Annual Ground and Surface Water Sampling
Bladen County Sanitary Landfill
Elizabethtown, North Carolina
March 31, 1992

Prepared For

Bladen County Health Department
Elizabethtown, North Carolina

SOLID WASTE SECTION
APR 01 199

Prepared By

Aquaterra, Inc.
Raleigh, North Carolina

AQUATERRA

AQUATERRA

Environmental Consultants

March 31, 1992

Mr. Steve Moffat
Bladen County Health Department
Post Office Box 188
Elizabethtown, North Carolina 28337

Reference: Annual Ground and Surface Water Monitoring Report
Bladen County Sanitary Landfill
Elizabethtown, North Carolina
Aquaterra Job No. 007

Dear Mr. Moffat:

In accordance with solid waste disposal permit ~~01009~~ 09-01 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.

Arnie Ogburn/by NBF

Arnie Ogburn
Principal Technician

David L. Duncklee, P.G.
Senior Project Manager

ACO/DLD/cbb

R1638-92

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P. O. Box 50328
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Annual Ground and Surface Water Sampling
Bladen County Landfill
Elizabethtown, North Carolina
March 31, 1992

1 Surface and Ground Water Sampling

In accordance with solid waste disposal permit 01009 issued by the North Carolina Department of Environment, Health, and Natural Resources (DEHNR), Division of Solid Waste Management, Solid Waste Section (SWS), 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 DEHNR, SWS.

Aquaterra maintains field log records of the field activities conducted during sampling events. The records include the sample collector's name and the activities conducted prior to and during sample collection. The following sections detail the field methodologies and present the laboratory analytical results for the 1992 annual surface and ground water sampling event.

1.1 Water Level Monitoring

On February 26, 1992, a staff geologist and principal technician were dispatched to the site to conduct the sampling. The depths to static water were measured in each monitoring well before well purging and sampling and were 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 surveyed mark at the top of the PVC casing for all the monitoring wells. The water level measurements were recorded in the field as a depth below the measuring point. The measurements and water level elevations are summarized in Table 1.

A shallow ground water table contour map was constructed based on the water level data (see Figure 2). Based on the contour map, the shallow ground water table at the site generally flows in a northeasterly direction.

1.2 Well Purging

The measured depth to water and the known well depth were used to calculate a well volume. Decontaminated, closed-top, bottom-loading Teflon bailers with new nylon rope were used to purge the wells. 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.

1.3 Sample Collection

Each of the nine shallow ground water monitoring wells (MW-1 through MW-4, MW-5a, and MW-6 through MW-9) were sampled using dedicated decontaminated Teflon bailers and new nylon rope. The sample collector wore clean vinyl gloves at each sampling location, and the samples were placed in clean containers provided by the analytical laboratory.

Two stream samples (SW-1 and SW-2) were collected downgradient of the landfill to determine surface water quality. The stream samples were collected by gently dipping the sample bottles into the water. The monitoring well locations and surface water sample collection points are shown in Figure 2.

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

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

3 Analytical Results

Of the twelve different total metals concentrations analyzed, five metals were detected at levels exceeding the water quality standards specified in North Carolina Administrative Code Title 15, Subchapter 2L, Section .0200. Cadmium was detected above the 0.005 mg/L standard in well MW-8 at a concentration of 0.03 mg/L. Chromium was detected above its standard of 0.05 mg/L in MW-2 (0.5 mg/L) and MW-5a (0.12 mg/L). Iron exceeded the 0.3 mg/L standard in eight monitoring wells ranging from 0.97 mg/L (MW-7) to 130 mg/L (MW-2). Manganese exceeded its 0.05 mg/L standard in six monitoring wells ranging from 0.06 mg/L (MW-7) to 0.40 mg/L (MW-2).

Metals are anticipated to naturally occur in ground water. However, the hydraulically downgradient wells (MW-2 through MW-8) consistently exhibit higher total metal concentrations than MW-1 and MW-9, the upgradient wells. Therefore, it is possible these metals are leaching from the landfill and are affecting ground water quality downgradient of the site.

Chloride was detected in each of the monitoring wells at levels ranging from 3.3 mg/L (MW-4) to 170 mg/L (MW-9). Fluoride was detected in five monitoring wells at levels ranging from 0.1 to 0.2 mg/L. Nitrate was found in wells MW-1 and MW-2 at a

concentration of 6.9 mg/L and 0.05 mg/L, respectively. Sulfate was reported in all of the wells except MW-1, MW-2, and MW-3, ranging from 9.8 mg/L (MW-6) to 120 mg/L (MW-5a). Typically (except for nitrate), levels were lowest for wells placed more hydraulically upgradient along the landfill and increased in wells located further downgradient. Nitrate was detected only in the two most upgradient wells (MW-1 and MW-2).

The concentrations of other indicator parameters – biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), and total organic carbon (TOC) – generally increased in wells furthest downgradient of the landfill. Of these parameters, only TDS has a determined water quality standard (500 mg/L). The detected levels of TDS were below this standard except in well MW-9 (1,000 mg/L).

Stream sample SW-1 was collected from Brown's Creek at a point upstream and sample SW-2 was collected directly downgradient of the site (see Figure 2). The presence of chloride, nitrate, sulfate, iron, manganese, COD, TDS, and total organic halides were detected in each of the samples at similar concentrations. Chromium was detected in the upstream sample at 0.04 mg/L, but was not found in the downstream sample.

The laboratory analytical results for the surface and ground water samples are summarized in Table 2 and documented in Attachment B.

4 Recommendations

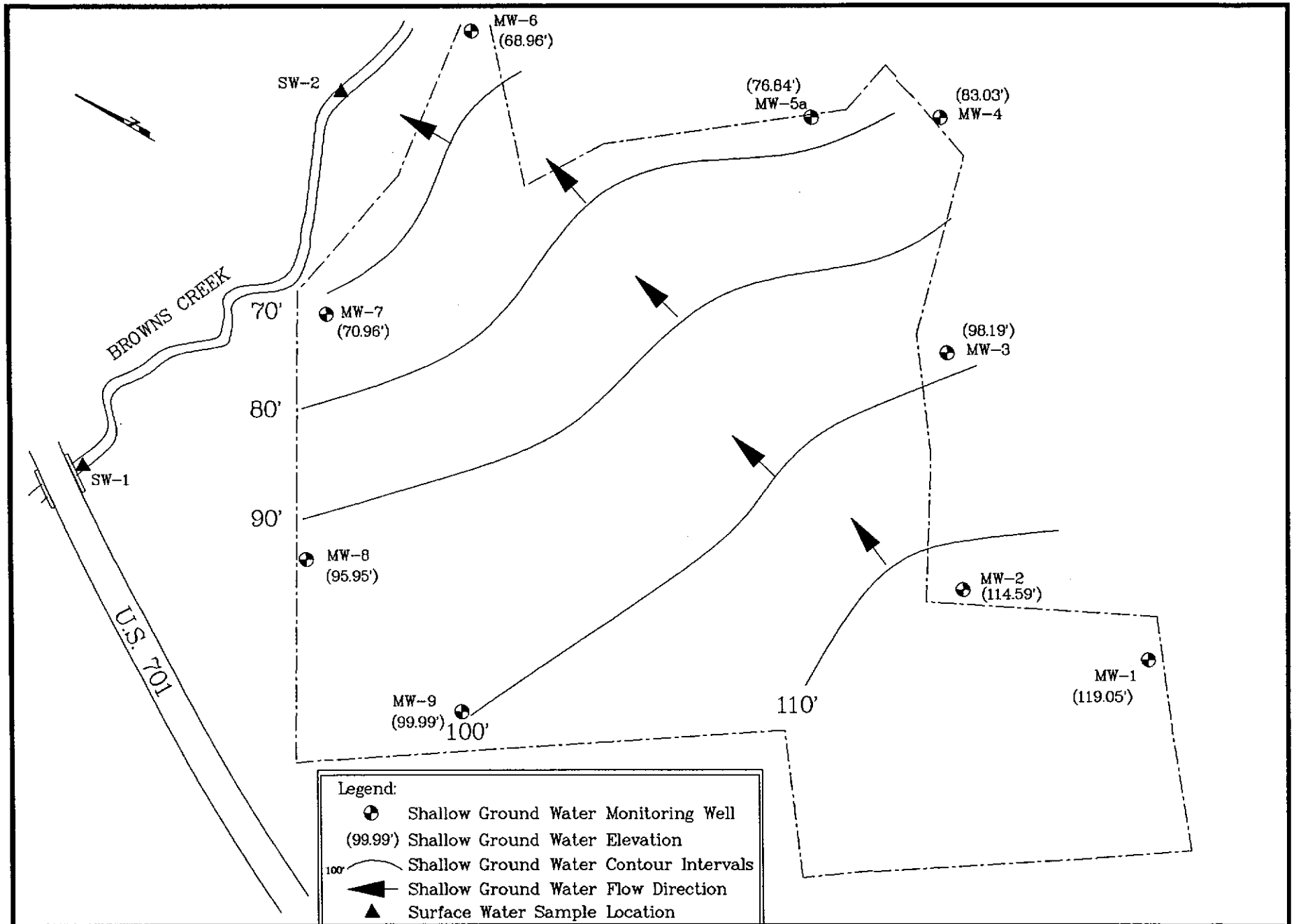
This sampling event confirms the presence of cadmium, chromium, iron, lead, and manganese in select downgradient wells at concentrations which exceed the current EPA drinking water standards. The laboratory analytical results for the surface water samples indicate the stream (Brown's Creek) is not being impacted from landfill leachate at this time. Aquaterra recommends that:

- Annual surface and ground water monitoring be continued in accordance with permit specifications and the *North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities.*

- Bladen County should submit a copy of this report to Mr. Bobby Lutfy 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

AQUATERRA, INC. RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA	Author ACO	Drawing	Layers	Date 03-25-92	Title Site Location Map
	Job No. 007	Revision	Figure 1	Scale 1" = 1 mile	Project Bladen County Landfill Elizabethtown, North Carolina



PROJECT:	TITLE: Site Plan With Shallow Ground Water Contour Map			
BLADEN COUNTY LANDFILL ELIZABETHTOWN, NORTH CAROLINA	JOB: 007	DRAWING: 007-1	FIGURE: 2	SCALE: 1"=~350'

AQUATERRA, INC.
RALEIGH, GREENSBORO, CHARLOTTE
NORTH CAROLINA

Table 1. February 26, 1992, Water Table Data for Bladen County Landfill.

Well ID	TOC Elev (ft)	Ground Water Depth (ft)	Ground Water Elevation (ft)
MW-1	134.48	15.43	119.05
MW-2	118.64	4.05	114.59
MW-3	107.91	9.72	98.19
MW-4	118.18	35.15	83.03
MW-5a	101.79	24.95	76.84
MW-6	69.50	0.54	68.96
MW-7	73.11	2.15	70.96
MW-8	112.32	16.37	95.95
MW-9	107.47	7.48	99.99

TOC = Top of Casing

Aquaterra Job No. 007
R1638-92

Table 2. Summary of Water Sample Laboratory Analysis Results for Bladen County Landfill Wells Sampled February 26, 1992.

09-01

Parameters	Units	Method Detection Limit	North Carolina Ground Water Standard	MW-1	MW-2	MW-3	MW-4	MW-5a	MW-6	MW-7	MW-8	MW-9	SW-1	SW-2
Inorganics														
Chloride	mg/L	1	250	4.4	4.8	7.8	3.3	9.4	5.5	15	7.7	170	12	13
Fluoride	mg/L	0.1	2	BDL	BDL	BDL	0.1	BDL	0.1	0.2	0.2	0.2	BDL	BDL
Nitrate	mg/L	0.02	10	6.9	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.37	0.38
Sulfate	mg/L	3.0	250	BDL	BDL	BDL	22	120	9.8	22	14	39	11	14
Metals														
Arsenic	mg/L	0.005	0.05	BDL	0.023	0.017	0.007	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Barium1	mg/L	0.1	1	BDL	0.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cadmium	mg/L	0.005	0.005	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
Chromium	mg/L	0.01	0.05	BDL	0.5	BDL	BDL	0.12	BDL	BDL	BDL	BDL	0.04	BDL
Copper	mg/L	0.02	1	BDL	0.07	BDL	BDL	BDL	0.02	BDL	BDL	BDL	BDL	BDL
Iron	mg/L	0.05	0.3	0.18	130	64	17	2.5	2.3	.97	8	1.6	1.2	1
Lead	mg/L	0.005	0.05	BDL	0.07	0.01	BDL	0.012	BDL	BDL	BDL	BDL	BDL	BDL
Manganese	mg/L	0.01	0.05	BDL	0.40	0.08	0.13	0.08	0.03	0.06	0.09	0.03	0.02	0.02
Mercury	mg/L	0.0005	0.0011	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Selenium	mg/L	0.005	0.01	BDL	0.009	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Silver	mg/L	0.01	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zinc	mg/L	0.02	5	BDL	0.24	0.03	0.05	BDL	0.02	BDL	BDL	BDL	BDL	BDL
Indicator Parameters														
COD	mg/L	25	NA	BDL	BDL	BDL	91	39	44	BDL	39	110	34	28
TDS	mg/L	10.0	500	62	44	150	230	390	110	260	110	1000	82	86
TOC	mg/L	1.0	NA	BDL	BDL	1.6	BDL	1.5	BDL	2.6	BDL	5.4	11	11
TOX	mg/L	0.01	NA	BDL	BDL	BDL	BDL	0.051	BDL	0.013	0.027	0.034	0.033	0.02
Conductance	µs/cm	10	NA	90	30	340	360	530	130	520	140	1350	100	120
pH	Std.Units	0.1	NA	5.4	4.8	6.9	7.2	7.0	6.9	7.0	6.5	6.5	6.5	6.7
BOD	mg/L	2.0	NA	BDL	6.3	BDL	BDL	4.7	BDL	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit
Analytical Laboratory: Industrial & Environmental Analysts, Inc. - Cary, NC
Aquaterra Job No. 007 — R1638-92

AQUATERRA, INC.
Well Inspection/Product Removal/Sample Collection

JOB NO. 007
SHEET NO. 1
DATE

NAME BLADEN COUNTY LANDFILL - ELIZABETHTOWN, N.C. COMPUTED BY D. RACKOCZY
SUBJECT ANNUAL SURFACE & GROUND WATER SAMPLING CHECKED BY A. OGBURN

WELL LOCATION	DIA. IN.	WATER LEVEL FT.	TOTAL DEPTH FT.	WATER COLUMN FT.	WELL VOLUME GAL.	VOLUME PURGED GAL.	SAMPLE TIME	SAMPLE DATE	SAMPLE pH	SAMPLE COND.	SAMPLE TEMP. C°	BAILER USED	I.D. NO.
MW-1	2	15.43	41.55	26.12	4.17	DRY @ 6.5	16:55	2/26/92	5.9	90	18°	—	
MW-2	2	4.05	22.2	18.15	2.9	DRY @ 5.0	16:15		5.6	30	17°	—	
MW-3	2	9.72	21.5	11.78	1.88	DRY @ 3.0	15:45		7.7	340	19°	—	
MW-4	2	35.15	45.3	10.15	1.62	5.0	11:50		7.4	360	19°	—	
MW-5a	2	24.95	40.0	15.05	2.40	DRY @ 2.5	15:00		7.1	530	19°	—	
MW-6	2	0.54	15.5	14.96	2.44	7.5	19:00		7.1	130	17°	—	
MW-7	2	2.15	14.95	12.8	2.04	6.5	19:30		7.3	520	18°	—	
MW-8	2	16.37	30.6	14.23	2.28	DRY @ 4.0	10:20		6.8	140	19°	—	
MW-9	2	7.48	20.0	12.52	2.0	6.0	10:15		6.6	1350	18°	—	
SW-1	NA	→					14:45		8.4	100	18°	—	
SW-2	NA	→					18:30		7.1	120	18°	—	

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

March 12, 1992

RECEIVED
MAR 1 3 1992

Arnie Ogburn
Aquaterra, Inc.
901 Jones Franklin Road
Raleigh, NC 27606

IEA Project No.: 196703
IEA Reference No.: W9202445
Client Project I.D.: 007

Dear Mr. Ogburn,

Transmitted herewith are the results of analyses on 11 samples submitted to our laboratory including a diskette.

The samples were received chilled and intact.

To review the diskette, the files may be retrieved by denoting A:*.* and getting a listing of filenames once you are in the lotus menu. Please note the following examples represent how the filenames will be listed.

703RES.WK1(filename):
703 = Project ID 196703, RES = Results
703BRES.WK1(filename):
703 = Project ID 196703, B = QC Blank , RES= Results

Analyses were performed according to approved methodologies and meet the requirements of the IEA Quality Assurance Program. Please see the enclosed reports for your results and a copy of the Chain of Custody documentation.

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

Please do not hesitate to call your Client Account Representative should you have any questions regarding this report.

Very truly yours,

IEA, Inc.

Darlene R. Branoff
for

Linda F. Mitchell
Director, Technical Support Services

State Certification:

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

IEA LABORATORY RESULTS

IEA Project #: 196-703
Client Name: Aquaterra Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
		TOTAL METALS:			
1	MW-9	Mercury	<0.0005	mg/L	03/04/92
2	MW-8	Mercury	<0.0005	mg/L	03/04/92
3	MW-4	Mercury	<0.0005	mg/L	03/04/92
4	SW-1	Mercury	<0.0005	mg/L	03/04/92
5	MW-5A	Mercury	<0.0005	mg/L	03/04/92
6	MW-3	Mercury	<0.0005	mg/L	03/04/92
7	MW-2	Mercury	<0.0005	mg/L	03/04/92
8	MW-1	Mercury	<0.0005	mg/L	03/04/92
9	MW-6	Mercury	<0.0005	mg/L	03/04/92
10	MW-7	Mercury	<0.0005	mg/L	03/04/92
11	SW-2	Mercury	<0.0005	mg/L	03/04/92
1	MW-9	Arsenic	<0.005	mg/L	03/02/92
2	MW-8	Arsenic	<0.005	mg/L	03/02/92
3	MW-4	Arsenic	0.007	mg/L	03/02/92
4	SW-1	Arsenic	<0.005	mg/L	03/02/92
5	MW-5A	Arsenic	<0.005	mg/L	03/02/92
6	MW-3	Arsenic	0.017	mg/L	03/02/92
7	MW-2	Arsenic	0.023	mg/L	03/02/92
8	MW-1	Arsenic	<0.005	mg/L	03/02/92
9	MW-6	Arsenic	<0.005	mg/L	03/02/92
10	MW-7	Arsenic	<0.005	mg/L	03/02/92
11	SW-2	Arsenic	<0.005	mg/L	03/02/92
1	MW-9	Lead	<0.005	mg/L	03/05/92
2	MW-8	Lead	<0.005	mg/L	03/05/92
3	MW-4	Lead	<0.005	mg/L	03/05/92
4	SW-1	Lead	<0.005	mg/L	03/05/92
5	MW-5A	Lead	0.012	mg/L	03/05/92
6	MW-3	Lead	0.010	mg/L	03/05/92
7	MW-2	Lead	0.070	mg/L	03/06/92
8	MW-1	Lead	<0.005	mg/L	03/05/92
9	MW-6	Lead	<0.005	mg/L	03/05/92
10	MW-7	Lead	<0.005	mg/L	03/05/92
11	SW-2	Lead	<0.005	mg/L	03/05/92
1	MW-9	Silver	<0.01	mg/L	03/05/92
2	MW-8	Silver	<0.01	mg/L	03/05/92
3	MW-4	Silver	<0.01	mg/L	03/05/92
4	SW-1	Silver	<0.01	mg/L	03/05/92
5	MW-5A	Silver	<0.01	mg/L	03/05/92
6	MW-3	Silver	<0.01	mg/L	03/05/92
7	MW-2	Silver	<0.01	mg/L	03/05/92
8	MW-1	Silver	<0.01	mg/L	03/05/92
9	MW-6	Silver	<0.01	mg/L	03/05/92
10	MW-7	Silver	<0.01	mg/L	03/05/92
11	SW-2	Silver	<0.01	mg/L	03/05/92

IEA LABORATORY RESULTS

IEA Project #: 196-703
Client Name: Aquaterra Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
1	MW-9	Barium	<0.10	mg/L	03/05/92
2	MW-8	Barium	<0.10	mg/L	03/05/92
3	MW-4	Barium	<0.10	mg/L	03/05/92
4	SW-1	Barium	<0.10	mg/L	03/05/92
5	MW-5A	Barium	<0.10	mg/L	03/05/92
6	MW-3	Barium	<0.10	mg/L	03/05/92
7	MW-2	Barium	0.30	mg/L	03/05/92
8	MW-1	Barium	<0.10	mg/L	03/05/92
9	MW-6	Barium	<0.10	mg/L	03/05/92
10	MW-7	Barium	<0.10	mg/L	03/05/92
11	SW-2	Barium	<0.10	mg/L	03/05/92
1	MW-9	Cadmium	<0.005	mg/L	03/05/92
2	MW-8	Cadmium	0.03	mg/L	03/05/92
3	MW-4	Cadmium	<0.005	mg/L	03/05/92
4	SW-1	Cadmium	<0.005	mg/L	03/05/92
5	MW-5A	Cadmium	<0.005	mg/L	03/05/92
6	MW-3	Cadmium	<0.005	mg/L	03/05/92
7	MW-2	Cadmium	<0.005	mg/L	03/05/92
8	MW-1	Cadmium	<0.005	mg/L	03/05/92
9	MW-6	Cadmium	<0.005	mg/L	03/05/92
10	MW-7	Cadmium	<0.005	mg/L	03/05/92
11	SW-2	Cadmium	<0.005	mg/L	03/05/92
1	MW-9	Chromium	<0.01	mg/L	03/05/92
2	MW-8	Chromium	<0.01	mg/L	03/05/92
3	MW-4	Chromium	<0.01	mg/L	03/05/92
4	SW-1	Chromium	0.04	mg/L	03/05/92
5	MW-5A	Chromium	0.12	mg/L	03/05/92
6	MW-3	Chromium	<0.01	mg/L	03/05/92
7	MW-2	Chromium	0.50	mg/L	03/05/92
8	MW-1	Chromium	<0.01	mg/L	03/05/92
9	MW-6	Chromium	<0.01	mg/L	03/05/92
10	MW-7	Chromium	<0.01	mg/L	03/05/92
11	SW-2	Chromium	<0.01	mg/L	03/05/92
1	MW-9	Copper	<0.02	mg/L	03/05/92
2	MW-8	Copper	<0.02	mg/L	03/05/92
3	MW-4	Copper	<0.02	mg/L	03/05/92
4	SW-1	Copper	<0.02	mg/L	03/05/92
5	MW-5A	Copper	<0.02	mg/L	03/05/92
6	MW-3	Copper	<0.02	mg/L	03/05/92
7	MW-2	Copper	0.07	mg/L	03/05/92
8	MW-1	Copper	<0.02	mg/L	03/05/92
9	MW-6	Copper	0.02	mg/L	03/05/92
10	MW-7	Copper	<0.02	mg/L	03/05/92
11	SW-2	Copper	<0.02	mg/L	03/05/92
1	MW-9	Iron	1.6	mg/L	03/05/92
2	MW-8	Iron	8.0	mg/L	03/05/92

IEA LABORATORY RESULTS

IEA Project #: 196-703
Client Name: Aquaterra Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
3	MW-4	Iron	17	mg/L	03/05/92
4	SW-1	Iron	1.2	mg/L	03/05/92
5	MW-5A	Iron	2.5	mg/L	03/05/92
6	MW-3	Iron	64	mg/L	03/05/92
7	MW-2	Iron	130	mg/L	03/05/92
8	MW-1	Iron	0.18	mg/L	03/05/92
9	MW-6	Iron	2.3	mg/L	03/05/92
10	MW-7	Iron	0.97	mg/L	03/05/92
11	SW-2	Iron	1.0	mg/L	03/05/92
1	MW-9	Manganese	0.03	mg/L	03/05/92
2	MW-8	Manganese	0.09	mg/L	03/05/92
3	MW-4	Manganese	0.13	mg/L	03/05/92
4	SW-1	Manganese	0.02	mg/L	03/05/92
5	MW-5A	Manganese	0.08	mg/L	03/05/92
6	MW-3	Manganese	0.08	mg/L	03/05/92
7	MW-2	Manganese	0.40	mg/L	03/05/92
8	MW-1	Manganese	<0.01	mg/L	03/05/92
9	MW-6	Manganese	0.03	mg/L	03/05/92
10	MW-7	Manganese	0.06	mg/L	03/05/92
11	SW-2	Manganese	0.02	mg/L	03/05/92
1	MW-9	Selenium	<0.005	mg/L	02/29/92
2	MW-8	Selenium	<0.005	mg/L	02/29/92
3	MW-4	Selenium	<0.005	mg/L	02/29/92
4	SW-1	Selenium	<0.005	mg/L	02/29/92
5	MW-5A	Selenium	<0.005	mg/L	02/29/92
6	MW-3	Selenium	<0.005	mg/L	02/29/92
7	MW-2	Selenium	0.009	mg/L	02/29/92
8	MW-1	Selenium	<0.005	mg/L	02/29/92
9	MW-6	Selenium	<0.005	mg/L	02/29/92
10	MW-7	Selenium	<0.005	mg/L	02/29/92
11	SW-2	Selenium	<0.005	mg/L	02/29/92
1	MW-9	Zinc	<0.02	mg/L	03/05/92
2	MW-8	Zinc	<0.02	mg/L	03/05/92
3	MW-4	Zinc	0.05	mg/L	03/05/92
4	SW-1	Zinc	<0.02	mg/L	03/05/92
5	MW-5A	Zinc	<0.02	mg/L	03/05/92
6	MW-3	Zinc	0.03	mg/L	03/05/92
7	MW-2	Zinc	0.24	mg/L	03/05/92
8	MW-1	Zinc	<0.02	mg/L	03/05/92
9	MW-6	Zinc	0.02	mg/L	03/05/92
10	MW-7	Zinc	<0.02	mg/L	03/05/92
11	SW-2	Zinc	<0.02	mg/L	03/05/92
1	MW-9	Ammonia-N	<0.1	mg/L	03/03/92
2	MW-8	Ammonia-N	<0.1	mg/L	03/03/92
3	MW-4	Ammonia-N	<0.1	mg/L	03/03/92
4	SW-1	Ammonia-N	<0.1	mg/L	03/03/92

IEA LABORATORY RESULTS

IEA Project #: 196-703
Client Name: Aquaterra Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
5	MW-5A	Ammonia-N	<0.1	mg/L	03/03/92
6	MW-3	Ammonia-N	<0.1	mg/L	03/03/92
7	MW-2	Ammonia-N	<0.1	mg/L	03/03/92
8	MW-1	Ammonia-N	<0.1	mg/L	03/03/92
9	MW-6	Ammonia-N	<0.1	mg/L	03/03/92
10	MW-7	Ammonia-N	<0.1	mg/L	03/03/92
11	SW-2	Ammonia-N	<0.1	mg/L	03/03/92
1	MW-9	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
2	MW-8	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
3	MW-4	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
4	SW-1	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
5	MW-5A	Biochemical Oxygen Demand	4.7	mg/L	02/28/92
6	MW-3	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
7	MW-2	Biochemical Oxygen Demand	6.3	mg/L	02/28/92
8	MW-1	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
9	MW-6	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
10	MW-7	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
11	SW-2	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
1	MW-9	Chloride	170	mg/L	03/03/92
2	MW-8	Chloride	7.7	mg/L	03/03/92
3	MW-4	Chloride	3.3	mg/L	03/03/92
4	SW-1	Chloride	12	mg/L	03/03/92
5	MW-5A	Chloride	9.4	mg/L	03/03/92
6	MW-3	Chloride	7.8	mg/L	03/03/92
7	MW-2	Chloride	4.8	mg/L	03/03/92
8	MW-1	Chloride	4.4	mg/L	03/03/92
9	MW-6	Chloride	5.5	mg/L	03/03/92
10	MW-7	Chloride	15	mg/L	03/03/92
11	SW-2	Chloride	13	mg/L	03/03/92
1	MW-9	Chemical Oxygen Demand	110	mg/L	03/02/92
2	MW-8	Chemical Oxygen Demand	39	mg/L	03/02/92
3	MW-4	Chemical Oxygen Demand	91	mg/L	03/02/92
4	SW-1	Chemical Oxygen Demand	34	mg/L	03/02/92
5	MW-5A	Chemical Oxygen Demand	39	mg/L	03/02/92
6	MW-3	Chemical Oxygen Demand	<25	mg/L	03/02/92
7	MW-2	Chemical Oxygen Demand	<25	mg/L	03/02/92
8	MW-1	Chemical Oxygen Demand	<25	mg/L	03/02/92
9	MW-6	Chemical Oxygen Demand	44	mg/L	03/02/92
10	MW-7	Chemical Oxygen Demand	<25	mg/L	03/04/92
11	SW-2	Chemical Oxygen Demand	28	mg/L	03/04/92
1	MW-9	Fluoride	0.2	mg/L	03/03/92
2	MW-8	Fluoride	0.2	mg/L	03/03/92
3	MW-4	Fluoride	0.1	mg/L	03/03/92
4	SW-1	Fluoride	<0.1	mg/L	03/03/92
5	MW-5A	Fluoride	<0.1	mg/L	03/03/92
6	MW-3	Fluoride	<0.1	mg/L	03/03/92

IEA LABORATORY RESULTS

IEA Project #: 196-703
Client Name: Aquaterra Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
7	MW-2	Fluoride	<0.1	mg/L	03/03/92
8	MW-1	Fluoride	<0.1	mg/L	03/03/92
9	MW-6	Fluoride	0.1	mg/L	03/03/92
10	MW-7	Fluoride	0.2	mg/L	03/03/92
11	SW-2	Fluoride	<0.1	mg/L	03/03/92
1	MW-9	Nitrate	<0.02	mg/L	02/28/92
2	MW-8	Nitrate	<0.02	mg/L	02/28/92
3	MW-4	Nitrate	<0.02	mg/L	02/28/92
4	SW-1	Nitrate	0.37	mg/L	02/28/92
5	MW-5A	Nitrate	<0.02	mg/L	02/28/92
6	MW-3	Nitrate	<0.02	mg/L	02/28/92
7	MW-2	Nitrate	0.05	mg/L	02/28/92
8	MW-1	Nitrate	6.9	mg/L	02/28/92
9	MW-6	Nitrate	<0.02	mg/L	02/28/92
10	MW-7	Nitrate	<0.02	mg/L	02/28/92
11	SW-2	Nitrate	0.38	mg/L	02/28/92
1	MW-9	pH	6.5		02/28/92
2	MW-8	pH	6.5		02/28/92
3	MW-4	pH	7.2		02/28/92
4	SW-1	pH	6.5		02/28/92
5	MW-5A	pH	7.0		02/28/92
6	MW-3	pH	6.9		02/28/92
7	MW-2	pH	4.8		02/28/92
8	MW-1	pH	5.4		02/28/92
9	MW-6	pH	6.9		02/28/92
10	MW-7	pH	7.0		02/28/92
11	SW-2	pH	6.7		02/28/92
1	MW-9	Sulfate	39	mg/L	02/28/92
2	MW-8	Sulfate	14	mg/L	02/28/92
3	MW-4	Sulfate	22	mg/L	02/28/92
4	SW-1	Sulfate	11	mg/L	02/28/92
5	MW-5A	Sulfate	120	mg/L	02/28/92
6	MW-3	Sulfate	<3.0	mg/L	02/28/92
7	MW-2	Sulfate	<3.0	mg/L	02/28/92
8	MW-1	Sulfate	<3.0	mg/L	02/28/92
9	MW-6	Sulfate	9.8	mg/L	02/28/92
10	MW-7	Sulfate	22	mg/L	02/28/92
11	SW-2	Sulfate	14	mg/L	02/28/92
1	MW-9	Total Dissolved Solids	1000	mg/L	03/02/92
2	MW-8	Total Dissolved Solids	110	mg/L	03/02/92
3	MW-4	Total Dissolved Solids	230	mg/L	03/02/92
4	SW-1	Total Dissolved Solids	82	mg/L	03/02/92
5	MW-5A	Total Dissolved Solids	390	mg/L	03/02/92
6	MW-3	Total Dissolved Solids	150	mg/L	03/02/92
7	MW-2	Total Dissolved Solids	44	mg/L	03/02/92
8	MW-1	Total Dissolved Solids	62	mg/L	03/02/92

IEA LABORATORY RESULTS

IEA Project #: 196-703
Client Name: Aquaterra Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
9	MW-6	Total Dissolved Solids	110	mg/L	03/02/92
10	MW-7	Total Dissolved Solids	260	mg/L	03/02/92
11	SW-2	Total Dissolved Solids	86	mg/L	03/02/92
1	MW-9	Total Organic Carbon	5.4	mg/L	03/05/92
2	MW-8	Total Organic Carbon	<1.0	mg/L	03/05/92
3	MW-4	Total Organic Carbon	<1.0	mg/L	03/05/92
4	SW-1	Total Organic Carbon	11	mg/L	03/05/92
5	MW-5A	Total Organic Carbon	1.5	mg/L	03/05/92
6	MW-3	Total Organic Carbon	1.6	mg/L	03/05/92
7	MW-2	Total Organic Carbon	<1.0	mg/L	03/06/92
8	MW-1	Total Organic Carbon	<1.0	mg/L	03/06/92
9	MW-6	Total Organic Carbon	<1.0	mg/L	03/06/92
10	MW-7	Total Organic Carbon	2.6	mg/L	03/06/92
11	SW-2	Total Organic Carbon	11	mg/L	03/06/92

IEA LABORATORY RESULTS

IEA Project #: 196-703
Client Name: Aquaterra Inc.

Client ID	Parameter	Results		Date Analyzed
	TOTAL METALS:			
QC Blank	Mercury	<0.0005	mg/L	03/04/92
QC Blank	Arsenic	<0.005	mg/L	03/02/92
QC Blank	Lead	<0.005	mg/L	03/05/92
QC Blank	Silver	<0.01	mg/L	03/05/92
QC Blank	Barium	<0.10	mg/L	03/05/92
QC Blank	Cadmium	<0.005	mg/L	03/05/92
QC Blank	Chromium	<0.01	mg/L	03/05/92
QC Blank	Copper	<0.02	mg/L	03/05/92
QC Blank	Iron	<0.03	mg/L	03/05/92
QC Blank	Manganese	<0.01	mg/L	03/05/92
QC Blank	Selenium	<0.005	mg/L	02/29/92
QC Blank	Zinc	<0.02	mg/L	03/05/92
QC Blank	Ammonia-N	<0.1	mg/L	03/03/92
QC Blank	Biochemical Oxygen Demand	<2.0	mg/L	02/28/92
QC Blank	Chloride	<1.0	mg/L	03/03/92
QC Blank	Chemical Oxygen Demand	<25	mg/L	03/02/92
QC Blank	Chemical Oxygen Demand	<25	mg/L	03/04/92
QC Blank	Fluoride	<0.1	mg/L	03/03/92
QC Blank	Nitrate	<0.02	mg/L	02/28/92
QC Blank	Sulfate	3.0	mg/L	02/28/92
QC Blank	Total Dissolved Solids	<10	mg/L	03/02/92
QC Blank	Total Organic Carbon	<1.0	mg/L	03/05/92
QC Blank	Total Organic Carbon	<1.0	mg/L	03/06/92

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

March 17, 1992

RECEIVED
MAR 18 1992

Arnie Ogburn
Aquaterra, Inc.
901 Jones Franklin Road
Raleigh, NC 27606

IEA Project No.: 196703(S)
IEA Reference No.: W9202445
Client Project I.D.: 007

Dear Mr. Ogburn,

Transmitted herewith are the results of analyses on 11 samples submitted to our laboratory including a diskette.

The samples were received chilled and intact.

To review the diskette, the files may be retrieved by denoting A:*.* and getting a listing of filenames once you are in the lotus menu. Please note the following examples represent how the filenames will be listed.

703SRES.WK1(filename):
703S = Project ID 196703(S), RES = Results
703SRPT.WK1(filename):
703S = Project ID 196703(S), RPT = Report

Analyses were performed according to approved methodologies and meet the requirements of the IEA Quality Assurance Program. Please see the enclosed reports for your results and a copy of the Chain of Custody documentation.

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

Please do not hesitate to call your Client Account Representative should you have any questions regarding this report.

Very truly yours,

IEA, Inc.

Linda F. Mitchell
Director, Technical Support Services

State Certification:

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

IEA LABORATORY RESULTS

IEA Project #: 196-703(S)
Client Name: Aquaterra, Inc.

Sample #	Client ID	Parameter	Results		Date Analyzed
1	MW-9	Total Organic Halide	0.034	mg/L	03/03/92
2	MW-8	Total Organic Halide	0.027	mg/L	03/03/92
3	MW-4	Total Organic Halide	<0.010	mg/L	03/02/92
4	SW-1	Total Organic Halide	0.033	mg/L	03/03/92
5	MW-5A	Total Organic Halide	0.051	mg/L	03/03/92
6	MW-3	Total Organic Halide	<0.010	mg/L	03/03/92
7	MW-2	Total Organic Halide	<0.010	mg/L	03/03/92
8	MW-1	Total Organic Halide	<0.010	mg/L	03/03/92
9	MW-6	Total Organic Halide	<0.010	mg/L	03/03/92
10	MW-7	Total Organic Halide	0.013	mg/L	03/03/92
11	SW-2	Total Organic Halide	0.020	mg/L	03/03/92
	QC Blank	Total Organic Halide	<0.010	mg/L	03/03/92

iea

an environmental testing company
3000 WESTON PKWY.
CARY, N.C. 27513

Aquaterra

CHAIN OF CUSTODY RECORD

NO: 25071

REGULATORY CLASSIFICATION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING WATER ☐ RCRA ☐ OTHER _____

PROJECT #: 007

PROJECT NAME: Bladen Co. Landfill

SAMPLERS: (SIGNATURE)

SAMPLE I.D.	DATE	TIME	COMP	GRAB	STATION LOCATION	# OF CONTAINERS	MATRIX SOIL	MATRIX WATER	BOD	COD	Fl, Cl	NH_3-N	NO_3	TDS, pH	TOX	TOC	SO_4	Metals			
MW-9	2/26/92	10:15		X	MW-9 Bladen Co Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
MW-8		10:20		X	MW-8 Bladen Co Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
MW-4		11:50		X	MW-4 Bladen Co Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
SW-1		14:45		X	Surface Water Location 1 Bladen Co. Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
MW-5A		15:00		X	MW-5A Bladen Co Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
MW-3		15:45		X	MW-3 Bladen Co. Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
MW-2		16:15		X	MW-2 Bladen Co. Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
MW-1		16:55		X	MW-1 Bladen Co Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
MW-6		19:00		X	MW-6 Bladen Co Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
MW-7		19:30		X	MW-7 Bladen Co Landfill	11		X	X	X	X	X	X	X	X	X	X	X			
SW-2		18:30		X	Surface Water Location 2 Bladen Co Landfill	11		X	X	X	X	X	X	X	X	X	X	X			

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY	DATE	TIME
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LAB BY	DATE	TIME
	2/27/92	10:52	Bill Sca	2/27/92	10:52

IEA QUOTE NO.	IEA RUSH NO.
W9202445	
PROJECT MANAGER (PLEASE PRINT)	**P.O. NO.**
Arnie Ogburn Aquaterra	R-4924

IEA REMARKS

IEA # 196-703

FIELD REMARKS

Metals analysis to include: Ag, As, Ba, Cd, Cr, Cu, Fe, Hg, Mn, Pb, Se, Zn

-16-1992 11:21 803 766 1178 GENERAL ENGINEERING LABORATORIES P.20

...ing company
3000 WESTON PKWY.
CARY, N.C. 27513

REGULATORY CLASSIFICATION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING WATER ☐ RCRA ☐ OTHER _____

NO. 27102

COMPANY: A-NC

Page 1 of 1

Ship to General Eng.

PROJECT #: 196-7035

PROJECT NAME: dient

SAMPLERS (SIGNATURE): 9202467

SAMPLE I.D.	DATE	TIME			STATION LOCATION	# OF CONTAINERS	MATRIX SOIL	MATRIX WATER	TOX												
1	2/26/92	1015			196-7035-1	1		X	✓												
2		1025			196-7035-2	1		X	✓												
3		1100			196-7035-3	1		X	✓												
4		245			196-7035-4	1		X	✓												
5		1500			196-7035-5	1		X	✓												
6		1545			196-7035-6	1		X	✓												
7		1615			196-7035-7	1		X	✓												
8		1655			196-7035-8	1		X	✓	~~this sample did not arrive [illegible]~~ sample arrived later in the after noon at 8:00pm											
9		1900			196-7035-9	1		X	✓												
10		1930			196-7035-10	1		X	✓												
11		1830			196-7035-11	1		X	✓												

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY	DATE	TIME	IEA QUOTE NO.	IEA RUSH NO.
[signature]	2/27/92	1548					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LAB BY	DATE	TIME	PROJECT MANAGER (PLEASE PRINT)	P.O. NO.
			Donna Ward	2-28-92	10:40am		

REMARKS ON SAMPLE RECEIPT: ☐ BOTTLE INTACT ☐ CUSTODY SEALS ☐ RESERVED ☐ SEALS INTACT ☐ LED ☐ SEE REMARKS

IEA REMARKS: Please send results to Julie Niemi

FIELD REMARKS

Solid Waste Management
Sanitary Landfill Anaytical Parameters

	Analytical Method
Inorganic Parameters	
Chloride	EPA Method No. 325.3
Fluoride	EPA Method No. 240.2
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