

April 14, 1988

**ANNUAL GROUND WATER MONITORING
BLADEN COUNTY SANITARY LANDFILL
ELIZABETHTOWN, NORTH CAROLINA
April 14, 1988**

Prepared For
Solid and Hazardous Waste Management Branch
Fayetteville, North Carolina

Prepared By
Aquaterra, Inc.
Raleigh, North Carolina





AQUATERRA

Aquaterra, Inc. • P.O. Box 50328 • Raleigh, NC 27650 • 919-839-0199

April 14, 1988

Solid and Hazardous Waste Management Branch
North Carolina Division of Health Services
P.O. Box 2091
Raleigh, North Carolina 27602-2091

Attention: Mr. Mike Babuoin

Reference: Annual Ground Water Monitoring
Bladen County Sanitary Landfill
Elizabethtown, North Carolina
Aquaterra Job #200-87-112

Dear Mr. Babuoin:

In conducting the annual ground water sampling in November, 1987, at the existing Bladen County Sanitary Landfill located in Elizabethtown, North Carolina, as shown in Figure 1, it was noted that MW-1 had been damaged and could not be sampled. It was decided that the well could be repaired and on January 20, 1988, the damaged PVC casing was replaced.

On February 22, 1988, the well was developed, sampled and analyzed in accordance with the water level monitoring, the well evacuation and the sample collection procedures contained in an Aquaterra report to the Bladen County Health Department. This report, dated November 24, 1987, summarizes the annual ground water monitoring at the existing Bladen County Landfill and is contained in Attachment B. The original report contained no analytical data pertaining to MW-1. Please note that the report shown in Attachment B has been updated to reflect the recent sampling and analysis of MW-1. Tables 3, 4 and 5 include the sampling and analysis data of all wells obtained in the annual ground water monitoring efforts.

Two additional monitoring wells, MW-7 and MW-8, were installed at the locations shown in Figure 2. The borings were advanced by means of a hollow stem auger driven by a CME-45 trailer-mounted rotary drilling rig. Upon completion of the boring, a permanent ground water monitoring well was constructed in accordance with 15 NCAC 2C "Well Construction Standards: Criteria and Standards Applicable to Water Supply and Certain Other Types of Wells", with Well Construction Records, Schematics and Installation Data shown in Attachment A.

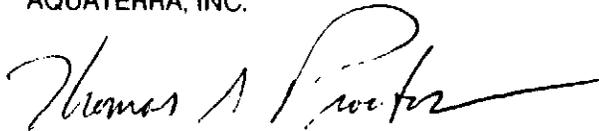
Mr. Ikle Guyton
Solid and Hazardous Waste Management Branch
April 14, 1988
Page 2

These two additional wells were developed subsequent to installation but were not sampled pending a decision by Jim Bales of the Fayetteville Regional Office of the North Carolina Department of Natural Resources and Community Development (NRCD) regarding the required analytical parameters to satisfy the Notice of Non-Compliance, as shown in Attachment C. Upon notification by NRCD of the required analytical parameters, we will propose a schedule to sample these two additional wells.

If you have any questions, please do not hesitate to contact us.

Sincerely,

AQUATERRA, INC.



Thomas A. Proctor
Project Geologist



Phillip L. Rahn, P.G.
Senior Hydrogeologist/Project Manager

CEJ/PLR/ltr

Attachment

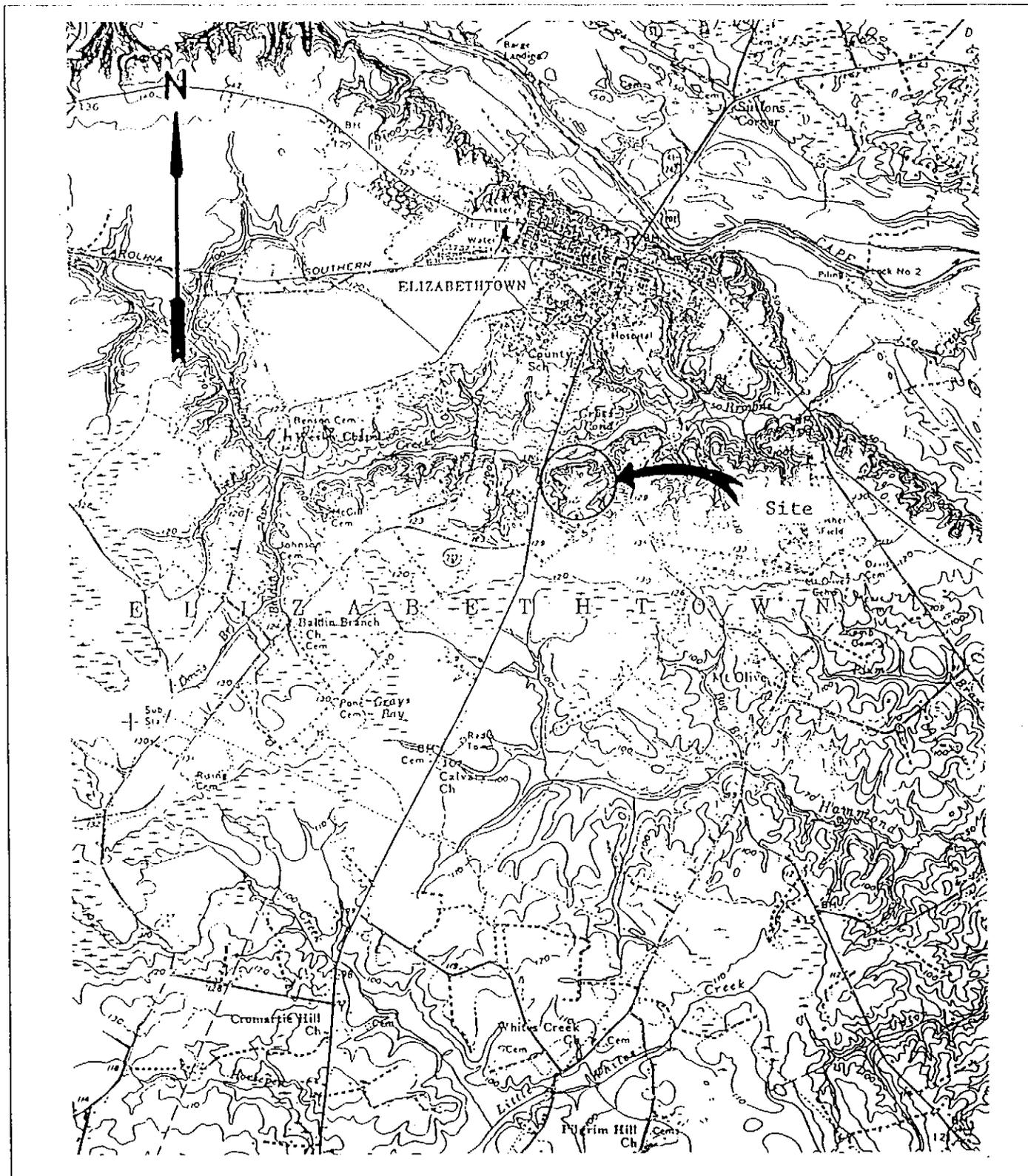
L196-88

cc: Ikle Guyton
Steve Moffat



FIGURES

SITE LOCATION MAP



PROJECT

Bladen County Landfill
Elizabethtown, N.C.

AQUATERRA,

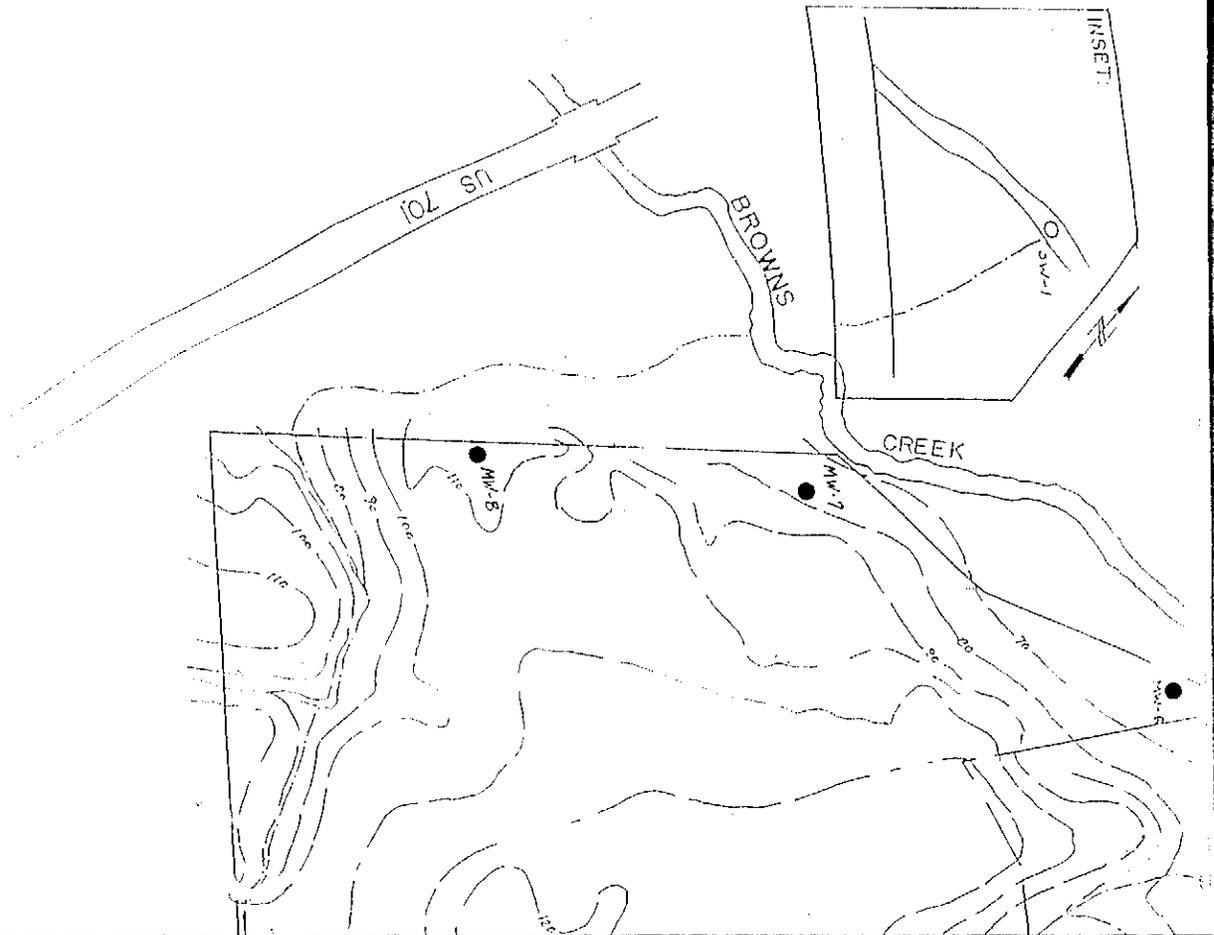
INCORPORATED

RALEIGH, NORTH CAROLINA

SCALE: 1" = 1 Mile

JOB NO: 200-87-112

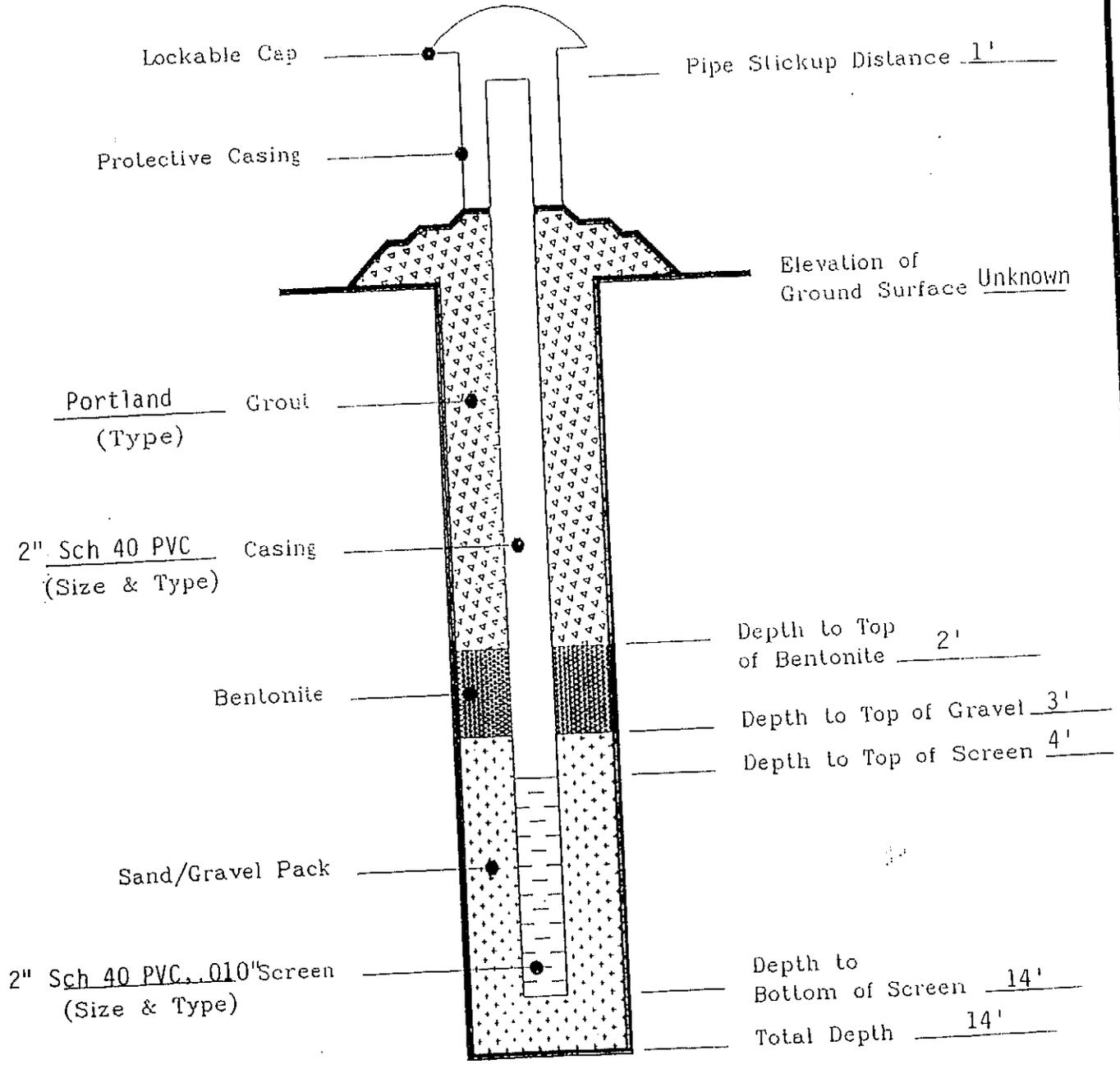
FIGURE NO: 1



ATTACHMENTS

ATTACHMENT A
WELL CONSTRUCTION RECORDS,
SCHEMATICS AND INSTALLATION DATA

Well Number MW-7 Drilling Method HSA
 Date Started 2-22-88 Drilling Fluids None
 Date Finished 2-22-88 Static Water Level N/A Date _____
 Geologist T. A. Proctor All Depths Referenced From
 Top of Casing



PROJECT
 Bladen Co. Landfill
 Elizabethtown, N.C.

AQUATERRA, INC.
 RALEIGH, NORTH CAROLINA

JOB NUMBER: 200-87-112
 SCALE: N.T.S.
 FIGURE NUMBER:

MONITORING WELL INSTALLATION DATA

Well Number: MW-7 Ground Elevation: Unknown

Dated Started: 2-22-88 Date Completed: 2-22-88

Geologists: T. A. Proctor

Drillers: Carolina Drilling

Observed By: _____

Weather Conditions: Fair and cool

CASING: Depth From: _____ to _____

I.D.: 2.067 O.D.: 2.375 Type: Sch 40

Length Above Ground Surface: Approx. 1 foot

GROUT: Depth From: 0 to 2'

Material: Portland

SCREEN: Depth From: 4' to 14'

Type of Opening: Sch 40, 0.010 slot

(Describe End of Screen)

BENTONITE: Depth From: 2' to 3'

Type of Bentonite: 1/8" pellets

GRAVEL: Depth From: 3' to 14'

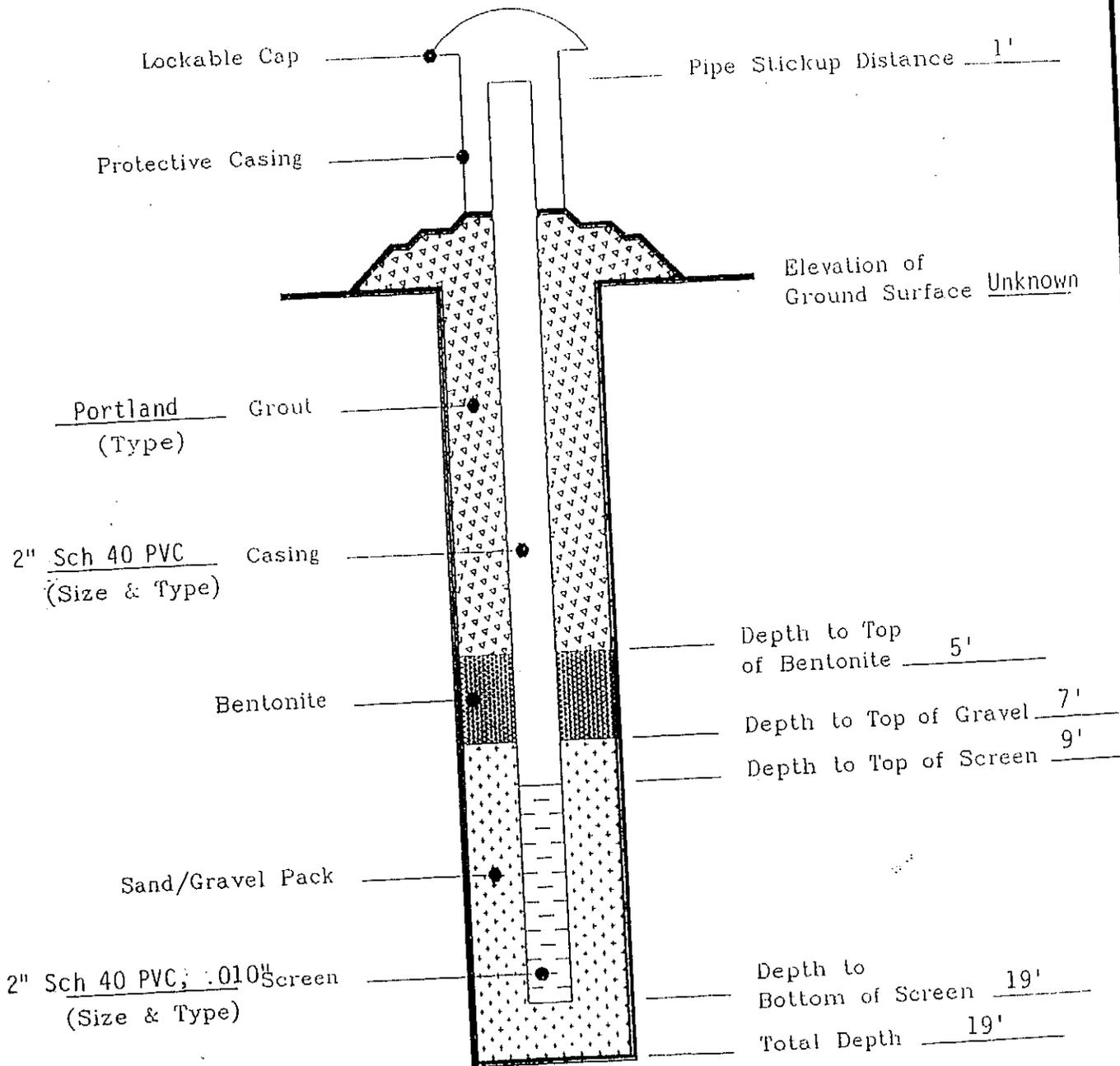
Depth Water Encountered: _____

Static Water Level: _____ Date: _____

Drilling Mud Type/Brand: None

Remarks: _____

Well Number MW-8 Drilling Method HSA
 Date Started 1-20-88 Drilling Fluids None
 Date Finished 1-21-88 Static Water Level N/A Date _____
 Geologist T. A. Proctor All Depths Referenced From
 Top of Casing



PROJECT

Bladen Co. Landfill
 Elizabethtown, N.C.

AQUATERRA, INC.
 RALEIGH, NORTH CAROLINA

JOB NUMBER: 200-87-112

SCALE: N.T.S.

FIGURE NUMBER:

MONITORING WELL INSTALLATION DATA

Well Number: MW-8 Ground Elevation: Unknown

Dated Started: 1-21-88 Date Completed: 1-22-88

Geologists: Tom Proctor

Drillers: Carolina Drilling

Observed By: _____

Weather Conditions: Rainy and cool

CASING: Depth From: _____ to _____

I.D.: 2.067 O.D.: 2.375 Type: Sch 40

Length Above Ground Surface: 1 foot

GROUT: Depth From: 0 to 7.5

Material: Portland

SCREEN: Depth From: 9 to 19

Type of Opening: Sch 40; 0.010 slot

(Describe End of Screen)

BENTONITE: Depth From: 8 to 7

Type of Bentonite: 1/8" pellets

GRAVEL: Depth From: 7 to 19

Depth Water Encountered: N/A

Static Water Level: N/A Date: _____

Drilling Mud Type/Brand: None

Remarks: _____

ATTACHMENT B
PREVIOUS AQUATERRA REPORT
DATED 11-24-87

1987

**GROUND WATER MONITORING AT
BLADEN COUNTY EXISTING SANITARY LANDFILL
ELIZABETHTOWN, NORTH CAROLINA
AQUATERRA JOB #200-87-112**

Prepared For

**Bladen County Health Department
Elizabethtown, North Carolina**

Prepared By

**Aquaterra, Inc.
Raleigh, North Carolina**

November 24, 1987





AQUATERRA

Aquaterra, Inc. • P.O. Box 50328 • Raleigh, NC 27650 • 919-839-0199

November 24, 1987

Bladen County Health Department
P.O. Box 188
Elizabethtown, North Carolina 28337

Attention: Mr. Steve Moffat

Subject: Ground Water Monitoring at Bladen County Existing Sanitary Landfill
Elizabethtown, North Carolina
Aquaterra Job #200-87-112

Dear Mr. Moffat:

Aquaterra, Inc. has completed the annual ground water sampling at the existing Bladen County sanitary landfill located in Elizabethtown, North Carolina, as shown in Figure 1. This sampling was in accordance with the North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities prepared by the North Carolina Solid and Hazardous Waste Management Branch (SHWMB). Herein is contained a description of the field investigation and the analytical results.

1.0 Ground Water Sampling

1.1 Data Log Book

The activities conducted during this sample round and subsequent sampling rounds will be recorded in a field log book. The record will include the sample collector's name and the activities conducted prior to, and during, collection of the sample. The field log records will be maintained by Aquaterra.

1.2 Water level Monitoring Procedure

The depths to static water level were measured in each monitoring well before well evacuation. The water levels were measured using an electronic water level detector with a calibrated cable. The measuring point is a mark at the top of the PVC casing for all the monitoring wells. The water level measurements were recorded in the field log book as a depth below the measuring point.

The procedure for measuring the water level with an electronic water level detector is as follows:

- o Begin with a clean detector and do not let the instrument cable contact the ground.
- o Lower the probe slowly down into the well while observing indicator on the detector.
- o Hold the cable against the top of the well casing at the point where the indicator just activates (typical indicators are lights or buzzers).
- o Measure the distance from the point being held to the nearest depth marker on the cable.
- o Record the cable marker value and the distance measured from the point being held in the log book. (The distance measured is subtracted from, or added to, the cable marker value depending on whether the distance measured was made up the cable toward the indicator or down the cable toward the probe.)
- o The depth to water below the measuring point will be recorded in the log book with the date and time of measurement.
- o Compare measurement to last recorded measurement. If there is a significant change, remeasure.
- o Decontaminate with deionized water.

The ground water depths and corresponding ground water elevation is shown in Table 1. Utilizing the ground water elevations, a shallow ground water contour map is shown in Figure 2.

1.3 Well Evacuation Procedure

Three to five well volumes of water were evacuated from the monitoring wells during the evaluation procedure. The volume of water standing in the well was calculated using the measured depth to water and the known well depth. The well evacuation was completed when a volume of water equal to 3 to 5 times the volume contained in the well casing and 0.3 of the volume in the annular space of the borehole outside the casing was removed as calculated in Figure 3. Monitoring well MW-1 could not be evacuated due to a utility truck damaging the PVC casing. Therefore, we were unable to sample this well.

The equipment used for well evacuation consisted of dedicated, decontaminated, closed-top, bottom-check, Teflon bailers with new nylon rope. Decontamination procedures are shown in Attachment A. The procedure for evacuating the monitoring wells using the Teflon bailer consisted of bailing water from the well and pouring the water into a collection container. The bailing continued until the required water volume had been removed from the well.

1.4 Sample Collection

All ground water monitoring wells were sampled using the same dedicated decontaminated Teflon bailers and a new nylon rope. The sample collector wore clean vinyl gloves for sampling at each well. Sample collection protocol and preservation techniques are shown in Table 2.

Upon collection of all ground water samples for laboratory analysis, pH and specific conductivity were measured. Prior to measuring these field parameters, the sampler completed the calibration of the field testing equipment before each use and according to the manufacturer's specifications.

All samples were labeled with a tag identifying sample number, date, time, location, method of collection, analysis to be conducted, samplers and remarks. The samples were kept in a cooler, chilled to approximately 4°C and transported to the analytical laboratory utilizing EPA approved chain-of-custody procedures. Care was taken to place the containers in such a way to inhibit breakage during transport.

2.0 Surface Water Sampling

Two surface water sampling locations were identified as shown in Figure 2 (SW-1 and SW-2). These were located to represent hydraulically upgradient and downgradient surface water conditions at the landfill. Care was taken to also select locations with minimal turbulence and aeration in the stream. Several of the sampling containers at each location were collected by first rinsing the container with water to be sampled prior to filling the container (chloride, nitrate, sulphate). These samples were filled by dipping the container into the stream (mouth down) and tilted up toward the current to fill with care taken not to breach the surface. All other containers were filled by first filling a decontaminated 500 ml jar by the same method mentioned previously and then filling the remaining containers with the 500 ml jar. This method was used since the remaining containers held a preservative.

Upon collection of the surface water samples for laboratory analysis, pH and specific conductivity were measured. Prior to measuring these field parameters, the sampler completed the calibration of the field testing equipment before each use and according to the manufacturer's specifications.

All samples were labeled with a tag identifying sample number, date, time, location, method of collection, analysis to be conducted, samplers and remarks. The samples were kept in a cooler, chilled to approximately 4°C and transported to the analytical laboratory utilizing EPA approved chain-of-custody procedures. Care was taken to place the containers in such a way to inhibit breakage during transport.

3.0 Laboratory Analysis

All ground and surface water samples were analyzed for the following parameters according to the following methods:

- A. Arsenic (SW-846 Method 7060)
- B. Barium (SW-846 Method 7080)
- C. Biological Oxygen Demand (Standard Methods 15th Edition #507)
- D. Cadmium (SW-846 Method 7131)
- E. Chemical Oxygen Demand (EPA 600/4-79-020 Method 410.4)
- F. Chloride (STandard Methods 15th Edition Method 407A)
- G. Chromium (SW-846 Method 7191)
- H. Copper (SW-846 Method 7210)
- I. Fluoride (EPA 600/4-79-020 Method 340.2)
- J. Iron (EPA 600/4-79-020 Method 236.1)
- K. Lead (SW-846 Method 7421)
- L. Manganese (EPA 600/4-79-020 Method 243.2)
- M. Mercury (SW-846 Method 7470)
- N. Nitrate (EPA 600/4-79-020 Method 353.2)
- O. Filterable Residue (Standard Methods 15th Edition #209B)
- P. Selenium (SW-846 Method 7740)
- Q. Silver (SW-846 Method 7760)
- R. Sulphate (EPA 600/4-79-020 Method 375.4)
- S. Total Organic Carbon (EPA 600/4-79-020 Method 415.1)
- T. Total Organic Halide (SW-846 Method 9020)
- U. Zinc (SW-846 Method 7950)
- V. pH (EPA 600/4-79-020 Method 150.1)
- W. Specific Conductance (EPA 600/4-79-020 Method 120.1)

The final two parameters, pH and specific conductance, were quantitated in the laboratory as well as the field for quality assurance and quality control assessment. All results are shown in Tables 3 through 5 and documented in Attachment B.

If there are any questions concerning this analysis or possibly replacing monitoring well MW-1, please contact me.

Sincerely,

AQUATERRA, INC.

Phillip L. Rahn, P.G.
Senior Hydrogeologist/Project Manager

PLR/ltr

R130-87

cc: Mike Babuoin
Charles Case
NRCD Central Files

TABLES

TABLE 1

Ground Water Levels As Of 9-24-87
Existing Bladen County Landfill
Elizabethtown, North Carolina
Aquaterra Job #200-87-112

<u>Well No.</u>	<u>Top of Casing Elevation</u>	<u>H₂O Depth Top of Casing</u>	<u>H₂O Elevation</u>
MW-1	134.48	18.35	116.13
MW-2	118.64	7.29	111.35
MW-3	107.91	11.71	96.20
MW-4	118.18	35.62	82.56
MW-5	100.46	25.80	74.66
MW-6	69.5	4.78	64.72
TW-7	104.84	3.60	101.24
TW-8	112.32	10.90	101.42
TW-9	73.11	3.51	69.60



TABLE 2

Sampling and Preservation Procedures for Detection Monitoring
 Existing Bladen County Sanitary Landfill
 Elizabethtown, North Carolina
 Aquaterra Job #200-87-112

<u>Parameter</u>	<u>Recommended Container</u>	<u>Preservative</u>	<u>Minimum Volume Required For Analysis</u>
<u>Indicators of Ground Water Contamination</u>			
pH	P	Field determined	25 ml
Specific Conductance	P	Field determined	100 ml
TOC	G, Teflon-lined cap	Cool 4°C, HCl to pH < 2	4 x 15 ml
TOX	G, amber, Teflon-lined cap	Cool 4°C, add 1 ml of 1.1M sodium sulfite	4 x 15 ml
<u>Ground-Water Quality Characteristics</u>			
Chloride	P	4°C	50 ml
Iron, Manganese	P	Field Acidified to pH < 2 with HNO ₃	200 ml
Sulfate	P	Cool, 4°C	50 ml
<u>EPA Interim Drinking Water Characteristics</u>			
Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver	P	<u>Total Metals</u> Field acidified to pH < 2 with HNO ₃	1,000 ml
Fluoride	P	Field acidified to pH < 2 with HNO ₃	300 ml
Nitrate	P	4°C	1,000 ml

Note: G = Glass
 P = Plastic

TABLE 3

Indicators of Ground Water Contamination
 Existing Bladen County Landfill
 Elizabethtown, North Carolina
 Aquaterra Job #200-87-112

<u>Parameter</u>	<u>Date</u> ¹	<u>Units</u>	<u>SW-1</u>	<u>SW-2</u>	<u>MW-1</u>	<u>MW-2</u>	<u>MW-3</u>	<u>MW-4</u>	<u>MW-5</u>	<u>MW-6</u>
pH	9-24-87	---	6.8	6.8	6.2	4.6	7.6	7.9	7.4	9.3
pH (Field)	9-24-87	---	6.93	6.69	6.43	4.98	7.03	7.40	7.37	8.18
Specific Conductance	9-24-87	us/cm	100	98	85	29	280	280	520	170
Specific Cond.(Field)	9-24-87	us/cm	94	87	119	41.4	320	300	610	157.9
TOC	9-24-87	mg/L	14	15	1.4	1.8	3.6	2.7	3.7	3.1
TOX	9-24-87	mg/L	<0.01	0.03	0.02	<0.01	<0.01	<0.01	<0.01	0.03
BOD	9-24-87	mg/L	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0
COD	9-24-87	mg/L	<25	34	<25	25	28	27	46	32

Analytical Laboratory: Industrial and Environmental Analysts, Inc.
 Cary, North Carolina

¹The Sampling Date of MW-1 is 2-22-88

Ground Water Quality Characteristics
 Existing Bladen County Landfill
 Elizabethtown, North Carolina
 Aquaterra Job #200-87-112

TABLE 4

Parameter	Date ¹	Units	SW-1	SW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
Chloride	9-24-87	mg/L	13	13	4.8	4.1	3.4	3.1	3.0	3.7
Iron	9-24-87	mg/L	1.1	1.1	0.27	8.4	32	4.3	3.8	2.5
Manganese	9-24-87	mg/L	0.01	0.01	0.04	0.01	0.02	0.03	0.09	0.05
Sulfate	9-24-87	mg/L	3.3	9.0	< 3.0	5.4	12	17	210	8.6

Analytical Laboratory: Industrial and Environmental Analysts, Inc.
 Cary, North Carolina

¹The Sampling Date of MW-1 is 2-22-88

EPA Interim Drinking Water Characteristics
 Existing Bladen County Landfill
 Elizabethtown, North Carolina
 Aquaterra Job #200-87-112

TABLE 5

Parameter	Date ¹	Units	SW-1	SW-2	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
Arsenic	9-24-87	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Barium	9-24-87	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Cadmium	9-24-87	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chromium	9-24-87	mg/L	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Lead	9-24-87	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Mercury	9-24-87	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0009
Selenium	9-24-87	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Silver	9-24-87	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoride	9-24-87	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Nitrate	9-24-87	mg/L	2.4	2.5	6.8	< 1.0	< 1.0	1.4	< 1.0	< 1.0

Analytical Laboratory: Industrial and Environmental Analysts, Inc.
 Cary, North Carolina

¹The Sampling Date of MW-1 is 2-22-88

ATTACHMENT C
NRCN NOTICE OF NON-COMPLIANCE



State of North Carolina
 Department of Natural Resources and Community Development

Division of Environmental Management
 512 North Salisbury Street • Raleigh, North Carolina 27611

James C. Martin, Governor
 S. Thomas Rhodes, Secretary

May 16, 1986

R. Paul Wilms
 Director

RECEIVED

MAY 21 1986

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Douglas L. Evans
 County Manager
 Bladen County Courthouse
 Elizabethtown, North Carolina

BLADEN COUNTY HEALTH DEPT.
 BY SDM

Dear Mr. Evans:

SUBJECT: Notice of Violation Groundwater Quality Standards,
 15 NCAC 2L,
 Bladen County Landfill Site,
 Elizabethtown, Bladen County

A review of water quality analyses submitted to DEM by the N.C. Department of Human Resources reveals concentrations of substances in three monitor wells at the above referenced landfill site which exceed established underground water quality standards. Maximum allowable contaminant levels for class GA waters are set forth in Title 15, Subchapter 2L, paragraph .0202(b) of the North Carolina Administrative Code. A copy of 15 NCAC 2L is enclosed.

Specifically, analyses show excessive concentrations of iron, manganese, total dissolved solids (TDS), and sulfates (So₄). The naturally occurring concentration of sulfates in GA waters in the Elizabethtown area is in the range of 5-25 mg/l. In addition, the sample collected from well C exhibits a pH value significantly lower than naturally occurring values.

The North Carolina General Statutes authorize and direct the Environmental Management Commission of the Department of Natural Resources and Community Development to protect and preserve the water resources of the State. The Division of Environmental Management (DEM) has the delegated authority to enforce adopted pollution control rules and regulations.

Pollution Prevention Pays

P.O. Box 27687, Raleigh, North Carolina 27611-7687 Telephone 919-733-7015

Equal Opportunity Affirmative Action Employer

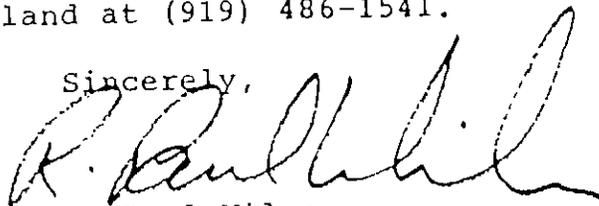
Based upon the above facts and pursuant to regulations established in paragraph .0103(h)(2)(c)(i) of 15 NCAC 2L, you are hereby requested to provide to the Fayetteville Regional Office, within thirty (30) days of receipt of this letter, a preliminary plan of action and time schedule which addresses the following:

1. Identification of all pollutants found beneath the compliance perimeter and emanating from same (compliance perimeter is defined in paragraph .0103(h), 15 NCAC 2L);
2. Delineation of the contaminant plume (horizontal and vertical geometry) which underlies the general landfill area;
3. Definition of the quality characteristics of the contaminant plume; and
4. Identification of existing impacts of the contaminants on human health and the environment (eg: contaminated drinking water supplies; surface water and groundwater degradation; etc.)

Based upon the results of your investigation as requested above, appropriate remedial action must be proposed by Bladen County to contain and/or restore the polluted groundwaters. Failure to respond as requested may result in the assessment of civil penalties as authorized by GS 143-215.6.

If you should have any questions or need assistance, please do not hesitate to call Mick Noland at (919) 486-1541.

Sincerely,



R. Paul Wilms

Attachment

cc: Office of Legal Affairs
Perry F. Nelson
Mick Noland
Bill Meyer

Table 1

Concentrations in Mg/l

	Well A						Well B						Well C			GA Standard			
	1982		1984		1985		1982		1984		1985		1982		1984		1985		
Iron	57.14	4.65	23.8	3.84	2.91	20.7	27.46	53.1	44.4	0.3									
Manganese	0.3	0.15	0.35	0.06	0.09	0.24	5.56	3.39	3.01	.05									
Sulfate	140	60	40	27	60	26	750	560	440	Naturally Occurring									
Total Dissolved Solids	308	206	307	204	512	535	1106	1052	954	500									
Total Organic Carbon	7	-	5	4	-	29	10	-	26	No Standard									

Wells B and C also had TOC (total organic carbon) concentrations of 29 mg/l and 26 mg/l, respectively. It is generally acknowledged that TOC concentrations in excess of 10 mg/l strongly suggest pollution.

The naturally occurring concentration of sulfates in shallow groundwaters in the Elizabethtown area is in the range of 5-25 mg/l. Thus, concentrations as high as those observed in monitor wells A and C indicate the presence of pollutants. Parameter concentrations which exceed GA standards represent violations of 15 NCAC 2L .0202 (b).