Annual Ground and Surface Water Sampling
Existing Sanitary Landfill
Bladen County, North Carolina
May 14, 1991

SOLID WASTE SECTION
MAY 20 1991

Prepared For

Bladen County Health Department
Elizabethtown, North Carolina

Prepared By

Aquaterra, Inc.
Raleigh, North Carolina

Aquaterra, Inc.

09-01

AQUATERRA

Environmental Consultants

May 14, 1991

Bladen County Health Department
Post Office Box 188
Elizabethtown, North Carolina 28337

Attention: Mr. Steve Moffat

Reference: Annual Ground Monitoring at Bladen County
Existing Sanitary Landfill
Elizabethtown, North Carolina
Aquaterra Job No. 35

Dear Mr. Moffat:

In accordance with permit 01009 issued by the North Carolina Department of Environment, Health, and Natural Resources (DEHNR), Division of Solid Waste Management, Solid Waste Section, Aquaterra, Inc. (Aquaterra) has completed the annual sampling for the Bladen County Landfill located near Elizabethtown, North Carolina. The sampling was conducted in accordance with the *North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities* prepared by the Solid Waste Section.

The attached report describes our field activities and presents the analytical results from the sampling. If you have any questions concerning this report, please call us at (919) 859-9987.

Sincerely,

AQUATERRA, INC.

Steve Czekalski

Steve Czekalski
Project Manager

Bryson Trexler

Bryson D. Trexler, Jr., Ph.D., P.G.
Senior Hydrogeologist/Program Manager

SJC/BDT/cbb
R1273-91

Corporate Office:
P O Box 50828
Raleigh, NC 27650
(919) 859-9987
FAX (919) 859-9930

Charlotte Office:
P O Box 668107
Charlotte, NC 28266-8107
(704) 525-8680
FAX (704) 527-2792

Greensboro Office:
P O Box 16241
Greensboro, NC 27416-0241
(919) 273-5003
FAX (919) 271-8138

Annual Ground Water and Surface Water Sampling
Of Existing Landfill
Bladen County, North Carolina
May 14, 1991

1 Ground and Surface Water Sampling

In accordance with permit 01009 issued by the North Carolina Department of Environment, Health, and Natural Resources (DEHNR), Division of Solid Waste Management, Solid Waste Section, Aquaterra, Inc. (Aquaterra) has completed the annual sampling for the Bladen County Landfill located near Elizabethtown, North Carolina (see Figure 1). The sampling was conducted in accordance with the *North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities* prepared by the North Carolina Department of Environment, Health, and Natural Resources, Solid Waste Section (SWS).

Aquaterra will maintain field log records of the field activities conducted during this and subsequent sampling rounds. The record will include the sample collector's name and the activities conducted prior to and during sample collection.

1.1 Water Level Monitoring Procedure

The depths to static water level were measured in each monitoring well before well purging and sampling and recorded on a data sheet for later reference (see Attachment A). 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. A water table map was constructed based on this data (see Figure 2). The ground water generally flows northeast.

1.2 Well Evacuation Procedure

The measured depth to water and the known well depth were used to calculate a well volume. Well purging was completed when a volume of water equal to three to five times the volume contained in the well casing was removed or until the well became essentially dry.

Decontaminated, closed-top, bottom-check, Teflon bailers with new nylon rope were used to purge the wells. Teflon bailers were used to bail water from the well; the removed water was emptied into a 5-gallon bucket, calibrated in gallon intervals. Bailing continued until the required water volume had been removed from the well or until the well became dry.

1.3 Sample Collection

All eight ground water monitoring wells were sampled on February 19 and 20, 1991, using dedicated decontaminated Teflon bailers and a new nylon rope. The sample collector wore clean vinyl gloves for sampling at each well. Two stream samples (SW-1 and SW-2) were also collected to determine surface water quality along the landfill. Stream samples were collected by gently dipping the sample bottles into the water. Sample collection points are shown on Figure 2.

Well MW-5 was not sampled for fluoride, sulfate, total metals, or total dissolved solids due to the limited amount of water in the well. A replacement well (MW-5a) was installed on April 5, 1991. The well was developed by surge block and sampled on April 23, 1991.

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

2 Laboratory Analysis

Ground water and stream samples were analyzed by Industrial & Environmental Analysts, Inc. of Cary, North Carolina for twelve metals, four inorganic parameters, and five indicator parameters (see Table 2 and Attachment B). Analytical methods are presented in Attachment C.

3 Discussion of Analytical Results

Of the twelve different total metals concentrations analyzed, three metals exceeded the water quality standards specified in North Carolina Administrative Code Title 15, Subchapter 2L, Section .0200 (chromium at 0.05 mg/L, iron at 0.3 mg/L, and manganese at 0.05 mg/L). Chromium was detected above its standard in MW-2 at a concentration of 0.12 mg/L. Iron exceeded the 0.3 mg/L standard in monitoring wells MW-2 (30 mg/L), MW-3 (110 mg/L), MW-4 (21 mg/L), MW-6 (13 mg/L), MW-7 (16 mg/L), and MW-8 (25 mg/L). Manganese exceeded its 0.05 mg/L standard in monitoring wells MW-2 (0.07 mg/L), MW-3 (0.18 mg/L), MW-4 (0.15 mg/L), MW-6 (0.11 mg/L), MW-7 (0.13 mg/L), and MW-8 (0.15 mg/L).

Metals are anticipated to naturally occur in ground water. However, the hydraulically downgradient wells (MW-2 through MW-8) are statistically higher than MW-1, the upgradient well for total metal concentrations. This is especially true for iron and manganese, as analytical results for these metals were below their water quality standards, while results from all downgradient wells indicate these metals exceeding the respective standards. Therefore, these metals may be leached from the landfill and are affecting ground water quality downgradient of the landfill.

Inorganic parameters chloride, fluoride, and sulfate were detected in some monitoring wells at levels below their water quality standards. Typically, levels were lowest for wells placed more hydraulically upgradient along the landfill and increased in wells located further downgradient. Nitrate was detected but in levels below its water quality standard in wells MW-1 (7.0 mg/L), MW-2 (0.03 mg/L) and MW-5 (0.05). The presence of this compound in the two most upgradient wells (MW-1 and MW-2) suggests some activity involving the use of nitrates upgradient from the landfill. Newly installed well MW-5a had an elevated concentrations of sulfate (480 mg/L).

The concentrations of other indicator parameters – biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), and total organic carbon (TOC) – increased in wells furthest downgradient of the landfill. Of these parameters, only TDS has a determined water quality standard (250 mg/L). The detected levels of TDS were below this standard except in MW-5a which had a concentration of 1,400 mg/L.

4 Recommendations

This sampling event confirms the presence of chromium, manganese, iron and zinc in select downgradient wells at concentrations which exceed the current EPA drinking water standards. Aquaterra recommends that

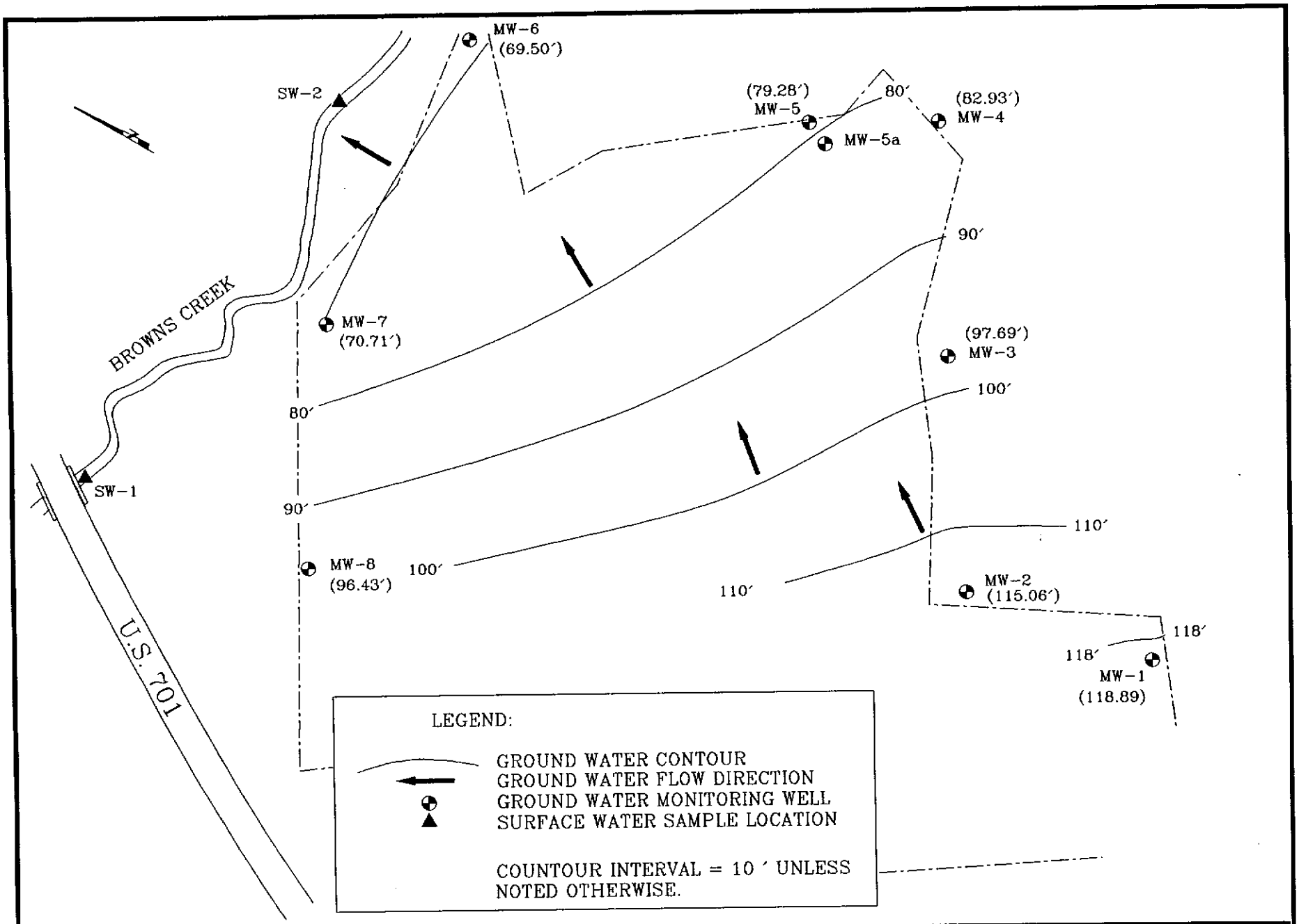
- Bladen County should submit a copy of this report to the Solid Waste Section at the following address:

  North Carolina Department of Environment,
  Health, and Natural Resources
  Division Solid Waste Management
  Solid Waste Section
  Post Office Box 2091
  Raleigh, North Carolina 27602-2091

  Attention: Mr. Bobby Lufty

Map from: UGSGS Topographic Map-Elizabethtown, 1955

PROJECT: Bladen County Landfil Elizabethtown, NC	TITLE: Site Location Map				AQUATERRA, INC. RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA
	JOB: 007	DRAWING:	FIGURE: 1	SCALE: 1"=5208	



PROJECT:	TITLE: GROUND WATER CONTOUR MAP			
BLADEN COUNTY LANDFILL ELIZABETHTOWN, NORTH CAROLINA	JOB: 007	DRAWING: 007-1	FIGURE: 2	SCALE: N.T.S.

AQUATERRA, INC.
RALEIGH, GREENSBORO, CHARLOTTE
NORTH CAROLINA

Table 1. **Water Table Data for Bladen County Landfill. February 19, 1991**

Well ID	Top of Casing TOC Elev (ft)	Ground Water Depth (ft)	Ground Water Elevation (ft)
MW-1	134.48	15.59	118.89
MW-2	118.64	3.58	115.06
MW-3	107.91	10.22	97.69
MW-4	118.18	35.25	82.93
MW-5	100.46	21.18	79.28
MW-6	69.50	0.00	69.50
MW-7	73.11	2.40	70.71
MW-8	112.32	15.89	96.43

TOC = Top of Casing

Note: MW-6 is artesian well.

Aquaterra Job No. 007
R1273-91

Table 2. **Summary of Water Sample Laboratory Analysis Results for Bladen County Landfill Wells Sampled February 19-20, 1991.***

Parameters	Units	Quantification Limit	MW-1	MW-2	MW-3	MW-4	MW-5	MW-5a	MW-6	MW-7	MW-8	SW-1	SW-2
Chloride	mg/L	1	5	6	4	3	3	18	5	28	7	11	11
Fluoride	mg/L	0.1	BDL	BDL	BDL	0.1	NS	0.2	0.1	0.2	0.1	0.1	0.1
Nitrate	mg/L	0.02	7.0	0.03	BDL	BDL	0.05	BDL	BDL	BDL	BDL	0.68	0.70
Sulfate	mg/L	3.0	BDL	BDL	6.4	25	NS	480	8.8	31	14	12	11
Arsenic	mg/L	0.005	BDL	0.005	0.030	BDL	NS	BDL	BDL	BDL	BDL	BDL	BDL
Barium	mg/L	0.1	BDL	BDL	BDL	BDL	NS	0.17	BDL	BDL	0.12	BDL	BDL
Cadmium	mg/L	0.01	BDL	BDL	BDL	BDL	NS	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	mg/L	0.03	BDL	0.12	0.03	BDL	NS	0.04	BDL	BDL	BDL	BDL	BDL
Copper	mg/L	0.02	BDL	BDL	BDL	BDL	NS	BDL	0.05	BDL	BDL	BDL	BDL
Iron	mg/L	0.05	OK 0.18	30	110	21	NS	38	13	16	25	1.1	0.71
Lead	mg/L	0.005	BDL	0.010	0.040	0.020	NS	0.011	0.010	0.005	BDL	BDL	BDL
Manganese	mg/L	0.01	BDL	0.07	0.18	0.15	NS	0.34	0.11	0.13	0.15	0.05	0.04
Mercury	mg/L	0.0005	BDL	BDL	BDL	BDL	NS	BDL	BDL	BDL	BDL	BDL	BDL
Selenium	mg/L	0.005	BDL	BDL	BDL	BDL	NS	BDL	BDL	BDL	BDL	BDL	BDL
Silver	mg/L	0.05	BDL	BDL	BDL	BDL	NS	BDL	BDL	BDL	BDL	BDL	BDL
Zinc	mg/L	0.02	BDL	0.06	0.06	0.05	NS	0.11	0.05	0.03	0.09	BDL	BDL
COD	mg/L	25	39	BDL	78	86	150	290	92	34	150	43	48
TDS	mg/L	10.0	65	42	150	180	NS	1,400	130	330	120	93	80
TOC	mg/L	1.0	1.6	BDL	2.9	3.2	6	32	2.2	3.1	1.1	14	14
TOX	mg/L	0.01	BDL	BDL	BDL	BDL	0.01	BDL	BDL	0.03	BDL	0.05	0.06
Conductance	µs/cm	10	40	70	390	380	NS	900	80	400	230	70	60
pH	Std.Units	0.1	5.8	5.2	7.8	7.5	NS	5.5	7.5	7.5	6.8	7.1	6.5
BOD	mg/L	2.0	BDL	BDL	2.2	4.4	NS	110	BDL	BDL	2.1	3.8	2.3

NS = Not Sampled
BDL = Below Detection Limit
** = Well MW-5A sampled on April 23, 1991*
Analytical Laboratory: Industrial & Environmental Analysts, Inc. - Cary, NC

Aquaterra Job No. 007
R1 273-91

AQUATERRA, INC.

Well Inspection/Product Removal/Sample Collection

JOB NO. 007

SHEET NO. 1

DATE 2-19-91

JOB NAME Bladen Co Landfill

COMPUTED BY

SUBJECT

CHECKED BY

WELL LOCATION	DIA. IN.	WATER LEVEL	TOTAL DEPTH	WATER COLUMN	WELL VOLUME	VOLUME PURGED	SAMPLE TIME	SAMPLE DATE	SAMPLE pH	SAMPLE COND.	SAMPLE TEMP.	BAILER USED	I.D. NO.
mw-7	2"	2.4	14.95	12.5	2.0	6 gal	13:00	2-19-91	7.5	400	20	Zea 158	
mw-6	2"	Top of casing	14.59	14.59	2.3	7 gal	14:00	2-19-91	7.5	180	18	Zea 193	
mw-5	2"	21.18	25.17	3.9	.65	Dry 1/2 gal	0900	2-20-91	—	—	—	Zea 156	
mw-4	2"	35.25	45.3	10.05	1.6	5 gal	14:45	2-19-91	7.5	350	20	Zea 247	
mw-3	2"	10.22	21.54	11.32	1.8	5.5	15:15	2-19-91	7.8	390	18	Zea 224	
mw-8	2	15.89	30.6	14.71	2.3	3.5 gal dry	17:10	2-19-91	6.8	230	20	Zea 229	
mw-2	2"	3.58	22.2	18.62	3.0	Dry 4 gal	16:45	2-19-91	5.2	70	20	Zea 214	
mw-1	2"	15.59	41.55	25.96	4.2	Dry 9 gal	16:15	2-19-91	5.8	140	20	Zea 121	
sw-1	—	—	—	—	—	—	1000	2-20-91	7.1	70	17	—	
sw-2	—	—	—	—	—	—	1030	2-20-91	6.5	60	14	—	

an environmental testing company
P.O. Box 12846
Research Triangle Park, North Carolina 27709
(919) 677-0090
FAX (919) 677-0427

March 6, 1991

MAR 1991
RECEIVED

Tom Taylor
Aquaterra, Inc.
P.O. Box 50328
Raleigh, NC 27650

Reference IEA Report No.: 196221
Project ID: 007

Dear Mr. Taylor,

Transmitted herewith are the results of analyses on seven samples submitted to our laboratory.

Please see the enclosed reports for your results.

Very truly yours,

INDUSTRIAL & ENVIRONMENTAL ANALYSTS, INC.

Linda F. Mitchell
Director, Technical Support Services

State Certification:

Alabama - #40210	New Jersey - #67719	South Carolina - #99021
Georgia - #816	Tennessee - #00296	North Carolina - #37720
Kansas - #E-158	Virginia - #00179	#84

IEA LABORATORY RESULTS

IEA Project #: 196-221
Client Name: Aquaterra, Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
		TOTAL METALS:			
1	MW-1	Arsenic	<0.005	mg/L	02/26/91
2	MW-2	Arsenic	0.005	mg/L	02/26/91
3	MW-3	Arsenic	0.030	mg/L	02/26/91
4	MW-4	Arsenic	<0.005	mg/L	02/26/91
5	MW-6	Arsenic	<0.005	mg/L	02/26/91
6	MW-7	Arsenic	<0.005	mg/L	02/26/91
7	MW-8	Arsenic	<0.005	mg/L	02/26/91
1	MW-1	Barium	<0.10	mg/L	02/26/91
2	MW-2	Barium	<0.10	mg/L	02/25/91
3	MW-3	Barium	<0.10	mg/L	02/25/91
4	MW-4	Barium	<0.10	mg/L	02/25/91
5	MW-6	Barium	<0.10	mg/L	02/25/91
6	MW-7	Barium	<0.10	mg/L	02/25/91
7	MW-8	Barium	0.12	mg/L	02/25/91
1	MW-1	Cadmium	<0.01	mg/L	02/26/91
2	MW-2	Cadmium	<0.01	mg/L	02/25/91
3	MW-3	Cadmium	<0.01	mg/L	02/25/91
4	MW-4	Cadmium	<0.01	mg/L	02/25/91
5	MW-6	Cadmium	<0.01	mg/L	02/25/91
6	MW-7	Cadmium	<0.01	mg/L	02/25/91
7	MW-8	Cadmium	<0.01	mg/L	02/25/91
1	MW-1	Chromium	<0.03	mg/L	02/26/91
2	MW-2	Chromium	0.12	mg/L	02/25/91
3	MW-3	Chromium	0.03	mg/L	02/25/91
4	MW-4	Chromium	<0.03	mg/L	02/25/91
5	MW-6	Chromium	<0.03	mg/L	02/25/91
6	MW-7	Chromium	<0.03	mg/L	02/25/91
7	MW-8	Chromium	<0.03	mg/L	02/25/91
1	MW-1	Copper	<0.02	mg/L	02/26/91
2	MW-2	Copper	<0.02	mg/L	02/25/91
3	MW-3	Copper	<0.02	mg/L	02/25/91
4	MW-4	Copper	<0.02	mg/L	02/25/91
5	MW-6	Copper	0.05	mg/L	02/25/91
6	MW-7	Copper	<0.02	mg/L	02/25/91
7	MW-8	Copper	<0.02	mg/L	02/25/91
1	MW-1	Iron	0.18	mg/L	02/26/91
2	MW-2	Iron	30	mg/L	02/25/91
3	MW-3	Iron	110	mg/L	02/25/91
4	MW-4	Iron	21	mg/L	02/25/91
5	MW-6	Iron	13	mg/L	02/25/91
6	MW-7	Iron	16	mg/L	02/25/91
7	MW-8	Iron	25	mg/L	02/25/91
1	MW-1	Lead	<0.005	mg/L	02/21/91
2	MW-2	Lead	0.010	mg/L	02/21/91

IEA LABORATORY RESULTS

IEA Project #: 196-221
Client Name: Aquaterra, Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
3	MW-3	Lead	0.040	mg/L	02/21/91
4	MW-4	Lead	0.020	mg/L	02/21/91
5	MW-6	Lead	0.010	mg/L	02/21/91
6	MW-7	Lead	0.005	mg/L	02/21/91
7	MW-8	Lead	<0.005	mg/L	02/21/91
1	MW-1	Manganese	<0.01	mg/L	02/26/91
2	MW-2	Manganese	0.07	mg/L	02/25/91
3	MW-3	Manganese	0.18	mg/L	02/25/91
4	MW-4	Manganese	0.15	mg/L	02/25/91
5	MW-6	Manganese	0.11	mg/L	02/25/91
6	MW-7	Manganese	0.13	mg/L	02/25/91
7	MW-8	Manganese	0.15	mg/L	02/25/91
1	MW-1	Mercury	<0.0005	mg/L	02/26/91
2	MW-2	Mercury	<0.0005	mg/L	02/26/91
3	MW-3	Mercury	<0.0005	mg/L	02/26/91
4	MW-4	Mercury	<0.0005	mg/L	02/26/91
5	MW-6	Mercury	<0.0005	mg/L	02/26/91
6	MW-7	Mercury	<0.0005	mg/L	02/26/91
7	MW-8	Mercury	<0.0005	mg/L	02/26/91
1	MW-1	Selenium	<0.005	mg/L	02/27/91
2	MW-2	Selenium	<0.005	mg/L	02/27/91
3	MW-3	Selenium	<0.005	mg/L	02/27/91
4	MW-4	Selenium	<0.005	mg/L	02/27/91
5	MW-6	Selenium	<0.005	mg/L	02/27/91
6	MW-7	Selenium	<0.005	mg/L	02/27/91
7	MW-8	Selenium	<0.005	mg/L	02/27/91
1	MW-1	Silver	<0.05	mg/L	02/26/91
2	MW-2	Silver	<0.05	mg/L	02/25/91
3	MW-3	Silver	<0.05	mg/L	02/25/91
4	MW-4	Silver	<0.05	mg/L	02/25/91
5	MW-6	Silver	<0.05	mg/L	02/25/91
6	MW-7	Silver	<0.05	mg/L	02/25/91
7	MW-8	Silver	<0.05	mg/L	02/25/91
1	MW-1	Zinc	<0.02	mg/L	02/26/91
2	MW-2	Zinc	0.06	mg/L	02/25/91
3	MW-3	Zinc	0.06	mg/L	02/25/91
4	MW-4	Zinc	0.05	mg/L	02/25/91
5	MW-6	Zinc	0.05	mg/L	02/25/91
6	MW-7	Zinc	0.03	mg/L	02/25/91
7	MW-8	Zinc	0.09	mg/L	02/25/91
1	MW-1	Biochemical Oxygen Demand	<2.0	mg/L	02/21/91
2	MW-2	Biochemical Oxygen Demand	<2.0	mg/L	02/21/91
3	MW-3	Biochemical Oxygen Demand	2.2	mg/L	02/21/91
4	MW-4	Biochemical Oxygen Demand	4.4	mg/L	02/21/91
5	MW-6	Biochemical Oxygen Demand	<2.0	mg/L	02/21/91
6	MW-7	Biochemical Oxygen Demand	<2.0	mg/L	02/21/91

IEA LABORATORY RESULTS

IEA Project #: 196-221
Client Name: Aquaterra, Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
7	MW-8	Biochemical Oxygen Demand	2.1	mg/L	02/21/91
1	MW-1	Chloride	5	mg/L	03/01/91
2	MW-2	Chloride	6	mg/L	03/01/91
3	MW-3	Chloride	4	mg/L	03/01/91
4	MW-4	Chloride	3	mg/L	03/01/91
5	MW-6	Chloride	5	mg/L	03/01/91
6	MW-7	Chloride	28	mg/L	03/01/91
7	MW-8	Chloride	7	mg/L	03/01/91
1	MW-1	Chemical Oxygen Demand	39	mg/L	03/04/91
2	MW-2	Chemical Oxygen Demand	<25	mg/L	03/04/91
3	MW-3	Chemical Oxygen Demand	78	mg/L	03/04/91
4	MW-4	Chemical Oxygen Demand	86	mg/L	03/04/91
5	MW-6	Chemical Oxygen Demand	92	mg/L	03/04/91
6	MW-7	Chemical Oxygen Demand	34	mg/L	03/04/91
7	MW-8	Chemical Oxygen Demand	150	mg/L	03/04/91
1	MW-1	Fluoride	<0.1	mg/L	03/04/91
2	MW-2	Fluoride	<0.1	mg/L	03/04/91
3	MW-3	Fluoride	<0.1	mg/L	03/04/91
4	MW-4	Fluoride	0.1	mg/L	03/04/91
5	MW-6	Fluoride	0.1	mg/L	03/04/91
6	MW-7	Fluoride	0.2	mg/L	03/04/91
7	MW-8	Fluoride	0.1	mg/L	03/04/91
1	MW-1	Nitrate	7.0	mg/L	02/21/91
2	MW-2	Nitrate	0.03	mg/L	02/21/91
3	MW-3	Nitrate	<0.02	mg/L	02/21/91
4	MW-4	Nitrate	<0.02	mg/L	02/21/91
5	MW-6	Nitrate	<0.02	mg/L	02/21/91
6	MW-7	Nitrate	<0.02	mg/L	02/21/91
7	MW-8	Nitrate	<0.02	mg/L	02/21/91
1	MW-1	Sulfate	<3.0	mg/L	02/28/91
2	MW-2	Sulfate	<3.0	mg/L	02/28/91
3	MW-3	Sulfate	6.4	mg/L	02/28/91
4	MW-4	Sulfate	25	mg/L	02/28/91
5	MW-6	Sulfate	8.8	mg/L	02/28/91
6	MW-7	Sulfate	31	mg/L	02/28/91
7	MW-8	Sulfate	14	mg/L	02/28/91
1	MW-1	Total Dissolved Solids	65	mg/L	02/25/91
2	MW-2	Total Dissolved Solids	42	mg/L	02/25/91
3	MW-3	Total Dissolved Solids	150	mg/L	02/25/91
4	MW-4	Total Dissolved Solids	180	mg/L	02/25/91
5	MW-6	Total Dissolved Solids	130	mg/L	02/25/91
6	MW-7	Total Dissolved Solids	330	mg/L	02/25/91
7	MW-8	Total Dissolved Solids	120	mg/L	02/25/91
1	MW-1	Total Organic Carbon	1.6	mg/L	03/05/91
2	MW-2	Total Organic Carbon	<1.0	mg/L	03/05/91
3	MW-3	Total Organic Carbon	2.9	mg/L	03/05/91

IEA LABORATORY RESULTS

IEA Project #: 196-221
Client Name: Aquaterra, Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
4	MW-4	Total Organic Carbon	3.2	mg/L	03/05/91
5	MW-6	Total Organic Carbon	2.2	mg/L	03/05/91
6	MW-7	Total Organic Carbon	3.1	mg/L	03/05/91
7	MW-8	Total Organic Carbon	1.1	mg/L	03/05/91
1	MW-1	Total Organic Halide	<0.01	mg/L	02/26/91
2	MW-2	Total Organic Halide	<0.01	mg/L	02/26/91
3	MW-3	Total Organic Halide	<0.01	mg/L	02/26/91
4	MW-4	Total Organic Halide	<0.01	mg/L	02/26/91
5	MW-6	Total Organic Halide	<0.01	mg/L	02/26/91
6	MW-7	Total Organic Halide	0.03	mg/L	02/26/91
7	MW-8	Total Organic Halide	<0.01	mg/L	02/26/91

3000 WESTON PKWY.
CARY, N.C. 27513

REGULATORY CLASSIFICATION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING WATER ☐ RCRA ☐ OTHER _____

NO. 12702

PROJECT #	PROJECT NAME
007	BLADEN CO. LANDFILL

SAMPLERS: *(SIGNATURE)* Tom Taylor

SAMPLE I.D.	1991 DATE	TIME	COMP	GRAB	STATION LOCATION	# OF CONTAINERS	MATRIX SOIL	MATRIX WATER	TOC	COD	TOX	BOD	TDS	NO3	SO4	CL	FL	METALS*			
MW-1	2/19			✓		11		✓	2	1	1	1	1	1	1	1	1	1			
MW-2	↓			✓		11		✓	2	1	1	1	1	1	1	1	1	1			
MW-3				✓		11		✓	2	1	1	1	1	1	1	1	1	1			
MW-4				✓		11		✓	2	1	1	1	1	1	1	1	1	1			
MW-6				✓		11		✓	2	1	1	1	1	1	1	1	1	1			
MW-7				✓		11		✓	2	1	1	1	1	1	1	1	1	1			
MW-8				✓		11		✓	2	1	1	1	1	1	1	1	1	1			

* METALS INCLUDE: As, Ba, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Se, Ag & Zn

NORMAL 10-DAY TURNAROUND

RELINQUISHED BY *(SIGNATURE)*	DATE	TIME	RECEIVED BY	DATE	TIME
Tom Taylor	2/20/91	12:20	Donna Tenney	2-20-91	11-20
RELINQUISHED BY *(SIGNATURE)*	**DATE**	**TIME**	**RECEIVED FOR LAB BY**	**DATE**	**TIME**
			Christine Alkins	2/20/91	1330

IEA QUOTE NO.	IEA RUSH NO.
PROJECT MANAGER (PLEASE PRINT)	**P.O. NO.**
TOM TAYLOR	R 3811

IEA REMARKS

IEA # 196-221

FIELD REMARKS

3 ADDITIONAL SAMPLES (MW-5, SW-1 & SW-2) + A TRIP BLANK WILL ARRIVE LATE ON 2-20-91

an environmental testing company
P.O. Box 12846
Research Triangle Park, North Carolina 27709
(919) 677-0090
FAX (919) 677-0427

March 7, 1991

Tom Taylor
Aquaterra, Inc.
P.O. Box 50328
Raleigh, NC 27650

Reference IEA Report No.: 196221(0)
Project ID: 007

Dear Mr. Taylor,

Transmitted herewith are the results of analyses on three samples submitted to our laboratory.

Please see the enclosed reports for your results.

Very truly yours,

INDUSTRIAL & ENVIRONMENTAL ANALYSTS, INC.

Linda F. Mitchell
Director, Technical Support Services

State Certification:

Alabama - #40210	New Jersey - #67719	South Carolina - #99021
Georgia - #816	Tennessee - #00296	North Carolina - #37720
Kansas - #E-158	Virginia - #00179	#84

IEA LABORATORY RESULTS

IEA Project #: 196-221(0)
Client Name: Aquaterra, Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
		TOTAL METALS:			
2	SW-1	Arsenic	<0.005	mg/L	02/26/91
3	SW-2	Arsenic	<0.005	mg/L	02/26/91
2	SW-1	Barium	<0.10	mg/L	02/26/91
3	SW-2	Barium	<0.10	mg/L	02/26/91
2	SW-1	Cadmium	<0.01	mg/L	02/26/91
3	SW-2	Cadmium	<0.01	mg/L	02/26/91
2	SW-1	Chromium	<0.03	mg/L	02/26/91
3	SW-2	Chromium	<0.03	mg/L	02/26/91
2	SW-1	Copper	<0.02	mg/L	02/26/91
3	SW-2	Copper	<0.02	mg/L	02/26/91
2	SW-1	Iron	1.1	mg/L	02/26/91
3	SW-2	Iron	0.71	mg/L	02/26/91
2	SW-1	Lead	<0.005	mg/L	02/22/91
3	SW-2	Lead	<0.005	mg/L	02/22/91
2	SW-1	Manganese	0.05	mg/L	02/26/91
3	SW-2	Manganese	0.04	mg/L	02/26/91
2	SW-1	Mercury	<0.0005	mg/L	02/26/91
3	SW-2	Mercury	<0.0005	mg/L	02/26/91
2	SW-1	Selenium	<0.005	mg/L	02/27/91
3	SW-2	Selenium	<0.005	mg/L	02/27/91
2	SW-1	Silver	<0.05	mg/L	02/26/91
3	SW-2	Silver	<0.05	mg/L	02/26/91
2	SW-1	Zinc	<0.02	mg/L	02/26/91
3	SW-2	Zinc	<0.02	mg/L	02/26/91
2	SW-1	Biochemical Oxygen Demand	3.8	mg/L	02/22/91
3	SW-2	Biochemical Oxygen Demand	2.3	mg/L	02/22/91
1	MW-5	Chloride	3	mg/L	03/05/91
2	SW-1	Chloride	11	mg/L	03/05/91
3	SW-2	Chloride	11	mg/L	03/05/91
1	MW-5	Chemical Oxygen Demand	150	mg/L	03/04/91
2	SW-1	Chemical Oxygen Demand	43	mg/L	03/04/91
3	SW-2	Chemical Oxygen Demand	48	mg/L	03/04/91
2	SW-1	Fluoride	0.1	mg/L	03/04/91
3	SW-2	Fluoride	0.1	mg/L	03/04/91
1	MW-5	Nitrate	0.05	mg/L	02/21/91
2	SW-1	Nitrate	0.68	mg/L	02/21/91
3	SW-2	Nitrate	0.70	mg/L	02/21/91
2	SW-1	Sulfate	12	mg/L	02/28/91
3	SW-2	Sulfate	11	mg/L	02/28/91
2	SW-1	Total Dissolved Solids	93	mg/L	02/25/91
3	SW-2	Total Dissolved Solids	80	mg/L	02/25/91
1	MW-5	Total Organic Carbon	6	mg/L	03/05/91
2	SW-1	Total Organic Carbon	14	mg/L	03/05/91
3	SW-2	Total Organic Carbon	14	mg/L	03/05/91

IEA LABORATORY RESULTS

IEA Project #: 196-221(0)
Client Name: Aquaterra, Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
1	MW-5	Total Organic Halide	0.01	mg/L	02/26/91
2	SW-1	Total Organic Halide	0.05	mg/L	02/26/91
3	SW-2	Total Organic Halide	0.06	mg/L	02/27/91

IEA ANALYSTS, INC.
3000 WESTON PKWY.
CARY, N.C. 27513

CHAIN OF CUSTODY RECORD

NO: 12194

REGULATORY CLASSIFICATION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING WATER ☐ RCRA ☐ OTHER _____

PROJECT #	PROJECT NAME
007	Bladen Co. Landfill

SAMPLERS: (SIGNATURE) Phillip Jerry

SAMPLE I.D.	DATE	TIME	COMP	GRAB	STATION LOCATION	# OF CONTAINERS	MATRIX SOIL	MATRIX WATER	Chloride	Flouride	Nitrate	Sulfate	As, Ba, Cd, Cr, Cu, Pb, Fe, Mn, Hg, Se, Ag, Zn	COD	TDS	TOC	TOX	BOD			
MW-5	2-20-91	0900		✓		6		✓	✓		✓			✓		✓	✓				
SW-1	2-20-91	1000		✓		11		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
SW-2	2-20-91	1030		✓		11		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			

REQUESTED PARAMETERS

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY	DATE	TIME
Phillip Jerry	2-20-91	17:06			
RELINQUISHED BY (SIGNATURE)	**DATE**	**TIME**	**RECEIVED FOR LAB BY**	**DATE**	**TIME**
			Christine DeKraker	2/20/90	1707

IEA QUOTE NO.	IEA RUSH NO.
PROJECT MANAGER (PLEASE PRINT)	**P.O. NO.**

IEA REMARKS

IEA # 196 - 221 (Ø)

FIELD REMARKS

Industrial & Environmental Analysts, Inc.
P.O. Box 12846
Research Triangle Park, North Carolina 27709
(919) 677-0090
FAX (919) 677-0427

May 8, 1991

MAY 1991 RECEIVED

Steve Czekalski
Aquaterra, Inc.
901 Jones Franklin Road
Raleigh, NC 27606

Reference IEA Report No.: 196281
Project ID: 007

Dear Mr. Czekalski,

Transmitted herewith are the results of analyses on two samples submitted to our laboratory.

Please see the enclosed reports for your results.

Very truly yours,

INDUSTRIAL & ENVIRONMENTAL ANALYSTS, INC.

Linda F. Mitchell
Director, Technical Support Services

State Certification:

Alabama - #40210	New Jersey - #67719	South Carolina - #99021
Georgia - #816	Tennessee - #00296	North Carolina - #37720 #84
Kansas - #E-158	Virginia - #00179	

IEA LABORATORY RESULTS

IEA Project #: 196-281
Client Name: Aquaterra, Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
		TOTAL METALS:			
1	MW-5a	Arsenic	<0.005	mg/L	05/02/91
1	MW-5a	Barium	0.17	mg/L	05/04/91
1	MW-5a	Cadmium	<0.01	mg/L	05/04/91
1	MW-5a	Chromium	0.04	mg/L	05/04/91
1	MW-5a	Copper	<0.02	mg/L	05/04/91
1	MW-5a	Iron	38	mg/L	05/04/91
2	MW-9	Iron	260	mg/L	05/05/91
1	MW-5a	Lead	0.011	mg/L	05/02/91
1	MW-5a	Manganese	0.34	mg/L	05/04/91
2	MW-9	Manganese	1.2	mg/L	05/04/91
1	MW-5a	Mercury	<0.0005	mg/L	04/30/91
1	MW-5a	Selenium	<0.005	mg/L	05/03/91
1	MW-5a	Silver	<0.05	mg/L	05/04/91
1	MW-5a	Zinc	0.11	mg/L	05/04/91
1	MW-5a	Biochemical Oxygen Demand	110	mg/L	04/25/91
1	MW-5a	Chloride	18	mg/L	05/02/91
1	MW-5a	Chemical Oxygen Demand	290	mg/L	04/26/91
1	MW-5a	Fluoride	0.2	mg/L	04/26/91
1	MW-5a	Nitrate	<0.02	mg/L	04/25/91
1	MW-5a	Sulfate	480	mg/L	05/01/91
1	MW-5a	Total Dissolved Solids	1400	mg/L	04/29/91
1	MW-5a	Total Organic Carbon	32	mg/L	04/29/91
1	MW-5a	Total Organic Halide	<0.01	mg/L	04/24/91

MW-9 ?

new well also - DEM request

PROJ. NO.	PROJECT NAME
007	Bladen Co. Landfill

SAMPLERS: (Signature) [signature]

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Metals Total	~~[illegible]~~	TOC	COD	[illegible]	BOD	REMARKS
MW-9	4/23/91	12:15		X	water	1 ~~2~~	X	~~X~~					page 1 of 2
MW-5	4/23/91	13:45		X	water	6 ~~2~~	X	~~X~~	X	X	X	X	
													Send Results to Steve Czekalski Raleigh
													Metals - Total As, Ba, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Se, Ag, +Zn

do well MW-9 for total Fe, Mn only

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	4/24/91 9:00	[signature]			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	4/24 1:30	[signature]			
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
		[signature]	4/24/91 1359	Normal Turnaround PO# R ~~4001~~ 4002	

DISTRIBUTION: Original and Pink copies accompany sample shipment to laboratory: Pink copy retained by laboratory: Yellow copy retained by samplers.

Solid Waste Management
Sanitary Landfill Anaytical Parameters

	Analytical Method
Inorganic Parameters	
Chloride	EPA Method No. 325.3 ?
Fluoride	EPA Method No. 240.2 340.2 ?
Nitrate	EPA Method No. 353.2
Sulfate Standard Methods No. 426C	
Indicator Parameters	
Biochemical Oxygen Demand	Standard Methods No. 507
Chemical Oxygen Demand	EPA Method No. 410.4
Total Dissolved Solids	EPA Method No. 160.1
Total Organic Carbon	EPA Method No. 415.1
Total Organic Halogens	SW-846 Method No. 9020
Metals	
Total Metal Concentration	
By Cold Vapor Mercury	245.1 CLP-M
By Graphite Furnace	
Arsenic	206.2 CLP-M
Lead	239.2 CLP-M
Selenium	270.2 CLP-M
Inductively Coupled Plasma (ICP)	
SW-846 3rd Edition Method No. 6010, revision 1	
Barium	Iron
Cadmium	Manganese
Chromium	Silver
Copper	Zinc
pH	field measurement