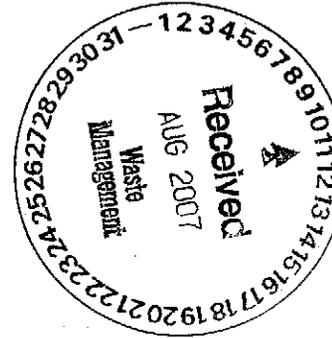




RCO 2906

August 10, 2007

Ms. Jaclynne Drummond  
Division of Waste Management - Solid Waste Section  
401 Oberlin Road, Suite 150  
Raleigh, NC 27605



Re: Submittal of Methane Monitoring Plan  
Lee County Landfill - Sanford, NC  
NCDWM-Solid Waste Section Permit # 53-01  
TerraQuest Project No. 02296

Dear Ms. Drummond:

On behalf of the Lee County Public Works Department, TerraQuest Environmental Consultants, P.C. hereby submits the enclosed Methane Monitoring Plan for the Lee County Landfill located south of Sanford, NC. The Plan proposes the number and placement of future methane gas monitoring points based upon the findings of our study. A monitoring schedule is also outlined in the Plan. Finally, a Contingency Plan is detailed, in the event that certain methane gas concentrations are observed.

Please review the enclosed Plan. Following your review, I welcome a telephone discussion or a face to face meeting to discuss any comments or concerns you have regarding the Plan. I can be reached at (919) 932-1590 for such discussions or to arrange a meeting. I would be happy to meet you at your office at your convenience. Once the Plan meets with your approval, please provide written acceptance of the Plan to the Lee County Public Works Department so that implementation of the Plan can begin.

Thanks so much for your help on this project!

Sincerely,

TERRAQUEST ENVIRONMENTAL CONSULTANTS, P.C.

Ryan D. Kerins  
Project Manager

Enclosure: Methane Monitoring Plan

Cc: Joe Cherry - Lee County Public Works Department



## METHANE MONITORING PLAN

LEE COUNTY LANDFILL  
331 LANDFILL ROAD  
SANFORD, LEE COUNTY, NORTH CAROLINA, 28355

Latitude: 32.22050° N Longitude: 79.11550° W

NCDWM-SW Permit No. 5301

**Responsible Party/Property Owner:**

Lee County Department of Public Works  
805 S. Fifth Street  
Sanford, NC 27331

TerraQuest Project No. 02296

August 10, 2007

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**CERTIFICATION FOR THE SUBMITTAL  
OF AN ENVIRONMENTAL / GEOLOGICAL ASSESSMENT**

Attached is the Methane Monitoring Plan for:

Site Name: Lee County Landfill  
Address: 331 Landfill Road  
City: Sanford State: NC Zip Code: 27331

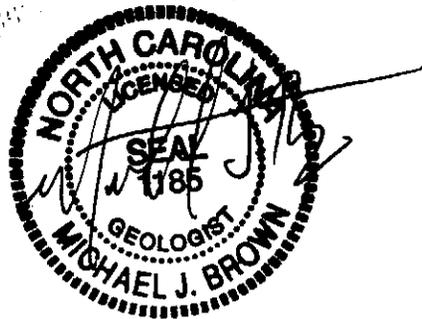
Responsible Party: Lee County Department of Public Works  
Address: 805 S. Fifth Street  
City: Sanford State: NC Zip Code: 27331

I, Michael J. Brown, a Licensed Geologist in the State of North Carolina for TERRAQUEST ENVIRONMENTAL CONSULTANTS, P.C. do hereby certify that I am familiar with and have reviewed all material including figures within this report and that to the best of my knowledge the data, site assessments, figures, and other associated materials are correct and accurate. All work was performed under my direct supervision. My seal and signature is affixed below. Additional seals and/or signatures are also affixed below.

**TERRAQUEST ENVIRONMENTAL CONSULTANTS, P.C.**



Ryan D. Kerins  
Project Manager



Michael J. Brown, P.G.  
President

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### TABLE

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### APPENDICES

- A. Technical Methods/Standard Procedures and Environmental Acronyms
- B. Typical Type II Monitoring Well Detail

## **1.0 INTRODUCTION**

On behalf of the Lee County Public Works Department, TerraQuest Environmental Consultants, P.C. has prepared this Methane Monitoring Plan for the landfill located in Lee County, North Carolina that has the NCDWM-SW permit number 5301. The Methane Monitoring Plan addresses those regulations for construction and demolition landfills that are contained within 15A NCAC 13B .0531 – .0547 which became effective on January 1, 2007. Note that the previously closed municipal solid waste landfill that operated adjacent to the currently active construction and demolition landfill was closed in 1993. No methane monitoring has occurred since closure. This Plan will incorporate the closed municipal solid waste landfill into the monitoring, so that both sites are monitored as requested by the NCDWM-SW.

The site location and surrounding cultural features are depicted in Figure 1. The site vicinity is depicted in Figure 2 and the site's layout is depicted in Figure 3. Technical methods and standard procedures practiced by TerraQuest personnel are detailed in Appendix A along with an explanation of environmental acronyms used in this report.

## **2.0 BACKGROUND**

The Lee County Landfill has operated under permit number 5301 mainly in two different capacities. The original landfill, closed in 1993, accepted municipal solid waste. The "newer" construction and demolition portion of the landfill opened around the same time and is still in operation. The various MSW and C&D cells at the property are approximated on Figure 4. Note that the cells shown on this map were adapted from a map titled "LEE COUNTY LANDFILL" generated by Bracken & Associates dated 11/23/92 that is on file with the NCDWM-SW. The landfill property itself is compromised of several different tax parcels as shown in Table 1. Table 1 also lists information concerning the property owners surrounding the landfill. The tax parcel identification numbers provided on Figure 2 correspond with the information provided in Table 1.

### 3.0 SITE GEOLOGY/HYDROGEOLOGY

The geology and hydrogeology of the landfill and surrounding area is briefly discussed in this section. The discussion is necessary as both the geology and hydrogeology could effect the generation and/or transportation of methane or other combustible gases at the landfill. The following summarizes previous geologic investigations conducted by others at the site as well as published geologic information of the area.

#### GEOLOGY SUMMARY:

The landfill lies on the western edge of the Coastal Plain Physiographic Province. The area has been mapped as underlain by the Middendorf Formation that was deposited in the Cretaceous Period (Brown, et. al., 1985). The Middendorf Formation is composed of sand, sandstone, and mudstone that is gray to pale gray with an orange cast. Bedding is laterally discontinuous and cross bedding is common.

In a *Report of Geotechnical Exploration* on file with the NCDWM-SW, the Law Engineering Testing Company documented the geology they encountered in the area of the current C&D portion of the landfill (Law Engineering Testing Company, 1986). The geology was confirmed as surficial sands of the Middendorf Formation and weathered material of the Carolina Slate Belt rocks.

In Patterson Exploration Service's *Geologic and Geotechnical Evaluation of the Proposed C&D Landfill* that was submitted in McKim & Creed's *Closure Plan for the Lee County (MSW) Landfill Site* (McKim & Creed, 1993), Patterson noted that: "*Based on our observations, a typical sequence, from bottom to surface, is as follows: orange to red to yellow clayey silty SAND to tan silty sandy CLAY overlain by orange to red clayey silty SAND with clay streaks, overlain to surface by fine-to-medium grained sand at the surface.*"

### HYDROGEOLOGY SUMMARY:

The hydrogeology at the site and surrounding area is dominated by the Cape Fear River Basin. Based on groundwater elevation data collected during historical semi-annual sampling events, groundwater flow at the landfill has been calculated to flow to the southeast toward Mare Branch Creek. Mare Branch Creek is listed as a Class C surface water body from its source to Juniper Creek by the NCDWQ. Class C surface water bodies are defined by the NCDWQ (<http://h2o.enr.state.nc.us/csu/swc.html#C>) as: "*Waters protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture and other uses suitable for Class C. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. There are no restrictions on watershed development or types of discharges.*" From Juniper Creek, flow is directed downstream to the Upper Little River and eventually discharges into the Cape Fear River.

### GEOLOGY IMPLICATIONS:

A review of the geology encountered by others did not reveal any geologic features that could act as conduits capable of conveying combustible gases to onsite or offsite areas where they could accumulate in harmful concentrations. While there may be unidentified clay/sand bed interfaces that could act as channels for gases, no such areas have been identified to date. Also, the organic content of the reported native lithologies does not appear high enough to generate harmful concentrations of methane or other such combustible gases due to its own degradation.

### HYDROGEOLOGY IMPLICATIONS:

The presence of Mare Branch Creek likely provides a natural barrier for any gases seeking to escape the landfill on the southern portion of the property. The generally shallow (average of 7.5 feet below ground level in April 2007) depth to water noted across the site limits the available vadose-zone soil that can accumulate combustible gases. Combustible gas transport through groundwater flow is not expected.

## **4.0 BASIS OF METHANE MONITORING PLAN**

The goal of this Methane Monitoring Plan is to identify potential areas where elevated levels of methane and other volatile organic vapors generated through decomposition of the landfill material might accumulate. That information will be used to establish a network of methane gas monitoring points. The Plan will also provide a schedule to monitor the potential vapors and outline a contingency plan should vapors be detected at concentrations that exceed the regulatory levels.

### **4.1 Sensitive Area Investigation**

The NCDWM-UST requires that the Methane Monitoring Plan site the number and location of methane monitoring points based upon:

1. the landfill's design,
2. the subsurface stratigraphy,
3. the proximity of buildings, dwellings, and natural barriers.

#### **4.1.1 Monitoring Points – Landfill Design**

On June 15, 2007, TerraQuest personnel visited the NCDWM-SW's headquarters located in Raleigh, NC. During this visit, both the active C&D and the closed MSW files were reviewed. The files contained previously submitted reports on the design and construction of the landfill along with numerous regulatory correspondences concerning operations. Based upon information contained in these files, TerraQuest has generated Figure 4 showing the cells the former MSW landfill was divided into along with the location of the currently active C&D landfill. No structures were noted in the landfill design that would act as direct channels for combustible gases.

#### **4.1.2 Monitoring Points – Subsurface Stratigraphy**

The subsurface stratigraphy does not contain any known geologic or man-made features that would factor into the placement of monitoring points.

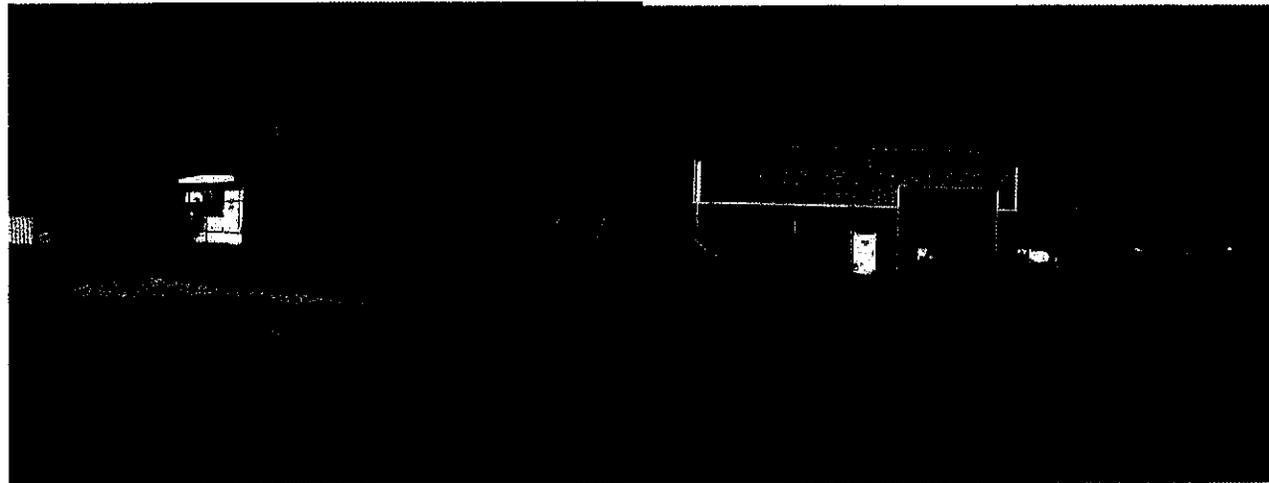
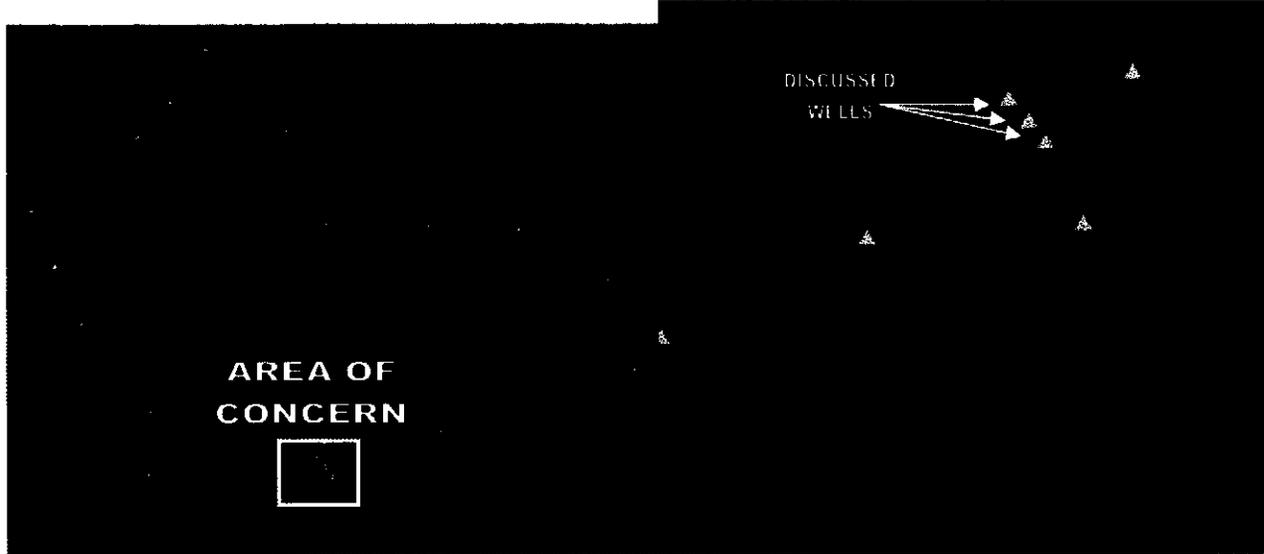
#### **4.1.3 Monitoring Points – Proximity of Buildings, Dwellings, and Natural Barriers**

Part of the determination of the number and location of methane monitoring wells proposed in this Plan involved a review of recent aerial photography collected in February of 2007. The aerial orthophoto, incorporated into Figure 4, was obtained from the Lee County Department of Strategic Services. After studying the orthophoto, TerraQuest personnel walked the property boundary of the Landfill on July 2, 2007 to check for any other areas, unseen on the Figure, that would have the potential to accumulate methane vapors.

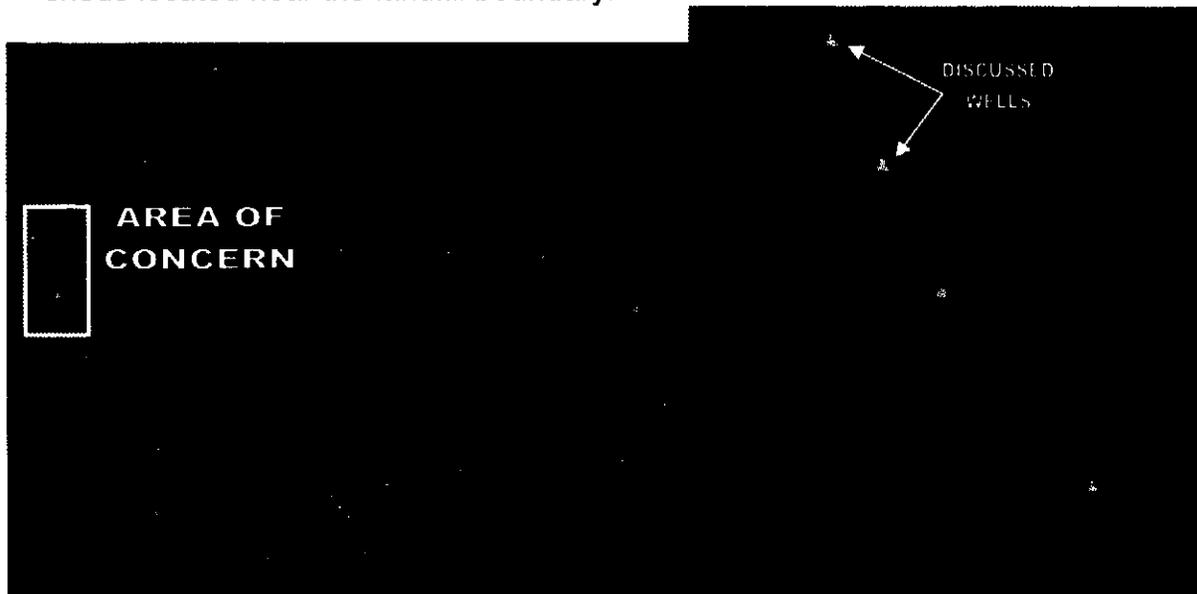
#### **4.1.4 Monitoring Points – Proposed Locations**

With the insight from the aforementioned considerations, TerraQuest is proposing monitoring points at the locations indicated on Figure 4. A total of twenty-three methane monitoring points are plotted. In general, monitoring points are situated approximately 50 feet inside the property boundary at 750 foot intervals. The 50 foot distance was recommended by the NCDWM-SW and helps to observe hazardous methane gas concentrations before they exit the facility. An arbitrary distance of 750 feet is chosen to cover the entire perimeter with a monitoring point on each leg of the boundary shape. In sensitive areas, monitoring points are proposed as shown on Figure 4 and as follows:

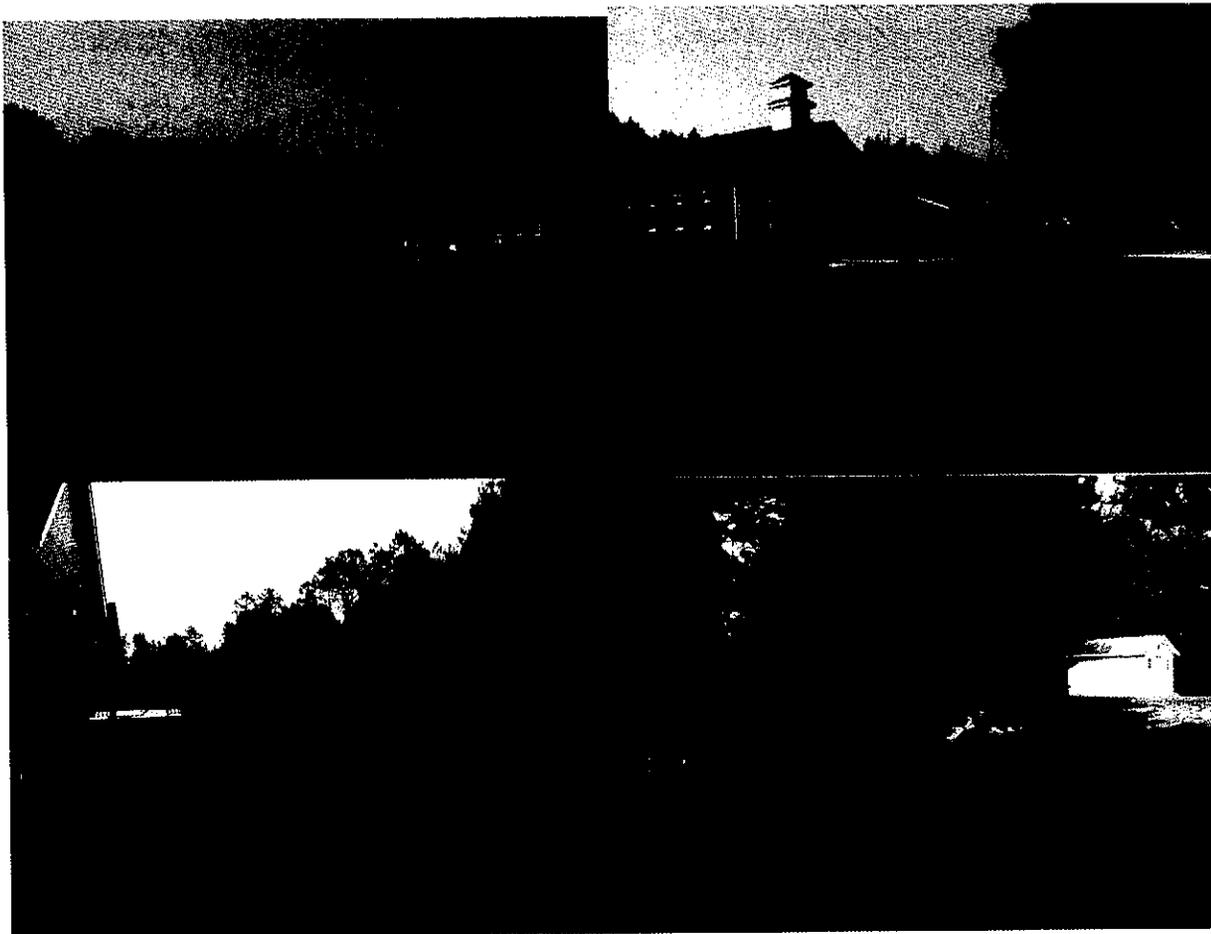
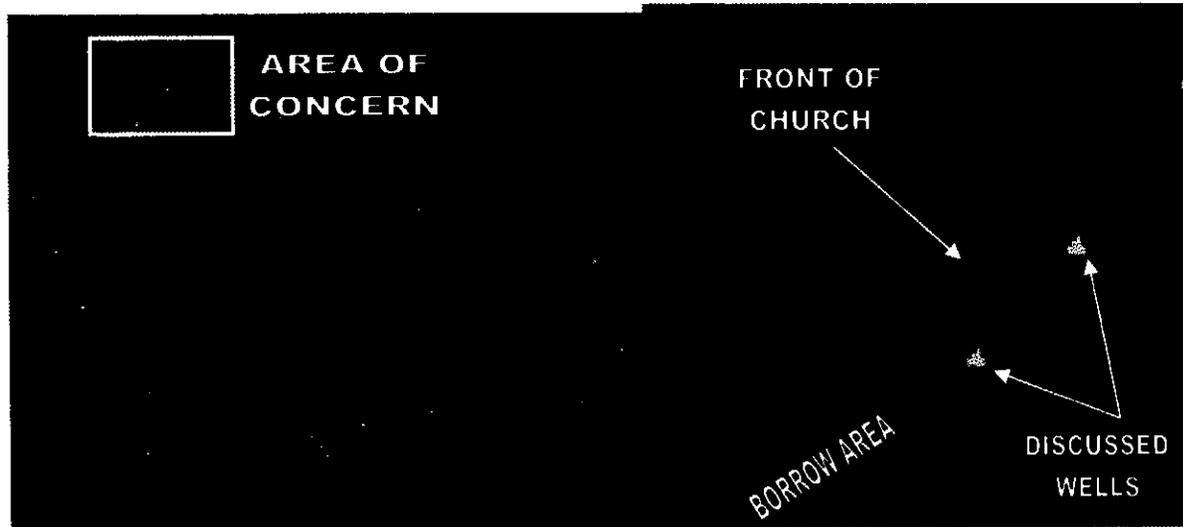
- one methane monitoring point is proposed next to the landfill's weight scale, one on the other side of the associated guard house, and one near the landfill's office/equipment storage buildings:



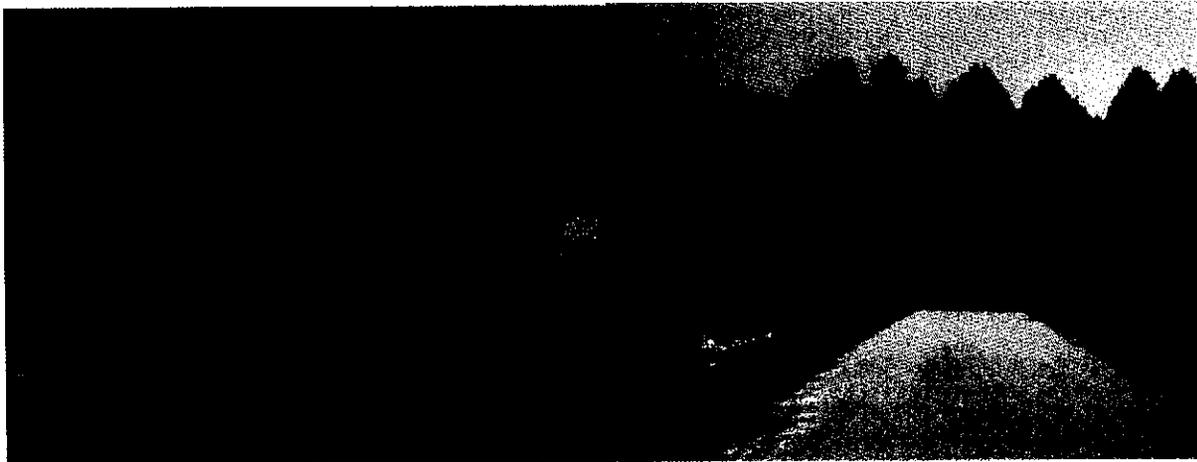
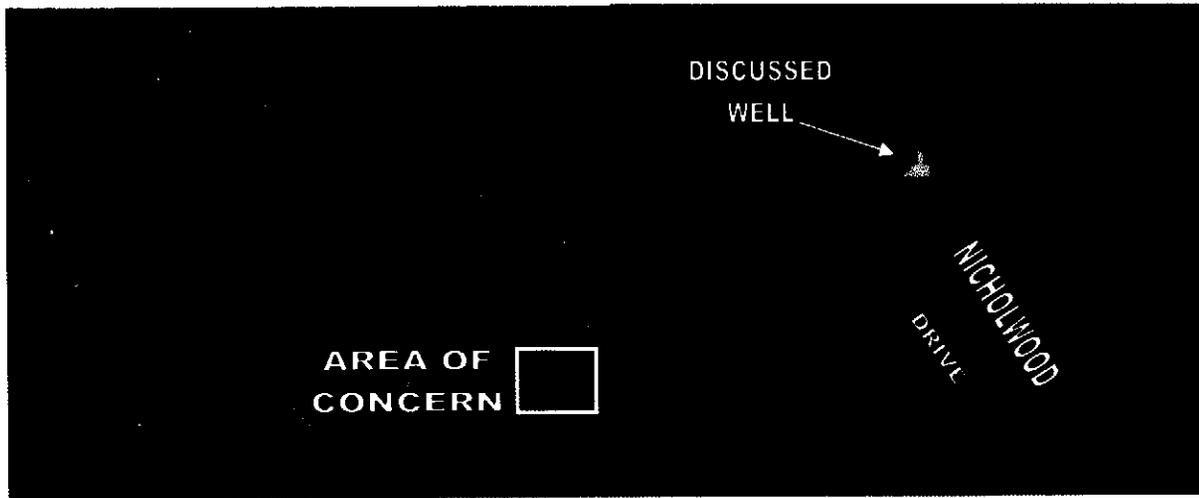
- two monitoring points are proposed near the tax parcel no 9549-10-5164-00 property that has tobacco drying trailers, soy bean silos, and farming equipment sheds located near the landfill boundary:



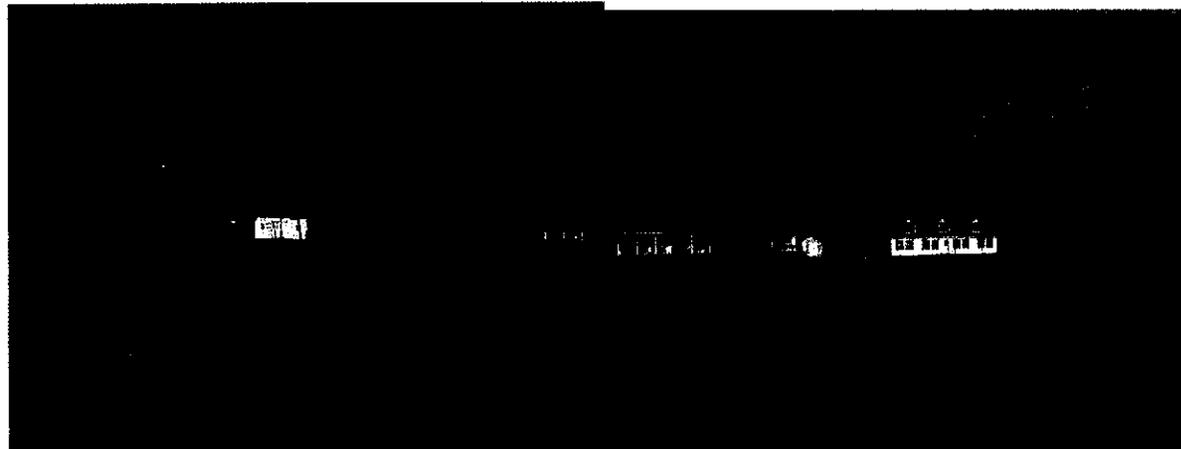
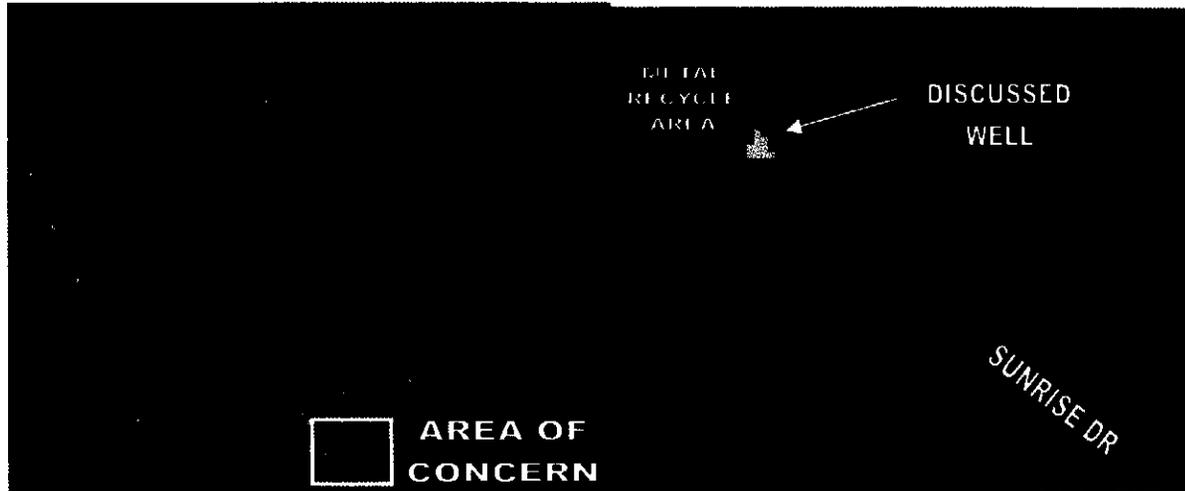
- two monitoring points are proposed near the 3329 McQueen Chapel United Method Church property housing the publicly-attended church sanctuary,



- one monitoring point is proposed at the end of Nicholwood Drive where it is likely that houses will be placed in the future,



- one monitoring point is proposed at the rear of the metal recycling area within the landfill that abuts the tax parcel 9548-48-2185-00 property which contains a primary residence,



Methane monitoring points will be constructed as shown on the well construction detail provided in Appendix B. The wells will be installed by an NC-licensed driller and will be finished with a protective stickup casing. Each monitoring well will be installed with a screened portion within the vadose-zone soil. The well will be sealed with an air-tight, lockable cap and a sampling port/valve to connect an OVM in such a way as to prevent any combustible gases from escaping prior to capture with the meter.

Note that while several of the recommended methane monitoring well locations are near existing groundwater monitoring wells, the construction of the groundwater monitoring wells prevents their use as methane monitoring points. Specifically, the screen intervals of the groundwater monitoring wells extend into the water table, allowing for an un-natural interaction between any present methane and the water table. Use of these wells is discounted since this could mask the true concentration of combustible gases in the vadose zone soil. Also, not all of the groundwater monitoring wells are screened across the entire vadose zone; a requirement of the monitoring points.

#### **4.2 Monitoring Schedule**

Current regulations require the minimum methane monitoring frequency to be no less than quarterly. The frequency of methane monitoring at the Lee County Landfill will be based upon that requirement, historical methane monitoring results, and future methane monitoring results.

Historical methane monitoring conducted by Patterson Exploration Services was documented in the Closure Plan for the MSW portion of the landfill. That Closure Plan was submitted by McKim & Creed and is on file with the NCDWM-SW (McKim & Creed, 1993). In the Closure Plan, Patterson Exploration Services stated that:

*“On September 28, 1993, personnel from Patterson Exploration Services conducted a landfill gas survey along the perimeter boundary of the entire Lee County Landfill. The*

survey consisted of walking the landfill boundary with a methane sensitive OVA/PID and a combustible gas OVA/PID to determine if any methane or other combustible gases were present. Although combustible gases and methane were detected in some of the older areas of the landfill, all of the readings on this date (September 28, 1993) were well below 5% of the lower explosive limit."

The aforementioned was considered in establishing the monitoring frequency. The fact that no incidents are on file with the NCDWM-SW where methane gas concentrations were reported at explosive levels was also considered. The concentrations observed during future monitoring will also be consulted when deciding monitoring frequency. To begin, TerraQuest recommends that the minimum quarterly monitoring be observed through the first two years. Once the varying seasons of the year have been observed twice, quarterly monitoring will continue unless observed concentrations dictate otherwise. Note that any observed concentration in excess of 25% of the LEL near structures on the landfill property, or at the LEL along the property boundary, or any detected concentrations in offsite structures will immediately alter the monitoring schedule as outlined in the Contingency Plan (presented in the next section).

Each quarterly monitoring event will begin with an inspection of the vapor monitoring wells to ensure that they have not been damaged. Damaged wells will be replaced before the next quarterly monitoring event. A methane vapor monitoring device such as an OVM will be attached to sampling ports on the wells and the readings recorded. The OVM used for this sampling will be periodically calibrated and maintained in accordance with the manufacture's recommendations. At the completion of each monitoring event, TerraQuest will provide the NCDWM-SW with documenting correspondence within a month. Quicker notification of violations will be handled as addressed in the Contingency Plan.

### 4.3 Contingency Plan

Should methane vapor concentrations be noted:

- at concentrations in excess of 25% of the LEL at onsite structures (landfill property),
- at the LEL along the property boundary,
- or if any detected concentrations are noted in offsite structures,

notice will be provided to the NCDWM-SW within one business week. The sampling location where the noted vapor violation concentration is noted shall be re-tested within that week. If a violation is not registered during the second testing, a written reason for the vapor concentration reading will be provided to the NCDWM-SW within that week and the normal sampling schedule will resume.

If a violation concentration is registered again during the second sampling, additional monitoring wells will be installed to determine the extent of the problem. Following delineation, the first step toward corrective action will be the installation of several passive venting wells as necessary for the size of the problem area. TerraQuest will consult with the NCDWM-SW to ensure that sufficient delineation of the problem area is conducted and that sufficient remedial venting wells are installed in a satisfactory location. Once a violation concentration is noted, monitoring will occur on a weekly to bi-weekly schedule until the concentrations are lowered to the applicable level. The exact frequency of monitoring will be based on the severity of the violation and is at the discretion of the NCDWM-SW.

Should violation concentrations remain following the installation of passive venting wells, or if the area of concern is too large for venting wells to be effective, trenches will be installed to vent the combustible vapors. If violation concentrations persist following installation of venting wells and trenches, the level of corrective action for the situation will vary on a case-by-case basis and will be determined in consultation with the NCDWM-SW.

Corrective actions may include the installation of active blowers and/or torches as needed to correct the situation. Sufficient monitoring points will be installed for all corrective actions that are initiated.

## **5.0 IMPLEMENTATION**

Following review and approval of this Methane Monitoring Plan by the NCDWM-SW, Lee County Department of Public Works should clear access to each of the monitoring points established in the approved Plan. The access should be made within sixty (60) days following receipt of written approval of the Methane Monitoring Plan from the NCDWM-SW. Once access for well installation and future monitoring is provided, TerraQuest will install each of the monitoring points within sixty (60) days. Immediately following installation, each of the wells will be sampled and the data will be provided to the NCDWM-SW. Subsequent sampling will be on a quarterly basis as previously discussed and will mimic the already established semi-annual groundwater sampling schedule of April and October. Therefore, once the monitoring network is established, methane monitoring will occur in the months of: April, July, October, January. Violations will alter the schedule in accordance with the Contingency Plan.

## **6.0 LIMITATIONS**

This report is limited to the investigation of areas that have the potential to accumulate explosive levels of methane gas at the Lee County Landfill, and does not imply that other unforeseen adverse impacts to the environment are not present at the facility. In addition, subsurface heterogeneities not identified during the current study may influence the migration of methane gas in unpredicted ways. The opinions and conclusions arrived at in this report are in accordance with industry-accepted geologic and hydrogeologic practices at this time and location. No warranty is implied or intended.

## REFERENCES

Bracken & Associates "RJW", 11/23/92, map entitled: "Lee County Landfill". Bracken & Associates, not to scale.

Brown, et al., 1985. map entitled: "Geologic Map of North Carolina, North Carolina". Department of Natural Resources and Community Development, 1:500,000 scale.

Law Engineering Testing Company (J. Allen Tice, P.E. and Richard Leach, P.E.), *Report of Geotechnical Evaluation – Lee County Landfill Expansion*, 1986.

McKim & Creed, *Closure Plan for Lee County Landfill Site*, 1993.

NCDENR – Division of Water Quality: *DWQ Primary Surface Water Classifications*  
<http://h2o.enr.state.nc.us/csu/swc.html#C>.

Table 1

Date: 8/10/07

| SURROUNDING PROPERTY OWNERS    |                                          |                                                  |                                            | Permit No. 5301 |
|--------------------------------|------------------------------------------|--------------------------------------------------|--------------------------------------------|-----------------|
| Site Name: Lee County Landfill |                                          |                                                  |                                            |                 |
| Tax Account Number             | Property Owner                           | Property Owner Address                           | Property Address                           |                 |
| 9549-21-3329-00                | McQueen's Chapel United Methodist Church | 331 McQueen Chapel Rd<br>Lemon Springs, NC 27355 | 331 McQueen Chapel Rd<br>Sanford, NC 27332 |                 |
| 9549-32-6648-00                | Elizabeth Brantley Heirs                 | 649 Broughton St<br>Troy, NC 27371               | 0 Greenwood Rd<br>Sanford, NC 27332        |                 |
| 9549-61-8289-00                | Elizabeth Brantley Heirs                 | 649 Broughton St<br>Troy, NC 27371               | 2185 Edwards Rd<br>Sanford, NC 27332       |                 |
| 9549-81-4434-00                | Shaw Farm Heirs<br>(c/o Amy McEntee)     | Chapel Hill, NC 27516                            | 600 Shaw Pond Rd<br>Sanford, NC 27332      |                 |
| 9548-68-2768-00                | Womble Builders, LLC                     | PO Box 1645<br>Sanford, NC 27331                 | Sanford, NC 27332                          |                 |
| 9548-58-8725-00                | Womble Builders, LLC                     | PO Box 1645<br>Sanford, NC 27331                 | 0 Nicholwood Dr<br>Sanford, NC 27332       |                 |
| 9548-58-3528-00                | Timothy Wayne Godfrey                    | Sanford, NC 27331                                | Sanford, NC 27332                          |                 |
| 9548-48-8403-00                | Timothy Wayne Godfrey                    | 179 Juniper Creek Rd<br>Sanford, NC 27332        | 0 Juniper Creek Rd<br>Sanford, NC 27332    |                 |
| 9548-48-3447-00                | Dale & Brenda Betts                      | 223 Juniper Creek Rd<br>Sanford, NC 27332        | 249 Costa Maya Ct<br>Sanford, NC 27332     |                 |
| 9548-48-2185-00                | William & Dolores Savino                 | 44 Costa Maya Ct<br>Sanford, NC 27332            | 44 Costa Maya Ct<br>Sanford, NC 27332      |                 |
| 9548-47-0926-00                | Costa Maya Development, LLC              | 27 Costa Maya Ct<br>Sanford, NC 27330            | 27 Costa Maya Ct<br>Sanford, NC 27330      |                 |
| 9548-37-1433-00                | Raymond Peterson                         | 92 Duck Crossing Ln<br>Sanford, NC 27330         | 0 Sunrise Dr<br>Sanford, NC 27330          |                 |
| 9548-18-2862-00                | Carl Douglas                             | 3 Hanover Sq<br>New York, NC 10004               | 0 Sanders Rd<br>Sanford, NC 27332          |                 |
| 9549-10-5164-00                | William Dalrymple                        | 1929 Sanders Rd<br>Sanford, NC 27332             | 1929 Sanders Rd<br>Sanford, NC 27332       |                 |
| 9549-11-8638-00                | William & Carolyn Dalrymple              | 1027 Sanders Rd<br>Sanford, NC 27330             | 0 Sanders Rd<br>Sanford, NC 27330          |                 |
| 9549-20-4358-00                | Lee County                               | 273 Frances Louise Ln<br>Sanford, NC 27332       | Sanford, NC 27330                          |                 |
| 9548-49-2208-00                |                                          | PO Box 1968<br>Sanford, NC 27331                 | 331 Landfill Road<br>Sanford, NC 27331     |                 |
| 9548-69-0339-00                |                                          |                                                  |                                            |                 |
| 9548-28-7551-00                |                                          |                                                  |                                            |                 |

## Notes:

- Information gathered from Lee County GIS online system.
- BOLD** portion of tax PIN numbers correspond with those displayed on Figure 2.



MAP SOURCE: USGS 7.5 MINUTE TOPOGRAPHICS - SANFORD AND MURCHISONTOWN, NC

GRAPHIC SCALE



# TERRAquest

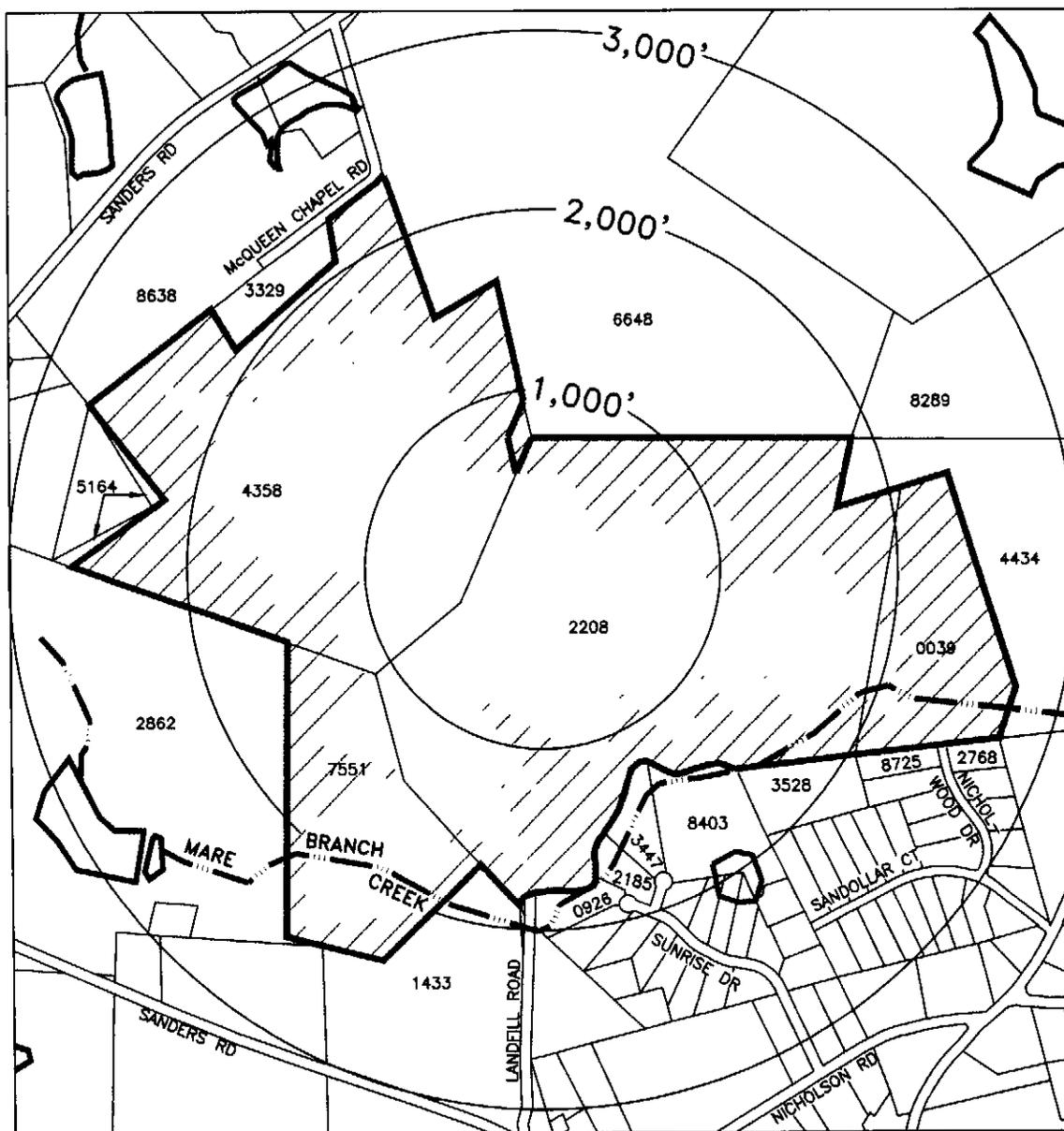
ENVIRONMENTAL CONSULTANTS, P.C.

SITE LOCATION MAP  
 LEE COUNTY LANDFILL  
 331 LANDFILL ROAD  
 LEE COUNTY, NORTH CAROLINA

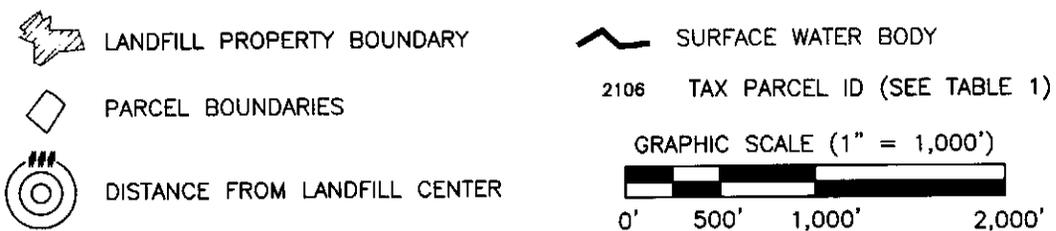
LEE COUNTY PUBLIC WORKS

SANFORD, NC

|             |            |             |     |            |        |
|-------------|------------|-------------|-----|------------|--------|
| PROJECT NO. | 02298      | DRAWN BY:   | RDK | DATE:      | 8/3/07 |
| SCALE:      | 1" = 2000' | CHECKED BY: | MJB | FIGURE NO. | 1      |



### LEGEND



(NOTE: MAP ADAPTED FROM INFORMATION PROVIDED BY THE LEE COUNTY DEPARTMENT OF STRATEGIC SERVICES)

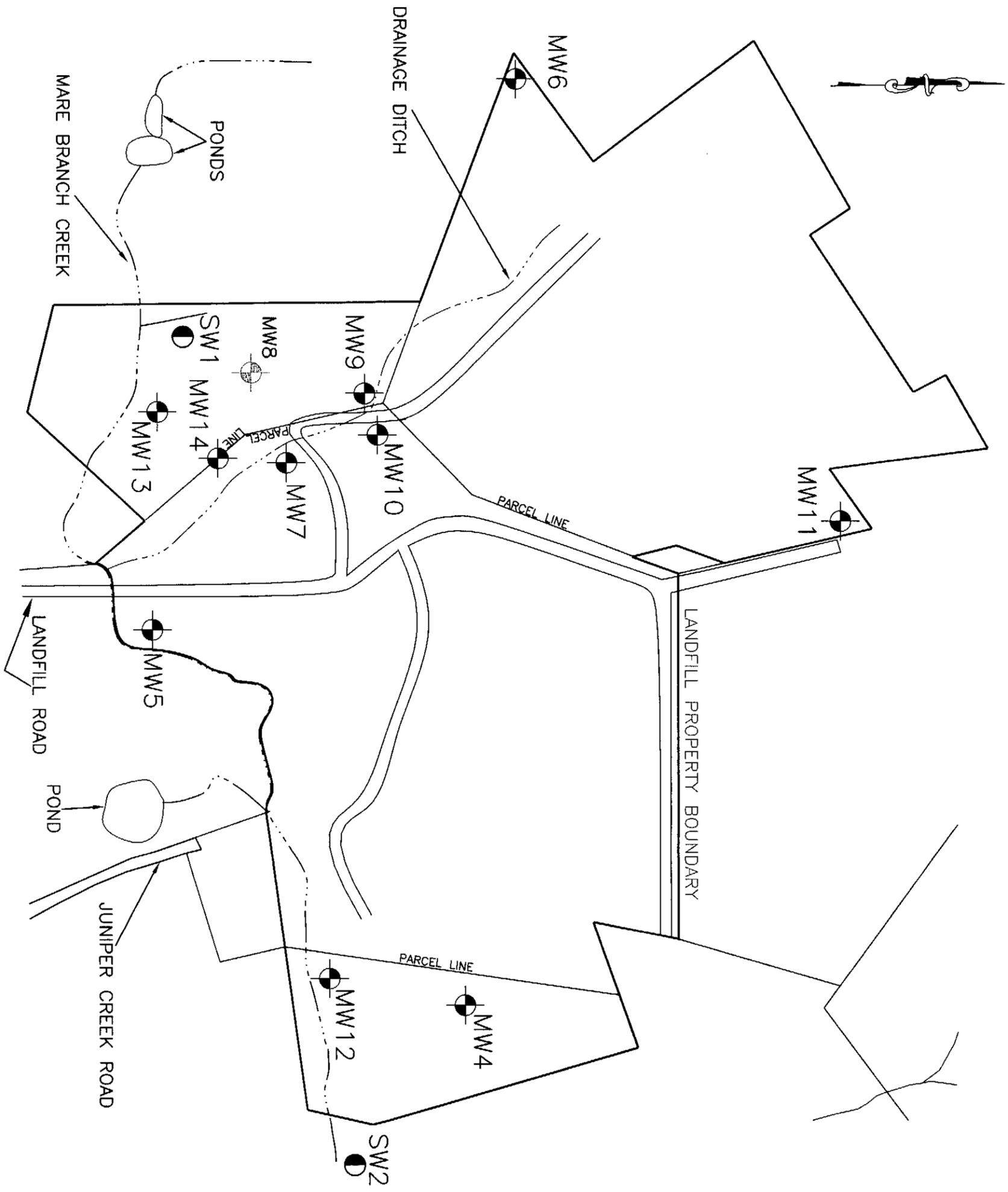
**TERRAquest**  
 ENVIRONMENTAL CONSULTANTS, P.C.

SITE VICINITY MAP  
 LEE COUNTY LANDFILL  
 331 LANDFILL ROAD  
 SANFORD, LEE COUNTY, NC 27332

LEE COUNTY PUBLIC WORKS

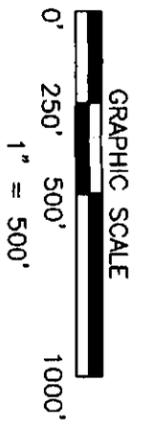
SANFORD, NC

|             |             |             |     |            |         |
|-------------|-------------|-------------|-----|------------|---------|
| PROJECT NO. | 02296       | DRAWN BY:   | RDK | DATE:      | 8/10/07 |
| SCALE:      | 1" = 1,000' | CHECKED BY: | MJB | FIGURE NO. | 2       |



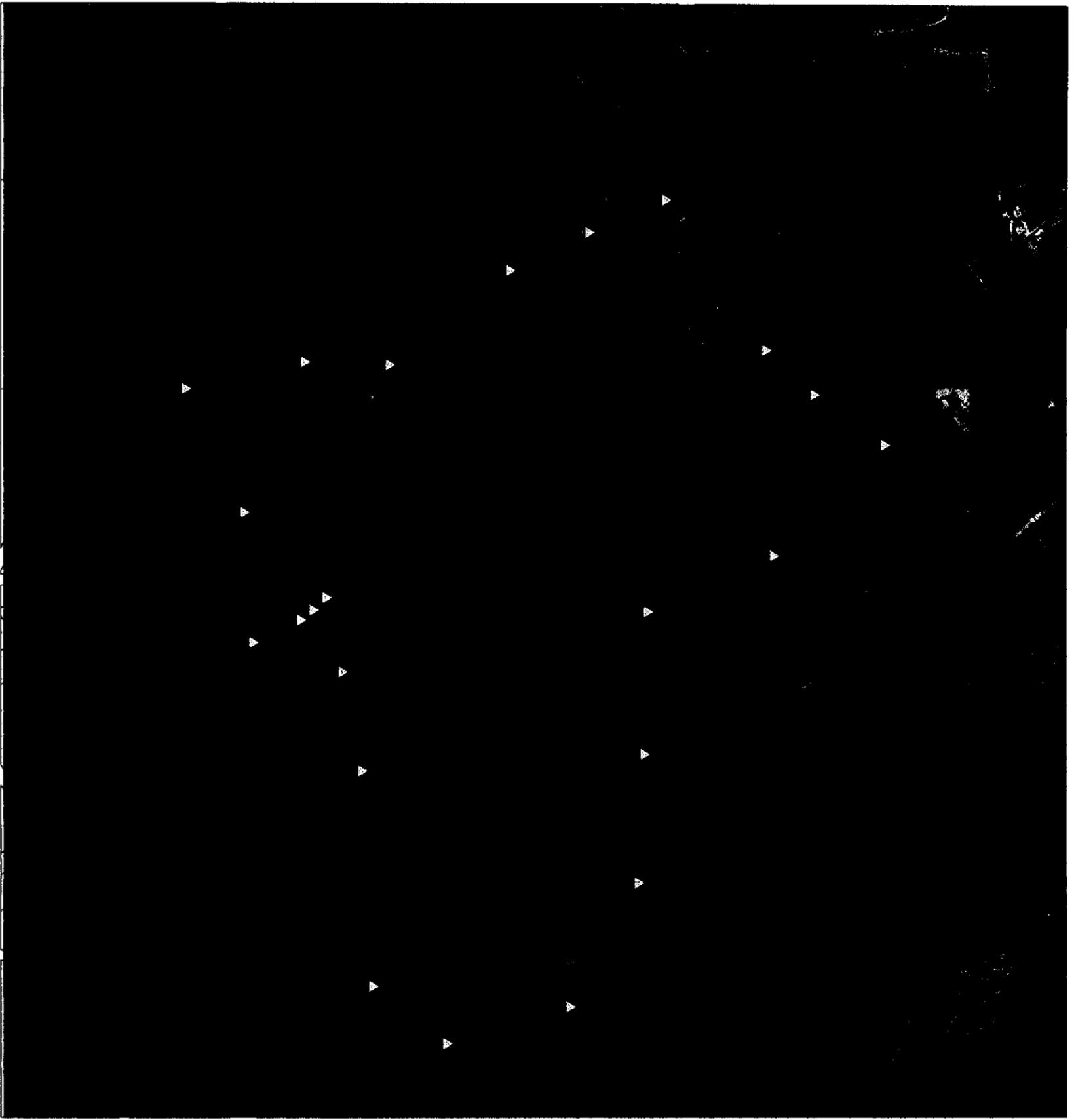
**LEGEND**

-  MONITORING WELL
-  SURFACE WATER SAMPLE
-  ABANDONED MONITORING WELL



**SITE LAYOUT MAP  
LEE COUNTY LANDFILL**

|                                    |                     |               |
|------------------------------------|---------------------|---------------|
| LEE COUNTY PUBLIC WORKS DEPARTMENT |                     | SANFORD, NC   |
| PROJECT NO: 02296                  | CHECKED BY: MJB/JRG | FIGURE NO. 3  |
| SCALE: 1" = 500'                   | DRAWN BY: JRG/RDK   | DATE: 8/10/07 |

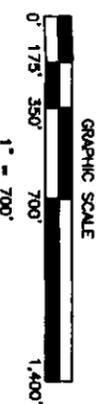
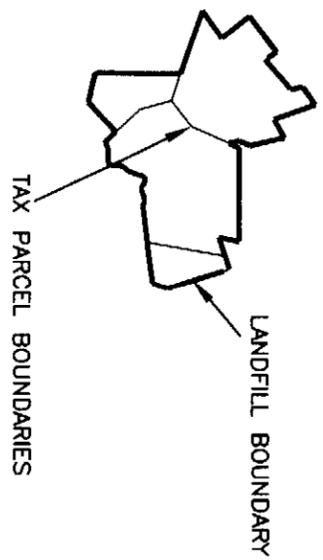


**LEGEND**

△ PROPOSED METHANE MONITORING WELL

AREAS 1 - 6 CLOSED MSW

C&D AREA STILL ACTIVE



(NOTE: MAP ADAPTED FROM INFORMATION PROVIDED BY THE LEE COUNTY DEPARTMENT OF STRATEGIC SERVICES)



SITE LAYOUT MAP - AERIAL VIEW  
LEE COUNTY LANDFILL  
SANFORD, LEE COUNTY, NC

|                         |                 |               |  |
|-------------------------|-----------------|---------------|--|
| LEE COUNTY PUBLIC WORKS |                 | SANFORD, NC   |  |
| PROJECT NO: 02296       | CHECKED BY: MJB | FIGURE NO. 4  |  |
| SCALE: 1" = 700'        | DRAWN BY: RDK   | DATE: 8/10/07 |  |

## **TECHNICAL METHODS/STANDARD PROCEDURES**

### **Groundwater Sampling**

Groundwater samples are collected from temporary or permanent monitoring wells according to established sampling protocol. When permanent monitoring wells are sampled the well is purged of a minimum of three well-bore volumes prior to sample collection in order to assure that sampled water is representative of aquifer conditions. In temporary wells, the first water which migrates into the open borehole is sampled. Samples from both temporary and permanent monitoring wells are collected using individually wrapped disposable teflon bailers by a field personnel wearing disposable latex gloves. Only one well is sampled with a given bailer in order to prevent sample cross-contamination. Also, field personnel change gloves between different samples to reduce the chance of cross-contamination. Water samples are transferred from the bailer to laboratory-prepared sampling containers using slow emptying devices to reduce the chance of contamination loss through volatilization. Preservatives, such as acids, are added to samples directly after they are collected if preservation is necessary. The samples are labeled with the sample location, sample identification, date of collection, time of collection, the analytical method, the preservative, and the sampler's initials. The samples are cooled on ice to four degrees centigrade, sent to a certified laboratory, and analyzed before the expiration of an analytical method's prescribed holding time. Chain-of-custody documentation is maintained for each sample collected in the field.

### **Surface Water Sampling**

Surface water samples, specifically samples from creeks or streams, are collected from a moving/flowing portion of the creek or stream to ensure that stagnant water is not collected.

Field personnel are careful to collect samples from flowing areas that are not so turbulent as to cause a loss of volatile contaminants which might have been contained in the creek's/stream's water. Samples are collected by field personnel wearing disposable latex gloves. Field personnel change gloves between different locations to reduce the chance of cross-contamination. Samples are collected directly from the appropriate creek or stream location and placed into the appropriate laboratory-prepared containers. Preservatives, such as acids, are added to samples directly after they are collected if preservation is necessary. The samples are labeled with the sample location, sample identification, date of collection, time of collection, the analytical method, the preservative, and the sampler's initials. The samples are cooled on ice to approximately four degrees centigrade, sent to a certified laboratory, and analyzed before the expiration of an analytical method's prescribed holding time. Chain-of-custody documentation is maintained for each sample collected in the field.

### **Field Measurements**

Field measurements taken to determine the pH, conductivity, temperature, and dissolved oxygen concentration of a particular groundwater sample are taken directly after a particular monitoring well has been adequately purged. Once purging of the monitoring

well is complete, a new, disposable teflon bailer is slowly lowered into the appropriate monitoring well and a representative groundwater sample is retrieved. A slow pouring device is fitted onto the end of the disposable bailer and the sample is slowly poured into a new, disposable plastic cup.

For pH, conductivity, and temperature, a Hanna Instruments Model 991300 portable meter is utilized. This unit is periodically calibrated and maintained in accordance with the unit's operations manual by field personnel. The procedure used for sample measurement involves lowering the meter's probe into the new, disposable cup containing the groundwater sample to be measured and slowly stirring the probe to force groundwater across the probe's membrane. The measurements displayed by the meter are then recorded.

For dissolved oxygen concentration measurements, a YSI Model 55 Handheld Dissolved Oxygen System is utilized. This unit is periodically calibrated and maintained in accordance with the unit's operations manual by field personnel. The procedure used for sample measurement involves adjusting the unit for the correct altitude where the sampling will take place and adjusting the reported units desired. Once this is done, the unit's probe is inserted into the new, disposable cup containing the groundwater sample to be measured and the probe is slowly stirred to force the groundwater across the probe's membrane. The measurements displayed by the unit are then recorded.

### **Gas Screening**

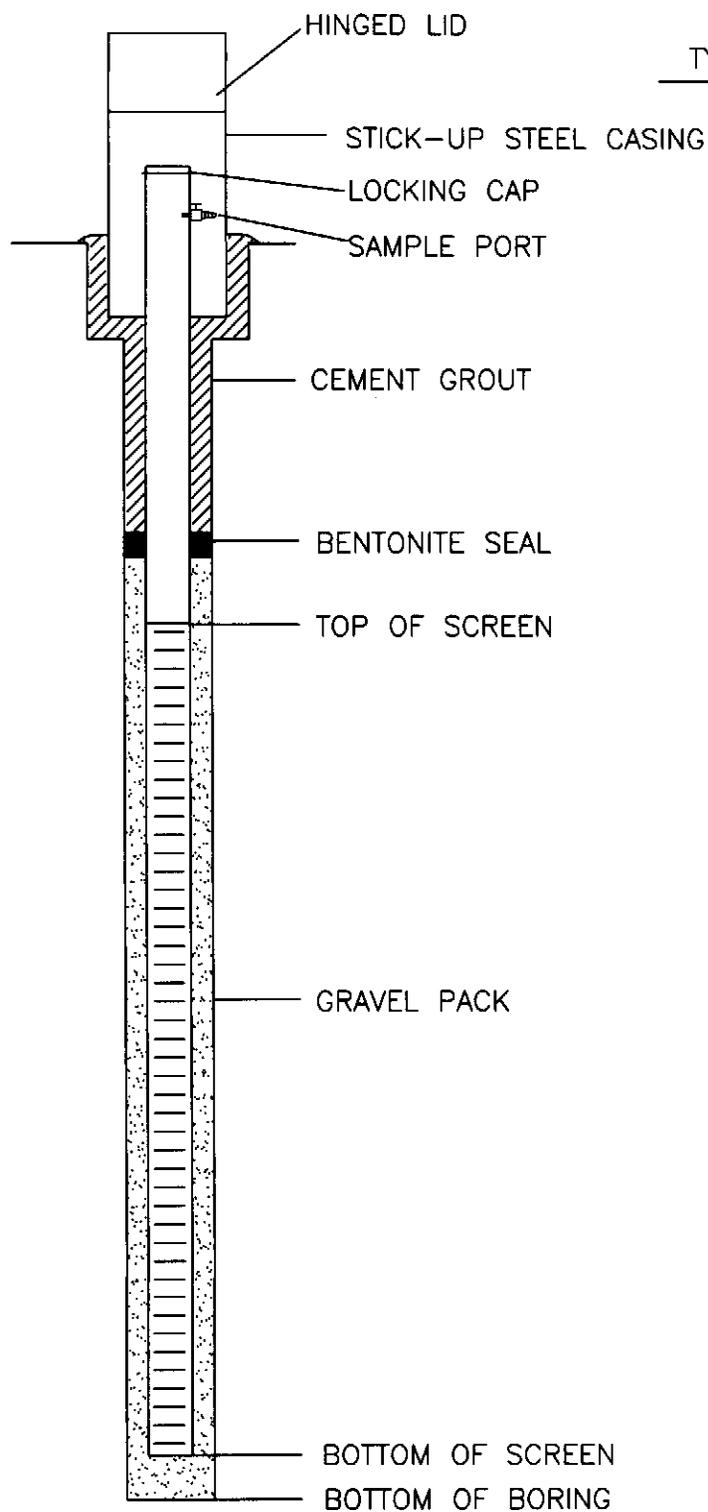
Volatile organic compounds (VOC) concentrations are measured using a Thermo Electron Corp. Innova Series catalytic organic vapor monitor (OVM). The OVM instrument is periodically calibrated according to the manufacturer's recommended procedures.

The OVM is a qualitative tool employed to detect and estimate the concentration of volatile organic vapors such as methane. A thin probe attached to the OVM is connected to a sampling location and air from the location is drawn through the probe into an internal chamber where the vapors are catalyzed. The concentration of the VOCs is registered on a digital scale in parts per million. Oxygen levels are field calibrated prior to each use. VOC calibration occurs periodically depending upon use by using a span gas of known concentration in a process recommended by the manufacturer.

## ENVIRONMENTAL ACRONYMS

|             |                                                         |
|-------------|---------------------------------------------------------|
| 2L Standard | Groundwater Standards under Title 15A NCAC 2L 0.0202(g) |
| 2B Standard | Surface Water Standards under Title 15A NCAC 2B         |
| AFVR        | Aggressive Fluid-Vapor Recovery                         |
| AST         | Aboveground Storage Tank                                |
| BGL         | Below Ground Level                                      |
| C&D         | Construction and Demolition                             |
| CAP         | Corrective Action Plan                                  |
| CSA         | Comprehensive Site Assessment                           |
| EPA         | Environmental Protection Agency                         |
| EPH         | Extractable Petroleum Hydrocarbons                      |
| ESA         | Environmental Site Assessment                           |
| GCL         | Gross Contamination Level                               |
| LEL         | Lower Explosive Limit                                   |
| LSA         | Limited Site Assessment                                 |
| IPE         | di-Isopropyl Ether                                      |
| MADEP       | Massachusetts Department of Environmental Protection    |
| MMPE        | Mobile Multi Phase Extraction                           |
| MSCC        | Maximum Soil Contaminant Concentration                  |
| MSW         | Municipal Solid Waste                                   |
| MtBE        | Methyl tertiary-Butyl Ether                             |
| NC          | North Carolina                                          |
| NCAC        | NC Administrative Code                                  |
| NCDENR      | NC Department of Environment and Natural Resources      |
| NCDOT       | NC Department of Transportation                         |
| NCDWM-SW    | NC Division of Waste Management's Solid Waste Section   |
| NCDWM-UST   | NC Division of Waste Management's UST Section           |
| NCDWQ       | NC Division of Water Quality                            |
| NORR        | Notice of Regulatory Requirements                       |
| NORP        | Notice of Residual Petroleum                            |
| NOV         | Notice of Violation                                     |
| NPDES       | National Pollutant Discharge Elimination System         |
| OVM         | Organic Vapor Meter                                     |
| POE         | Point of Entry (water treatment system)                 |
| POTW        | Publicly Owned Treatment Works                          |
| RBCA        | Risk Based Corrective Action                            |
| SVE         | Soil Vapor Extraction                                   |
| STG         | Soil to Groundwater (MSCC)                              |
| TA          | Task Authorization                                      |
| TCC         | Target Cleanup Concentrations                           |
| TerraQuest  | TerraQuest Environmental Consultants, P.C.              |
| TPH         | Total Petroleum Hydrocarbon                             |
| UST         | Underground Storage Tank                                |
| VOA         | Volatile Organic Analysis                               |
| VOC         | Volatile Organic Compound                               |
| VPH         | Volatile Petroleum Hydrocarbons                         |

APPENDIX B  
TYPICAL TYPE II MONITORING WELL DETAIL



GENERAL INFORMATION

Methane monitoring wells are simple 2" diameter wells used to monitor the presence of combustible gases such as methane. They are constructed as shown in the diagram to the left. The wells are screened within vadose zone soils only and generally do not breach the water table. Sufficient casing is placed in the top of the well's construction so that the well can be properly cemented at the surface. Screened casing is placed beyond the casing to the bottom of the well to allow for the uninhibited entry of gases.