BUNNELL-LAMMONS ENGINEERING, INC.

GEOTECHNICAL, ENVIRONMENTAL AND CONSTRUCTION MATERIALS CONSULTANTS

REPORT OF LIMITED GROUNDWATER CONTAMINATION ASSESSMENT

Macon County Lined Landfill - Permit No. 57-03
Franklin, North Carolina

Prepared for

NCDENR
Division of Waste Management
Environmental Compliance – Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Prepared by

BUNNELL-LAMMONS ENGINEERING, INC.
6004 Ponders Court
Greenville, South Carolina 29615

December 19, 2007

BLE Project Number J07-1101-03

BLE INC.
BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL, ENVIRONMENTAL AND CONSTRUCTION MATERIALS CONSULTANTS

December 19, 2007

NCDENR
Division of Waste Management
Environmental Compliance – Solid Waste Section
1646 Mail Service Center
Raleigh, NC 27699-1646

Attention: Mr. Ervin Lane
Hydrogeologist

Subject: **Report of Limited Groundwater Contamination Assessment**
Macon County Lined Landfill, Permit #57-03
Franklin, North Carolina
BLE Project Number J07-1101-03

Dear Mr. Lane:

Bunnell-Lammons Engineering, Inc. (BLE) is pleased to submit this report to the North Carolina Department of Environment and Natural Resources (NCDENR) on behalf of our client (Macon County, North Carolina). The data presented herein is part of a limited groundwater assessment at the subject site.

PROJECT INFORMATION

Macon County owns and operates a recycling center and solid waste disposal facility at 1448 Lakeside Drive in Franklin, North Carolina (Figure 1). The facility includes a network of groundwater monitoring wells which are sampled semi-annually in accordance with the facility permit (Figures 2 and 3). Groundwater sampling and reporting is currently performed by REI Consultants, Inc (REIC) under contract with the county.

Based on the continued detection of volatile organic compounds in two monitoring wells (MW-1A and MW-1B) which exceed North Carolina groundwater standards promulgated under NCAC Title 15A 02L .0202 (2L Standards), the NCDENR required the facility to initiate an assessment monitoring program. The county was notified of the requirement in a NCDENR letter dated August 24, 2007.

The letter required the county to submit a groundwater assessment plan to the NCDENR within 30 days of the receipt of the letter. BLE was retained by Macon County to prepare the work plan which was submitted to the NCDENR on September 13, 2007 (*Groundwater Contamination Assessment Plan,* BLE Project No. J07-1101-02). The work plan was approved by NCDENR on September 14, 2007 in a letter to Chris Stahl of Macon County. BLE was retained by Macon County to perform the required assessment defined in the approved work plan.

6004 PONDERS COURT
GREENVILLE, SOUTH CAROLINA 29615

PHONE (864) 288-1265
FAX (864) 288-4430

This report documents the performance of the limited groundwater assessment and includes well logs, development logs, a potentiometric surface map, laboratory analytical results, and conclusions and recommendations.

SCOPE OF SERVICES PERFORMED

The required tasks for this assessment were limited to the installation and sampling of three groundwater monitoring wells. These wells were used to establish the on-site groundwater flow direction in the area of concern and to determine if the subject contaminants have impacted groundwater quality.

Monitoring Well Installation, Development, and Survey

BLE mobilized an ATV-mounted CME-750 drill rig and a truck-mounted Schramm drill rig to install 3 (three) monitoring wells at the locations shown on Figure 2. Groundwater monitoring well MW-23 was installed using the CME rig via hollow stem auger on September 12, 2007. Groundwater monitoring wells MW-1D and MW-5D were installed using the Schramm rig via downhole air hammer on September 20, 2007. The actual well installation locations and depths were dependent on site conditions and were in drilled and installed in general accordance with the approved assessment plan. The well drilling and installation procedures are included in Appendices A and B. Each well included a surface completion consisting of a 3 by 3 foot by 4-inch thick concrete pad with a lockable well cap and steel stickup cover. Well logs are included in Appendix B.

BLE provided well development services for each newly installed monitoring well. The monitoring wells were developed to remove fine particles from the sand pack around the well screen. The well development consisted of the following:

1. Place a manual hand pump or bailer in the monitoring well;
2. Purge the well; and
3. Intermittently surge the well with a surge block.

Groundwater turbidity was measured periodically during well development using a HF Scientific model DRT-15 Portable Turbidity Meter, or equivalent. Well development logs are included in Appendix C.

The three new monitoring wells' location and elevation were surveyed by North Carolina registered land surveyor provided by McGill Associates (McGill) under direct contract with the county. The survey data is included in Appendix D.

Groundwater Sampling and Analysis

Groundwater levels were obtained (by REIC) from the new and previously existing monitoring wells and a potentiometric surface map was prepared by BLE (Figure 2). A well construction and water level summary table has been prepared by REIC (Table 1).

REIC collected groundwater samples from each of the newly installed wells on October 16, 2007. We understand that the groundwater sampling was performed in general accordance with the facility permit. The samples from each of the new wells were analyzed for the NC Appendix I compound list.

As part of the approved groundwater assessment REIC collected samples from a three (3) well subset for NC Appendix II monitoring. Those wells are included MW-17 (background), MW-1A, and MW-1B. Future Appendix II monitoring requirements are to be determined based on the results of this initial event.

The laboratory analysis data is included in Appendix E. A summary table of the laboratory analysis results has been prepared by REIC (Table 2). The data is also summarized on Figure 3.

RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Laboratory analysis results indicate that low levels of Appendix I VOCs were detected above the Solid Waste Section Limits (SWSL) in monitoring wells MW-1A, MW-1B, MW-1D, and MW-5D. Appendix I VOCs were not detected above the SWSL in the remaining wells including the downgradient well MW-23 (Figures 2 and 3). Please note that several of the VOCs were detected below SWSLs and that those results are "J-flagged" indicating detections below calibration range (Appendix E). The results are indicated as "J" values, since they are below instrument calibration range and therefore not quantifiable.

Laboratory analysis results also indicate that concentrations of bis(2-ethylhexyl)phthalate (an Appendix II compound) was detected above the SWSL in each of the three wells sampled for Appendix II parameters. These wells included MW-17 (background), MW-1A, and MW-1B. No other Appendix II compounds were detected above SWSLs. Please note that parameters detected below SWSLs are indicated as "J" values in the laboratory report.

We conclude that a release of VOCs into the groundwater has occurred at the site which has impacted a localized area west-northwest of the Phase 1/Phase 2 cell overlap (Figure 3). The horizontal and vertical extent of the release appears to be defined with the data collected from the new assessment wells MW-5D, MW-1D, and MW-23. Areas southeast (MW-2 & MW-3A), northeast (MW-22 & MW-22), and southeast (MW-17 background) have not been affected. Since areas downgradient of the release (MW-23) have not been affected we conclude that it is unlikely that the Little Tennessee River (potential receptor) has been impacted.

We conclude that the "J" values (in the laboratory data) are below calibration range and therefore subject to false positives. We also conclude that the detected phthalate compound is a possible field sampling artifact since it was detected in background well (MW17) at the same magnitude as downgradient wells (MW-1A and MW-1B) and therefore should not be considered sufficient evidence of a release from the landfill.

We recommend that the water quality monitoring plan for the landfill be amended to include substitution of the MW-5D for MW-5 which is often dry. We also recommend that MW-1D and

MW-23 be added to the semi-annual monitoring plan for assessment purposes only. If similar results to those presented herein are obtained after three additional consecutive monitoring events, sampling of MW-1D and MW-23 should be discontinued.

We recommend that Appendix II sampling be discontinued since no evidence of a release of Appendix II compounds from the landfill has been confirmed.

We also recommend that no further assessment be performed at this time since the affected groundwater is limited in extent, appears to be confined to the landfill property, and no receptors appear to be affected. Furthermore we do not recommend implementation of corrective action for this release beyond the changes to the groundwater quality monitoring plan recommended above.

CLOSING

BLE appreciates the opportunity to work with NCDENR on this project. Please provide comments on this report at your earliest convenience. Please contact BLE at (864) 288-1265 if you have any questions.

Sincerely,

BUNNELL-LAMMONS ENGINEERING, INC.

Andrew W. Alexander, P.G.
Senior Hydrogeologist
Registered, NC #1475

NORTH CAROLINA LICENSED SEAL 1475 GEOLOGIST ANDREW W. ALEXANDER

Trevor J. Benton, P.G.
Staff Hydrogeologist
Registered, NC #2025

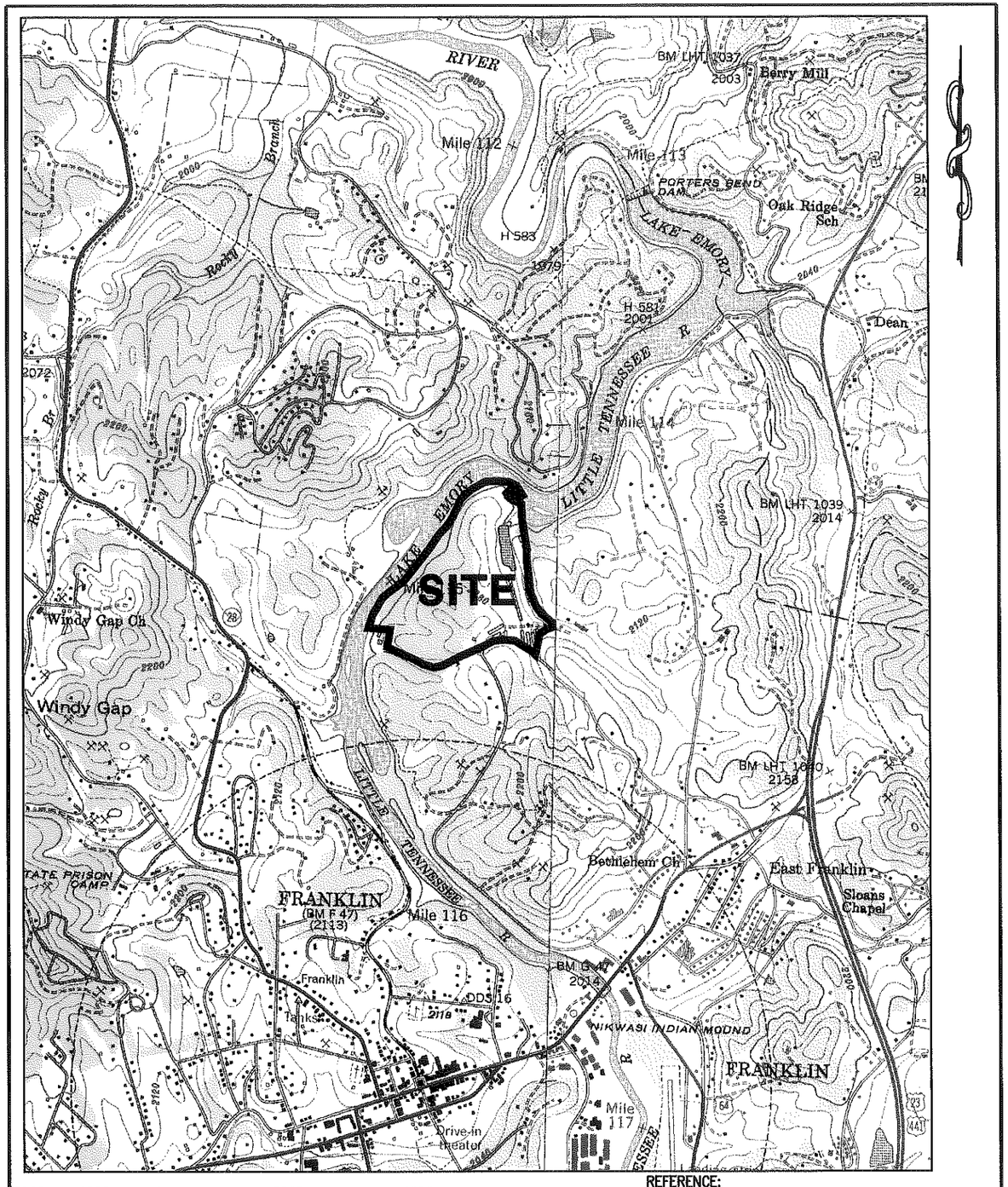
NORTH CAROLINA LICENSED SEAL 2025 GEOLOGIST TREVOR J. BENTON

CC: Mr. M. Chris Stahl – Macon County
Mr. Jeff Bishop, PE – McGill
Mr. Mike Hofe -- REIC

Attachments: Figures
Tables
Appendices

c:\awa\active projects\mcgill\macon county landfill\1101-03 well installation for gw assessment\report groundwater assessment macon mswlf 1101-03.doc

FIGURES



2000 1000 0 2000 4000

APPROXIMATE SCALE IN FEET

REFERENCE:
USGS TOPOGRAPHIC MAP, 7.5 MINUTE SERIES, CORBIN KNOB AND FRANKLIN, N.C. QUADRANGLES, PHOTOREVISED 1978.

DRAWN: AEH	DATE: 10-11-07	IBLE INC. BURNELL-LAMMONS ENGINEERING, INC. 6004 PONDERS COURT GREENVILLE, SOUTH CAROLINA 29615 PHONE: (864)288-1265 FAX: (864)288-4430	FIGURE
CHECKED: AWA	CAD: MACONCOLF-03SLM	SITE LOCATION MAP MACON COUNTY LANDFILL FRANKLIN, NORTH CAROLINA	1
APPROVED:	JOB NO: J07-1101-03		

TABLES

Table 1
Macon County MSW Landfill
Permit No. 57-03

Monitoring Point	Northing*	Westing*	Northing**	Easting**	TOC*** (ft amsl)	Depth to Water 10/16-17/07 (below TOC)	Groundwater Elevation (ft amsl)	Well Depth (below TOC)	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Comments
Monitoring Wells											
MW-1A	3068.8	-20.7			**2012.25**	9.58	2002.67	31.10	19.5	29.5	Prior survey TOC=2010.20
MW-1B	3050.1	-5.6			**2012.19**	9.54	2002.65	17.45	5	15	Prior survey TOC=2010.15
MW-1D	-	-	557540.8	691268.4	**2013.65**	50.70	1962.95	63.05	-	-	New well
MW-2	2790.0	273.5			2014.78	13.82	2000.96	20.15	8	18	
MW-3A	2283.1	177.4			2070.55	60.65	2009.90	67.62	52	65	
MW-5	2651.1	-8.7			**2072.92**	-	<2017.72	55.20	38	53	Dry; prior survey TOC=2070.88
MW-5D	-	-	557151.2	691279.4	**2075.67**	60.50	2015.17	69.82	-	-	New well
MW-10	2859.7	-1083.9			2115.08	58.98	2056.10	67.60	55	65	
MW-14	3708.3	-1370.3			2049.54	35.39	2014.15	42.57	29	39	
MW-15	3344.5	-1483.6			2029.19	13.91	2015.28	17.97	7	17	
MW-17	2496.6	-802.7			2133.30	71.47	2061.83	83.30	66	81	
MW-18	2710.2	-1023.1			2115.40	53.44	2061.96	62.08	48	63	
MW-19	3750.6	-756.4			2021.00	20.20	2000.80	25.80	7	22	
MW-19A	3763.6	-744.0			2020.80	19.62	2001.18	57.09	51.5	54	
MW-20	3552.6	-538.7			2015.40	13.64	2001.76	23.03	6	21	
MW-21	3341.1	-366.7			2020.90	18.21	2002.69	26.93	8.5	23.5	
MW-22	3191.2	-169.2			**2020.92**	18.48	2002.44	25.10	8	23	Prior survey TOC=2020.60
MW-22A	3200.8	-151.0			**2017.94**	15.15	2002.79	42.30	36.5	39.5	Prior survey TOC=2017.60
MW-23	-	-	557666.4	691140.8	**2007.08**	6.20	2000.88	30.95	-	-	New well
Surface Water Locations											
SW-1	2898.1	455.5			NA	NA	NA	NA	NA	NA	
SW-2	3952.3	-533.7			NA	NA	NA	NA	NA	NA	
SW-3	2578.0	-1899.0			NA	NA	NA	NA	NA	NA	
SW-4	4016.5	-1716.5			NA	NA	NA	NA	NA	NA	
Other Wells											
MW-3B	2311.2	186.2			NA	NA	NA	NA	NA	NA	Not sampled
MW-4	2503.9	-512.1			NA	NA	NA	NA	NA	NA	Not sampled

* Coordinates from "Monitoring Well, Surface Water, and Leachate Pond Sample Location Map", Altamont Environmental, Inc., May 14, 2003
** Coordinates from McGill 10/3/07 survey
*** Bold values from McGill 10/3/07 survey, all others from prior survey, date unknown
TOC - top of casing
amsl - above mean sea level
bgs - below ground surface
NA - not available/not applicable

This table prepared by REIC

Table 2
Macon County MSW Landfill
Permit #57-03
2nd Semiannual 2007 Water Quality Monitoring
Summary of Results

Analyte	Units	SWSL	MW-1A	MW-1A DUP	MW-1B	MW-1D	MW-2	MW-3A	MW-5D	MW-5D DUP	MW-10	MW-14	MW-15	MW-17	MW-18	MW-18 DUP	MW-19	MW-19A	MW-20	MW-21	MW-22	MW-22A	MW-23	SW-1	SW-2	SW-3	SW-4
Arsenic	µg/L	10	-	-	-	-	27.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	µg/L	100	-	-	-	317	261	-	1410	1100	226	119	359	125	146	139	965	-	-	-	371	-	128	-	-	-	-
Cobalt	µg/L	10	12.5	12.3	-	12.4	30.4	-	17.1	18.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	10	-	-	-	-	-	-	13.2	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.8	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	10	29.8	12.7	18.7	19.4	-	14.1	37.2	29.7	-	-	18.0	23.0	29.4	15.5	21.8	10.6	13.7	12.3	29.5	-	26.4	21.9	-	17.6	-
Benzene	µg/L	1.0	2.2	2.3	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	µg/L	3.0	5.1	5.3	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	µg/L	1.0	5.9	6.6	5.7	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	µg/L	1.0	-	-	-	-	-	-	1.2	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl chloride	µg/L	1.0	2.2	1.8	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes	µg/L	3.0	-	-	-	-	-	-	5.8	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	µg/L	12	22	18	30	NA	NA	NA	NA	NA	NA	NA	NA	18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

SWSL - Solid Waste Section Limit (µg/L)
"-" indicates that the parameter was not quantified, i.e., not detected above the SWSL
NA - not analyzed
Only parameters detected above SWSLs are listed
Samples MW-1A, MW-1A DUP, MW-1B, and MW-17 were analyzed for NCDENR Appendix II parameters; all others were analyzed for NCDENR Appendix I parameters

This table prepared by REIC

APPENDIX A

DRILLING PROCEDURES

Air Hammer Drilling

Air drilled borings will be advanced through the unconsolidated and consolidated materials using a downhole air hammer and compressed air to remove the soil and rock cuttings. The pneumatic drill hammer rapidly strikes the soil or rock while the drill pipe is slowly rotated. The drill hammers are typically constructed of alloy steel with tungsten-carbide inserts that provide the chipping or cutting surfaces. An in-line air filter is attached to the air compressor on the rig to remove oil from the air and to prevent oil contamination in the borehole.

Representative portions of the soil samples will be placed in glass jars or plastic bags. The samples will be examined by a geologist to verify the technician's and/or driller's field classifications and Soil Boring Records will be prepared. Soil borings are assumed to be advanced to their required termination depths for monitoring well installation.

Hollow Stem Auger Drilling

Soil borings will be advanced by mechanically twisting a continuous flight steel auger into the soil. Soil sampling will be performed by collecting samples of the auger cuttings or split spoon sampler, as needed.

General

To help prevent cross-contamination between borings, all downhole drilling equipment will be steam cleaned prior to drilling each boring.

APPENDIX B

WELL INSTALLATION PROCEDURES AND LOGS

Type II Monitoring Well

Type II ground-water monitoring wells will consist of 2-inch Schedule 40 polyvinyl chloride (PVC) casing with flush-threaded joints installed in a borehole. The bottom 5- or 10-foot section of each well will consist of a manufactured well screen with 0.01-inch wide machined slots. The well screen will be installed to the termination depth of the borehole.

In the Type II wells, a washed sand filter pack will be placed around the outside of the casing from the bottom of the well casing to from one to five feet above the top of the well screen. The sand filter pack is used to stabilize the formation and to help yield a less turbid ground-water sample.

A two-foot thick (minimum) bentonite seal will be installed on top of the sand filter pack to seal the monitoring well at the desired level. The well annulus will then be grouted to the surface with a cement/bentonite grout mixture. A lockable PVC cap and a protective steel cover will be placed over each well.

KEY TO SOIL CLASSIFICATIONS AND CONSISTENCY DESCRIPTIONS

BUNNELL-LAMMONS ENGINEERING, INC.
GREENVILLE, SOUTH CAROLINA

Penetration Resistance* Blows per Foot	Relative Density
SANDS	
0 to 4	Very Loose
5 to 10	Loose
11 to 20	Firm
21 to 30	Very Firm
31 to 50	Dense
over 50	Very Dense

Penetration Resistance* Blows per Foot	Consistency
SILTS and CLAYS	
0 to 2	Very Soft
3 to 4	Soft
5 to 8	Firm
9 to 15	Stiff
16 to 30	Very Stiff
31 to 50	Hard
over 50	Very Hard

*ASTM D 1586

Particle Size Identification

Boulder: Greater than 300 mm
Cobble: 75 to 300 mm
Gravel:
Coarse - 19 to 75 mm
Fine - 4.75 to 19 mm
Sand:
Coarse - 2 to 4.75 mm
Medium - 0.425 to 2 mm
Fine - 0.075 to 0.425 mm
Silt & Clay: Less than 0.075 mm

KEY TO DRILLING SYMBOLS

Grab Sample

Split Spoon Sample

Undisturbed Sample

NR = No reaction to HCL

NA = Not applicable

NS = No sample

Groundwater Table at Time of Drilling

Groundwater Table 24 Hours after Completion of Drilling

KEY TO SOIL CLASSIFICATIONS

Well-graded Gravel
GW

Poorly-graded Gravel
GP

Partially Weathered Rock
BLDRCBBL

High Plasticity Clay
CH

Low Plasticity Clay
CL

Sandy Clay
CLS

Silty Clay
CL-ML

Silt
ML

Clayey Silt
MH

Sandy Silt
MLS

Sand
SW

Clayey Sand
SC

Silty Sand
SM

Topsoil
TOPSOIL

Trash
MUCKPEAT

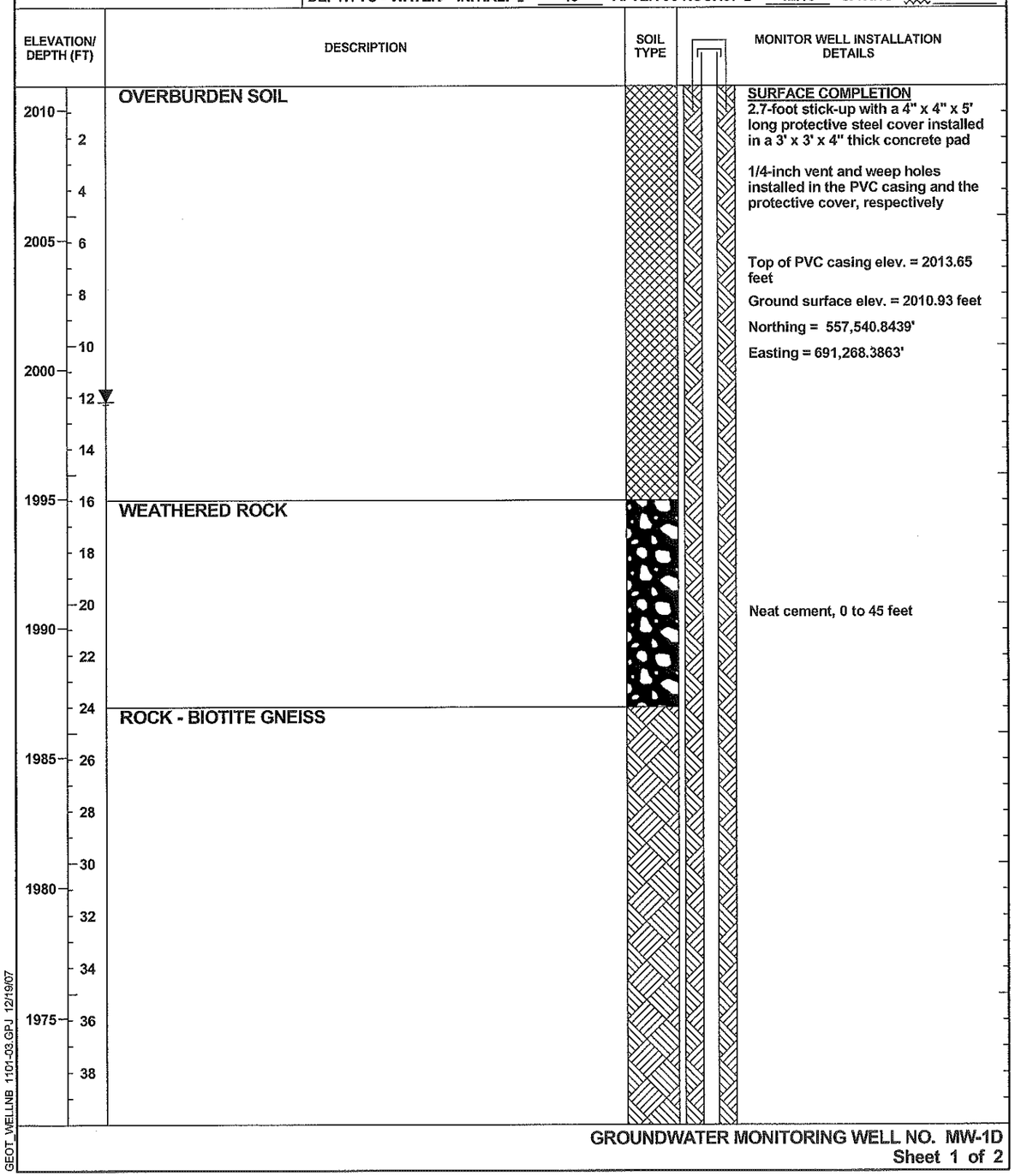
Fill
FILL

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

GROUNDWATER MONITORING WELL NO. MW-1D

PROJECT: Macon County Landfill — PROJECT NO.: J07-1101-03
CLIENT: Macon County — START: 9-20-07 END: 9-20-07
LOCATION: Franklin, North Carolina — ELEVATION: 2010.93
DRILLER: Landprobe, R. Rowe/F. Caro — LOGGED BY: R. Rowe
DRILLING METHOD: Air rotary - 6.125-inch air hammer
DEPTH TO - WATER> INITIAL: ▽ 48 AFTER 96 HOURS: ▼ 12.18 CAVING>



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GROUNDWATER MONITORING WELL NO. MW-1D

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PROJECT: Macon County Landfill — PROJECT NO.: J07-1101-03
CLIENT: Macon County — START: 9-20-07 END: 9-20-07
LOCATION: Franklin, North Carolina — ELEVATION: 2010.93
DRILLER: Landprobe, R. Rowe/F. Caro — LOGGED BY: R. Rowe
DRILLING METHOD: Air rotary - 6.125-inch air hammer
DEPTH TO - WATER> INITIAL: ▽ 48 AFTER 96 HOURS: ▼ 12.18 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	MONITOR WELL INSTALLATION DETAILS
1970 / 42	ROCK - BIOTITE GNEISS		Neat cement, 0 to 45 feet
44			
1965 / 46			Bentonite seal, 45 to 48 feet
48 ▽			Filter pack, sand 48 to 60.5 feet
50			
1960 / 52			
54	Water bearing fracture at 54 feet		10 feet of 2-inch diameter, 0.010-inch slotted Schedule 40 PVC well screen, 50 to 60 feet
1955 / 56			
58			
60			Pipe cap
1950 / 62	Boring terminated at 60.5 feet. Groundwater encountered at 48 feet at time of drilling and at 12.18 feet after 96 hours.		Total well depth, 60.2 feet
64			Total borehole depth, 60.5 feet
1945 / 66			Borehole diameter, 6.125-inches
68			
70			
1940 / 72			
74			
1935 / 76			
78			

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BLE INC.

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

GROUNDWATER MONITORING WELL NO. MW-5D

PROJECT: Macon County Landfill — PROJECT NO.: J07-1101-03
CLIENT: Macon County — START: 9-20-07 END: 9-20-07
LOCATION: Franklin, North Carolina — ELEVATION: 2072.97
DRILLER: Landprobe, R. Rowe/F. Caro — LOGGED BY: R. Rowe
DRILLING METHOD: Air rotary - 6.125-inch air hammer
DEPTH TO - WATER> INITIAL: ▽ 51 AFTER 96 HOURS: ▼ 56.92 CAVING> ▨

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	MONITOR WELL INSTALLATION DETAILS
2070 / 2	OVERBURDEN SOIL		SURFACE COMPLETION 2.7-foot stick-up with a 4" x 4" x 5' long protective steel cover installed in a 3' x 3' x 4" thick concrete pad 1/4-inch vent and weep holes installed in the PVC casing and protective cover, respectively Top of PVC casing elev. = 2075.67 feet Ground surface elev. = 2072.97 feet Northing = 557,151.1925' Easting = 691,279.4424'
4			
6			
2065 / 8			
10			
12			
2060 / 14			
16			
2055 / 18			
20			Neat cement, 0 to 52 feet
22			
2050 / 24			
26			
2045 / 28			
30			
32			
2040 / 34			
36			
2035 / 38			

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GROUNDWATER MONITORING WELL NO. MW-5D

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

PROJECT: Macon County Landfill — PROJECT NO.: J07-1101-03
CLIENT: Macon County — START: 9-20-07 END: 9-20-07
LOCATION: Franklin, North Carolina — ELEVATION: 2072.97
DRILLER: Landprobe, R. Rowe/F. Caro — LOGGED BY: R. Rowe
DRILLING METHOD: Air rotary - 6.125-inch air hammer
DEPTH TO - WATER> INITIAL: ▽ 51 AFTER 96 HOURS: ▼ 56.92 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	MONITOR WELL INSTALLATION DETAILS
42	SOIL - (fill)		
2030 — 44	WEATHERED ROCK		
46			Neat cement, 0 to 52 feet
2025 — 48			
50 ▽			
52	ROCK - BIOTITE GNEISS Solid rock with no fractures from 52 to 54 feet		
2020 — 54	Soil seam with water from 54 to 56 feet		Bentonite seal, 52 to 55 feet Filter pack, sand 55 to 67.5 feet
56 ▼	Rock with water bearing quartz veins from 56 to 67 feet		
2015 — 58			
60			
62			10 feet of 2-inch diameter, 0.010-inch slotted Schedule 40 PVC well screen, 57 to 67 feet
2010 — 64			
66			
2005 — 68	Boring terminated at 67.5 feet. Groundwater encountered at 51 feet at time of drilling and at 56.92 feet after 96 hours.		Pipe cap Total well depth, 67.2 feet Total borehole depth, 67.5 feet Borehole diameter, 6.125-inches
70			
72			
2000 — 74			
76			
1995 — 78			

GEOT_WELLNB 1101-03.GPJ 12/19/07

BLE INC.

BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

GROUNDWATER MONITORING WELL NO. MW-23

PROJECT: Macon County Landfill — PROJECT NO.: J07-1101-03
CLIENT: Macon County — START: 9-12-07 END: 9-12-07
LOCATION: Franklin, North Carolina — ELEVATION: 2004.34
DRILLER: Landprobe, T. Gradwell, BE — LOGGED BY: T. Gradwell
DRILLING METHOD: 4-1/4 ID inch hollow stem auger (8.25-inch OD)
DEPTH TO - WATER> INITIAL: ▽ 3.1 AFTER 96 HOURS: ▼ 3.25 CAVING>

ELEVATION/ DEPTH (FT)	DESCRIPTION	SOIL TYPE	SAMPLES	STANDARD PENETRATION RESULTS BLOWS/FOOT (2 5 10 20 30 40 50 70 90)
2000	6-inches of TOPSOIL Very loose, dark brown, micaceous, silty SAND		1 2 1	
	Very loose, dark brown, micaceous, wet, silty SAND with some clay		WOH 1 1	WOH
	Very soft, dark brown, micaceous, wet, sandy, silty CLAY		WOH 1 1	WOH
1995			1 1 1	
1990	Very loose, dark brown, micaceous, silty SAND		WOH 1 2	WOH
1985	Loose, dark blackish SAND with pebbles		5 9 6	
1980	Firm, orange, dry, micaceous SAND - (residuum)		5 7 9	
1975	Dense, brown, weathered layers rock, micaceous, silty SAND		6 12 25	
1970	Boring terminated at 30 feet. Groundwater encountered at 3.1 feet at time of drilling and at 3.25 feet after 96 hours.			
1965				

MONITOR WELL INSTALLATION DETAILS

SURFACE COMPLETION
2.74-foot stick-up with a 4" x 4" x 5' long protective steel cover installed in a 3' x 3' x 4" thick concrete pad
1/4-inch vent and weep holes installed in the PVC casing and protective cover, respectively
Top of PVC casing elev. = 2007.08 feet
Ground surface elev. = 2004.34 feet
Northing = 557,666.3548'
Easting = 691,140.8171'

Neat cement, 0 to 13.9 feet

Bentonite seal, 13.9 to 16 feet

Filter pack, sand 16 to 30 feet

10 feet of 2-inch diameter, 0.010-inch slotted Schedule 40 PVC well screen, 18.4 to 28.4 feet

Pipe cap

Total well depth, 28.6 feet
Total borehole depth, 30 feet
Borehole diameter, 8.25-inches

GEOT_WELL 1101-03.GPJ 12/11/07

APPENDIX C

MONITORING WELL DEVELOPMENT LOGS

MONITORING WELL DEVELOPMENT LOG

DATE	9/24/07	TOTAL WELL DEPTH (TWD); TOP OF CASING =	63.0	1/100 ft
PERSONNEL	TDL	DEPTH TO GROUND WATER (DGW) =	14.88	1/100 ft
SITE	Macon County LF Wells	LENGTH OF WATER COLUMN (LWC) = TWD - DGW =	48.12	1/100 ft
JOB #	1101-03	1 CASING VOLUME (CV) = LWC x 0.17 =	8.18	gallons
WELL ID	MW-1D	__ WELL VOLUMES = CV x __ =	1.53	gallons
WEATHER		TOTAL VOLUME OF WATER REMOVED =	12.5	gallons
AIR TEMP.		METHOD OF WELL DEVELOPMENT =	Pump	

TIME	VOLUME PURGED (gallons)	WATER TEMP (C)	pH (units)	Eh	SPECIF. COND. (umho/cm)	TURBIDITY NTU	SAND CONTENT (%)	Remarks
1455	0	15.8	6.89		490	72000		
1510	5	16.3	7.20		412	>2,000		
1525	10	17.2	7.21		515	851		
1540	12.5	18.2	7.20		499	908		

MONITORING WELL DEVELOPMENT LOG

DATE	9/24/07	TOTAL WELL DEPTH (TWD); TOP OF CASING =	71.2	1/100 ft
PERSONNEL	TDL	DEPTH TO GROUND WATER (DGW) =	59.62	1/100 ft
SITE	Macon County LF Wells	LENGTH OF WATER COLUMN (LWC) = TWD - DGW =	11.58	1/100 ft
JOB #	1101-03	1 CASING VOLUME (CV) = LWC x 0.17 =	1.97	gallons
WELL ID	MW-5D	__ WELL VOLUMES = CV x __ =	22.9	gallons
WEATHER	P. Cloudy	TOTAL VOLUME OF WATER REMOVED =	45	gallons
AIR TEMP.	76°F	METHOD OF WELL DEVELOPMENT =	Pump	

TIME	VOLUME PURGED (gallons)	WATER TEMP (C)	pH (units)	Eh	SPECIF. COND. (umho/cm)	TURBIDITY NTU	SAND CONTENT (%)	Remarks
1620	0	24.2	6.93		178	501		
1625	15	20.3	5.96		79.8	30.6		
1640	30	20.1	5.84		72.7	375		
1655	45	20.1	5.81		70.1	16.99		

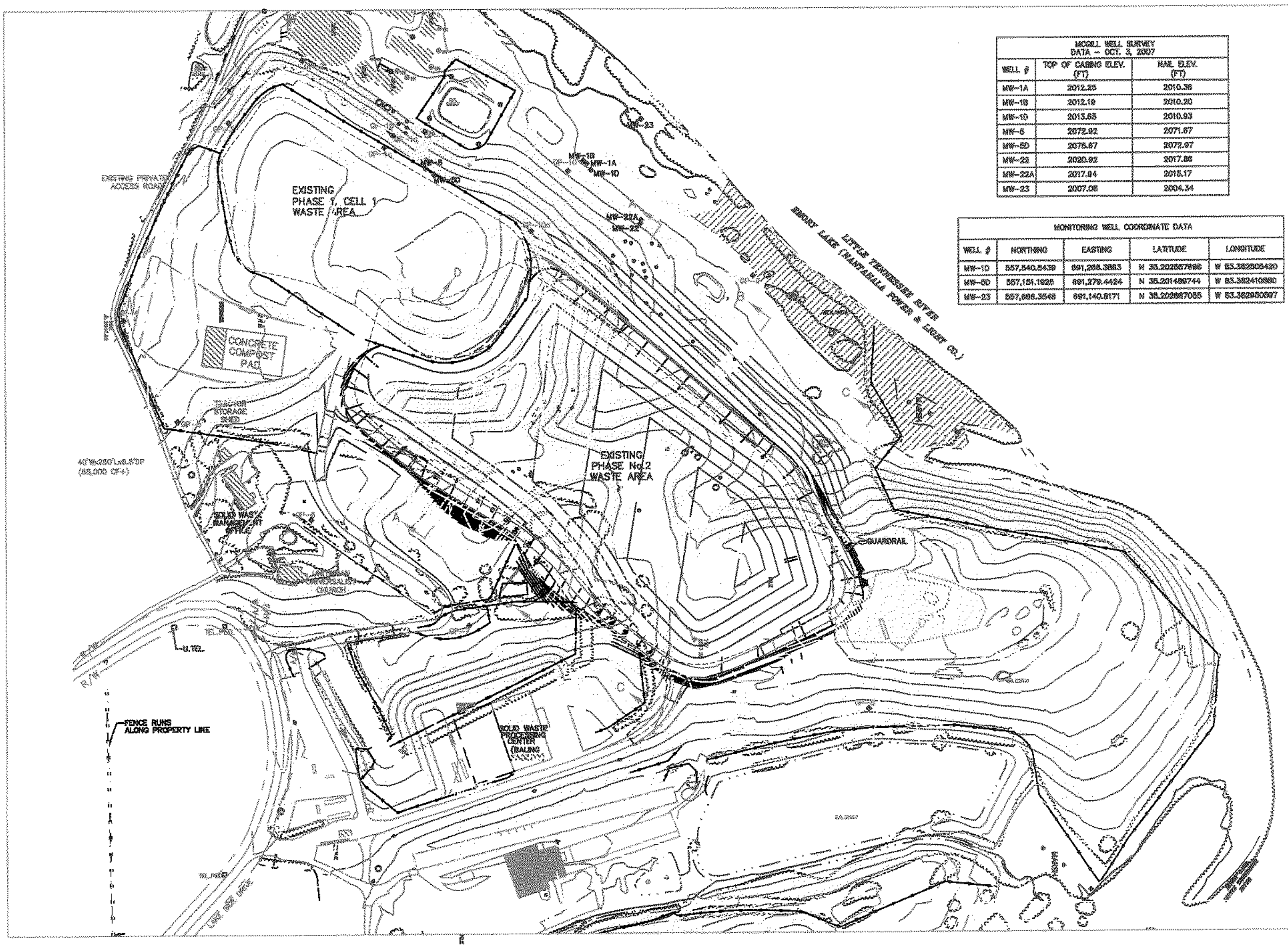
MONITORING WELL DEVELOPMENT LOG

DATE	9/24/07	TOTAL WELL DEPTH (TWD); TOP OF CASING =	31.2	1/100 ft
PERSONNEL	TDL	DEPTH TO GROUND WATER (DGW) =	5.99	1/100 ft
SITE	Macon County LF Wells	LENGTH OF WATER COLUMN (LWC) = TWD - DGW =	25.21	1/100 ft
JOB #	1101-03	1 CASING VOLUME (CV) = LWC x 0.17 =	4.29	gallons
WELL ID	MW-23	__ WELL VOLUMES = CV x __ =	10.0	gallons
WEATHER		TOTAL VOLUME OF WATER REMOVED =	43	gallons
AIR TEMP.		METHOD OF WELL DEVELOPMENT =	Pump	

TIME	VOLUME PURGED (gallons)	WATER TEMP (C)	pH (units)	Eh	SPECIF. COND. (umho/cm)	TURBIDITY NTU	SAND CONTENT (%)	Remarks
1305	0	15.1	6.36		252	133.8		
1320	10	15.7	6.19		234	112.8		
1335	23	15.3	6.16		249	58.0		
1350	23	14.2	6.12		245	42.2		
1305	33	14.7	6.16		239	63.1		
1320	43	14.5	6.15		240	24.2		

APPENDIX D

SURVEY MAP AND DATA



MCGILL WELL SURVEY DATA – OCT. 3, 2007		
WELL #	TOP OF CASING ELEV. (FT)	NAIL ELEV. (FT)
MW-1A	2012.25	2010.36
MW-1B	2012.19	2010.20
MW-1D	2013.65	2010.93
MW-5	2072.92	2071.67
MW-5D	2075.67	2072.97
MW-22	2020.92	2017.86
MW-22A	2017.94	2015.17
MW-23	2007.08	2004.34

MONITORING WELL COORDINATE DATA				
WELL #	NORTHING	EASTING	LATITUDE	LONGITUDE
MW-1D	557,540.8439	891,268.3883	N 35.202567998	W 83.382505420
MW-5D	557,151.1925	891,279.4424	N 35.201489744	W 83.382410880
MW-23	557,866.3548	891,140.8171	N 35.202867055	W 83.382950597

McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC PH. (828) 252-0575

PHASE 2, CELL 1

MACON COUNTY, NORTH CAROLINA

GROUNDWATER MONITORING WELL MAP

SHEET 1 OF 1

N.C. GRID NORTH N.A.D. 1983

TOWN OF FRANKLIN WASTEWATER TREATMENT PLANT

MW-2 2000.96

GP-2

MW-3A 2009.90

MW-3B NM

GP-3

PHASE 1 LINER EDGE

GP-1b

GP-1

GP-1a

GP-1c

MW-5 2017.72

MW-5D 2015.17

LEACHATE STORGE IMPOUNDMENT

W/L 2025.7

MW-23 2000.88

MW-1B 2002.65

MW-1A 2002.67

GP-10

MW-1D 1962.95

EXISTING PRIVATE ACCESS ROAD

CLOSED PHASE 1, CELL 1 WASTE AREA

MW-22A 2002.79

MW-22 2002.44

GP-10a

LITTLE TENNESSEE RIVER

EMORY LAKE (NANTAHALA POWER & LIGHT CO.)

MW-21 2002.69

GP-9

WETLANDS

150' GRASS BUFFER (50' REQ'D)

STORAGE

OPEN

GP-4

CONCRETE COMPOST PAD

EXISTING LINER EDGE

MW-20 2001.76

DITCH

15" CMP CULVERT

TRACTOR STORAGE SHED

GP-5

MW-19 2000.80

MW-19A 2001.18

MARSH

ACTIVE PHASE 2 WASTE AREA

MW-17 2061.83

SOLID WASTE MANAGEMENT OFFICE

GP-6

SIERRA DRIVE

MW-18 2061.96

UNITARIAN UNIVERSALIST CHURCH

MW-10 2056.10

F.H.

TEL.PED

U.TEL.

R/W

GP-7

PZ-3A NM

PZ-3 NM

PHASE 2 LINER EDGE

WOOD PALLET STOCKPILE AREA

W/L 2077.6

PZ-10 NM

PZ-10A NM

MW-13 NM

PROPANE TANK

GP-8

MW-14 2014.15

FENCE RUNS ALONG PROPERTY LINE

C&D DROP-OFF

FUTURE EXPANSION

MW-15 2015.28

YARD WASTE TREATMENT & PROCESSING AREA, (1.0 AC ±)

C&D ROLL-OFF DUMPSTERS

TIRE STORAGE TRAILERS

MW-12 NM

ROLL-OFF DUMPSTER FOR CULL/PAINTED LUMBER

RECYCLING DROP-OFF

REFRIGERANT REMOVAL & STORAGE AREA

COMPACTOR

W/L 2014.7

ACCESS BINS

CONC. PAD

WHITE GOODS PAD & LOADING AREA

TEL.PED

EXISTING SCALES

LAKE SIDE DRIVE

RECYCLING FACILITY EXPANSION

RECYCLING CENTER

BATTERIES, USED OIL & ANTI-FREEZE

MARSH

EMORY LAKE LITTLE TENNESSEE RIVER

2000 2010 2020 2030 2040 2050 2060

100 50 0 100 200

APPROXIMATE SCALE IN FEET

LEGEND

MW-23	SURVEYED LOCATION OF NEW GROUNDWATER MONITORING WELL
MW-1A	GROUNDWATER MONITORING WELL
GP-10	LANDFILL GAS MONITORING WELL
PZ-10A	PIEZOMETER
----------	WASTE LIMITS OR LINER EDGE
2010	GROUNDWATER ELEVATION CONTOUR IN FEET ABOVE MSL ON 10/16-17/2007 BY REIC
2002.65	GROUNDWATER ELEVATION IN FEET ABOVE MSL BY REIC ON 10/16-17/2007
NM	NOT MEASURED

REFERENCE:
DRAWING TITLED "GROUNDWATER MONITORING WELL MAP" BY McGILL ASSOCIATES DATED OCTOBER 2007.

REVISIONS		
No.	DESCRIPTION	BY

DRAWN: AEH
CHECKED: AWA
APPROVED:

DATE: 11-01-07
CAD FILE: MACONCLF-03GWECM
JOB NO: J07-1101-03

BLE INC.
BUNNELL-LAMMONS ENGINEERING, INC.
6004 PONDERS COURT
GREENVILLE, SOUTH CAROLINA 29615
PHONE: (864)288-1265 FAX: (864)288-5490

SITE AND GROUNDWATER ELEVATION CONTOUR MAP
MACON COUNTY LANDFILL
FRANKLIN, NORTH CAROLINA

FIGURE NO. 2

N.C. GRID NORTH N.A.D. 1983

LEGEND

MW-1A ⊕	GROUNDWATER MONITORING WELL
GP-10 ⊕	LANDFILL GAS MONITORING WELL
PZ-10A ○	PIEZOMETER
----------	WASTE LIMITS OR LINER EDGE
ND	NOT DETECTED ABOVE THE SWSL
NS	NOT SAMPLED
NA	NOT APPLICABLE/NOT ANALYZED

NOTES:

1. WELLS SAMPLED BY REIC ON 10-16-07. APPENDIX II SAMPLING LIST FOR MW-17, MW-1A AND MW-1B.
2. REMAINING WELLS SAMPLED FOR APPENDIX I LIST, METALS RESULTS NOT SHOWN.

MONITORING WELL #		MW-1B
BENZENE	ug/l	2.3
CHLOROBENZENE	ug/l	5.0
1,4-DICHLOROBENZENE	ug/l	5.7
METHYLENE CHLORIDE	ug/l	ND
VINYL CHLORIDE	ug/l	2.3
XYLENES	ug/l	ND
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	30

MONITORING WELL #		MW-1A
BENZENE	ug/l	2.2
CHLOROBENZENE	ug/l	5.1
1,4-DICHLOROBENZENE	ug/l	5.9
METHYLENE CHLORIDE	ug/l	ND
VINYL CHLORIDE	ug/l	2.2
XYLENES	ug/l	ND
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	22

MONITORING WELL #		MW-1D
BENZENE	ug/l	ND
CHLOROBENZENE	ug/l	ND
1,4-DICHLOROBENZENE	ug/l	1.3
METHYLENE CHLORIDE	ug/l	ND
VINYL CHLORIDE	ug/l	ND
XYLENES	ug/l	ND
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	NA

MONITORING WELL #		MW-5D
BENZENE	ug/l	ND
CHLOROBENZENE	ug/l	ND
1,4-DICHLOROBENZENE	ug/l	ND
METHYLENE CHLORIDE	ug/l	1.2
VINYL CHLORIDE	ug/l	ND
XYLENES	ug/l	5.8
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	NA

MONITORING WELL #		MW-17
BENZENE	ug/l	ND
CHLOROBENZENE	ug/l	ND
1,4-DICHLOROBENZENE	ug/l	ND
METHYLENE CHLORIDE	ug/l	ND
VINYL CHLORIDE	ug/l	ND
XYLENES	ug/l	ND
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	18

REFERENCE:
DRAWING TITLED "GROUNDWATER MONITORING WELL MAP" BY McGILL ASSOCIATES DATED OCTOBER 2007.

100 50 0 100 200
APPROXIMATE SCALE IN FEET

REVISIONS		
No.	DESCRIPTION	BY

DRAWN:	AEH
CHECKED:	AWA
APPROVED:	

DATE:	12-03-07
CAD FILE:	MACONCLF-03GWCOC
JOB NO:	J07-1101-03

BLE INC.
BUNNELL-LAMMONS ENGINEERING, INC.
6004 PONDERS COURT
GREENVILLE, SOUTH CAROLINA 29615
PHONE: (864)288-2965 FAX: (864)288-4480

LABORATORY ANALYSIS DATA – VOCs AND SVOCs ONLY ON 10/16/07
MACON COUNTY LANDFILL
FRANKLIN, NORTH CAROLINA

FIGURE NO. 3