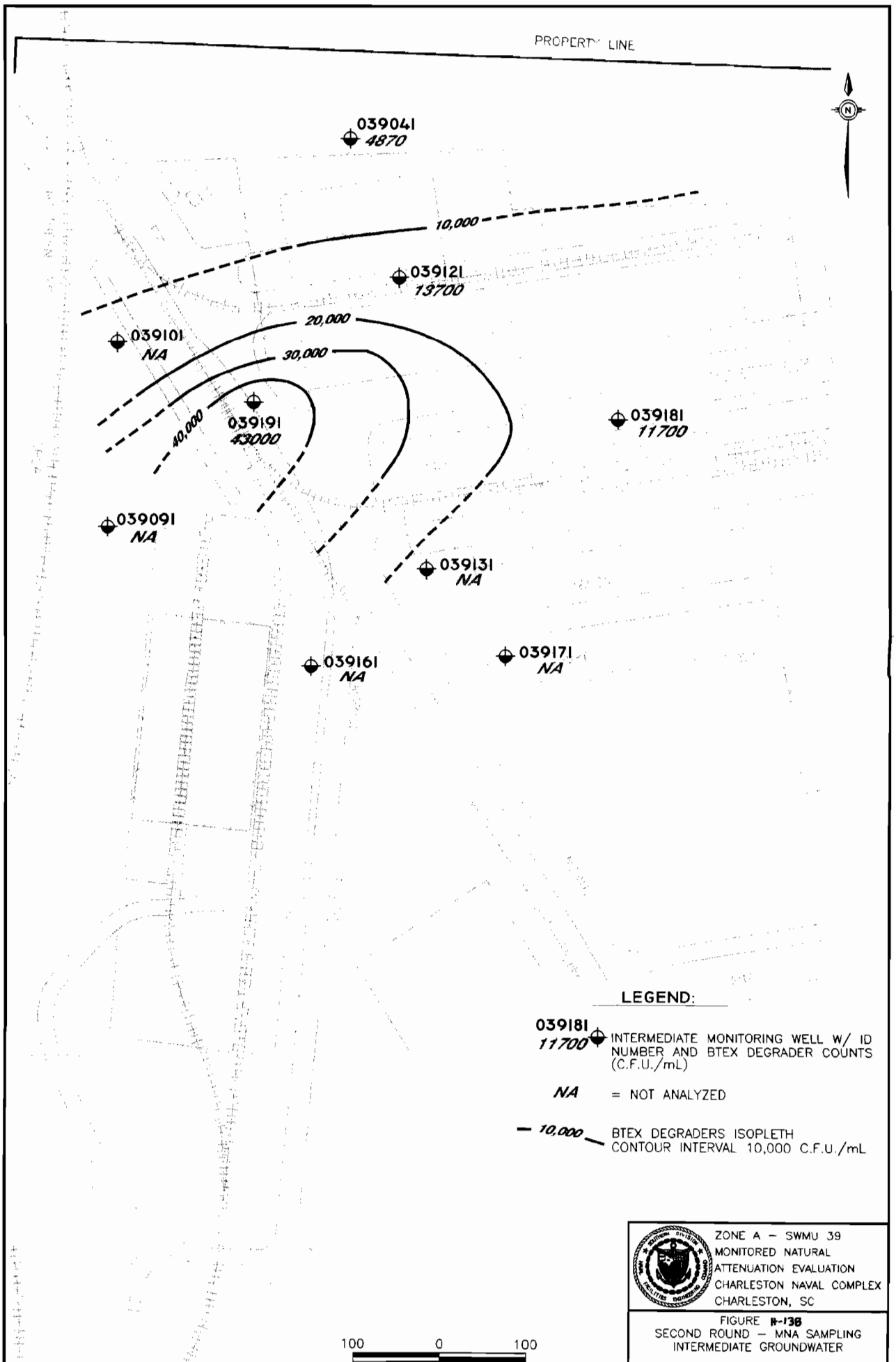


ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-136
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

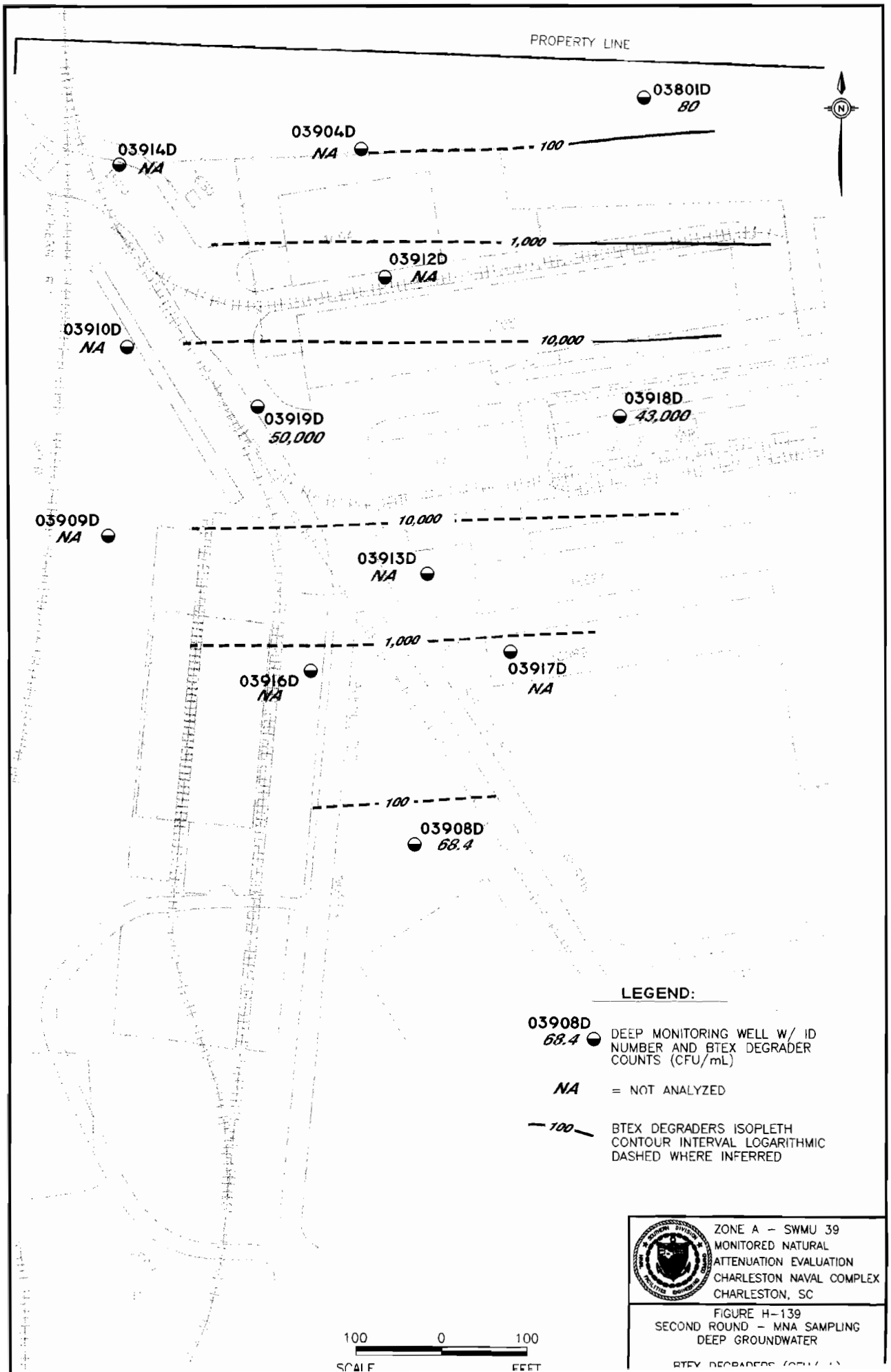
HETEROTROPHIC PLATE COUNTS (CFU/mL)


PROPERTY LINE
039011
10
039002
13.3
039001
6330
039004
113
039005
417
039014
937
039003
36.7
038002
310
002004
NA
039012
8130
039006
NA
039010
NA
039019
13,000
039018
663
039009
NA
002006
NA
039013
NA
039007
NA
039017
NA
039016
NA
039008
NA
042001
NA
042002
NA
042003
NA
505001
NA
10
100
1000
10,000
LEGEND:
038002
310
SHALLOW MONITORING WELL W/ ID NUMBER AND BTEX DEGRADER COUNTS (CFU/mL)
NA
= NOT ANALYZED
100
BTEX DEGRADER ISOPLETH CONTOUR INTERVAL LOGARITHMIC (DASHED WHERE INFERRED)
100
0
100
SCALE
FEET
ZONE A – SWMU 39
MONITORED NATURAL ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE H-137
SECOND ROUND – MNA SAMPLING
SHALLOW GROUNDWATER
BTEX DEGRADER COUNTS (CFU/mL)



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE B-138
SECOND ROUND – MNA SAMPLING
INTERMEDIATE GROUNDWATER



ZONE A – SWMU 39
MONITORED NATURAL
ATTENUATION EVALUATION
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC

FIGURE H-139
SECOND ROUND – MNA SAMPLING
DEEP GROUNDWATER

BTEX DEGRADERS (CFU/mL)

Memorandum

To: Todd Haverkost

From: Todd Kafka and Charlie Vernoy

Subject: Monitored Natural Attenuation Status Report

Date: January 29, 1999

As part of the ongoing Monitored Natural Attenuation (MNA) evaluation of groundwater contamination at SWMUs 9, 17, 39, 166 and AOC 607 at Charleston Naval Complex (CNC), a status report presenting the accomplishments to date will be delivered to the Charleston project team in March. The report will include the evaluation and interpretation of analytical and geochemical data for two rounds of MNA sampling.

Each of the five sites will comprise its own section in the status report. This report will be laden with graphics, primarily 2D isocontour maps of site VOCs and geochemistry. It is currently estimated that approximately 260 individual isocontour maps are to be generated to depict the MNA results at all five sites. In order to facilitate interpretation of the data and allow the report to be more "user-friendly" and less cumbersome, the isocontour figures will be presented by contaminant or geochemical parameter per sampling round per aquifer (i.e., shallow, intermediate, or deep) on 24" by 34" or 34" by 44" sheets. For instance, at a given site, first and second round shallow well solvent concentrations will be shown side by side on one sheet to fully demonstrate nature and extent of solvent contamination; a second sheet will show the extent of terminal electron acceptor concentrations (i.e., sulfate, ferrous iron) from first and second round shallow well results to discuss their influence on chlorinated solvent contamination. This step, however, increases the amount and complexity of the graphics to be completed. As a result, we propose submitting the sites in packages, beginning in March 1999 with SWMU 166. A schedule for the remaining sites will be submitted once we can better estimate the time required to produce the amount of graphics for each site.

The tentative focus of the MNA status report is outlined below:

A) Discussion of the geochemical and analytical data trends at each site in terms of:

- Increases and decreases of volatile organic compounds over time.
- Increases and decreases of electron acceptors (i.e. iron III, nitrate, sulfate) over time.
- Effects of electron acceptor trends on chemical data concentrations (i.e. iron reduction denitrification, sulfate reduction).
- Establishment of aerobic and anaerobic zones using oxidation-reduction potential results to examine the potential range of reductive dechlorination.
- An evaluation of the effectiveness of MNA at each site as it pertains to the geochemical data.

B) Discussion of the influence of treatability studies that are occurring at SWMU 166 and AOC 607 on MNA:

- Should MNA evaluations continue at this time or restart once treatability studies and/or active remedial measures are complete?
- How is site geochemistry impacted by treatability studies?

C) Discussion of SWMUs 9 and 17 and their appropriateness for MNA evaluation:

- Landfill monitoring-type network in place at SWMU 9; limited groundwater flowpaths monitored.
- SWMU 17 contaminant history: sporadic detections/observations of DNAPL (PCBs), LNAPL (gasoline), SVOCs and VOCs; investigation of DNAPL and LNAPL sources necessary before MNA feasible.

D) Sites requiring further evaluation to demonstrate MNA potential will be examined more quantitatively to focus on such processes as mass degradation, hydrogeological influences, and fate and transport considerations.

ENSAFE

M e m o r a n d u m

To: **Project Team**

From: **Todd Kafka and Charlie Vernoy**

Date: **April 14, 1999**

Subject: **MNA Project Refresher**

Two rounds of MNA sampling completed at five sites currently in CMS process: SWMUs 9 and 17 in Zone H; SWMU 39 in Zone A; SWMU 166 in Zone K; and AOC 607 in Zone F.

Phased MNA Analysis:

1) Qualitative assessment of effectiveness of MNA as it pertains to geochemical and analytical data **only** through temporal and spatial data analysis and in context to current understanding of geologic and hydrogeologic conditions (i.e., groundwater flowpaths);
2) Quantitative analysis of MNA including mass degradation and fate and transport for only those sites with ample geochemical evidence from step 1.

- Completion of step 1 above requires time-intensive graphical data presentation, primarily isocontour maps of all chemical parameters and time series plots. As a result, submittal of all five sites as one document was not practical or feasible. Additionally, each of the five sites was progressing at its own rate within the CMS in terms of treatability studies (TS), which will greatly affect the MNA study.

- Decided to submit SWMU 166, which was the furthest along in the CMS process of the five sites.
- SWMU 166 Interim MNA report submitted on March 17, 1999 (approx. 2.5 months to complete).

Contents of SWMU 166 Interim Report

- Graphical presentation of historical VOC history delineating chlorinated solvent plume
- Isopleths figures of VOCs and pertinent geochemical data collected during both MNA sampling rounds for shallow and deep groundwater.
- Preliminary and refined conceptual model using available geologic/hydrogeologic data and newly acquired chemical data.
- Geochemical data interpretation
- Conclude and Recommend:
    1. MNA cannot be primary remedial option at site since VOCs exceed MCLs off-site.
    2. Active TS to be implemented at site and may greatly alter physical/chemical conditions in aquifer; additional baseline MNA data required after TS to examine potential of MNA to attenuate remaining VOC concentrations as secondary remedial option after active remediation phase.

Limitations at remaining Sites

- *AOC 607*: TCE in shallow and intermediate groundwater
    1. Solvent contamination in shallow and intermediate groundwater. HOWEVER, no shallow or intermediate groundwater flowpath exists for evaluation due to influence of sanitary sewer on site.
    B. Both MNA data rounds indicate aquifer conditions are not favorable for MNA (screening ranking).
    3. Active TS planned, implementation will significantly alter physical/chemical conditions in aquifer; additional baseline MNA data required after TS to examine potential of MNA to attenuate remaining VOC concentrations as secondary remedial option after active remediation phase.

- *SWMU 39*: BTEX in shallow and intermediate groundwater; chlorinated solvents (PCE through Vinyl Chloride) in shallow, intermediate, and deep groundwater.

  1. MCL exceedances of chlorinated solvents detected at western property boundary -> MNA not effective at this locale.
  2. Nature & extent of VOC plume still being defined.
  3. Resolution of secondary source still required. Investigation planned during CMS.
  4. Active TS planned, implementation may significantly alter physical/chemical conditions in aquifer; additional baseline MNA data is required after TS to examine potential of MNA to attenuate remaining VOC concentrations as secondary remedial option after active remediation phase.
  5. MNA may be secondary alternative after active remediation along western boundary; may still be an option as primary remedial strategy for interior of site.

- *SWMU 9*: BTEX, chlorinated solvents (PCE through Vinyl Chloride), and Chlorobenzene in shallow groundwater

  1. Current MW network appropriate for landfill monitoring, not MNA due to length of groundwater flowpaths.
  2. Two locations with highest chlorinated solvents and BTEX are immediately upgradient of closest receptor (marsh or creek). Third location also lies upgradient to the marsh and has benzene concentrations exceeding MCL.
  3. Since no source control or removal, MNA cannot be adequately evaluated since its effectiveness cannot be predicted.

- *SWMU 17*: BTEX and Chlorobenzene in shallow groundwater
    1. LNAPL at site requires removal or source control prior to effective MNA evaluation.
    2. Active TS planned to remove source, implementation may significantly alter physical/chemical conditions in aquifer; additional baseline MNA data is required after TS to examine potential of MNA to attenuate remaining VOC concentrations as secondary remedial option after active remediation phase.

Where do we go from here?:

The MNA project has been greatly refined over the last several months since we last presented data to the project team after the first round of MNA data acquisition. The primary issue revolves around the integration of active remedial treatability studies concurrent with MNA evaluations occurring at many sites. The treatability studies to be evaluated will have a profound effect on the aquifer system physically and chemically at each site, although the degree to which cannot be adequately predicted at this time. As a result, the effectiveness of MNA at each site cannot be evaluated due to changing conditions. The competing issues of MNA and TS indicate a shift in our goal of MNA: that from a sole remedial option to a secondary option after an active remedial phase. However, additional MNA data must be gathered once the TS at these sites are completed to determine how aquifer geochemistry has been affected. Furthermore, this data will be necessary for evaluating whether or not MNA will be a viable secondary option to attenuate remaining VOC concentrations to MCLs. It is currently believed that subsequent MNA data would not be as intensive or rigorous as the previous two rounds of data collected.

As a result of the impending TS at these sites and the time-intensive nature of producing the SWMU 166 Interim MNA Report, we plan to submit no additional interim MNA reports. Instead each MNA evaluation will be included as part of the Final CMS report at each site. These evaluations will include all data evaluation and interpretation from the first two rounds of MNA data plus additional data collected after the TS to determine its influence on the aquifer system as well as providing data necessary to predict the effectiveness of MNA to reduce the remaining contaminant mass after the active remediation phase.

JULY 1999
CHARLESTON AP, SC
LOCAL CLIMATOLOGICAL DATA

NOAA, National Climatic Data Center

I certify that this is an official publication of the National Oceanic and Atmospheric Administration (NOAA). It is compiled using information from weather observing sites operated by NOAA–National Weather Service / Department Of Transportation–Federal Aviation Administration and received at the National Climatic Data Center (NCDC), Asheville, North Carolina 28801.

Thomas R Karl

DIRECTOR

NOTICE

Effective July 1, 1996, the National Weather Service & Federal Aviation Administration began using the METAR format for Hourly Observations.

We welcome your questions or comments, please contact us at
828–271–4800 (voice), 828–271–4876 (fax),
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JULY 1999
LOCAL CLIMATOLOGICAL DATA
NOAA, National Climatic Data Center

CHARLESTON AP, SC
CHARLESTON INT'L AIRPORT (CHS)
Lat: 32°53' N Long: 80°02' W Elev (Ground): 40 Feet
Time Zone: EASTERN WBAN: 13880 ISSN #:0198-4624

DATE	TEMPERATURE °F MAXIMUM	MINIMUM	AVERAGE	DEP FROM NORMAL	AVERAGE DEW PT	AVERAGE WET BULB	DEG DAYS BASE 65° HEATING	COOLING	WEATHER	SNOW/ICE ON GND(IN) 0700 LST DEPTH	1300 LST WATER EQUIV	PRECIPITATION (INCHES) 2400 LST SNOW-FALL	2400 LST WATER EQUIV	PRESSURE (INCHES OF HG) AVERAGE STATION	AVERAGE SEA LEVEL	WIND SPEED = MPH DIR = TENS OF DEGREES RESULTANT SPEED	RES DIR	AVERAGE SPEED	MAXIMUM 5-SEC SPEED	DIR	2-MIN SPEED	DIR	DATE
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
01	81	72	77	-3	72	73	0	12	RA FG BR				0.76	30.07	30.12	8.8	19	9.3	30	17	24	17	01
02	89	70	80	-1	72	74	0	15	MIFG BR				0.00	30.11	30.16	3.9	15	5.0	20	16	16	16	02
03	87	71	79	-2	73	75	0	14	RA BR				T	30.17	30.22	6.4	15	7.5	21	16	17	16	03
04	89	71	80	-1	73	75	0	15	BR				0.00	30.17	30.22	4.0	17	6.5	18	15	15	16	04
05	92	74	83	2	74	77	0	18	BR				0.00	30.08	30.13	5.3	23	7.2	20	19	16	19	05
06	86	69	78	-3	73	74	0	13	TSRA RA BR				0.32	29.99	30.04	2.5	23	6.1	41	06	30	03	06
07	89	70	80	-1	72	74	0	15	BR				0.00	29.98	30.03	8.5	19	8.6	22	19	18	19	07
08	91	72	82	1	75	77	0	17	HZ				0.00	30.00	30.05	7.5	20	7.7	24	23	18	24	08
09	93	75	84	3	74	77	0	19	BR				0.00	30.05	30.10	7.9	21	8.5	21	21	17	18	09
10	93	76	85	4	73	76	0	20					0.00	30.01	30.06	10.5	23	11.1	24	25	18	23	10
11	90	73	82	1	74	75	0	17	TS TSRA RA BR				0.33	30.02	30.07	3.7	25	7.5	24	02	21	03	11
12	86	72	79	-2	73	74	0	14	TS TSRA RA BR				0.11	30.01	30.06	2.1	23	4.1	21	17	18	18	12
13	84	69	77*	-4	73	74	0	12	TS TSRA RA BR				0.32	30.01	30.06	3.0	29	5.6	22	27	18	27	13
14	87	68*	78	-3	72	73	0	13	TS TSRA RA FG+ BR HZ				0.81	30.08	30.13	3.0	02	4.7	17	15	15	15	14
15	85	71	78	-4	73	75	0	13	RA BR HZ				T	30.11	30.16	2.4	05	4.2	14	12	11	13	15
16	85	73	79	-3	74	75	0	14	TS TSRA FG+ BR HZ				0.04	30.13	30.18	1.5	03	3.6	13	04	10	20	16
17	87	71	79	-3	72	74	0	14	BR HZ				0.00	30.15	30.20	2.0	16	4.3	16	15	14	16	17
18	89	72	81	-1	73	75	0	16	TS RA BR				0.01	30.15	30.20	2.2	22	3.0	17	15	14	17	18
19	90	74	82	0	74	76	0	17	TSRA RA				0.02	30.09	30.14	5.0	23	5.9	18	23	16	22	19
20	92	75	84	2	74	77	0	19	BR HZ				0.00	30.03	30.08	7.5	25	8.1	16	23	14	24	20
21	94	78	86	4	76	78	0	21	TS TSRA BR HZ				0.03	30.01	30.06	3.4	28	5.8	30	12	24	11	21
22	96	77	87	5	76	78	0	22	TS TSRA GR RA BR HZ SQ				0.18	29.97	30.02	1.6	15	4.4	55*	11	32*	12	22
23	96	76	86	4	78	80	0	21	TS TSRA RA BR HZ				0.26	29.91	29.96	4.2	22	6.5	16	20	15	20	23
24	95	78	87	5	78	80	0	22	RA BR HZ				T	29.88	29.93	6.7	22	8.7	20	01	16	20	24
25	92	75	84	2	74	76	0	19	BR HZ				0.00	29.87	29.92	2.9	25	6.1	23	20	20	20	25
26	97	75	86	4	75	78	0	21	BR HZ				0.00	29.85	29.90	7.2	26	8.2	18	27	15	25	26
27	97	75	86	4	74	78	0	21	BR HZ				0.00	29.87	29.92	5.4	30	6.6	15	33	11	27	27
28	97	77	87	5	73	78	0	22	BR HZ				0.00	29.88	29.93	3.6	31	5.5	16	34	13	35	28
29	98	80	89	7	74	78	0	24	BR HZ				0.00	29.78	29.83	9.3	26	9.9	22	26	18	26	29
30	100	76	88	6	74	78	0	23	BR HZ				0.00	29.75	29.80	4.2	25	5.5	16	24	14	27	30
31	101*	79	90*	8	78	81	0	25	BR HZ				0.00	29.78	29.82	1.8	25	4.6	16	06	11	06	31
	91.2	73.7	82.5	■■	74.0	76.2	0.0	17.7	< MONTHLY AVERAGES	TOTALS->			3.19	30.00	30.05	1.0	30	6.5	<- MONTHLY AVERAGES				
	1.0	1.0	1.0	■■	<---------- DEPARTURE FROM NORMAL ---------->								-3.65	SUNSHINE, CLOUD, & VISIBILITY TABLES ON PAGE 3									

DEGREE DAYS

	MONTHLY TOTAL	MONTHLY DEPARTURE	SEASON TO DATE TOTAL	SEASON TO DATE DEPARTURE
HEATING:	0	0	0	0
COOLING:	548	36	1262	-2

GREATEST 24-HR PRECIPITATION: 0.81 DATE: 14
GREATEST 24-HR SNOWFALL: DATE:
GREATEST SNOW DEPTH: DATE:

SEA LEVEL PRESSURE		DATE	TIME
MAXIMUM	30.27	04	0756
MINIMUM	29.75	30	1756

NUMBER OF DAYS WITH →

MAXIMUM TEMP ≥ 90:	18	MINIMUM TEMP ≤ 32:	0	PRECIPITATION ≥ 0.01 INCH:	12
MAXIMUM TEMP ≤ 32:	0	MINIMUM TEMP ≤ 0:	0	PRECIPITATION ≥ 0.10 INCH:	8
THUNDERSTORMS:	11	HEAVY FOG:	2	SNOWFALL ≥ 1.0 INCH:	

HOURLY PRECIPITATION

(WATER EQUIVALENT IN INCHES)

CHARLESTON AP, SC

JULY 1999 CHS WBAN # 13880

DATE	FOR HOUR (LST) ENDING AT 1	2	3	4	5	6	7	8	9	10	11	12
01											0.05	0.66
02												
03										T	T	
04												
05												
06									T	T		
07												
08												
09												
10												
11												
12	T											
13	0.04	T	T		T	T	T	0.02	0.01	T	T	
14				T								
15												
16												0.03
17												
18												
19												
20												
21												
22												
23					0.26	T						
24												
25												
26												
27												
28												
29												
30												
31												

DATE	FOR HOUR (LST) ENDING AT 13	14	15	16	17	18	19	20	21	22	23	24	DATE	Sum if Different (See Note)	2400 LST Water Equiv.
01	0.05								T	T			01		0.76
02													02		0.00
03													03		T
04													04		0.00
05													05		0.00
06	0.25	0.04	0.03										06		0.32
07													07		0.00
08													08		0.00
09													09		0.00
10													10		0.00
11	T	0.13	0.01			0.03	0.07	0.02	0.01	T	0.05	0.01	11		0.33
12				0.11	T	T				T	T		12		0.11
13		T	T	0.01	0.04	0.19	0.01				T	T	13		0.32
14						T	0.76	0.02	0.02	T	0.01	T	14		0.81
15											T		15		T
16	0.01												16		0.04
17													17		0.00
18			0.01	T			T	T					18		0.01
19				0.02									19		0.02
20													20		0.00
21						0.01	0.02						21		0.03
22			0.10	0.08									22		0.18
23													23		0.26
24												T	24		T
25													25		0.00
26													26		0.00
27													27		0.00
28													28		0.00
29													29		0.00
30													30		0.00
31													31		0.00

3-18" total July

MAXIMUM SHORT DURATION PRECIPITATION (See Note)

Time Period (Minutes)	5	10	15	20	30	45	60	80	100	120	150	180
Precipitation (Inches)												
Ending Date												
Ending Time (Hour/Min)												

Date and time are not entered for TRACE amounts.

Note : The sum of the hourly totals is given when it differs from the daily total. NWS does not edit ASOS hourly values but may edit daily and monthly totals. Hourly, daily, and monthly totals are printed as reported by the ASOS site.

REFERENCE NOTES & SUPPLEMENTAL SUMMARIES

* = Extreme for the month (last occurence if more than one)
T = Trace precipitation amount
+ = also occurs on earlier date
FG+ = Heavy fog, visibility .25 miles or less
BLANK entries denote missing or unreported data

Resultant wind is the vector sum of the wind speeds and directions divided by the number of observations.

Wind direction is recorded in tens of degrees (2 digits) clockwise from true north. '00' = calm, 'VR' = variable.

Precipitation is for the 24-hour period ending at the time indicated in the column heading.

Water Equivalent of snow on the ground is reported only when the depth is 2 or more inches.

NORMALS ARE FOR THE YEARS 1961-1990

WEATHER NOTATIONS

QUALIFIER	WEATHER PHENOMENA		
DESCRIPTOR	PRECIPITATION	OBSCURATION	OTHER
BC Patches	DZ Drizzle	BR Mist	DS Duststorm
BL Blowing	GR Hail	DU Widespread Dust	FC Funnel Cloud
DR Low Drifting	GS Small Hail and/or Snow Pellets	FG Fog	+FC Tornado Waterspout
FZ Freezing	IC Ice Crystals	FU Smoke	PO Well-Developed Dust/Sand Whirls
MI Shallow	PL Ice Pellets	HZ Haze	SQ Squalls
PR Partial	RA Rain	PY Spray	SS Sandstorm
SH Shower(s)	SG Snow Grains	SA Sand	GL Glaze
TS Thunderstorm	SN Snow	VA Volcanic Ash	
VC In the Vicinity	UP Unknown Precipitation		

Intensity (as indicated on pages 4 to 6):
'+' = Heavy ' ' = Moderate '-' = Light

CHARLESTON AP, SC
JULY 1999

Ceilometer (30-second) data are used to derive cloudiness at or below 12,000 feet. This cloudiness is the mean cloud cover detected during sunrise to sunset (SR-SS), or midnight to midnight (MN-MN).

Satellite data are used to derive cloudiness above 12,000 feet. Effective Cloud Amount is based on the cloud cover and the transparency of the clouds within the satellite field of view (approx. 31x31 miles).

Sky Condition is based on the sum (not to exceed 8) of the sunrise to sunset cloud cover below and above 12,000 feet. Both ceilometer and satellite data must be present to compute Sky Condition. Clear = 0-2 oktas, Partly Cloudy = 3-6 oktas, Cloudy = 7-8 oktas.

A Heating (Cooling) Degree Day is the difference between the average daily temperature and 65 degrees F. The HDD season begins July 1, the CDD season begins January 1.

Dew Point is the temperature to which the air must be cooled to achieve 100% relative humidity. Wet Bulb is the temperature the air would have if cooled at constant pressure by evaporation of moisture into it, to 100% relative humidity.

Snow Depth, Snowfall, and Sunshine data may come from nearby sites that the National Weather Service deems Climatologically representative of this site.

ADDITIONAL NOTES:

DATE	SUNSHINE		CLOUDINESS (OKTAS)				VISIBILITY (MILES)		RESERVED
			SR-SS		MN-MN				
	TOTAL MINUTES	PERCENT POSSIBLE	CEILOMETER	SATELLITE	CEILOMETER	SATELLITE	MINIMUM	MAXIMUM	
01							2.00	10.00	
02							6.00	10.00	
03							5.00	10.00	
04							4.00	10.00	
05							3.00	10.00	
06							2.50	10.00	
07							5.00	10.00	
08							6.00	10.00	
09							6.00	10.00	
10							9.00	10.00	
11							4.00	10.00	
12							3.00	10.00	
13							1.25	10.00	
14							<.25	8.00	
15							1.75	7.00	
16							.75	7.00	
17							1.50	10.00	
18							5.00	10.00	
19							9.00	10.00	
20							3.00	9.00	
21							2.00	5.00	
22							.50	9.00	
23							2.00	5.00	
24							2.00	7.00	
25							3.00	7.00	
26							2.50	8.00	
27							4.00	6.00	
28							2.00	7.00	
29							2.00	5.00	
30							2.00	7.00	
31							1.75	5.00	
MONTHLY AVGS							3.28	8.45	

SUNSHINE (MINUTES)

Total: Possible:
Percent Possible:

NUMBER OF DAYS WITH:

SKY CONDITION

CLR	PTLY CLDY	CLOUDY	MISSING
			31

MINIMUM VISIBILITY (MILES)

<=0.25	<=3.0	>=7.0
1	20	2

OBSERVATIONS AT 3-HOURLY INTERVALS

CHARLESTON AP, SC

JULY 1999 CHS WBAN # 13880

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	DEW POINT	WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	SEA LEVEL
					SUNRISE: 0515	JUL 01			SUNSET: 1932					
01	FEW	NC			7.00		75	71	72	88	13	18	29.99	30.03
04	OVC	014			10.00		75	71	72	88	7	19	30.00	30.04
07	BKN	039			8.00		76	72	73	88	10	23	30.05	30.10
10	BKN	017			7.00		80	74	76	82	8	19	30.09	30.13
13	CLR	NC			10.00		76	72	73	88	9	19	30.10	30.15
16	BKN	120			10.00		80	71	74	74	13	19	30.08	30.12
19	BKN	120			10.00		76	71	73	85	6	20	30.08	30.13
22	BKN	120			10.00		72	71	71	97	6	17	30.10	30.14
					SUNRISE: 0516	JUL 02			SUNSET: 1932					
01	CLR	NC			10.00		74	72	73	94	7	15	30.07	30.12
04	CLR	NC			7.00		71	71	71	100	0	00	30.06	30.11
07	SCT	NC			7.00		73	72	72	96	5	03	30.13	30.17
10	SCT	NC			10.00		82	69	73	65	0	00	30.14	30.19
13	SCT	NC			10.00		87	68	74	53	5	15	30.11	30.16
16	SCT	NC			10.00		85	71	75	63	13	14	30.10	30.14
19	SCT	NC			10.00		80	72	75	76	9	15	30.10	30.15
22	FEW	NC			10.00		75	73	74	94	0	00	30.15	30.20
					SUNRISE: 0516	JUL 03			SUNSET: 1932					
01	CLR	NC			10.00		74	73	73	97	5	17	30.14	30.18
04	CLR	NC			7.00		71	71	71	100	3	01	30.13	30.17
07	SCT	NC			9.00		77	74	75	90	5	05	30.16	30.21
10	SCT	NC			10.00		84	72	76	67	8	12	30.20	30.25
13	SCT	NC			10.00		87	72	77	61	16	16	30.18	30.23
16	SCT	NC			10.00		85	71	75	63	14	16	30.18	30.22
19	FEW	NC			10.00		81	72	75	74	9	15	30.19	30.23
22	CLR	NC			9.00		77	73	74	88	7	15	30.19	30.24
					SUNRISE: 0517	JUL 04			SUNSET: 1932					
01	CLR	NC			9.00		75	73	74	94	0	00	30.17	30.22
04	CLR	NC			6.00	BR	73	72	72	96	3	04	30.18	30.22
07	CLR	NC			7.00		76	73	74	91	6	05	30.22	30.27
10	SCT	NC			10.00		83	72	75	70	6	17	30.21	30.26
13	SCT	NC			10.00		89	73	78	59	8	17	30.19	30.23
16	CLR	NC			10.00		87	73	77	63	13	18	30.15	30.20
19	CLR	NC			10.00		82	74	76	77	10	19	30.14	30.18
22	CLR	NC			5.00	BR	76	74	75	94	5	21	30.15	30.20
					SUNRISE: 0517	JUL 05			SUNSET: 1932					
01	CLR	NC			8.00		76	74	75	94	3	27	30.15	30.19
04	CLR	NC			7.00		75	74	74	96	6	26	30.12	30.17
07	FEW	NC			7.00		76	75	75	97	7	28	30.15	30.20
10	CLR	NC			10.00		87	74	78	65	9	31	30.12	30.17
13	BKN	041			10.00		89	73	78	59	3	23	30.09	30.14
16	CLR	NC			10.00		90	75	79	62	13	19	30.04	30.09
19	CLR	NC			10.00		83	74	77	74	12	20	30.03	30.08
22	CLR	NC			10.00		78	75	76	90	5	20	30.04	30.09
					SUNRISE: 0518	JUL 06			SUNSET: 1932					
01	CLR	NC			9.00		77	75	76	94	6	23	30.02	30.07
04	OVC	060			10.00		77	75	76	94	5	23	29.99	30.04
07	CLR	NC			10.00		78	74	75	87	9	24	30.02	30.06
10	CLR	NC			10.00		84	76	78	77	7	21	30.02	30.06
13	OVC	028			2.50	TSRA BR	70	68	69	93	10	08	30.06	30.10
16	CLR	NC			10.00		77	73	74	88	9	22	29.93	29.98
19	CLR	NC			9.00		75	72	73	90	0	00	29.95	29.99
22	CLR	NC			8.00		73	72	72	96	0	00	29.99	30.03

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	DEW POINT	WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	SEA LEVEL
					SUNRISE: 0518	JUL 07			SUNSET: 1932					
01	OVC	100			9.00		76	74	75	94	3	21	29.99	30.04
04	CLR	NC			5.00	BR	71	71	71	100	0	00	29.96	30.01
07	CLR	NC			9.00		77	75	76	94	7	19	29.98	30.02
10	FEW	NC			10.00		82	74	76	77	13	19	30.00	30.04
13	SCT	NC			10.00		86	73	77	65	15	19	29.99	30.04
16	CLR	NC			10.00		86	70	75	59	14	19	29.95	30.00
19	CLR	NC			10.00		80	68	72	67	9	19	29.97	30.02
22	CLR	NC			10.00		75	73	74	94	3	17	30.02	30.07
					SUNRISE: 0519	JUL 08			SUNSET: 1932					
01	CLR	NC			10.00		73	72	72	96	7	19	29.99	30.03
04	CLR	NC			8.00		73	72	72	96	5	21	29.96	30.01
07	CLR	NC			10.00		77	75	76	94	5	19	30.02	30.06
10	FEW	NC			10.00		86	74	78	67	6	22	30.02	30.07
13	FEW	NC			10.00		89	75	79	63	10	20	30.01	30.05
16	SCT	NC			10.00		89	76	80	65	10	19	29.97	30.02
19	CLR	NC			7.00		83	75	77	77	9	19	30.00	30.04
22	CLR	NC			7.00		79	77	78	94	7	21	30.05	30.09
					SUNRISE: 0519	JUL 09			SUNSET: 1931					
01	CLR	NC			7.00		78	76	77	93	8	21	30.03	30.07
04	CLR	NC			7.00		76	75	75	97	3	22	30.04	30.09
07	CLR	NC			8.00		79	75	76	88	6	25	30.10	30.15
10	CLR	NC			10.00		89	71	77	55	7	25	30.09	30.14
13	FEW	NC			10.00		92	72	78	52	10	20	30.06	30.10
16	SCT	NC			9.00		90	76	80	63	12	20	30.02	30.06
19	CLR	NC			10.00		85	74	77	70	10	20	30.02	30.06
22	CLR	NC			8.00		81	74	76	79	9	20	30.04	30.09
					SUNRISE: 0520	JUL 10			SUNSET: 1931					
01	CLR	NC			9.00		79	74	76	85	8	22	30.03	30.08
04	CLR	NC			10.00		77	74	75	90	9	24	30.03	30.08
07	BKN	095			10.00		77	72	74	85	10	24	30.07	30.12
10	CLR	NC			10.00		87	73	77	63	10	24	30.05	30.09
13	FEW	NC			10.00		91	72	78	54	13	25	30.00	30.05
16	BKN	050			10.00		89	76	80	65	14	20	29.96	30.01
19	CLR	NC			10.00		83	77	79	82	15	20	29.97	30.02
22	CLR	NC			10.00		80	70	73	71	10	22	30.02	30.06
					SUNRISE: 0520	JUL 11			SUNSET: 1931					
01	FEW	NC			10.00		78	73	75	85	14	22	30.01	30.05
04	CLR	NC			10.00		78	73	75	85	12	23	29.98	30.03
07	FEW	NC			10.00		78	73	75	85	9	24	30.02	30.06
10	CLR	NC			10.00		86	75	78	70	7	29	30.02	30.07
13	BKN	055			9.00	TS	76	72	73	88	15	35	30.02	30.07
16	SCT	NC			9.00		79	74	76	85	7	14	30.00	30.05
19	CLR	NC			4.00	-RA BR	76	75	75	97	3	16	30.04	30.08
22	OVC	022			5.00	-RA BR	76	75	75	97	5	33	30.04	30.09
					SUNRISE: 0521	JUL 12			SUNSET: 1931					
01	BKN	021			10.00	-RA	73	72	72	96	3	23	30.02	30.06
04	FEW	NC			8.00		73	72	72	96	7	27	30.02	30.06
07	BKN	004			7.00		73	72	72	96	6	35	30.02	30.07
10	OVC	012			10.00		77	72	74	85	6	27	30.06	30.11
13	BKN	029			10.00		83	73	76	72	3	23	30.02	30.06
16	BKN	045			3.00	-TSRA BR	75	73	74	94	0	00	29.99	30.04
19	FEW	NC			7.00		77	74	75	90	3	19	29.99	30.03
22	FEW	NC			8.00	-RA	76	75	75	97	3	20	30.00	30.05

OBSERVATIONS AT 3-HOURLY INTERVALS

CHARLESTON AP, SC

JULY 1999 CHS WBAN # 13880

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	TEMPERATURE °F DEW POINT	TEMPERATURE °F WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	WIND DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	PRESSURE (INCHES,HG) SEA LEVEL
					SUNRISE: 0521	JUL 13			SUNSET: 1930					
01	BKN	026			8.00		75	74	74	96	3	27	29.99	30.04
04	BKN	095			10.00		74	72	73	94	0	00	29.96	30.01
07	OVC	015			5.00	-RA BR	74	72	73	94	3	17	30.02	30.07
10	BKN	009			9.00		77	74	75	90	0	00	30.02	30.07
13	BKN	034			10.00		82	74	76	77	12	19	30.00	30.05
16	OVC	009			7.00	-RA	78	74	75	87	10	34	29.99	30.04
19	OVC	006			2.50	BR	74	73	73	97	7	32	30.02	30.07
22	OVC	003			3.00	BR	70	70	70	100	7	34	30.07	30.11
					SUNRISE: 0522	JUL 14			SUNSET: 1930					
01	OVC	001			1.50	BR	69	68	68	96	7	33	30.06	30.10
04	OVC	003			5.00	BR	69	68	68	96	3	02	30.04	30.09
07	OVC	003			1.50	BR	70	70	70	100	6	02	30.08	30.13
10	OVC	011			6.00	BR	75	71	72	88	7	03	30.11	30.16
13	BKN	016			6.00	HZ	81	74	76	79	3	VR	30.10	30.15
16	CLR	NC			7.00		85	73	77	68	8	12	30.07	30.11
19	OVC	003			0.25	+TSRA FG	76	75	75	97	8	05	30.06	30.11
22	BKN	060			2.00	BR	76	75	75	97	0	00	30.09	30.14
					SUNRISE: 0522	JUL 15			SUNSET: 1930					
01	FEW	NC			1.75	BR	74	73	73	97	3	01	30.10	30.15
04	CLR	NC			4.00	BR	72	72	72	100	0	00	30.08	30.13
07	CLR	NC			5.00	BR	74	73	73	97	7	36	30.12	30.16
10	BKN	010			4.00	HZ	80	75	77	85	8	01	30.14	30.18
13	BKN	016			4.00	HZ	83	74	77	74	6	VR	30.14	30.18
16	CLR	NC			4.00	HZ	84	72	76	67	6	VR	30.10	30.15
19	SCT	NC			4.00	HZ	80	75	77	85	8	13	30.09	30.14
22	CLR	NC			4.00	BR	77	74	75	90	0	00	30.13	30.17
					SUNRISE: 0523	JUL 16			SUNSET: 1929					
01	CLR	NC			1.75	BR	75	74	74	96	3	36	30.12	30.16
04	CLR	NC			2.00	BR	74	74	74	100	6	04	30.09	30.14
07	CLR	NC			1.75	BR	75	75	75	100	3	01	30.13	30.18
10	BKN	100			4.00	HZ	83	75	77	77	8	05	30.15	30.20
13	BKN	047			3.00	TS BR	77	75	76	94	9	07	30.16	30.21
16	SCT	NC			7.00		76	72	73	88	0	00	30.13	30.18
19	FEW	NC			4.00	BR	77	74	75	90	5	24	30.11	30.15
22	CLR	NC			2.50	BR	73	72	72	96	3	36	30.14	30.18
					SUNRISE: 0524	JUL 17			SUNSET: 1929					
01	CLR	NC			2.50	BR	71	71	71	100	5	34	30.15	30.19
04	CLR	NC			2.00	BR	71	71	71	100	3	35	30.14	30.18
07	CLR	NC			3.00	BR	74	72	73	94	3	34	30.17	30.22
10	OVC	023			6.00	HZ	82	72	75	72	6	VR	30.18	30.23
13	SCT	NC			6.00	HZ	86	70	75	59	0	00	30.16	30.21
16	CLR	NC			8.00		85	74	77	70	12	14	30.13	30.18
19	CLR	NC			10.00		80	73	75	79	8	19	30.12	30.17
22	CLR	NC			10.00		77	73	74	88	3	20	30.17	30.21
					SUNRISE: 0524	JUL 18			SUNSET: 1928					
01	CLR	NC			10.00		73	72	72	96	0	00	30.17	30.21
04	CLR	NC			10.00		73	72	72	96	0	00	30.15	30.19
07	CLR	NC			7.00		76	74	75	94	0	00	30.17	30.22
10	FEW	NC			10.00		83	72	75	70	0	00	30.18	30.22
13	CLR	NC			10.00		88	71	76	57	6	19	30.15	30.19
16	SCT	NC			10.00		83	74	77	74	8	21	30.11	30.16
19	CLR	NC			10.00	-RA	77	73	74	88	0	00	30.11	30.16
22	CLR	NC			10.00		76	74	75	94	3	25	30.15	30.19

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	TEMPERATURE °F DEW POINT	TEMPERATURE °F WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	WIND DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	PRESSURE (INCHES,HG) SEA LEVEL
					SUNRISE: 0525	JUL 19			SUNSET: 1928					
01	CLR	NC			10.00		77	75	76	94	5	26	30.14	30.18
04	CLR	NC			10.00		76	74	75	94	0	00	30.11	30.16
07	CLR	NC			10.00		77	75	76	94	5	23	30.13	30.17
10	CLR	NC			10.00		83	74	77	74	8	25	30.13	30.18
13	CLR	NC			10.00		88	74	78	63	7	28	30.09	30.14
16	FEW	NC			10.00		86	76	79	72	6	16	30.05	30.09
19	CLR	NC			10.00		83	73	76	72	9	18	30.03	30.08
22	CLR	NC			10.00		78	74	75	87	6	22	30.07	30.12
					SUNRISE: 0525	JUL 20			SUNSET: 1927					
01	CLR	NC			9.00		77	74	75	90	6	25	30.05	30.09
04	CLR	NC			8.00		76	73	74	91	8	24	30.03	30.08
07	CLR	NC			8.00		77	73	74	88	9	26	30.07	30.12
10	CLR	NC			7.00		86	73	77	65	12	27	30.07	30.12
13	CLR	NC			4.00	HZ	91	74	79	57	12	26	30.03	30.08
16	CLR	NC			4.00	HZ	92	73	79	54	9	28	29.99	30.04
19	FEW	NC			3.00	HZ	88	75	79	66	8	23	29.99	30.03
22	CLR	NC			5.00	BR	81	79	80	94	6	20	30.02	30.07
					SUNRISE: 0526	JUL 21			SUNSET: 1927					
01	CLR	NC			5.00	HZ	82	76	78	82	7	24	30.01	30.06
04	CLR	NC			3.00	HZ	80	74	76	82	8	26	30.00	30.04
07	CLR	NC			2.00	BR	79	75	76	88	7	30	30.04	30.08
10	CLR	NC			3.00	HZ	89	76	80	65	7	28	30.05	30.10
13	SCT	NC			4.00	HZ	93	76	81	58	8	32	30.03	30.08
16	SCT	NC			4.00	HZ	94	76	81	56	9	27	29.97	30.02
19	SCT	NC			2.50	BR	81	77	78	88	3	13	29.98	30.03
22	CLR	NC			3.00	BR	81	78	79	91	3	20	30.00	30.05
					SUNRISE: 0527	JUL 22			SUNSET: 1926					
01	CLR	NC			3.00	BR	78	76	77	93	5	20	29.98	30.03
04	CLR	NC			3.00	BR	79	77	78	94	0	00	29.96	30.01
07	CLR	NC			2.00	BR	81	78	79	91	5	31	30.00	30.05
10	CLR	NC			3.00	HZ	91	76	80	61	6	28	30.01	30.06
13	SCT	NC			3.00	HZ	94	76	81	56	5	VR	29.98	30.03
16	SCT	NC			8.00	TS	80	70	73	71	17	13	29.97	30.01
19	SCT	NC			4.00	HZ	83	76	78	79	3	32	29.95	29.99
22	CLR	NC			4.00	BR	79	76	77	90	3	21	29.95	30.00
					SUNRISE: 0527	JUL 23			SUNSET: 1926					
01	FEW	NC			2.50	BR	79	78	78	97	3	23	29.95	30.00
04	OVC	049			5.00	HZ	80	75	77	85	3	24	29.92	29.97
07	CLR	NC			5.00	HZ	80	75	77	85	3	34	29.93	29.98
10	CLR	NC			3.00	HZ	90	78	81	68	3	05	29.95	29.99
13	CLR	NC			3.00	HZ	95	75	80	53	5	18	29.91	29.96
16	SCT	NC			3.00	TS HZ	91	79	82	68	13	21	29.88	29.93
19	FEW	NC			3.00	HZ	87	80	82	80	9	19	29.86	29.91
22	CLR	NC			3.00	BR	84	81	82	91	9	22	29.92	29.96
					SUNRISE: 0528	JUL 24			SUNSET: 1925					
01	CLR	NC			2.50	BR	82	80	81	94	6	23	29.90	29.94
04	CLR	NC			2.50	BR	80	78	79	94	6	21	29.88	29.92
07	CLR	NC			3.00	BR	79	76	77	90	6	20	29.91	29.96
10	CLR	NC			3.00	HZ	89	77	80	68	12	25	29.93	29.98
13	CLR	NC			3.00	HZ	93	79	83	64	9	20	29.90	29.95
16	CLR	NC			4.00	HZ	94	75	80	54	15	20	29.82	29.86
19	CLR	NC			3.00	HZ	86	79	81	80	9	20	29.85	29.89
22	CLR	NC			4.00	BR	82	80	81	94	7	21	29.89	29.93

OBSERVATIONS AT 3-HOURLY INTERVALS

CHARLESTON AP, SC

JULY 1999 CHS WBAN # 13880

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE: OBSERVATION TIME (LST)	SATELLITE: EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F: DRY BULB	TEMPERATURE °F: DEW POINT	TEMPERATURE °F: WET BULB	RELATIVE HUMIDITY (PCT)	WIND: SPEED (MPH)	WIND: DIRECTION TENS OF DEG	PRESSURE (INCHES,HG): STATION	PRESSURE (INCHES,HG): SEA LEVEL
						SUNRISE: 0529 JUL 25 SUNSET: 1925								
01	CLR	NC			6.00	BR	77	73	74	88	8	08	29.87	29.92
04	CLR	NC			5.00	BR	76	74	75	94	0	00	29.84	29.89
07	CLR	NC			5.00	HZ	77	72	74	85	0	00	29.89	29.94
10	CLR	NC			6.00	HZ	83	73	76	72	8	29	29.92	29.96
13	CLR	NC			4.00	HZ	90	74	79	59	12	27	29.88	29.93
16	CLR	NC			3.00	HZ	91	75	80	59	6	VR	29.84	29.88
19	CLR	NC			5.00	HZ	82	75	77	79	8	22	29.85	29.90
22	CLR	NC			5.00	BR	80	76	77	87	7	24	29.88	29.92
						SUNRISE: 0529 JUL 26 SUNSET: 1924								
01	CLR	NC			4.00	BR	79	76	77	90	7	25	29.86	29.91
04	CLR	NC			4.00	BR	76	73	74	91	6	27	29.86	29.91
07	CLR	NC			2.50	BR	78	75	76	90	6	28	29.87	29.92
10	CLR	NC			5.00	HZ	91	75	80	59	9	28	29.89	29.93
13	CLR	NC			6.00	HZ	96	71	78	44	7	VR	29.86	29.91
16	CLR	NC			7.00		96	71	78	44	13	27	29.82	29.87
19	CLR	NC			7.00		92	73	78	54	6	24	29.81	29.86
22	CLR	NC			5.00	HZ	84	79	80	85	10	23	29.85	29.90
						SUNRISE: 0530 JUL 27 SUNSET: 1923								
01	CLR	NC			6.00	HZ	82	74	76	77	9	25	29.84	29.88
04	CLR	NC			6.00	HZ	77	72	74	85	6	29	29.84	29.88
07	CLR	NC			4.00	HZ	79	71	74	77	5	30	29.88	29.93
10	CLR	NC			4.00	HZ	91	75	80	59	6	36	29.90	29.95
13	CLR	NC			4.00	HZ	93	72	78	50	7	31	29.89	29.94
16	CLR	NC			5.00	HZ	96	72	79	46	8	28	29.85	29.89
19	CLR	NC			5.00	HZ	91	74	79	57	8	26	29.86	29.91
22	CLR	NC			4.00	HZ	86	76	79	72	5	29	29.90	29.94
						SUNRISE: 0531 JUL 28 SUNSET: 1923								
01	CLR	NC			3.00	BR	79	75	76	88	0	00	29.88	29.93
04	CLR	NC			3.00	HZ	79	74	75	85	5	34	29.88	29.92
07	CLR	NC			2.50	HZ	80	74	76	82	5	33	29.89	29.94
10	CLR	NC			4.00	HZ	92	72	78	52	5	35	29.92	29.97
13	CLR	NC			5.00	HZ	95	74	80	51	7	VR	29.90	29.95
16	SCT	NC			5.00	HZ	96	74	80	49	10	36	29.85	29.90
19	CLR	NC			7.00		92	70	77	49	5	27	29.84	29.89
22	CLR	NC			6.00	HZ	86	74	77	67	7	24	29.86	29.91
						SUNRISE: 0531 JUL 29 SUNSET: 1922								
01	CLR	NC			4.00	BR	81	77	78	88	6	24	29.85	29.90
04	CLR	NC			2.50	BR	83	80	81	91	7	23	29.81	29.85
07	CLR	NC			2.50	HZ	82	74	76	77	7	28	29.83	29.87
10	CLR	NC			3.00	HZ	91	74	79	57	9	29	29.83	29.87
13	CLR	NC			4.00	HZ	96	71	78	44	15	26	29.80	29.84
16	SCT	NC			5.00	HZ	96	69	77	42	14	27	29.74	29.79
19	CLR	NC			4.00	HZ	91	73	78	56	8	25	29.74	29.78
22	CLR	NC			5.00	HZ	87	73	77	63	9	24	29.74	29.79
						SUNRISE: 0532 JUL 30 SUNSET: 1921								
01	CLR	NC			4.00	HZ	83	74	77	74	7	25	29.74	29.79
04	CLR	NC			3.00	BR	76	74	75	94	3	25	29.73	29.77
07	CLR	NC			2.50	BR	79	75	76	88	5	29	29.77	29.82
10	CLR	NC			4.00	HZ	92	75	80	58	3	VR	29.79	29.84
13	FEW	NC			7.00		98	67	76	36	5	VR	29.76	29.81
16	CLR	NC			6.00	HZ	99	66	76	34	10	26	29.73	29.77
19	CLR	NC			4.00	HZ	90	79	82	70	8	21	29.72	29.76
22	CLR	NC			5.00	HZ	84	78	80	82	7	23	29.76	29.81

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE: OBSERVATION TIME (LST)	SATELLITE: EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F: DRY BULB	TEMPERATURE °F: DEW POINT	TEMPERATURE °F: WET BULB	RELATIVE HUMIDITY (PCT)	WIND: SPEED (MPH)	WIND: DIRECTION TENS OF DEG	PRESSURE (INCHES,HG): STATION	PRESSURE (INCHES,HG): SEA LEVEL
						SUNRISE: 0533 JUL 31 SUNSET: 1920								
01	CLR	NC			4.00	BR	83	79	80	88	8	24	29.74	29.79
04	CLR	NC			4.00	HZ	82	77	78	85	3	33	29.74	29.79
07	CLR	NC			2.50	BR	82	78	79	88	0	00	29.79	29.83
10	CLR	NC			4.00	HZ	89	76	80	65	3	VR	29.81	29.86
13	CLR	NC			5.00	HZ	98	75	81	48	6	35	29.79	29.83
16	CLR	NC			5.00	HZ	100	75	82	45	7	VR	29.75	29.80
19	CLR	NC			4.00	HZ	95	79	83	60	8	28	29.76	29.80
22	CLR	NC			4.00	HZ	87	80	82	80	5	17	29.81	29.86

3-HOURLY OBSERVATION NOTES

Sky Cover is the amount of the sky obscured. CLR or SKC = 0, FEW = 1/8-2/8, SCT = 3/8-4/8, BKN = 5/8-7/8, OVC = 8/8, VV = Vertical Visibilty = 8/8.
Ceiling is reported in hundreds of feet above ground level for clouds at or below 12,000 feet. NC= No ceiling detected.
& = Original observation contained additional weather elements.
See page 3 for additional notes.

SUMMARY BY HOUR

HOUR (LST)	AVERAGES: CEILOMETER	AVERAGES: EFF CLD AMT	AVERAGES: DRY BULB	AVERAGES: DEW POINT	AVERAGES: WET BULB	AVERAGES: RELATIVE HUMIDITY	AVERAGES: PRESSURE (INCHES,HG) STATION	AVERAGES: PRESSURE (INCHES,HG) SEA LEVEL	AVERAGES: VISIBILITY (MILES)	AVERAGES: WIND SPEED (MPH)	RESULTANT WIND (MPH): SPEED	RESULTANT WIND (MPH): DIRECTION
01			77	74	75	91	30.00	30.05	6.34	6	4	23
02			77	74	75	92	29.99	30.04	6.12	4	3	23
03			76	74	74	92	29.99	30.03	6.10	4	3	24
04			76	73	74	93	29.98	30.03	6.03	4	3	25
05			75	73	74	93	29.99	30.04	5.70	4	3	26
06			75	73	74	94	30.01	30.05	4.74	4	2	27
07			77	74	75	90	30.02	30.07	5.70	5	3	28
08			80	74	76	83	30.03	30.08	6.45	6	3	27
09			83	74	77	75	30.03	30.08	6.94	6	3	28
10			85	74	77	69	30.03	30.08	6.94	6	3	27
11			87	74	78	65	30.03	30.08	6.76	6	3	24
12			88	74	78	64	30.02	30.07	6.67	7	3	26
13			88	73	77	62	30.01	30.06	6.85	7	3	22
14			88	73	78	63	30.00	30.04	6.87	9	5	22
15			88	74	78	65	29.98	30.03	7.15	9	5	19
16			88	73	77	64	29.97	30.02	7.19	9	6	20
17			87	73	77	65	29.97	30.02	7.33	10	7	20
18			85	74	77	71	29.97	30.01	6.73	8	5	21
19			83	74	77	77	29.98	30.02	6.43	7	5	20
20			81	75	77	83	29.98	30.03	6.90	6	4	20
21			80	75	76	86	30.00	30.04	6.53	5	4	22
22			79	75	76	88	30.01	30.05	6.27	5	4	22
23			78	75	76	90	30.01	30.05	6.34	5	3	22
24			78	75	76	90	30.00	30.05	6.45	5	3	22

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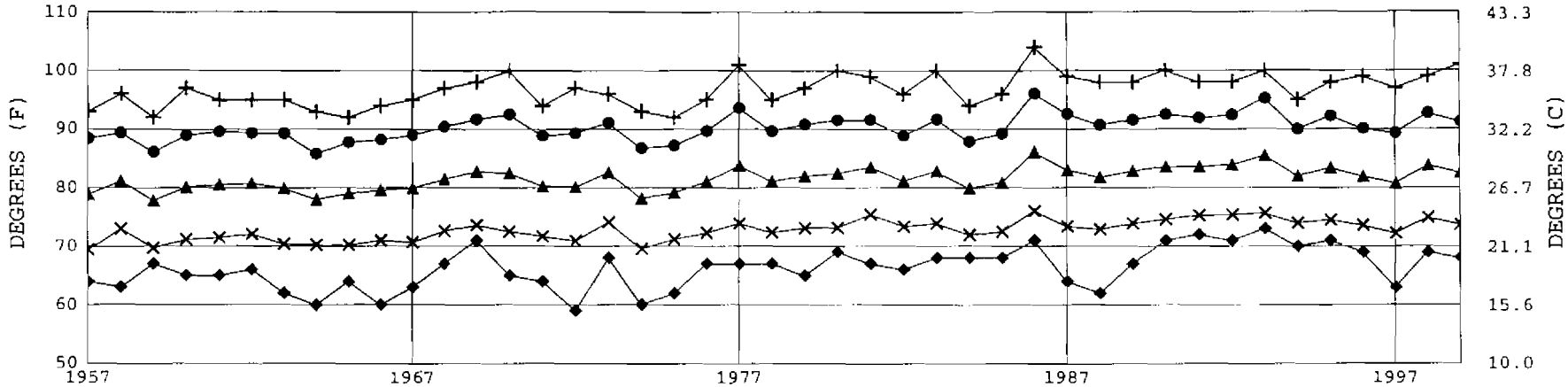
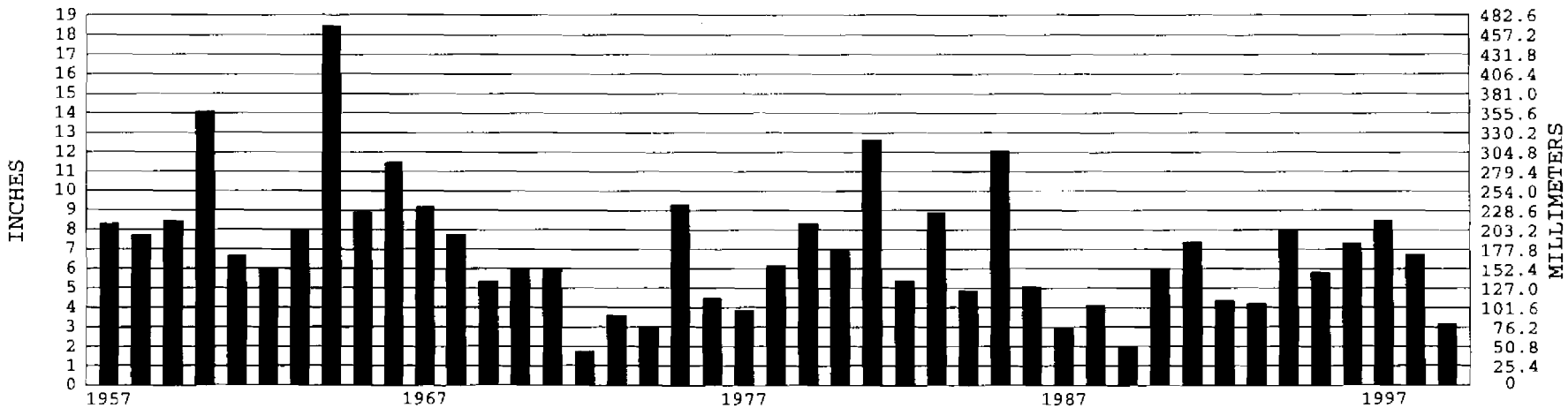
CHARLESTON AP, SC JULY TEMPERATURES



+ Extreme Max. ● Mean Max. ▲ Mean × Mean Min. ◆ Extreme Min.

Long-Term (1957-1999) Mean: 81.5 1961-1990 Normal: 81.5

CHARLESTON AP, SC JULY PRECIPITATION



Long-Term (1957-1999) Mean Monthly Total: 6.96 1961-1990 Normal: 6.84

AUGUST 1999
CHARLESTON, SC
LOCAL CLIMATOLOGICAL DATA

NOAA, National Climatic Data Center

I certify that this is an official publication of the National Oceanic and Atmospheric Administration (NOAA). It is compiled using information from weather observing sites operated by NOAA—National Weather Service / Department Of Transportation—Federal Aviation Administration and received at the National Climatic Data Center (NCDC), Asheville, North Carolina 28801.

Thomas R Karl

DIRECTOR

NOTICE

Effective July 1, 1996, the National Weather Service & Federal Aviation Administration began using the METAR format for Hourly Observations.

We welcome your questions or comments, please contact us at
828—271—4800 (voice), 828—271—4876 (fax),
828—271—4010(TDD)
or orders@ncdc.noaa.gov
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AUGUST 1999
LOCAL CLIMATOLOGICAL DATA
NOAA, National Climatic Data Center

CHARLESTON, SC
CHARLESTON INT'L AIRPORT (CHS)
Lat: 32°53' N Long: 80°02' W Elev (Ground): 40 Feet
Time Zone: EASTERN WBAN: 13880 ISSN #:0198–4624

DATE	TEMPERATURE °F MAXIMUM	MINIMUM	AVERAGE	DEP FROM NORMAL	AVERAGE DEW PT	AVERAGE WET BULB	DEG DAYS BASE 65° HEATING	COOLING	WEATHER	SNOW/ICE ON GND(IN) 0700 LST DEPTH	1300 LST WATER EQUIV	PRECIPITATION (INCHES) 2400 LST SNOW-FALL	2400 LST WATER EQUIV	PRESSURE (INCHES OF HG) AVERAGE STATION	AVERAGE SEA LEVEL	WIND SPEED = MPH DIR = TENS OF DEGREES RESULTANT SPEED	RES DIR	AVERAGE SPEED	MAXIMUM 5-SEC SPEED	DIR	MAXIMUM 2-MIN SPEED	DIR	DATE
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
01	105*	81	93*	11	77	81	0	28	BR HZ				0.00	29.81	29.86	4.6	27	6.3	17	25	14	26	01
02	95	76	86	4	73	76	0	21	RA HZ				T	29.85	29.90	5.7	02	6.6	21	05	15	05	02
03	92	73	83	1	66	72	0	18	BR HZ				0.00	29.90	29.95	6.7	03	7.7	22	04	18	04	03
04	93	72	83	2	69	73	0	18	BR				0.00	29.86	29.90	2.7	04	7.4	21	03	15	04	04
05	94	72	83	2	70	74	0	18	BR HZ				0.00	29.84	29.89	2.1	16	5.7	22	14	16	15	05
06	95	74	85	4	73	76	0	20	BR HZ				0.00	29.89	29.94	3.0	17	6.0	21	14	17	16	06
07	94	74	84	3	75	78	0	19	BR				0.00	29.95	30.00	5.5	17	6.1	20	14	16	14	07
08	99	77	88	7	75	77	0	23	TS TSRA BR HZ				0.08	29.88	29.93	7.8	22	9.1	29	24	21	24	08
09	94	75	85	4	74	76	0	20	TS TSRA RA FG+ BR HZ				0.94	29.78	29.82	6.1	26	9.2	26	05	23	07	09
10	93	76	85	4	76	78	0	20	RA BR HZ				T	29.79	29.84	3.8	20	5.5	17	20	15	18	10
11	96	78	87	6	77	79	0	22	TS BR HZ				0.00	29.81	29.86	7.1	21	8.1	22	23	17	20	11
12	96	79	88	7	78	80	0	23	TS BR HZ				0.00	29.83	29.88	3.7	17	5.9	20	28	17	29	12
13	93	79	86	5	78	80	0	21	BR HZ				0.00	29.86	29.91	9.0	17	9.2	18	17	16	17	13
14	93	74	84	3	76	78	0	19	TS TSRA RA BR HZ				0.04	29.82	29.87	7.7	20	9.6	23	33	21	18	14
15	94	73	84	3	75	77	0	19	TS BR HZ				0.00	29.93	29.98	3.2	18	6.3	17	32	14	17	15
16	92	73	83	2	75	77	0	18	TS TSRA RA GS FG BR HZ				0.57	30.09	30.14	1.8	18	3.6	33	17	29	18	16
17	91	76	84	3	76	78	0	19	RA BR				0.57	30.02	30.07	4.3	23	5.9	16	24	15	25	17
18	96	77	87	6	76	78	0	22	HZ				0.00	29.86	29.91	9.2	22	9.7	20	21	17	20	18
19	94	70	82	2	74	77	0	17	TS TSRA RA BR HZ				0.51	29.88	29.92	8.0	22	10.8	38	32	30*	32	19
20	91	72	82	2	72	75	0	17	RA BR				T	29.91	29.95	6.9	22	9.1	22	22	17	22	20
21	92	72	82	2	71	75	0	17					0.00	29.90	29.95	6.4	25	7.6	23	27	14	27	21
22	93	73	83	3	73	76	0	18	TS RA BR HZ				0.08	29.92	29.97	2.9	09	7.5	32	19	28	17	22
23	89	73	81	1	72	75	0	16	BR HZ				0.00	29.94	29.99	7.8	11	8.4	24	11	21	12	23
24	87	73	80	0	73	75	0	15	RA BR HZ				0.03	29.91	29.96	4.5	13	5.8	20	15	17	16	24
25	91	75	83	3	74	76	0	18	RA				T	29.88	29.92	6.2	20	7.6	17	20	15	20	25
26	90	77	84	4	75	78	0	19	TS RA				T	29.85	29.90	7.0	21	7.9	23	19	18	20	26
27	92	76	84	4	76	78	0	19	TS TSRA BR				0.11	29.85	29.90	4.8	19	6.1	21	36	14	14	27
28	90	75	83	3	76	78	0	18	TS TSRA RA BR				0.09	29.85	29.90	5.4	08	6.3	23	10	18	10	28
29	79	76	78	-2	76	76	0	13	RA BR HZ				0.66	29.68	29.73	14.2	01	15.1	38*	02	28	36	29
30	84	66	75	-4	62	68	0	10	HZ				0.00	29.81	29.86	11.8	35	13.8	28	36	23	33	30
31	81	61*	71*	-8	56	62	0	6					0.00	30.03	30.08	7.6	01	8.1	22	02	18	02	31
	92.2	74.1	83.2		73.2	76.0	0.0	18.4	< MONTHLY AVERAGES	TOTALS->			3.68	29.88	29.92	1.7	22	7.8	<- MONTHLY AVERAGES				
	3.2	1.9	2.6		<---------- DEPARTURE FROM NORMAL ---------->								-3.54	SUNSHINE, CLOUD, & VISIBILITY TABLES ON PAGE 3									

DEGREE DAYS

	MONTHLY TOTAL	MONTHLY DEPARTURE	SEASON TO DATE TOTAL	SEASON TO DATE DEPARTURE
HEATING:	0	0	0	0
COOLING:	571	87	1833	85

GREATEST 24-HR PRECIPITATION: 1.14 DATE :16-17
GREATEST 24-HR SNOWFALL: DATE :
GREATEST SNOW DEPTH: DATE :

SEA LEVEL PRESSURE DATE TIME
MAXIMUM : 30.21 16 1356
MINIMUM : 29.61 30 0056

NUMBER OF DAYS WITH →
MAXIMUM TEMP ≥ 90: 26
MAXIMUM TEMP ≤ 32 : 0
THUNDERSTORMS : 12
MINIMUM TEMP ≤ 32 : 0
MINIMUM TEMP ≤ 0 : 0
HEAVY FOG : 1
PRECIPITATION ≥ 0.01 INCH : 11
PRECIPITATION ≥ 0.10 INCH : 6
SNOWFALL ≥ 1.0 INCH :

HOURLY PRECIPITATION

(WATER EQUIVALENT IN INCHES)

CHARLESTON, SC

AUGUST 1999 CHS WBAN # 13880

DATE	FOR HOUR (LST) ENDING AT												DATE	FOR HOUR (LST) ENDING AT												DATE	Sum if Different (See Note)	2400 LST Water Equiv.
	1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17	18	19	20	21	22	23	24			
01													01													01		0.00
02													02				T									02		T
03													03													03		0.00
04													04													04		0.00
05													05													05		0.00
06													06													06		0.00
07													07													07		0.00
08													08				0.08	T								08		0.08
09													09				T		0.56	0.38						09		0.94
10	T												10													10		T
11													11													11		0.00
12													12													12		0.00
13													13													13		0.00
14													14								0.03	0.01	T			14		0.04
15													15													15		0.00
16													16		0.18	0.39										16		0.57
17												0.53	17	0.04	T											17		0.57
18													18													18		0.00
19													19								T	0.38	0.06	0.05	0.02	19		0.51
20	T												20													20		T
21													21													21		0.00
22													22					0.06	T						0.02	22		0.08
23													23													23		0.00
24												0.02	24	T	0.01	T										24		0.03
25						T							25													25		T
26													26	T												26		T
27													27	0.07	0.03	T		0.01								27		0.11
28											T	T	28	0.09												28		0.09
29									0.01	0.04	0.11	0.01	29	T	0.04	0.04	0.03	T	T	0.02	0.08	0.08	0.16	0.04		29		0.66
30													30													30		0.00
31													31													31		0.00

1.02

MAXIMUM SHORT DURATION PRECIPITATION (See Note)

Time Period (Minutes)	5	10	15	20	30	45	60	80	100	120	150	180
Precipitation (Inches)												
Ending Date												
Ending Time (Hour/Min)												

Date and time are not entered for TRACE amounts.

Note : The sum of the hourly totals is given when it differs from the daily total. NWS does not edit ASOS hourly values but may edit daily and monthly totals. Hourly, daily, and monthly totals are printed as reported by the ASOS site.

REFERENCE NOTES & SUPPLEMENTAL SUMMARIES

* = Extreme for the month (last occurence if more than one)
T = Trace precipitation amount
+ = also occurs on earlier date
FG+ = Heavy fog, visibility .25 miles or less
BLANK entries denote missing or unreported data

Resultant wind is the vector sum of the wind speeds and directions divided by the number of observations.

Wind direction is recorded in tens of degrees (2 digits) clockwise from true north. '00' = calm, 'VR' = variable.

Precipitation is for the 24-hour period ending at the time indicated in the column heading.

Water Equivalent of snow on the ground is reported only when the depth is 2 or more inches.

NORMALS ARE FOR THE YEARS 1961-1990

WEATHER NOTATIONS

QUALIFIER	WEATHER PHENOMENA		
DESCRIPTOR	PRECIPITATION	OBSCURATION	OTHER
BC Patches	DZ Drizzle	BR Mist	DS Duststorm
BL Blowing	GR Hail	DU Widespread Dust	FC Funnel Cloud
DR Low Drifting	GS Small Hail and/or Snow Pellets	FG Fog	+FC Tornado Waterspout
FZ Freezing	IC Ice Crystals	FU Smoke	PO Well-Developed Dust/Sand Whirls
MI Shallow	PL Ice Pellets	HZ Haze	SQ Squalls
PR Partial	RA Rain	PY Spray	SS Sandstorm
SH Shower(s)	SG Snow Grains	SA Sand	GL Glaze
TS Thunderstorm	SN Snow	VA Volcanic Ash	
VC In the Vicinity	UP Unknown Precipitation		

Intensity (as indicated on pages 4 to 6):
'+' = Heavy ' ' = Moderate '-' = Light

CHARLESTON, SC
AUGUST 1999

Ceilometer (30-second) data are used to derive cloudiness at or below 12,000 feet. This cloudiness is the mean cloud cover detected during sunrise to sunset (SR-SS), or midnight to midnight (MN-MN).

Satellite data are used to derive cloudiness above 12,000 feet. Effective Cloud Amount is based on the cloud cover and the transparency of the clouds within the satellite field of view (approx. 31x31 miles).

Sky Condition is based on the sum (not to exceed 8) of the sunrise to sunset cloud cover below and above 12,000 feet. Both ceilometer and satellite data must be present to compute Sky Condition. Clear = 0-2 oktas, Partly Cloudy = 3-6 oktas, Cloudy = 7-8 oktas.

A Heating (Cooling) Degree Day is the difference between the average daily temperature and 65 degrees F. The HDD season begins July 1, the CDD season begins January 1.

Dew Point is the temperature to which the air must be cooled to achieve 100% relative humidity. Wet Bulb is the temperature the air would have if cooled at constant pressure by evaporation of moisture into it, to 100% relative humidity.

Snow Depth, Snowfall, and Sunshine data may come from nearby sites that the National Weather Service deems Climatologically representative of this site.

ADDITIONAL NOTES:

DATE	SUNSHINE		CLOUDINESS (OKTAS)				VISIBILITY (MILES)		RESERVED
			SR-SS		MN-MN				
	TOTAL MINUTES	PERCENT POSSIBLE	CEILOMETER	SATELLITE	CEILOMETER	SATELLITE	MINIMUM	MAXIMUM	
01							1.00	8.00	
02							4.00	10.00	
03							4.00	10.00	
04							6.00	10.00	
05							2.00	10.00	
06							2.50	9.00	
07							2.00	10.00	
08							3.00	10.00	
09							.25	9.00	
10							2.00	5.00	
11							3.00	5.00	
12							1.75	5.00	
13							1.25	5.00	
14							2.50	10.00	
15							3.00	8.00	
16							1.00	10.00	
17							3.00	10.00	
18							5.00	10.00	
19							2.50	10.00	
20							6.00	10.00	
21							8.00	10.00	
22							3.00	10.00	
23							3.00	10.00	
24							2.50	10.00	
25							9.00	10.00	
26							9.00	10.00	
27							1.25	10.00	
28							5.00	10.00	
29							1.75	10.00	
30							4.00	10.00	
31							10.00	10.00	
MONTHLY AVGS							3.62	9.16	

SUNSHINE (MINUTES)

Total: Possible:
Percent Possible:

NUMBER OF DAYS WITH:

SKY CONDITION

CLR	PTLY CLDY	CLOUDY	MISSING
			31

MINIMUM VISIBILITY (MILES)

<=0.25	<=3.0	>=7.0
1	20	4

OBSERVATIONS AT 3-HOURLY INTERVALS

CHARLESTON, SC

AUGUST 1999 CHS WBAN # 13880

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	TEMPERATURE °F DEW POINT	TEMPERATURE °F WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	WIND DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	PRESSURE (INCHES,HG) SEA LEVEL
SUNRISE: 0533						AUG 01		SUNSET: 1920						
01	CLR	NC			3.00	BR	84	81	82	91	6	20	29.81	29.85
04	CLR	NC			2.50	BR	82	80	81	94	0	00	29.78	29.82
07	CLR	NC			2.00	BR	85	83	83	94	3	35	29.82	29.86
10	CLR	NC			4.00	HZ	96	76	81	52	7	VR	29.84	29.89
13	CLR	NC			6.00	HZ	102	72	80	38	9	29	29.83	29.88
16	CLR	NC			4.00	HZ	102	74	81	41	9	30	29.79	29.83
19	CLR	NC			7.00		96	73	80	48	8	24	29.79	29.84
22	CLR	NC			4.00	HZ	88	79	81	75	7	24	29.83	29.88
SUNRISE: 0534						AUG 02		SUNSET: 1919						
01	CLR	NC			5.00	HZ	84	76	78	77	6	34	29.81	29.86
04	CLR	NC			5.00	HZ	79	74	75	85	6	34	29.81	29.85
07	CLR	NC			6.00	HZ	83	71	75	67	10	01	29.84	29.89
10	CLR	NC			6.00	HZ	88	74	78	63	10	36	29.87	29.92
13	CLR	NC			6.00	HZ	92	75	80	58	8	32	29.86	29.91
16	CLR	NC			6.00	HZ	89	72	77	57	8	34	29.84	29.89
19	CLR	NC			9.00		88	71	76	57	7	05	29.84	29.88
22	CLR	NC			9.00		80	71	74	74	0	00	29.88	29.93
SUNRISE: 0535						AUG 03		SUNSET: 1918						
01	CLR	NC			7.00		74	70	71	88	6	02	29.87	29.92
04	CLR	NC			7.00		74	70	71	88	5	02	29.89	29.94
07	CLR	NC			6.00	HZ	76	69	71	79	12	03	29.93	29.97
10	CLR	NC			10.00		87	62	71	43	16	05	29.95	29.99
13	CLR	NC			10.00		89	60	70	38	9	02	29.91	29.96
16	CLR	NC			10.00		91	58	70	33	7	04	29.88	29.92
19	CLR	NC			10.00		84	69	74	61	5	19	29.88	29.92
22	CLR	NC			10.00		79	70	73	74	0	00	29.90	29.95
SUNRISE: 0535						AUG 04		SUNSET: 1917						
01	CLR	NC			10.00		76	68	71	77	3	35	29.87	29.92
04	CLR	NC			10.00		74	66	69	76	8	02	29.86	29.91
07	CLR	NC			8.00		74	67	69	79	10	01	29.89	29.93
10	CLR	NC			10.00		87	67	74	51	10	02	29.89	29.93
13	SCT	NC			10.00		90	65	73	44	8	36	29.86	29.91
16	CLR	NC			10.00		91	65	74	42	3	VR	29.80	29.85
19	CLR	NC			7.00		82	74	76	77	9	15	29.83	29.87
22	CLR	NC			8.00		78	74	75	87	5	17	29.87	29.91
SUNRISE: 0536						AUG 05		SUNSET: 1916						
01	CLR	NC			6.00	BR	76	73	74	91	0	00	29.84	29.89
04	CLR	NC			5.00	BR	73	72	72	96	0	00	29.82	29.87
07	CLR	NC			2.00	BR	76	74	75	94	6	32	29.85	29.90
10	CLR	NC			8.00		87	69	75	55	7	VR	29.86	29.90
13	SCT	NC			8.00		91	64	73	41	3	VR	29.83	29.88
16	CLR	NC			10.00		90	65	73	44	13	15	29.81	29.86
19	CLR	NC			10.00		84	69	74	61	9	16	29.82	29.87
22	CLR	NC			9.00		78	73	75	85	5	18	29.86	29.91
SUNRISE: 0537						AUG 06		SUNSET: 1915						
01	CLR	NC			6.00	BR	75	72	73	90	3	18	29.87	29.92
04	CLR	NC			5.00	BR	75	74	74	96	0	00	29.86	29.90
07	CLR	NC			2.50	BR	75	75	75	100	6	31	29.89	29.94
10	CLR	NC			7.00		88	73	77	61	6	VR	29.91	29.96
13	CLR	NC			7.00		95	64	74	36	6	09	29.90	29.95
16	CLR	NC			9.00		90	68	75	49	13	14	29.88	29.93
19	CLR	NC			6.00	HZ	84	75	78	74	8	18	29.89	29.93
22	CLR	NC			6.00	BR	79	75	76	88	5	20	29.93	29.98

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	TEMPERATURE °F DEW POINT	TEMPERATURE °F WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	WIND DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	PRESSURE (INCHES,HG) SEA LEVEL
SUNRISE: 0538						AUG 07		SUNSET: 1915						
01	CLR	NC			4.00	BR	78	75	76	90	0	00	29.92	29.96
04	CLR	NC			2.50	BR	76	75	75	97	0	00	29.92	29.97
07	CLR	NC			2.00	BR	79	76	77	90	0	00	29.97	30.02
10	CLR	NC			10.00		89	73	78	59	3	VR	29.99	30.03
13	CLR	NC			10.00		93	74	79	54	10	14	29.98	30.02
16	FEW	NC			10.00		90	75	79	62	12	14	29.94	29.99
19	CLR	NC			10.00		85	75	78	72	12	18	29.93	29.97
22	CLR	NC			7.00		81	76	77	85	6	18	29.96	30.01
SUNRISE: 0538						AUG 08		SUNSET: 1914						
01	CLR	NC			7.00		79	77	78	94	6	19	29.94	29.99
04	CLR	NC			5.00	BR	77	76	76	96	3	20	29.91	29.96
07	CLR	NC			6.00	BR	80	77	78	90	8	22	29.94	29.99
10	CLR	NC			6.00	HZ	89	77	80	68	5	VR	29.92	29.96
13	CLR	NC			5.00	HZ	94	76	81	56	12	21	29.87	29.91
16	BKN	110			3.00	TS BR	78	74	75	87	13	16	29.84	29.88
19	SCT	NC			10.00		77	68	71	74	13	23	29.86	29.90
22	CLR	NC			8.00		78	71	73	79	9	23	29.85	29.89
SUNRISE: 0539						AUG 09		SUNSET: 1913						
01	CLR	NC			9.00		77	74	75	90	16	23	29.82	29.87
04	FEW	NC			9.00		77	74	75	90	9	26	29.79	29.84
07	BKN	009			6.00	BR	78	74	75	87	10	27	29.80	29.85
10	CLR	NC			4.00	HZ	87	74	78	65	9	27	29.80	29.84
13	FEW	NC			5.00	HZ	92	73	78	54	9	25	29.77	29.81
16	CLR	NC			5.00	HZ	92	73	78	54	3	VR	29.70	29.75
19	SCT	NC			6.00	TS BR	77	75	76	94	10	21	29.73	29.77
22	CLR	NC			5.00	BR	76	74	75	94	5	10	29.78	29.83
SUNRISE: 0540						AUG 10		SUNSET: 1912						
01	BKN	120			4.00	BR	76	74	75	94	6	04	29.76	29.81
04	FEW	NC			4.00	BR	78	75	76	90	3	22	29.75	29.80
07	CLR	NC			2.00	BR	78	75	76	90	7	26	29.79	29.83
10	OVC	012			2.50	HZ	81	76	77	85	3	VR	29.83	29.88
13	SCT	NC			2.50	HZ	87	76	79	70	3	19	29.81	29.86
16	SCT	NC			4.00	HZ	93	73	79	52	5	VR	29.76	29.80
19	CLR	NC			4.00	HZ	84	78	80	82	9	18	29.79	29.83
22	CLR	NC			4.00	BR	82	79	80	91	6	15	29.81	29.86
SUNRISE: 0540						AUG 11		SUNSET: 1911						
01	CLR	NC			4.00	BR	81	78	79	91	6	22	29.80	29.85
04	CLR	NC			5.00	BR	79	76	77	90	7	24	29.80	29.84
07	FEW	NC			4.00	HZ	79	76	77	90	7	25	29.83	29.88
10	CLR	NC			4.00	HZ	89	77	80	68	3	VR	29.85	29.90
13	SCT	NC			5.00	HZ	95	75	80	53	10	22	29.82	29.87
16	FEW	NC			4.00	HZ	92	75	80	58	8	17	29.77	29.82
19	SCT	NC			3.00	HZ	85	80	81	85	10	20	29.79	29.84
22	CLR	NC			4.00	BR	83	80	81	91	9	20	29.82	29.87
SUNRISE: 0541						AUG 12		SUNSET: 1910						
01	CLR	NC			2.50	BR	82	80	81	94	5	18	29.81	29.86
04	CLR	NC			4.00	BR	82	78	79	88	3	28	29.80	29.84
07	CLR	NC			1.75	BR	81	78	79	91	0	00	29.82	29.86
10	CLR	NC			2.50	HZ	91	79	82	68	6	13	29.86	29.91
13	SCT	NC			3.00	TS HZ	94	76	81	56	12	15	29.84	29.89
16	FEW	NC			3.00	HZ	90	77	81	66	6	16	29.82	29.87
19	FEW	NC			2.50	HZ	86	78	80	77	9	15	29.82	29.87
22	CLR	NC			3.00	BR	82	79	80	91	5	14	29.89	29.93

OBSERVATIONS AT 3–HOURLY INTERVALS

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AUGUST 1999 CHS WBAN # 13880

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	DEW POINT	WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	SEA LEVEL
SUNRISE: 0542						**AUG 13**			**SUNSET: 1909**					
01	CLR	NC			2.50	BR	81	80	80	97	6	15	29.85	29.89
04	CLR	NC			1.75	BR	80	79	79	97	5	14	29.84	29.89
07	CLR	NC			1.75	BR	82	80	81	94	6	15	29.88	29.93
10	CLR	NC			4.00	HZ	89	77	80	68	9	17	29.92	29.96
13	CLR	NC			5.00	HZ	92	76	80	60	14	16	29.89	29.94
16	CLR	NC			4.00	HZ	90	73	78	58	13	17	29.83	29.88
19	CLR	NC			4.00	HZ	85	77	79	77	13	18	29.83	29.88
22	CLR	NC			4.00	BR	82	78	79	88	9	17	29.84	29.89
SUNRISE: 0542						**AUG 14**			**SUNSET: 1908**					
01	CLR	NC			4.00	BR	80	77	78	90	5	21	29.83	29.88
04	CLR	NC			4.00	BR	78	76	77	93	6	19	29.82	29.87
07	FEW	NC			3.00	BR	81	78	79	91	6	19	29.83	29.88
10	SCT	NC			5.00	HZ	90	77	81	66	10	20	29.85	29.90
13	FEW	NC			5.00	HZ	92	78	82	64	13	22	29.82	29.87
16	CLR	NC			7.00		91	74	79	57	16	19	29.75	29.80
19	OVC	042			10.00		78	67	71	69	15	32	29.89	29.93
22	CLR	NC			5.00	BR	76	73	74	91	10	17	29.81	29.85
SUNRISE: 0543						**AUG 15**			**SUNSET: 1907**					
01	FEW	NC			4.00	BR	76	74	75	94	8	31	29.85	29.90
04	CLR	NC			4.00	BR	74	72	73	94	5	04	29.87	29.91
07	CLR	NC			3.00	BR	76	73	74	91	3	VR	29.91	29.95
10	FEW	NC			7.00		87	75	78	67	6	21	29.95	29.99
13	FEW	NC			7.00		91	72	78	54	8	17	29.93	29.98
16	BKN	042			7.00	TS	89	76	80	65	8	20	29.92	29.97
19	CLR	NC			6.00	HZ	85	76	79	75	9	19	29.96	30.00
22	CLR	NC			4.00	BR	81	78	79	91	7	19	30.01	30.06
SUNRISE: 0544						**AUG 16**			**SUNSET: 1906**					
01	SCT	NC			4.00	BR	80	77	78	90	6	14	30.03	30.08
04	CLR	NC			5.00	BR	79	77	78	94	0	00	30.04	30.09
07	FEW	NC			4.00	BR	80	78	79	94	3	20	30.07	30.12
10	CLR	NC			7.00		88	73	77	61	3	VR	30.13	30.18
13	SCT	NC			6.00	HZ	90	73	78	58	7	VR	30.11	30.15
16	CLR	NC			9.00		79	71	74	77	5	15	30.09	30.14
19	CLR	NC			5.00	HZ	82	76	78	82	3	11	30.09	30.14
22	CLR	NC			5.00	BR	79	77	78	94	0	00	30.11	30.15
SUNRISE: 0544						**AUG 17**			**SUNSET: 1904**					
01	CLR	NC			5.00	BR	78	77	77	97	0	00	30.09	30.14
04	BKN	047			5.00	BR	77	76	76	96	3	27	30.08	30.13
07	SCT	NC			3.00	BR	78	76	77	93	6	30	30.08	30.13
10	CLR	NC			10.00		88	74	78	63	0	00	30.08	30.13
13	BKN	045			7.00	-RA	82	73	76	74	6	25	30.03	30.08
16	SCT	NC			10.00		90	74	79	59	12	20	29.95	30.00
19	CLR	NC			8.00		84	78	80	82	9	19	29.94	29.99
22	CLR	NC			7.00		80	77	78	90	7	21	29.95	30.00
SUNRISE: 0545						**AUG 18**			**SUNSET: 1903**					
01	CLR	NC			9.00		81	76	77	85	8	24	29.92	29.96
04	CLR	NC			10.00		78	74	75	87	8	23	29.90	29.94
07	CLR	NC			10.00		79	74	75	85	9	23	29.90	29.95
10	CLR	NC			6.00	HZ	88	76	79	68	8	24	29.89	29.94
13	CLR	NC			5.00	HZ	93	76	81	58	10	20	29.84	29.88
16	FEW	NC			5.00	HZ	93	78	82	62	14	21	29.79	29.84
19	CLR	NC			8.00		86	76	79	72	12	19	29.81	29.86
22	CLR	NC			10.00		83	76	78	79	12	20	29.85	29.90

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	DEW POINT	WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	SEA LEVEL
SUNRISE: 0546						**AUG 19**			**SUNSET: 1902**					
01	CLR	NC			10.00		82	76	78	82	10	20	29.83	29.87
04	CLR	NC			9.00		81	76	77	85	7	23	29.83	29.87
07	CLR	NC			6.00	HZ	81	75	77	82	8	23	29.87	29.91
10	CLR	NC			5.00	HZ	89	76	80	65	9	22	29.90	29.94
13	FEW	NC			5.00	HZ	93	76	81	58	13	20	29.87	29.92
16	CLR	NC			8.00		91	76	80	61	17	19	29.81	29.86
19	CLR	NC			9.00		84	75	78	74	8	19	29.91	29.95
22	BKN	050			6.00	-RA BR	72	70	71	94	0	00	29.94	29.98
SUNRISE: 0546						**AUG 20**			**SUNSET: 1860**					
01	CLR	NC			9.00		72	70	71	94	5	21	29.90	29.95
04	CLR	NC			8.00		73	70	71	90	10	27	29.86	29.90
07	CLR	NC			7.00		76	73	74	91	5	22	29.93	29.97
10	CLR	NC			10.00		84	71	75	65	3	VR	29.93	29.98
13	CLR	NC			10.00		88	67	74	50	8	25	29.94	29.99
16	FEW	NC			10.00		91	69	76	49	7	VR	29.89	29.94
19	CLR	NC			8.00		82	76	78	82	8	19	29.90	29.95
22	CLR	NC			10.00		82	76	78	82	13	18	29.88	29.93
SUNRISE: 0547						**AUG 21**			**SUNSET: 1859**					
01	CLR	NC			10.00		77	68	71	74	8	28	29.91	29.96
04	CLR	NC			10.00		76	66	70	72	7	27	29.88	29.93
07	FEW	NC			10.00		75	68	70	79	7	27	29.94	29.98
10	SCT	NC			10.00		83	73	76	72	9	26	29.93	29.97
13	BKN	038			10.00		90	73	78	58	7	VR	29.89	29.94
16	SCT	NC			9.00		91	70	76	50	6	27	29.86	29.90
19	CLR	NC			8.00		87	72	77	61	6	28	29.86	29.91
22	CLR	NC			10.00		81	78	79	91	7	21	29.92	29.96
SUNRISE: 0548						**AUG 22**			**SUNSET: 1858**					
01	FEW	NC			10.00		79	77	78	94	6	24	29.91	29.95
04	SCT	NC			5.00	BR	76	73	74	91	5	35	29.89	29.94
07	CLR	NC			4.00	HZ	77	72	74	85	5	36	29.92	29.97
10	CLR	NC			5.00	HZ	86	74	78	67	10	05	29.96	30.00
13	FEW	NC			6.00	HZ	91	67	75	45	6	36	29.92	29.97
16	BKN	070			5.00	HZ	86	72	76	63	15	13	29.90	29.95
19	FEW	NC			5.00	HZ	81	75	77	82	10	14	29.93	29.98
22	CLR	NC			5.00	HZ	80	75	77	85	7	12	29.96	30.01
SUNRISE: 0548						**AUG 23**			**SUNSET: 1856**					
01	CLR	NC			10.00		74	69	71	85	0	00	29.95	29.99
04	CLR	NC			7.00		74	72	73	94	3	05	29.92	29.97
07	FEW	NC			3.00	BR	76	74	75	94	3	36	29.96	30.01
10	SCT	NC			5.00	HZ	86	74	78	67	12	10	29.98	30.02
13	CLR	NC			6.00	HZ	89	68	75	50	15	12	29.95	30.00
16	CLR	NC			5.00	HZ	84	71	75	65	16	12	29.92	29.96
19	SCT	NC			5.00	HZ	81	73	75	77	10	12	29.94	29.98
22	CLR	NC			8.00		79	73	75	82	8	12	29.95	30.00
SUNRISE: 0549						**AUG 24**			**SUNSET: 1855**					
01	SCT	NC			5.00	BR	76	74	75	94	3	07	29.92	29.96
04	CLR	NC			4.00	BR	74	73	73	97	5	04	29.89	29.93
07	CLR	NC			3.00	BR	76	75	75	97	5	04	29.93	29.98
10	FEW	NC			10.00		85	73	77	68	5	15	29.95	29.99
13	BKN	060			10.00		83	74	77	74	9	12	29.93	29.98
16	FEW	NC			10.00		83	71	75	67	9	15	29.88	29.93
19	FEW	NC			10.00		80	73	75	79	7	16	29.90	29.94
22	CLR	NC			10.00		78	74	75	87	6	16	29.92	29.97

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					SUNRISE: 0550	**AUG 25**			**SUNSET: 1854**					
01	FEW	NC			10.00		77	74	75	90	5	15	29.90	29.95
04	CLR	NC			10.00		78	74	75	87	3	10	29.86	29.91
07	SCT	NC			10.00		76	73	74	91	7	20	29.91	29.95
10	CLR	NC			10.00		84	70	74	63	8	24	29.93	29.98
13	FEW	NC			10.00		88	71	76	57	8	25	29.89	29.93
16	SCT	NC			10.00		91	71	77	52	8	22	29.83	29.87
19	FEW	NC			9.00		82	75	77	79	9	19	29.85	29.89
22	CLR	NC			10.00		80	76	77	87	10	19	29.88	29.93
					SUNRISE: 0550	**AUG 26**			**SUNSET: 1853**					
01	CLR	NC			10.00		78	75	76	90	6	21	29.87	29.91
04	CLR	NC			10.00		77	75	76	94	3	18	29.84	29.89
07	FEW	NC			9.00		79	76	77	90	5	21	29.88	29.93
10	SCT	NC			10.00		87	74	78	65	9	24	29.90	29.94
13	FEW	NC			9.00		88	77	80	70	7	25	29.83	29.88
16	CLR	NC			10.00		86	76	79	72	15	19	29.83	29.88
19	CLR	NC			10.00		83	74	77	74	13	18	29.82	29.87
22	CLR	NC			10.00		80	76	77	87	8	19	29.85	29.90
					SUNRISE: 0551	**AUG 27**			**SUNSET: 1852**					
01	FEW	NC			10.00		79	76	77	90	6	17	29.84	29.89
04	CLR	NC			10.00		77	75	76	94	5	16	29.83	29.87
07	FEW	NC			10.00		80	78	79	94	5	19	29.86	29.91
10	CLR	NC			10.00		89	76	80	65	12	19	29.88	29.93
13	BKN	027			1.25	+TSRA BR	79	75	76	88	5	27	29.86	29.91
16	BKN	055			10.00	TS	80	73	75	79	9	33	29.84	29.89
19	BKN	070			5.00	BR	80	77	78	90	7	15	29.84	29.89
22	CLR	NC			10.00		79	77	78	94	5	17	29.86	29.91
					SUNRISE: 0552	**AUG 28**			**SUNSET: 1850**					
01	CLR	NC			9.00		77	77	77	100	0	00	29.85	29.89
04	CLR	NC			6.00	BR	76	76	76	100	0	00	29.83	29.88
07	CLR	NC			7.00		78	77	77	97	7	08	29.87	29.92
10	SCT	NC			10.00		87	76	79	70	5	VR	29.89	29.94
13	SCT	NC			10.00		86	78	80	77	8	07	29.88	29.92
16	CLR	NC			10.00		87	75	78	67	7	08	29.82	29.87
19	FEW	NC			10.00		83	74	77	74	9	07	29.83	29.88
22	CLR	NC			10.00		80	77	78	90	6	04	29.84	29.89
					SUNRISE: 0552	**AUG 29**			**SUNSET: 1849**					
01	CLR	NC			10.00		78	76	77	93	9	04	29.80	29.85
04	SCT	NC			9.00		77	76	76	96	9	02	29.75	29.80
07	BKN	009			8.00		78	76	77	93	13	03	29.76	29.81
10	BKN	013			1.75	+RA BR	78	76	77	93	13	04	29.77	29.82
13	OVC	017			9.00	-RA	79	77	78	94	21	02	29.69	29.74
16	BKN	019			10.00	-RA	79	76	77	90	21	01	29.62	29.67
19	OVC	028			6.00	-RA BR	78	74	75	87	24	36	29.58	29.63
22	BKN	028			6.00	-RA BR	76	74	75	94	13	34	29.57	29.62
					SUNRISE: 0553	**AUG 30**			**SUNSET: 1848**					
01	BKN	037			7.00		79	71	74	77	21	33	29.56	29.61
04	CLR	NC			6.00	HZ	78	70	73	76	15	32	29.60	29.65
07	CLR	NC			4.00	HZ	78	69	72	74	15	34	29.71	29.76
10	CLR	NC			9.00		79	58	66	49	18	35	29.82	29.86
13	CLR	NC			9.00		82	58	67	44	21	36	29.85	29.90
16	CLR	NC			9.00		83	57	67	41	10	36	29.86	29.90
19	CLR	NC			9.00		76	58	65	54	5	06	29.91	29.96
22	CLR	NC			10.00		69	56	61	63	8	05	29.99	30.04

HOUR (LST)	SKY COVER	CEILING 100'S OF FT	SATELLITE OBSERVATION TIME (LST)	SATELLITE EFF CLD AMT Oktas	VISIBILITY (MILES)	WEATHER	TEMPERATURE °F DRY BULB	TEMPERATURE °F DEW POINT	TEMPERATURE °F WET BULB	RELATIVE HUMIDITY (PCT)	WIND SPEED (MPH)	WIND DIRECTION TENS OF DEG	PRESSURE (INCHES,HG) STATION	PRESSURE (INCHES,HG) SEA LEVEL
					SUNRISE: 0554	**AUG 31**			**SUNSET: 1847**					
01	CLR	NC			10.00		67	53	59	61	12	05	30.03	30.07
04	CLR	NC			10.00		62	51	56	67	6	01	30.03	30.07
07	CLR	NC			10.00		64	53	58	68	8	01	30.06	30.11
10	CLR	NC			10.00		72	55	62	55	10	01	30.08	30.12
13	CLR	NC			10.00		79	60	67	52	10	36	30.05	30.09
16	CLR	NC			10.00		78	60	67	54	8	01	30.01	30.06
19	CLR	NC			10.00		71	59	64	66	6	35	30.00	30.05
22	CLR	NC			10.00		65	60	62	84	3	33	30.02	30.07

3-HOURLY OBSERVATION NOTES

Sky Cover is the amount of the sky obscured. CLR or SKC = 0, FEW = 1/8-2/8, SCT = 3/8-4/8, BKN = 5/8-7/8, OVC = 8/8, VV = Vertical Visibilty = 8/8.
Ceiling is reported in hundreds of feet above ground level for clouds at or below 12,000 feet. NC= No ceiling detected.
& = Original observation contained additional weather elements.
See page 3 for additional notes.

SUMMARY BY HOUR

HOUR (LST)	AVERAGES CEILOMETER	EFF CLD AMT	DRY BULB	DEW POINT	WET BULB	RELATIVE HUMIDITY	PRESSURE (INCHES,HG) STATION	PRESSURE (INCHES,HG) SEA LEVEL	VISIBILITY (MILES)	WIND SPEED (MPH)	RESULTANT WIND (MPH) SPEED	RESULTANT WIND (MPH) DIRECTION
01			78	74	75	89	29.87	29.92	6.97	6	1	24
02			77	74	75	89	29.86	29.91	6.85	6	2	24
03			77	74	75	90	29.86	29.90	6.56	5	1	28
04			76	73	74	90	29.86	29.90	6.38	5	2	29
05			76	73	74	91	29.87	29.91	6.02	5	2	26
06			76	73	74	91	29.88	29.93	5.13	5	2	27
07			78	74	75	88	29.89	29.94	5.29	6	2	31
08			81	74	76	79	29.90	29.95	6.84	8	3	31
09			84	73	76	71	29.91	29.95	7.06	8	1	31
10			86	73	77	64	29.91	29.96	7.06	6	0	0
11			88	73	77	62	29.91	29.95	7.18	8	1	24
12			89	72	77	58	29.90	29.94	7.31	9	1	19
13			89	72	77	58	29.89	29.93	7.02	9	1	21
14			90	71	77	57	29.87	29.92	7.05	11	3	18
15			89	72	77	58	29.85	29.90	7.23	10	2	17
16			88	71	77	59	29.85	29.89	7.61	10	4	16
17			87	72	77	64	29.85	29.89	7.58	12	6	18
18			85	73	77	68	29.85	29.90	7.36	11	5	17
19			83	73	76	74	29.86	29.91	7.40	9	5	18
20			81	73	76	79	29.88	29.92	7.74	8	3	19
21			80	74	76	83	29.89	29.93	7.21	7	4	18
22			79	74	76	86	29.89	29.94	7.32	6	4	18
23			79	74	76	87	29.89	29.94	7.35	7	4	21
24			78	74	75	88	29.89	29.93	7.29	6	2	24

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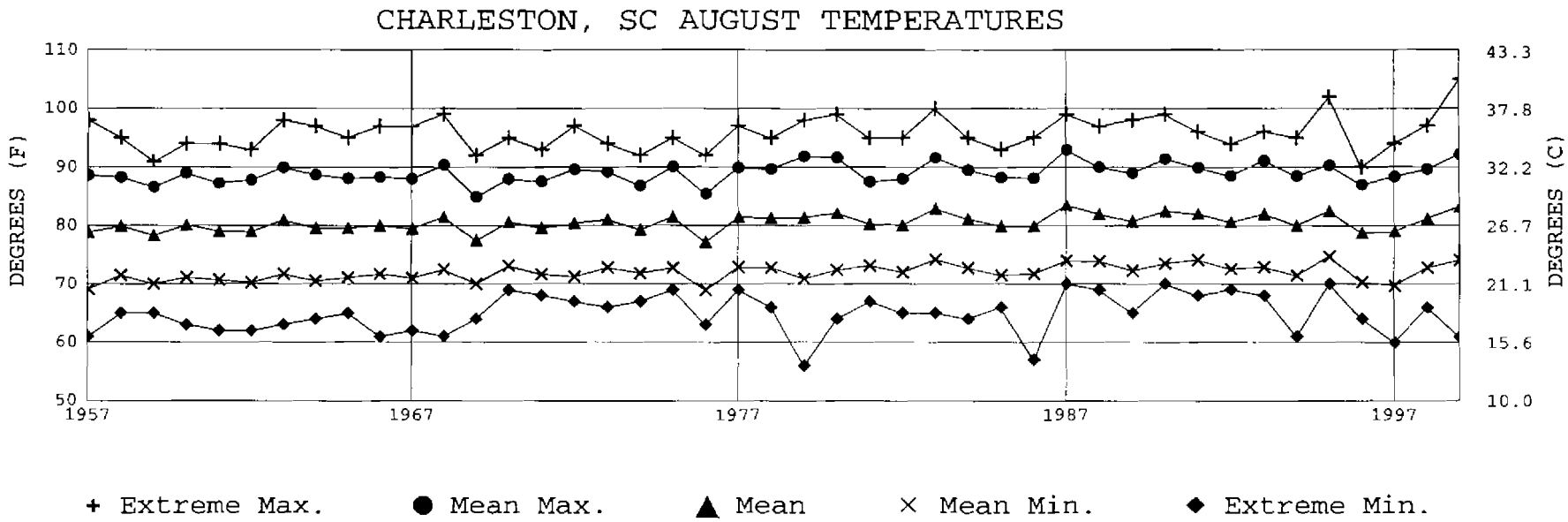
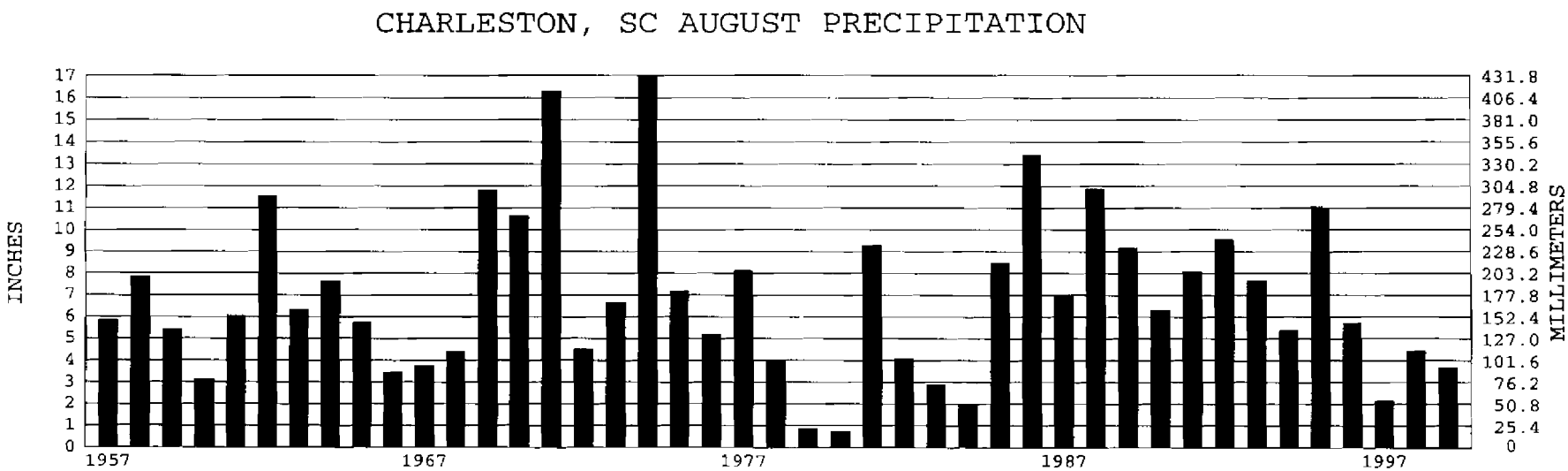


Long-Term (1957-1999) Mean: 80.5 1961-1990 Normal: 80.6



Long-Term (1957-1999) Mean Monthly Total: 6.90 1961-1990 Normal: 7.22

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

KALINITY	SAMPLE ID ------->	002-G-W004-03	002-G-W006-03	038-G-W002-03	038-G-W01D-03	039-G-W001-03	039-G-W002-03
	ORIGINAL ID ----->	002GW00403	002GW00603	038GW00203	038GW01D03	039GW00103	039GW00203
	LAB SAMPLE ID --->	39864.09	39883.20	39813.08	39813.01	39813.10	39813.09
	ID FROM REPORT -->	002GW00403	002GW00603	038GW00203	038GW01D03	039GW00103	039GW00203
	SAMPLE DATE ----->	08/06/99	08/09/99	08/04/99	08/04/99	08/04/99	08/04/99
	DATE ANALYZED --->	08/20/99	08/11/99	08/11/99	08/11/99	08/11/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	39883	39813	39813	39813	39813
471-34-1	Alkalinity (as CaCO3)	525.	20. U	162.	320.	312.	158.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ALINITY	SAMPLE ID ------->	039-G-W003-03	039-G-W004-03	039-G-W005-03	039-G-W006-03	039-G-W007-03	039-G-W008-03
	ORIGINAL ID ----->	039GW00303	039GW00403	039GW00503	039GW00603	039GW00703	039GW00803
	LAB SAMPLE ID --->	39813.02	39853.07	39813.11	39864.10	39883.15	39883.06
	ID FROM REPORT -->	039GW00303	039GW00403	039GW00503	039GW00603	039GW00703	039GW00803
	SAMPLE DATE ----->	08/04/99	08/05/99	08/04/99	08/06/99	08/09/99	08/07/99
	DATE ANALYZED --->	08/11/99	08/13/99	08/11/99	08/20/99	08/11/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39813	39853	39813	39864	39883	39883
471-34-1	Alkalinity (as CaCO3)	145.	166.	179.	371.	608.	790.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ALINITY	SAMPLE ID ------->	039-G-W009-04	039-G-W010-03	039-G-W011-03	039-G-W012-03	039-G-W013-03	039-G-W014-03
	ORIGINAL ID ----->	039GW00904	039GW01003	039GW01103	039GW01203	039GW01303	039GW01403
	LAB SAMPLE ID --->	39883.08	39864.11	39906.07	39853.03	39883.02	39813.04
	ID FROM REPORT -->	039GW00904	039GW01003	039GW01103	039GW01203	039GW01303	039GW01403
	SAMPLE DATE ----->	08/08/99	08/06/99	08/10/99	08/05/99	08/07/99	08/04/99
	DATE ANALYZED --->	08/11/99	08/20/99	08/17/99	08/13/99	08/11/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39864	39906	39853	39883	39813
471-34-1	Alkalinity (as CaCO3)	129.	123.	329.	203.	100.	179.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ALINITY							
	SAMPLE ID ------->	039-G-W016-04	039-G-W017-04	039-G-W018-04	039-G-W019-04	039-G-W020-03	039-G-W021-03
	ORIGINAL ID ----->	039GW01604	039GW01704	039GW01804	039GW01904	039GW02003	039GW02103
	LAB SAMPLE ID --->	39864.07	39864.03	39906.06	39883.03	39883.11	39906.05
	ID FROM REPORT -->	039GW01604	039GW01704	039GW01804	039GW01904	039GW02003	039GW02103
	SAMPLE DATE ----->	08/06/99	08/06/99	08/10/99	08/07/99	08/08/99	08/10/99
	DATE ANALYZED --->	08/20/99	08/20/99	08/17/99	08/11/99	08/11/99	08/17/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	39864	39906	39883	39883	39906
471-34-1	Alkalinity (as CaCO3)	166.	52.	128.	229.	25.	254.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

CALINITY							
	SAMPLE ID ------->	039-G-W022-03	039-G-W023-03	039-G-W04D-03	039-G-W04I-03	039-G-W08D-03	039-G-W09D-04
	ORIGINAL ID ----->	039GW02203	039GW02303	039GW04D03	039GW04I03	039GW08D03	039GW09D04
	LAB SAMPLE ID --->	39906.04	39906.02	39853.09	39853.08	39883.07	39883.10
	ID FROM REPORT -->	039GW02203	039GW02303	039GW04D03	039GW04I03	039GW08D03	039GW09D04
	SAMPLE DATE ----->	08/10/99	08/10/99	08/05/99	08/05/99	08/07/99	08/08/99
	DATE ANALYZED --->	08/17/99	08/17/99	08/13/99	08/13/99	08/11/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39906	39906	39853	39853	39883	39883
471-34-1	Alkalinity (as CaCO3)	156.	212.	171.	146.	67.	208.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

CALINITY	SAMPLE ID ------->	039-G-W09I-04	039-G-W10D-03	039-G-W10I-03	039-G-W12D-03	039-G-W12I-03	039-G-W13D-03
	ORIGINAL ID ----->	039GW09I04	039GW10D03	039GW10I03	039GW12D03	039GW12I03	039GW13D03
	LAB SAMPLE ID --->	39883.09	39813.06	39864.12	39853.02	39853.01	39864.04
	ID FROM REPORT -->	039GW09I04	039GW10D03	039GW10I03	039GW12D03	039GW12I03	039GW13D03
	SAMPLE DATE ----->	08/08/99	08/04/99	08/06/99	08/05/99	08/05/99	08/06/99
	DATE ANALYZED --->	08/11/99	08/11/99	08/20/99	08/13/99	08/13/99	08/20/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39813	39864	39853	39853	39864
471-34-1	Alkalinity (as CaCO3)	628.	216.	138.	120.	241.	214.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

KALINITY							
	SAMPLE ID ------->	039-G-W13I-03	039-G-W14D-03	039-G-W16D-04	039-G-W16I-04	039-G-W17D-04	039-G-W17I-04
	ORIGINAL ID ----->	039GW13I03	039GW14D03	039GW16D04	039GW16I04	039GW17D04	039GW17I04
	LAB SAMPLE ID --->	39883.01	39813.05	39864.05	39864.06	39864.01	39864.02
	ID FROM REPORT -->	039GW13I03	039GW14D03	039GW16D04	039GW16I04	039GW17D04	039GW17I04
	SAMPLE DATE ----->	08/07/99	08/04/99	08/06/99	08/06/99	08/06/99	08/06/99
	DATE ANALYZED --->	08/11/99	08/11/99	08/20/99	08/20/99	08/20/99	08/20/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39813	39864	39864	39864	39864
471-34-1	Alkalinity (as CaCO3)	108.	125.	177.	149.	99.	48.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

KALINITY

	SAMPLE ID ------->	039-G-W18D-04	039-G-W18I-04	039-G-W19D-04	039-G-W19I-04	039-G-W20D-03	039-G-W20I-03
	ORIGINAL ID ----->	039GW18D04	039GW18I04	039GW19D04	039GW19I04	039GW20D03	039GW20I03
	LAB SAMPLE ID --->	39853.04	39853.05	39883.05	39883.04	39883.13	39883.12
	ID FROM REPORT -->	039GW18D04	039GW18I04	039GW19D04	039GW19I04	039GW20D03	039GW20I03
	SAMPLE DATE ----->	08/05/99	08/05/99	08/07/99	08/07/99	08/08/99	08/08/99
	DATE ANALYZED --->	08/13/99	08/13/99	08/11/99	08/11/99	08/11/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39853	39853	39883	39883	39883	39883
471-34-1	Alkalinity (as CaCO3)	129.	270.	179.	171.	191.	112.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

.KALINITY	SAMPLE ID ------->	039-G-W21D-03	039-G-W21I-03	039-G-W22D-03	039-G-W23D-03	042-G-W002-03	042-G-W02D-03
	ORIGINAL ID ----->	039GW21D03	039GW21I03	039GW22D03	039GW23D03	042GW00203	042GW02D03
	LAB SAMPLE ID --->	39883.17	39883.16	39906.03	39906.01	39883.19	39883.18
	ID FROM REPORT -->	039GW21D03	039GW21I03	039GW22D03	039GW23D03	042GW00203	042GW02D03
	SAMPLE DATE ----->	08/09/99	08/09/99	08/10/99	08/10/99	08/09/99	08/09/99
	DATE ANALYZED --->	08/11/99	08/11/99	08/24/99	08/17/99	08/11/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39883	39906	39906	39883	39883
471-34-1	Alkalinity (as CaCO3)	815.	786.	56.2	266.	50.	316.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ON (FE)	SAMPLE ID ------->	002-G-W004-03	002-G-W006-03	038-G-W002-03	038-G-W01D-03	039-G-W001-03	039-G-W002-03
	ORIGINAL ID ----->	002GW00403	002GW00603	038GW002D3	038GW01D03	039GW00103	039GW00203
	LAB SAMPLE ID --->	39864.09	39883.20	39813.08	39813.01	39813.10	39813.09
	ID FROM REPORT -->	002GW00403	002GW00603	038GW00203	038GW01D03	039GW00103	039GW00203
	SAMPLE DATE ----->	08/06/99	08/09/99	08/04/99	08/04/99	08/04/99	08/04/99
	DATE ANALYZED --->	09/12/99	09/12/99	09/09/99	09/09/99	09/09/99	09/09/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	39883	39813	39813	39813	39813
7439-89-6	Iron (Fe)	88.	0.1	1.7	7.5	160.	14.5

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ON (FE)	SAMPLE ID ------->	039-G-W003-03	039-G-W004-03	039-G-W005-03	039-G-W006-03	039-G-W007-03	039-G-W008-03
	ORIGINAL ID ----->	039GW00303	039GW00403	039GW00503	039GW00603	039GW00703	039GW00803
	LAB SAMPLE ID --->	39813.02	39853.07	39813.11	39864.10	39883.15	39883.06
	ID FROM REPORT -->	039GW00303	039GW00403	039GW00503	039GW00603	039GW00703	039GW00803
	SAMPLE DATE ----->	08/04/99	08/05/99	08/04/99	08/06/99	08/09/99	08/07/99
	DATE ANALYZED --->	09/09/99	09/12/99	09/09/99	09/12/99	09/12/99	09/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39813	39853	39813	39864	39883	39883
7439-89-6	Iron (Fe)	0.2	101.	295.	4.4	45.2	43.3

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ON (FE)							
	SAMPLE ID ------->	039-G-W009-04	039-G-W010-03	039-G-W011-03	039-G-W012-03	039-G-W013-03	039-G-W014-03
	ORIGINAL ID ----->	039GW00904	039GW01003	039GW01103	039GW01203	039GW01303	039GW01403
	LAB SAMPLE ID --->	39883.08	39864.11	39906.07	39853.03	39883.02	39813.04
	ID FROM REPORT -->	039GW00904	039GW01003	039GW01103	039GW01203	039GW01303	039GW01403
	SAMPLE DATE ----->	08/08/99	08/06/99	08/10/99	08/05/99	08/07/99	08/04/99
	DATE ANALYZED --->	09/12/99	09/12/99	09/13/99	09/12/99	09/12/99	09/09/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39864	39906	39853	39883	39813
7439-89-6	Iron (Fe)	155.	10.1	83.9	119.	1.2	141.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

RON (FE)							
	SAMPLE ID ------->	039-G-W016-04	039-G-W017-04	039-G-W018-04	039-G-W019-04	039-G-W020-03	039-G-W021-03
	ORIGINAL ID ----->	039GW01604	039GW01704	039GW01804	039GW01904	039GW02003	039GW02103
	LAB SAMPLE ID --->	39864.07	39864.03	39906.06	39883.03	39883.11	39906.05
	ID FROM REPORT -->	039GW01604	039GW01704	039GW01804	039GW01904	039GW02003	039GW02103
	SAMPLE DATE ----->	08/06/99	08/06/99	08/10/99	08/07/99	08/08/99	08/10/99
	DATE ANALYZED --->	09/12/99	09/12/99	09/13/99	09/12/99	09/12/99	09/13/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	UG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	39864	39906	39883	39883	39906
7439-89-6	Iron (Fe)	7.6	0.5	30.3	367.	111.	17.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

?ON (FE)	SAMPLE ID ------->	039-G-W022-03	039-G-W023-03	039-G-W04D-03	039-G-W04I-03	039-G-W08D-03	039-G-W09D-04
	ORIGINAL ID ----->	039GW02203	039GW02303	039GW04D03	039GW04I03	039GW08D03	039GW09D04
	LAB SAMPLE ID --->	39906.04	39906.02	39853.09	39853.08	39883.07	39883.10
	ID FROM REPORT -->	039GW02203	039GW02303	039GW04D03	039GW04I03	039GW08D03	039GW09D04
	SAMPLE DATE ----->	08/10/99	08/10/99	08/05/99	08/05/99	08/07/99	08/08/99
	DATE ANALYZED --->	09/13/99	09/13/99	09/12/99	09/12/99	09/12/99	09/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39906	39906	39853	39853	39883	39883
7439-89-6	Iron (Fe)	252.	81.3	0.9	7.2	150.	3.6

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

RON (FE)	SAMPLE ID ------->	039-G-W09I-04	039-G-W10D-03	039-G-W10I-03	039-G-W12D-03	039-G-W12I-03	039-G-W13D-03
	ORIGINAL ID ----->	039GW09I04	039GW10D03	039GW10I03	039GW12D03	039GW12I03	039GW13D03
	LAB SAMPLE ID --->	39883.09	39813.06	39864.12	39853.02	39853.01	39864.04
	ID FROM REPORT -->	039GW09I04	039GW10D03	039GW10I03	039GW12D03	039GW12I03	039GW13D03
	SAMPLE DATE ----->	08/08/99	08/04/99	08/06/99	08/05/99	08/05/99	08/06/99
	DATE ANALYZED --->	09/12/99	09/09/99	09/12/99	09/12/99	09/12/99	09/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39813	39864	39853	39853	39864
7439-89-6	Iron (Fe)	9.2	0.5	73.5	2.4	1.7	0.6

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

RON (FE)	SAMPLE ID ------->	039-G-W13I-03	039-G-W14D-03	039-G-W16D-04	039-G-W16I-04	039-G-W17D-04	039-G-W17I-04
	ORIGINAL ID ----->	039GW13I03	039GW14D03	039GW16D04	039GW16I04	039GW17D04	039GW17I04
	LAB SAMPLE ID --->	39883.01	39813.05	39864.05	39864.06	39864.01	39864.02
	ID FROM REPORT -->	039GW13I03	039GW14D03	039GW16D04	039GW16I04	039GW17D04	039GW17I04
	SAMPLE DATE ----->	08/07/99	08/04/99	08/06/99	08/06/99	08/06/99	08/06/99
	DATE ANALYZED --->	09/12/99	09/09/99	08/27/99	09/12/99	09/12/99	09/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	UG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39813	39864	39864	39864	39864
7439-89-6	Iron (Fe)	0.4	5.9	5. U	2.8	9.3	0.1 U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ION (FE)	SAMPLE ID ------->	039-G-W18D-04	039-G-W18I-04	039-G-W19D-04	039-G-W19I-04	039-G-W20D-03	039-G-W20I-03
	ORIGINAL ID ----->	039GW18D04	039GW18I04	039GW19D04	039GW19I04	039GW20D03	039GW20I03
	LAB SAMPLE ID --->	39853.04	39853.05	39883.05	39883.04	39883.13	39883.12
	ID FROM REPORT -->	039GW18D04	039GW18I04	039GW19D04	039GW19I04	039GW20D03	039GW20I03
	SAMPLE DATE ----->	08/05/99	08/05/99	08/07/99	08/07/99	08/08/99	08/08/99
	DATE ANALYZED --->	09/12/99	09/12/99	09/12/99	09/12/99	09/12/99	09/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39853	39853	39883	39883	39883	39883
7439-89-6	Iron (Fe)	8.3	15.	1.1	7.2	1.8	7.1

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

RON (FE)	SAMPLE ID ------->	039-G-W21D-03	039-G-W21I-03	039-G-W22D-03	039-G-W23D-03	042-G-W002-03	042-G-W02D-03
	ORIGINAL ID ----->	039GW21D03	039GW21I03	039GW22D03	039GW23D03	042GW00203	042GW02D03
	LAB SAMPLE ID --->	39883.17	39883.16	39906.03	39906.01	39883.19	39883.18
	ID FROM REPORT -->	039GW21D03	039GW21I03	039GW22D03	039GW23D03	042GW00203	042GW02D03
	SAMPLE DATE ----->	08/09/99	08/09/99	08/10/99	08/10/99	08/09/99	08/09/99
	DATE ANALYZED --->	09/12/99	09/12/99	09/13/99	09/13/99	09/12/99	09/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39883	39906	39906	39883	39883
7439-89-6	Iron (Fe)	190.	30.	2.9	6.1	35.6	0.6

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

-NITRATE	SAMPLE ID ------->	039-G-W016-03	039-G-W017-03	039-G-W018-03	039-G-W019-03	039-G-W020-02	039-G-W021-02
	ORIGINAL ID ----->	039GW01603	039GW01703	039GW01803	039GW01903	039GW02002	039GW02102
	LAB SAMPLE ID --->	37429.01	37448.03	37457.01	37497.01	37471.03	37478.01
	ID FROM REPORT -->	039GW01603	039GW01703	039GW01803	039GW01903	039GW02002	039GW02102
	SAMPLE DATE ----->	02/12/99	02/15/99	02/16/99	02/19/99	02/17/99	02/18/99
	DATE ANALYZED --->	02/13/99	02/16/99	02/17/99	02/20/99	02/18/99	02/20/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	37429	37448	37457	37497	37471	37478
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.36	0.1 U	0.1 U	0.1 U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

NITRATE	SAMPLE ID ------->	039-G-W16D-03	039-G-W16I-03	039-G-W17D-03	039-G-W17I-03	039-G-W18D-03	039-G-W18I-03
	ORIGINAL ID ----->	039GW16D03	039GW16I03	039GW17D03	039GW17I03	039GW18D03	039GW18I03
	LAB SAMPLE ID --->	37429.03	37429.02	37448.05	37448.04	37457.03	37457.02
	ID FROM REPORT -->	039GW16D03	039GW16I03	039GW17D03	039GW17I03	039GW18D03	039GW18I03
	SAMPLE DATE ----->	02/12/99	02/12/99	02/15/99	02/15/99	02/16/99	02/16/99
	DATE ANALYZED --->	02/13/99	02/13/99	02/16/99	02/16/99	02/17/99	02/17/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	37429	37429	37448	37448	37457	37457
4797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.94	1.2	0.1 U	0.17

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

NITRATE	SAMPLE ID ------->	039-G-W19D-03	039-G-W19I-03	039-G-W20D-02	039-G-W20I-02	039-G-W21D-02	039-G-W21I-02
	ORIGINAL ID ----->	039GW19D03	039GW19I03	039GW20D02	039GW20I02	039GW21D02	039GW21I02
	LAB SAMPLE ID --->	37497.03	37497.02	37471.05	37471.04	37471.02	37471.01
	ID FROM REPORT -->	039GW19D03	039GW19I03	039GW20D02	039GW20I02	039GW21D02	039GW21I02
	SAMPLE DATE ----->	02/19/99	02/19/99	02/17/99	02/17/99	02/17/99	02/17/99
	DATE ANALYZED --->	02/20/99	02/20/99	02/18/99	02/18/99	02/18/99	02/18/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	37497	37497	37471	37471	37471	37471
4797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.91	0.39

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TRATE	SAMPLE ID ------->	002-G-W004-02	002-G-W006-02	038-G-W002-02	038-G-W01D-02	039-G-W001-02	039-G-W002-02
	ORIGINAL ID ----->	002GW00402	002GW00602	038GW00202	038GW01D02	039GW00102	039GW00202
	LAB SAMPLE ID --->	35864.01	35864.02	35848.06	35848.07	35848.08	35848.09
	ID FROM REPORT -->	002GW00402	002GW00602	038GW00202	038GW01D02	039GW00102	039GW00202
	SAMPLE DATE ----->	10/07/98	10/07/98	10/06/98	10/06/98	10/06/98	10/06/98
	DATE ANALYZED --->	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35848	35848	35848	35848	35848
9000-01-1	Nitrate-Nitrite-N	0.1 U	1.2	0.1 U	0.54	0.1 U	0.1 U
4797-55-8	Nitrate (as N)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ITRATE							
	SAMPLE ID ------->	039-G-W003-02	039-G-W004-02	039-G-W005-02	039-G-W006-02	039-G-W007-02	039-G-W008-02
	ORIGINAL ID ----->	039GW00302	039GW00402	039GW00502	039GW00602	039GW00702	039GW00802
	LAB SAMPLE ID --->	35848.04	35848.03	35848.05	35886.21	35864.03	35886.05
	ID FROM REPORT -->	039GW00302	039GW00402	039GW00502	039GW00602	039GW00702	039GW00802
	SAMPLE DATE ----->	10/06/98	10/06/98	10/06/98	10/08/98	10/07/98	10/08/98
	DATE ANALYZED --->	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35848	35848	35886	35848	35886
99000-01-1	Nitrate-Nitrite-N	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14797-55-8	Nitrate (as N)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TRATE							
	SAMPLE ID ------->	039-G-W009-02	039-G-W010-02	039-G-W011-02	039-G-W012-02	039-G-W013-02	039-G-W014-02
	ORIGINAL ID ----->	039GW00902	039GW01002	039GW01102	039GW01202	039GW01302	039GW01402
	LAB SAMPLE ID --->	35886.16	35864.09	35848.10	35864.11	35886.07	35864.05
	ID FROM REPORT -->	039GW00902	039GW01002	039GW01102	039GW01202	039GW01302	039GW01402
	SAMPLE DATE ----->	10/08/98	10/07/98	10/06/98	10/07/98	10/08/98	10/07/98
	DATE ANALYZED --->	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35848	35848	35848	35886	35848
9000-01-1	Nitrate-Nitrite-N	0.1 U	0.1 U	0.1 U	0.1 U	0.61	0.1 U
4797-55-8	Nitrate (as N)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TRATE							
	SAMPLE ID ------->	039-G-W016-02	039-G-W017-02	039-G-W018-02	039-G-W019-02	039-G-W04D-02	039-G-W04I-02
	ORIGINAL ID ----->	039GW01602	039GW01702	039GW01802	039GW01902	039GW04D02	039GW04I02
	LAB SAMPLE ID --->	35886.17	35886.10	35864.14	35886.03	35848.02	35848.01
	ID FROM REPORT -->	039GW01602	039GW01702	039GW01802	039GW01902	039GW04D02	039GW04I02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/07/98	10/08/98	10/06/98	10/06/98
	DATE ANALYZED --->	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35848	35886	35848	35848
9000-01-1	Nitrate-Nitrite-N	0.1 U	0.1 U	0.62	0.1 U	0.1 U	0.1 U
4797-55-8	Nitrate (as N)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TRATE							
	SAMPLE ID ------->	039-G-W08D-02	039-G-W09D-02	039-G-W09I-02	039-G-W10D-02	039-G-W10I-02	039-G-W12D-02
	ORIGINAL ID ----->	039GW08D02	039GW09D02	039GW09I02	039GW10D02	039GW10I02	039GW12D02
	LAB SAMPLE ID --->	35886.04	35886.15	35886.14	35864.07	35864.08	35864.12
	ID FROM REPORT -->	039GW08D02	039GW09D02	039GW09I02	039GW10D02	039GW10I02	039GW12D02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/08/98	10/07/98	10/07/98	10/07/98
	DATE ANALYZED --->	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35886	35848	35848	35848
9000-01-1	Nitrate-Nitrite-N	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14797-55-8	Nitrate (as N)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ITRATE							
	SAMPLE ID ------->	039-G-W12I-02	039-G-W13D-02	039-G-W13I-02	039-G-W14D-02	039-G-W16D-02	039-G-W16I-02
	ORIGINAL ID ----->	039GW12I02	039GW13D02	039GW13I02	039GW14D02	039GW16D02	039GW16I02
	LAB SAMPLE ID --->	35864.13	35886.09	35886.08	35864.06	35886.19	35886.18
	ID FROM REPORT -->	039GW12I02	039GW13D02	039GW13I02	039GW14D02	039GW16D02	039GW16I02
	SAMPLE DATE ----->	10/07/98	10/08/98	10/08/98	10/07/98	10/08/98	10/08/98
	DATE ANALYZED --->	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35886	35886	35848	35886	35886
99000-01-1	Nitrate-Nitrite-N	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14797-55-8	Nitrate (as N)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ITRATE	SAMPLE ID ------->	039-G-W17D-02	039-G-W17I-02	039-G-W18D-02	039-G-W18I-02	039-G-W19D-02	039-G-W19I-02
	ORIGINAL ID ----->	039GW17D02	039GW17I02	039GW18D02	039GW18I02	039GW19D02	039GW19I02
	LAB SAMPLE ID --->	35886.11	35886.12	35864.15	35864.16	35886.01	35886.02
	ID FROM REPORT -->	039GW17D02	039GW17I02	039GW18D02	039GW18I02	039GW19D02	039GW19I02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/07/98	10/07/98	10/08/98	10/08/98
	DATE ANALYZED --->	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35848	35848	35886	35886
99000-01-1	Nitrate-Nitrite-N	0.53	0.28	0.1 U	0.1 U	0.1 U	0.1 U
14797-55-8	Nitrate (as N)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

ITRATE							
	SAMPLE ID ------->	042-G-W001-02	042-G-W002-02	505-G-W001-02			
	ORIGINAL ID ----->	042GW00102	042GW00202	505GW00102			
	LAB SAMPLE ID --->	35886.22	35907.01	35907.02			
	ID FROM REPORT -->	042GW00102	042GW00202	505GW00102			
	SAMPLE DATE ----->	10/08/98	10/09/98	10/09/98			
	DATE ANALYZED --->	10/12/98	10/26/98	10/26/98			
	MATRIX ---------->	Water	Water	Water			
	UNITS ---------->	MG/L	MG/L	MG/L			
CAS #	Parameter	35886	35886	35886			
99000-01-1	Nitrate-Nitrite-N	0.1 U	0.1 U	0.1 U			
14797-55-8	Nitrate (as N)	NR	NR	NR			

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

PHOSPHOROU							
	SAMPLE ID ------->	039-G-W003-02	039-G-W004-02	039-G-W005-02	039-G-W006-02	039-G-W007-02	039-G-W008-02
	ORIGINAL ID ----->	039GW00302	039GW00402	039GW00502	039GW00602	039GW00702	039GW00802
	LAB SAMPLE ID --->	35848.04	35848.03	35848.05	35886.21	35864.03	35886.05
	ID FROM REPORT -->	039GW00302	039GW00402	039GW00502	039GW00602	039GW00702	039GW00802
	SAMPLE DATE ----->	10/06/98	10/06/98	10/06/98	10/08/98	10/07/98	10/08/98
	DATE EXTRACTED -->	10/12/98	10/12/98	10/12/98	10/18/98	10/13/98	10/18/98
	DATE ANALYZED --->	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35848	35848	35886	35848	35886
22569-71-7	Total phosphorus	0.19	0.49	0.46	0.1 U	0.27	0.35

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

PHOSPHOROU							
	SAMPLE ID ------->	039-G-W009-02	039-G-W010-02	039-G-W011-02	039-G-W012-02	039-G-W013-02	039-G-W014-02
	ORIGINAL ID ----->	039GW00902	039GW01002	039GW01102	039GW01202	039GW01302	039GW01402
	LAB SAMPLE ID --->	35886.16	35864.09	35848.10	35864.11	35886.07	35864.05
	ID FROM REPORT -->	039GW00902	039GW01002	039GW01102	039GW01202	039GW01302	039GW01402
	SAMPLE DATE ----->	10/08/98	10/07/98	10/06/98	10/07/98	10/08/98	10/07/98
	DATE EXTRACTED -->	10/18/98	10/13/98	10/12/98	10/13/98	10/18/98	10/13/98
	DATE ANALYZED --->	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35848	35848	35848	35886	35848
22569-71-7	Total phosphorus	0.15	0.1 U	0.19	0.22	0.12	0.4

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

PHOSPHOROU							
	SAMPLE ID ------->	039-G-W016-02	039-G-W017-02	039-G-W018-02	039-G-W019-02	039-G-W04D-02	039-G-W041-02
	ORIGINAL ID ----->	039GW01602	039GW01702	039GW01802	039GW01902	039GW04D02	039GW04102
	LAB SAMPLE ID --->	35886.17	35886.10	35864.14	35886.03	35848.02	35848.01
	ID FROM REPORT -->	039GW01602	039GW01702	039GW01802	039GW01902	039GW04D02	039GW04102
	SAMPLE DATE ----->	10/08/98	10/08/98	10/07/98	10/08/98	10/06/98	10/06/98
	DATE EXTRACTED -->	10/18/98	10/18/98	10/13/98	10/18/98	10/12/98	10/12/98
	DATE ANALYZED --->	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35848	35886	35848	35848
22569-71-7	Total phosphorus	0.19	2.9	0.4	0.51	0.12	0.19

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

PHOSPHOROU	SAMPLE ID ------->	039-G-W08D-02	039-G-W09D-02	039-G-W09I-02	039-G-W10D-02	039-G-W10I-02	039-G-W12D-02
	ORIGINAL ID ----->	039GW08D02	039GW09D02	039GW09I02	039GW10D02	039GW10I02	039GW12D02
	LAB SAMPLE ID --->	35886.04	35886.15	35886.14	35864.07	35864.08	35864.12
	ID FROM REPORT -->	039GW08D02	039GW09D02	039GW09I02	039GW10D02	039GW10I02	039GW12D02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/08/98	10/07/98	10/07/98	10/07/98
	DATE EXTRACTED -->	10/18/98	10/18/98	10/18/98	10/13/98	10/13/98	10/13/98
	DATE ANALYZED --->	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35886	35848	35848	35848
22569-71-7	Total phosphorus	1.3	0.26	0.29	0.26	0.1 U	0.19

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

PHOSPHOROU							
	SAMPLE ID ------->	039-G-W12I-02	039-G-W13D-02	039-G-W13I-02	039-G-W14D-02	039-G-W16D-02	039-G-W16I-02
	ORIGINAL ID ----->	039GW12I02	039GW13D02	039GW13I02	039GW14D02	039GW16D02	039GW16I02
	LAB SAMPLE ID --->	35864.13	35886.09	35886.08	35864.06	35886.19	35886.18
	ID FROM REPORT -->	039GW12I02	039GW13D02	039GW13I02	039GW14D02	039GW16D02	039GW16I02
	SAMPLE DATE ----->	10/07/98	10/08/98	10/08/98	10/07/98	10/08/98	10/08/98
	DATE EXTRACTED -->	10/13/98	10/18/98	10/18/98	10/13/98	10/18/98	10/18/98
	DATE ANALYZED --->	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35886	35886	35848	35886	35886
22569-71-7	Total phosphorus	0.23	1.2	0.23	0.31	0.25	0.32

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

PHOSPHOROU							
	SAMPLE ID ------->	039-G-W17D-02	039-G-W17I-02	039-G-W18D-02	039-G-W18I-02	039-G-W19D-02	039-G-W19I-02
	ORIGINAL ID ----->	039GW17D02	039GW17I02	039GW18D02	039GW18I02	039GW19D02	039GW19I02
	LAB SAMPLE ID --->	35886.11	35886.12	35864.15	35864.16	35886.01	35886.02
	ID FROM REPORT -->	039GW17D02	039GW17I02	039GW18D02	039GW18I02	039GW19D02	039GW19I02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/07/98	10/07/98	10/08/98	10/08/98
	DATE EXTRACTED -->	10/18/98	10/18/98	10/13/98	10/13/98	10/18/98	10/18/98
	DATE ANALYZED --->	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35848	35848	35886	35886
22569-71-7	Total phosphorus	0.12	0.29	0.37	2.	0.34	0.25

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

PHOSPHOROU	SAMPLE ID ------->	042-G-W001-02	042-G-W002-02	505-G-W001-02			
	ORIGINAL ID ----->	042GW00102	042GW00202	505GW00102			
	LAB SAMPLE ID --->	35886.22	35907.01	35907.02			
	ID FROM REPORT -->	042GW00102	042GW00202	505GW00102			
	SAMPLE DATE ----->	10/08/98	10/09/98	10/09/98			
	DATE EXTRACTED -->	10/18/98	10/18/98	10/18/98			
	DATE ANALYZED --->	10/21/98	10/22/98	10/22/98			
	MATRIX ---------->	Water	Water	Water			
	UNITS ---------->	MG/L	MG/L	MG/L			
CAS #	Parameter	35886	35886	35886			
22569-71-7	Total phosphorus	0.14	0.14	0.78			

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFANITRA							
	SAMPLE ID ------->	002-G-W004-03	002-G-W006-03	038-G-W002-03	038-G-W01D-03	039-G-W001-03	039-G-W002-03
	ORIGINAL ID ----->	002GW00403	002GW00603	038GW00203	038GW01D03	039GW00103	039GW00203
	LAB SAMPLE ID --->	39864.09	39883.20	39813.08	39813.01	39813.10	39813.09
	ID FROM REPORT -->	002GW00403	002GW00603	038GW00203	038GW01D03	039GW00103	039GW00203
	SAMPLE DATE ----->	08/06/99	08/09/99	08/04/99	08/04/99	08/04/99	08/04/99
	DATE ANALYZED --->	08/07/99	08/12/99	08/05/99	08/05/99	08/06/99	08/06/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	39883	39813	39813	39813	39813
14797-55-8	Nitrate (as N)	0.1 U	1.	0.1 U	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	4.9	31.7	12.6	9.6	2.4	19.1

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULF&NITRA							
	SAMPLE ID ------->	039-G-W003-03	039-G-W004-03	039-G-W005-03	039-G-W006-03	039-G-W007-03	039-G-W008-03
	ORIGINAL ID ----->	039GW00303	039GW00403	039GW00503	039GW00603	039GW00703	039GW00803
	LAB SAMPLE ID --->	39813.02	39853.07	39813.11	39864.10	39883.15	39883.06
	ID FROM REPORT -->	039GW00303	039GW00403	039GW00503	039GW00603	039GW00703	039GW00803
	SAMPLE DATE ----->	08/04/99	08/05/99	08/04/99	08/06/99	08/09/99	08/07/99
	DATE ANALYZED --->	08/05/99	08/07/99	08/06/99	08/07/99	08/12/99	08/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39813	39853	39813	39864	39883	39883
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	17.2	34.9	6.	4.5	1.7	76.7

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFENITRA							
	SAMPLE ID ------->	039-G-W009-04	039-G-W010-03	039-G-W011-03	039-G-W012-03	039-G-W013-03	039-G-W014-03
	ORIGINAL ID ----->	039GW00904	039GW01003	039GW01103	039GW01203	039GW01303	039GW01403
	LAB SAMPLE ID --->	39883.08	39864.11	39906.07	39853.03	39883.02	39813.04
	ID FROM REPORT -->	039GW00904	039GW01003	039GW01103	039GW01203	039GW01303	039GW01403
	SAMPLE DATE ----->	08/08/99	08/06/99	08/10/99	08/05/99	08/07/99	08/04/99
	DATE ANALYZED --->	08/12/99	08/08/99	08/12/99	08/07/99	08/12/99	08/05/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39864	39906	39853	39883	39813
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.28	0.1 U
14808-79-8	Sulfate	6.4	2.4	0.2 U	4.5	29.9	2.2

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULF&NITRA							
	SAMPLE ID ------->	039-G-W016-04	039-G-W017-04	039-G-W018-04	039-G-W019-04	039-G-W020-03	039-G-W021-03
	ORIGINAL ID ----->	039GW01604	039GW01704	039GW01804	039GW01904	039GW02003	039GW02103
	LAB SAMPLE ID --->	39864.07	39864.03	39906.06	39883.03	39883.11	39906.05
	ID FROM REPORT -->	039GW01604	039GW01704	039GW01804	039GW01904	039GW02003	039GW02103
	SAMPLE DATE ----->	08/06/99	08/06/99	08/10/99	08/07/99	08/08/99	08/10/99
	DATE ANALYZED --->	08/07/99	08/07/99	08/12/99	08/12/99	08/12/99	08/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ----------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	39864	39906	39883	39883	39906
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.27	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	22.8	1.5	29.6	0.34	96.5	5.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFNITRA							
	SAMPLE ID ------->	039-G-W022-03	039-G-W023-03	039-G-W04D-03	039-G-W04I-03	039-G-W08D-03	039-G-W09D-04
	ORIGINAL ID ----->	039GW02203	039GW02303	039GW04D03	039GW04I03	039GW08D03	039GW09D04
	LAB SAMPLE ID --->	39906.04	39906.02	39853.09	39853.08	39883.07	39883.10
	ID FROM REPORT -->	039GW02203	039GW02303	039GW04D03	039GW04I03	039GW08D03	039GW09D04
	SAMPLE DATE ----->	08/10/99	08/10/99	08/05/99	08/05/99	08/07/99	08/08/99
	DATE ANALYZED --->	08/12/99	08/12/99	08/07/99	08/07/99	08/12/99	08/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39906	39906	39853	39853	39883	39883
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	15.5	30.	9.2	25.8	138.	2.9

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFENITRA							
	SAMPLE ID ------->	039-G-W09I-04	039-G-W10D-03	039-G-W10I-03	039-G-W12D-03	039-G-W12I-03	039-G-W13D-03
	ORIGINAL ID ----->	039GW09I04	039GW10D03	039GW10I03	039GW12D03	039GW12I03	039GW13D03
	LAB SAMPLE ID --->	39883.09	39813.06	39864.12	39853.02	39853.01	39864.04
	ID FROM REPORT -->	039GW09I04	039GW10D03	039GW10I03	039GW12D03	039GW12I03	039GW13D03
	SAMPLE DATE ----->	08/08/99	08/04/99	08/06/99	08/05/99	08/05/99	08/06/99
	DATE ANALYZED --->	08/12/99	08/05/99	08/08/99	08/07/99	08/07/99	08/07/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39813	39864	39853	39853	39864
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	4.3	22.6	0.71	13.7	10.4	30.2

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFNITRA							
	SAMPLE ID ------->	039-G-W13I-03	039-G-W14D-03	039-G-W16D-04	039-G-W16I-04	039-G-W17D-04	039-G-W17I-04
	ORIGINAL ID ----->	039GW13I03	039GW14D03	039GW16D04	039GW16I04	039GW17D04	039GW17I04
	LAB SAMPLE ID --->	39883.01	39813.05	39864.05	39864.06	39864.01	39864.02
	ID FROM REPORT -->	039GW13I03	039GW14D03	039GW16D04	039GW16I04	039GW17D04	039GW17I04
	SAMPLE DATE ----->	08/07/99	08/04/99	08/06/99	08/06/99	08/06/99	08/06/99
	DATE ANALYZED --->	08/12/99	08/05/99	08/07/99	08/07/99	08/07/99	08/07/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39813	39864	39864	39864	39864
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	1.	0.8
14808-79-8	Sulfate	21.7	31.	35.3	8.2	66.4	73.9

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULF&NITRA							
	SAMPLE ID ------->	039-G-W18D-04	039-G-W18I-04	039-G-W19D-04	039-G-W19I-04	039-G-W20D-03	039-G-W20I-03
	ORIGINAL ID ----->	039GW18D04	039GW18I04	039GW19D04	039GW19I04	039GW20D03	039GW20I03
	LAB SAMPLE ID --->	39853.04	39853.05	39883.05	39883.04	39883.13	39883.12
	ID FROM REPORT -->	039GW18D04	039GW18I04	039GW19D04	039GW19I04	039GW20D03	039GW20I03
	SAMPLE DATE ----->	08/05/99	08/05/99	08/07/99	08/07/99	08/08/99	08/08/99
	DATE ANALYZED --->	08/07/99	08/07/99	08/12/99	08/12/99	08/12/99	08/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39853	39853	39883	39883	39883	39883
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	22.4	15.4	11.4	1.5	4.4	31.6

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFRNITRA							
	SAMPLE ID ------->	039-G-W21D-03	039-G-W21I-03	039-G-W22D-03	039-G-W23D-03	042-G-W002-03	042-G-W02D-03
	ORIGINAL ID ----->	039GW21D03	039GW21I03	039GW22D03	039GW23D03	042GW00203	042GW02D03
	LAB SAMPLE ID --->	39883.17	39883.16	39906.03	39906.01	39883.19	39883.18
	ID FROM REPORT -->	039GW21D03	039GW21I03	039GW22D03	039GW23D03	042GW00203	042GW02D03
	SAMPLE DATE ----->	08/09/99	08/09/99	08/10/99	08/10/99	08/09/99	08/09/99
	DATE ANALYZED --->	08/12/99	08/12/99	08/12/99	08/12/99	08/12/99	08/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39883	39906	39906	39883	39883
14797-55-8	Nitrate (as N)	6.1	0.1 U	0.13	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	44.2	55.8	12.	96.5	92.	96.4

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFATE							
	SAMPLE ID ------->	002-G-W004-02	002-G-W006-02	038-G-W002-02	038-G-W01D-02	039-G-W001-02	039-G-W002-02
	ORIGINAL ID ----->	002GW00402	002GW00602	038GW00202	038GW01D02	039GW00102	039GW00202
	LAB SAMPLE ID --->	35864.01	35864.02	35848.06	35848.07	35848.08	35848.09
	ID FROM REPORT -->	002GW00402	002GW00602	038GW00202	038GW01D02	039GW00102	039GW00202
	SAMPLE DATE ----->	10/07/98	10/07/98	10/06/98	10/06/98	10/06/98	10/06/98
	DATE ANALYZED --->	10/26/98	10/26/98	10/23/98	10/23/98	10/23/98	10/23/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35848	35848	35848	35848	35848
14808-79-8	Sulfate	31.	36.	12.	17.	49.	2600.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFATE							
	SAMPLE ID ------->	039-G-W003-02	039-G-W004-02	039-G-W005-02	039-G-W006-02	039-G-W007-02	039-G-W008-02
	ORIGINAL ID ----->	039GW00302	039GW00402	039GW00502	039GW00602	039GW00702	039GW00802
	LAB SAMPLE ID --->	35848.04	35848.03	35848.05	35886.21	35864.03	35886.05
	ID FROM REPORT -->	039GW00302	039GW00402	039GW00502	039GW00602	039GW00702	039GW00802
	SAMPLE DATE ----->	10/06/98	10/06/98	10/06/98	10/08/98	10/07/98	10/08/98
	DATE ANALYZED --->	10/23/98	10/23/98	10/23/98	10/27/98	10/26/98	10/27/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35848	35848	35886	35848	35886
14808-79-8	Sulfate	16.	66.	100.	8.7	14.	360.

NATURAL ATTENUATION-CHARLESTON
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SULFATE							
	SAMPLE ID ------->	039-G-W009-02	039-G-W010-02	039-G-W011-02	039-G-W012-02	039-G-W013-02	039-G-W014-02
	ORIGINAL ID ----->	039GW00902	039GW01002	039GW01102	039GW01202	039GW01302	039GW01402
	LAB SAMPLE ID --->	35886.16	35864.09	35848.10	35864.11	35886.07	35864.05
	ID FROM REPORT -->	039GW00902	039GW01002	039GW01102	039GW01202	039GW01302	039GW01402
	SAMPLE DATE ----->	10/08/98	10/07/98	10/06/98	10/07/98	10/08/98	10/07/98
	DATE ANALYZED --->	10/27/98	10/26/98	10/23/98	10/26/98	10/27/98	10/26/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35848	35848	35848	35886	35848
14808-79-8	Sulfate	9.	7.9	28.	22.	30.	54.

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SULFATE							
	SAMPLE ID ------->	039-G-W016-02	039-G-W017-02	039-G-W018-02	039-G-W019-02	039-G-W04D-02	039-G-W04I-02
	ORIGINAL ID ----->	039GW01602	039GW01702	039GW01802	039GW01902	039GW04D02	039GW04I02
	LAB SAMPLE ID --->	35886.17	35886.10	35864.14	35886.03	35848.02	35848.01
	ID FROM REPORT -->	039GW01602	039GW01702	039GW01802	039GW01902	039GW04D02	039GW04I02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/07/98	10/08/98	10/06/98	10/06/98
	DATE ANALYZED --->	10/27/98	10/27/98	10/26/98	10/27/98	10/23/98	10/23/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35848	35886	35848	35848
14808-79-8	Sulfate	15.	62.	44.	12.	1.4	30.

NATURAL ATTENUATION-CHARLESTON
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SULFATE							
	SAMPLE ID ------->	039-G-W08D-02	039-G-W09D-02	039-G-W09I-02	039-G-W10D-02	039-G-W10I-02	039-G-W12D-02
	ORIGINAL ID ----->	039GW08D02	039GW09D02	039GW09I02	039GW10D02	039GW10I02	039GW12D02
	LAB SAMPLE ID --->	35886.04	35886.15	35886.14	35864.07	35864.08	35864.12
	ID FROM REPORT -->	039GW08D02	039GW09D02	039GW09I02	039GW10D02	039GW10I02	039GW12D02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/08/98	10/07/98	10/07/98	10/07/98
	DATE ANALYZED --->	10/27/98	10/27/98	10/27/98	10/26/98	10/26/98	10/26/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35886	35848	35848	35848
14808-79-8	Sulfate	140.	9.	10.	19.	17.	9.8

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SULFATE							
	SAMPLE ID ------->	039-G-W12I-02	039-G-W13D-02	039-G-W13I-02	039-G-W14D-02	039-G-W16D-02	039-G-W16I-02
	ORIGINAL ID ----->	039GW12I02	039GW13D02	039GW13I02	039GW14D02	039GW16D02	039GW16I02
	LAB SAMPLE ID --->	35864.13	35886.09	35886.08	35864.06	35886.19	35886.18
	ID FROM REPORT -->	039GW12I02	039GW13D02	039GW13I02	039GW14D02	039GW16D02	039GW16I02
	SAMPLE DATE ----->	10/07/98	10/08/98	10/08/98	10/07/98	10/08/98	10/08/98
	DATE ANALYZED --->	10/26/98	10/27/98	10/27/98	10/26/98	10/27/98	10/27/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35886	35886	35848	35886	35886
14808-79-8	Sulfate	11.	26.	17.	32.	37.	11.

NATURAL ATTENUATION-CHARLESTON
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SULFATE							
	SAMPLE ID ------->	039-G-W17D-02	039-G-W17I-02	039-G-W18D-02	039-G-W18I-02	039-G-W19D-02	039-G-W19I-02
	ORIGINAL ID ----->	039GW17D02	039GW17I02	039GW18D02	039GW18I02	039GW19D02	039GW19I02
	LAB SAMPLE ID --->	35886.11	35886.12	35864.15	35864.16	35886.01	35886.02
	ID FROM REPORT -->	039GW17D02	039GW17I02	039GW18D02	039GW18I02	039GW19D02	039GW19I02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/07/98	10/07/98	10/08/98	10/08/98
	DATE ANALYZED --->	10/27/98	10/27/98	10/26/98	10/26/98	10/27/98	10/27/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35848	35848	35886	35886
14808-79-8	Sulfate	58.	65.	35.	24.	5.9	18.

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SULFATE	SAMPLE ID ------->	042-G-W001-02	042-G-W002-02	505-G-W001-02			
	ORIGINAL ID ----->	042GW00102	042GW00202	505GW00102			
	LAB SAMPLE ID --->	35886.22	35907.01	35907.02			
	ID FROM REPORT -->	042GW00102	042GW00202	505GW00102			
	SAMPLE DATE ----->	10/08/98	10/09/98	10/09/98			
	DATE ANALYZED --->	10/27/98	10/29/98	10/29/98			
	MATRIX ---------->	Water	Water	Water			
	UNITS ---------->	MG/L	MG/L	MG/L			
CAS #	Parameter	35886	35886	35886			
14808-79-8	Sulfate	60.	100.	52.			

NATURAL ATTENUATION-CHARLESTON
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SULFATE-IC							
	SAMPLE ID ------->	039-G-W001-01	039-G-W002-01	039-G-W003-01	039-G-W004-01	039-G-W005-01	039-G-W006-01
	ORIGINAL ID ----->	039GW00101	039GW00201	039GW00301	039GW00401	039GW00501	039GW00601
	LAB SAMPLE ID --->	32813.04	32771.03	32813.05	32753.02	32771.02	32853.04
	ID FROM REPORT -->	039GW00101	039GW00201	039GW00301	039GW00401	039GW00501	039GW00601
	SAMPLE DATE ----->	02/17/98	02/13/98	02/17/98	02/12/98	02/13/98	02/18/98
	DATE ANALYZED --->	02/19/98	02/15/98	02/19/98	02/14/98	02/15/98	02/20/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32753	32753	32753	32753	32753	32753
16887-00-6	Chloride	7.5	8.1	12.6	12.1	9.8	387.
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	5520.	34.8	5710.	12.5	0.62	5620.

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SULFATE-IC							
	SAMPLE ID ------->	039-G-W007-01	039-G-W008-01	039-G-W009-01	039-G-W010-01	039-G-W011-01	039-G-W012-01
	ORIGINAL ID ----->	039GW00701	039GW00801	039GW00901	039GW01001	039GW01101	039GW01201
	LAB SAMPLE ID --->	32853.05	32894.03	32869.03	32853.01	32753.03	32813.02
	ID FROM REPORT -->	039GW00701	039GW00801	039GW00901	039GW01001	039GW01101	039GW01201
	SAMPLE DATE ----->	02/18/98	02/20/98	02/19/98	02/18/98	02/12/98	02/17/98
	DATE ANALYZED --->	02/20/98	02/22/98	02/22/98	02/20/98	02/14/98	02/19/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32753	32869	32869	32753	32753	32753
16887-00-6	Chloride	265.	68.8	4.1	0.2 U	5.7	0.2 U
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	5340.	997.	10.6	4490.	0.2 U	5090.

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

SULFATE-IC							
	SAMPLE ID ------->	039-G-W013-01	039-G-W014-01	039-G-W015-01	039-G-W04D-01	039-G-W04I-01	039-G-W08D-01
	ORIGINAL ID ----->	039GW01301	039GW01401	039GW01501	039GW04D01	039GW04I01	039GW08D01
	LAB SAMPLE ID --->	32869.06	32869.01	32894.01	32771.01	32753.01	32894.04
	ID FROM REPORT -->	039GW01301	039GW01401	039GW01501	039GW04D01	039GW04I01	039GW08D01
	SAMPLE DATE ----->	02/19/98	02/19/98	02/20/98	02/13/98	02/12/98	02/20/98
	DATE ANALYZED --->	02/22/98	02/22/98	02/22/98	02/15/98	02/14/98	02/22/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32869	32869	32869	32753	32753	32869
16887-00-6	Chloride	4.	16.5	1800.	16.4	6.4	14.
14797-55-8	Nitrate (as N)	0.34	0.1 U	0.1 U	0.34	0.13	0.1 U
14808-79-8	Sulfate	33.7	7.3	78.6	6.4	34.7	123.

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SULFATE-IC							
	SAMPLE ID ------->	039-G-W09D-01	039-G-W09I-01	039-G-W10D-01	039-G-W10I-01	039-G-W12D-01	039-G-W12I-01
	ORIGINAL ID ----->	039GW09D01	039GW09I01	039GW10D01	039GW10I01	039GW12D01	039GW12I01
	LAB SAMPLE ID --->	32869.05	32869.04	32853.03	32853.02	32813.01	32813.03
	ID FROM REPORT -->	039GW09D01	039GW09I01	039GW10D01	039GW10I01	039GW12D01	039GW12I01
	SAMPLE DATE ----->	02/19/98	02/19/98	02/18/98	02/18/98	02/17/98	02/17/98
	DATE ANALYZED --->	02/22/98	02/22/98	02/20/98	02/20/98	02/19/98	02/19/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32869	32869	32753	32753	32753	32753
16887-00-6	Chloride	14.9	9.3	7.	5.	0.2 U	11.8
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
14808-79-8	Sulfate	3.2	4.9	5700.	5510.	4930.	5210.

NATURAL ATTENUATION-CHARLESTON
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SULFATE-IC							
	SAMPLE ID ------->	039-G-W13D-01	039-G-W13I-01	039-G-W14D-01	039-G-W15D-01		
	ORIGINAL ID ----->	039GW13D01	039GW13I01	039GW14D01	039GW15D01		
	LAB SAMPLE ID --->	32869.08	32869.07	32869.02	32894.02		
	ID FROM REPORT -->	039GW13D01	039GW13I01	039GW14D01	039GW15D01		
	SAMPLE DATE ----->	02/19/98	02/19/98	02/19/98	02/20/98		
	DATE ANALYZED --->	02/22/98	02/22/98	02/22/98	02/23/98		
	MATRIX ---------->	Water	Water	Water	Water		
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L		
CAS #	Parameter	32869	32869	32869	32869		
16887-00-6	Chloride	13.9	7.4	6.	153.		
14797-55-8	Nitrate (as N)	0.1 U	0.1 U	0.1 U	0.1 U		
14808-79-8	Sulfate	26.7	19.9	28.4	49.8		

NATURAL ATTENUATION-CHARLESTON
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SULFIDE							
	SAMPLE ID ------->	002-G-W004-02	002-G-W004-03	002-G-W006-02	002-G-W006-03	038-G-W002-02	038-G-W002-03
	ORIGINAL ID ----->	002GW00402	002GW00403	002GW00602	002GW00603	038GW00202	038GW00203
	LAB SAMPLE ID --->	35864.01	39864.09	35864.02	39883.20	35848.06	39813.08
	ID FROM REPORT -->	002GW00402	002GW00403	002GW00602	002GW00603	038GW00202	038GW00203
	SAMPLE DATE ----->	10/07/98	08/06/99	10/07/98	08/09/99	10/06/98	08/04/99
	DATE ANALYZED --->	10/12/98	08/13/99	10/12/98	08/14/99	10/09/98	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39864	35848	39883	35848	39813
18496-25-8	Sulfide	1. U	1.4	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
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SULFIDE							
	SAMPLE ID ------->	038-G-W01D-02	038-G-W01D-03	039-G-W001-02	039-G-W001-03	039-G-W002-02	039-G-W002-03
	ORIGINAL ID ----->	038GW01D02	038GW01D03	039GW00102	039GW00103	039GW00202	039GW00203
	LAB SAMPLE ID --->	35848.07	39813.01	35848.08	39813.10	35848.09	39813.09
	ID FROM REPORT -->	038GW01D02	038GW01D03	039GW00102	039GW00103	039GW00202	039GW00203
	SAMPLE DATE ----->	10/06/98	08/04/99	10/06/98	08/04/99	10/06/98	08/04/99
	DATE ANALYZED --->	10/09/98	08/11/99	10/09/98	08/11/99	10/09/98	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39813	35848	39813	35848	39813
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
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SULFIDE							
	SAMPLE ID ------->	039-G-W003-02	039-G-W003-03	039-G-W004-02	039-G-W004-03	039-G-W005-02	039-G-W005-03
	ORIGINAL ID ----->	039GW00302	039GW00303	039GW00402	039GW00403	039GW00502	039GW00503
	LAB SAMPLE ID --->	35848.04	39813.02	35848.03	39853.07	35848.05	39813.11
	ID FROM REPORT -->	039GW00302	039GW00303	039GW00402	039GW00403	039GW00502	039GW00503
	SAMPLE DATE ----->	10/06/98	08/04/99	10/06/98	08/05/99	10/06/98	08/04/99
	DATE ANALYZED --->	10/09/98	08/11/99	10/09/98	08/11/99	10/09/98	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39813	35848	39853	35848	39813
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
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SULFIDE							
	SAMPLE ID ------->	039-G-W006-02	039-G-W006-03	039-G-W007-02	039-G-W007-03	039-G-W008-02	039-G-W008-03
	ORIGINAL ID ----->	039GW00602	039GW00603	039GW00702	039GW00703	039GW00802	039GW00803
	LAB SAMPLE ID --->	35886.21	39864.10	35864.03	39883.15	35886.05	39883.06
	ID FROM REPORT -->	039GW00602	039GW00603	039GW00702	039GW00703	039GW00802	039GW00803
	SAMPLE DATE ----->	10/08/98	08/06/99	10/07/98	08/09/99	10/08/98	08/07/99
	DATE ANALYZED --->	10/13/98	08/13/99	10/12/98	08/14/99	10/13/98	08/14/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39864	35848	39883	35886	39883
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
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SULFIDE							
	SAMPLE ID ------->	039-G-W009-02	039-G-W009-04	039-G-W010-02	039-G-W010-03	039-G-W011-02	039-G-W011-03
	ORIGINAL ID ----->	039GW00902	039GW00904	039GW01002	039GW01003	039GW01102	039GW01103
	LAB SAMPLE ID --->	35886.16	39883.08	35864.09	39864.11	35848.10	39906.07
	ID FROM REPORT -->	039GW00902	039GW00904	039GW01002	039GW01003	039GW01102	039GW01103
	SAMPLE DATE ----->	10/08/98	08/08/99	10/07/98	08/06/99	10/06/98	08/10/99
	DATE ANALYZED --->	10/13/98	08/14/99	10/12/98	08/13/99	10/09/98	08/17/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39883	35848	39864	35848	39906
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
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SULFIDE							
	SAMPLE ID ------->	039-G-W012-02	039-G-W012-03	039-G-W013-02	039-G-W013-03	039-G-W014-02	039-G-W014-03
	ORIGINAL ID ----->	039GW01202	039GW01203	039GW01302	039GW01303	039GW01402	039GW01403
	LAB SAMPLE ID --->	35864.11	39853.03	35886.07	39883.02	35864.05	39813.04
	ID FROM REPORT -->	039GW01202	039GW01203	039GW01302	039GW01303	039GW01402	039GW01403
	SAMPLE DATE ----->	10/07/98	08/05/99	10/08/98	08/07/99	10/07/98	08/04/99
	DATE ANALYZED --->	10/12/98	08/11/99	10/13/98	08/14/99	10/12/98	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39853	35886	39883	35848	39813
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
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SULFIDE							
	SAMPLE ID ------->	039-G-W016-02	039-G-W016-04	039-G-W017-02	039-G-W017-04	039-G-W018-02	039-G-W018-04
	ORIGINAL ID ----->	039GW01602	039GW01604	039GW01702	039GW01704	039GW01802	039GW01804
	LAB SAMPLE ID --->	35886.17	39864.07	35886.10	39864.03	35864.14	39906.06
	ID FROM REPORT -->	039GW01602	039GW01604	039GW01702	039GW01704	039GW01802	039GW01804
	SAMPLE DATE ----->	10/08/98	08/06/99	10/08/98	08/06/99	10/07/98	08/10/99
	DATE ANALYZED --->	10/13/98	08/13/99	10/13/98	08/13/99	10/12/98	08/17/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39864	35886	39864	35848	39906
18496-25-8	Sulfide	1. U	1. U	1. U	4.6	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	039-G-W019-02	039-G-W019-04	039-G-W020-03	039-G-W021-03	039-G-W022-03	039-G-W023-03
	ORIGINAL ID ----->	039GW01902	039GW01904	039GW02003	039GW02103	039GW02203	039GW02303
	LAB SAMPLE ID --->	35886.03	39883.03	39883.11	39906.05	39906.04	39906.02
	ID FROM REPORT -->	039GW01902	039GW01904	039GW02003	039GW02103	039GW02203	039GW02303
	SAMPLE DATE ----->	10/08/98	08/07/99	08/08/99	08/10/99	08/10/99	08/10/99
	DATE ANALYZED --->	10/13/98	08/14/99	08/14/99	08/17/99	08/17/99	08/17/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39883	39883	39906	39906	39906
18496-25-8	Sulfide	1. U	1. U	1. U	1.2	1. U	1.2

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	039-G-W04D-02	039-G-W04D-03	039-G-W04I-02	039-G-W04I-03	039-G-W08D-02	039-G-W08D-03
	ORIGINAL ID ----->	039GW04D02	039GW04D03	039GW04I02	039GW04I03	039GW08D02	039GW08D03
	LAB SAMPLE ID --->	35848.02	39853.09	35848.01	39853.08	35886.04	39883.07
	ID FROM REPORT -->	039GW04D02	039GW04D03	039GW04I02	039GW04I03	039GW08D02	039GW08D03
	SAMPLE DATE ----->	10/06/98	08/05/99	10/06/98	08/05/99	10/08/98	08/07/99
	DATE ANALYZED --->	10/09/98	08/11/99	10/09/98	08/11/99	10/13/98	08/14/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39853	35848	39853	35886	39883
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1.

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	039-G-W09D-02	039-G-W09D-04	039-G-W09I-02	039-G-W10D-02	039-G-W10D-03	039-G-W10I-02
	ORIGINAL ID ----->	039GW09D02	039GW09D04	039GW09I02	039GW10D02	039GW10D03	039GW10I02
	LAB SAMPLE ID --->	35886.15	39883.10	35886.14	35864.07	39813.06	35864.08
	ID FROM REPORT -->	039GW09D02	039GW09D04	039GW09I02	039GW10D02	039GW10D03	039GW10I02
	SAMPLE DATE ----->	10/08/98	08/08/99	10/08/98	10/07/98	08/04/99	10/07/98
	DATE ANALYZED --->	10/13/98	08/14/99	10/13/98	10/12/98	08/11/99	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39883	35886	35848	39813	35848
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	039-G-W10I-03	039-G-W12D-02	039-G-W12D-03	039-G-W12I-02	039-G-W12I-03	039-G-W13D-02
	ORIGINAL ID ----->	039GW10I03	039GW12D02	039GW12D03	039GW12I02	039GW12I03	039GW13D02
	LAB SAMPLE ID --->	39864.12	35864.12	39853.02	35864.13	39853.01	35886.09
	ID FROM REPORT -->	039GW10I03	039GW12D02	039GW12D03	039GW12I02	039GW12I03	039GW13D02
	SAMPLE DATE ----->	08/06/99	10/07/98	08/05/99	10/07/98	08/05/99	10/08/98
	DATE ANALYZED --->	08/13/99	10/12/98	08/11/99	10/12/98	08/11/99	10/13/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	35848	39853	35848	39853	35886
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	039-G-W13D-03	039-G-W13I-02	039-G-W13I-03	039-G-W14D-02	039-G-W14D-03	039-G-W16D-02
	ORIGINAL ID ----->	039GW13D03	039GW13I02	039GW13I03	039GW14D02	039GW14D03	039GW16D02
	LAB SAMPLE ID --->	39864.04	35886.08	39883.01	35864.06	39813.05	35886.19
	ID FROM REPORT -->	039GW13D03	039GW13I02	039GW13I03	039GW14D02	039GW14D03	039GW16D02
	SAMPLE DATE ----->	08/06/99	10/08/98	08/07/99	10/07/98	08/04/99	10/08/98
	DATE ANALYZED --->	08/13/99	10/13/98	08/14/99	10/12/98	08/11/99	10/13/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	35886	39883	35848	39813	35886
18496-25-8	Sulfide	1.2	1. U	1.8	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	039-G-W16D-04	039-G-W16I-02	039-G-W16I-04	039-G-W17D-02	039-G-W17D-04	039-G-W17I-02
	ORIGINAL ID ----->	039GW16D04	039GW16I02	039GW16I04	039GW17D02	039GW17D04	039GW17I02
	LAB SAMPLE ID --->	39864.05	35886.18	39864.06	35886.11	39864.01	35886.12
	ID FROM REPORT -->	039GW16D04	039GW16I02	039GW16I04	039GW17D02	039GW17D04	039GW17I02
	SAMPLE DATE ----->	08/06/99	10/08/98	08/06/99	10/08/98	08/06/99	10/08/98
	DATE ANALYZED --->	08/13/99	10/13/98	08/13/99	10/13/98	08/13/99	10/13/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	35886	39864	35886	39864	35886
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	039-G-W17I-04	039-G-W18D-02	039-G-W18D-04	039-G-W18I-02	039-G-W18I-04	039-G-W19D-02
	ORIGINAL ID ----->	039GW17I04	039GW18D02	039GW18D04	039GW18I02	039GW18I04	039GW19D02
	LAB SAMPLE ID --->	39864.02	35864.15	39853.04	35864.16	39853.05	35886.01
	ID FROM REPORT -->	039GW17I04	039GW18D02	039GW18D04	039GW18I02	039GW18I04	039GW19D02
	SAMPLE DATE ----->	08/06/99	10/07/98	08/05/99	10/07/98	08/05/99	10/08/98
	DATE ANALYZED --->	08/13/99	10/12/98	08/11/99	10/12/98	08/11/99	10/13/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	35848	39853	35848	39853	35886
18496-25-8	Sulfide	2.	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	039-G-W19D-04	039-G-W19I-02	039-G-W19I-04	039-G-W20D-03	039-G-W20I-03	039-G-W21D-03
	ORIGINAL ID ----->	039GW19D04	039GW19I02	039GW19I04	039GW20D03	039GW20I03	039GW21D03
	LAB SAMPLE ID --->	39883.05	35886.02	39883.04	39883.13	39883.12	39883.17
	ID FROM REPORT -->	039GW19D04	039GW19I02	039GW19I04	039GW20D03	039GW20I03	039GW21D03
	SAMPLE DATE ----->	08/07/99	10/08/98	08/07/99	08/08/99	08/08/99	08/09/99
	DATE ANALYZED --->	08/14/99	10/13/98	08/14/99	08/14/99	08/14/99	08/14/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	35886	39883	39883	39883	39883
18496-25-8	Sulfide	1. U	1. U	1. U	1. U	1. U	1.8

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE	SAMPLE ID ------->	039-G-W21I-03	039-G-W22D-03	039-G-W23D-03	042-G-W001-02	042-G-W002-02	042-G-W002-03
	ORIGINAL ID ----->	039GW21I03	039GW22D03	039GW23D03	042GW00102	042GW00202	042GW00203
	LAB SAMPLE ID --->	39883.16	39906.03	39906.01	35886.22	35907.01	39883.19
	ID FROM REPORT -->	039GW21I03	039GW22D03	039GW23D03	042GW00102	042GW00202	042GW00203
	SAMPLE DATE ----->	08/09/99	08/10/99	08/10/99	10/08/98	10/09/98	08/09/99
	DATE ANALYZED --->	08/14/99	08/17/99	08/17/99	10/13/98	10/15/98	08/14/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39883	39906	39906	35886	35886	39883
18496-25-8	Sulfide	4.4	1. U	1. U	1. U	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SULFIDE							
	SAMPLE ID ------->	042-G-W02D-03	505-G-W001-02				
	ORIGINAL ID ----->	042GW02D03	505GW00102				
	LAB SAMPLE ID --->	39883.18	35907.02				
	ID FROM REPORT -->	042GW02D03	505GW00102				
	SAMPLE DATE ----->	08/09/99	10/09/98				
	DATE ANALYZED --->	08/14/99	10/15/98				
	MATRIX ---------->	Water	Water				
	UNITS ---------->	MG/L	MG/L				
CAS #	Parameter	39883	35886				
18496-25-8	Sulfide	1. U	1. U				

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	002-G-W004-02		002-G-W004-03		002-G-W006-02		002-G-W006-03		038-G-W002-02		038-G-W002-03	
	ORIGINAL ID ----->	002GW00402		002GW00403		002GW00602		002GW00603		038GW00202		038GW00203	
	LAB SAMPLE ID --->	35864.01		39864.09		35864.02		39883.20		35848.06		39813.08	
	ID FROM REPORT -->	002GW00402		002GW00403		002GW00602		002GW00603		038GW00202		038GW00203	
	SAMPLE DATE ----->	10/07/98		08/06/99		10/07/98		08/09/99		10/06/98		08/04/99	
	DATE ANALYZED --->	10/12/98		08/12/99		10/12/98		08/16/99		10/09/98		08/06/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	35848		39864		35848		39883		35848		39813	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	1.	J
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	2.	J	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	6.		5.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	002-G-W004-02	002-G-W004-03	002-G-W006-02	002-G-W006-03	038-G-W002-02	038-G-W002-03
	ORIGINAL ID ----->	002GW00402	002GW00403	002GW00602	002GW00603	038GW00202	038GW00203
	LAB SAMPLE ID --->	35864.01	39864.09	35864.02	39883.20	35848.06	39813.08
	ID FROM REPORT -->	002GW00402	002GW00403	002GW00602	002GW00603	038GW00202	038GW00203
	SAMPLE DATE ----->	10/07/98	08/06/99	10/07/98	08/09/99	10/06/98	08/04/99
	DATE ANALYZED --->	10/12/98	08/12/99	10/12/98	08/16/99	10/09/98	08/06/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35848	39864	35848	39883	35848	39813
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	038-G-W01D-02		038-G-W01D-03		039-G-W001-02		039-G-W001-03		039-G-W002-02		039-G-W002-03	
	ORIGINAL ID ----->	038GW01D02		038GW01D03		039GW00102		039GW00103		039GW00202		039GW00203	
	LAB SAMPLE ID --->	35848.07		39813.01		35848.08		39813.10		35848.09		39813.09	
	ID FROM REPORT -->	038GW01D02		038GW01D03		039GW00102		039GW00103		039GW00202		039GW00203	
	SAMPLE DATE ----->	10/06/98		08/04/99		10/06/98		08/04/99		10/06/98		08/04/99	
	DATE ANALYZED --->	10/09/98		08/06/99		10/09/98		08/13/99		10/09/98		08/11/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	35848		39813		35848		39813		35848		39813	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	4.	J	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	140.		5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	7.		5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	53.		5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	260.		5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	6.		8.		7.		5.	U	49.		5.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	038-G-W01D-02	038-G-W01D-03	039-G-W001-02	039-G-W001-03	039-G-W002-02	039-G-W002-03
	ORIGINAL ID ----->	038GW01D02	038GW01D03	039GW00102	039GW00103	039GW00202	039GW00203
	LAB SAMPLE ID --->	35848.07	39813.01	35848.08	39813.10	35848.09	39813.09
	ID FROM REPORT -->	038GW01D02	038GW01D03	039GW00102	039GW00103	039GW00202	039GW00203
	SAMPLE DATE ----->	10/06/98	08/04/99	10/06/98	08/04/99	10/06/98	08/04/99
	DATE ANALYZED --->	10/09/98	08/06/99	10/09/98	08/13/99	10/09/98	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35848	39813	35848	39813	35848	39813
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA															
	SAMPLE ID ------->	039-G-W003-02		039-G-W003-03		039-G-W004-02		039-G-W004-03		039-G-W005-02		039-G-W005-03	
	ORIGINAL ID ----->	039GW00302		039GW00303		039GW00402		039GW00403		039GW00502		039GW00503	
	LAB SAMPLE ID --->	35848.04		39813.02		35848.03		39853.07		35848.05		39813.11	
	ID FROM REPORT -->	039GW00302		039GW00303		039GW00402		039GW00403		039GW00502		039GW00503	
	SAMPLE DATE ----->	10/06/98		08/04/99		10/06/98		08/05/99		10/06/98		08/04/99	
	DATE ANALYZED --->	10/08/98		08/06/99		10/08/98		08/11/99		10/08/98		08/13/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	35848		39813		35848		39853		35848		39813	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	1.	J	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	20.		5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	1.	J	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	10.		5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	1.	J	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	28.		16.		3.	J	2.	J	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	91.		5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	23.		3.	J	3.	J	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	8.		15.		33.		52.		90.		5.	U
156-59-2	cis-1,2-Dichloroethene	13.		1.	J	5.	J	5.	J	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W003-02	039-G-W003-03	039-G-W004-02	039-G-W004-03	039-G-W005-02	039-G-W005-03
	ORIGINAL ID ----->	039GW00302	039GW00303	039GW00402	039GW00403	039GW00502	039GW00503
	LAB SAMPLE ID --->	35848.04	39813.02	35848.03	39853.07	35848.05	39813.11
	ID FROM REPORT -->	039GW00302	039GW00303	039GW00402	039GW00403	039GW00502	039GW00503
	SAMPLE DATE ----->	10/06/98	08/04/99	10/06/98	08/05/99	10/06/98	08/04/99
	DATE ANALYZED --->	10/08/98	08/06/99	10/08/98	08/11/99	10/08/98	08/13/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35848	39813	35848	39853	35848	39813
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
		SAMPLE ID ------->	039-G-W006-02		039-G-W006-03		039-G-W007-02		039-G-W007-03		039-G-W008-02		039-G-W008-03
		ORIGINAL ID ----->	039GW00602		039GW00603		039GW00702		039GW00703		039GW00802		039GW00803
		LAB SAMPLE ID --->	35886.21		39864.10		35864.03		39883.15		35886.05		39883.06
		ID FROM REPORT -->	039GW00602		039GW00603		039GW00702		039GW00703		039GW00802		039GW00803
		SAMPLE DATE ----->	10/08/98		08/06/99		10/07/98		08/09/99		10/08/98		08/07/99
		DATE ANALYZED --->	10/13/98		08/12/99		10/12/98		08/16/99		10/12/98		08/12/99
		MATRIX ---------->	Water		Water		Water		Water		Water		Water
		UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L
CAS #	Parameter		35886		39864		35848		39883		35886		39883
74-87-3	Chloromethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
74-83-9	Bromomethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
75-01-4	Vinyl chloride		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
75-00-3	Chloroethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
75-09-2	Methylene chloride		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
67-64-1	Acetone		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
75-15-0	Carbon disulfide		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
75-35-4	1,1-Dichloroethene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
75-34-3	1,1-Dichloroethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
67-66-3	Chloroform		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
107-06-2	1,2-Dichloroethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
78-93-3	2-Butanone (MEK)		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
71-55-6	1,1,1-Trichloroethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
56-23-5	Carbon tetrachloride		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
75-27-4	Bromodichloromethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
78-87-5	1,2-Dichloropropane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
10061-01-5	cis-1,3-Dichloropropene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
79-01-6	Trichloroethene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
124-48-1	Dibromochloromethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
79-00-5	1,1,2-Trichloroethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
71-43-2	Benzene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
10061-02-6	trans-1,3-Dichloropropene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
75-25-2	Bromoform		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
108-10-1	4-Methyl-2-Pentanone (MIBK)		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
591-78-6	2-Hexanone		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
127-18-4	Tetrachloroethene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
79-34-5	1,1,2,2-Tetrachloroethane		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
108-88-3	Toluene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
108-90-7	Chlorobenzene		5.	U	5.	U	5.		5.	U	5.	U	5. U
100-41-4	Ethylbenzene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
100-42-5	Styrene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
1330-20-7	Xylene (Total)		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
108-05-4	Vinyl acetate		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
110-75-8	2-Chloroethyl vinyl ether		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
1634-04-4	Methyl tert-butyl ether		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
156-59-2	cis-1,2-Dichloroethene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U
156-60-5	trans-1,2-Dichloroethene		5.	U	5.	U	5.	U	5.	U	5.	U	5. U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	039-G-W006-02	039-G-W006-03	039-G-W007-02	039-G-W007-03	039-G-W008-02	039-G-W008-03
	ORIGINAL ID ----->	039GW00602	039GW00603	039GW00702	039GW00703	039GW00802	039GW00803
	LAB SAMPLE ID --->	35886.21	39864.10	35864.03	39883.15	35886.05	39883.06
	ID FROM REPORT -->	039GW00602	039GW00603	039GW00702	039GW00703	039GW00802	039GW00803
	SAMPLE DATE ----->	10/08/98	08/06/99	10/07/98	08/09/99	10/08/98	08/07/99
	DATE ANALYZED --->	10/13/98	08/12/99	10/12/98	08/16/99	10/12/98	08/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35886	39864	35848	39883	35886	39883
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	039-G-W009-02		039-G-W009-03		039-G-W009-04		039-G-W010-02		039-G-W010-03		039-G-W011-02	
	ORIGINAL ID ----->	039GW00902		039GW00903		039GW00904		039GW01002		039GW01003		039GW01102	
	LAB SAMPLE ID --->	35886.16		37478.02		39883.08		35864.09		39864.11		35848.10	
	ID FROM REPORT -->	039GW00902		039GW00903		039GW00904		039GW01002		039GW01003		039GW01102	
	SAMPLE DATE ----->	10/08/98		02/18/99		08/08/99		10/07/98		08/06/99		10/06/98	
	DATE ANALYZED --->	10/13/98		02/26/99		08/12/99		10/09/98		08/12/99		10/09/98	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	35886		37478		39883		35848		39864		35848	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	90.		5.	U	4.	J	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	14.		5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	6.		5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	10.		5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	16.		5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	47.		5.	U	5.	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	2.	J	5.	U	5.	U	5.	U	5.	U	210.	E
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	50.		5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	12.	
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	160.	
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	460.	
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	690.	E	5.	U	20.		5.	U	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	22.		5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	039-G-W009-02	039-G-W009-03	039-G-W009-04	039-G-W010-02	039-G-W010-03	039-G-W011-02
	ORIGINAL ID ----->	039GW00902	039GW00903	039GW00904	039GW01002	039GW01003	039GW01102
	LAB SAMPLE ID --->	35886.16	37478.02	39883.08	35864.09	39864.11	35848.10
	ID FROM REPORT -->	039GW00902	039GW00903	039GW00904	039GW01002	039GW01003	039GW01102
	SAMPLE DATE ----->	10/08/98	02/18/99	08/08/99	10/07/98	08/06/99	10/06/98
	DATE ANALYZED --->	10/13/98	02/26/99	08/12/99	10/09/98	08/12/99	10/09/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35886	37478	39883	35848	39864	35848
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA																	
	SAMPLE ID ------->	039-G-W011-03		039-G-W012-02		039-G-W012-03		039-G-W013-02		039-G-W013-03		039-G-W014-02	
	ORIGINAL ID ----->	039GW01103		039GW01202		039GW01203		039GW01302		039GW01303		039GW01402	
	LAB SAMPLE ID --->	39906.07		35864.11		39853.03		35886.07		39883.02		35864.05	
	ID FROM REPORT -->	039GW01103		039GW01202		039GW01203		039GW01302		039GW01303		039GW01402	
	SAMPLE DATE ----->	08/10/99		10/07/98		08/05/99		10/08/98		08/07/99		10/07/98	
	DATE ANALYZED --->	08/17/99		10/12/98		08/10/99		10/12/98		08/12/99		10/09/98	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39906		35848		39853		35886		39883		35848	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	65.		7.		5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	6.		3.	J	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	20.		4.	J	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	110.		87.		5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	96.		18.		5.	U	5.	U	5.	U	10.	
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	1.	J	1.	J	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	2.	J	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	44.		3.	J	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	120.		3.	J	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	54.		50.		5.	U	5.	U	12.	
156-59-2	cis-1,2-Dichloroethene	5.	U	380.	E	170.		12.		15.		5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	10.		5.		5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	039-G-W011-03	039-G-W012-02	039-G-W012-03	039-G-W013-02	039-G-W013-03	039-G-W014-02
	ORIGINAL ID ----->	039GW01103	039GW01202	039GW01203	039GW01302	039GW01303	039GW01402
	LAB SAMPLE ID --->	39906.07	35864.11	39853.03	35886.07	39883.02	35864.05
	ID FROM REPORT -->	039GW01103	039GW01202	039GW01203	039GW01302	039GW01303	039GW01402
	SAMPLE DATE ----->	08/10/99	10/07/98	08/05/99	10/08/98	08/07/99	10/07/98
	DATE ANALYZED --->	08/17/99	10/12/98	08/10/99	10/12/98	08/12/99	10/09/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39906	35848	39853	35886	39883	35848
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA																			
	SAMPLE ID ------->	039-G-W014-03		039-G-W016-02		039-G-W016-03		039-G-W016-04		039-G-W017-02		039-G-W017-03	
	ORIGINAL ID ----->	039GW01403		039GW01602		039GW01603		039GW01604		039GW01702		039GW01703	
	LAB SAMPLE ID --->	39813.04		35886.17		37429.01		39864.07		35886.10		37448.03	
	ID FROM REPORT -->	039GW01403		039GW01602		039GW01603		039GW01604		039GW01702		039GW01703	
	SAMPLE DATE ----->	08/04/99		10/08/98		02/12/99		08/06/99		10/08/98		02/15/99	
	DATE ANALYZED --->	08/06/99		10/13/98		02/25/99		08/11/99		10/12/98		02/24/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39813		35886		37429		39864		35886		37448	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	69.		4.	J	40.		5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	1.	J	5.	U	5.	U	5.	U
67-64-1	Acetone	15.		5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	8.		5.	U	4.	J	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	15.		5.	U	7.		5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	23.		5.	U	13.		5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	2.	J	5.	U	1.	J	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	40.		5.	U	9.		5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	14.		5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	510.	E	38.		260.	E	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	13.		5.	U	9.		5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	039-G-W014-03	039-G-W016-02	039-G-W016-03	039-G-W016-04	039-G-W017-02	039-G-W017-03
	ORIGINAL ID ----->	039GW01403	039GW01602	039GW01603	039GW01604	039GW01702	039GW01703
	LAB SAMPLE ID --->	39813.04	35886.17	37429.01	39864.07	35886.10	37448.03
	ID FROM REPORT -->	039GW01403	039GW01602	039GW01603	039GW01604	039GW01702	039GW01703
	SAMPLE DATE ----->	08/04/99	10/08/98	02/12/99	08/06/99	10/08/98	02/15/99
	DATE ANALYZED --->	08/06/99	10/13/98	02/25/99	08/11/99	10/12/98	02/24/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39813	35886	37429	39864	35886	37448
104-51-8	n-Butylbenzene	NR	NR	5. U	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	039-G-W017-04		039-G-W018-02		039-G-W018-03		039-G-W018-04		039-G-W019-02		039-G-W019-03	
	ORIGINAL ID ----->	039GW01704		039GW01802		039GW01803		039GW01804		039GW01902		039GW01903	
	LAB SAMPLE ID --->	39864.03		35864.14		37457.01		39906.06		35886.03		37497.01	
	ID FROM REPORT -->	039GW01704		039GW01802		039GW01803		039GW01804		039GW01902		039GW01903	
	SAMPLE DATE ----->	08/06/99		10/07/98		02/16/99		08/10/99		10/08/98		02/19/99	
	DATE ANALYZED --->	08/11/99		10/12/98		02/24/99		08/17/99		10/12/98		02/24/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39864		35848		37457		39906		35886		37497	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	7.	B	5.	U	5.	U	6.	B
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	2.	J	15.		3.	J	5.	U	1.	J
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	3.	J	5.	U	5.	U	3.	J
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	9.		15.		10.		5.	U	1.	J
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W017-04	039-G-W018-02	039-G-W018-03	039-G-W018-04	039-G-W019-02	039-G-W019-03
	ORIGINAL ID ----->	039GW01704	039GW01802	039GW01803	039GW01804	039GW01902	039GW01903
	LAB SAMPLE ID --->	39864.03	35864.14	37457.01	39906.06	35886.03	37497.01
	ID FROM REPORT -->	039GW01704	039GW01802	039GW01803	039GW01804	039GW01902	039GW01903
	SAMPLE DATE ----->	08/06/99	10/07/98	02/16/99	08/10/99	10/08/98	02/19/99
	DATE ANALYZED --->	08/11/99	10/12/98	02/24/99	08/17/99	10/12/98	02/24/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39864	35848	37457	39906	35886	37497
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA																			
	SAMPLE ID ------->	039-G-W019-04		039-G-W020-02		039-G-W020-03		039-G-W021-02		039-G-W021-03		039-G-W022-03	
	ORIGINAL ID ----->	039GW01904		039GW02002		039GW02003		039GW02102		039GW02103		039GW02203	
	LAB SAMPLE ID --->	39883.03		37471.03		39883.11		37478.01		39906.05		39906.04	
	ID FROM REPORT -->	039GW01904		039GW02002		039GW02003		039GW02102		039GW02103		039GW02203	
	SAMPLE DATE ----->	08/07/99		02/17/99		08/08/99		02/18/99		08/10/99		08/10/99	
	DATE ANALYZED --->	08/12/99		02/22/99		08/16/99		02/26/99		08/17/99		08/17/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39883		37471		39883		37478		39906		39906	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	2.	J	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	2.	J	16.		5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	1.	J
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	1.	J	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	4.	J	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	1.	J	2.	J	3.	J	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W019-04	039-G-W020-02	039-G-W020-03	039-G-W021-02	039-G-W021-03	039-G-W022-03
	ORIGINAL ID ----->	039GW01904	039GW02002	039GW02003	039GW02102	039GW02103	039GW02203
	LAB SAMPLE ID --->	39883.03	37471.03	39883.11	37478.01	39906.05	39906.04
	ID FROM REPORT -->	039GW01904	039GW02002	039GW02003	039GW02102	039GW02103	039GW02203
	SAMPLE DATE ----->	08/07/99	02/17/99	08/08/99	02/18/99	08/10/99	08/10/99
	DATE ANALYZED --->	08/12/99	02/22/99	08/16/99	02/26/99	08/17/99	08/17/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39883	37471	39883	37478	39906	39906
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA						
SAMPLE ID ------->	039-G-W023-03	039-G-W04D-02	039-G-W04D-03	039-G-W04I-02	039-G-W04I-03	039-G-W08D-02
ORIGINAL ID ----->	039GW02303	039GW04D02	039GW04D03	039GW04I02	039GW04I03	039GW08D02
LAB SAMPLE ID --->	39906.02	35848.02	39853.09	35848.01	39853.08	35886.04
ID FROM REPORT -->	039GW02303	039GW04D02	039GW04D03	039GW04I02	039GW04I03	039GW08D02
SAMPLE DATE ----->	08/10/99	10/06/98	08/05/99	10/06/98	08/05/99	10/08/98
DATE ANALYZED --->	08/17/99	10/08/98	08/10/99	10/09/98	08/11/99	10/12/98
MATRIX ---------->	Water	Water	Water	Water	Water	Water
UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L

CAS #	Parameter	39906		35848		39853		35848		39853		35886	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	10.		5.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	039-G-W023-03	039-G-W04D-02	039-G-W04D-03	039-G-W04I-02	039-G-W04I-03	039-G-W08D-02
	ORIGINAL ID ----->	039GW02303	039GW04D02	039GW04D03	039GW04I02	039GW04I03	039GW08D02
	LAB SAMPLE ID --->	39906.02	35848.02	39853.09	35848.01	39853.08	35886.04
	ID FROM REPORT -->	039GW02303	039GW04D02	039GW04D03	039GW04I02	039GW04I03	039GW08D02
	SAMPLE DATE ----->	08/10/99	10/06/98	08/05/99	10/06/98	08/05/99	10/08/98
	DATE ANALYZED --->	08/17/99	10/08/98	08/10/99	10/09/98	08/11/99	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39906	35848	39853	35848	39853	35886
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA															
	SAMPLE ID ------->	039-G-W08D-03		039-G-W09D-02		039-G-W09D-03		039-G-W09D-04		039-G-W09I-02		039-G-W09I-03	
	ORIGINAL ID ----->	039GW08D03		039GW09D02		039GW09D03		039GW09D04		039GW09I02		039GW09I03	
	LAB SAMPLE ID --->	39883.07		35886.15		37478.04		39883.10		35886.14		37478.03	
	ID FROM REPORT -->	039GW08D03		039GW09D02		039GW09D03		039GW09D04		039GW09I02		039GW09I03	
	SAMPLE DATE ----->	08/07/99		10/08/98		02/18/99		08/08/99		10/08/98		02/18/99	
	DATE ANALYZED --->	08/12/99		10/13/98		02/26/99		08/16/99		10/12/98		02/26/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39883		35886		37478		39883		35886		37478	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	11.		5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	15.		3.	J	5.	U	1.	J
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	3.	J
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	2.	J	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	47.		5.	U	5.	U	5.	U	9.	
156-60-5	trans-1,2-Dichloroethene	5.	U	1.	J	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	039-G-W08D-03	039-G-W09D-02	039-G-W09D-03	039-G-W09D-04	039-G-W09I-02	039-G-W09I-03
	ORIGINAL ID ----->	039GW08D03	039GW09D02	039GW09D03	039GW09D04	039GW09I02	039GW09I03
	LAB SAMPLE ID --->	39883.07	35886.15	37478.04	39883.10	35886.14	37478.03
	ID FROM REPORT -->	039GW08D03	039GW09D02	039GW09D03	039GW09D04	039GW09I02	039GW09I03
	SAMPLE DATE ----->	08/07/99	10/08/98	02/18/99	08/08/99	10/08/98	02/18/99
	DATE ANALYZED --->	08/12/99	10/13/98	02/26/99	08/16/99	10/12/98	02/26/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39883	35886	37478	39883	35886	37478
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA															
	SAMPLE ID ------->	039-G-W09I-04		039-G-W10D-02		039-G-W10D-03		039-G-W10I-02		039-G-W10I-03		039-G-W12D-02	
	ORIGINAL ID ----->	039GW09I04		039GW10D02		039GW10D03		039GW10I02		039GW10I03		039GW12D02	
	LAB SAMPLE ID --->	39883.09		35864.07		39813.06		35864.08		39864.12		35864.12	
	ID FROM REPORT -->	039GW09I04		039GW10D02		039GW10D03		039GW10I02		039GW10I03		039GW12D02	
	SAMPLE DATE ----->	08/08/99		10/07/98		08/04/99		10/07/98		08/06/99		10/07/98	
	DATE ANALYZED --->	08/12/99		10/09/98		08/06/99		10/09/98		08/12/99		10/12/98	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39883		35848		39813		35848		39864		35848	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	3.	J	1.	J	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	2.	J	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	12.		24.		4.	J	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	4.	J	5.	U	5.	U	20.		10.		1.	J
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W09I-04	039-G-W10D-02	039-G-W10D-03	039-G-W10I-02	039-G-W10I-03	039-G-W12D-02
	ORIGINAL ID ----->	039GW09I04	039GW10D02	039GW10D03	039GW10I02	039GW10I03	039GW12D02
	LAB SAMPLE ID --->	39883.09	35864.07	39813.06	35864.08	39864.12	35864.12
	ID FROM REPORT -->	039GW09I04	039GW10D02	039GW10D03	039GW10I02	039GW10I03	039GW12D02
	SAMPLE DATE ----->	08/08/99	10/07/98	08/04/99	10/07/98	08/06/99	10/07/98
	DATE ANALYZED --->	08/12/99	10/09/98	08/06/99	10/09/98	08/12/99	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39883	35848	39813	35848	39864	35848
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	039-G-W12D-03		039-G-W12I-02		039-G-W12I-03		039-G-W13D-02		039-G-W13D-03		039-G-W13I-02	
	ORIGINAL ID ----->	039GW12D03		039GW12I02		039GW12I03		039GW13D02		039GW13D03		039GW13I02	
	LAB SAMPLE ID --->	39853.02		35864.13		39853.01		35886.09		39864.04		35886.08	
	ID FROM REPORT -->	039GW12D03		039GW12I02		039GW12I03		039GW13D02		039GW13D03		039GW13I02	
	SAMPLE DATE ----->	08/05/99		10/07/98		08/05/99		10/08/98		08/06/99		10/08/98	
	DATE ANALYZED --->	08/10/99		10/12/98		08/10/99		10/12/98		08/11/99		10/12/98	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39853		35848		39853		35886		39864		35886	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.		5.	U	8.		4.	J	13.	
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	6.		4.	J	5.	J	2.	J	1.	J
75-34-3	1,1-Dichloroethane	5.	U	2.	J	5.	U	3.	J	2.	J	4.	J
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	3.	J	120.		73.		87.		38.		24.	
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	2.	J	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	53.		17.		100.	
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	9.		13.		5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	10.		400.	E	270.	E	190.		90.		130.	
156-60-5	trans-1,2-Dichloroethene	5.	U	4.	J	5.	J	5.	U	1.	J	2.	J

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W12D-03	039-G-W12I-02	039-G-W12I-03	039-G-W13D-02	039-G-W13D-03	039-G-W13I-02
	ORIGINAL ID ----->	039GW12D03	039GW12I02	039GW12I03	039GW13D02	039GW13D03	039GW13I02
	LAB SAMPLE ID --->	39853.02	35864.13	39853.01	35886.09	39864.04	35886.08
	ID FROM REPORT -->	039GW12D03	039GW12I02	039GW12I03	039GW13D02	039GW13D03	039GW13I02
	SAMPLE DATE ----->	08/05/99	10/07/98	08/05/99	10/08/98	08/06/99	10/08/98
	DATE ANALYZED --->	08/10/99	10/12/98	08/10/99	10/12/98	08/11/99	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39853	35848	39853	35886	39864	35886
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	039-G-W13I-03		039-G-W14D-02		039-G-W14D-03		039-G-W16D-02		039-G-W16D-03		039-G-W16D-04	
	ORIGINAL ID ----->	039GW13I03		039GW14D02		039GW14D03		039GW16D02		039GW16D03		039GW16D04	
	LAB SAMPLE ID --->	39883.01		35864.06		39813.05		35886.19		37429.03		39864.05	
	ID FROM REPORT -->	039GW13I03		039GW14D02		039GW14D03		039GW16D02		039GW16D03		039GW16D04	
	SAMPLE DATE ----->	08/07/99		10/07/98		08/04/99		10/08/98		02/12/99		08/06/99	
	DATE ANALYZED --->	08/12/99		10/09/98		08/06/99		10/13/98		02/25/99		08/11/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39883		35848		39813		35886		37429		39864	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	10.		5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	10.		5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	2.	J	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	3.	J	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	18.		5.	U	5.	U	5.	U	3.	J	4.	J
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	29.		5.	U	5.	U	5.	U	5.	U	5.	
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	16.		13.		5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	100.		5.	U	5.	U	5.	U	2.	J	2.	J
156-60-5	trans-1,2-Dichloroethene	2.	J	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W131-03	039-G-W14D-02	039-G-W14D-03	039-G-W16D-02	039-G-W16D-03	039-G-W16D-04
	ORIGINAL ID ----->	039GW13I03	039GW14D02	039GW14D03	039GW16D02	039GW16D03	039GW16D04
	LAB SAMPLE ID --->	39883.01	35864.06	39813.05	35886.19	37429.03	39864.05
	ID FROM REPORT -->	039GW13I03	039GW14D02	039GW14D03	039GW16D02	039GW16D03	039GW16D04
	SAMPLE DATE ----->	08/07/99	10/07/98	08/04/99	10/08/98	02/12/99	08/06/99
	DATE ANALYZED --->	08/12/99	10/09/98	08/06/99	10/13/98	02/25/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39883	35848	39813	35886	37429	39864
104-51-8	n-Butylbenzene	NR	NR	NR	NR	5. U	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	039-G-W16I-02		039-G-W16I-03		039-G-W16I-04		039-G-W17D-02		039-G-W17D-03		039-G-W17D-04	
	ORIGINAL ID ----->	039GW16I02		039GW16I03		039GW16I04		039GW17D02		039GW17D03		039GW17D04	
	LAB SAMPLE ID --->	35886.18		37429.02		39864.06		35886.11		37448.05		39864.01	
	ID FROM REPORT -->	039GW16I02		039GW16I03		039GW16I04		039GW17D02		039GW17D03		039GW17D04	
	SAMPLE DATE ----->	10/08/98		02/12/99		08/06/99		10/08/98		02/15/99		08/06/99	
	DATE ANALYZED --->	10/13/98		02/24/99		08/11/99		10/12/98		02/26/99		08/11/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ----------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	35886		37429		39864		35886		37448		39864	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	110.		51.		10.		9.		4.	J
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	6.		4.	J	6.		6.		5.	U
75-34-3	1,1-Dichloroethane	5.	U	11.		10.		5.		5.	J	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	1.	J	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	4.	J	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	7.		18.		13.		110.		100.		51.	
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	2.	J	1.	J	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	36.		13.		25.		26.		10.	
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	18.		400.	E	320.	E	310.	E	270.	E	140.	
156-60-5	trans-1,2-Dichloroethene	5.	U	11.		10.		4.	J	3.	J	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W16I-02	039-G-W16I-03	039-G-W16I-04	039-G-W17D-02	039-G-W17D-03	039-G-W17D-04
	ORIGINAL ID ----->	039GW16I02	039GW16I03	039GW16I04	039GW17D02	039GW17D03	039GW17D04
	LAB SAMPLE ID --->	35886.18	37429.02	39864.06	35886.11	37448.05	39864.01
	ID FROM REPORT -->	039GW16I02	039GW16I03	039GW16I04	039GW17D02	039GW17D03	039GW17D04
	SAMPLE DATE ----->	10/08/98	02/12/99	08/06/99	10/08/98	02/15/99	08/06/99
	DATE ANALYZED --->	10/13/98	02/24/99	08/11/99	10/12/98	02/26/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35886	37429	39864	35886	37448	39864
104-51-8	n-Butylbenzene	NR	5. U	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA															
	SAMPLE ID ------->	039-G-W17I-02		039-G-W17I-03		039-G-W17I-04		039-G-W18D-02		039-G-W18D-03		039-G-W18D-04	
	ORIGINAL ID ----->	039GW17I02		039GW17I03		039GW17I04		039GW18D02		039GW18D03		039GW18D04	
	LAB SAMPLE ID --->	35886.12		37448.04		39864.02		35864.15		37457.03		39853.04	
	ID FROM REPORT -->	039GW17I02		039GW17I03		039GW17I04		039GW18D02		039GW18D03		039GW18D04	
	SAMPLE DATE ----->	10/08/98		02/15/99		08/06/99		10/07/98		02/16/99		08/05/99	
	DATE ANALYZED --->	10/12/98		02/26/99		08/11/99		10/12/98		02/24/99		08/11/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	35886		37448		39864		35848		37457		39853	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	7.		4.	J	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	15.		5.	U	5.	U	6.	B	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	11.		14.		5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.		6.		5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	1.	J	5.	U	5.	U	430.	E	520.	E	2.	J
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	2.	J	2.	J	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.		5.	U	2.	J	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	3.	J	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	4.	J	5.	U	2.	J	450.	E	510.	E	5.	
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	6.		8.		5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W17I-02	039-G-W17I-03	039-G-W17I-04	039-G-W18D-02	039-G-W18D-03	039-G-W18D-04
	ORIGINAL ID ----->	039GW17I02	039GW17I03	039GW17I04	039GW18D02	039GW18D03	039GW18D04
	LAB SAMPLE ID --->	35886.12	37448.04	39864.02	35864.15	37457.03	39853.04
	ID FROM REPORT -->	039GW17I02	039GW17I03	039GW17I04	039GW18D02	039GW18D03	039GW18D04
	SAMPLE DATE ----->	10/08/98	02/15/99	08/06/99	10/07/98	02/16/99	08/05/99
	DATE ANALYZED --->	10/12/98	02/26/99	08/11/99	10/12/98	02/24/99	08/11/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35886	37448	39864	35848	37457	39853
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	039-G-W18I-02		039-G-W18I-03		039-G-W18I-04		039-G-W19D-02		039-G-W19D-03		039-G-W19D-04	
	ORIGINAL ID ----->	039GW18I02		039GW18I03		039GW18I04		039GW19D02		039GW19D03		039GW19D04	
	LAB SAMPLE ID --->	35864.16		37457.02		39853.05		35886.01		37497.03		39883.05	
	ID FROM REPORT -->	039GW18I02		039GW18I03		039GW18I04		039GW19D02		039GW19D03		039GW19D04	
	SAMPLE DATE ----->	10/07/98		02/16/99		08/05/99		10/08/98		02/19/99		08/07/99	
	DATE ANALYZED --->	10/12/98		02/26/99		08/11/99		10/12/98		02/24/99		08/12/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	35848		37457		39853		35886		37497		39883	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	8.		5.	U	5.	U	5.	U	3.	J	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	7.	B	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	2.	JB	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	1.	J	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	24.		4.	J	8.		5.	U	3.	J	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	3.	J	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	1.	J	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	26.		5.	J	10.		5.	U	26.		5.	U
156-60-5	trans-1,2-Dichloroethene	7.		5.	U	3.	J	5.	U	2.	J	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W18I-02	039-G-W18I-03	039-G-W18I-04	039-G-W19D-02	039-G-W19D-03	039-G-W19D-04
	ORIGINAL ID ----->	039GW18I02	039GW18I03	039GW18I04	039GW19D02	039GW19D03	039GW19D04
	LAB SAMPLE ID --->	35864.16	37457.02	39853.05	35886.01	37497.03	39883.05
	ID FROM REPORT -->	039GW18I02	039GW18I03	039GW18I04	039GW19D02	039GW19D03	039GW19D04
	SAMPLE DATE ----->	10/07/98	02/16/99	08/05/99	10/08/98	02/19/99	08/07/99
	DATE ANALYZED --->	10/12/98	02/26/99	08/11/99	10/12/98	02/24/99	08/12/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35848	37457	39853	35886	37497	39883
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	039-G-W19I-02		039-G-W19I-03		039-G-W19I-04		039-G-W20D-02		039-G-W20D-03		039-G-W20I-02	
	ORIGINAL ID ----->	039GW19I02		039GW19I03		039GW19I04		039GW20D02		039GW20D03		039GW20I02	
	LAB SAMPLE ID --->	35886.02		37497.02		39883.04		37471.05		39883.13		37471.04	
	ID FROM REPORT -->	039GW19I02		039GW19I03		039GW19I04		039GW20D02		039GW20D03		039GW20I02	
	SAMPLE DATE ----->	10/08/98		02/19/99		08/07/99		02/17/99		08/08/99		02/17/99	
	DATE ANALYZED --->	10/12/98		02/24/99		08/17/99		02/22/99		08/16/99		02/22/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	35886		37497		39883		37471		39883		37471	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	83.		140.		5.	U	5.	U	5.	U	34.	
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	8.	B	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	2.	JB	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	13.		14.		5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	26.		31.		5.	U	5.	U	5.	U	3.	J
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	78.		100.		5.	U	5.	U	5.	U	18.	
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	1.	J	3.	J	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	1.	J	5.	U	5.	U	22.	
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	3.	J	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	3.	J	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	650.	E	810.	E	5.	U	5.	U	2.	J	110.	
156-60-5	trans-1,2-Dichloroethene	12.		15.		5.	U	5.	U	5.	U	3.	J

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

SW846-VOA	SAMPLE ID ------->	039-G-W19I-02	039-G-W19I-03	039-G-W19I-04	039-G-W20D-02	039-G-W20D-03	039-G-W20I-02
	ORIGINAL ID ----->	039GW19I02	039GW19I03	039GW19I04	039GW20D02	039GW20D03	039GW20I02
	LAB SAMPLE ID --->	35886.02	37497.02	39883.04	37471.05	39883.13	37471.04
	ID FROM REPORT -->	039GW19I02	039GW19I03	039GW19I04	039GW20D02	039GW20D03	039GW20I02
	SAMPLE DATE ----->	10/08/98	02/19/99	08/07/99	02/17/99	08/08/99	02/17/99
	DATE ANALYZED --->	10/12/98	02/24/99	08/17/99	02/22/99	08/16/99	02/22/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	35886	37497	39883	37471	39883	37471
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA													
	SAMPLE ID ------->	039-G-W20I-03		039-G-W21D-02		039-G-W21D-03		039-G-W21I-02		039-G-W21I-03		039-G-W22D-03	
	ORIGINAL ID ----->	039GW20I03		039GW21D02		039GW21D03		039GW21I02		039GW21I03		039GW22D03	
	LAB SAMPLE ID --->	39883.12		37471.02		39883.17		37471.01		39883.16		39906.03	
	ID FROM REPORT -->	039GW20I03		039GW21D02		039GW21D03		039GW21I02		039GW21I03		039GW22D03	
	SAMPLE DATE ----->	08/08/99		02/17/99		08/09/99		02/17/99		08/09/99		08/10/99	
	DATE ANALYZED --->	08/16/99		02/22/99		08/16/99		02/22/99		08/16/99		08/17/99	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39883		37471		39883		37471		39883		39906	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	8.		5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	2.	J	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	7.		5.	U	5.	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	1.	J
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	7.		5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	1.	J	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	41.		5.	U	5.	U	5.	U	5.	U	6.	
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W20I-03	039-G-W21D-02	039-G-W21D-03	039-G-W21I-02	039-G-W21I-03	039-G-W22D-03
	ORIGINAL ID ----->	039GW20I03	039GW21D02	039GW21D03	039GW21I02	039GW21I03	039GW22D03
	LAB SAMPLE ID --->	39883.12	37471.02	39883.17	37471.01	39883.16	39906.03
	ID FROM REPORT -->	039GW20I03	039GW21D02	039GW21D03	039GW21I02	039GW21I03	039GW22D03
	SAMPLE DATE ----->	08/08/99	02/17/99	08/09/99	02/17/99	08/09/99	08/10/99
	DATE ANALYZED --->	08/16/99	02/22/99	08/16/99	02/22/99	08/16/99	08/17/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39883	37471	39883	37471	39883	39906
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846-VOA															
	SAMPLE ID ------->	039-G-W23D-03		042-G-W001-02		042-G-W002-02		042-G-W002-03		042-G-W02D-03		505-G-W001-02	
	ORIGINAL ID ----->	039GW23D03		042GW00102		042GW00202		042GW00203		042GW02D03		505GW00102	
	LAB SAMPLE ID --->	39906.01		35886.22		35907.01		39883.19		39883.18		35907.02	
	ID FROM REPORT -->	039GW23D03		042GW00102		042GW00202		042GW00203		042GW02D03		505GW00102	
	SAMPLE DATE ----->	08/10/99		10/08/98		10/09/98		08/09/99		08/09/99		10/09/98	
	DATE ANALYZED --->	08/17/99		10/13/98		10/13/98		08/16/99		08/16/99		10/13/98	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	39906		35886		35886		39883		39883		35886	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	130.	
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	3.	J	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1634-04-4	Methyl tert-butyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
156-59-2	cis-1,2-Dichloroethene	5.	U	5.	U	5.	U	4.	J	88.		5.	U
156-60-5	trans-1,2-Dichloroethene	5.	U	5.	U	5.	U	5.	U	2.	J	5.	U

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

SW846-VOA							
	SAMPLE ID ------->	039-G-W23D-03	042-G-W001-02	042-G-W002-02	042-G-W002-03	042-G-W02D-03	505-G-W001-02
	ORIGINAL ID ----->	039GW23D03	042GW00102	042GW00202	042GW00203	042GW02D03	505GW00102
	LAB SAMPLE ID --->	39906.01	35886.22	35907.01	39883.19	39883.18	35907.02
	ID FROM REPORT -->	039GW23D03	042GW00102	042GW00202	042GW00203	042GW02D03	505GW00102
	SAMPLE DATE ----->	08/10/99	10/08/98	10/09/98	08/09/99	08/09/99	10/09/98
	DATE ANALYZED --->	08/17/99	10/13/98	10/13/98	08/16/99	08/16/99	10/13/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
CAS #	Parameter	39906	35886	35886	39883	39883	35886
104-51-8	n-Butylbenzene	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846_VOA													
	SAMPLE ID ------->	039-G-W001-01		039-G-W002-01		039-G-W003-01		039-G-W004-01		039-G-W005-01		039-G-W006-01	
	ORIGINAL ID ----->	039GW00101		039GW00201		039GW00301		039GW00401		039GW00501		039GW00601	
	LAB SAMPLE ID --->	32813.04		32771.03		32813.05		32753.02		32771.02		32853.04	
	ID FROM REPORT -->	039GW00101		039GW00201		039GW00301		039GW00401		039GW00501		039GW00601	
	SAMPLE DATE ----->	02/17/98		02/13/98		02/17/98		02/12/98		02/13/98		02/18/98	
	DATE ANALYZED --->	02/19/98		02/17/98		02/19/98		02/17/98		02/17/98		02/20/98	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	32753		32753		32753		32753		32753		32753	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	5.	U	5.	U	46.		5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	4.	J	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	41.		5.	U	5.		5.	U	5.	U	2.	J
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.		5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	58.		5.	U
540-59-0	1,2-Dichloroethene (total)	5.	U	5.	U	24.		5.	U	220.	E	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	10.		5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	35.		5.	U	130.		5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	460.	E	5.	U	5.	U	5.	U	110.		5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	30.		5.	U	9.		5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	6.		5.	U	5.	U	5.	U	1.	J	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	63.		5.	U	5.	U	5.	U	60.		5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	78.		5.	U	5.	U	5.	U	33.		5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

SW846_VOA																			
	SAMPLE ID ------->	039-G-W007-01		039-G-W008-01		039-G-W009-01		039-G-W010-01		039-G-W011-01		039-G-W012-01	
	ORIGINAL ID ----->	039GW00701		039GW00801		039GW00901		039GW01001		039GW01101		039GW01201	
	LAB SAMPLE ID --->	32853.05		32894.03		32869.03		32853.01		32753.03		32813.02	
	ID FROM REPORT -->	039GW00701		039GW00801		039GW00901		039GW01001		039GW01101		039GW01201	
	SAMPLE DATE ----->	02/18/98		02/20/98		02/19/98		02/18/98		02/12/98		02/17/98	
	DATE ANALYZED --->	02/20/98		02/24/98		02/22/98		02/20/98		02/17/98		02/19/98	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	32753		32869		32869		32753		32753		32753	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	5.	U	6.		5.	U	5.	U	3.	J
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	2.	J
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	1.	J
540-59-0	1,2-Dichloroethene (total)	5.	U	5.	U	37.		5.	U	5.	U	110.	
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	1.	J	5.	U	5.	U	78.	
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	180.		2.	J
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	20.		5.	U
108-90-7	Chlorobenzene	1.	J	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	170.		5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	440.		5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846_VOA																			
	SAMPLE ID ------->	039-G-W013-01			039-G-W014-01			039-G-W015-01			039-G-W04D-01			039-G-W04I-01			039-G-W08D-01		
	ORIGINAL ID ----->	039GW01301			039GW01401			039GW01501			039GW04D01			039GW04I01			039GW08D01		
	LAB SAMPLE ID --->	32869.06			32869.01			32894.01			32771.01			32753.01			32894.04		
	ID FROM REPORT -->	039GW01301			039GW01401			039GW01501			039GW04D01			039GW04I01			039GW08D01		
	SAMPLE DATE ----->	02/19/98			02/19/98			02/20/98			02/13/98			02/12/98			02/20/98		
	DATE ANALYZED --->	02/22/98			02/22/98			02/24/98			02/17/98			02/17/98			02/24/98		
	MATRIX ---------->	Water			Water			Water			Water			Water			Water		
	UNITS ---------->	UG/L			UG/L			UG/L			UG/L			UG/L			UG/L		
CAS #	Parameter	32869			32869			32869			32753			32753			32869		
74-87-3	Chloromethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
74-83-9	Bromomethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
75-01-4	Vinyl chloride	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
75-00-3	Chloroethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
75-09-2	Methylene chloride	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
67-64-1	Acetone	5.	U		7.			5.	U		2.	J		5.	U		5.	U	
75-15-0	Carbon disulfide	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
75-35-4	1,1-Dichloroethene	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
75-34-3	1,1-Dichloroethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
540-59-0	1,2-Dichloroethene (total)	13.			5.	U		5.	U		5.	U		5.	U		5.	U	
67-66-3	Chloroform	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
107-06-2	1,2-Dichloroethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
78-93-3	2-Butanone (MEK)	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
71-55-6	1,1,1-Trichloroethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
56-23-5	Carbon tetrachloride	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
75-27-4	Bromodichloromethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
78-87-5	1,2-Dichloropropane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
10061-01-5	cis-1,3-Dichloropropene	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
79-01-6	Trichloroethene	2.	J		5.	U		5.	U		5.	U		5.	U		5.	U	
124-48-1	Dibromochloromethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
79-00-5	1,1,2-Trichloroethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
71-43-2	Benzene	5.	U		14.			5.	U		5.	U		5.	U		5.	U	
10061-02-6	trans-1,3-Dichloropropene	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
75-25-2	Bromoform	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
591-78-6	2-Hexanone	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
127-18-4	Tetrachloroethene	6.			5.	U		5.	U		5.	U		5.	U		5.	U	
79-34-5	1,1,2,2-Tetrachloroethane	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
108-88-3	Toluene	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
108-90-7	Chlorobenzene	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
100-41-4	Ethylbenzene	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
100-42-5	Styrene	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
1330-20-7	Xylene (Total)	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
108-05-4	Vinyl acetate	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	
110-75-8	2-Chloroethyl vinyl ether	5.	U		5.	U		5.	U		5.	U		5.	U		5.	U	

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846_VOA													
	SAMPLE ID ------->	039-G-W09D-01		039-G-W09I-01		039-G-W10D-01		039-G-W10I-01		039-G-W12D-01		039-G-W12I-01	
	ORIGINAL ID ----->	039GW09D01		039GW09I01		039GW10D01		039GW10I01		039GW12D01		039GW12I01	
	LAB SAMPLE ID --->	32869.05		32869.04		32853.03		32853.02		32813.01		32813.03	
	ID FROM REPORT -->	039GW09D01		039GW09I01		039GW10D01		039GW10I01		039GW12D01		039GW12I01	
	SAMPLE DATE ----->	02/19/98		02/19/98		02/18/98		02/18/98		02/17/98		02/17/98	
	DATE ANALYZED --->	02/22/98		02/22/98		02/20/98		02/20/98		02/19/98		02/19/98	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	32869		32869		32753		32753		32753		32753	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	5.	U	2.	J	5.	U	4.	J	5.	U	3.	J
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	2.	J	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
540-59-0	1,2-Dichloroethene (total)	5.	U	7.		2.	J	22.		5.	U	420.	E
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	130.	
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	1.	J
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

SW846_VOA									
	SAMPLE ID ------->	039-G-W13D-01		039-G-W13I-01		039-G-W14D-01		039-G-W15D-01	
	ORIGINAL ID ----->	039GW13D01		039GW13I01		039GW14D01		039GW15D01	
	LAB SAMPLE ID --->	32869.08		32869.07		32869.02		32894.02	
	ID FROM REPORT -->	039GW13D01		039GW13I01		039GW14D01		039GW15D01	
	SAMPLE DATE ----->	02/19/98		02/19/98		02/19/98		02/20/98	
	DATE ANALYZED --->	02/22/98		02/22/98		02/22/98		02/24/98	
	MATRIX ---------->	Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	32869		32869		32869		32869	
74-87-3	Chloromethane	5.	U	5.	U	5.	U	5.	U
74-83-9	Bromomethane	5.	U	5.	U	5.	U	5.	U
75-01-4	Vinyl chloride	6.		9.		5.	U	5.	U
75-00-3	Chloroethane	5.	U	5.	U	5.	U	5.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	5.	U	5.	U	5.	U	5.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	3.	J	2.	J	5.	U	5.	U
75-34-3	1,1-Dichloroethane	2.	J	2.	J	5.	U	5.	U
540-59-0	1,2-Dichloroethene (total)	130.		89.		5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	5.	U	5.	U	5.	U	5.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	72.		30.		5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.	U	5.	U	5.	U	5.	U
591-78-6	2-Hexanone	5.	U	5.	U	5.	U	5.	U
127-18-4	Tetrachloroethene	50.		140.		5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	5.	U	5.	U	5.	U	5.	U
110-75-8	2-Chloroethyl vinyl ether	5.	U	5.	U	5.	U	5.	U

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TKN							
	SAMPLE ID ------->	002-G-W004-02	002-G-W006-02	038-G-W002-02	038-G-W01D-02	039-G-W001-02	039-G-W002-02
	ORIGINAL ID ----->	002GW00402	002GW00602	038GW00202	038GW01D02	039GW00102	039GW00202
	LAB SAMPLE ID --->	35864.01	35864.02	35848.06	35848.07	35848.08	35848.09
	ID FROM REPORT -->	002GW00402	002GW00602	038GW00202	038GW01D02	039GW00102	039GW00202
	SAMPLE DATE ----->	10/07/98	10/07/98	10/06/98	10/06/98	10/06/98	10/06/98
	DATE ANALYZED --->	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35848	35848	35848	35848	35848
7727-37-9	Nitrogen	6.2	2.8	2.	2.2	1.4	1.7

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TKN							
	SAMPLE ID ------->	039-G-W003-02	039-G-W004-02	039-G-W005-02	039-G-W006-02	039-G-W007-02	039-G-W008-02
	ORIGINAL ID ----->	039GW00302	039GW00402	039GW00502	039GW00602	039GW00702	039GW00802
	LAB SAMPLE ID --->	35848.04	35848.03	35848.05	35886.21	35864.03	35886.05
	ID FROM REPORT -->	039GW00302	039GW00402	039GW00502	039GW00602	039GW00702	039GW00802
	SAMPLE DATE ----->	10/06/98	10/06/98	10/06/98	10/08/98	10/07/98	10/08/98
	DATE ANALYZED --->	10/21/98	10/21/98	10/21/98	10/24/98	10/21/98	10/24/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35848	35848	35886	35848	35886
7727-37-9	Nitrogen	1. U	1.1	1.1	4.2	7.3	7.6

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TKN							
	SAMPLE ID ------->	039-G-W009-02	039-G-W010-02	039-G-W011-02	039-G-W012-02	039-G-W013-02	039-G-W014-02
	ORIGINAL ID ----->	039GW00902	039GW01002	039GW01102	039GW01202	039GW01302	039GW01402
	LAB SAMPLE ID --->	35886.16	35864.09	35848.10	35864.11	35886.07	35864.05
	ID FROM REPORT -->	039GW00902	039GW01002	039GW01102	039GW01202	039GW01302	039GW01402
	SAMPLE DATE ----->	10/08/98	10/07/98	10/06/98	10/07/98	10/08/98	10/07/98
	DATE ANALYZED --->	10/24/98	10/21/98	10/21/98	10/21/98	10/24/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35848	35848	35848	35886	35848
7727-37-9	Nitrogen	1. U	2.2	4.8	2.2	1. U	2.8

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TKN							
	SAMPLE ID ------->	039-G-W016-02	039-G-W017-02	039-G-W018-02	039-G-W019-02	039-G-W04D-02	039-G-W04I-02
	ORIGINAL ID ----->	039GW01602	039GW01702	039GW01802	039GW01902	039GW04D02	039GW04I02
	LAB SAMPLE ID --->	35886.17	35886.10	35864.14	35886.03	35848.02	35848.01
	ID FROM REPORT -->	039GW01602	039GW01702	039GW01802	039GW01902	039GW04D02	039GW04I02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/07/98	10/08/98	10/06/98	10/06/98
	DATE ANALYZED --->	10/24/98	10/24/98	10/21/98	10/24/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35848	35886	35848	35848
7727-37-9	Nitrogen	1. U	5.3	2.	11.	1. U	1.4

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TKN							
	SAMPLE ID ------->	039-G-W08D-02	039-G-W09D-02	039-G-W09I-02	039-G-W10D-02	039-G-W10I-02	039-G-W12D-02
	ORIGINAL ID ----->	039GW08D02	039GW09D02	039GW09I02	039GW10D02	039GW10I02	039GW12D02
	LAB SAMPLE ID --->	35886.04	35886.15	35886.14	35864.07	35864.08	35864.12
	ID FROM REPORT -->	039GW08D02	039GW09D02	039GW09I02	039GW10D02	039GW10I02	039GW12D02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/08/98	10/07/98	10/07/98	10/07/98
	DATE ANALYZED --->	10/24/98	10/24/98	10/24/98	10/21/98	10/21/98	10/21/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35886	35848	35848	35848
7727-37-9	Nitrogen	1. U	1.7	1. U	1.4	3.9	1.4

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MNA PARAMETERS FOR SWMU 039

TKN							
	SAMPLE ID ------->	039-G-W12I-02	039-G-W13D-02	039-G-W13I-02	039-G-W14D-02	039-G-W16D-02	039-G-W16I-02
	ORIGINAL ID ----->	039GW12I02	039GW13D02	039GW13I02	039GW14D02	039GW16D02	039GW16I02
	LAB SAMPLE ID --->	35864.13	35886.09	35886.08	35864.06	35886.19	35886.18
	ID FROM REPORT -->	039GW12I02	039GW13D02	039GW13I02	039GW14D02	039GW16D02	039GW16I02
	SAMPLE DATE ----->	10/07/98	10/08/98	10/08/98	10/07/98	10/08/98	10/08/98
	DATE ANALYZED --->	10/21/98	10/24/98	10/24/98	10/21/98	10/24/98	10/24/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	35886	35886	35848	35886	35886
7727-37-9	Nitrogen	1.1	1. U	1. U	2.5	1. U	1. U

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TKN							
	SAMPLE ID ------->	039-G-W17D-02	039-G-W17I-02	039-G-W18D-02	039-G-W18I-02	039-G-W19D-02	039-G-W19I-02
	ORIGINAL ID ----->	039GW17D02	039GW17I02	039GW18D02	039GW18I02	039GW19D02	039GW19I02
	LAB SAMPLE ID --->	35886.11	35886.12	35864.15	35864.16	35886.01	35886.02
	ID FROM REPORT -->	039GW17D02	039GW17I02	039GW18D02	039GW18I02	039GW19D02	039GW19I02
	SAMPLE DATE ----->	10/08/98	10/08/98	10/07/98	10/07/98	10/08/98	10/08/98
	DATE ANALYZED --->	10/24/98	10/24/98	10/21/98	10/21/98	10/24/98	10/24/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	35886	35848	35848	35886	35886
7727-37-9	Nitrogen	1. U	1. U	3.6	1. U	1. U	1. U

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MNA PARAMETERS FOR SWMU 039

TKN							
	SAMPLE ID ------->	042-G-W001-02	042-G-W002-02	505-G-W001-02			
	ORIGINAL ID ----->	042GW00102	042GW00202	505GW00102			
	LAB SAMPLE ID --->	35886.22	35907.01	35907.02			
	ID FROM REPORT -->	042GW00102	042GW00202	505GW00102			
	SAMPLE DATE ----->	10/08/98	10/09/98	10/09/98			
	DATE ANALYZED --->	10/24/98	10/28/98	10/28/98			
	MATRIX ---------->	Water	Water	Water			
	UNITS ----------->	MG/L	MG/L	MG/L			
CAS #	Parameter	35886	35886	35886			
7727-37-9	Nitrogen	1. U	1.1	1.7			

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	002-G-W004-02	002-G-W004-03	002-G-W006-02	002-G-W006-03	038-G-W002-02	038-G-W002-03
	ORIGINAL ID ----->	002GW00402	002GW00403	002GW00602	002GW00603	038GW00202	038GW00203
	LAB SAMPLE ID --->	35864.01	39864.09	35864.02	39883.20	35848.06	39813.08
	ID FROM REPORT -->	002GW00402	002GW00403	002GW00602	002GW00603	038GW00202	038GW00203
	SAMPLE DATE ----->	10/07/98	08/06/99	10/07/98	08/09/99	10/06/98	08/04/99
	DATE ANALYZED --->	10/12/98	08/19/99	10/12/98	08/23/99	10/08/98	08/18/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39864	35848	39883	35848	39813
9999900-01-4	Total Organic Carbon (TOC)	9.4	18.3	1. U	3.3	6.1	NR
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	5.6

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	038-G-W01D-02	038-G-W01D-03	039-G-W001-01	039-G-W001-02	039-G-W001-03	039-G-W002-01
	ORIGINAL ID ----->	038GW01D02	038GW01D03	039GW00101	039GW00102	039GW00103	039GW00201
	LAB SAMPLE ID --->	35848.07	39813.01	32813.04	35848.08	39813.10	32771.03
	ID FROM REPORT -->	038GW01D02	038GW01D03	039GW00101	039GW00102	039GW00103	039GW00201
	SAMPLE DATE ----->	10/06/98	08/04/99	02/17/98	10/06/98	08/04/99	02/13/98
	DATE ANALYZED --->	10/08/98	08/18/99	03/09/98	10/08/98	08/18/99	03/09/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39813	32753	35848	39813	32753
9999900-01-4	Total Organic Carbon (TOC)	4.5	NR	9.7	8.1	NR	4.3
9999900-04-2	TOC (EPA 415.1)	NR	5.4	NR	NR	5.6	NR

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W002-02	039-G-W002-03	039-G-W003-01	039-G-W003-02	039-G-W003-03	039-G-W004-01
	ORIGINAL ID ----->	039GW00202	039GW00203	039GW00301	039GW00302	039GW00303	039GW00401
	LAB SAMPLE ID --->	35848.09	39813.09	32813.05	35848.04	39813.02	32753.02
	ID FROM REPORT -->	039GW00202	039GW00203	039GW00301	039GW00302	039GW00303	039GW00401
	SAMPLE DATE ----->	10/06/98	08/04/99	02/17/98	10/06/98	08/04/99	02/12/98
	DATE ANALYZED --->	10/08/98	08/18/99	03/09/98	10/08/98	08/18/99	02/22/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39813	32753	35848	39813	32753
9999900-01-4	Total Organic Carbon (TOC)	4.5	NR	2. U	1.7	NR	4.1
9999900-04-2	TOC (EPA 415.1)	NR	5.7	NR	NR	2.5	NR

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W004-02	039-G-W004-03	039-G-W005-01	039-G-W005-02	039-G-W005-03	039-G-W006-01
	ORIGINAL ID ----->	039GW00402	039GW00403	039GW00501	039GW00502	039GW00503	039GW00601
	LAB SAMPLE ID --->	35848.03	39853.07	32771.02	35848.05	39813.11	32853.04
	ID FROM REPORT -->	039GW00402	039GW00403	039GW00501	039GW00502	039GW00503	039GW00601
	SAMPLE DATE ----->	10/06/98	08/05/99	02/13/98	10/06/98	08/04/99	02/18/98
	DATE ANALYZED --->	10/08/98	08/18/99	03/09/98	10/08/98	08/18/99	03/09/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39853	32753	35848	39813	32753
9999900-01-4	Total Organic Carbon (TOC)	4.	3.2	5.1	4.1	NR	9.8
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	5.	NR

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W006-02	039-G-W006-03	039-G-W007-01	039-G-W007-02	039-G-W007-03	039-G-W008-01
	ORIGINAL ID ----->	039GW00602	039GW00603	039GW00701	039GW00702	039GW00703	039GW00801
	LAB SAMPLE ID --->	35886.21	39864.10	32853.05	35864.03	39883.15	32894.03
	ID FROM REPORT -->	039GW00602	039GW00603	039GW00701	039GW00702	039GW00703	039GW00801
	SAMPLE DATE ----->	10/08/98	08/06/99	02/18/98	10/07/98	08/09/99	02/20/98
	DATE ANALYZED --->	10/12/98	08/19/99	03/09/98	10/12/98	08/23/99	03/09/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39864	32753	35848	39883	32869
9999900-01-4	Total Organic Carbon (TOC)	8.2	20.	9.8	13.	52.6	11.5
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
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MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W008-02	039-G-W008-03	039-G-W009-01	039-G-W009-02	039-G-W009-04	039-G-W010-01
	ORIGINAL ID ----->	039GW00802	039GW00803	039GW00901	039GW00902	039GW00904	039GW01001
	LAB SAMPLE ID --->	35886.05	39883.06	32869.03	35886.16	39883.08	32853.01
	ID FROM REPORT -->	039GW00802	039GW00803	039GW00901	039GW00902	039GW00904	039GW01001
	SAMPLE DATE ----->	10/08/98	08/07/99	02/19/98	10/08/98	08/08/99	02/18/98
	DATE ANALYZED --->	10/12/98	08/22/99	03/09/98	10/12/98	08/23/99	03/09/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39883	32869	35886	39883	32753
9999900-01-4	Total Organic Carbon (TOC)	15.	128.	6.8	3.1	17.4	2. U
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
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TOC							
	SAMPLE ID ------->	039-G-W010-02	039-G-W010-03	039-G-W011-01	039-G-W011-02	039-G-W011-03	039-G-W012-01
	ORIGINAL ID ----->	039GW01002	039GW01003	039GW01101	039GW01102	039GW01103	039GW01201
	LAB SAMPLE ID --->	35864.09	39864.11	32753.03	35848.10	39906.07	32813.02
	ID FROM REPORT -->	039GW01002	039GW01003	039GW01101	039GW01102	039GW01103	039GW01201
	SAMPLE DATE ----->	10/07/98	08/06/99	02/12/98	10/06/98	08/10/99	02/17/98
	DATE ANALYZED --->	10/12/98	08/19/99	02/22/98	10/08/98	08/19/99	03/09/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39864	32753	35848	39906	32753
9999900-01-4	Total Organic Carbon (TOC)	1.6	9.1	29.3	36.	15.7	3.4
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
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TOC							
	SAMPLE ID ------->	039-G-W012-02	039-G-W012-03	039-G-W013-01	039-G-W013-02	039-G-W013-03	039-G-W014-01
	ORIGINAL ID ----->	039GW01202	039GW01203	039GW01301	039GW01302	039GW01303	039GW01401
	LAB SAMPLE ID --->	35864.11	39853.03	32869.06	35886.07	39883.02	32869.01
	ID FROM REPORT -->	039GW01202	039GW01203	039GW01301	039GW01302	039GW01303	039GW01401
	SAMPLE DATE ----->	10/07/98	08/05/99	02/19/98	10/08/98	08/07/99	02/19/98
	DATE ANALYZED --->	10/12/98	08/18/99	03/09/98	10/12/98	08/22/99	03/09/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39853	32869	35886	39883	32869
9999900-01-4	Total Organic Carbon (TOC)	3.5	2.7	2. U	1. U	17.9	6.2
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
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TOC							
	SAMPLE ID ------->	039-G-W014-02	039-G-W014-03	039-G-W015-01	039-G-W016-02	039-G-W016-04	039-G-W017-02
	ORIGINAL ID ----->	039GW01402	039GW01403	039GW01501	039GW01602	039GW01604	039GW01702
	LAB SAMPLE ID --->	35864.05	39813.04	32894.01	35886.17	39864.07	35886.10
	ID FROM REPORT -->	039GW01402	039GW01403	039GW01501	039GW01602	039GW01604	039GW01702
	SAMPLE DATE ----->	10/07/98	08/04/99	02/20/98	10/08/98	08/06/99	10/08/98
	DATE ANALYZED --->	10/12/98	08/18/99	03/09/98	10/12/98	08/19/99	10/12/98
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39813	32869	35886	39864	35886
9999900-01-4	Total Organic Carbon (TOC)	5.3	NR	16.6	3.1	9.6	15.
9999900-04-2	TOC (EPA 415.1)	NR	6.2	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
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TOC							
	SAMPLE ID ------->	039-G-W017-04	039-G-W018-02	039-G-W018-04	039-G-W019-02	039-G-W019-04	039-G-W020-03
	ORIGINAL ID ----->	039GW01704	039GW01802	039GW01804	039GW01902	039GW01904	039GW02003
	LAB SAMPLE ID --->	39864.03	35864.14	39906.06	35886.03	39883.03	39883.11
	ID FROM REPORT -->	039GW01704	039GW01802	039GW01804	039GW01902	039GW01904	039GW02003
	SAMPLE DATE ----->	08/06/99	10/07/98	08/10/99	10/08/98	08/07/99	08/08/99
	DATE ANALYZED --->	08/19/99	10/12/98	08/19/99	10/12/98	08/22/99	08/24/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39864	35848	39906	35886	39883	39883
9999900-01-4	Total Organic Carbon (TOC)	34.3	10.	8.7	10.	71.4	11.8
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
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TOC							
	SAMPLE ID ------->	039-G-W021-03	039-G-W022-03	039-G-W023-03	039-G-W04D-01	039-G-W04D-02	039-G-W04D-03
	ORIGINAL ID ----->	039GW02103	039GW02203	039GW02303	039GW04D01	039GW04D02	039GW04D03
	LAB SAMPLE ID --->	39906.05	39906.04	39906.02	32771.01	35848.02	39853.09
	ID FROM REPORT -->	039GW02103	039GW02203	039GW02303	039GW04D01	039GW04D02	039GW04D03
	SAMPLE DATE ----->	08/10/99	08/10/99	08/10/99	02/13/98	10/06/98	08/05/99
	DATE ANALYZED --->	08/19/99	08/19/99	08/19/99	03/09/98	10/08/98	08/18/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39906	39906	39906	32753	35848	39853
9999900-01-4	Total Organic Carbon (TOC)	59.1	9.1	7.4	2. U	1.1	1.1
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W04I-01	039-G-W04I-02	039-G-W04I-03	039-G-W08D-01	039-G-W08D-02	039-G-W08D-03
	ORIGINAL ID ----->	039GW04I01	039GW04I02	039GW04I03	039GW08D01	039GW08D02	039GW08D03
	LAB SAMPLE ID --->	32753.01	35848.01	39853.08	32894.04	35886.04	39883.07
	ID FROM REPORT -->	039GW04I01	039GW04I02	039GW04I03	039GW08D01	039GW08D02	039GW08D03
	SAMPLE DATE ----->	02/12/98	10/06/98	08/05/99	02/20/98	10/08/98	08/07/99
	DATE ANALYZED --->	02/22/98	10/08/98	08/18/99	03/09/98	10/12/98	08/22/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32753	35848	39853	32869	35886	39883
9999900-01-4	Total Organic Carbon (TOC)	3.2	2.3	2.1	2. U	1.	36.6
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W09D-01	039-G-W09D-02	039-G-W09D-04	039-G-W09I-01	039-G-W09I-02	039-G-W09I-04
	ORIGINAL ID ----->	039GW09D01	039GW09D02	039GW09D04	039GW09I01	039GW09I02	039GW09I04
	LAB SAMPLE ID --->	32869.05	35886.15	39883.10	32869.04	35886.14	39883.09
	ID FROM REPORT -->	039GW09D01	039GW09D02	039GW09D04	039GW09I01	039GW09I02	039GW09I04
	SAMPLE DATE ----->	02/19/98	10/08/98	08/08/99	02/19/98	10/08/98	08/08/99
	DATE ANALYZED --->	03/09/98	10/12/98	08/24/99	03/09/98	10/12/98	08/23/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32869	35886	39883	32869	35886	39883
9999900-01-4	Total Organic Carbon (TOC)	2. U	7.3	23.5	2. U	2.	16.
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W10D-01	039-G-W10D-02	039-G-W10D-03	039-G-W10I-01	039-G-W10I-02	039-G-W10I-03
	ORIGINAL ID ----->	039GW10D01	039GW10D02	039GW10D03	039GW10I01	039GW10I02	039GW10I03
	LAB SAMPLE ID --->	32853.03	35864.07	39813.06	32853.02	35864.08	39864.12
	ID FROM REPORT -->	039GW10D01	039GW10D02	039GW10D03	039GW10I01	039GW10I02	039GW10I03
	SAMPLE DATE ----->	02/18/98	10/07/98	08/04/99	02/18/98	10/07/98	08/06/99
	DATE ANALYZED --->	03/09/98	10/12/98	08/18/99	03/09/98	10/12/98	08/19/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32753	35848	39813	32753	35848	39864
9999900-01-4	Total Organic Carbon (TOC)	2. U	3.6	NR	3.1	5.4	32.7
9999900-04-2	TOC (EPA 415.1)	NR	NR	1.6	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W12D-01	039-G-W12D-02	039-G-W12D-03	039-G-W12I-01	039-G-W12I-02	039-G-W12I-03
	ORIGINAL ID ----->	039GW12D01	039GW12D02	039GW12D03	039GW12I01	039GW12I02	039GW12I03
	LAB SAMPLE ID --->	32813.01	35864.12	39853.02	32813.03	35864.13	39853.01
	ID FROM REPORT -->	039GW12D01	039GW12D02	039GW12D03	039GW12I01	039GW12I02	039GW12I03
	SAMPLE DATE ----->	02/17/98	10/07/98	08/05/99	02/17/98	10/07/98	08/05/99
	DATE ANALYZED --->	03/09/98	10/12/98	08/18/99	03/09/98	10/12/98	08/18/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32753	35848	39853	32753	35848	39853
9999900-01-4	Total Organic Carbon (TOC)	2. U	1.1	1. U	2. U	2.	1.7
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W13D-01	039-G-W13D-02	039-G-W13D-03	039-G-W13I-01	039-G-W13I-02	039-G-W13I-03
	ORIGINAL ID ----->	039GW13D01	039GW13D02	039GW13D03	039GW13I01	039GW13I02	039GW13I03
	LAB SAMPLE ID --->	32869.08	35886.09	39864.04	32869.07	35886.08	39883.01
	ID FROM REPORT -->	039GW13D01	039GW13D02	039GW13D03	039GW13I01	039GW13I02	039GW13I03
	SAMPLE DATE ----->	02/19/98	10/08/98	08/06/99	02/19/98	10/08/98	08/07/99
	DATE ANALYZED --->	03/09/98	10/12/98	08/19/99	03/09/98	10/12/98	08/22/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32869	35886	39864	32869	35886	39883
9999900-01-4	Total Organic Carbon (TOC)	2. U	1.1	12.2	2. U	1.6	27.
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W14D-01	039-G-W14D-02	039-G-W14D-03	039-G-W15D-01	039-G-W16D-02	039-G-W16D-04
	ORIGINAL ID ----->	039GW14D01	039GW14D02	039GW14D03	039GW15D01	039GW16D02	039GW16D04
	LAB SAMPLE ID --->	32869.02	35864.06	39813.05	32894.02	35886.19	39864.05
	ID FROM REPORT -->	039GW14D01	039GW14D02	039GW14D03	039GW15D01	039GW16D02	039GW16D04
	SAMPLE DATE ----->	02/19/98	10/07/98	08/04/99	02/20/98	10/08/98	08/06/99
	DATE ANALYZED --->	03/09/98	10/12/98	08/18/99	03/09/98	10/15/98	08/19/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	32869	35848	39813	32869	35886	39864
9999900-01-4	Total Organic Carbon (TOC)	2. U	1.8	NR	2. U	1. U	8.
9999900-04-2	TOC (EPA 415.1)	NR	NR	1.3	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W16I-02	039-G-W16I-04	039-G-W17D-02	039-G-W17D-04	039-G-W17I-02	039-G-W17I-04
	ORIGINAL ID ----->	039GW16I02	039GW16I04	039GW17D02	039GW17D04	039GW17I02	039GW17I04
	LAB SAMPLE ID --->	35886.18	39864.06	35886.11	39864.01	35886.12	39864.02
	ID FROM REPORT -->	039GW16I02	039GW16I04	039GW17D02	039GW17D04	039GW17I02	039GW17I04
	SAMPLE DATE ----->	10/08/98	08/06/99	10/08/98	08/06/99	10/08/98	08/06/99
	DATE ANALYZED --->	10/12/98	08/19/99	10/12/98	08/19/99	10/12/98	08/19/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39864	35886	39864	35886	39864
9999900-01-4	Total Organic Carbon (TOC)	2.1	10.4	1.	6.5	1.8	4.9
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W18D-02	039-G-W18D-04	039-G-W18I-02	039-G-W18I-04	039-G-W19D-02	039-G-W19D-04
	ORIGINAL ID ----->	039GW18D02	039GW18D04	039GW18I02	039GW18I04	039GW19D02	039GW19D04
	LAB SAMPLE ID --->	35864.15	39853.04	35864.16	39853.05	35886.01	39883.05
	ID FROM REPORT -->	039GW18D02	039GW18D04	039GW18I02	039GW18I04	039GW19D02	039GW19D04
	SAMPLE DATE ----->	10/07/98	08/05/99	10/07/98	08/05/99	10/08/98	08/07/99
	DATE ANALYZED --->	10/12/98	08/18/99	10/12/98	08/18/99	10/12/98	08/22/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35848	39853	35848	39853	35886	39883
9999900-01-4	Total Organic Carbon (TOC)	3.4	2.	4.7	4.1	4.1	22.6
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W19I-02	039-G-W19I-04	039-G-W20D-03	039-G-W20I-03	039-G-W21D-03	039-G-W21I-03
	ORIGINAL ID ----->	039GW19I02	039GW19I04	039GW20D03	039GW20I03	039GW21D03	039GW21I03
	LAB SAMPLE ID --->	35886.02	39883.04	39883.13	39883.12	39883.17	39883.16
	ID FROM REPORT -->	039GW19I02	039GW19I04	039GW20D03	039GW20I03	039GW21D03	039GW21I03
	SAMPLE DATE ----->	10/08/98	08/07/99	08/08/99	08/08/99	08/09/99	08/09/99
	DATE ANALYZED --->	10/12/98	08/22/99	08/24/99	08/24/99	08/23/99	08/23/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	35886	39883	39883	39883	39883	39883
9999900-01-4	Total Organic Carbon (TOC)	4.2	38.4	20.3	25.3	46.4	33.
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	039-G-W22D-03	039-G-W23D-03	042-G-W001-02	042-G-W002-02	042-G-W002-03	042-G-W02D-03
	ORIGINAL ID ----->	039GW22D03	039GW23D03	042GW00102	042GW00202	042GW00203	042GW02D03
	LAB SAMPLE ID --->	39906.03	39906.01	35886.22	35907.01	39883.19	39883.18
	ID FROM REPORT -->	039GW22D03	039GW23D03	042GW00102	042GW00202	042GW00203	042GW02D03
	SAMPLE DATE ----->	08/10/99	08/10/99	10/08/98	10/09/98	08/09/99	08/09/99
	DATE ANALYZED --->	08/19/99	08/19/99	10/15/98	10/15/98	08/23/99	08/23/99
	MATRIX ---------->	Water	Water	Water	Water	Water	Water
	UNITS ---------->	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CAS #	Parameter	39906	39906	35886	35886	39883	39883
9999900-01-4	Total Organic Carbon (TOC)	6.9	9.6	2.3	1. U	15.4	21.1
9999900-04-2	TOC (EPA 415.1)	NR	NR	NR	NR	NR	NR

NATURAL ATTENUATION-CHARLESTON
NATURAL ATTENUATION-CHARLESTON
MNA PARAMETERS FOR SWMU 039

TOC							
	SAMPLE ID ------->	505-G-W001-02					
	ORIGINAL ID ----->	505GW00102					
	LAB SAMPLE ID --->	35907.02					
	ID FROM REPORT -->	505GW00102					
	SAMPLE DATE ----->	10/09/98					
	DATE ANALYZED --->	10/15/98					
	MATRIX ---------->	Water					
	UNITS ---------->	MG/L					
CAS #	Parameter	35886					
9999900-01-4	Total Organic Carbon (TOC)	1. U					
9999900-04-2	TOC (EPA 415.1)	NR					

PAGE 1 OF 1

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2901-08440
COC #:
BPA/SO: P.O. 4, Rel 35

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNON
ADDRESS: ZONE A-Natural Attenuation
TELEPHONE NO.: 803 884-0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO.:
SAMPLERS: (SIGNATURE)

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	DISSOLVED GAS	IRON	ALKALINITY					REMARKS
NBCA039GW00401	2/12/98	10:30	GW	125 mL Poly		N/A	1		X	X					
NBCA039GW00401	2/12/98	10:30	GAS	60 mL Syringe		N/A	2	X							
NBCA039GW04I01	2/12/98	11:50	GW	125 mL Poly		N/A	1		X	X					
NBCA039GW04I01	2/12/98	11:50	GAS	60 mL Syringe		NA	2	X							
NBCA039GW04D01	2/12/98	13:55	GW	125 mL Poly		NA	1		X	X					
NBCA039GW04D01	2/12/98	13:55	GAS	60 mL Syringe		NA	2	X							
NBCA039GW00501	2/12/98	15:12	GW	125 mL Poly		NA	1		X						
NBCA039GW00501	2/12/98	15:12	GAS	60 mL Syringe		NA	2	X							

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE	2/12/98	SIGNATURE RC Williams	2/12/98	SIGNATURE		SIGNATURE	
PRINTED CHARLES KIRK		PRINTED RC WILLIAMS		PRINTED		PRINTED	
COMPANY TARGET	TIME	COMPANY TARGET	TIME	COMPANY	TIME	COMPANY	TIME
REASON ANALYSIS	1617	REASON ANALYSIS	1617	REASON		REASON	

METHOD OF SHIPMENT:
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☐ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCDCR1

PAGE 1 OF 1

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2901-08440
COC #:
BPA/SO: P.O.4, Rel 35

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
ADDRESS: Zone A - Natural Attenuation
TELEPHONE NO.: (803) 884-0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO.:
SAMPLERS: (SIGNATURE) Matth G. Bost

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	TOC	Chl. Sul. Nit					REMARKS
NBCA\039GW04I01	2-12-98	1410	H_2O	8, 16 oz polys 40 ml vials	4°C	VOC - HCl TOC - H_2SO_4	4	✓	✓	✓					
NBCA\039GW00401	2-12-98	1455	↓	↓	↓	↓	4	✓	✓	✓					
NBCA\039GW01101	2-12-98	0938	↓	↓	↓	↓	4	✓	✓	✓					
NBCA\039TW01101	2-12-98	—	↓	40 ml vials	4°C	HCl	2	✓							

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE: Matth G. Bost	2-12-98	SIGNATURE:		SIGNATURE:		SIGNATURE:	
PRINTED: Matt Bost	TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe	1630	COMPANY:		COMPANY:		COMPANY:	
REASON: Ship to lab		REASON:		REASON:		REASON:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO.: 4848175150
SPECIAL INSTRUCTION:

COMMENTS: DQO 3

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☑ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

02/13/98 18:14 TEL 7477306 ENSAFE ALLEN HOS → CHARSAFE

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

CTO-TASK: 2901-08440
COC #:
EPA/SO: P04 REL35

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Verney
ADDRESS: Zone A - NATURAL ATTENUATION
TELEPHONE NO.: 803-884-0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO.:
SAMPLERS: (SIGNATURE)

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Dissolved GAS	Iron	Alkalinity					REMARKS
NBCA039GW00101	2/13/98	9:27	GW	125 ml Poly		N/A	1		X	X					
NBCA039GW00101	2/13/98	9:27	gas	60 ml Syringe		N/A	2	X							
NBCA039GW00201	2/13/98	11:22	GW	125 ml Poly		N/A	1		X	X					
NBCA039GW00201	2/13/98	11:22	gas	60 ml Syringe		N/A	2	X							
NBCA039GW00301	2/13/98	12:28	GW	125 ml ~~Syringe~~ Poly		N/A	1		X	X					
NBCA039GW00301	2/13/98	12:28	gas	60 ml Syringe		N/A	2	X							
NBCA039GW01201	2/13/98	13:58	GW	125ml ~~Poly~~ Poly		N/A	1		X	X					
NBCA039GW01201	2/13/98	13:58	GAS	60 ml Syringe		N/A	2	X							
NBCA039GW12I01	2/13/98	[illegible]	GW	125ml Poly		NA	1		X	X					
NBCA039GW12I01	2/13/98	[illegible]	GAS	60ml Syringe		NA	2	X							

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE [signature]	2/13/98	SIGNATURE [signature]	2/13/98	SIGNATURE		SIGNATURE	
PRINTED Charles Kirk	TIME	PRINTED Eric Marder	TIME	PRINTED	TIME	PRINTED	TIME
COMPANY Target		COMPANY Target	17:00	COMPANY		COMPANY	
REASON Analysis		REASON Analysis		REASON		REASON	

METHOD OF SHIPMENT:
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☐ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

02/13/98 18:14 TEL 7477306 ENSAFE ALLEN HOS →→→ CHARSAFE 002

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

CTO-TASK: 2901-08440
COC #:
BPA/SO: P04 REL 35

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNOY
ADDRESS: ZONE A-NATURAL ATTENUATION
TELEPHONE NO.: 803-884-0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO.:
SAMPLERS: (SIGNATURE) [signature]

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	ANALYSIS REQUIRED: DISSOLVED GAS	IRON	ALKALINITY					REMARKS
NBCA039GW12D01	2/13/98	14:55	GW	125ml Poly		N/A	1		X	X					
NBCA039GW12D01	2/13/98	14:55	GAS	60ml Syringe		N/A	2	X							

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE [signature]	2/13/98	SIGNATURE E Mandor	2/13	SIGNATURE		SIGNATURE	
PRINTED CHARLES KIRK	TIME	PRINTED Eric Mandor	TIME	PRINTED	TIME	PRINTED	TIME
COMPANY TARGET		COMPANY Target	1700	COMPANY		COMPANY	
REASON Analysis		REASON Analysis		REASON		REASON	

METHOD OF SHIPMENT:
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☐ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

PAGE 1 OF 1

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2901-08440
COC #:
BPA/SO: P.O. 4, Rel 35

CLIENT: Naval Base Charleston
ADDRESS: Zone A
PROJECT NAME/NUMBER: 2901-08440
SAMPLERS: (SIGNATURE) Matthew A. Bost

PROJECT MANAGER: Charlie Vernoy
TELEPHONE NO.: (803) 884-0029
FAX. NO.:

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	ANALYSIS REQUIRED: VOC	TOC	Sul.Chl.Nit.					REMARKS
NBCA\039GW04D01	2-13-98	1230	H_2O	8,16 oz poly 40 ml vials	4°C	VOC-HCl TOC-H_2SO_4	4	✓	✓	✓					
NBCA\039GW00501		1330					4	✓	✓	✓					
NBCA\039GW00201		1513					4	✓	✓	✓					
NBCA\039TW00201		—					2	✓							

Matthew A. Bost

RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	DATE / TIME	RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	DATE / TIME
SIGNATURE: Matthew A. Bost	2-13-98	SIGNATURE:		SIGNATURE:		SIGNATURE:	
PRINTED: Matt Bost		PRINTED:		PRINTED:		PRINTED:	
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	
REASON: Ship to lab	1700	REASON:		REASON:		REASON:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO.: 4848175161
SPECIAL INSTRUCTION:

COMMENTS: DQO 2

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☑ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

PAGE 1 OF 1

NAVY CLEAN

ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2901 - 068440
COC #:
BPA/SO: P04, Rel.#35

CLIENT: Naval Base Charleston
ADDRESS: Zone A/Natural Attenuation
PROJECT NAME/NUMBER: 2901-068440
SAMPLERS: (SIGNATURE) Matthew A. Boost

PROJECT MANAGER: Charlie Vernoy
TELEPHONE NO.: (803) 884-0629
FAX. NO.:

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	Chloride, Sulfate, Nitrate	TOC					REMARKS
NBCA\039GW12D01	12-17-98	1147	H_2O	8,16oz poly 40 ml vials	4°C	VOC-HCl TOC-H_2SO_4	4	✓	✓	✓					
NBCA\039GW01201		1400					4	✓	✓	✓					
NBCA\039GW12I01		1545					4	✓	✓	✓					
NBCA\039GW00101		1500					4	✓	✓	✓					
NBCA\039GW00301		1600					4	✓	✓	✓					
NBCA\039TW00301		—		40 ml vials			2	✓	~~✓~~ MAB	~~✓~~					VOCs only
Matthew A. Boost															

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE: Matthew A. Boost	12-17-98	SIGNATURE:		SIGNATURE:		SIGNATURE:	
PRINTED: Matt Boost	TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe	1700	COMPANY:		COMPANY:		COMPANY:	
REASON: Ship to lab		REASON:		REASON:		REASON:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO. 4849149266
SPECIAL INSTRUCTION:

COMMENTS: DQO 2

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☒ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCDCR1

PAGE 1 OF 1

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2901-08440
COC #:
BPA/SO: PO4 REL 35

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Verney
ADDRESS: Zone A/Natural Attenuation
TELEPHONE NO.: 803-884-0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO.:
SAMPLERS: (SIGNATURE) R Brand

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Dissolved GAS	Iron	Alkalinity					REMARKS
NBCA039GW01001	2-17-98	11:14	GW	125ml Poly		N/A	1		X	X					
NBCA039GW01001	2-17-98	11:50	GAS	60 ml Syringe		N/A	2	X							
NBCA039GW01001	2-17-98	1253	GW	125 ml Poly		N/A	1		X	X					
NBCA039GW01001	2-17-98		GAS	60 ml Syringe		N/A	2	X							
NBCA039GW01001	2-17-98	1421	GW	125ml Poly		N/A	1		X	X					
NBCA039GW01001	2-17-98	1458	GAS	60ml Syringe		N/A	2	X							
NBCA039GW00601	2-17-98	1611	GW	125 ml Poly		N/A	1		X	X					
NBCA039GW00601	2-17-98	1658	GAS	60 ml Syringe		N/A	2	X							

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE Randy Brand	2/17/98	SIGNATURE E Meyler	2-17-98	SIGNATURE		SIGNATURE	
PRINTED Randy Brand		PRINTED Eric Meyler		PRINTED		PRINTED	
COMPANY TARGET	TIME	COMPANY Target	TIME	COMPANY	TIME	COMPANY	TIME
REASON ANALYSIS	1713	REASON Analysis	1723	REASON		REASON	

METHOD OF SHIPMENT:
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- [x] DISPOSED OF
- [ ] STORED (90 DAYS MAX)
- [ ] STORED OVER 90 DAYS
- [ ] RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCDCR1

TARGET LABORATORIES

9180 Rumsey Road, Columbia, Md 21045
Office: 410-992-6622 Fax: 410-992-0347

CHAIN-OF-CUSTODY RECORD

JOB CODE: EAH005M

CLIENT: ENSAFE / Naval Activities
ADDRESS:
PHONE: 803-884-0029 FAX:
CLIENT PROJECT #: PROJECT MANAGER: Charlie Vernoy

DATE: 2/17/98 PAGE 1 OF 1
P.O.# :
LOCATION: Charleston Naval Base
COLLECTOR: Brand / Hobson DATE OF COLLECTION: 2/17/98

Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010	VOA 602/8020	VOA 624/8260	Semi Vol 625/8270	TPH 418.1	TPH 8015 (gasoline)	TPH 8015 (diesel)	TPH 8015 (g & d)	PNA 610/8100	PEST/PCBs 8080	TOC	BOD	LEAD 239.2	pH	Ignitability	Metals 6000/7000	Reactivity	Cyanide / Metal	Preservative (Y/N)	FIELD NOTES	Total Number of Containers	Laboratory Note Number
VBCA039GW	0101	1114	GW	125 ml Poly																	X		N		1	
				40 ml VOA		X																	Y	HCl	2	
				40 ml VOA										X									Y	H_2SO_4	2	
VBCA038GW	0101	1253	GW	125 ml Poly																	X		N		1	
				40 ml VOA		X																	Y	HCl	2	
				40 ml VOA										X									Y	H_2SO_4	2	
VBCA039GW	0101	1121	GW	125 ml Poly																	X		N		1	
				40 ml VOA		X																	Y	HCl	2	
				40 ml VOA										X									Y	H_2SO_4	2	
VBCA039GW	0101	1611	GW	125 ml Poly																	X		N		1	
				40 ml VOA		X																	Y	HCL	2	
				40 ml VOA										X									Y	H_2SO_4	2	

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME
[illegible]	2-17-98	E Maylor	2-17-98
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME

SAMPLE RECEIPT	
Total Number of Containers	20
Chain of Custody Seals Y/N NA	N/A
Seals Intact? Y/N NA	Y
Received Good Cond./Cold	Y
Notes:	

LABORATORY NOTES:

02/18/98 09:20 TEL 7477306 ENSAFE ALLEN HUS →→→ CHARSAFE

PAGE 1 OF 1

CTO-TASK: 2901-08440
COC #:
BPA/SO:

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Verney
ADDRESS: Zone A-NATURAL ATTENUATION
TELEPHONE NO.: 803-884-0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO.:
SAMPLERS: (SIGNATURE) R Brand

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Dissolved GAS	Iron	Alkalinity					REMARKS
NBCA039GW01001	2-17-98	11:14	GW	125ml Poly		N/A	1		X	X					
NBCA039GW01001	2-17-98	11:50	GAS	60 ml Syringe		N/A	2	X							
NBCA039GW01001	2-17-98	1253	GW	125 ml Poly		N/A	1		X	X					
NBCA039GW01001	2-17-98		GAS	60 ml Syringe		N/A	2	X							
NBCA039GW01001	2-17-98	1421	GW	125ml Poly		N/A	1		X	X					
NBCA039GW01001	2-17-98	1458	GAS	60 ml Syringe		N/A	2	X							
NBCA039GW00601	2-17-98	1611	GW	125 mL Poly		N/A	1		X	X					
NBCA039GW00601	2-17-98	1658	GAS	60 mL syringe		N/A	2	X							

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE: Randy Brand	2/17/98	SIGNATURE: E Maeder	2-17-98	SIGNATURE:		SIGNATURE:	
PRINTED: RANDY BRAND		PRINTED: Eric Maeder		PRINTED:		PRINTED:	
COMPANY: TARGET	TIME	COMPANY: Target	TIME	COMPANY:	TIME	COMPANY:	TIME
REASON: ANALYSIS	1713	REASON: Analysis	1239	REASON:		REASON:	

METHOD OF SHIPMENT:
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☐ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

TARGET LABORATORIES

9180 Rumsey Road, Columbia, Md 21045
Office: 410-992-6622 Fax: 410-992-0347

CHAIN-OF-CUSTODY RECORD

JOB CODE: EAH005M

CLIENT: EnSafe
ADDRESS:
PHONE: 803-884-0029 FAX:
CLIENT PROJECT #: PROJECT MANAGER: Charlie Vernoy

DATE: 2/17/98 PAGE 1 OF 1
P.O.# :
LOCATION: Charleston Naval Base
COLLECTOR: Brand / Hobson DATE OF COLLECTION: 2/17/98

Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010	VOA 602/8020	VOA 624/8260	Semi Vol 625/8270	TPH 418.1	TPH 8015 (gasoline)	TPH 8015 (diesel)	PNA 610/8100	PEST/PCBs 8080	TOC	BOD	LEAD 2392	pH	Ignitability	Metals 6000/7000	Reactivity	Anion / metal	Preservative (Y/N)	FIELD NOTES	Total Number of Containers	Laboratory Note Number
NBCA039GW	01001	11:14	GW	125ml Poly																	X	N		1	
				40 ml VOA		X																Y	HCl	2	
				40 ml VOA										X								Y	H_2SO_4	2	
NBCA037GW	010101	1253	GW	125 ml Poly																	X	N		1	
				40 ml VOA		X																Y	HCl	2	
				40 ml VOA										X								Y	H_2SO_4	2	
NBCA039GW	010001	1421	GW	125 ml ~~VOA~~ Poly																	X	N		1	
				40 ml VOA		X																Y	HCl	2	
				40 ml VOA										X								Y	H_2SO_4	2	
NBCA039GW	00601	1611	GW	125 ml Poly																	X	N		1	
				40 ml VOA		X																Y	HCL	2	
				40 ml VOA										X								Y	H_2SO_4	2	

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME
Randy Brand	2-17-98	E Maylor	17:20 2-17-98
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME

SAMPLE RECEIPT	
Total Number of Containers	20
Chain of Custody Seals Y/N NA	N/A
Seals Intact? Y/N NA	Y
Received Good Cond./Cold	Y
Notes:	

LABORATORY NOTES:

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

CTO-TASK: 2901-08440
COC #:
BPA/SO: PO4 REL 35

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
ADDRESS: Zone A-NATURAL ATTENUATION
TELEPHONE NO. 803-884-0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO. 803-856-0107
SAMPLERS: (SIGNATURE)

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	TOC	Chloride, Nitrate	Sulfate				REMARKS
NBCA\039GW01001	2-18-98	0920	H_2O	40mL vial, 250mL poly 500mL poly	4°C	VOA=HCL TOC=H_2SO_4	4	X	X	X	X				
NBCA\039GW10I01		0945	H_2O				4	X	X	X	X				
NBCA\039GW10D01		1010	H_2O				4	X	X	X	X				
NBCA\039GW00601		1120	H_2O				4	X	X	X	X				
NBCA\039GW00701		1450	H_2O				4	X	X	X	X				
NBCA\039TW01001		—	H_2O	40mL vial		HCL	2	X							

2-18-98

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE	2/18/98	SIGNATURE		SIGNATURE		SIGNATURE	
PRINTED Todd B. Temple		PRINTED		PRINTED		PRINTED	
COMPANY ENSAFE	TIME 1600	COMPANY	TIME	COMPANY	TIME	COMPANY	TIME
REASON Ship to Lab		REASON		REASON		REASON	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO. 4849149255
SPECIAL INSTRUCTION:

COMMENTS: 0202

AFTER ANALYSIS, SAMPLES ARE TO BE:
- [x] DISPOSED OF
- [ ] STORED (90 DAYS MAX)
- [ ] STORED OVER 90 DAYS
- [ ] RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCDCR1

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

CTO-TASK: 2901-08440
COC #:
BPA/SO: PO 4 Rel 35

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNON
ADDRESS: ZONE A - NATURAL ATTENUATION
TELEPHONE NO.: 803 884 0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO.:
SAMPLERS: (SIGNATURE) R. Brand

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	IRON	ALKALINITY	OXYGEN	CARBON DIOXIDE	NITROGEN	HYDROGEN/METHANE	ETHANE/ETHENE	REMARKS
NBCA039GW20701	2-18-98	1012	GW	125 mL Poly		N/A	1	X	X						
NBCA039GW00701	2-18-98	1141	GAS	60 mL SYRINGE		N/A	2			X	X	X	X	X	
NBCA039GW01401	2-18-98	1226	GW	125 mL Poly		N/A	1	X	X						
NBCA0396W01401	2-18-98	1314	GAS	60 mL SYRINGE		N/A	2			X	X	X	X	X	
NBCA039GW14D01	2-18-98	1355	GW	125 mL Poly		N/A	1	X	X						
NBCA039GW14D01	2-18-98	1425	GAS	60 mL SYRINGE		N/A	2			X	X	X	X	X	
NBCA039GW00901	2-18-98	1444	GW	125 mL Poly		N/A	1	X	X						
NBCA039GW00901	2-18-98	1540	GAS	60 mL SYRINGE		N/A	2			X	X	X	X	X	
NBCA039GW09I01	2-18-98	1600	GW	125 mL Poly		N/A	1	X	X						
NBCA039GW09I01	2-18-98	1639	GAS	60 mL SYRINGE		N/A	2			X	X	X	X	X	

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE: Randy Brand	2/18/98	SIGNATURE:		SIGNATURE:		SIGNATURE:	
PRINTED: Randy Brand	TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: TARGET	1725	COMPANY:		COMPANY:		COMPANY:	
REASON:		REASON:		REASON:		REASON:	

METHOD OF SHIPMENT:
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☒ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

02/19/98 09:19 TEL/FAX 803 884 0029 ENSAFE ALLEN HOS ### CHARGAID PAGE 02

TARGET LABORATORIES

9180 Rumsey Road, Columbia, Md 21045
Office: 410-992-6622 Fax: 410-992-0347

CHAIN-OF-CUSTODY RECORD

JOB CODE: EAH005M

CLIENT: ENSAFE
ADDRESS:
PHONE: 803-884-0029 FAX:
CLIENT PROJECT #: PROJECT MANAGER: Charlie Verney

DATE: 2/18/98 PAGE 1 OF 1
P.O.# :
LOCATION: Charleston Naval Base
COLLECTOR: Brand / Hobson DATE OF COLLECTION: 2/18

Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010	VOA 602/8020	VOA 624/8260	Semi Vol 625/8270	TPH 418.1	TPH 8015 (gasoline)	TPH 8015 (diesel)	TPH 8015 (g & d)	PNA 610/8100	PEST/PCBs 8080	TOC	BOD	LEAD 239.2	pH	Ignitability	Metals 6000/7000	Reactivity	Preservative (Y/N)	FIELD NOTES	Total Number of Containers	Laboratory Note Number
NBCA039GW	00701	1042	GW	125 ml poly																	X	N		1	
				40 ml VOA		X																Y	HCl	2	
				40 ml VOA											X							Y	H_2SO_4	2	
NBCA039GW	01401	1226	GW	125 ml poly																	X	N		1	
				40 ml VOA		X																Y	HCl	2	
				40 ml VOA											X							Y	H_2SO_4	2	
NBCA039GW	[illegible]	1355	GW	125 ml poly																	X	N		1	
				40 ml VOA		X																Y	HCl	2	
				40 ml VOA											X							Y	H_2SO_4	2	
NBCA039GW	09901	1444	GW	125 ml poly																	X	N		1	
				40 ml VOA		X																Y	HCl	2	
				40 ml VOA											X							Y	H_2SO_4	2	
NBCA039GW	09301	1600	GW	125 ml poly																	X	N		1	
				40 ml VOA		X																Y	HCl	2	
				40 ml VOA											X							Y	H_2SO_4	2	

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME
Douglas B. Hobson	2-18-98 1720		
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME

SAMPLE RECEIPT	
Total Number of Containers	
Chain of Custody Seals Y/N NA	
Seals Intact? Y/N NA	
Received Good Cond./Cold	
Notes:	

LABORATORY NOTES:

PAGE 2 OF 2

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2901-08440
COC #:
BPA/SO:

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNOY
ADDRESS: ZONE A - NATURAL ATTENUATION
TELEPHONE NO.: 403-884-0029
PROJECT NAME/NUMBER: 2901-08440
FAX. NO.:
SAMPLERS: (SIGNATURE)

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	ANALYSIS REQUIRED: IRON	ALKALINITY	OXYGEN	CARBON DIOXIDE	NITROGEN	HYDROGEN	METHANE/ETHANE-ENE	REMARKS
NBCA039GW00801	2/19/98	15:36	GW	125 ml Poly			1	X	X						
NBCA039GW00801	2/19/98	15:36	GAS	60 cc Syringe			2			X	X	X	X	X	
NBCA039GW01501	2/19/98	13:02	GW	125 ml Poly			1	X	X						
NBCA039GW01501	2/19/98	13:02	GAS	60 cc Syringe			2			X	X	X	X	X	
NBCA039GW15D01	2/19/98	14:16	GW	125 ml Poly			1	X	X						
NBCA039GW15D01	2/19/98	14:16	GAS	60 cc Syringe			2			X	X	X	X	X	

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE: [signature]	2/19/98	SIGNATURE: E Maudar	2/19/98	SIGNATURE:		SIGNATURE:	
PRINTED: CHARLIE KIRK		PRINTED: Eric Maudar		PRINTED:		PRINTED:	
COMPANY: TARGET	TIME	COMPANY: Target	TIME	COMPANY:	TIME	COMPANY:	TIME
REASON: ANALYSIS	18:02	REASON: Analysis	1808	REASON:		REASON:	

METHOD OF SHIPMENT:
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☐ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCDCR1

PAGE 1 OF 2

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2901-08440
COC #:
BPA/SO:

CLIENT Naval Base Charleston PROJECT MANAGER Charlie Vernoy
ADDRESS Zone A - NATURAL ATTENUATION TELEPHONE NO. 803-884 0029
PROJECT NAME/NUMBER 2901-08440 FAX. NO.
SAMPLERS: (SIGNATURE) [signature]

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Iron	Alkalinity	Oxygen	Carbon Dioxide	Nitrogen	Hydrogen/methane	Ethane/Ethene	REMARKS
NBCA039GW09D01	2/19/98	0926	GW	125ml Poly		N/A	1	X	X						
NBCA039GW09D01	2/19/98	1003	gas	60ml Syringe		N/A	2			X	X	X	X	X	
NBCA039GW13D01	2/19/98	0934	GW	125ml Poly		N/A	1	X	X						
NBCA039GW13D01	2/19/98	1000	gas	60ml Syringe		N/A	2			X	X	X	X	X	
NBCA039GW01301	2/19/98	1131	GW	125ml Poly		N/A	1	X	X						
NBCA039GW13I01	2/19/98	1100	GW	125ml Poly		N/A	1	X	X						
NBCA039GW01301	2/19/98	1210	gas	60ml Syringe		N/A	2			X	X	X	X	X	
NBCA 039GW13I01	2/19/98	1137	gas	60ml Syringe		N/A	2			X	X	X	X	X	
NBCA039GW08D01	2/19/98	1351	GW	125ml Poly		N/A	1	X	X						
NBCA039GW08D01	2/19/98	1425	gas	60ml Syringe		N/A	2			X	X	X	X	X	

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE [signature]	2/19/98	SIGNATURE E Maslar	2/19/98	SIGNATURE		SIGNATURE	
PRINTED CHARLES KIRK		PRINTED Eric Maslar		PRINTED		PRINTED	
COMPANY TARGET	TIME	COMPANY Target	TIME	COMPANY	TIME	COMPANY	TIME
REASON ANALYSIS	18:42	REASON Analysis	1808	REASON		REASON	

METHOD OF SHIPMENT:
SHIPMENT NO.
SPECIAL INSTRUCTION:

COMMENTS:

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☐ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

TARGET LABORATORIES

9180 Rumsey Road, Columbia, Md 21045
Office: 410-992-6622 Fax: 410-992-0347

CHAIN-OF-CUSTODY RECORD

JOB CODE: EAH005m

CLIENT: ENSAFE
ADDRESS:
PHONE: 803-744-0029 FAX:
CLIENT PROJECT #: PROJECT MANAGER: Charlie Verney

DATE: 2/19/98 PAGE 1 OF 2
P.O.# :
LOCATION: Charleston Naval Base
COLLECTOR: DATE OF COLLECTION: 2/19

Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010	VOA 602/8020	VOA 624/8260	Semi Vol 625/8270	TPH 418.1	TPH 8015 (gasoline)	TPH 8015 (diesel)	PNA 610/8100	PEST/PCBs 8080	TOC	BOD	LEAD 239.2	pH	Ignitability	Metals 6000/7000	Reactivity	Anions/Metals	Preservative (Y/N)	FIELD NOTES	Total Number of Containers	Laboratory Note Number
NBCA039GW	09001	0926	GW	125 ml Poly																X		N		1	
				40 ml VOA			X															Y	HCl	2	
				40 ml VOA										X								N	~~HCl~~	2	
NBCA039GW	13001	934	GW	125 ml Poly																X		N		1	
				40 ml VOA			X															Y	HCl	2	
				40 ml VOA										X								N	~~HCl~~	2	
NBCA039GW	13201	1100	GW	125 ml Poly																X		N		1	
				40 ml VOA			X															Y	HCl	2	
				40 ml VOA										X								N	~~HCl~~	2	
NBCA039GW	13301	1131	GW	125 ml Poly																X		N		1	
				40 ml VOA			X															Y	HCl	2	
				40 ml VOA										X								N	~~HCl~~	2	
NBCA039GW	~~13501~~	1357	GW	125 ml Poly																X		N		1	
	08001			40 ml VOA			X															Y	HCl	2	
	08001			40 ml VOA										X								N	~~HCl~~	2	
NCBA039GW	00801	15:36	GW	125 ml Poly																X		N		1	
				40 ml VOA			X															Y		2	
				40 ml VOA										X								N		2	

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME
[signature]	2/19/98 18:04	[signature]	2/19/98 18:10
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME

SAMPLE RECEIPT	
Total Number of Containers	
Chain of Custody Seals Y/N NA	
Seals Intact? Y/N NA	
Received Good Cond./Cold	
Notes:	

LABORATORY NOTES:

TARGET LABORATORIES

9180 Rumsey Road, Columbia, Md 21045
Office: 410-992-6622 Fax: 410-992-0347

CHAIN-OF-CUSTODY RECORD

JOB CODE: EAH005M

CLIENT: ENSAFE

ADDRESS:

PHONE: 803-884-0029 FAX:

CLIENT PROJECT #: PROJECT MANAGER: CHARLIE VETINOY

DATE: 2-19-98 PAGE 2 OF 2

P.O.# :

LOCATION: CHARLESTON NAVAL BASE

COLLECTOR: KICK, BARNES, HOBSON DATE OF COLLECTION: 2/19/98

Sample Number	Depth	Time	Sample Type	Container Type	VOA 601/8010	VOA 602/8020	VOA 624/8260	Semi Vol 625/8270	TPH 418.1	TPH 8015 (gasoline)	TPH 8015 (diesel)	PNA 610/8100	PEST/PCBs 8080	TOC	BOD	LEAD 239.2	pH	Ignitability	Metals 6000/7000	Reactivity	HNO3/HCl	Preservative (Y/N)	FIELD NOTES	Total Number of Containers	Laboratory Note Number
NBCA039GW	01501	1302	GW	125m Poly																X		N		1	
↓	↓	↓	↓	40m VOA		X																Y	HCL	2	
				40m VOA										X								N		2	
NBCA039GW	15D01	1416		125m Poly																X		N		1	
↓	↓	↓	↓	40m VOA		X																Y	HCL	2	
				40m VOA										X								N		2	

RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME
[signature]	2/19/98 18:04	E Munden	2/19/98 18:10
RELINQUISHED BY: (Signature)	DATE/TIME	RECEIVED BY: (Signature)	DATE/TIME

SAMPLE RECEIPT	
Total Number of Containers	
Chain of Custody Seals Y/N NA	
Seals Intact? Y/N NA	
Received Good Cond./Cold	
Notes:	

LABORATORY NOTES:

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

CTO-TASK: 2901-0844Ø
COC #:
BPA/SO: PO 4, Rel# 35

CLIENT: Naval Base Charleston
ADDRESS: Zone A/Natural Attenuation
PROJECT NAME/NUMBER: 29Ø1-Ø844Ø
SAMPLERS: (SIGNATURE) Matthew A. Bost

PROJECT MANAGER: Charlie Vernoy
TELEPHONE NO. (8Ø3) 884-ØØ27
FAX. NO.

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	TOC	Chloride, Sulfate, Nitrate					REMARKS
NBCA\Ø39GW14Ø1	2-19-98	ØØØØ	H_2O	8,16 oz poly 4Ø ml vials	4°C	VOC-HCl TOC-H_2SO_4	4	✓	✓	✓					
NBCA\Ø39GW14DØ1		Ø925						✓	✓	✓					
NBCA\Ø39GWØØ9Ø1		1115						✓	✓	✓					
NBCA\Ø39GWØ9IØ1		1145						✓	✓	✓					
NBCA\Ø39GWØ9DØ1		12Ø5						✓	✓	✓					
NBCA\Ø39GWØ13Ø1		15ØØ						✓	✓	✓					~~No custody seals~~ N/A
NBCA\Ø39GW13IØ1		151Ø						✓	✓	✓					No custody seals on one VOC
NBCA\Ø39GW13DØ1		16Ø5						✓	✓	✓					No custody seals
NBCA\Ø39TW13DØ1		—		4Ø ml vial		HCl	2	✓							No custody seals

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE: Matthew A. Bost	2-19-98	SIGNATURE:		SIGNATURE:		SIGNATURE:	
PRINTED: Matt Bost	TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	
REASON: Ship to lab	17ØØ	REASON:		REASON:		REASON:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO. 4849149244
SPECIAL INSTRUCTION:

COMMENTS: DQO 2; Please send custody seals

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☒ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

PAGE 1 OF 1

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2901-08440
COC #:
BPA/SO: P.O.4, Rel #35

CLIENT: Naval Base Charleston
ADDRESS: Zone A/Natural Attenuation
PROJECT NAME/NUMBER: 2901-08440
SAMPLERS: (SIGNATURE) Matthew C. Bost

PROJECT MANAGER: Charlie Vernoy
TELEPHONE NO.: (803) 884-0029
FAX. NO.:

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	TOC	Chloride, Sulfate, Nitrate					REMARKS
NBCA\039GW015D01	7-20-98	0910	H2O	8,16 oz Poly 40 ml glass vials	4°C	VOC-HCl TOC-H2SO4	4	✓	✓	✓					No custody seals
NBCA\039GW15D01		0950					4	✓	✓	✓					
NBCA\039GW0801		1055					4	✓	✓	✓					
NBCA\039GW08D01		1155					4	✓	✓	✓					
NBCA\039TW15D01		—		40 ml vial		HCl	2	✓							

Matthew C. Bost
7-20-98

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE: Matthew C. Bost	7-20-98	SIGNATURE:		SIGNATURE:		SIGNATURE:	
PRINTED: Matt Bost	TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe	1700	COMPANY:		COMPANY:		COMPANY:	
REASON: Ship to lab		REASON:		REASON:		REASON:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO. 4849149222
SPECIAL INSTRUCTION:

COMMENTS: DQO 2; Please, PLEASE send custody seals

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☑ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

PAGE 1 OF 1

NAVY CLEAN
ENSAFE/ALLEN&HOSHALL
(901) 383-9115

CHAIN OF CUSTODY RECORD

CTO-TASK: 2905-08440
COC #:
BPA/SO: ~~2010~~ po4 rel 42

CLIENT: Naval Base Charleston
ADDRESS: Zone E/Natural Attenuation
PROJECT NAME/NUMBER: 2905-08440
SAMPLERS: (SIGNATURE) Matthew A. Bost

PROJECT MANAGER: Charlie Vernoy
TELEPHONE NO.: (803) 884-0029
FAX. NO.:

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	TOC	Chloride/Sulfate Nitrate					REMARKS
NBCE\065GW00701	2-20-98	1430	H_2O	8;16oz poly 40ml vial	4°C	VOC-HCl TOC-H_2SO_4	4	✓	✓	✓					No custody seals

Matthew A. Bost 2-20-98

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
SIGNATURE: Matthew A. Bost	2/20/98	SIGNATURE:		SIGNATURE:		SIGNATURE:	
PRINTED: Matt Bost		PRINTED:		PRINTED:		PRINTED:	
COMPANY: EnSafe	TIME 1700	COMPANY:	TIME	COMPANY:	TIME	COMPANY:	TIME
REASON: Ship to lab		REASON:		REASON:		REASON:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO.: 4849149222
SPECIAL INSTRUCTION:

COMMENTS: DQO 2

AFTER ANALYSIS, SAMPLES ARE TO BE:
- ☑ DISPOSED OF
- ☐ STORED (90 DAYS MAX)
- ☐ STORED OVER 90 DAYS
- ☐ RETURNED TO CUSTOMER

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

CLNCOCR1

ENSAFE

800-588-7962
MEMPHIS, TENNESSEE
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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 29001 ~~29000~~ ~~0001~~ 08-414
COC NO: —
PO NO: ~~6100~~ 4
REL NO: ~~400~~ 59
LAB NAME: SWL

CLIENT Naval Base Charleston
PROJECT MANAGER Charlie Vernoy
LOCATION Zone A MNA
TELE/FAX NO. (843)884-0029 / (843)856-0107
SAMPLERS: (SIGNATURE) Angie Hartson / [signature]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3	SO4	S'	P	TKN	TOC				REMARKS
0386WW0202	10/6/98	0958	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				*HCl, H_2SO_4, NaOH Zn Acetate
~~0386WW0102~~ (TK)	10/6/98	1122	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				
0396WW0102	10/6/98	1225	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				**40ml vials
0396WW0202	10/6/98	1342	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				500ml poly
0396WW1102	10/6/98	1433	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				250ml poly
0396TW1102 (*)	10/6/98	1438	H_2O	40ml vials	4°C	HCl	2	✓	✓									500ml amber glass
																		(*) Sheen observed on groundwater
~~0396W1D02~~ (TK)																		

Angie Hartson 10/6/98

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Angie Hartson	TIME 1545	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: General Engineering		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO. ~~8056135148 05~~ (TK) 8086259481 49
SEND RESULTS TO:

COMMENTS: - DQ03 and TICS

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

ENSCOC2
REV. 05/98

ENSAFE

800-588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC; CINCINNATI,OH; DALLAS,TX; JACKSON,TN; KNOXVILLE,TN; LANCASTER,PA; NASHVILLE,TN; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL; RALEIGH,NC; COLOGNE, GERMANY

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-00[illegible]-08-414-00
COC NO: 4
PO NO: 4
REL NO: 59
LAB NAME: SWL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A MNA
TELE/FAX NO.: (843) 884-0029 / (843) 856-0107
SAMPLERS: (SIGNATURE) N Ball Carol Sandel

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3	SO4	S	D	TKN	TOC			REMARKS
039GW04I02	10.6.98	1032	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			* HCl, NaOH,
039GW04D02	10.6.98	1057	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			Zn Acetate,
039GW00402	10.6.98	1138	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			H_2SO_4
039GW00302	10.6.98	1228	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			
039GW00502	10.6.98	1321	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			** 40ml vial
039TW00502	10.6.98	1321	H_2O	** 40ml vial	4°C	* HCl	2	✓									500 ml poly
																	250 ml poly
																	500 ml amber

N Ball 10/6/98

RELINQUISHER: N Ball	DATE 10/6/98	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Nathaniel I. Ball	TIME 1518	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: General Engineering		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fed Ex
SHIPMENT NO. ~~8018814514162~~ TX
SEND RESULTS TO: 808625948149

COMMENTS: All Samples DQO3's and TICs

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

ENSCOC2
REV. 05/98

ENSAFE

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MEMPHIS, TENNESSEE
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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

PROJECT/JOB NO: 2901-001-06-414-00
COC NO:
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A MNA
TELE/FAX NO.: (843)884-2929 / (843)856-0107
SAMPLERS: (SIGNATURE) Angie Hauton / [signature]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic Plate Counts	REMARKS
039GW00102	10/6/98	1225	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓	
039GW00202	10/6/98	1342	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓	
039GW01102	10/6/98	1433	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓	

Angie Hauton 10/6/98

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Angie Hauton	10/6/98	[signature]	10/6/98				
PRINTED: Angie Hauton	TIME 1525	PRINTED: Nathaniel I. Ball	TIME 1525	PRINTED:	TIME	PRINTED:	TIME
COMPANY: General Engineering		COMPANY: General Engineering		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Hand Delivered
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ENSAFE

800-588-7962
MEMPHIS, TENNESSEE
CHARLESTON, SC; CINCINNATI, OH; DALLAS, TX; JACKSON, TN; KNOXVILLE, TN; LANCASTER, PA; NASHVILLE, TN; NORFOLK, VA; PADUCAH, KY; PENSACOLA, FL; RALEIGH, NC; COLOGNE, GERMANY

CHAIN OF CUSTODY RECORD

PAGE _____ OF _____
PROJECT/JOB NO: 2981-00[redacted]8-414-00
COC NO:
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT: Naval Base Charleston
LOCATION: Zone A MNA
SAMPLERS: (SIGNATURE) [signature] Carol Sandel
PROJECT MANAGER: Charlie Verney
TELE/FAX NO. (843) 884-0029 / (843) 856-0107

ANALYSIS REQUIRED: Hexadecane, Flue, Cumene

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Hexadecane	Flue	Cumene	REMARKS
~~036 (DUP)~~											
039GW00302	10.6.98	1208	H_2O	125 ml poly	4°C	Thiosulfate	1	✓			
039GW00502	10.6.98	1301	H_2O	125 ml poly	4°C	Thiosulfate	1	✓			

[signature] 10/6/98

RELINQUISHER	DATE	TIME	RECEIVER	DATE	TIME	RELINQUISHER	DATE	TIME	RECEIVER	DATE	TIME
[signature]	10/6/98	1505									
PRINTED: Nathaniel I. Bell			PRINTED:			PRINTED:			PRINTED:		
COMPANY: Geleel Engineering			COMPANY:			COMPANY:			COMPANY:		

METHOD OF SHIPMENT: Hand Delivered
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

ENSCOC2

10/06/98 17:02 TEL 7477306 ENSAFE ALLEN HOS →→→ CHARSAFE 06

ENSAFE

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MEMPHIS, TENNESSEE
CHARLESTON,SC; CINCINNATI,OH; DALLAS,TX; JACKSON,TN; KNOXVILLE,TN; LANCASTER,PA; NASHVILLE,TN; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL; RALEIGH,NC; COLOGNE, GERMANY

CHAIN OF CUSTODY RECORD

PAGE _____ OF _____
PROJECT/JOB NO: 2901-001-08-414-00
COC NO:
PO NO: 2055
REL NO:
LAB NAME: GEL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernon
LOCATION: Zone A MNA
TELE/FAX NO.: (843)584-0029 / (843)556-0107
SAMPLERS: (SIGNATURE) [signature] Carol Sandel

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic Plate Counts										REMARKS
039GW04I02	10/6/98	1032	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓										
039GW004002	10/6/98	1158	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓										

[signature] 10/6/98

RELINQUISHER: [signature]	DATE 10/6/98	RECEIVER: Stephanie Betterton	DATE 10-6-98	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Nathaniel I. Ball	TIME 1203	PRINTED: Stephanie Betterton	TIME 12:04	PRINTED:	TIME	PRINTED:	TIME
COMPANY: General Engineering		COMPANY: GEL		COMPANY:		COMPANY:	

METHOD OF SHIPMENT:
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

ENSCOC2
REV. 05/98

ENSAFE

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MEMPHIS, TENNESSEE
CHARLESTON, SC; CINCINNATI, OH; DALLAS, TX; JACKSON, TN; KNOXVILLE, TN; LANCASTER, PA; NASHVILLE, TN; NORFOLK, VA; PADUCAH, KY; PENSACOLA, FL; RALEIGH, NC; COLOGNE, GERMANY

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-001-00-414-00
COC NO:
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A NNA
TELE/FAX NO.: (843) 881-0029 / (843) 856-
SAMPLERS: (SIGNATURE) Angie Hartson

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	# CONTAINERS	Acetophenone Pyrene Cumene	REMARKS
038GW002 02	10/6/98	0958	H_2O	125 ml poly	4°C	Na Thiosulfate	1	/	
038GW0002 02	10/6/98	1122	H_2O	125 ml poly	4°C	Na Thiosulfate	1	/	

Angie Hartson 10/6/98

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Angie Hartson	10/6/98	Stephanie Berkerton	10-6-98				
PRINTED: Angie Hartson	TIME 1204	PRINTED: Stephanie Berkerton	TIME 1204	PRINTED:	TIME	PRINTED:	TIME
COMPANY: General Engineering		COMPANY: GEL		COMPANY:		COMPANY:	

METHOD OF SHIPMENT:
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 29Ø1-ØØ1-Ø8-414-ØØ
COC NO: NA
PO NO: 4
REL NO: 54
LAB NAME: SWL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Veynoy
LOCATION: Zone A MWA
TELE/FAX NO.: (843) 884-0029 / (843) 856-0107
SAMPLERS: (SIGNATURE) [signature] / Carol Sandel

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOCs	NO3	SO4	S'	P	TKN	TOC				REMARKS
Ø39GWØ14Ø2	10/7/98	1Ø15	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				* HCl, H_2SO_4, NaOH, Zinc Acetate
Ø39GW14DØ2	10/7/98	1Ø42	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				
Ø39GW1ØDØ2	10/7/98	12ØØ	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				
Ø39GW1ØIØ2	10/7/98	12Ø5	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				** 40 ml vials
Ø39GWØ1ØØ2	10/7/98	131Ø	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				500 ml poly
Ø39GWØ1ØØ2	10/7/98	1321	H_2O	40 ml vials	4°C	HCl	2	✓										250 ml poly
																		500 ml amber glass

10-7-98

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: [signature]	10-7-98 TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: Gen. Engineering	1420	COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fed Ex
SHIPMENT NO. 8Ø8625948150
SEND RESULTS TO:

COMMENTS: All sample DQØ3 & TICs.

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

PROJECT/JOB NO: 2901-0001-08-414-04
COC NO: —
PO NO: 4
REL NO: 59
LAB NAME: SWL

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERDOY
LOCATION: ZONE A MNA
TELE/FAX NO. (843) 884-0029 / (843) 856-0107
SAMPLERS: (SIGNATURE)

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3	SO4	S2-	P	TKN	TOC				REMARKS
0396W012002	10/7/98	1005	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				* HCl, H2SO4, NaOH Zn ACETATE
0396W12D02	10/7/98	1051	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				
0396W12I02	10/7/98	1126	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				** 40 ml VIALS
0396W0180 2	10/7/98	1340	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				500 ml POLY
0396W18D02	10/7/98	1250	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				250 ml POLY
0396W18I02	10/7/98	1228	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				500 ml AMBER GL
039TW0180 2	10/7/98	1345	H2O	40 ml VIAL	4°C	HCl	2	✓										

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
PRINTED: GARY A DALTON	TIME 1445	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: GENERAL ENGINEERING		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: ~~FED EX HAND DELIVERED~~
SHIPMENT NO. @ FED EX 8086259481 50
SEND RESULTS TO:

COMMENTS: ALL SAMPLES DQ03 & TICS

ENSAFE

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-00[redacted]98-414-00
COC NO:
PO NO: 4
REL NO: 59
LAB NAME: Southwest Laboratories

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernon
LOCATION: Zone A MNA
TELE/FAX NO. 843884 0029 / 843856 0107
SAMPLERS: (SIGNATURE) [signature]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3, SO4	S	TOC	TKN, P					REMARKS
0026W0402	10-7-98	0955	H_2O	*	4°C	**	6	X	X	X	X	X					*40ml vials (2)
0026W0602	↓	1130	↓	↓	↓	↓	6	X	X	X	X	X					500ml poly (2)
0396W0702	↓	1445	↓	40-ml vials		HCl	6	X	X	X	X	X					500ml Amber (1)
~~0397W0702~~	TK																250ml poly (1)
0202TW0402	10-7-98	1700	H_2O	*		**	2	X									** HCl, H_2SO_4, NaOH,

Matthew A. Root 10-7-98

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
[signature]	10-7-98						
PRINTED: Thomas D. Stricklant	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO. 8168625948150
SEND RESULTS TO: MAB

COMMENTS: All samples are DQ03 + TICs

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

PROJECT/JOB NO: 29Ø1-[redacted]-Ø8-414-Ø

COC NO:

PO NO: 2053

REL NO:

LAB NAME: GEL

CLIENT: NAVAL BASE CHARLESTON

PROJECT MANAGER: CHARLIE VERNOY

LOCATION: ZONE A MNA

TELE/FAX NO. (843) 884-ØØ29 / (843) 856-ØØ07

SAMPLERS: (SIGNATURE)

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic HPC	REMARKS
Ø39GWØ12Ø2	10/7/98	1ØØ5	H_2O	125ml POLY	4°C	Na THIOSULFATE	1	✓	
Ø39GW12IØ2	10/7/98	1126	H_2O	125ml POLY	4°C	Na THIOSULFATE	1	✓	
Ø39GW18IØ2	10/7/98	1228	H_2O	125ml POLY	4°C	Na THIOSULFATE	1	✓	

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
	10/7/98		10-7-98		10/7/98		10-7-98
PRINTED: GARY A DALTON	TIME	PRINTED: Stephanie Betterton	TIME 1228	PRINTED: Stephanie Betterton	TIME 1250	PRINTED: PETE LUCBER	TIME
COMPANY: GENERAL ENGINEERING		COMPANY: GEL		COMPANY: GEL		COMPANY: GEL	

METHOD OF SHIPMENT: HAND DELIVERED

SHIPMENT NO.

SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

PROJECT/JOB NO: 2901-001-08-414-00
COC NO: —
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT: NAVAL BASE CHARLESTON
LOCATION: ZONE A MNA
SAMPLERS: (SIGNATURE)

PROJECT MANAGER: CHARLIE VERNOY
TELE/FAX NO: (843) 884-0029 / (843) 856-0107

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	HETEROTROPHIC CFS	REMARKS
0396W18D02	10/7/98	1250	H_2O	125 ml POLY	4°C	Na_2 Thiosulfate	1	✓	
0396W0182	10/7/98	1340	H_2O	125 ml POLY	4°C	Na_2 Thiosulfate	1	✓	

RELINQUISHER	DATE	RECEIVER	DATE
PRINTED: GARY A DALTON	10/7/98	PRINTED:	TIME
COMPANY: GENERAL ENGINEERING	TIME 1500	COMPANY:	

RELINQUISHER	DATE	RECEIVER	DATE
PRINTED:	TIME	PRINTED:	TIME
COMPANY:		COMPANY:	

METHOD OF SHIPMENT: HAND DELIVERED
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-001-08-4K1-00
COC NO:
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Veney
LOCATION: Zone A MNA
TELE/FAX NO.: (843) 884-0029 / (843) 856-6107
SAMPLERS: (SIGNATURE) [signature] Carol Bandel

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic Plate Count										REMARKS
0346W01002 ~~[illegible]~~	10-7-98	1310	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓										

RELINQUISHER: [signature]	DATE 10-7-98	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: [signature]	TIME 1420	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: Con Fujitsu		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Hand Deliver
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-001-08-414-00
COC NO:
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Verney
LOCATION: Zone A MNA
TELE/FAX NO.: (843) 884-0029 / (843) 856-0107
SAMPLERS: (SIGNATURE) [signature] / Carol Sandel

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic Plate Count										REMARKS
039GW014Ø2	10/7/98	1015	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓										
039GW10IØ2	10/7/98	1205	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓										
039GW10DØ2	10/7/98	1200	H_2O	125 ml poly	4°C	Na Thiosulfate	1	✓										

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
[signature]	10-7-98	Stephanie Betterton	10-7-98				
PRINTED: [signature]	TIME	PRINTED: Stephanie Betterton	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: Gen Engineering	1224	COMPANY: Gen Engineering	1225	COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Hand Deliver
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2908-[illegible]-08-414-[illegible]
COC NO:
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT Naval Base Charleston
PROJECT MANAGER Charlie Vernoy
LOCATION Zone H SWMU 9
TELE/FAX NO. 8438840029/8438560107
SAMPLERS: (SIGNATURE) Thomas O. Streufert

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Standard Plate Count										REMARKS
009GW02202	10-7-98	0845	H_2O	125ml poly	4°C	Na thiosulfate	1	X										

Thomas O. Streufert 10-7-98

RELINQUISHER: Thomas O. Streufert	DATE 10-7-98	RECEIVER: [signature]	DATE 10-7-98	RELINQUISHER: [signature]	DATE 10-7-98	RECEIVER: Stephanie Betterton	DATE 10-7-98
PRINTED: Thomas O. Streufert	TIME 1200	PRINTED: Douglas W. Welch	TIME 1156	PRINTED: [signature]	TIME 1228	PRINTED: Stephanie Betterton	TIME 1228
COMPANY: EnSafe		COMPANY: Gen. Eng. Lab		COMPANY: Gen. Eng. Lab		COMPANY: GEL	

METHOD OF SHIPMENT: Hand Deliver
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

RECEIVED [signature] 10-7-98

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2908 0 [illegible] 84M 00
COC NO:
PO NO: 2[illegible]
REL NO:
LAB NAME: GEL

CLIENT: NAVBASE CHARLESTON
PROJECT MANAGER: C. VERNOY
LOCATION: ZONE H MNA
TELE/FAX NO. 843884 0029 / 856 0147
SAMPLERS: (SIGNATURE) [signature]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic Plate Cts.										REMARKS
009GW01502	10/7/98	1000	H2O	125ml Poly	4°C	Na Thiosulfate	1	X										
009GW02402	10/7/98	1045	H2O	↓	↓	↓	1	X										

[signature] 10/7/98

RELINQUISHER: [signature]	DATE 10/7/98	RECEIVER: Stephanie Bertleth	DATE 10-7-98	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Brett Heeney	TIME 1115	PRINTED:	TIME 1250	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY: GEL		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: HAND RECEIVER
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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9810230!

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

PROJECT/JOB NO: 2901-[redacted]-98-414-0

COC NO:

PO NO: 2053

REL NO:

LAB NAME: OEL

CLIENT Naval Base Charleston

PROJECT MANAGER Charlie Vernon

LOCATION Zone TS [redacted] A

TELE/FAX NO. 8438840029/8438860107

SAMPLERS: (SIGNATURE) Thomas O. Street

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Standard Methane	REMARKS
0026W0001002	10-6-98	0955	H2O	125ml poly	4°C	Na Thiosulfate	1	X	

Thomas O. Street 10-7-98

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Thomas O. Street	10-7-98	[signature]	10-7-98	[signature]	10-7-98	Stephanie Betterton	10-7-98
PRINTED: Thomas O. Street	TIME 0120	PRINTED: Douglas H. Wade	TIME 1157	PRINTED: Douglas H. Wade	TIME 1227	PRINTED: Stephanie Betterton	TIME 1227
COMPANY: EnSafe		COMPANY: Cor Engineering		COMPANY: Cor Engineering		COMPANY: OEL	

METHOD OF SHIPMENT: Hand Deliver

SHIPMENT NO.

SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE) received by: Stephanie Betterton 10-7-98 12:58

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-00[illegible]8-414-00
COC NO:
PO NO: 4
REL NO: 59
LAB NAME: SWL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernon
LOCATION: Zone A MNA
TELE/FAX NO.: (843) 884-0029 / (843) 856-0107
SAMPLERS: (SIGNATURE) [signature] Carol Sandel

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3	SO4	S	P	TKN	TOC			REMARKS
039GW09I02	10.8.98	1027	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			* HCl, NaOH
039GW09D02	10.8.98	1047	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			Zn Acetate,
039GW009 02	10.8.98	1114	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			H_2SO_4
039GW016 02	10.8.98	1333	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			
039GW16I02	10.8.98	1227	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			** 40 ml vial
039GW16D02	10.8.98	1305	H_2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓			250 ml poly
039TW016 02	10.8.98	1333	H_2O	40 ml vial	4°C	*	2	✓									500 ml poly
																	500 ml amber

[signature] 10/8/98

RELINQUISHER: [signature]	DATE 10.8.98	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Nathaniel I. Ball	TIME 1418	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: General Engineering		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: ~~[illegible]~~ FedEx
SHIPMENT NO. 808625948182
SEND RESULTS TO:

COMMENTS: All Samples DQ03 and TICs

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 29Ø1-ØØ-Ø8-414-ØØ
COC NO:
PO NO: 4
REL NO: 59
LAB NAME: SWL

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNOY
LOCATION: ZONE A MNA
TELE/FAX NO. (843) 884-Ø429 / (843) 856-Ø1Ø7
SAMPLERS: (SIGNATURE)

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3	SO4	S	P	TKN	TOC				REMARKS
~~Ø39Ø1~~ (G)																		* HCl, H2SO4, NaOH Zn Acetate
Ø39GWØ13Ø2	10/8/98	1Ø1Ø	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				
(G) Ø39GW~~17~~13IØ2	10/8/98	1Ø48	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				** 40 ml vials
(G) Ø39GW~~17~~13DØ2	10/8/98	1148	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				500 ml poly
Ø39GWØ17Ø2	10/8/98	1257	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				250 ml poly
~~Ø39GWØ1~~ (G)																		500 ml Amber GL
Ø39GW17DØ2	10/8/98	1315	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				
Ø39GW17IØ2	10/8/98	1336	H2O	**	4°C	*	6	✓	✓	✓	✓	✓	✓	✓				
Ø39TW17IØ2	10/8/98	1341	H2O	40ml. VIALS	4°C	HCl	2	✓										

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: GENERAL ENGINEERING	10/8/98 TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: GARY A DALTON	1430	COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FED EX
SHIPMENT NO. 808625948182
SEND RESULTS TO:

COMMENTS: ALL SAMPLES DQ03 & TICS

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

ENSCOC2

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-00[illegible]08-414-00
COC NO:
PO NO: 62
REL NO:
LAB NAME: Southwest Laboratories

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A
TELE/FAX NO.: 8438840029/8438560107
SAMPLERS: (SIGNATURE) [signature]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3, SO4	S=	TOC	P=, TKN						REMARKS
039GW19D02	10-8-98	1000	H_2O	*	4°C	**	6	X	X	X	X	X						*40ml vial (2)
039GW19I02	↓	1000	↓	↓	↓	↓	6	X	X	X	X	X						500ml poly (2)
039GW019 02	↓	1055	↓	↓	↓	↓	6	X	X	X	X	X						500ml ~~poly~~
039GW08D02	↓	1410	↓	↓	↓	↓	6	X	X	X	X	X						amber (1)
039 GW008 02	↓	1445	↓	↓	↓	↓	6	X	X	X	X	X						250ml poly (1)
039TW019 02	↓	1700	↓	~~[illegible]~~ 40ml vial	↓	HCl	2	X										
																		** HCl, H_2SO_4
																		NaOH

RELINQUISHER: [signature]	DATE 10-8-98	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Thomas Streufert	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fedex
SHIPMENT NO. 808 625 948 182
SEND RESULTS TO:

COMMENTS: All Samples DQO3 & TICs

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901[illegible]084M01
COC NO:
PO NO: 4
REL NO: 59
LAB NAME: SWC

CLIENT: NAVBASE CHARLESTON ANA
PROJECT MANAGER: C. VERNON
LOCATION: ZONE A
TELE/FAX NO.: 843/8[illegible]/856 0107
SAMPLERS: (SIGNATURE) [signature]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3	SOL	S	Phosphorus	TKN	TOC			REMARKS
039GW00602	10.8.98	1220	H2O	*	4°C	**	6	X	X	X	X	X	X	X			(2) *500ml Poly
042GW00102		1450					6	X	X	X	X	X	X	X			500ml Amber
~~[illegible]~~		~~1715~~ DH	~~H2O~~ DH	~~[illegible]~~ DH	~~4°C~~	~~None~~ DH	~~1~~	X	DH								250ml Poly
																	(2) 40ml VOA
																	** VOC-HCl
																	[illegible]
																	NaOH
																	TOC/TKN: H2SO4
																	TOC: H2SO4

[signature] 10/8/98

RELINQUISHER: Brett Heaney	DATE 10/8/98	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Brett Heane	TIME 1715	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FED EX
SHIPMENT NO. 8[illegible].259 48182
SEND RESULTS TO:

COMMENTS: All samples D.G.O.B + TICS

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO:
COC NO:
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT: NAVBASE CHARLESTON
PROJECT MANAGER: C. VERNON
LOCATION: ZONE A
TELE/FAX NO.: 843-884-0024 / 856-0107
SAMPLERS: (SIGNATURE) [signature]

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	ANALYSIS REQUIRED: STD PLATE COUNT	REMARKS
Ø39GW ØØ6Ø2	10/8/98	1235	H2O	125ml	4°C	non thiosulfate	1	X	
Ø42GW ØØ1Ø2		1450					1	X	
Ø39GW08DØ2		1410					1	X	

[signature] 10-8-98

RELINQUISHER: [signature]	DATE 10/8/98	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: BRETT HEENEY	TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: HAND DELIVERED
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: [illegible]
COC NO:
PO NO: [illegible]
REL NO: 1
LAB NAME: GEL

CLIENT [illegible]
LOCATION [illegible]
SAMPLERS: (SIGNATURE) [illegible]
PROJECT MANAGER [illegible]
TELE/FAX NO. [illegible]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	[illegible]	REMARKS
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	X	
[illegible]		[illegible]							
[illegible]		[illegible]							

RELINQUISHER: [illegible]	DATE [illegible]	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: [illegible]	TIME [illegible]	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: [illegible]		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT:
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-401-08-414-00
COC NO:
PO NO: 2053
REL NO:
LAB NAME: GEL

CLIENT Naval Base Charleston
PROJECT MANAGER Charlie Vernay
LOCATION MNA Zone A
TELE/FAX NO. (843)884-0029 / (843)886-0107
SAMPLERS: (SIGNATURE) [signature] Carol Sandel

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic Plate Counts									REMARKS
039 GW09I02	10.8.98	1027	H_2O	125 ml poly	4°C	Ac. Thiosulfate	1	✓									
039 GW09D02	10.8.98	1047	H_2O	125 ml poly	4°C	Ac. Thiosulfate	1	✓									
039 GW009D02	10.8.98	1114	H_2O	125 ml poly	4°C	Ac. Thiosulfate	1	✓									

[signature] 10/8/98

RELINQUISHER: [signature]	DATE 10.8.98	RECEIVER: Stephanie Betterton	DATE 10.8.98	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Nathaniel I. Ball	TIME 1215	PRINTED: Stephanie Betterton	TIME 1215	PRINTED:	TIME	PRINTED:	TIME
COMPANY: General Engineering		COMPANY: GEL.		COMPANY:		COMPANY:	

METHOD OF SHIPMENT:
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 3901-001-08-414-00
COC NO:
PO NO: 253
REL NO:
LAB NAME: GEL

CLIENT Naval Base Charleston
PROJECT MANAGER Charlie Vernon
LOCATION MNA Zone A
TELE/FAX NO. (843) 884-0029 / (843) 856-0107
SAMPLERS: (SIGNATURE) [signature] Carol Sandel

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic Plate Counts	REMARKS
039GW16I02	10 8 98	1227	H_2O	125ml poly	4°C	Na Thiosulfate	1	✓	
039GW016D02	10 8 98	1333	H_2O	125ml poly	4°C	Na Thiosulfate	1	✓	
039GW16D02	10 8 98	1345	H_2O	125ml poly	4°C	Na Thiosulfate	1	✓	

[signature] 10/8/98

RELINQUISHER: [signature]	DATE 10 8 98	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Nathaniel I. Ball	TIME 1450	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: General Engineering		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Hand Deliver
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

SAFE

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PHIS, TENNESSEE
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N; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL;
H,NC; COLOGNE, GERMANY

CHAIN OF CUSTODY RECORD

P. 1 OF

PROJECT/JOB NO: 2901-001-08-414-00
COC NO: —
PO NO: 2053
REL NO: —
LAB NAME: GEL

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNOY
LOCATION: ZONE A MNA
TELE/FAX NO: (843) 884-0029 (843) 856-0107
SAMPLERS: (SIGNATURE)

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	ANALYSIS REQUIRED: HETEROTROPHIC CTS	REMARKS
039GW013 02	10/8/98	1010	H_2O	125 ml POLY	4°C	Na THIOSULFATE	1	✓	
039GW13I02	10/8/98	1048	H_2O	125 ml POLY	4°C	Na THIOSULFATE	1	✓	
039GW13D02	10/8/98	1148	H_2O	125 ml POLY	4°C	Na THIOSULFATE	1	✓	

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: GARY A DALTON	10/8/98	PRINTED: Stephanie Betterton	10-8-98	PRINTED:		PRINTED:	
COMPANY: GENERAL ENGINEERING	TIME 1210	COMPANY: G.E.L	TIME 1211	COMPANY:	TIME	COMPANY:	TIME

METHOD OF SHIPMENT: HAND DELIVERED
SHIPMENT NO.
SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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588-7962
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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

PROJECT/JOB NO: 2901-001-[illegible] 414-04

COC NO: —

PO NO: 2053

REL NO: —

LAB NAME: GEL

CLIENT: NAVAL BASE CHARLESTON

PROJECT MANAGER: CHARLIE VERNOY

LOCATION: ZONE A MNA

TELE/FAX NO: (843) 884-0029 | (843) 856-0107

SAMPLERS: (SIGNATURE)

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Heterotrophic CFU	REMARKS
039GW01702	10/8/98	1257	H_2O	125ml poly	4°C	Na Thiosulfate	1	✓	
039GW17D02	10/8/98	1315	H_2O	125ml poly	4°C	Na Thiosulfate	1	✓	
039GW17I02	10/8/98	1336	H_2O	125ml poly	4°C	Na Thiosulfate	1	✓	

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
PRINTED: GARY A DALTON	TIME 1430	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: GENERAL ENGINEERING		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: HAND DELIVERED

SHIPMENT NO.

SEND RESULTS TO:

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2931-001-98-414-00
COC NO:
PO NO: 4
REL NO: 59
LAB NAME: Southwest Labs

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernon
LOCATION: Zone A
TELE/FAX NO. 8438840029/8438560107
SAMPLERS: (SIGNATURE) Thomas E. [illegible]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	NO3 SO4	S=	TOC	P+3 TKN					REMARKS
042GW00202	10-9-98	1040	H_2O	*	4°C	**	6	X	X	X	X	X					*40ml vial (2)
505GW00102	10-9-98	1130	↓	↓	↓	↓	6	X	X	X	X	X					500ml poly (2)
042TW00202	10-9-98	1700	↓	TS 40ml vials	↓	HCl	2										500ml amber (1)
																	250ml poly (1)
																	** HCl,
																	H_2SO_4, NaOH

Thomas O. [illegible]
10-9-98

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Thomas [illegible]	10-9-98						
PRINTED: Thomas [illegible]	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fedex
SHIPMENT NO. 808625948171
SEND RESULTS TO:

COMMENTS: All samples are DQ03 + TKS.

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-00[redacted]-014-00
COC NO:
PO NO: 4
REL NO: 81
LAB NAME: SWL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Veaney
LOCATION: Zone A
TELE/FAX NO. 843-884-0029
SAMPLERS: (SIGNATURE) [signature]

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA	Nitrate								REMARKS
NBCA\039GW01602	2-12-99	1545	W	2-40ml vial 1-500ml poly	4°C	See Remarks	3	X	X								40ml - HCL
NBCA\039GW16I02	↓	1710	W	↓	↓	↓	3	X	X								
NBCA\039GW16D02	↓	1725	W	↓	↓	↓	3	X	X								
NBCA\039TW16D02	↓	—	W	2-40ml vial	↓	↓	2	X									

2-12-99

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: J. Watson	TIME 1830	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FEDEX
SHIPMENT NO. 808625948528
SEND RESULTS TO: Charlie Veaney

COMMENTS: DQOTII

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-[redacted]-09-014-00
COC NO:
PO NO: 4
REL NO: 81
LAB NAME: SWL

CLIENT: NAVAL BASE Charleston
PROJECT MANAGER: Charlie Verney
LOCATION: Zone A
TELE/FAX NO. 843-884-0029
SAMPLERS: (SIGNATURE) J. Watson

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA	Nitrate									REMARKS
NBCA\039EW01702	2-15-99	0815	W	2-500ml Poly 2-40ml	4°C	HCL	3	X	X									40ml - HCL Poly - None
NBCA\039DW01702	2-15-99	0820	W		4°C	HCL	3	X	X									
NBCA\039GW01702		1500	W		4°C	HCL	3	X	X									
NBCA\039GW17I02		1655	W		4°C	HCL	3	X	X									
NBCA\039GW17D02		1815	W		4°C	HCL	3	X	X									
NBCA\039TW17D02		—	W	2-40ml vials	4°C	HCL	2	X										

2-15-99

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
J. Watson	2-15-99						
PRINTED: J. Watson Sr	TIME 1910	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fedex
SHIPMENT NO. 808625948540
SEND RESULTS TO: Charlie Verney

COMMENTS: DQO III

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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REV. 05/98

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CHAIN OF CUSTODY RECORD

PAGE ___ OF ___

PROJECT/JOB NO: 2901-0[redacted]09-014-06
COC NO:
PO NO: 4
REL NO: 81
LAB NAME: SWL

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNOY
LOCATION: ZONE A
TELE/FAX NO. 843-884-0029
SAMPLERS: (SIGNATURE) Andrew Wertz

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA	NITRATE									REMARKS
NBCA\039GW01802	2-16-99	1340	W	2-40ml vial 1-500 ml poly	4°C	SEE REMARKS	3	X	X									40 ml vial - HCl
NBCA\039GW18I02	↓	1415	↓	↓	↓	↓	3	X	X									
NBCA\039GW18D02	↓	1445	↓	↓	↓	↓	3	X	X									
NBCA\039TW18D02	2-16-99	—	W	2-40ml vial	4°C	* HCl	2	X										

Andrew Wertz
2-16-99

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Andrew Wertz	2-16-99						
PRINTED: ANDREW WERTZ	TIME 1600	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FEDEX
SHIPMENT NO. 808625948550
SEND RESULTS TO: CHARLIE VERNOY

COMMENTS:
DQO III

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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REV. 05/98

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-0[redacted]19-014-00
COC NO:
PO NO: 4
REL NO: 81
LAB NAME: SWL

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNOY
LOCATION: ZONE A
TELE/FAX NO. 843-884-0029/856-0107
SAMPLERS: (SIGNATURE) Andrew Wertz

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA	NITRATE									REMARKS
NBCA\039GW21I02	2-17-99	1135	W	2-40ml vial 1-500ml poly	4°C	see remarks	3	X	X									40ml-HCl
NBCA\039GW21D02	↓	1225	↓	↓	↓	↓	3	X	X									
NBCA\039GW02002	↓	1547	↓	↓	↓	↓	3	X	X									
NBCA\039GW20I02	↓	1515	↓	↓	↓	↓	3	X	X									
NBCA\039GW20D02	↓	1615	↓	↓	↓	↓	3	X	X									
NBCA\039TW20D02	↓	–	↓	2-40ml vial	↓	HCl	2	X										

Andrew Wertz
2-17-99

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Andrew Wertz	2-17-99						
PRINTED: ANDREW WERTZ	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FEDEX
SHIPMENT NO. 808625948561
SEND RESULTS TO: CHARLIE VERNOY

COMMENTS: DQO III

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

PROJECT/JOB NO: 2901-001-014-00
COC NO:
PO NO: 4
REL NO: 81
LAB NAME: SWL

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: CHARLIE VERNOY
LOCATION: ZONE A
TELE/FAX NO. 843-884-0029/856-0107
SAMPLERS: (SIGNATURE) Andrew Wertz

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA	NITRATE									REMARKS
NBCA\039GW02I02	2-18-99	0905	W	2-40 ml vial 1-500ml poly	4°C	see remarks	3	X	X									40ml-HCl
NBCA\039GW00903	↓	1332	↓	2-40 ml vial	↓	HCl	2	X										
NBCA\039GW09I03	↓	1354	↓	↓	↓	↓	2	X										
NBCA\039GW09D03	↓	1415	↓	↓	↓	↓	2	X										
NBCA\039TW09D03	↓	—	↓	↓	↓	↓	2	X										

Andrew C. Wertz
2-18-99

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Andrew Wertz	2-18-99						
PRINTED: ANDREW WERTZ	TIME 1530	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FEDEX
SHIPMENT NO. 808625948572
SEND RESULTS TO: CHARLIE VERNOY

COMMENTS:
DQO III

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-00[illegible]09-014-00
COC NO:
PO NO: 4
REL NO: 81
LAB NAME: SWL

CLIENT NAVAL BASE CHARLESTON
PROJECT MANAGER CHARLIE VERNOY
LOCATION ZONE A
TELE/FAX NO. 843-884-0029/856-0107
SAMPLERS: (SIGNATURE) Andrew Wertz

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA	NITRATE									REMARKS
NBCA039GW01903	2-19-99	1210	W	2-40 ml vial 1-500 ml poly	4°C	see remarks	3	X	X									40ml - HCl
NBCA039GW19I03	↓	1300	↓	↓	↓	↓	3	X	X									
NBCA039GW19D03	↓	1355	↓	↓	↓	↓	3	X	X									
NBCA039TW19D03	↓	—	↓	2-40 ml vial	↓	HCl	2	X										

Andrew Wertz
2-19-99

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Andrew Wertz	2-19-99						
PRINTED: ANDREW WERTZ	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FEDEX
SHIPMENT NO. 808625948583
SEND RESULTS TO: CHARLIE VERNOY

COMMENTS: DQO III

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

Amended COC 8/5/99

PAGE 1 OF 1

PROJECT/JOB NO: 2901-00[redacted]8-414-00
COC NO: 080499BEH
PO NO: #04
REL NO: ~~#5~~ 116
LAB NAME: Southwest

CLIENT: Naval base Charleston
LOCATION: Zone A MNA
SAMPLERS: (SIGNATURE)

PROJECT MANAGER: Charlie Vernoy
TELE/FAX NO. 843-884-0029 / 843-856-0107

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA	TOC	Fe^{2+}	Sulfate	Nitrate	Alkalinity	Sulfide				REMARKS
Ø39GWØ14Ø3	8/4/99	11:37	Water	*	4°C	**	6	X	X	X	X	X	X	X				
Ø39GW14DØ3	8/4/99	14:45	Water	*	4°C	**	6	X	X	X	X	X	X	X				
Ø39GW1ØDØ3	8/4/99	16:30	Water	*	4°C	**	6	X	X	X	X	X	X	X				
Ø39TW1ØDØ3	8/4/99	1700	Water	2-40mL VIAL	4°C	HCL	2	X										

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
PRINTED: Robert Batts	8/4/99	PRINTED:		PRINTED:		PRINTED:	
COMPANY: EnSafe	TIME 1730	COMPANY:	TIME	COMPANY:	TIME	COMPANY:	TIME

METHOD OF SHIPMENT: Fed Ex
SHIPMENT NO. 4848179980
SEND RESULTS TO: Charlie Vernoy

COMMENTS:
* 2-40 mL Vial 1-500 mL Amber (wm) 1-500 mL poly 1-500 mL Amber (Wm) 1-250 mL poly
** HCL H_2SO_4 None HCL NaOH

D203

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

Amended COC 8/5/99

PAGE 1 OF 1

PROJECT/JOB NO: 2901-00 [redacted]3-4/4-00
COC NO: 080499TKR
PO NO: 4
REL NO: ~~115~~ 116
LAB NAME: SWL

CLIENT: Naval Base Charleston
LOCATION: Zone A - MNA
SAMPLERS: (SIGNATURE) / Todd K Kafka

PROJECT MANAGER: Charlie Vernoy
TELE/FAX NO. 843-884-0029 / 856-0107

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	Alkalinity, Sulfate, Nitrate	Fe2+	Sulfide	TOC	VOC						REMARKS
NBCA\038GW01D03	8/4/99	1345	W	500mL Amber, 500mL poly, 250mL, Poly, 40mL Vial	4°C	*	6	X	X	X	X	X						
NBCA\039GW0003	8/4/99	15.00	W	500mL Amber, 500mL Poly, 250mL, Poly, 40mL Vial	4°C	*	6	X	X	X	X	X						
NBCA\039TW0003	8/4/99	1630	W	2-40mL VIAL	4°C	HCL	2					X						

TK 8-4-99

RELINQUISHER: TK Kafka	DATE 1700	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: TK KAFKA	TIME 8/4/99	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FEDEX
SHIPMENT NO. 4848179980
SEND RESULTS TO: Charlie Vernoy

COMMENTS: DQ03

* Fe^{2+} = 10mL HCL VOC = HCL
Sulfide = NaOH

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

Amended COC 8/5/99

PAGE 1 OF 1
PROJECT/JOB NO: 2901-0[redacted]08-414-a
COC NO: QB0499CDE
PO NO: #04
REL NO: ~~115~~ 116
LAB NAME: Southwest

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charles Verney
LOCATION: Zone A - MNA
TELE/FAX NO.: 843-884-0029/8560107
SAMPLERS: (SIGNATURE) Charles Ivey

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE 1999	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA	TOC	Ferrous Iron	Sulfate, Nitrate	Alkalinity	Sulfide					REMARKS
Q38GW0Q2Q3	8/4	1025	H2O	2 40ml, 3 500ml, 1 250ml	4°C	HCL, NaOH, H2SO4,	6	X	X	X	X	X	X					APPRO 24ml Acid
Q39GW0Q2Q3		1110					6	X	X	X	X	X	X					" " "
Q39GW0Q1Q3		1400					6	X	X	X	X	X	X					
Q39GW0Q5Q3		1515					6	X	X	X	X	X	X					
Q39TW0Q5Q3		1600		2 40ml VOAs		HCL	2	X										Trip Blank was lab supplied

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Charlie Ivey	8/4/99						
PRINTED: Charlie Ivey	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fed Ex
SHIPMENT NO. 4848179980
SEND RESULTS TO: Charlie Verney

COMMENTS: DQ03

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

Amended COC 8/9/99

PAGE 1 OF 1
PROJECT/JOB NO: 2901-001-08-414-00
COC NO:
PO NO: 4
REL NO: 116
LAB NAME: Southwest Labs

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A (MNA)
TELE/FAX NO.: 843-884-0029 / 856-0107
SAMPLERS: (SIGNATURE)

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	TOC	Sulfide	Fe2+	Alkalinity, Sulfate, Nitrate					REMARKS
NBCA\039GW12I03	8/5/99	1055	W	500 mL Amber, 250 ml poly, 40 mL vial, 500 ml poly	4°C	*	6	X	X	X	X	X					
NBCA\039GW12D03	8/5/99	1415	W			*	6	X	X	X	X	X					
NBCA\039GW01203	8/5/99	1530	W			*	6	X	X	X	X	X					
NBCA\039GW18D03	8/5/99	1130	W			*	6	X	X	X	X	X					
NBCA\039GW18I03	8/5/99	1540	W			*	6	X	X	X	X	X					
NBCA\039TW01203	8/5/99	—	W	40 mL VOA		HCl	2	X									TRIP BLANK

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
PRINTED: Brett Heaney	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fedex
SHIPMENT NO. 4849448765
SEND RESULTS TO:

COMMENTS: DQO III

* Fe^{2+} = HCL
VOA = HCL
TOC = H_2SO_4

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PROJECT/JOB NO: 2901-001-[illegible]-414-00
COC NO: 0B0599CDI
PO NO: 4
REL NO: 116
LAB NAME: Southwest

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Verney
LOCATION: Zone A
TELE/FAX NO. 8438840029/8560107
SAMPLERS: (SIGNATURE) Charlie Ivey

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE 1999	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOA'S	TOC	FERRAS IRON	Sulfide	Sulfate, Nitrate, Alkalinity						REMARKS
039GW04D3	8/5	0945	H2O	40ml, 250, 500	4°C	HCL, ~~[illegible]~~ H2SO4,	6	X	X	X	X	X						
039GW04I03	↓	1115	↓	↓	↓	↓	6	X	X	X	X	X						
039GW04D03	↓	1540	↓	↓	↓	↓	6	X	X	X	X	X						
039TW04D03	↓	1700	↓	40ml	↓	HCL	2	X										

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Charlie Ivey	8/5/99						
PRINTED: Charles Ivey	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fed. Ex
SHIPMENT NO. 4849148765
SEND RESULTS TO: Charlie Verney

COMMENTS: DQOII

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

PROJECT/JOB NO: 2901-001-08-414-0
COC NO: 080699RMW
PO NO: 04
REL NO: 116
LAB NAME: Southwest

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A - MNA
TELE/FAX NO.: (843) 856-0107 (fax) (843) 884-0029 (tele)
SAMPLERS: (SIGNATURE) Rachel M. White

FIELD SAMPLE NUMBER	1999	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOAs	TOC	Ferrous Iron	Sulfide	Sulfate, Nitrate, Alkalinity						REMARKS
002GW0004 03	8/6	0840	H_2O	40mL 500mL 250mL	4°C	HCl, NaOH H_2SO_4	6	X	X	X	X	X						
039GW0006 03		1135					6	X	X	X	X	X						
039GW0103 03		1345					6	X	X	X	X	X						
039GW10I03		1115					6	X	X	X	X	X						
039TW10I03		1600		40mL VOAs		HCl	2	X										

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Rachel M. White	8/6/99						
PRINTED: Rachel M. White	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fed Ex
SHIPMENT NO. 4849148743
SEND RESULTS TO: Charlie Vernoy

COMMENTS: DQOII

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

Amended COC 8/9/99

PAGE 1 OF

PROJECT/JOB NO: 2901-0 08-414-a
COC NO: 080699
PO NO: 4
REL NO: 116
LAB NAME: SWL

CLIENT: Naval Base Charleston
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A (MNA)
TELE/FAX NO. 843-884-0029/856-0107
SAMPLERS: (SIGNATURE)

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOAs	TOC	Fe2+	Sulfide	Sulfate, Nitrate, Alkalinity					REMARKS
NBCA\039GW17D03	8/6/99	1100	W	40mL, 250mL 500mL	4°C	*	6	X	X	X	X	X					
NBCA\039GW17I03		1215					6	X	X	X	X	X					
NBCA\039GW017D3		1300					6	X	X	X	X	X					
NBCA\039GW13D03		1505					6	X	X	X	X	X					
NBCA\039GW16D03		1035					6	X	X	X	X	X					
NBCA\039GW16I03		1210					6	X	X	X	X	X					
NBCA\039GW016D3		1530					6	X	X	X	X	X					
NBCA\039TW13D03		—					2	X									

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
PRINTED: Todd B. Temple	TIME	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: ENSAFE	8/6/99	COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FedEx
SHIPMENT NO. 4849148743
SEND RESULTS TO:

COMMENTS: DQOII

* TOC = H_2SO_4 Sulfate = NaOH
Fe^{2+} = HCL

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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EnSafe

1915

CHAIN OF CUSTODY RECORD
NATURAL ATTENUATION-CHARLESTON

CTO-Task: 2900-000-01-000
CoC: 99219-TKK
BPA/SO: 0P04REL116/000

Page: 1 of 1

Address: 935 Houston Northcutt
Mt. Pleasant, SC 29464

Project Manager: Todd
Telephone No.: (803) 884-0029
Fax No.: (803) 856-0107

Database Number 2900-00001

Samplers: (Signature): _____

Field Sample Number	Date	Time	Sample Type	Type/Size Of Container	Preservation TEMP.	Preservation Chemical	No. of Containers	ALKALINITY	FE2	NITRATE	SULFATE	SULFIDE	SW846-VOA	TOC				Remarks
039GW00B03	08/07/99	14:45	Water		4ø C		6	X	X	X	X	X	X	X				
039GW01303	08/07/99	10:30	Water		4ø C		6	X	X	X	X	X	X	X				
039GW01904	08/07/99	10:50	Water		4ø C		6	X	X	X	X	X	X	X				
039GW08D03	08/07/99	15:45	Water		4ø C		6	X	X	X	X	X	X	X				
039GW13I03	08/07/99	10:35	Water		4ø C		6	X	X	X	X	X	X	X				
039GW19D04	08/07/99	14:05	Water		4ø C		6	X	X	X	X	X	X	X				
039GW19I04	08/07/99	12:15	Water		4ø C		6	X	X	X	X	X	X	X				

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
Signature:	08/09/99	Signature:		Signature:		Signature:	
Printed: TODD K KAFKA		Printed:		Printed:		Printed:	
Company: E/A&H	TIME	Company:	TIME	Company:	TIME	Company:	TIME
Reason: Ship to Lab	16:00	Reason:		Reason:		Reason:	

Method of Shipment: FED-EX
Shipment No.: 4849148732
Special Instruction: SWL

Comments: DQ03

After Analysis, Samples are to be:
X Disposed of
___ Stored (90 days Max)
___ Stored Over 90 Days
___ Returned to Customer

Lab: SOUTHWEST LABS OF OKLAHOMA

Analytical Data Received by: (initials & date) _____

EnSafe

1915

CHAIN OF CUSTODY RECORD
NATURAL ATTENUATION-CHARLESTON

CTO-Task: 2900-000-01-000
CoC: 99220-TKK
BPA/SO: 0P04REL116/000

Page: 1 of 1

Address: 935 Houston Northcutt
Mt. Pleasant, SC 29464

Project Manager: Todd
Telephone No.: (803) 884-0029
Fax No.: (803) 856-0107

Database Number 2900-00001

Samplers: (Signature): _____

Field Sample Number	Date	Time	Sample Type	Type/Size Of Container	Preservation TEMP.	Preservation Chemical	No. of Containers	ALKALINITY	FE2	NITRATE	SULFATE	SULFIDE	SW846-VOA	TOC				Remarks
039GW00904	08/08/99	12:00	Water		4ø C		6	X	X	X	X	X	X	X				
039GW02003	08/08/99	11:35	Water		4ø C		6	X	X	X	X	X	X	X				
039GW09D04	08/08/99	10:15	Water		4ø C		6	X	X	X	X	X	X	X				
039GW09I04	08/08/99	11:45	Water		4ø C		6	X	X	X	X	X	X	X				
039GW20D03	08/08/99	10:25	Water		4ø C		6	X	X	X	X	X	X	X				
039GW20I03	08/08/99	10:32	Water		4ø C		6	X	X	X	X	X	X	X				
039TW02003	08/08/99	17:00	Water		4ø C		2						X					

RELINQUISHED BY:	DATE	RECEIVED BY:	DATE	RELINQUISHED BY:	DATE	RECEIVED BY:	DATE
Signature:	08/09/99	Signature:		Signature:		Signature:	
Printed: TODD K KAFKA		Printed:		Printed:		Printed:	
Company: E/A&H	TIME	Company:	TIME	Company:	TIME	Company:	TIME
Reason: Ship to Lab	16:00	Reason:		Reason:		Reason:	

Method of Shipment: FED-EX
Shipment No.: 4849148732
Special Instruction: SWL

Comments: DQ03

After Analysis, Samples are to be:
X Disposed of
___ Stored (90 days Max)
___ Stored Over 90 Days
___ Returned to Customer

Lab: SOUTHWEST LABS OF OKLAHOMA

Analytical Data Received by: (initials & date) _____

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CHAIN OF CUSTODY RECORD

Amended COC 8/11/99

PROJECT/JOB NO: 2901-00[illegible]8-414-00
COC NO:
PO NO: 4
REL NO: 116
LAB NAME: Southwest

CLIENT: NAVAL BASE CHARLESTON
PROJECT MANAGER: C VERNOY
LOCATION: ZONE A - MNA
TELE/FAX NO. 843.884.0029/856[illegible]
SAMPLERS: (SIGNATURE) [signature]

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	TOC	Fe2+	Sulfate Nitr./Alk	Sulfide						REMARKS
039GW13I03	8/7/99	1035	H2O	*	4°C	*	6	X	X	X	X	X	~~5~~ BH					
039GW01303	8/7/99	1030					6	X	X	X	X	X						
039GW01903	8-7-99	1050					6	X	X	X	X	X						
039GW19I03	8-7-99	1215					6	X	X	X	X	X						
039GW19D03	8-7-99	1405					6	X	X	X	X	X						
039GW00803	8-7-99	1445					6	X	X	X	X	X						
039GW08D03	8-7-99	1545					6	X	X	X	X	X						
039GW00903	8-8-99	1200					6	X	X	X	X	X						
039GW09I03		1145					6	X	X	X	X	X						
039GW09D03		1015					6	X	X	X	X	X						
039GW02003		1135					6	X	X	X	X	X						
039GW20I03		~~1045~~ 1032 JW					6	X	X	X	X	X						
039GW20D03		~~1032~~ 1026 JW					6	X	X	X	X	X						
039TW02003	8/8/99	1700					2	X										

[signature] 8/9/99

RELINQUISHER: [signature]	DATE 8/9/99	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Todd Kafka	TIME 1600	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fedex Priority
SHIPMENT NO. 4849148732
SEND RESULTS TO: CHARLIE VERNOY

COMMENTS: * VOC - (2) 40 mL VOA w/HCl; 1 - 500 mL Amber w/H2SO4 TOC; Fe2+ 1 500 mL Amber no pres; Sulfate Nitrate, Alk 1-500 mL plastic no pres; Sulfide 1-250 mL poly w/NaOH

L III DQO

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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REV. 05/98

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CHAIN OF CUSTODY RECORD

Amended COC 8/11/99

PAGE 1 OF 1

PROJECT/JOB NO: 2901-[illegible]1-08-4449
COC NO:
PO NO: 4
REL NO: 116
LAB NAME: S.W LABS

CLIENT: NAVBASE CHS ZONE A
PROJECT MANAGER: C VERNON
LOCATION: ZONE A - MNA
TELE/FAX NO. 843.884.0029/0107
SAMPLERS: (SIGNATURE)

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	B260 VOA	TOC	Fe2+	Sulfate/Nitrate/Alk	Sulfide					REMARKS
039GW00703	8/9/99	1330	H_2O	X	4°C	X	6	X	X	X	X	X					
039GW21I03	↓	1510	↓	↓	↓	↓	6	X	X	X	X	X					
039GW21D03	↓	1050	↓	↓	↓	↓	6	X	X	X	X	X					
042GW02D03	↓	1107	↓	↓	↓	↓	6	X	X	X	X	X					
042GW00203	↓	1203	↓	↓	↓	↓	6	X	X	X	X	X					
002GW00603	↓	1308	↓	↓	↓	↓	6	X	X	X	X	X					
039TW21D03	↓	—	↓	↓	↓	HCl	2	X									Trip Blank

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
PRINTED: Brett Hearn	8/9/99	PRINTED:		PRINTED:		PRINTED:	
COMPANY: Ensafe	TIME 1630	COMPANY:	TIME	COMPANY:	TIME	COMPANY:	TIME

METHOD OF SHIPMENT: FedEx
SHIPMENT NO. 4849148732
SEND RESULTS TO: CHARLIE VERNON

COMMENTS: LHC DQO
VOC - 2 4mL VOA - HCl; TOC - 500ml Amber - H250ml; Fe2+ - 500ml Amber - No Pres.; Sulfate, Nitrate, Alk - 1 - 500ml poly no pres.; Sulfide 1-250mL poly w/NaOH

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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REV. 05/98

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-00[redacted]8-444-00
COC NO:
PO NO: 3075
REL NO: 000
LAB NAME: Microseeps

CLIENT: Charleston Naval Complex
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A MNA
TELE/FAX NO.:
SAMPLERS: (SIGNATURE) TK Kafka

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	CO_2	CH_4	Ethene	Ethane	Hydrogen						REMARKS
Ø39GWØ2ØØ3	8/8/99	1135	Gas/H2O	20mL vials 40mL vials	4°C	—	3	X	X	X	X	X						
Ø39GW2Ø7Ø3		1045					3	X	X	X	X	X						
Ø39GW2ØDØ3		1025					3	X	X	X	X	X						
Ø39GW21DØ3	8/9/99	1050					3	X	X	X	X	X						
Ø39GWØ18Ø3	8/10/99	1132					3	X	X	X	X	X						

TK Kafka 8/10/99

RELINQUISHER:	DATE	RECEIVER:	DATE	RELINQUISHER:	DATE	RECEIVER:	DATE
TK Kafka	8/10/99						
PRINTED: Todd K Kafka	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FEDEX
SHIPMENT NO. 8096094 00293
SEND RESULTS TO: Charlie Vernoy
935 Houston Northcutt Blvd Ste 1B
Mt. Pleasant SC 29464

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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REV. 05/98

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CHAIN OF CUSTODY RECORD

PAGE 1 OF 1
PROJECT/JOB NO: 2901-001-414-00
COC NO:
PO NO: 3075
REL NO: 000
LAB NAME: Microseeps

CLIENT: Charleston Naval Complex
PROJECT MANAGER: Charlie Vernoy
LOCATION: Zone A MNA
TELE/FAX NO.: 843.856.0107 FAX/843.884.0029
SAMPLERS: (SIGNATURE) TK Kafka

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	CO_2	CH_4	Ethene	Ethane	Hydrogen					REMARKS
Ø39GW18DØ3	8/5/99	1130	GW/H2O	20mL vial, 40mL vials	4°C	—	3	X	X	X	X	X					
Ø39GW18IØ3		1540					3	X	X	X	X	X					
Ø39GWØ4DØ3		0900					3	X	X	X	X	X					
Ø39GWØ4IØ3		1136					3	X	X	X	X	X					
Ø39GWØ4DØ3		1555					3	X	X	X	X	X					
Ø39GW12DØ3		1415					3	X	X	X	X	X					
Ø39GW12IØ3		1055					3	X	X	X	X	X					
Ø39GWØ12Ø3		1530					3	X	X	X	X	X					
Ø39GW17IØ3	8/6/99	1215					3	X	X	X	X	X					
Ø39GWØ17Ø3		1300					3	X	X	X	X	X					
Ø39GW17DØ3		1100					3	X	X	X	X	X					
Ø39GWØ16Ø3		1515					3	X	X	X	X	X					
Ø39GW16IØ3		1210					3	X	X	X	X	X					
Ø39GW16DØ3		1035					3	X	X	X	X	X					
Ø39GWØ8DØ3	8/7/99	1545					3	X	X	X	X	X					

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
TK Kafka	8/10/99						
PRINTED: Todd K Kafka	TIME 1700	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: FEDEX
SHIPMENT NO. 809609460293
SEND RESULTS TO: Charlie Vernoy
935 Houston Northcutt Blvd Ste 113
Mt. Pleasant SC 29464
843.884.0029

COMMENTS:

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

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CHAIN OF CUSTODY RECORD

Amended COC 8/11/99

PAGE 1 OF 1
PROJECT/JOB NO: 2901-0[illegible]08-414-00
COC NO:
PO NO: 4
REL NO: 116
LAB NAME: SWL

CLIENT: Charleston Naval Complex
LOCATION: Zone A NNA
SAMPLERS: (SIGNATURE) Todd Kafka
PROJECT MANAGER: Charlie Verney
TELE/FAX NO. 843-884-0029/843-886-0107

ANALYSIS REQUIRED

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION TEMP.	PRESERVATION CHEMICAL	NO. OF CONTAINERS	VOC	TOC	Fe	Sulfate, Nitrate, Alk	Sulfide						REMARKS
039GW23D03	8-10-99	1015	Water	*	4°C	*	6	X	X	X	X	X						
039GW02303		1115					6	X	X	X	X	X						
039GW22D03		1050					6	X	X	X	X	X						
039GW02203		1145					6	X	X	X	X	X						
039GW02103		0930					6	X	X	X	X	X						effer.
039GW01803		1125					6	X	X	X	X	X						effer.
039GW01103		1430					6	X	X	X	X	X						
039TW01103	8-10-99	1700	Water				2	X										

TK 8/10/99

RELINQUISHER	DATE	RECEIVER	DATE	RELINQUISHER	DATE	RECEIVER	DATE
Todd Kafka	8/10/99						
PRINTED: Todd Kafka	TIME 1630	PRINTED:	TIME	PRINTED:	TIME	PRINTED:	TIME
COMPANY: EnSafe		COMPANY:		COMPANY:		COMPANY:	

METHOD OF SHIPMENT: Fedex priority overnight
SHIPMENT NO. 4849148721
SEND RESULTS TO: Charlie Verney

COMMENTS: * VOC (2) 40 mL VOA w/HCl; 1-500mL Amber w/H_2SO_4 - TOC; Fe^{2+} - 1 500mL Amber No pres.; Sulfate, Nitrate, Alk 1-500mL plastic No pres.; Sulfide 1-250 mL plastic w/NaOH

ANALYTICAL DATA RECEIVED BY (INITIALS/DATE)

ENSCOC2
REV. 05/98

ATTACHMENT I

FATE AND TRANSPORT MODELING

I.1 INTRODUCTION

The Biochlor beta version 1.0 (Groundwater Services, Inc., 1998) analytical Fate and Transport model was used in an attempt to predict biodegradation rates for tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) originating under Buildings 1604 and 1605 on the CNC. Historically, Buildings 1604 and 1605 were both used for hazardous materials storage beginning in 1942. The U.S. Navy stopped storing hazardous materials in building 1604 in 1970 and in Building 1605 in 1989. The plume emanating from beneath these buildings has had approximately 57 years to develop.

The purpose of identifying biodegradation rates was to satisfy a portion of Directive 92004.4-17 set forth by OSWER in 1997, which identifies three lines of evidence that can be used to estimate the natural attenuation of chlorinated ethenes:

1) Demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentration over time.
2) Demonstrate indirectly the types(s) of natural attenuation processes active at the site, and the rate at which such processes decrease contaminant concentrations to required levels.
3) Directly demonstrate the occurrence of a particular attenuation process through field or microcosm studies.

This modeling effort will address the second line of evidence. The purpose of these simulations is to gauge the potential migration of the plume off-site toward a marsh west of the CNC property boundary.

I.2 MODELING APPROACH

The first step in the modeling approach entails screening the available groundwater VOC data to find groundwater samples that are optimal for determining fate and transport parameters. Using the empirical data, the groundwater system is inversely modeled with well-specific aquifer parameters, if possible, to determine dispersion coefficients, retardation factors, and first order decay coefficients (biodegradation rate), fate and transport properties that are too difficult or expensive to measure in the field. Literature values were consulted for cases where site-specific data were not available.

Once these parameters are determined, the predictive aspects of the model may be used to "forward" model the distribution of VOC contamination.

I.3 MODELING PLATFORM

Biochlor beta v1.0 is a spreadsheet based (Microsoft Excel) screening tool that is used to gauge the natural attenuation of dissolved chlorinated solvents. Biochlor can be used to simulate 1-dimensional advection, 3-dimensional dispersion, linear adsorption, and biodegradation by reductive dechlorination. It is based upon the semi-analytical solution developed by Domenico (1987). In using Biochlor, several assumptions must be made concerning the system to be modeled:

1) Aquifer conditions are anaerobic.
2) Biodegradation occurs as a sequential first order decay process.
3) Biodegradation occurs only in the aqueous phase.
4) The aquifer and flow field are homogeneous and isotropic.
5) Groundwater velocities are fast enough that molecular diffusion can be ignored.
6) Adsorption is a reversible process which can be represented by a linear isotherm.

Biochlor is limited in the following ways:

1) The model should not be applied in complicated flow systems such as those adjacent to pumping systems.
2) The model should not be applied where vertical contaminant transport is important.
3) The model should not be applied where the site hydrogeology changes dramatically over the model domain.

As a result, each of the three groundwater "flow zones" discussed in Section 3.0 must be modeled separately. After evaluating several factors such as the historical VOC distribution and consistent groundwater flowpaths, it was deemed that shallow groundwater was the most suitable for modeling.

I.4 MODEL INPUT PARAMETERS

Seven main input parameters are found in Biochlor.

1) *Advection* occurs when dissolved solids are transported with the moving groundwater. The rate of transport is equal to the interstitial groundwater velocity or seepage velocity. In the Biochlor model, seepage velocity can be specified directly; or porosity, hydraulic gradient, and hydraulic conductivity can be entered and Biochlor will compute seepage velocity.

2) *Dispersion* occurs when contamination in groundwater spreads out as it moves through the interconnected pore network of an aquifer and mixes with uncontaminated water. This results in the dilution of chemicals in the groundwater. Dispersion occurs in the direction of groundwater flow (longitudinal dispersion) and in the direction normal (at a right angle

to, which includes the vertical direction) groundwater flow (transverse dispersion). Values for longitudinal and transverse dispersion are Biochlor input parameters.

3) *Adsorption* occurs when a molecule or atom becomes adsorbed to the aquifer matrix and is removed from the aqueous phase, rendering it immobile. As the plume migrates, adsorption leads to contaminant retardation. In the Biochlor model, a value for retardation may be input directly or it may be calculated from data entered for soil bulk density, fraction or organic carbon, and the partitioning coefficient.

4) *Biodegradation* is the process mediated by microorganisms through which electrons are transferred between compounds. Under aerobic and anaerobic conditions, electron donors may be naturally-occurring or anthropogenic organic compounds; however, electron acceptors are inorganic in aerobic conditions but may be inorganic or organic in anaerobic conditions. Reductive dechlorination occurs under anaerobic conditions where chlorinated VOCs behave as electron acceptors. During this process, each chlorinated VOC is reduced by one chlorine atom while gaining a hydrogen atom. For each degradation step from PCE -> TCE -> DCE -> VC -> Ethene, there is a single decay coefficent, which expresses the amount of time for the parent compound to degrade to the daughter product. The decay coefficient for each step in the reductive dechlorination sequence may be entered in Biochlor, or the model will calculate it provided the half-life for each step is entered.

5) The *general* data section consists of simulation time input (in years) and the model domain dimensions (i.e., width and length). The model domain is typically adjusted such that the simulated plume is contained within the domain. However, the emphasis of a centerline simulation for SWMU 039 means the width variable is not critical.

6) The *source* data section provides a place to input the saturated zone thickness, the source width, the concentration of VOCs at the source, and the source geometry (i.e., single planar or spatially varying).

7) The *field data for comparison* section is used when attempting to estimate site-specific parameters such as biodegradation decay coefficients, adsorption parameters, or dispersion. Model input values for these parameters are manipulated until they most closely match the observed field data.

8) For a more detailed explanation of these parameters please refer to the Biochlor User's Manual (Aziz and Newell, 1999) or the text books *Contaminant Hydrogeology* (Fetter, 1993) *Physical and Chemical Hydrogeology* (Domenico and Schwartz, 1990).

I.5 INVERSE MODELING

The fate and transport parameters of biodegradation (first order decay coefficients), retardation, and dispersion will be estimated by inverse modeling where each is manipulated as an unknown variable in the Biochlor governing equation until the observed field data is most closely matched. Once the inverse problem is solved for each unknown parameter, the estimates are used to simulate the system to predict contaminant migration to areas where no field data is available. Situations where a site-specific estimates for attenuation mechanisms could not be inversely modeled, subsequent forward simulations were run using literature values.

Inverse models were solved three times with dispersion, retardation, and first order decay coefficients as the dominant variable to be solved separately. In each model, the other two mechanisms are set using literature values or are estimated from site characteristics. The resulting solution for each mechanism is compared to literature values and judged whether it is reasonable

or not. A fourth inverse model used literature values for all three mechanisms as another comparison.

Estimating biodegradation rates, retardation factors, or dispersion (longitudinal) from field data requires:

- A minimum of two monitoring wells. Solving the inverse problem is essentially best fitting a line over the observed data. To fit a line over a data set, there must be a minimum of two data points. If more data points are available a better estimate may be obtained.

- The chemicals of concern must be detected in the groundwater at these wells.

- The wells must lie along the same groundwater flowpath. This is because the processes (i.e., biodegradation, retardation, dispersion) occurring in the groundwater at each well must be related (i.e., the concentrations of contaminants in the down gradient well arise due to processes occurring between it and the upgradient well).

- The concentration of contaminants in the upgradient well must be greater than those in the downgradient well (retardation and dispersion). The concentration of the contaminants must decrease along the flow path (i.e., retardation removes contamination from the groundwater as it flows through the aquifer, dispersion dilutes contamination as it flow through the aquifer, biodegradation destroys contamination by converting it to other chemicals). Concentrations increasing along the flow path, suggest a secondary source is present or the suspected source well is not the source. A possible secondary source is biodegradation. As parent product biodegrades to a daughter product, the concentration of the daughter product will increase in the groundwater. If a daughter product

biodegrades more slowly than is produced by the parent, the daughter product concentration will increase downgradient.

- The groundwater system *must* be steady-state. Using data that fluctuates significantly to determine an aquifer parameter that is assumed representative of the systems at all times is not optimal.

The main difficultly in designing the inverse models was identifying acceptable well pairs along the same groundwater flowpath, which is due in part to location of wells at the site for delineating contamination and not evaluating groundwater flowpaths. Shallow wells 039012 and 039018 were identified as acceptable candidates for the inverse modeling based on groundwater flow directions (see Figure 3.4 in Section 3.2). The October 1998 and August 1999 MNA data results were used for fitting the unknown parameters in the inverse modeling. It is believed that two data rounds will increase the accuracy of the model results since it allows for the comparison of two sets of results.

I.5.2 Inverse Model Data Input

The following input parameters were constant in each inverse model:

Advection

Seepage velocity for the inverse models are computed by entering hydraulic conductivity, hydraulic gradient, and porosity. The hydraulic conductivity (Kh) in the vicinity of 039012 is 4.55E-03 cm/sec as determined by site-specific slug testing. Though aquifer test data is inherently more accurate than slug test data, the slug test result was favored since it was site-specific and the aquifer test data was from a separate portion of the site where geologic conditions differ somewhat. Nonetheless, Kh estimates from each method are of the same order of magnitude as

that produced from the slug test at 039012, so model results can be considered representative of all Kh estimates sitewide. No Kh data is available for the downgradient well location 039018.

The hydraulic gradient was established from groundwater gauging during the October 1998 and August 1999 sampling events (see Figure 3.4 in Section 3.2). The distance between the two monitoring wells is approximately 300 feet. The hydraulic gradients computed for October 1998 and August 1999 were 0.01 ft/ft and 0.0093 ft/ft, respectively. Aquifer porosity was measured in a 1996 shelby tube sample taken at 039012 as 38%.

General

Since the model must be steady state, a simulation time of 1,000 years (Aziz and Newell, 1999) was selected. The modeled areas width and length are 1,000 feet and 300 feet, respectively. The choice of the 1,000 foot model width is arbitrary because all models, both inverse and forward will be centerline simulations. The model length corresponded to the distance between the two monitoring wells.

Source Data

The source is represented as a single plane of constant concentration. This representation provides the necessary level of detail needed for centerline simulations at this site. The source thickness in the saturated zone was assumed to be equal to the saturated thickness, or about 40 feet, which is a reasonable approximation of the saturated thickness at 039012. A source width value of 500 feet was used since VOC isopleth maps indicate the plume is roughly that wide at location 039012. VOC data for the endpoints of the flowpath were obtained from the second and third MNA rounds in October 1998 and August 1999, respectively. These data were presented previously in Table 4-4 in Section 4 and may be seen graphically in Attachment B (Figures B-16 - B-18 and B-22 - B-24). Note that no PCE was detected at either well location and that no VC was detected downgradient at 039018 in either round.

Estimates for retardation factor (R), dispersion, and first order decay rates were required in the inverse models when solving for any one of those three variables. For example, when solving for dispersion, estimates of R and first order decay coefficients are required, even though they are unknown. However, site-specific data is often available to provide very close approximations and provide a good comparison to model results. These approximations are listed below:

Retardation factor (R)

Using site-specific data at 039012, R may be estimated as follows:

$$R = 1 + \frac{Kd\rho_b}{n}$$

Where an aquifer bulk density (ρ_b) of 1.89 kg/L, a fraction of organic carbon (f_{oc}) of 9.8E-05 kg-organic carbon per kg-soil, and porosity (n) of 0.38 were obtained from shelby tube data at 039012. The contaminant-specific distribution coefficient (Kd) is estimated by Kd = K_{oc}*f_{oc} where the partition coefficients (Koc) for PCE, TCE, and DCE, averaged from the end members in the range reported in literature, were determined to be 267, 120, and 65, respectively (USEPA, 1998). No partition coefficient was estimated for VC since it was not detected at the downgradient well. The resulting retardation factor was calculated at approximately 1.0, suggesting that almost no retardation is occurring at 039012. This is most likely the result of a limited amount of organic carbon in the aquifer matrix at 039012, which may not be true for the remainder of the aquifer at the site.

Dispersion

A common approach for computing the longitudinal dispersion (alpha X) uses the relationship of alpha X = 0.1 * L_p (Pickens and Grisak, 1981). Transverse dispersion components (alpha Y and alpha Z) are estimated by alpha Y = 0.33 * alpha X (ASTM, 1995; EPA, 1986) and alpha Z = 0.025 * alpha X (EPA, 1986). The plume length (L_p) is approximately 300 feet, an average for the site, yielding results of alpha X= 30 feet, alpha Y = 9.9 feet, and alpha Z = 0.75 feet.

First Order Decay Coefficients

First order decay coefficients are calculated by the model based on the entered half-life for each VOC compound. For the inverse model flowpath, half-lives were entered as the median values of literature data for TCE -> DCE (12.5 years), DCE -> VC (2.75 years), and VC -> Ethene (45.3 years) (Aziz et al, 1999). No PCE -> TCE half-life was required since PCE was not detected at either well. Since VC was detected at 039012 but not 039018, the longest half-life was estimated.

I.5.2.1 Dispersion Inverse Modeling

As stated earlier, solving the dispersion inverse problem consists of manipulating the longitudinal dispersion coefficient in the model until the output best matches the observed data. Input data for October 1998 and August 1999 is presented in Table 1 and Figure 1a (Biochlor input screen) and Table 2, Figure 2a (Biochlor input screen), respectively. Biochlor output results are presented in Figure 1b and 2b for October 1998 and August 1999, respectively.

Table 1 Inverse Dispersion Model
October 1998 Data

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	123.9	Biochlor
	Hydraulic Conductivity (cm/sec)	4.55E-5	Slug test @ 039012
	Gradient (ft/ft)	0.01	Oct. 98 gauging
	Porosity	0.38	Shelby tube @ 039012
Dispersion	Alpha x	5,000	Best Fit
	Alpha y/Alpha x	0.333	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	0.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	1.89	Shelby tube @ 039012
	Fraction of Organic Carbon	9.8E-5	Shelby tube @ 039012
	Koc PCE (L/kg)	267	USEPA, 1998
	Koc TCE (L/kg)	120	USEPA, 1998
	Koc DCE (L/kg)	65	USEPA, 1998
	Koc VC (L/kg)	20	USEPA, 1998
	Common R	1.0	Biochlor
Biodegradation	PCE Half-life	NA	NA
	TCE Half-life	12.5	Aziz et al, 1999
	DCE Half-life	2.75	Aziz et al, 1999
	VC Half-life	45.3	Aziz et al, 1999

Table 1 Inverse Dispersion Model
October 1998 Data

	Variable	Data	Source
General	Simulation Time (yr)	1,000	Aziz et al, 1999
	Modeled Area Width (ft)	1,000	Aziz et al, 1999
	Modeled Area Length (ft)	300	Dist. between 012 and 018.
	Zone 1 Length (ft)	300	Default assuming single plume zone
Source Data	Source Thickness (ft)	40	Approx. saturated thickness @ 039012
	Source Width (ft)	500	Approx. plume width @ 039012
	Source Concentration PCE (mg/L)	non-detect	Oct. 1998 data
	Source Concentration TCE (mg/L)	0.110	Oct. 1998 data
	Source Concentration DCE (mg/L)	0.350	Oct. 1998 data
	Source Concentration VC (mg/L)	0.065	Oct. 1998 data
Field Data	Receptor PCE (mg/L)	non-detect	Oct. 1998 data
	Receptor TCE (mg/L)	0.002	Oct. 1998 data
	Receptor DCE (mg/L)	0.009	Oct. 1998 data
	Receptor VC (mg/L)	non-detect	Oct. 1998 data

Table 2
Inverse Dispersion Model
August 1999 Data

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	121.4	Biochlor
	Hydraulic Conductivity (cm/sec)	4.55E-5	Slug test @ 039012
	Gradient (ft/ft)	0.0098	Aug. 99 gauging
	Porosity	0.38	Shelby tube @ 039012
Dispersion	Alpha x	2,000	Best Fit
	Alpha y/Alpha x	0.33	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	0.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	1.89	Shelby tube @ 039012
	Fraction of Organic Carbon	9.8E-5	Shelby tube @ 039012
	Koc PCE (L/kg)	267	USEPA, 1998
	Koc TCE (L/kg)	120	USEPA, 1998
	Koc DCE (L/kg)	65	USEPA, 1998
	Koc VC (L/kg)	20	USEPA, 1998
	Common R	1.0	Biochlor
Biodegradation	PCE Half-life	NA	NA
	TCE Half-life	12.5	Aziz et al, 1999
	DCE Half-life	2.75	Aziz et al, 1999
	VC Half-life	45.3	Aziz et al, 1999
General	Simulation Time (yr)	1,000	Aziz et al, 1999
	Modeled Area Width (ft)	1,000	Aziz et al, 1999
	Modeled Area Length (ft)	300	Dist. between 012 and 018.
	Zone 1 Length (ft)	300	Default assuming single plume zone

Table 2
Inverse Dispersion Model
August 1999 Data

	Variable	Data	Source
Source Data	Source Thickness (ft)	40	Approx. saturated thickness @ 039012
	Source Width (ft)	500	Approx. plume width @ 039012
	Source Concentration PCE (mg/L)	non-detect	Aug. 1999 data
	Source Concentration TCE (mg/L)	0.087	Aug. 1999 data
	Source Concentration DCE (mg/L)	0.170	Aug. 1999 data
	Source Concentration VC (mg/L)	0.007	Aug. 1999 data
Field Data	Receptor PCE (mg/L)	non-detect	Aug. 1999 data
	Receptor TCE (mg/L)	0.003	Aug. 1999 data
	Receptor DCE (mg/L)	0.010	Aug. 1999 data
	Receptor VC (mg/L)	non-detect	Aug. 1999 data

The October 1998 field data produced an alpha X estimate of approximately 5,000 feet, a computed alpha Y of 1650 feet, and a computed alpha Z of 125 feet. The August 1999 field data yielded an alpha X estimate of 2,000 feet, a computed alpha Y of 667 feet, and a computed alpha Y of 50 feet. Dispersion values were found to vary between 0.33 feet to 6.56 feet over relatively short transport distances (Domenico and Schwartz, 1990). Thus, the dispersion estimates are 2-3 orders of magnitude above the observed range and probably do not realistically represent the system.

I.5.2.2 Retardation Factor Inverse Modeling

Retardation factors were manipulated to best match the observed field data. Input data for October 1998 and August 1999 is presented in Table 3 and Figure 3a (Biochlor input screen) and Table 4 Figure 4a (Biochlor input screen), respectively. Biochlor output results are presented in Figure 3b and 4b for October 1998 and August 1999, respectively.

Table 3
Inverse Retardation Model
October 1998 Data

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	123.9	Biochlor
	Hydraulic Conductivity (cm/sec)	4.55E-3	Slug test @ 039012
	Gradient (ft/ft)	0.01	Oct. 98 gauging
	Porosity	.38	Shelby tube @ 039012
Dispersion	Alpha x	30	0.1 * L_p ; L_p = 300 ft (Pickens & Grisak, 1981)
	Alpha y/Alpha x	.33	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	not used	
	Fraction of Organic Carbon	not used	
	Koc PCE (L/kg)	not used	
	Koc TCE (L/kg)	not used	
	Koc DCE (L/kg)	not used	
	Koc VC (L/kg)	not used	
	Common R	1050	Best fit
Biodegradation	PCE Half-life	not used	NA
	TCE Half-life	12.5	Aziz et al, 1999
	DCE Half-life	2.75	Aziz et al, 1999
	VC Half-life	45.3	Aziz et al, 1999
General	Simulation Time (yr)	1,000	Aziz et al, 1999
	Modeled Area Width (ft)	1,000	Aziz et al, 1999
	Modeled Area Length (ft)	300	Dist. between 012 and 018
	Zone 1 Length (ft)	300	Default assuming single plume zone
Source Data	Source Thickness (ft)	40	Approx. saturated thickness @ 039012
	Source Width (ft)	500	Approx. plume width @ 039012
	Source Concentration PCE (mg/L)	non-detect	Oct. 1998 data
	Source Concentration TCE (mg/L)	0.110	Oct. 1998 data
	Source Concentration DCE (mg/L)	0.350	Oct. 1998 data
	Source Concentration VC (mg/L)	0.065	Oct. 1998 data
Field Data	Receptor PCE (mg/L)	non-detect	Oct. 1998 data
	Receptor TCE (mg/L)	0.002	Oct. 1998 data
	Receptor DCE (mg/L)	0.009	Oct. 1998 data
	Receptor VC (mg/L)	non-detect	Oct. 1998 data

Table 4
Inverse Retardation Model
August 1999 Data

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	121.4	Biochlor
	Hydraulic Conductivity (cm/sec)	4.6E-3	Slug test @ 039012
	Gradient (ft/ft)	0.0098	Aug. 99 gauging
	Porosity	0.38	Shelby tube @ 039012
Dispersion	Alpha x	30	0.1 * L_p ; L_p = 300 ft (Pickens & Grisak, 1981)
	Alpha y/Alpha x	0.33	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	not used	
	Fraction of Organic Carbon	not used	
	Koc PCE (L/kg)	not used	
	Koc TCE (L/kg)	not used	
	Koc DCE (L/kg)	not used	
	Koc VC (L/kg)	not used	
	Common R	900	Best fit
Biodegradation	PCE Half-life	not used	NA
	TCE Half-life	12.5	Aziz et al, 1999
	DCE Half-life	2.75	Aziz et al, 1999
	VC Half-life	45.3	Aziz et al, 1999
General	Simulation Time (yr)	1,000	Aziz et al, 1999
	Modeled Area Width (ft)	1,000	Aziz et al, 1999
	Modeled Area Length (ft)	300	Dist. between 012 and 018.
	Zone 1 Length (ft)	300	Default assuming single plume zone
Source Data	Source Thickness (ft)	40	Approx. saturated thickness @ 039012
	Source Width (ft)	500	Approx. plume width @ 039012
	Source Concentration PCE (mg/L)	non-detect	Aug. 1999 data
	Source Concentration TCE (mg/L)	0.087	Aug. 1999 data
	Source Concentration DCE (mg/L)	0.170	Aug. 1999 data
	Source Concentration VC (mg/L)	0.007	Aug. 1999 data
Field Data	Receptor PCE (mg/L)	non-detect	Aug. 1999 data
	Receptor TCE (mg/L)	0.003	Aug. 1999 data
	Receptor DCE (mg/L)	0.010	Aug. 1999 data
	Receptor VC (mg/L)	non-detect	Aug. 1999 data

When fitting a retardation factor to the field data, values of 1050 and 900 were generated from the October 1998 and August 1999 data, respectively. Based on literature data, retardation factors range from 1 to 6 for hydrocarbons (Aziz and Newell, 1999), indicating that those values produced from the model are wildly inaccurate and not representative of retardation in this aquifer.

I.5.2.3 Biodegradation Decay Coefficient Estimates

The VOC half-lives were manipulated to produce first order decay coefficients that best represented the observed field data. Input data for October 1998 and August 1999 is presented in Table 5 and Figure 5a (Biochlor input screen) and Table 6 Figure 6a (Biochlor input screen), respectively. Biochlor output results are presented in Figure 5b and 6b for October 1998 and August 1999, respectively.

Table 5
Inverse Biodegradation Model
October 1998 Data

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	123.9	Biochlor
	Hydraulic Conductivity (cm/sec)	4.6E-3	Slug test @ 039012
	Gradient (ft/ft)	0.01	Sept 98 gauging
	Porosity	.38	Shelby tube @ 039012
Dispersion	Alpha x	30	0.1 * L_p ; L_p = 300 ft (Pickens & Grisak, 1981)
	Alpha y/Alpha x	.33	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	1.89	Shelby tube @ 039012
	Fraction of Organic Carbon	9.8E-5	Shelby tube @ 039012
	Koc PCE (L/kg)	267	USEPA, 1998
	Koc TCE (L/kg)	120	USEPA, 1998
	Koc DCE (L/kg)	65	USEPA, 1998
	Koc VC (L/kg)	20	USEPA, 1998
	Common R	1.0	Biochlor
Biodegradation	PCE Half-life	non- detect	
	TCE Half-life	0.30	Best fit
	DCE Half-life	0.29	Best fit
	VC Half-life	0.04	Best fit
General	Simulation Time (yr)	1,000	Aziz et al, 1999
	Modeled Area Width (ft)	1,000	Aziz et al, 1999
	Modeled Area Length (ft)	300	Dist. between 012 and 018
	Zone 1 Length (ft)	300	Default assuming single plume zone
Source Data	Source Thickness (ft)	40	Approx. saturated thickness @ 039012
	Source Width (ft)	500	Approx. plume width @ 039012
	Source Concentration PCE (mg/L)	non-detect	Oct. 1998 data
	Source Concentration TCE (mg/L)	0.110	Oct. 1998 data
	Source Concentration DCE (mg/L)	0.350	Oct. 1998 data
	Source Concentration VC (mg/L)	0.065	Oct. 1998 data
Field Data	Receptor PCE (mg/L)	non-detect	Oct. 1998 data
	Receptor TCE (mg/L)	0.002	Oct. 1998 data
	Receptor DCE (mg/L)	0.009	Oct. 1998 data
	Receptor VC (mg/L)	non- detect	Oct. 1998 data

Table 6
Inverse Biodegradation Model
August 1999 Data

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	121.4	Biochlor
	Hydraulic Conductivity (cm/sec)	4.6E-3	Slug test @ 039012
	Gradient (ft/ft)	0.0098	Aug 99 gauging
	Porosity	.38	Shelby tube @ 039012
Dispersion	Alpha x	30	0.1 * L_p ; L_p = 300 ft (Pickens & Grisak, 1981)
	Alpha y/Alpha x	.33	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	1.89	Shelby tube @ 039012
	Fraction of Organic Carbon	9.8E-5	Shelby tube @ 039012
	Koc PCE (L/kg)	267	USEPA, 1998
	Koc TCE (L/kg)	120	USEPA, 1998
	Koc DCE (L/kg)	64.6	USEPA, 1998
	Koc VC (L/kg)	19.6	USEPA, 1998
	Common R	1.0	Biochlor
Biodegradation	PCE Half-life	non-detect	
	TCE Half-life	0.40	Best fit
	DCE Half-life	0.35	Best fit
	VC Half-life	0.05	Best fit
General	Simulation Time (yr)	1,000	Aziz et al, 1999
	Modeled Area Width (ft)	1,000	Aziz et al, 1999
	Modeled Area Length (ft)	300	Dist. between 012 and 018
	Zone 1 Length (ft)	300	Default assuming single plume zone.
Source Data	Source Thickness (ft)	40	Approx. saturated thickness @ 039012
	Source Width (ft)	500	Approx. plume width @ 039012
	Source Concentration PCE (mg/L)	non-detect	Aug. 1999 data
	Source Concentration TCE (mg/L)	0.087	Aug. 1999 data
	Source Concentration DCE (mg/L)	0.170	Aug. 1999 data
	Source Concentration VC (mg/L)	0.007	Aug. 1999 data
Field Data	Receptor PCE (mg/L)	non-detect	Aug. 1999 data
	Receptor TCE (mg/L)	0.003	Aug. 1999 data
	Receptor DCE (mg/L)	0.010	Aug. 1999 data
	Receptor VC (mg/L)	non-detect	Aug. 1999 data

The October 1998 calibration data was best reproduced with half-lives of 0.3 years for TCE -> DCE and 0.29 years for DCE -> VC (Figure 5b). The August 1999 field data was best reproduced with half-lives of 0.40 years for TCE -> DCE and 0.35 years for DCE -> VC (Figure 6b). Since VC was not detected in the downgradient groundwater during either sampling round, the VC estimated half-life represented a maximum value (i.e., the longest half-life that will render VC not detectable in the groundwater when it reaches 039018), which was 0.04 years in October 1998 and 0.05 in August 1999.

Both of these values are lower than the low end of the range reported in the literature (0.23 years) (USEPA, 1998). This may indicate that a different mechanism, such as the oxidation of VC, is causing the decrease in VC concentration and not reductive dechlorination. The similarities between the TCE and DCE decay coefficients between both calibration rounds makes them credible.

I.5.2.4 Inverse Modeling Using Literature Values

For comparative purposes, simulations were run using literature values for dispersion, biodegradation rates, and retardation factor. The literature estimates for dispersion, retardation, and first order decay coefficients/half-lives outlined in Sections I.5.2. Input data for October 1998 and August 1999 is presented in Table 7 and Figure 7a (Biochlor input screen) and Table 8, Figure 8a (Biochlor input screen), respectively. Biochlor output results are presented in Figure 7b and 8b for October 1998 and August 1999, respectively.

Table 7
Literature Values for Dispersion, Retardation and Biodegradation
October 1998 Data

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	123.9	Biochlor
	Hydraulic Conductivity (cm/sec)	4.6E-3	Slug test @ 039012
	Gradient (ft/ft)	0.01	Scott 98 gauging
	Porosity	.38	Shelby tube @ 039012
Dispersion	Alpha x	30	0.1 * L_p ; L_p = 300 ft (Pickens & Grisak, 1981)
	Alpha y/Alpha x	.33	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	1.89	Shelby tube @ 039012
	Fraction of Organic Carbon	9.8E-5	Shelby tube @ 039012
	Koc PCE (L/kg)	267	USEPA, 1998
	Koc TCE (L/kg)	120	USEPA, 1998
	Koc DCE (L/kg)	64.6	USEPA, 1998
	Koc VC (L/kg)	19.6	USEPA, 1998
	Common R	1.0	Biochlor
Biodegradation	PCE Half-life	non-detect	NA
	TCE Half-life	12.5	Aziz et al, 1999
	DCE Half-life	2.75	Aziz et al, 1999
	VC Half-life	45.3	Aziz et al, 1999

Table 7
Literature Values for Dispersion, Retardation and Biodegradation
October 1998 Data

	Variable	Data	Source
General	Simulation Time (yr)	1,000	Aziz et al, 1999
	Modeled Area Width (ft)	1,000	Aziz et al, 1999
	Modeled Area Length (ft)	300	Dist. between 012 and 018
	Zone 1 Length (ft)	300	Default assuming single plume zone
Source Data	Source Thickness (ft)	40	Approx. saturated thickness @ 039012
	Source Width (ft)	500	Approx. plume width @ 039012
	Source Concentration PCE (mg/L)	non- detect	Oct. 1998 data
	Source Concentration TCE (mg/L)	0.110	Oct. 1998 data
	Source Concentration DCE (mg/L)	0.350	Oct. 1998 data
	Source Concentration VC (mg/L)	0.065	Oct. 1998 data
Field Data	Receptor PCE (mg/L)	non-detect	Oct. 1998 data
	Receptor TCE (mg/L)	0.002	Oct. 1998 data
	Receptor DCE (mg/L)	0.009	Oct. 1998 data
	Receptor VC (mg/L)	non- detect	Oct. 1998 data

Table 8
Literature Values for Dispersion, Retardation and Biodegradation
August 1999 Data

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	121.4	Biochlor
	Hydraulic Conductivity (cm/sec)	4.6E-3	Slug test @ 039012
	Gradient (ft/ft)	0.0098	Aug 99 gauging
	Porosity	.38	Shelby tube @ 039012
Dispersion	Alpha x	30	0.1 * L_p ; L_p = 300 ft (Pickens & Grisak, 1981)
	Alpha y/Alpha x	.33	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	1.89	Shelby tube @ 039012
	Fraction of Organic Carbon	9.8E-5	Shelby tube @ 039012
	Koc PCE (L/kg)	267	USEPA, 1998
	Koc TCE (L/kg)	120	USEPA, 1998
	Koc DCE (L/kg)	64.6	USEPA, 1998
	Koc VC (L/kg)	19.6	USEPA, 1998
	Common R	1.0	Biochlor
Biodegradation	PCE Half-life	non-detect	NA
	TCE Half-life	12.5	Aziz et al, 1999
	DCE Half-life	2.75	Aziz et al, 1999
	VC Half-life	45.3	Aziz et al, 1999
General	Simulation Time (yr)	1,000	Aziz et al, 1999
	Modeled Area Width (ft)	1,000	Aziz et al, 1999
	Modeled Area Length (ft)	300	Dist. between 012 and 018.
	Zone 1 Length (ft)	300	Default assuming single plume zone
Source Data	Source Thickness (ft)	40	Approx. saturated thickness @ 039012
	Source Width (ft)	500	Approx. plume width @ 039012
	Source Concentration PCE (mg/L)	non-detect	Aug. 1999 data
	Source Concentration TCE (mg/L)	0.087	Aug. 1999 data
	Source Concentration DCE (mg/L)	0.170	Aug. 1999 data
	Source Concentration VC (mg/L)	0.007	Aug. 1999 data
Receptor Data	Receptor PCE (mg/L)	non-detect	Aug. 1999 data
	Receptor TCE (mg/L)	0.003	Aug. 1999 data
	Receptor DCE (mg/L)	0.010	Aug. 1999 data
	Receptor VC (mg/L)	non-detect	Aug. 1999 data

The simulation results showed no decrease in VOC concentrations along the flowpath, indicating that the combination of all literature and computed variables were not representative of reductive dechlorination at the site.

I.6 FORWARD SIMULATIONS

Once reasonable estimate could be applied to the critical fate and transport processes of retardation, dispersion, and biodegradation rate; the model's predictive capabilities could be utilized to determine potential contaminant distribution.

The starting point for the forward simulation is the analytical data from shallow well 039009 in October 1998. Well 039009 was used because it had extensive VOC contamination at that time and serves as a point of compliance due to its location immediately west of the CNC property boundary and an off-site marsh. Although the VOCs were not encountered in Round 3 data (August 1999), it was decided that this location remains a good choice for forward modeling should contaminants reappear. Contaminant isopleth maps from October 1998 allowed for effective assessment of the spatial distribution of contamination.

I.6.1 039009 Simulation

Advection

The seepage velocity for the forward model is computed by entering the hydraulic conductivity, hydraulic gradient, and porosity. The hydraulic conductivity value of 5.3E-03 cm/sec from the shallow groundwater aquifer test conducted at the well cluster 250 feet downgradient was used. A hydraulic gradient of 0.00525 was computed from the October 1998 gauging round (see Figure 3.4 in Section 3.2). The linear distance used in this calculation was from 039009 to the 3.0 foot elevation contour approximately 400 feet downgradient, since no fixed downgradient measuring point were available. The sitewide porosity is 0.436, as was computed as the average of 11 shelby tube samples.

Dispersion

Dispersion coefficients of 30 feet, 9.9 feet, and 0.75 feet were used for alpha X, alpha Y, and alpha Z, respectively, as discussed in Section I.5.2.1.

Retardation Factor

The retardation factor of 1.0, calculated in Section I.5.2.2, was used for the forward simulation. Since this value was based on site-specific data from the 039012 locale and predicts no sorption, another retardation factor was calculated as a spatially-averaged value for the site as a comparison. The average bulk density of the aquifer was determined to be 1.91 kg/L based on ten shelby tube samples having a range of 1.13 to 2.14 kg/L. An average f_{oc} of 0.00955 (0.95%) was determined from seven shelby tube samples having a range of f_{oc} from 0.0 to 0.06. The partitioning coefficients for PCE, TCE, and DCE were entered as averages of the end members of the ranges presented in Table B.2.1 of the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (USEPA, 1998).

I.6.1.1 Biodgradation

The biodegradation half-lives for TCE and DCE were taken from the inverse modeling results in Section I.5.2.3. The October 1998 and August 1999 half-life results were averaged, resulting in a TCE half-life of 0.35 years (4.2 months) and DCE half-life of 0.32 years (3.8 months). The reductive dechlorination half-lives for PCE and VC were entered as the median of the reported literature ranges, 1.975 years and 45.33 years respectively (Aziz, et al, 1999).

I.6.1.2 General

The forward simulation was run to determine if the VOC plume would migrate to the off-site receptor (point of compliance). It is important to distinguish between the linear distance between well 039009 and the point of compliance (280 feet) and the most logical groundwater flowpath. Based on the shallow groundwater contours presented previously in Figure 3.4, the most logical groundwater flowpath from 039009 to the receptor runs south toward well 039020 and then west as it is influenced by piezometric lows in the southwest. This flowpath is approximately 600 feet in length, which was set equal to the model area length as well. The model area width was set at 1,000 feet, although irrelevant due to the centerline nature of the simulation.

I.6.1.3 Source

The source is defined by the monitoring well 039009. Its October 1998 concentrations were: 0.05 mg/L PCE, 0.047 mg/L TCE, 0.552 mg/L DCE, 0.09 mg/L VC, and 0.002 mg/L ethene. Source thickness was kept at 40 feet, a conservative estimate considering the shallow well is only 13 feet below ground surface. Source width was also kept at 500 feet to remain conservative.

The input data for the forward simulation is presented in Table 9 and in the Biochlor input screens (Figure 9a and 9c). Biochlor output data is presented in Figures 9b and 9d.

Table 9
Forward simulation input summary

	Variable	Data	Source
Advection	Seepage Velocity (ft/yr)	66.0	Biochlor
	Hydraulic Conductivity (cm/sec)	5.3E-3	Aquifer Test
	Gradient (ft/ft)	0.00525	Sept 98 gauging event
	Porosity	0.436	Avg. of 11 shelby tube analyses
Dispersion	Alpha x	30	0.1 * L_p ; L_p = 300 ft (Pickens & Grisak, 1981)
	Alpha y/Alpha x	.33	ASTM, 1995; USEPA, 1986
	Alpha z/Alpha x	.025	USEPA, 1986
Retardation	Soil Bulk Density (kg/L)	1.91	Avg. of 10 shelby tube analyses
	Fraction of Organic Carbon	9.6E-3	Avg. of 7 shelby tube analyses
	Koc PCE (L/kg)	267	USEPA, 1998
	Koc TCE (L/kg)	120	USEPA, 1998
	Koc DCE (L/kg)	64.6	USEPA, 1998
	Koc VC (L/kg)	19.6	USEPA, 1998
	Common R	3.7	Biochlor
Biodegradation	PCE Half-life	1.975	Median literature value
	TCE Half-life	0.35	Inverse simulation
	DCE Half-life	0.32	Inverse simulation
	VC Half-life	45.33	Median literature value
General	Simulation Time (yr)	68	Site history
	Modeled Area Width (ft)	1,000	Arbitrary
	Modeled Area Length (ft)	600	Dist. from 039009 to pt. of compliance via flowpath
	Zone 1 Length (ft)	600	Dist. from 039009 to pt. of compliance via flowpath.
Source Data	Source Thickness (ft)	40	Constant from inv. model
	Source Width (ft)	500	Constant from inv. model
	Source Concentration PCE (mg/L)	0.050	Oct. 1998 data
	Source Concentration TCE (mg/L)	0.047	Oct. 1998 data
	Source Concentration DCE (mg/L)	0.552	Oct. 1998 data
	Source Concentration VC (mg/L)	0.090	Oct. 1998 data
	Source Concentration Ethene (mg/L)	0.002	Oct. 1998 data
Field Data	Receptor PCE (mg/L)	NA	Not applicable
	Receptor TCE (mg/L)	NA	Not applicable
	Receptor DCE (mg/L)	NA	Not applicable
	Receptor VC (mg/L)	NA	Not applicable

I.6.2 Results and Discussion

The resulting distribution of contamination after 68 years shows a decline in the predicted concentration of PCE, TCE, and DCE using both a retardation factor of 3.7 and 1.0 (Figures 9b and 9d). The predicted concentrations of TCE and DCE decrease to non-detectable levels by approximately 450 feet from the source, which is approximately 150 feet before the point of compliance (marsh). The predicted PCE concentration appears elevated at 600 feet downgradient, but when compared to MCLs (Table 10), it is clear that PCE also successfully degrades before reaching the point of compliance. Only VC had predicted concentrations above MCLs at 600 feet downgradient. This is a consequence of no site-specific biodegradation rate constant available for VC. Since VC does not degrade readily under reducing conditions, the transition of the plume from reducing conditions to oxidizing would likely hasten its decay.

This simulation used a conservative a source thickness of 40 feet, which is roughly twice the actual thickness of the aquifer monitored by 039009. Plume length would be even shorter using a site-specific source thickness.

Table 10
Predicted VOC concentration versus MCL

Compound	Predicted Concentration (mg/l) 600 feet Downgradient	MCL (mg/L)
PCE	0.0024	0.005
TCE	0.0004	0.005
DCE	0.0003	0.07
VC	0.3387	0.002

The raw output data for all forward and inverse simulations is shown in Table 11.

I.7 SUMMARY AND CONCLUSIONS

Through the use of inverse modeling, the biodegradation rates of TCE and DCE were determined in a site-specific manner. The average TCE half-life and biodegradation rate constant were found to be 0.35 years and 1.98 years, respectively. The average DCE half-life and biodegradation rate constant were found to be 0.32 years and 2.17 yr, respectively. Unfortunately, PCE and VC detections were not spatially distributed such that a half-life and a rate constant could be inversely modeled.

Additional natural attenuation mechanisms, dispersion and retardation were also investigated during the inverse modeling process. The decline in VOC concentrations could not be explained with either of these two mechanisms. Inverse model solutions using these mechanisms were well above the accepted ranges present in the literature. Based upon the inverse modeling, it appears biodegradation is the primary attenuation mechanism in the vicinity of monitoring wells 039012 and 039018. The variation in the biodegradation rate over the SWMU 39 has not been investigated.

A forward simulation was run using October 1998 analytical data drawn from monitoring well 039009. This area was chosen to be modeled because of its proximity to the property boundary, the presence of the adjacent wetland, and the anomalously high concentrations detected at this location in October 1998. Other areas, such as Buildings 1604 and 1605, which have definite plumes did not appear to be immediately threatening any off-site receptors (i.e., non-detected VOC concentration downgradient of the plume while still on-site).

The predicted concentrations of PCE, TCE, and DCE decline below their respective MCLs at the point of compliance (marsh), even though the conservative source thickness term used in the simulation is roughly twice as great as its actual thickness. VC does not decline before the point of compliance, reflecting the use of a literature-derived biodegradation rate constant instead of a site-specific one. While it appears that VC may not be effectively attenuated by reductive dechlorination, VC may also be oxidized in more aerobic aquifer conditions. A downgradient

well, 039020 was installed prior to the August 1999 sampling event to address potential southerly VOC migration from 039009. The August 1999 data at 039020 revealed that less reducing conditions were present (60 mV ORP compared to -44 mV at 039009) downgradient, although DO concentrations at both well locations were similar and below 0.5 mg/L.

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BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1* — Dispersion (October1998) Best Fit

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	123.9	(ft/yr)
or		or	
Hydraulic Conductivity	K	4.6E-03	(cm/sec)
Hydraulic Gradient	i	0.01	(ft/ft)
Porosity	n	0.38	(-)

2. DISPERSION

Alpha x Calc. Method	5000	(ft)
(Alpha y) / (Alpha x)	0.33	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.89	(kg/L)		
FractionOrganicCarbon, foc	9.8E-5	(-)		
Partition Coefficient	Koc			
PCE	267.0	(L/kg)	1.1	(-)
TCE	120.0	(L/kg)	1.1	(-)
DCE	65.0	(L/kg)	1.0	(-)
VC	20.0	(L/kg)	1.0	(-)
ETH		(L/kg)	1.0	(-)
	1	odel)* =	1.0	

4. BIODEGRADATION -1st Order Decay Coef*

Zone 1	λ (1/yr)	half-life (yrs)	Yield*
PCE → TCE	0.00		0.79
TCE → DCE	0.06	12.50	0.74
DCE → VC	0.25	2.75	0.64
VC → ETH	0.02	45.30	0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Product	0.00	

5. GENERAL

Simulation Time*	1000	(yr)
Modeled Area Width*	1000	(ft)
Modeled Area Length*	300	(ft)
Zone 1 Length*	300	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

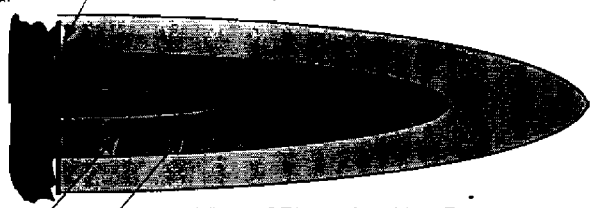
Source Options — TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 500

Conc. (mg/L)*	C1
PCE	0.000
TCE	0.110
DCE	0.350
VC	0.065
ETH	0.000

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	.002										
DCE Conc. (mg/L)	.009										
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)	300										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Data Input Instructions:

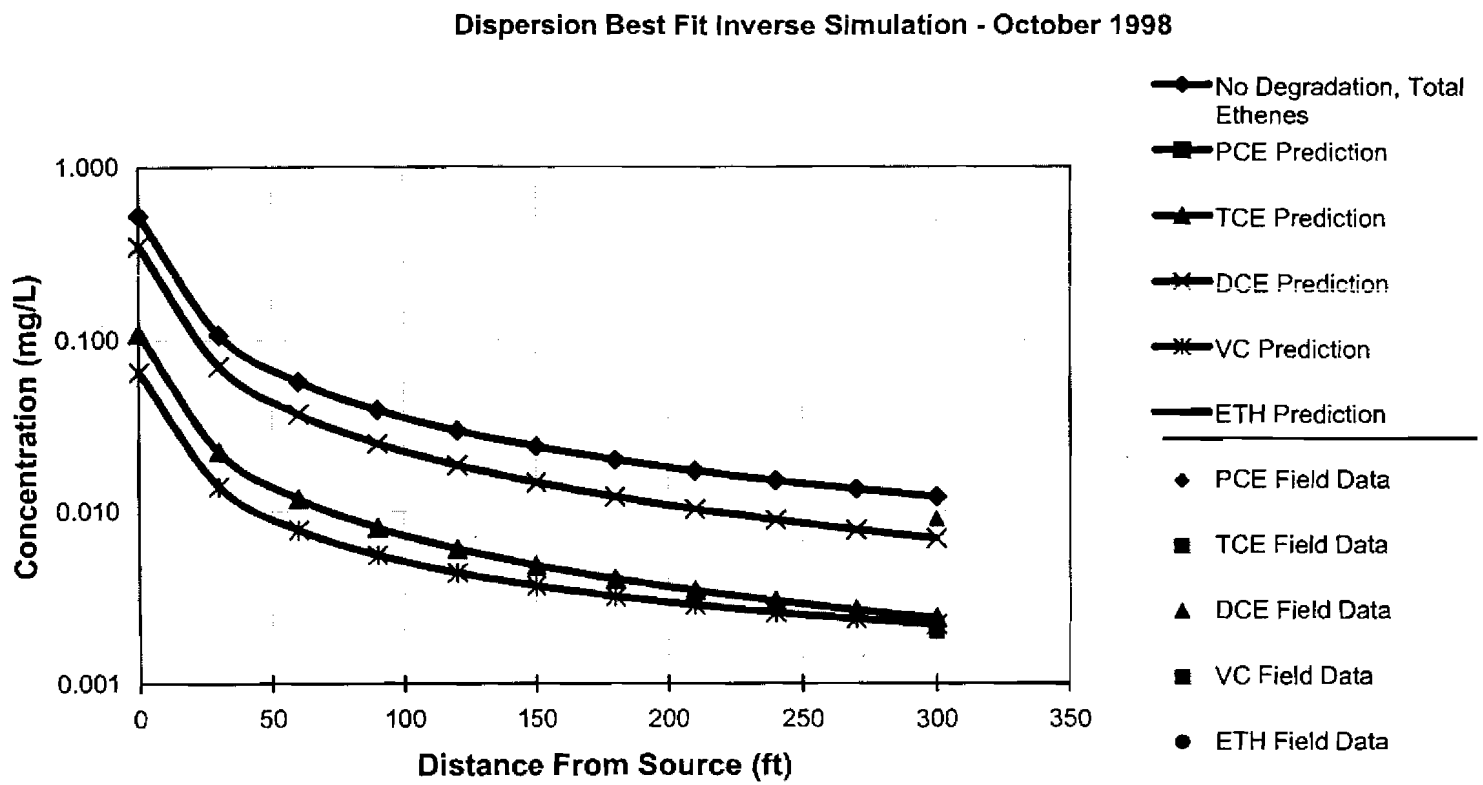
115 ▸1. Enter value directly....or
or 2. Calculate by filling in grey
0.02 cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

Figure 1b



Time:
1,000 Years

To Input

To Individual Compounds

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Dispersion (August 1999)

Data Input Instructions:

115 → 1. Enter value directly....or
or
0.02 → 2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	121.4	(ft/yr)
or		or	
Hydraulic Conductivity	K	4.6E-03	(cm/sec)
Hydraulic Gradient	i	0.0098	(ft/ft)
Porosity	n	0.38	(-)

2. DISPERSION

Alpha x Calc. Method	2000	(ft)
(Alpha y) / (Alpha x)	0.33	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.89	(kg/L)		
FractionOrganicCarbon, foc	9.8E-5	(-)		
Partition Coefficient	Koc			
PCE	267.0	(L/kg)	1.1	(-)
TCE	120.0	(L/kg)	1.1	(-)
DCE	65.0	(L/kg)	1.0	(-)
VC	20.0	(L/kg)	1.0	(-)
ETH		(L/kg)	1.0	(-)
Common R (used in model)* =			1.0	

4. BIODEGRADATION

-1st Order Decay Coef*

Zone 1	λ (1/yr)	half-life (yrs)	Yield*
PCE → TCE	0.00		0.79
TCE → DCE	0.06	12.50	0.74
DCE → VC	0.25	2.75	0.64
VC → ETH	0.02	45.30	0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Product	0.00	

5. GENERAL

Simulation Time*	1000	(yr)
Modeled Area Width*	1000	(ft)
Modeled Area Length*	300	(ft)
Zone 1 Length*	300	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

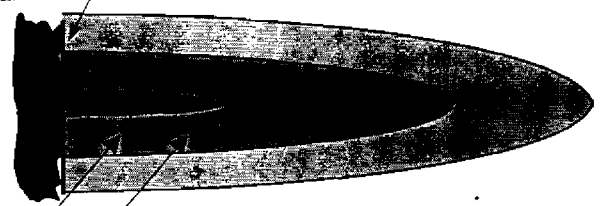
Source Options — TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 500

Conc. (mg/L)*	C1
PCE	0.000
TCE	0.087
DCE	0.170
VC	0.007
ETH	0.000

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

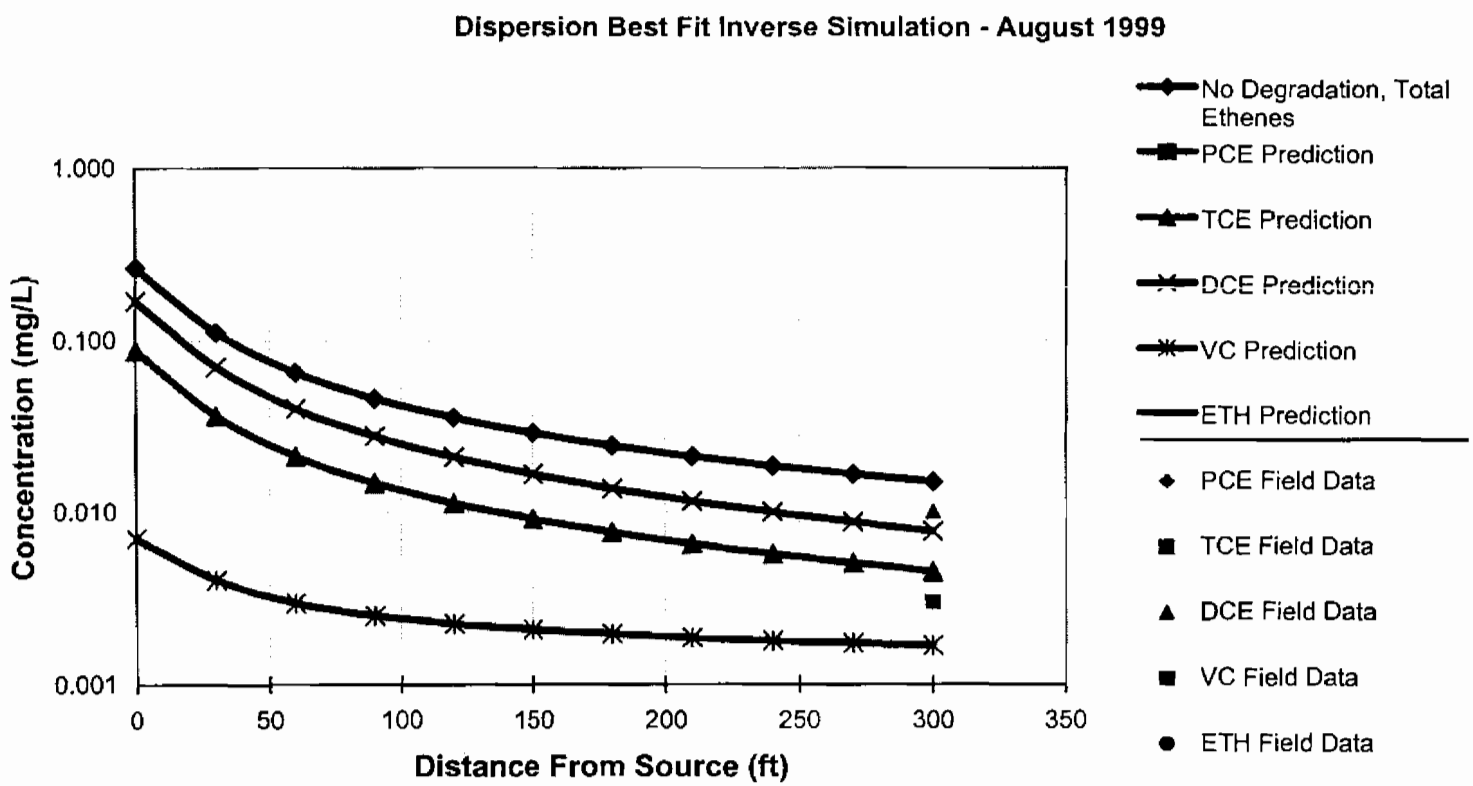
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	.003										
DCE Conc. (mg/L)	.01										
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)	300										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Figure 2b



Time:

1,000 Years

To Input

To Individual Compounds

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Retardation (October 1998) Best Fit

Data Input Instructions:

115 → 1. Enter value directly....or
or
0.02 → 2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	123.9	(ft/yr)
or		or	
Hydraulic Conductivity	K	4.6E-03	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Porosity	n	0.38	(-)

2. DISPERSION

Alpha x Calc. Method	30	(ft)
(Alpha y) / (Alpha x)	0.33	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho		(kg/L)	
FractionOrganicCarbon, foc		(-)	
Partition Coefficient	Koc		
PCE		(L/kg)	1.0 (-)
TCE		(L/kg)	1.0 (-)
DCE		(L/kg)	1.0 (-)
VC		(L/kg)	1.0 (-)
ETH		(L/kg)	1.0 (-)
Common R (used in model)* =			**1050.0**

4. BIODEGRADATION

-1st Order Decay Coef*

Zone 1

	λ (1/yr)	half-live (yrs)	Yield*
PCE → TCE	0.00		0.79
TCE → DCE	0.06	12.50	0.74
DCE → VC	0.25	2.75	0.64
VC → ETH	0.02	45.30	0.45

Zone 2

	λ (1/yr)	half-live (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Product	0.00	

5. GENERAL

Simulation Time*	1000	(yr)
Modeled Area Width*	1000	(ft)
Modeled Area Length*	300	(ft)
Zone 1 Length*	300	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

Source Options

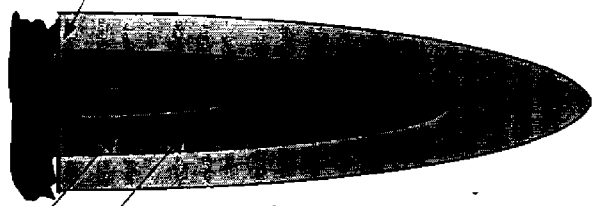
TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 500

Conc. (mg/L)*	C1
PCE	0.000
TCE	0.110
DCE	0.350
VC	0.065
ETH	0.000

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

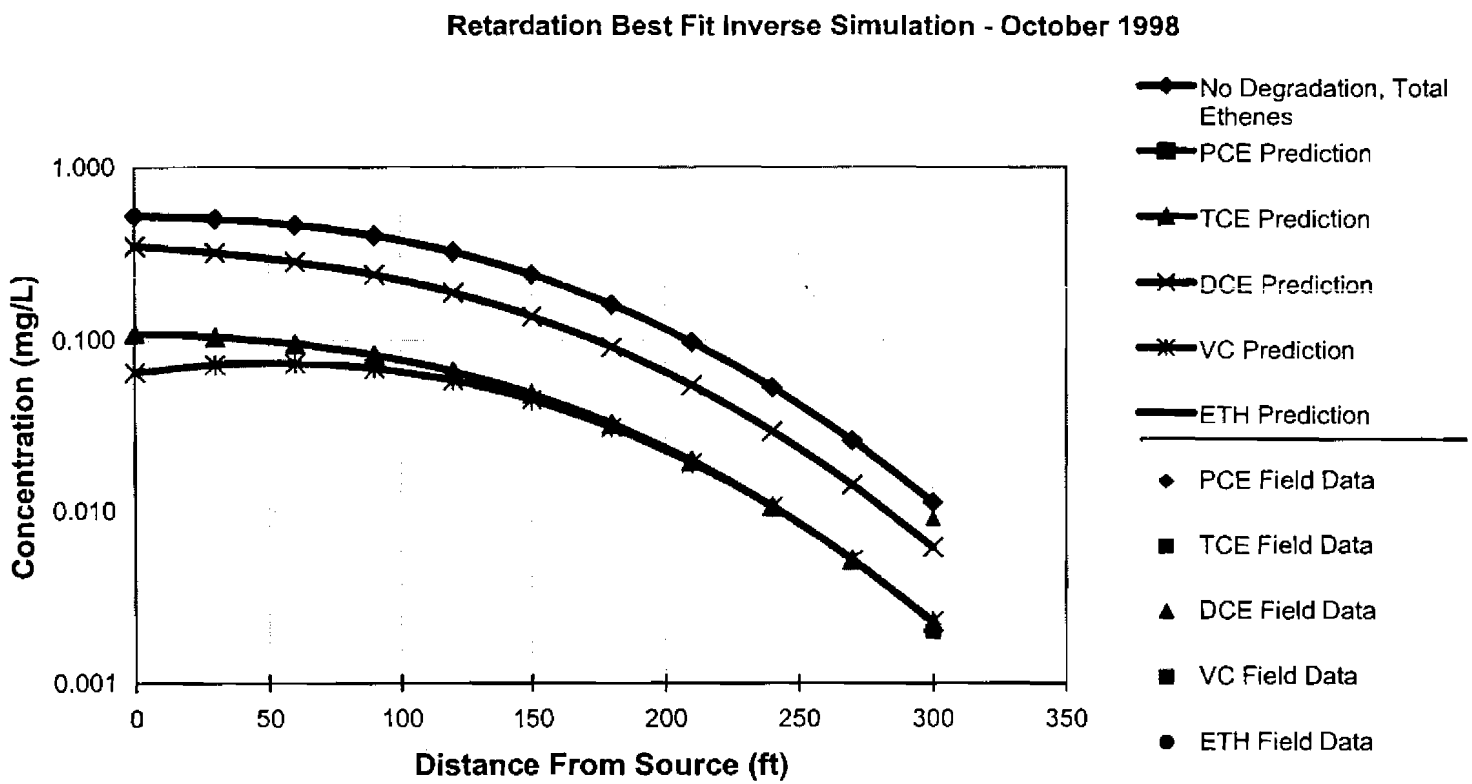
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	.002										
DCE Conc. (mg/L)	.009										
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)	300										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Figure 3b



Time:
1,000 Years

To Input

To Individual Compounds

Fi 4a

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Retardation (August 1999) Best Fit

Data Input Instructions:

115 → 1. Enter value directly....or
or
0.02 → 2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	121.4	(ft/yr)
or		or	
Hydraulic Conductivity	K	4.6E-03	(cm/sec)
Hydraulic Gradient	i	0.0098	(ft/ft)
Porosity	n	0.38	(-)

2. DISPERSION

Alpha x Calc. Method	30	(ft)
(Alpha y) / (Alpha x)	0.33	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho		(kg/L)		
FractionOrganicCarbon, foc		(-)		
Partition Coefficient	Koc			
PCE		(L/kg)	1.0	(-)
TCE		(L/kg)	1.0	(-)
DCE		(L/kg)	1.0	(-)
VC		(L/kg)	1.0	(-)
ETH		(L/kg)	1.0	(-)
Common R (used in model)* =			**900.0**	

4. BIODEGRADATION

-1st Order Decay Coef*

Zone 1	λ (1/yr)	half-live (yrs)	Yield*
PCE → TCE	0.00		0.79
TCE → DCE	0.06	12.50	0.74
DCE → VC	0.25	2.75	0.64
VC → ETH	0.02	45.30	0.45

Zone 2	λ (1/yr)	half-live (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Product	0.00	

5. GENERAL

Simulation Time*	1000	(yr)
Modeled Area Width*	1000	(ft)
Modeled Area Length*	300	(ft)
Zone 1 Length*	300	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

Source Options

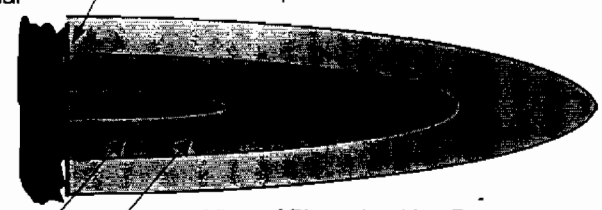
TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 500

Conc. (mg/L)*	C1
PCE	0.000
TCE	0.087
DCE	0.170
VC	0.007
ETH	0.000

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

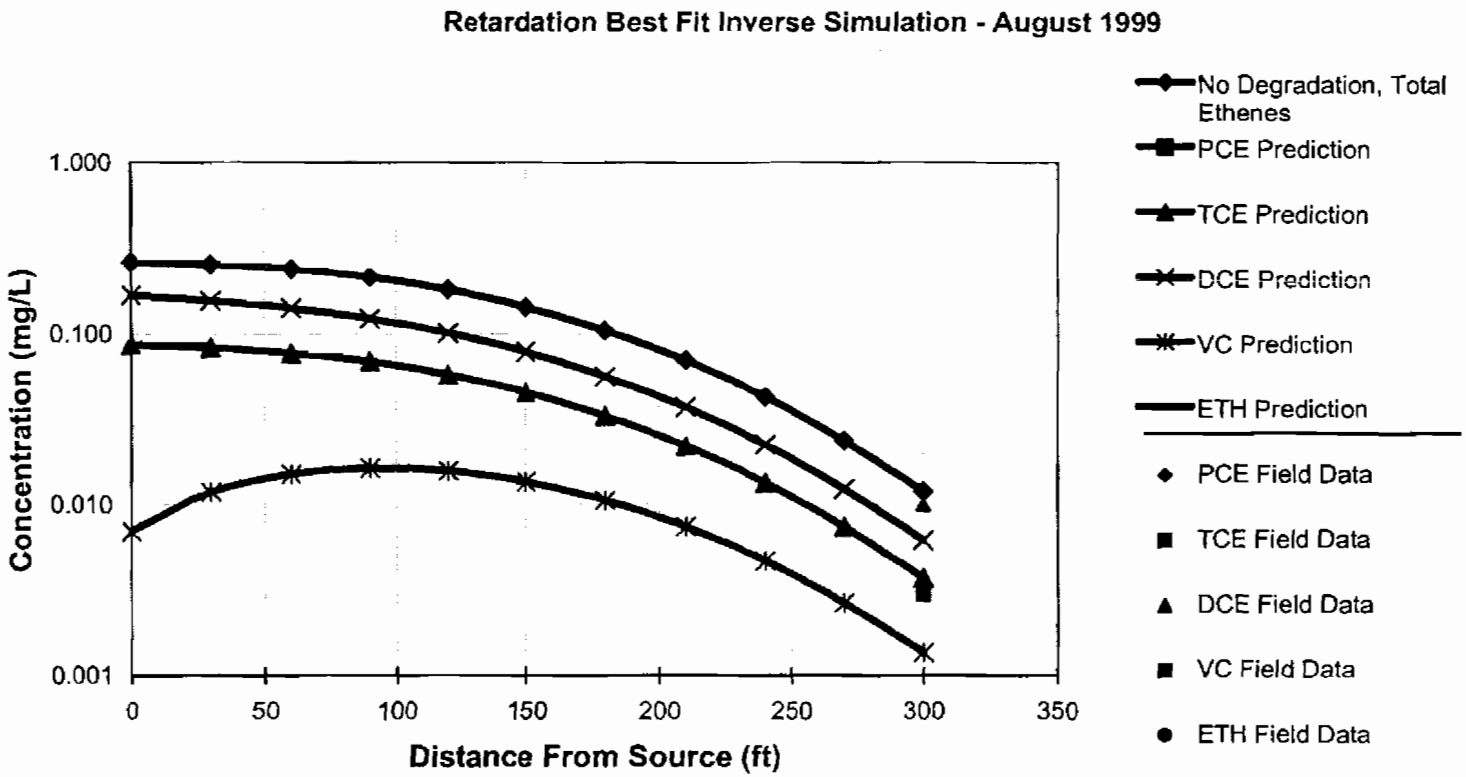
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	.003										
DCE Conc. (mg/L)	.01										
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)	300										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Figure 4b



Time:
1,000 Years

To Input

To Individual Compounds

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Biodegradation (October 1998) Best Fit

Data Input Instructions:

115 ← 1. Enter value directly....or
or
0.02 ← 2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	123.9	(ft/yr)
or		or	
Hydraulic Conductivity	K	4.6E-03	(cm/sec)
Hydraulic Gradient	i	0.015	(ft/ft)
Porosity	n	0.38	(-)

2. DISPERSION

Alpha x Calc. Method	30	(ft)
(Alpha y) / (Alpha x)	0.33	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.89	(kg/L)		
FractionOrganicCarbon, foc	9.8E-4	(-)		
Partition Coefficient	Koc			
PCE	267.0	(L/kg)	1.1	(-)
TCE	120.0	(L/kg)	1.1	(-)
DCE	64.6	(L/kg)	1.0	(-)
VC	19.6	(L/kg)	1.0	(-)
ETH	[illegible]	(L/kg)	1.0	(-)
Common R (used in model)* =			**1.0**	

4. BIODEGRADATION

Zone 1	λ (1/yr)	half-live (yrs)	Yield*
PCE → TCE	0.00	[illegible]	0.79
TCE → DCE	2.31	0.30	0.74
DCE → VC	2.39	0.29	0.64
VC → ETH	17.33	0.04	0.45

-1st Order Decay Coef*

Zone 2	λ (1/yr)	half-live (yrs)
PCE → TCE	0.00	[illegible]
TCE → DCE	0.00	[illegible]
DCE → VC	0.00	[illegible]
VC → ETH	0.00	[illegible]
ETH → Product	0.00	[illegible]

5. GENERAL

Simulation Time*	1000	(yr)
Modeled Area Width*	1000	(ft)
Modeled Area Length*	300	(ft)
Zone 1 Length*	300	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

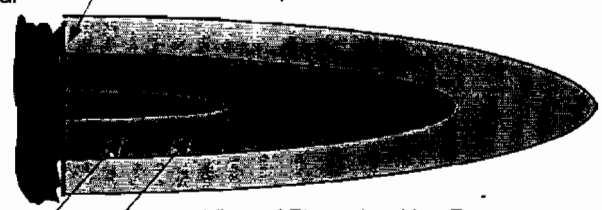
Source Options — TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 500

Conc. (mg/L)*	C1
PCE	0.0
TCE	0.1
DCE	0.4
VC	0.1
ETH	0.0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

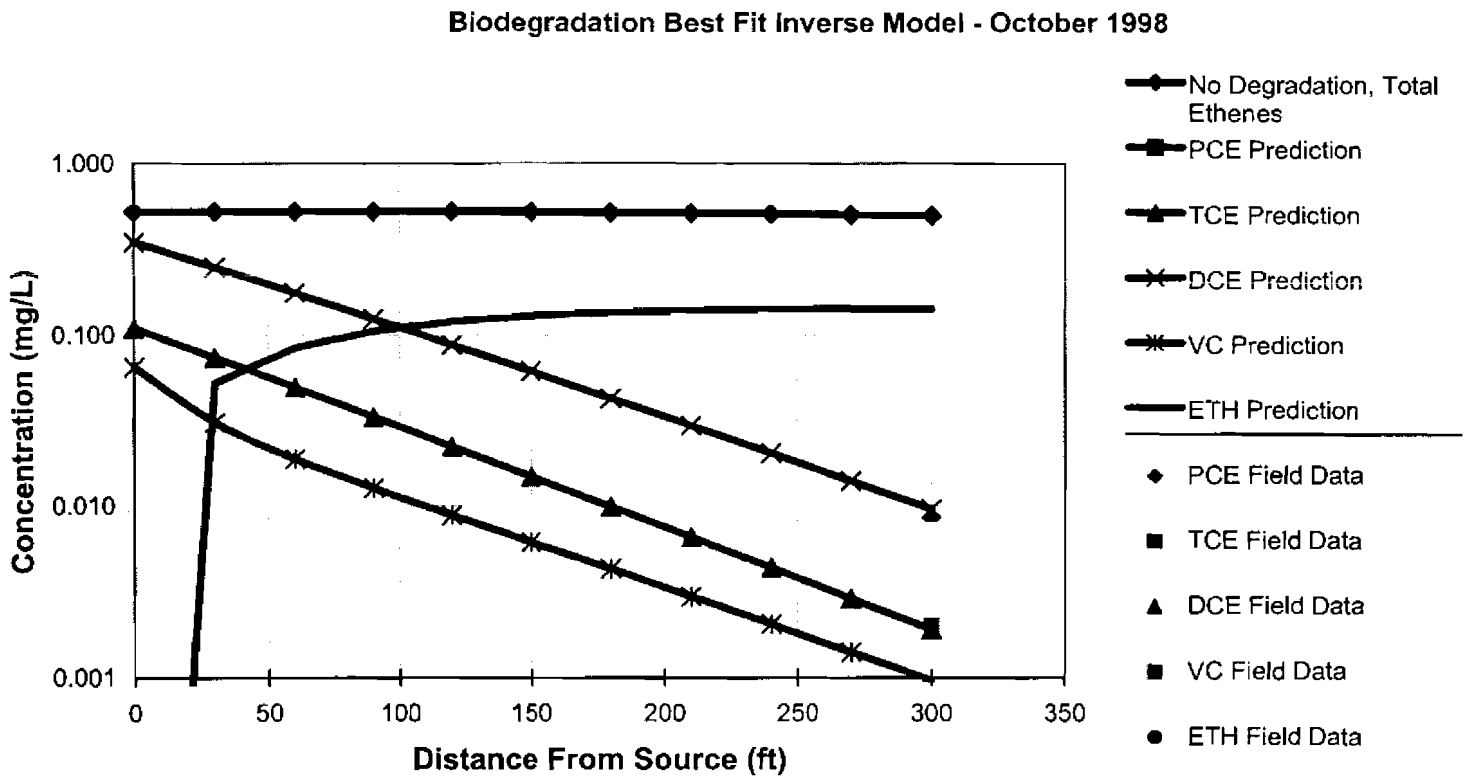
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	.002										
DCE Conc. (mg/L)	.009										
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)	300										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Figure 5b



Time:
1,000 Years

To Input

To Individual Compounds

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Biodegradation (August 1999) Best Fit

Data Input Instructions:

115 ▸1. Enter value directly....or
or
0.02 ▸2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	121.4	(ft/yr)
or		or	
Hydraulic Conductivity	K	4.6E-03	(cm/sec)
Hydraulic Gradient	i	0.0098	(ft/ft)
Porosity	n	0.38	(-)

2. DISPERSION

Alpha x Calc. Method	30	(ft)
(Alpha y) / (Alpha x)	0.33	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.89	(kg/L)		
FractionOrganicCarbon, foc	9.8E-5	(-)		
Partition Coefficient	Koc			
PCE	267.0	(L/kg)	1.1	(-)
TCE	120.0	(L/kg)	1.1	(-)
DCE	64.6	(L/kg)	1.0	(-)
VC	19.6	(L/kg)	1.0	(-)
ETH		(L/kg)	1.0	(-)
Common R (used in model)* =			**1.0**	

4. BIODEGRADATION -1st Order Decay Coef*

Zone 1	λ (1/yr)	half-live (yrs)	Yield*
PCE → TCE	0.00		0.79
TCE → DCE	1.73	0.40	0.74
DCE → VC	1.98	0.35	0.64
VC → ETH	13.86	0.05	0.45

Zone 2	λ (1/yr)	half-live (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Product	0.00	

5. GENERAL

Simulation Time*	1000	(yr)
Modeled Area Width*	1000	(ft)
Modeled Area Length*	300	(ft)
Zone 1 Length*	300	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

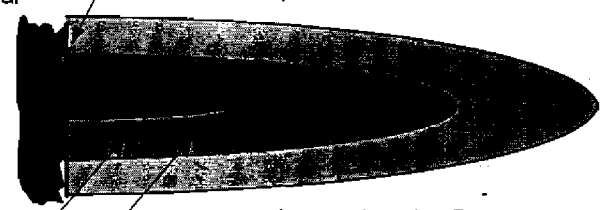
Source Options — TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 500

Conc. (mg/L)*	C1
PCE	0.0
TCE	0.1
DCE	0.2
VC	0.0
ETH	0.0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

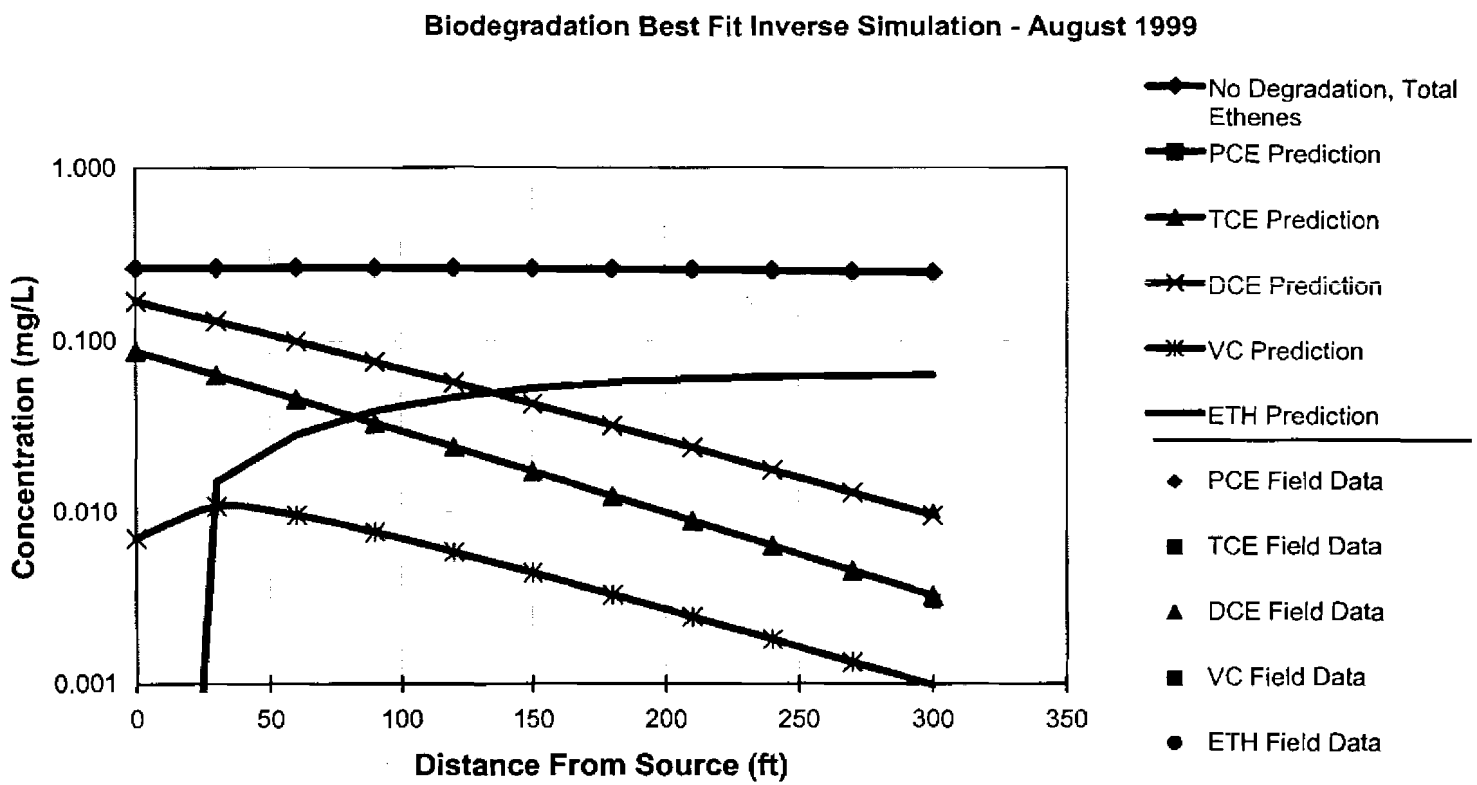
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	.003										
DCE Conc. (mg/L)	.01										
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)	300										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Figure 6b



Time:
1,000 Years

To Input

To Individual Compounds

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Lit. Values (October 1998)
Run Name

Data Input Instructions:

115 ← 1. Enter value directly....or
or
0.02 ← 2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	123.9	(ft/yr)
or		or	
Hydraulic Conductivity	K	4.6E-03	(cm/sec)
Hydraulic Gradient	i	0.01	(ft/ft)
Porosity	n	0.38	(-)

2. DISPERSION

Alpha x Calc. Method	30	(ft)
(Alpha y) / (Alpha x)	0.333	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.89	(kg/L)		
FractionOrganicCarbon, foc	9.8E-5	(-)		
Partition Coefficient	Koc			
PCE	267.0	(L/kg)	1.1	(-)
TCE	120.0	(L/kg)	1.1	(-)
DCE	65.0	(L/kg)	1.0	(-)
VC	20.0	(L/kg)	1.0	(-)
ETH		(L/kg)	1.0	(-)
Common R (used in model)* =			1.0	

4. BIODEGRADATION -1st Order Decay Coef*

Zone 1	λ (1/yr)	half-live (yrs)	Yield*
PCE → TCE	0.00		0.79
TCE → DCE	0.06	12.50	0.74
DCE → VC	0.25	2.75	0.64
VC → ETH	0.02	45.30	0.45

Zone 2	λ (1/yr)	half-live (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Product	0.00	

5. GENERAL

Simulation Time*	1000	(yr)
Modeled Area Width*	300	(ft)
Modeled Area Length*	300	(ft)
Zone 1 Length*	300	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

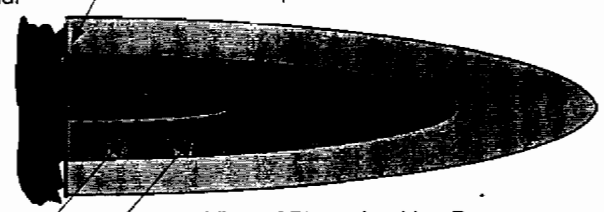
Source Options — TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 300

Conc. (mg/L)*	C1
PCE	0.000
TCE	0.110
DCE	0.350
VC	0.065
ETH	0.000

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

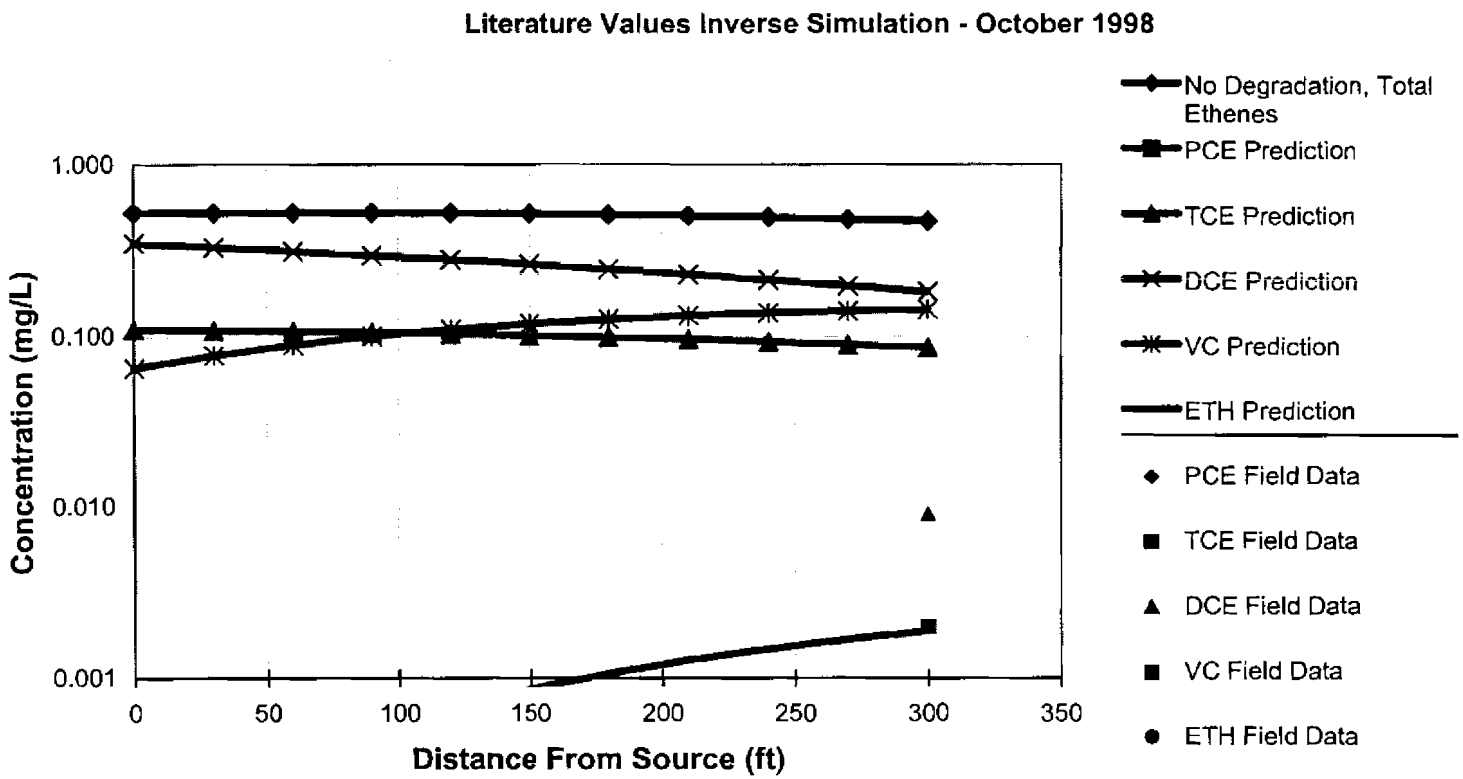
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	.002										
DCE Conc. (mg/L)	.009										
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)	300										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Figure 7b



Time:
1,000 Years

To Input

To Individual Compounds

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Lit.Values (August 1999)
Run Name

Data Input Instructions:

115 or 0.02
1. Enter value directly....or
2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	121.4	(ft/yr)
or		or	
Hydraulic Conductivity	K	4.6E-03	(cm/sec)
Hydraulic Gradient	i	0.0098	(ft/ft)
Porosity	n	0.38	(-)

2. DISPERSION

Alpha x Calc. Method	30	(ft)
(Alpha y) / (Alpha x)	0.333	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.89	(kg/L)		
FractionOrganicCarbon, foc	9.8E-5	(-)		
Partition Coefficient	Koc			
PCE	267.0	(L/kg)	1.1	(-)
TCE	120.0	(L/kg)	1.1	(-)
DCE	65.0	(L/kg)	1.0	(-)
VC	20.0	(L/kg)	1.0	(-)
ETH		(L/kg)	1.0	(-)
Common R (used in model)* =			**1.0**	

4. BIODEGRADATION — -1st Order Decay Coef*

Zone 1	λ (1/yr)	half-live (yrs)	Yield*
PCE → TCE	0.00		0.79
TCE → DCE	0.06	12.50	0.74
DCE → VC	0.25	2.75	0.64
VC → ETH	0.02	45.30	0.45

Zone 2	λ (1/yr)	half-live (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Product	0.00	

5. GENERAL

Simulation Time*	1000	(yr)
Modeled Area Width*	300	(ft)
Modeled Area Length*	300	(ft)
Zone 1 Length*	300	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

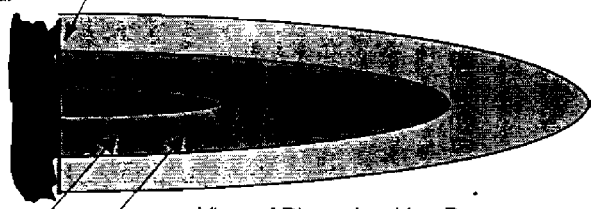
Source Options — TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 300

Conc. (mg/L)*	C1
PCE	0.000
TCE	0.087
DCE	0.170
VC	0.007
ETH	0.000

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

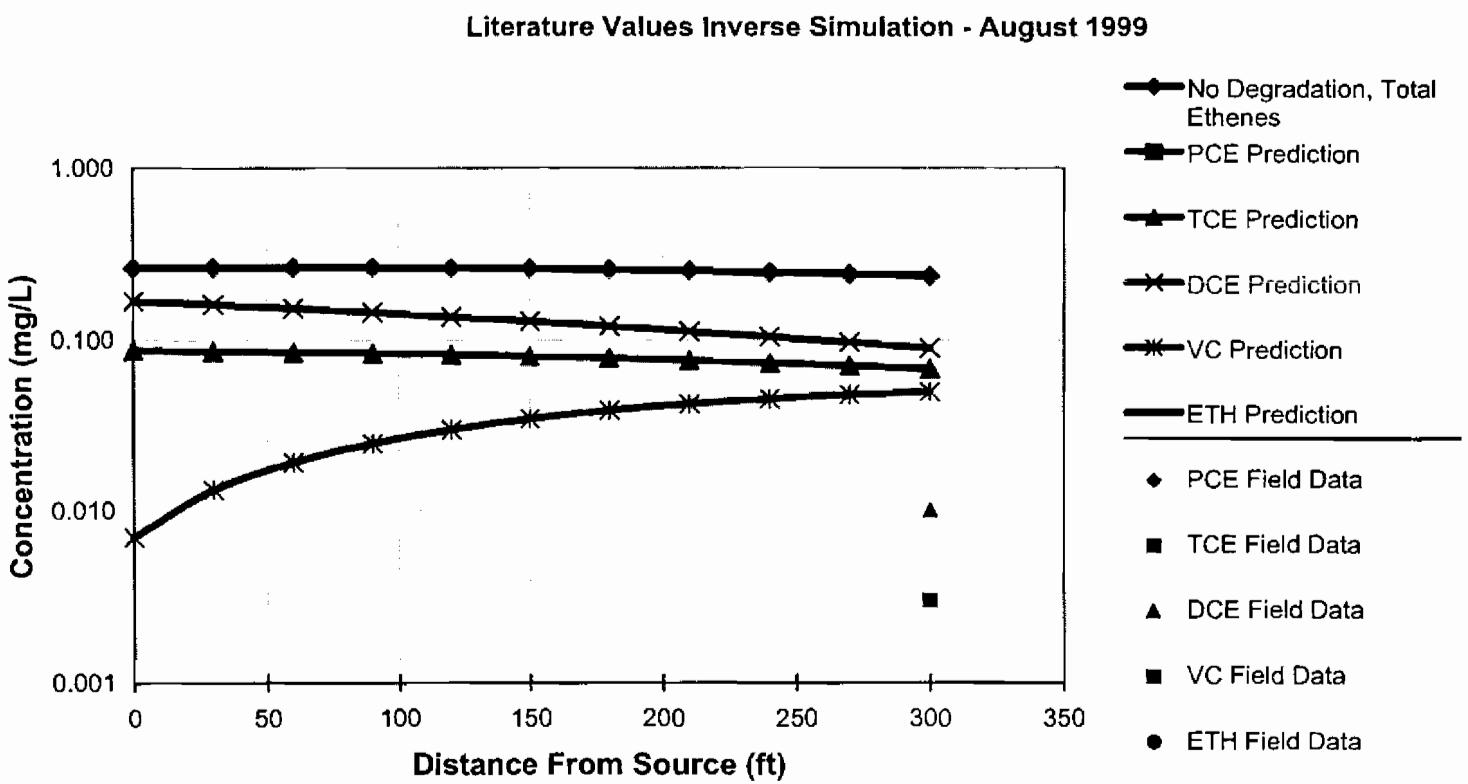
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	.003										
DCE Conc. (mg/L)	.01										
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)	300										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore Formulas | RESET | *SEE OUTPUT* | Paste Example Dataset

Figure 8b



Time:
1,000 Years

To Input

To Individual Compounds

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Fwd. Sim.
039009

Data Input Instructions:

115 → 1. Enter value directly....or
or
0.02 → 2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	66.0	(ft/yr)
or		or	
Hydraulic Conductivity	K	5.3E-03	(cm/sec)
Hydraulic Gradient	i	0.00525	(ft/ft)
Porosity	n	0.436	(-)

2. DISPERSION

Alpha x Calc. Method	30	(ft)
(Alpha y) / (Alpha x)	0.33	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.91	(kg/L)		
FractionOrganicCarbon, foc	9.6E-3	(-)		
Partition Coefficient	Koc			
PCE	267.0	(L/kg)	12.2	(-)
TCE	120.0	(L/kg)	6.0	(-)
DCE	65.0	(L/kg)	3.7	(-)
VC	20.0	(L/kg)	1.8	(-)
ETH		(L/kg)	1.0	(-)
Common R (used in model)* =			**3.7**	

4. BIODEGRADATION

-1st Order Decay Coef*

Zone 1	λ (1/yr)	half-live (yrs)	Yield*
PCE → TCE	0.35	1.98	0.79
TCE → DCE	1.98	0.35	0.74
DCE → VC	2.17	0.32	0.64
VC → ETH	0.02	45.33	0.45

Zone 2	λ (1/yr)	half-live (yrs)
PCE → TCE	0.00	
TCE → DCE	0.00	
DCE → VC	0.00	
VC → ETH	0.00	
ETH → Product	0.00	

5. GENERAL

Simulation Time*	68	(yr)
Modeled Area Width*	1000	(ft)
Modeled Area Length*	600	(ft)
Zone 1 Length*	600	(ft)
Zone 2 Length*		(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

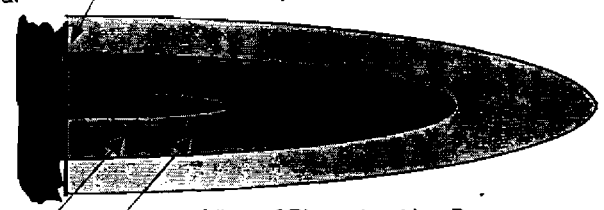
Source Options — TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 500

Conc. (mg/L)*	C1
PCE	0.050
TCE	0.047
DCE	0.552
VC	0.090
ETH	0.002

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

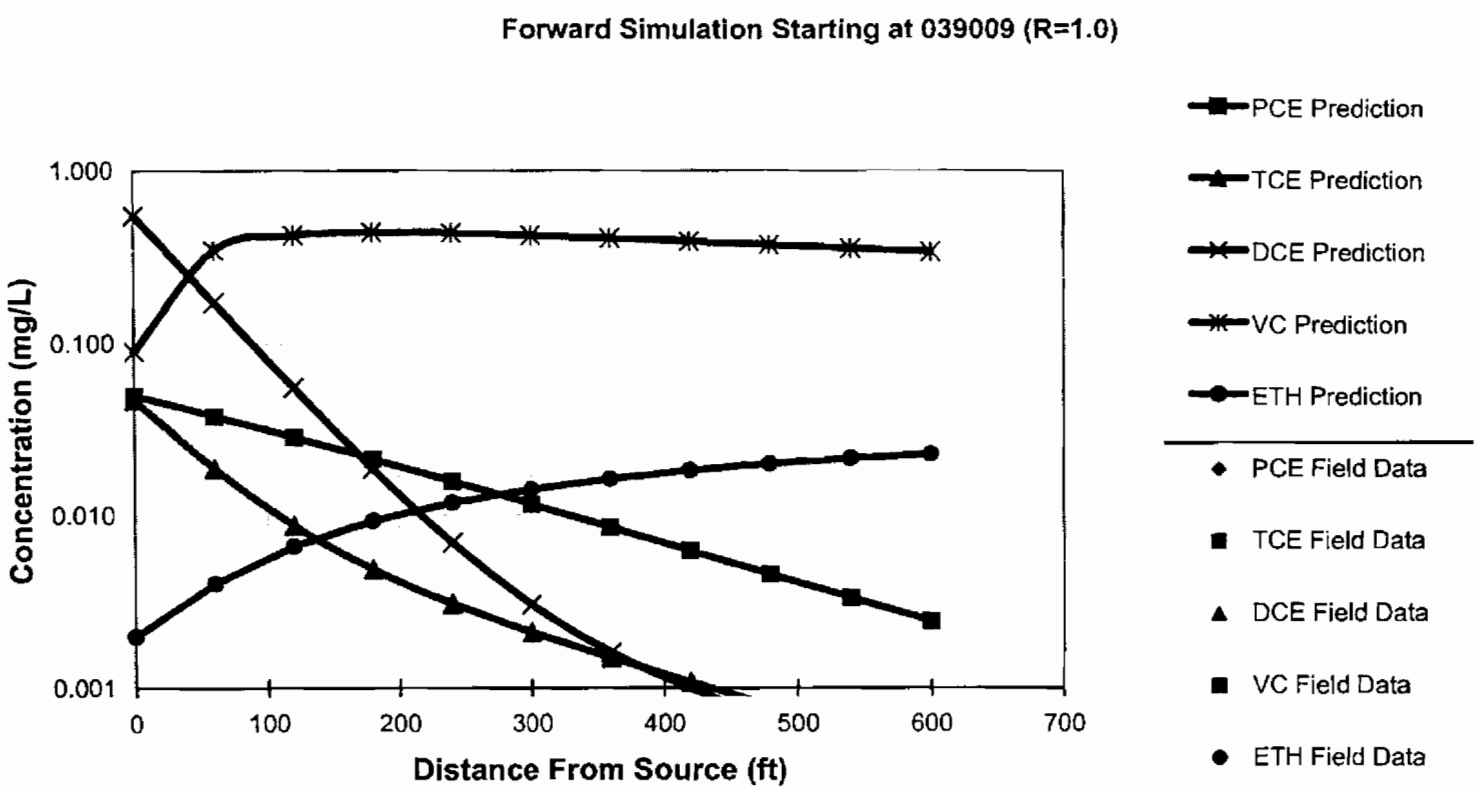
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)											

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Figure 9b



Time:
68 Years

To Input

To Individual Compounds

BIOCHLOR Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence — *Version Beta 0.1*

Fwd. Sim.
039009
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or
0.02 → 2. Calculate by filling in grey cells. Press Enter, then

(To restore formulas, hit "Restore Formulas" button)

Variable* → Data used directly in model.

Test if Biodegradation is Occurring → AFCEE Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	66.0	(ft/yr)
or		or	
Hydraulic Conductivity	K	5.3E-03	(cm/sec)
Hydraulic Gradient	i	0.00525	(ft/ft)
Porosity	n	0.436	(-)

2. DISPERSION

Alpha x Calc. Method	30	(ft)
(Alpha y) / (Alpha x)	0.33	(-)
(Alpha z) / (Alpha x)	3.E-02	(-)

Change Alpha x Calc. Method

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho		(kg/L)		
FractionOrganicCarbon, foc		(-)		
Partition Coefficient	Koc			
PCE		(L/kg)		(-)
TCE		(L/kg)		(-)
DCE		(L/kg)		(-)
VC		(L/kg)		(-)
ETH		(L/kg)		(-)

Common R (used in model)* = 1.0

4. BIODEGRADATION

		-1st Order Decay Coef*		
Zone 1		λ (1/yr)	half-live (yrs)	Yield*
PCE →	TCE	0.35	1.98	0.79
TCE →	DCE	1.98	0.35	0.74
DCE →	VC	2.17	0.32	0.64
VC →	ETH	0.02	45.33	0.45
Zone 2		λ (1/yr)	half-live (yrs)	
PCE →	TCE	0.00		
TCE →	DCE	0.00		
DCE →	VC	0.00		
VC →	ETH	0.00		
ETH →	Product	0.00		

5. GENERAL

Simulation Time*	68	(yr)
Modeled Area Width*	1000	(ft)
Modeled Area Length*	600	(ft)
Zone 1 Length*	600	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

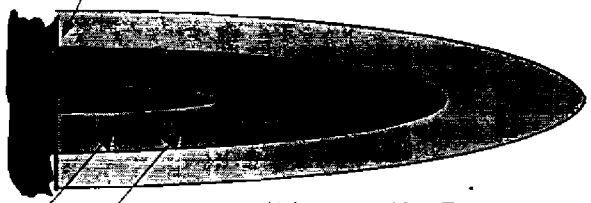
Source Options — TYPE: Single Planar

Source Thickness in Sat. Zone* 40 (ft)

Width* (ft) 500

Conc. (mg/L)*	C1
PCE	0.050
TCE	0.047
DCE	0.552
VC	0.090
ETH	0.002

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

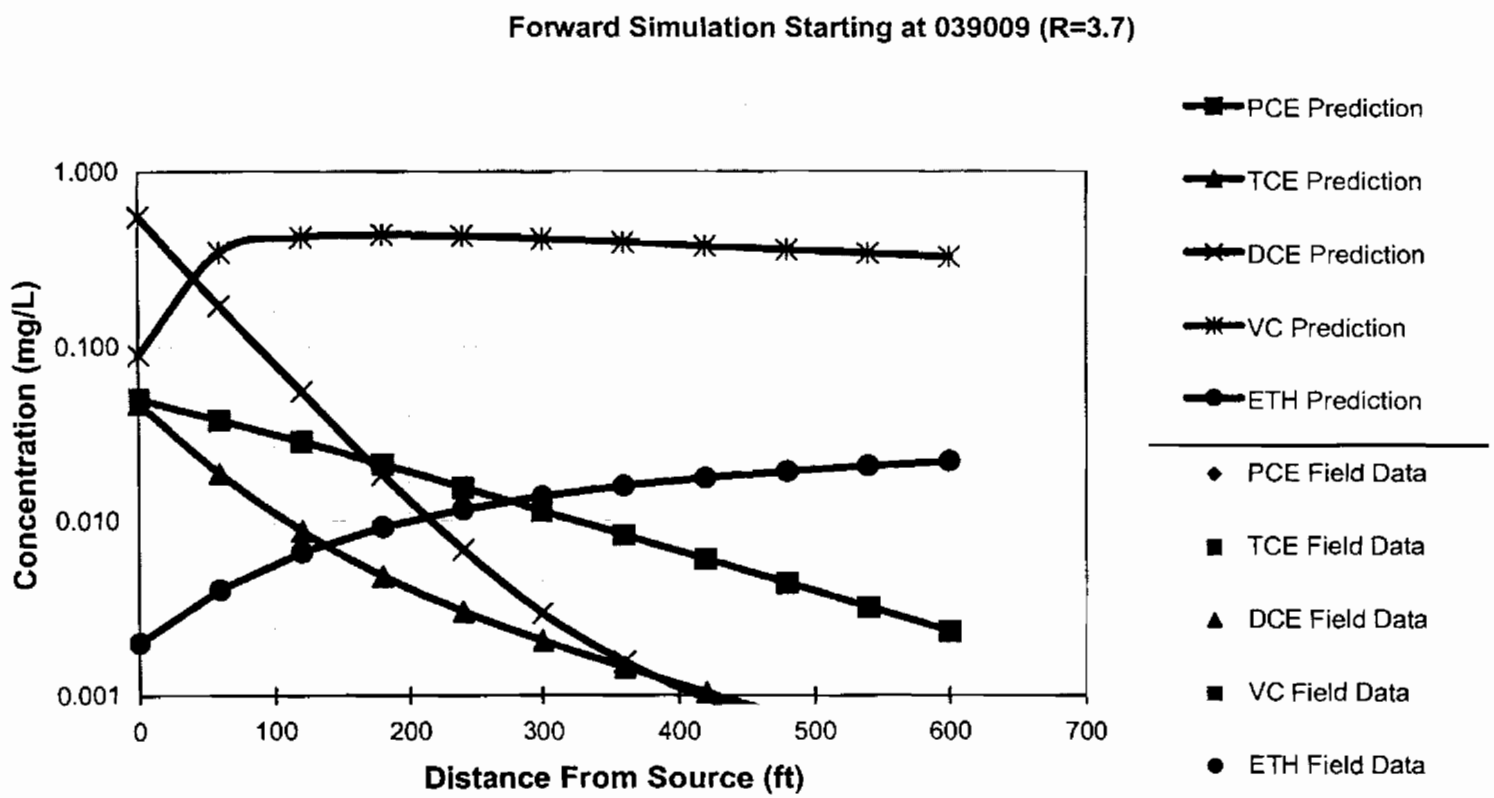
7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Dist. from Source (ft)											

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example Dataset

Figure 9d



Time:
68 Years

To Input

To Individual Compounds

TABLE 11

Inverse Dispersion October 1998

	Distance from Source (ft)										
	0.000	30.000	60.000	90.000	120.000	150.000	180.000	210.000	240.000	270.000	300.000
No Degradation, Total Ethenes	0.525	0.107	0.057	0.039	0.030	0.024	0.020	0.017	0.015	0.013	0.012
PCE Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TCE Prediction	0.110	0.022	0.012	0.008	0.006	0.005	0.004	0.003	0.003	0.003	0.002
DCE Prediction	0.350	0.070	0.037	0.025	0.019	0.015	0.012	0.010	0.009	0.008	0.007
VC Prediction	0.065	0.014	0.008	0.006	0.004	0.004	0.003	0.003	0.003	0.002	0.002
ETH Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Inverse Dispersion August 1999

	Distance from Source (ft)										
	0.000	30.000	60.000	90.000	120.000	150.000	180.000	210.000	240.000	270.000	300.000
No Degradation, Total Ethenes	0.264	0.112	0.065	0.046	0.035	0.029	0.024	0.021	0.018	0.016	0.015
PCE Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TCE Prediction	0.087	0.036	0.021	0.015	0.011	0.009	0.008	0.007	0.006	0.005	0.004
DCE Prediction	0.170	0.070	0.040	0.028	0.021	0.017	0.014	0.012	0.010	0.009	0.008
VC Prediction	0.007	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002
ETH Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Inverse Retardation October 1998

	Distance from Source (ft)										
	0.000	30.000	60.000	90.000	120.000	150.000	180.000	210.000	240.000	270.000	300.000
No Degradation, Total Ethenes	0.525	0.503	0.463	0.402	0.324	0.239	0.161	0.097	0.053	0.026	0.011
PCE Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TCE Prediction	0.110	0.104	0.095	0.082	0.066	0.048	0.032	0.020	0.011	0.005	0.002
DCE Prediction	0.350	0.321	0.285	0.240	0.189	0.137	0.091	0.054	0.029	0.014	0.006
VC Prediction	0.065	0.072	0.073	0.068	0.058	0.045	0.031	0.019	0.011	0.005	0.002
ETH Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Inverse Retardation August 1999

	Distance from Source (ft)										
	0.000	30.000	60.000	90.000	120.000	150.000	180.000	210.000	240.000	270.000	300.000
No Degradation, Total Ethenes	0.264	0.256	0.240	0.215	0.182	0.143	0.105	0.070	0.043	0.024	0.012
PCE Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TCE Prediction	0.087	0.083	0.077	0.069	0.058	0.045	0.033	0.022	0.013	0.007	0.004
DCE Prediction	0.170	0.157	0.142	0.123	0.102	0.078	0.056	0.037	0.022	0.012	0.006
VC Prediction	0.007	0.012	0.015	0.016	0.016	0.014	0.011	0.007	0.005	0.003	0.001
ETH Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

TABLE 11

Inverse Biodegradation October 1998

	Distance from Source (ft)										
	0.000	30.000	60.000	90.000	120.000	150.000	180.000	210.000	240.000	270.000	300.000
No Degradation, Total Ethenes	0.525	0.525	0.525	0.525	0.523	0.521	0.517	0.512	0.506	0.500	0.493
PCE Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TCE Prediction	0.110	0.074	0.049	0.033	0.022	0.015	0.010	0.007	0.004	0.003	0.002
DCE Prediction	0.350	0.249	0.176	0.124	0.087	0.061	0.042	0.029	0.020	0.014	0.010
VC Prediction	0.065	0.031	0.019	0.013	0.009	0.006	0.004	0.003	0.002	0.001	0.001
ETH Prediction	0.000	0.052	0.084	0.105	0.120	0.129	0.136	0.139	0.141	0.142	0.141

Inverse Biodegradation August 1999

	Distance from Source (ft)										
	0.000	30.000	60.000	90.000	120.000	150.000	180.000	210.000	240.000	270.000	300.000
No Degradation, Total Ethenes	0.264	0.264	0.264	0.264	0.263	0.262	0.260	0.258	0.255	0.251	0.248
PCE Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TCE Prediction	0.087	0.063	0.046	0.033	0.024	0.017	0.012	0.009	0.006	0.005	0.003
DCE Prediction	0.170	0.130	0.099	0.075	0.057	0.043	0.032	0.024	0.017	0.013	0.009
VC Prediction	0.007	0.011	0.010	0.008	0.006	0.004	0.003	0.002	0.002	0.001	0.001
ETH Prediction	0.000	0.015	0.028	0.039	0.047	0.053	0.057	0.060	0.061	0.062	0.063

Inverse Literature Simulation October 1998

	Distance from Source (ft)										
	0.000	30.000	60.000	90.000	120.000	150.000	180.000	210.000	240.000	270.000	300.000
No Degradation, Total Ethenes	0.525	0.525	0.525	0.524	0.522	0.518	0.511	0.502	0.491	0.480	0.468
PCE Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TCE Prediction	0.110	0.109	0.107	0.106	0.104	0.102	0.099	0.096	0.093	0.089	0.086
DCE Prediction	0.350	0.331	0.314	0.297	0.280	0.263	0.246	0.229	0.212	0.196	0.182
VC Prediction	0.065	0.077	0.089	0.100	0.110	0.119	0.126	0.132	0.137	0.141	0.144
ETH Prediction	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.002	0.002

Inverse Literature Simulation August 1999

	Distance from Source (ft)										
	0.000	30.000	60.000	90.000	120.000	150.000	180.000	210.000	240.000	270.000	300.000
No Degradation, Total Ethenes	0.264	0.264	0.264	0.264	0.263	0.260	0.257	0.252	0.247	0.241	0.235
PCE Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TCE Prediction	0.087	0.086	0.085	0.083	0.082	0.080	0.078	0.076	0.073	0.070	0.068
DCE Prediction	0.170	0.161	0.153	0.145	0.137	0.128	0.120	0.112	0.104	0.096	0.089
VC Prediction	0.007	0.013	0.019	0.025	0.030	0.034	0.039	0.042	0.045	0.048	0.050
ETH Prediction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001

TABLE 11

Forward Simulation 039009

	Distance from Source (ft)										
	0.000	60.000	120.000	180.000	240.000	300.000	360.000	420.000	480.000	540.000	600.000
No Degradation, Total Ethenes	0.741	0.741	0.739	0.730	0.715	0.696	0.676	0.654	0.632	0.610	0.588
PCE Prediction	0.050	0.038	0.028	0.021	0.016	0.012	0.009	0.006	0.005	0.003	0.002
TCE Prediction	0.047	0.019	0.009	0.005	0.003	0.002	0.001	0.001	0.001	0.001	0.000
DCE Prediction	0.552	0.173	0.056	0.019	0.007	0.003	0.002	0.001	0.001	0.000	0.000
VC Prediction	0.090	0.348	0.425	0.441	0.436	0.423	0.407	0.390	0.373	0.356	0.339
ETH Prediction	0.002	0.004	0.007	0.009	0.012	0.014	0.016	0.018	0.020	0.021	0.023