

Attachment I

LFG Monitoring Plan

**Martin County, North Carolina
C&D Landfill (Permit No. 59-01)
Permit Amendment Application**

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Landfill Gas Monitoring Plan

Martin County C&D Landfill
Williamston, North Carolina
NC Solid Waste Permit No. 59-01 CDLF



Prepared for:
Martin County Solid Waste Management
P.O. Box 668
Williamston, NC 27892

January 2012



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LANDFILL GAS MONITORING PLAN

**Martin County C&D Landfill
Williamston, North Carolina
NC Solid Waste Permit No. 59-01**

Prepared for:



**Martin County Solid Waste Management Dept.
Williamston, North Carolina**

RSG Project No. **Martin-11-1**



Joan A. Smyth, P.G.
Senior Hydrogeologist



January 2012



14 N. BOYLAN AVENUE
RALEIGH, NORTH CAROLINA 27603
NC LICENSE NO. C-0828 (ENGINEERING)

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MARTIN COUNTY C&D LANDFILL
NC SOLID WASTE PERMIT NO. 59-01

LANDFILL GAS MONITORING PLAN
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MARTIN COUNTY C&D LANDFILL
NC SOLID WASTE PERMIT NO. 59-01

LANDFILL GAS MONITORING PLAN

1.0 INTRODUCTION

1.1 Project Description

This Landfill Gas Monitoring Plan (Plan) has been prepared by Richardson Smith Gardner & Associates, Inc. (RSG) to present a comprehensive landfill gas (LFG) monitoring program at the Martin County C&D Landfill (NC Solid Waste Permit 59-01). The site is located on Landfill Road in Williamston, North Carolina as shown in **Figure 1**. The proposed plan presents the rationale for the monitoring program as well as necessary actions required by the Owner to protect and safeguard the area surrounding the C&D landfill and to satisfy North Carolina Solid Waste Management Rules [13B.0544(d)] for monitoring and controlling LFG.

At a minimum, these regulations require owners of landfills to ensure that the facility does not exceed:

- *25% of the lower explosive limit (LEL) or 1.25% CH₄ by volume in structures; and*
- *100% of the LEL or 5% CH₄ by volume at the facility property boundary.*

The Engineer has utilized the best available site data, practices, experience, and judgment to develop this plan. However, the program may require modifications and maintenance over time to accommodate changing landfill conditions, changing receptors in areas adjacent and around the landfill, or other conditions that cannot be fully anticipated. Maintenance suggestions are also included in this plan to assist in the identification of secondary conditions that may require updates to this Plan.

Uncontrolled migration of LFG can result in loss of property, loss of life, injury, vegetative damage, and intolerable odors. The monitoring of landfills includes exposure to explosive gases. All operational and/or monitoring staff should be specifically trained in the management and response for situations such as fire or explosion, confined space, drilling, and overhead hazards, and possess an awareness of changing conditions around these sites.

1.2 Contact Information

In case of emergencies, or if questions arise during the implementation of this program, please contact the following:

1.2.1 Owner

Martin County Integrated Solid Waste Management Department
1445 Landfill Road
Williamston, NC 27892
Phone: (252) 792-1240
Director of Solid Waste Management: Maurice Robinson
email: mrobinson@martincountyncgov.com

1.2.3 *Engineer*

Richardson Smith Gardner & Associates, Inc.

14 N. Boylan Avenue

Raleigh, North Carolina 27603

Phone: (919) 828-0577

Ms. Joan A. Smyth, P.G., Senior Hydrogeologist

email: joan@rsgengineers.com

Mr. Pieter K. Scheer, P.E., Senior Engineer

email: pieter@rsgengineers.com

1.2.4 *Solid Waste Regulatory Agency*

North Carolina Department of Environment and Natural Resources

Division of Waste Management:

North Carolina DENR - Fayetteville Regional Office (FRO)

225 Green Street, Suite 714

Fayetteville, NC 28301

Phone: (910) 486-1541

Fax: (910) 486-0707

North Carolina DENR - Raleigh Central Office (RCO)

1646 Mail Service Center

Raleigh, NC 27699-1646

217 West Jones Street

Raleigh, NC 27603

Phone: (919) 707-8200

Division of Waste Management (DWM) - Solid Waste Section:

Field Operations Branch Head:

Mark Poindexter (RCO)

Eastern District Supervisor:

Dennis Shackelford (FRO)

Waste Management Specialist:

Ben Barnes ((252) 459-4502)

1.3 **Existing Site Conditions**

The facility operates as a Construction and Demolition (C&D) landfill. Facilities located on the property include:

- A closed municipal solid waste (MSW) landfill;
- C&D Landfill;
- Wood Waste Processing Area;
- White Goods Handling Area;
- Used Tire Storage Area;

- Used Pesticide Container Storage Building; and
- Office and Scalehouse.

1.3.1 Topography

The landfill site lies in the midst of two water features which are located to the north, east and west of the landfill as shown in **Figure 1**. Existing ground surface elevations range from El. 36 (feet mean sea level) near the unnamed tributary to El. 76 at the top of the C&D landfill. In general the surrounding topography of the area is relatively flat and is typical of the Coastal Plain Physiographic Province.

1.3.2 Adjacent Areas

Access to the C&D landfill areas is via McCaskey and Landfill Roads from Williamston. The surrounding area is predominantly undeveloped with the nearest structure being a home located approximately 1,270 feet from the southwest edge of the C&D landfill.

1.3.3 Site Geology

The Martin County landfill is located off McCaskey Road near Williamston in the Coastal Plain Physiographic Province. According to the Geologic Map of North Carolina (1985) this area is underlain by the Yorktown Formation. The Yorktown Formation is characterized by fossiliferous clay with varying amounts of fine-grained sand, bluish gray, shell material commonly concentrated in lenses.

1.4 Regulatory Status

According to 15A NCAC 13B.0544(d), a gas control plan is required for C&D landfills. This landfill gas monitoring plan is prepared in accordance with NCDENR's landfill gas monitoring guidance¹.

2.0 MONITORING PROGRAM

2.1 Perimeter Monitoring Network

2.1.1 Introduction

The monitoring network for the Martin County C&D Landfill includes two (2) proposed LFG monitoring wells (LFG-1 and LFG-2) are shown on **Figure 2**. The perimeter LFG monitoring system is designed with wells located to intercept potential migrating LFG in the direction of potential receptors.

¹ NC Dept. Of Environment and Natural Resources Solid Waste Section Landfill Gas Monitoring Guidance, November 2010.

2.1.2 Well Placement

The LFG monitoring well locations have been evaluated based on the surrounding area conditions, soil types, location of waste on property, and nearby bodies of water. As described below:

- The closest residence is located approximately 1,270' to the southwest of the C&D landfill (see **Figure 1**); and
- Surface water located north, east and west of the C&D landfill. Surface water will prevent the migration of LFG in the subsurface in this area.

These conclusions directed the placement of proposed LFG monitoring wells in the areas shown on **Figure 2**. These should be sufficient to monitor subsurface LFG migration in the vicinity of the C&D landfill. Additionally, site structures including the scalehouse, and offices will be monitored.

2.1.3 Monitoring Well Construction

The LFG monitoring wells will be installed using a Geoprobe™ rig and will be constructed of two-inch diameter, manufactured PVC well screens with 10-slot per inch intake spacings to the approximate depth of groundwater. Wells will be completed with five (5) to 10 feet of solid PVC riser pipe below grade. A sand filter pack will be placed around each screened interval, to a height of up to two (2) feet above the screen, and a hydrated bentonite plug of two (2) to five (5) feet in thickness will be placed above the sand pack to seal each well. Wells will be completed with a steel protective casing and a cement pad for surface protection as shown on **Figure 3**. Each well casing will be distinguishable as a LFG monitoring well rather than an on-site ground water monitoring well. A “female” Colder® type quick-connect (or equivalent) fitting will be installed on the PVC portion of the well or in the cap as a monitoring port. Once the LFG monitoring wells are completed, the boring logs will be submitted to NCDENR and Martin County under separate cover. This information will also be added to **Appendix A** of this plan.

2.2 Monitoring and Reporting

Monitoring and reporting of LFG gas concentrations shall be performed in accordance with guidance by the Division of Waste Management document “[Methane Monitoring Guidance](http://www.wastenotnc.org/swhome/met_mon.html)” (www.wastenotnc.org/swhome/met_mon.html) and as outlined below.

2.3.1 Frequency

LFG monitoring will be completed on a quarterly frequency. Monthly, or more frequent, monitoring may be necessary if concentrations are close to the regulatory levels or demonstrate a pattern which indicates that it may be approaching this limit.

2.3.2 Personnel

LFG monitoring will be performed by trained personnel knowledgeable of the LFG hazard and the use of explosive gas meters. A designated landfill technician will be assigned to regular LFG monitoring duty. If site personnel perform the monitoring, annual training shall be performed and documented on the LFG monitoring training log, provided in **Appendix B**, to refresh personnel on any site changes or updates to this plan.

2.3.3 Equipment

A combustible gas indicator will be used for monitoring (Landtec Gem 2000, or equivalent). This meter operates using the infra-red spectral property of methane (CH₄) to measure concentrations in air below the LEL.

The meter will have Tygon tubing, including a “male” Colder® type quick-connect (or equivalent) fitting, attached to the inlet.

2.3.4 Procedures

Each monitoring event should begin by calibrating the gas meter with a known calibration standard in accordance with manufacturer’s recommendations and operated only as instructed.

Procedures for the LFG monitoring wells should include the following:

- Check calibration date on the meter;
- Perform “bump test” against known gas concentration;
- Connect tubing to sample port on the monitoring well without removing the cap;
- Record data on the monitoring log form provided in **Appendix C**; and
- If less than 50% LEL, move to next LFG monitoring well.

- * If explosive gas concentrations **equal to or greater than 50%** of the LEL in any of the LFG monitoring wells, personnel should implement Precautionary Action Plan located in **Section 2.3.5**.

IF EXPLOSIVE GAS CONCENTRATIONS EQUAL TO OR GREATER THAN 100% OF THE LEL IN ANY OF THE LFG MONITORING WELLS, THE FOLLOWING ACTIONS WILL BE TAKEN BY PERSONNEL:

- (1) **Immediately** contact the Solid Waste Director.
- (2) Recalibrate monitoring equipment and confirm results.
- (3) If concentrations still exceed 100% LEL, Martin County and the Engineer will implement the Compliance Action Plan located in **Section 3.2**.

2.3.5 *Precautionary Action Plan*

If explosive gas concentrations are **equal to or greater than 50%** of the LEL in any of the LFG monitoring wells, personnel should perform the following additional steps:

- Monitor gas pressure in each well head (in inches of water) using magnehelic gauge or other appropriate metering device;
- Monitor initial gas concentration through sampling port;
- Open well cap and allow to stabilize for at least three (3) minutes;
- Monitor gas concentration inside well just below the top of casing; and
- Evaluate surrounding areas for potential receptors to or signs of LFG migration. LFG can stress vegetation, and can kill trees and grass by root asphyxiation. Note any areas of stressed/dead vegetation on the monitoring form.

Monitoring should be completed in this manner for all wells with concentrations equal to or greater than 50% LEL during all monitoring events. This information should be recorded, kept in the operating record, and reported to the Solid Waste Director and to the Engineer for further evaluation.

2.3.6 *Record Keeping*

All readings will be documented on the LFG monitoring log form provided in **Appendix C**. The completed forms will be reviewed and initialed by the County Solid Waste Director following each monitoring event and placed in the landfill operating records. The monitoring logs will remain on file with other landfill records in the landfill office (see **Section 1.2.1**). These readings should be available for review by NCDENR personnel upon request.

If readings above 100% LEL are measured, a copy of the LFG monitoring form and an Environmental Data Reporting Form (also provided in **Appendix C**) will be submitted to NCDENR. A copy shall be kept in the landfill operating records.

2.4 **Maintenance**

In addition to the monitoring program, periodic maintenance and site observations will be conducted to the program components as follows (at a minimum):

- Factory calibration of the gas meter;
- Maintaining access to monitoring wells;
- Observing landfill cover conditions, potential erosion areas, landfill seeps, odors, etc.;
- Monitoring well maintenance such accessibility, operational locks, steel casing and concrete pad conditions, etc.

Any deficiencies shall be noted on the monitoring forms and reported to the Solid Waste

Director for repair or replacement as necessary.

3.0 CONTINGENCY PLAN

3.1 Introduction

In the event explosive gas concentrations exceed safe levels (>100% LEL), a contingency plan is recommended and warranted. The contingency plan includes the specific step by step actions that should be implemented to protect human health and the environment.

3.2 Compliance Action Plan

If explosive gas concentrations **equal to or greater than 100%** of the LEL in any of the LFG monitoring wells, the following actions shall be taken by personnel:

3.2.1 Immediate Action Plan

The Solid Waste Director will take immediate action to ensure the protection of human health and safety as follows:

- (1) Determine potential receptors surrounding the site;
- (2) If warranted by the degree of intensity of the LFG concentration, check the LFG concentrations in structures of receptors surrounding the site, such as the scalehouse, maintenance building, and offices;
- (3) If further warranted by the degree of intensity (>25% LEL) of the LFG concentration in structures, evacuate the area;
- (4) Contact the County Fire Marshal;
- (5) Notify verbally the DWM Waste Management Specialist and the District Supervisor (See Section 1.2.4);
- (6) Investigate and identify the source(s) and conduit(s) for LFG migration that have caused the excessive readings (i.e. the path that the LFG is taking to the monitoring location);
- (7) Identify the extent of the LFG problem through additional wells or bar hole punch sampling methodology; and
- (8) As appropriate, begin to take corrective action to control the LFG levels in building(s) surrounding the landfill site.

3.2.2 Reporting and Documentation

Following the **Immediate Action Plan**, the County must take the following actions within seven (7) days:

- (1) Place documentation of the **Immediate Action Plan** in the operating records of the landfill; and,
- (2) Provide documentation of the **Immediate Action Plan** and a description of the steps taken to protect human health in writing to the DWM Waste Management Specialist and the District Supervisor (see **Section 1.2.4**)

It is also suggested that at this time, a plan be developed which:

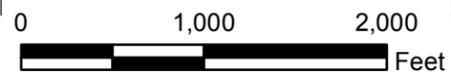
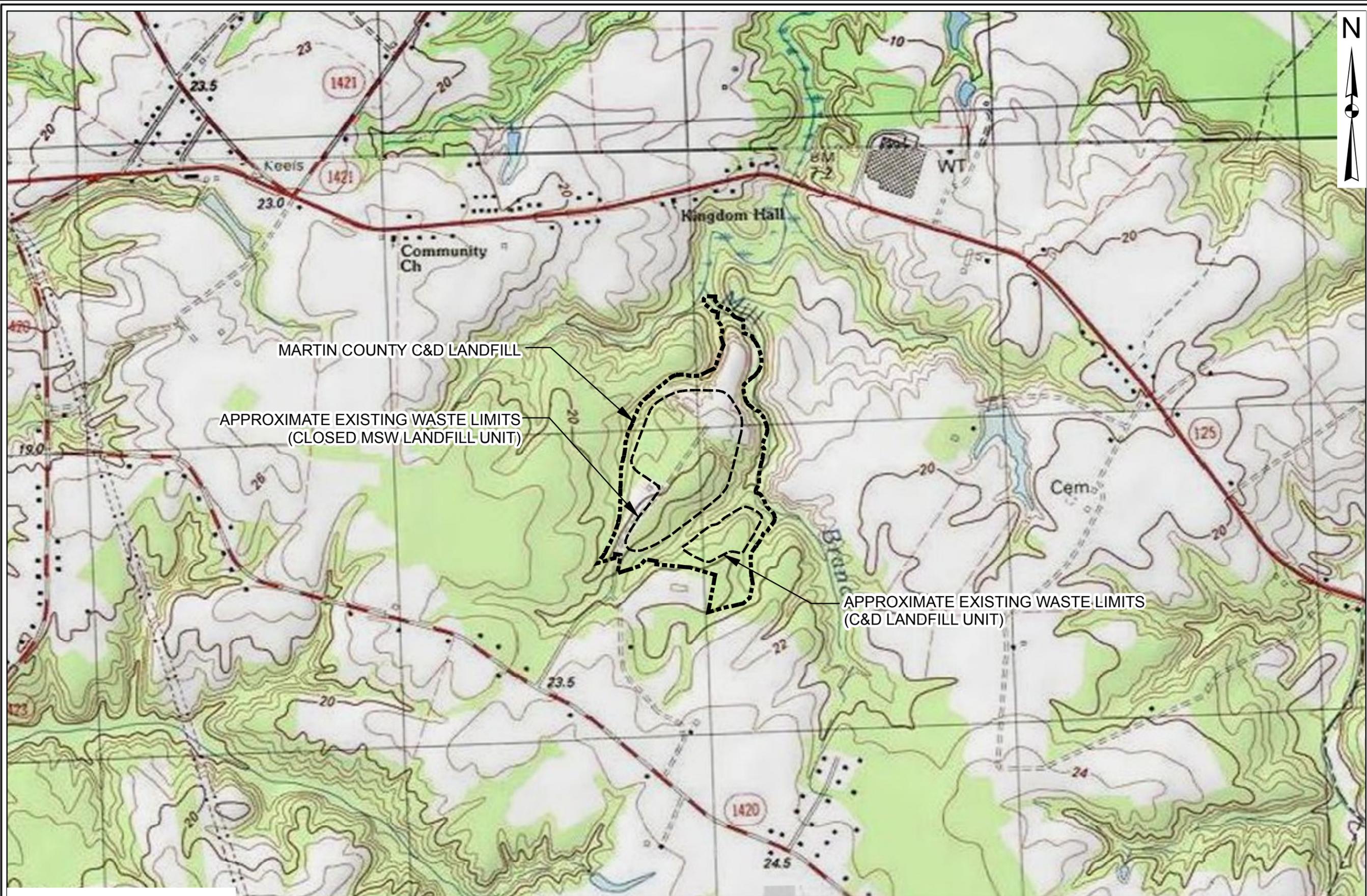
- Describes the nature and extent of the problem; and
- Proposes future actions to access/remediate the problem.

3.2.3 *Remediation Plan*

In the event the prolonged explosive gas concentrations exist and as identified during the **Immediate Action Plan**, the County shall prepare and implement a Remediation Plan to mitigate the migration of landfill gas off property. Extensions may be granted by the Division of Waste Management upon written request and depending on severity of the situation.

FIGURES

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REFERENCE: TOPOGRAPHY FROM U.S.G.S. 7.5 MIN. QUADRANGLES "WILLIAMSTON, NC", PHOTOREVISED 1982, AND "QUITSNA", PHOTOREVISED 2002.

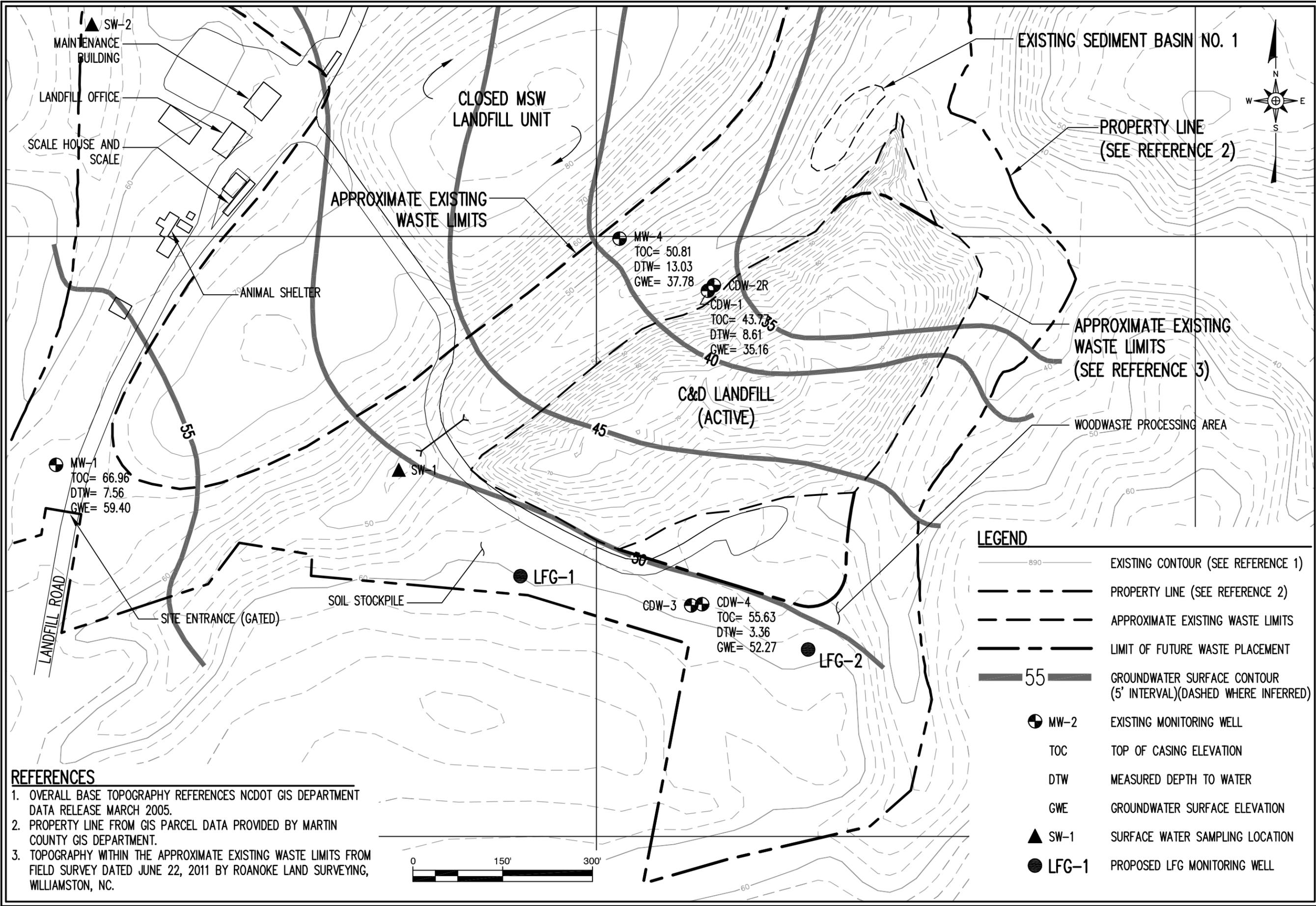

RICHARDSON SMITH GARDNER & ASSOCIATES
 ENGINEERING & GEOLOGICAL SERVICES

FIGURE NO.	1	FILE NAME	MARTIN-B0013
SCALE:	AS SHOWN	PROJECT NO.	MARTIN 11-2
CHECKED BY:	J.A.S.	DATE:	JAN. 2012
DRAWN BY:	C.T.J.		

MARTIN COUNTY C&D LANDFILL
SITE VICINITY MAP

TITLE:

G:\CAD\Martin County\Martin 11-2\sheet\MARTIN-B0010.dwg - 1/26/2012 10:42 AM



REFERENCES

1. OVERALL BASE TOPOGRAPHY REFERENCES NCDOT GIS DEPARTMENT DATA RELEASE MARCH 2005.
2. PROPERTY LINE FROM GIS PARCEL DATA PROVIDED BY MARTIN COUNTY GIS DEPARTMENT.
3. TOPOGRAPHY WITHIN THE APPROXIMATE EXISTING WASTE LIMITS FROM FIELD SURVEY DATED JUNE 22, 2011 BY ROANOKE LAND SURVEYING, WILLIAMSTON, NC.



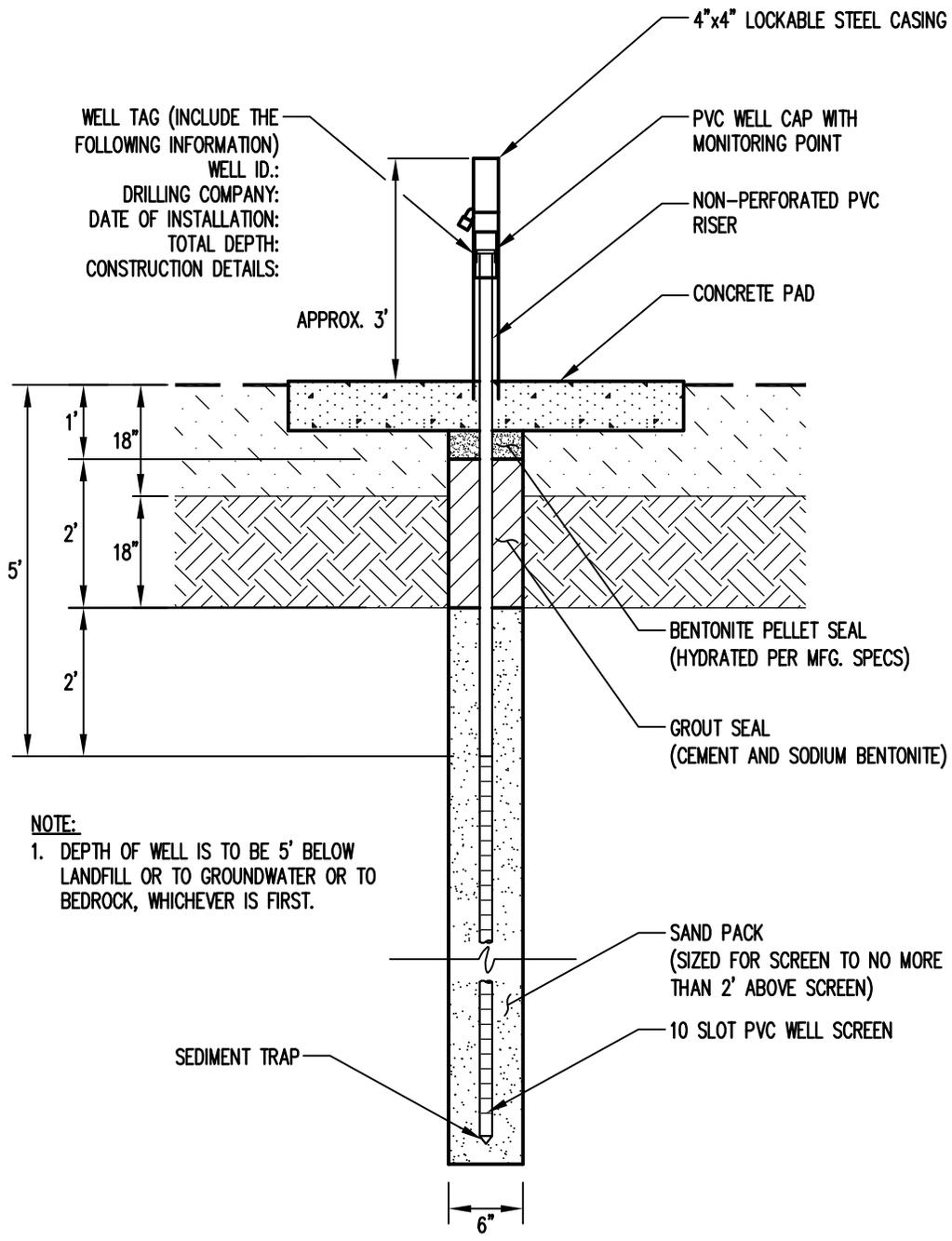
LEGEND

- EXISTING CONTOUR (SEE REFERENCE 1)
- PROPERTY LINE (SEE REFERENCE 2)
- APPROXIMATE EXISTING WASTE LIMITS
- LIMIT OF FUTURE WASTE PLACEMENT
- 55 GROUNDWATER SURFACE CONTOUR (5' INTERVAL)(DASHED WHERE INFERRED)
- MW-2 EXISTING MONITORING WELL
- TOC TOP OF CASING ELEVATION
- DTW MEASURED DEPTH TO WATER
- GWE GROUNDWATER SURFACE ELEVATION
- SW-1 SURFACE WATER SAMPLING LOCATION
- LFG-1 PROPOSED LFG MONITORING WELL

RICHARDSON SMITH GARDNER & ASSOCIATES
 P.L.L.C.
 14 N. Boylan Ave.
 Raleigh, N.C. 27603
 www.rsgengineers.com
 ph: 919-826-0577
 fax: 919-826-3899

CHECKED BY:	J.A.S.	PROJECT NO.:	MARTIN 11-2
SCALE:	AS SHOWN	FILE NAME:	MARTIN-B0010
FIGURE NO.:	2	DATE:	Jan. 2012

TITLE:
PROPOSED LANDFILL GAS MONITORING WELL LOCATIONS



LFG MONITORING WELL DETAIL



RICHARDSON SMITH GARDNER & ASSOCIATES
 14 N. Boylan Ave.
 Raleigh, N.C. 27603
 NC LIC. NO. C-0828 (Engineering)
 www.rsgengineers.com
 ph: 919-828-0577
 fax: 919-828-3899

SCALE: AS SHOWN	DRAWN BY: W.R.B.	CHECKED BY: J.A.S.	DATE: Jan. 2012	PROJECT NO. MARTIN 11-1	FIGURE NO. 3	FILE NAME MARTIN-A0014
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APPENDIX A
BORING LOGS

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APPENDIX B
ANNUAL TRAINING LOG

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LFG MONITORING TRAINING LOG
(This log must be completed annually if on-site personnel perform LFG monitoring)

**MARTIN COUNTY C&D LANDFILL
WILLIAMSTON, NORTH CAROLINA
NC SOLID WASTE PERMIT NO. 59-01**

INSTRUCTOR INFORMATION:

Name(s): _____

Company: _____

Address: _____

TRAINING INFORMATION:

Date(s) (MM/DD/YYYY): _____

Program Content: _____

Instrument Type(s): _____

ATTENDANCE:

<u>Name</u>	<u>Title</u>	<u>Training Date</u>	<u>Trainee Signature</u>	<u>Instructor Initials</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Instructor Signature: _____ Date: _____

Martin County Representative Signature: _____ Date: _____

Note: This form should be maintained in the landfill operating record.

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APPENDIX C

MONITORING LOG AND REPORTING FORM

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NC Division of Waste Management - Solid Waste Section

Landfill Gas Monitoring Data Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Facility Name: _____ Permit Number: _____

Date of Sampling: _____ NC Landfill Rule (.0500 or .1600): _____

Name and Position of Sample Collector: _____

Type and Serial Number of Gas Meter: _____ Calibration Date of Gas Meter: _____

Date and Time of Field Calibration: _____

Type of Field Calibration Gas (15/15 or 35/50): _____ Expiration Date of Field Calibration Gas Canister: _____

Pump Rate of Gas Meter: _____

Ambient Air Temperature: _____ Barometric Pressure: _____ General Weather Conditions: _____

Instructions: Under "Location or LFG Well" identify the monitoring wells or describe the location for other tests (e.g., inside buildings). A drawing showing the location of test must be attached. Report methane readings in both % LEL and % methane by volume. A reading in percent methane by volume can be converted to % LEL as follows: % methane by volume = % LEL/20

Location or LFG Well ID	Sample Tube Purge	Time	Time Pumped (s)	Initial %LEL	Stabilized %LEL	%CH4 by Volume	%O2	%CO2	Notes

If your facility has more gas monitoring locations than there is room on this form, please attach additional sheets listing the same information as contained on this form.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

SIGNATURE

TITLE

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DENR USE ONLY:

Paper Report

Electronic Data - Email CD (data loaded: Yes / No)

Doc/Event #:

NC DENR

Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- Prepare one form for each individually monitored unit.
- Please type or print legibly.
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i)).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: _____ Phone: _____

E-mail: _____

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)

Environmental Status: (Check all that apply)

Initial/Background Monitoring Detection Monitoring Assessment Monitoring Corrective Action

Type of data submitted: (Check all that apply)

Groundwater monitoring data from monitoring wells Methane gas monitoring data
 Groundwater monitoring data from private water supply wells Corrective action data (specify) _____
 Leachate monitoring data
 Surface water monitoring data Other(specify) _____

Notification attached?

- No. No groundwater or surface water standards were exceeded.
- Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
- Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Facility Representative Name (Print)

Title

(Area Code) Telephone Number

Affix NC Licensed/ Professional Geologist Seal

Signature

Date

Facility Representative Address

NC PE Firm License Number (if applicable effective May 1, 2009)

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