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SCS ENGINEERS, PC

07007-03-11

October 9, 2006
File No. 02204303.02

Mr. Tony Duque
North Carolina Department of Environment and Natural Resources
Division of Waste Management
1601 Mail Service Center
Raleigh, North Carolina 27699-1601

Subject: Landfill Gas Control Plan
Brownfield Agreement; NCBP Project No. 07007-03-11
Elk Mountain Landfill Project
Town of Woodfin, North Carolina

Dear Mr. Duque:

SCS Engineers, PC (SCS) is pleased to submit two copies of the Landfill Gas Control Plan (Plan) for controlling landfill gas (methane) migration at the Elk Mountain Landfill. This Plan has been prepared by SCS on behalf of the Town of Woodfin in accordance with the Brownfields Agreement (BFA) between the Town and North Carolina Department of Environment and Natural Resources, N.C. Brownfields Program for the former Elk Mountain Landfill.

Based on the results of the investigations to date and SCS's experience in the field of landfill gas (LFG) control, the objectives of this Plan are to:

- Provide the required information for development of the selected engineering controls to control LFG migration,
- Provide conceptual design plans and specifications for the selected engineering controls to control the migration of methane gas into on-site structures,
- Provide monitoring guidelines for the selected engineering controls, and
- Provide sample certifications to be used by a Registered Professional Engineer during the design, construction, and post-construction phases of LFG controls.

The selected remedy presented in the Plan provides a comprehensive strategy to address potential risk at the proposed development. The primary engineering control to minimize methane gas migration and intrusion in nearby structures is a LFG Cutoff Trench designed to mitigate methane migration near the source. The secondary means of methane gas control includes a methane barrier installed underneath any structure constructed near the LFG Cutoff Trench or any other areas where methane gas and static pressure have been detected in the subsurface. And finally, monitoring will be used to verify the effectiveness of the engineering controls.

This Plan will be used to guide the development of Final Construction Drawings for installation of the LFG Cutoff Trench and membrane barrier/venting systems to be installed underneath structures where methane gas in the subsurface is a concern.

As you are aware, SCS is also preparing on behalf of the Town of Woodfin various reports and Bid Documents for the initial portion of the LFG Cutoff Trench in support of an EPA Clean Up Grant. For that reason, a copy of this Plan has also been transmitted to Region IV EPA. Future submittals required by the Clean Up Grant will also be transmitted to NCDENR.

If you have any questions, please contact Steve Lamb at (704) 504-3107.

Sincerely,

Steven C. Lamb, P.E.
Project Director
SCS ENGINEERS, PC

Eric Peterson/SCL
Eric Peterson, P.E.
Vice President
SCS ENGINEERS, PC

cc: Mr. Jason Young, Town of Woodfin
Mr. Oliver Pau, Cherokee Investment Partners, LLC
Ms. Beverly Williams, USEPA Region IV

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OCT 2006

LANDFILL GAS CONTROL PLAN
ELK MOUNTAIN LANDFILL
BROWNFIELDS PROJECT

WOODFIN, NORTH CAROLINA

Submitted to:

North Carolina Department of Natural Resources
N.C. Brownfields Program
401 Oberlin Road, Suite 150
Raleigh, North Carolina 27605

Prepared for:

Town of Woodfin
90 Elk Mountain Road
Woodfin, North Carolina 28804

Prepared by:

SCS Engineers, P.C.
2520 Whitehall Park Drive, Suite 450
Charlotte, North Carolina 28273

File No. 02204303.02
October 9, 2006

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DISCLAIMER

This Landfill Gas Control Plan has been prepared for the Town of Woodfin with specific application to methane gas control for the Elk Mountain Landfill property located at in Woodfin, North Carolina. This report has been prepared in accordance with the care and skill generally exercised by reputable professionals, under similar circumstances, at this or similar localities. No other warranty, either expressed or implied, is made as to the professional advice presented herein. No other party, known or unknown to SCS Engineers is intended as a beneficiary of this work product, its content or information embedded herein. Third parties use this report at their own risk. SCS Engineers assumes no responsibility for the accuracy of information obtained from, compiled or provided by third-party sources such as regulatory agency listings.

ENGINEER'S CERTIFICATION

I, Steven C. Lamb, P.E., do hereby certify that this Landfill Gas Control Plan was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of North Carolina. Furthermore, I certify that the methane mitigation systems presented herein, if designed, constructed, and maintained properly, will control the infiltration of methane gas into structures developed on the Elk Mountain Landfill property.

Signature of North Carolina Registered Professional Engineer

Name and Affiliation Steven C. Lamb, SCS Engineers

Date 10/9/2006

[PE SEAL]

NORTH CAROLINA PROFESSIONAL SEAL 028684 ENGINEER STEVEN C. LAMB 10/9/06

SECTION 1

INTRODUCTION

This Landfill Gas Control Plan (Plan) has been prepared by SCS Engineers, P.C. (SCS) on behalf of the Town of Woodfin (Town) in accordance with the Brownfields Agreement (BFA) between the Town and North Carolina Department of Environment and Natural Resources (NCDENR), N.C. Brownfields Program for the former Elk Mountain Landfill. The landfill is located on U.S. Highway 19, in the Town of Woodfin, in Buncombe County, North Carolina.

SCS understands the Town intends to transfer the property to Cherokee Investment Partners, LLC on or near December 31, 2006. Furthermore, we understand the BFA will be signed by the Town prior to the property transfer.

1.1 Objectives

Previous investigations of the Elk Mountain Landfill (the "site") have identified the nature and extent of landfill gas (LFG) concerns at the site in order to support an informed risk management decision regarding the development of appropriate LFG migration controls for the site. Based on the results of the investigations to date and SCS's experience in the field of LFG control, the objectives of this Plan are to:

- Provide the required information for development of the selected engineering controls to control LFG migration,
- Provide design plans and specifications for the selected engineering controls to control the migration of methane gas into on-site structures,
- Provide monitoring guidelines for the selected engineering controls, and
- Provide sample certifications to be used by a Registered Professional Engineer during the design, construction, and post-construction phases of LFG controls.

1.2 Background

The Town of Woodfin purchased a 156-acre parcel of land off Beaverdam Creek Road in Woodfin, North Carolina in 1985 from private landowners (Figure 1 - Site Vicinity Map). From the mid 1960s to approximately 1980, the City of Asheville leased the property for the disposal of municipal solid waste (MSW). In 1999, the Town developed a 9-hole golf course on the property. The Town closed the golf course in February 2003.

The Land-of-Sky Regional Council has been awarded a US EPA Brownfields Assessment Demonstration Pilot Grant for the four-county region of Buncombe, Madison, Henderson, and Transylvania counties in North Carolina. The Town of Woodfin is located in Buncombe County.

The Town prepared a "Brownfields Letter of Intent" on April 7, 2003 to NCDENR that outlined the Town's plans and justification for site work. The Town retained the Fletcher Group to prepare a *Quality Assurance Project Plan* (QAPP) (Fletcher, 2003) for site assessment activities that included the installation of soil borings and groundwater monitoring wells. The groundwater monitoring wells were sampled in accordance with the QAPP. The results of the site assessment activities are contained in the *Brownfields Assessment Report for Elk Mountain Landfill* (Fletcher, 2004). This report was submitted to NCDENR.

Three distinct areas of the Elk Mountain Landfill property were used for the disposal of municipal solid wastes. These three areas are indicated on Figure 2 and designated as Area A, Area B, and Area C. The proposed development for the property involves constructing residential buildings (houses, condominiums, town houses, etc) in between the waste areas.

The limits of waste shown on the figures and drawings in this Plan were obtained from previous investigations performed by others. The actual limits of waste will be established in field by excavating test pits or other exploration activities. A revised Survey Plat will be recorded with Buncombe County and issued to the State following the limit of waste investigations.

1.3 Landfill Gas Migration Evaluation

Methane has been detected in the subsurface of the site at various concentrations. Methane is a colorless and odorless gas. In its pure form, methane gas is lighter than air, but in decomposition gas, methane is mixed with carbon dioxide and other gases, and the mixture typically has a density near that of air. Methane gas between a concentration of approximately 5 to 15 percent in the presence of oxygen and a source of ignition is explosive.

To assess the current and potential future methane gas concentrations in the subsurface, SCS conducted the following activities:

- Installed 20 LFG monitoring probes,
- Monitored the 20 LFG monitoring probes, and
- Estimated LFG generation rates at the site.

The following sections describe the above activities.

1.3.1 LFG Monitoring Probes

On September 22 and 23, 2004, SCS directed the installation of 20 methane monitoring probes situated around portions of the limits of waste for Area A and Area B. (At that time, residential units in the vicinity of Area C were not being considered. In the event future residential units near Area C are considered, additional methane monitoring probes may be required to assess landfill gas migration.) The 20 probes installed in 2004 are designated P-01 through P-20 and their locations are shown on Figure 3. All probes were installed by Probe Technologies using a track-mounted Geoprobe with direct push technology. The probes were installed to depths between 10 and 20 feet depending on geologic conditions.

Each probe consists of a five-foot section of one-inch diameter solid pipe that extends approximately three feet above grade. From two feet below grade to the bottom of the boring, each probe is completed with a one-inch diameter PVC slotted pipe. The slotted section has a sand pack of #2 filter sand. The sand fills the boring up to half a foot above the slotted pipe. The top one and a half feet of the boring is sealed with a bentonite plug which is mounded around the base of the pipe at the surface. Each probe was equipped with an end cap to seal the probe. The location of each probe was surveyed by a registered land surveyor. Refer to Figure 4 for a detail of the LFG monitoring probe.

1.3.2 Monitoring Results

Following completion of the probes on September 23, SCS measured the gas composition within each probe using a Landtec GEM-2000 gas analyzer. This was done by taking the cap off of the probe and inserting the input tube of the GEM-2000 into the probe and allowing the instrument to draw in gas from the well for two minutes. After two minutes the gas composition readings appeared to stabilize. These results varied from zero percent methane in P-1 to 61.9 percent methane in P-9. SCS returned to the Site on October 13, 2004 and measured the gas composition of each probe again. This time the results varied from 0.1 percent methane in P-1 to 61.6 percent methane in P-4.

A third, fourth and fifth round of monitoring was conducted on November 10, 2004, December 23, 2004, and June 8, 2005, respectively. During these monitoring events the gas composition and static pressures were measured for each probe. The results for these three rounds varied from zero to 70.1 percent methane. Static pressures recorded at the probes ranges from -0.1 to 0.9 inches of water column.

Based on the monitoring results, it is evident methane gas has migrated from the waste containing areas and mitigation measures to prevent methane gas migrating into on site structures will be needed to develop this site.

The entire set of data for all monitoring activities can be seen in Exhibit 1.

1.3.3 Estimated LFG Generation Rates

In an effort to predict yearly LFG generation rates for the site for use in establishing the appropriate remedial measures, SCS performed landfill gas generation modeling utilizing SCS's LFG recovery model, which is similar to EPA's landfill gas emissions model (LandGEM).

Model Inputs

To estimate LFG generation rates, SCS developed a first-order decay model for estimating LFG generation potential of landfills (the SCS Model). The model, essentially a modified version of the EPA's landfill gas emissions model (LandGEM), is based on actual LFG collection/recovery data from over 150 sites across the United States. When calibrating the model, SCS identified trends in the LFG collection data that were used to develop the model. Specifically, it was apparent that different values for the decay rate constant [k] and, to a lesser extent, the ultimate

methane generation potential [L_o], were appropriate depending upon the amount of precipitation a landfill receives per year.

The methane generation rate constant, k, determines how quickly the methane generation rate decreases once it reaches the peak rate after waste placement. The higher the value of k, the faster the methane generation flow rate from a mass of waste decreases over time. The value of k is generally taken to be a function of the following major factors: (1) refuse moisture content, (2) availability of the nutrients for methanogens, (3) pH, and (4) temperature. In general, increasing moisture content increases the rate of methane generation.

The value for ultimate methane generation potential, L_o, depends mainly on the type of refuse. For example, the higher the cellulose content of the refuse, the higher the value of the theoretical methane generation capacity. However, the value for L_o at a landfill is also influenced by the nutrient availability, pH, and moisture content within a landfill.

SCS utilized the following model parameters in estimating LFG generation for the Elk Mountain Landfill:

- **Refuse Filling History and Projections**: Since no yearly waste filling records were available for use in the model, yearly tonnage was calculated based on approximate landfill acreage, depth of waste, and an assumed density. The total mass of waste landfilled was then divided by the number of years the landfill operated (16) to provide a yearly waste tonnage (82,764 tons/year) for input to the model.

- **LFG Decay Rate Constant (k)**: A k value of 0.0665 yr^{-1} was used for this site. This value considers SCS's default value for k for the average annual precipitation rate at the site of approximately 38 inches.

- **Ultimate Methane Generation Rate (L_o)**: An L_o value of 3,000 ft^3/ton was used for this site. This value was chosen considering SCS's default value for L_o for the average annual precipitation rate at the Landfill of about 38 inches.

Modeling Results

SCS estimates that the gas generation rate for the site in 2006 will be approximately 113 cubic feet per minute (cfm) at an assumed 50 percent (%) methane content. This minimal generation rate is equivalent to only 1.3 scfm per acre of landfilled area. Since the peak generation rate of approximately 600 cfm was reached in 1981, the 2006 value represents an 80% decrease in the peak generation rate. It is expected that gas generation for the site will continue decreasing at an approximate rate of 6.5% per year in subsequent years. Results of the LFG generation modeling are summarized and graphically illustrated in Exhibit 2.

The LFG generation projections are based on a desktop analysis and waste receipt calculations using historical information, as well as our engineering judgment as of the date of this report. Changes in landfill conditions (e.g., variations in waste composition and tonnage from what was assumed) may affect future gas generation at the site. SCS does not guarantee the quantity or the quality of landfill gas generated.

1.4 Summary of Problem

Methane gas has been detected at ambient pressures in the subsurface at the site at concentrations as high as 70.1 percent by volume. Such concentrations indicate that decomposition gas (normally 52 to 55 percent methane and 48 to 45 percent carbon dioxide) is being altered by subsurface conditions. The most likely explanation for the high concentrations of methane found at the site is that carbon dioxide is being removed from the soil gas as it dissolves in soil moisture at the site. Methane forms an explosive mixture with air at concentrations between 5 and 15 percent by volume. Accordingly, the primary concern associated with this project is the potential hazard created by the movement (migration) of subsurface methane into proposed residential structures.

The absence of significant soil gas pressure measured in the monitoring probes at the site is important because it indicates that LFG is not being formed rapidly. In the absence of a driving pressure, LFG containing methane will dissipate slowly into the atmosphere. The LFG modeling results also indicate that LFG is not being formed rapidly.

SECTION 2

REMEDIAL DESIGN/REMEDIAL ACTION

The overall objective for implementation of the selected remedy is to mitigate potential risk to, and provide adequate protection of, public safety. Specifically, the objective of the selected remedy for the site is to prevent methane gas from accumulating in confined spaces or structures at concentrations posing an explosion hazard. Engineering controls and institutional controls will be implemented to achieve the overall objective for the site. This section presents the remedial design criteria and objectives, detailed description of the remedial approach and implementation strategy, monitoring strategies to verify performance and compliance, implementation requirements (access, permits, etc.), and contingency responses.

Methane mitigation techniques such as Cutoff Trenches, vent layers and membrane barriers are proven technologies that have been safely used at a wide variety of real estate developments in the United States and elsewhere.

2.1 Detailed Description of Remedy

The selected remedy provides a comprehensive strategy to address potential risk at the proposed development. The primary engineering control is a LFG Cutoff Trench designed to mitigate methane migration near the source. The secondary means of methane gas control includes a methane barrier installed underneath any structure constructed near the LFG Cutoff Trench or any other areas where methane gas and static pressure have been detected in the subsurface. And finally, monitoring will be used to verify the effectiveness of the engineering controls.

The selected remedy, which provides a comprehensive strategy to address potential risk at the proposed development, includes the following primary components:

Primary Engineering Controls: Primary engineering controls have been developed to control future LFG migration from the waste areas. Primary engineering controls will be installed around the waste limits in areas where methane gas has been detected in the subsurface. The primary engineering controls will include a LFG Cutoff Trench installed along the perimeter of the waste areas to control LFG migration out of the waste-containing areas.

Secondary Engineering Controls: Secondary engineering controls will be incorporated into the design of each structure located within 100 feet of the LFG Cutoff Trench or in areas where methane has been detected in the subsurface above 5 percent. The secondary engineering controls will include a passive gas protection system that consists of a membrane barrier liner and vent pipes installed below the structure.

Pre-occupancy Monitoring: Monitoring will be used to confirm the effectiveness of engineering controls prior to occupancy of the homes. Methane monitoring will be conducted at least four times for each structure after construction of the engineering controls. Monitoring rounds will be separated by at least two weeks.

2.1.1 Primary Engineering Controls

The primary engineering controls selected to control LFG from migrating towards the planned development will consist of a passive LFG Cutoff Trench. The depth of the LFG Cutoff Trench will typically be extended to depth to bedrock or groundwater, which is typically 8 to 17 feet below ground surface. The trench will be 2 to 2.5 feet wide, backfilled with gravel, and will include a geomembrane liner to minimize the lateral migration of LFG. The upper three feet of the trench will be backfilled with on-site soils, through which methane will disperse vertically out of the trench. The soil backfill over the gravel serves two purposes: 1) to inhibit stormwater infiltration into the trench and 2) to inhibit short-circuiting of air into the trench if it is converted to an active system at a later date. A geotextile fabric will be installed between the soil and gravel to prevent clogging.

To determine the effectiveness of the Cutoff Trench, LFG probes installed on either side of the trench will be monitored. A perforated (or slotted) 4-in diameter pipe will be installed within the trench along its length, and if needed the LFG Cutoff Trench could be converted into an active system by applying a vacuum to the pipe at one of its access ports.

A set of engineering drawings that depict the primary engineering controls is included in Appendix A. The proposed location of the LFG Cutoff Trench shown on Drawing 3, Appendix A, is based on preliminary development plans for the site. The actual location and extent of the LFG Cutoff Trench will depend on areas to be developed and actual subsurface methane concentrations. For example, at this time development is not planned in the areas south of Landfill Area C or west of Landfill Area B, so the LFG Cutoff Trench will not be constructed in these areas.

Final construction drawings and bidding documents for the initial portion of the LFG Cutoff Trench are currently being prepared by SCS under contract with the Town. SCS has been retained to serve as the Task Manager of the Brownfield Cleanup Cooperative Agreement Work Plan (Work Plan) which was prepared by the Land-of-Sky Regional Council in support of an US EPA Brownfields cleanup grant.

2.1.2 Secondary Engineering Controls

In addition to the primary engineering controls, secondary engineering controls will also be constructed to mitigate the potential for methane to accumulate in confined spaces or buildings on the property.

The secondary controls will consist of a membrane barrier/venting system constructed below buildings located within 100 feet of the LFG Cutoff Trench or in areas where methane has been detected in the subsurface above 5 percent. The membrane barrier system will include a barrier (either 20-mil PVC liner, spray-on emulsive, or equivalent). A venting layer will also be installed below the membrane to vent LFG that may accumulate below.

Details of the secondary controls are included on Drawing No. 6 in Appendix A. These details are considered conceptual at this time since final architectural drawings have not been prepared

for each building or structure. Final drawings depicting these secondary engineering controls will be prepared and certified per Section 3.2 of this Plan by SCS, and incorporated into the developer's Final Construction Drawings to be submitted to the Town during the building permit process.

2.1.3 Miscellaneous Engineering Controls

In addition to the primary and secondary engineering controls presented above, miscellaneous engineering controls may also be incorporated in the development of the site, as needed. These miscellaneous engineering controls include, but are not limited to, the following:

- Utility Dams – these are intended to stop the migration of methane gas within a utility trench (e.g., electric, water, sewer). Utility dams are constructed within a utility trench near buildings by placing a concrete or bentonite plug in the trench to minimize methane gas movement within the trench bedding material.

- Pavement Vents – these consists of subsurface perforated vent pipes placed in the gravel subbase to vent off accumulated methane gas from underneath large paved areas, such as parking lots or tennis courts. These are typically needed only under a large paved area if it is adjacent to a structure, for example a parking lot by an apartment complex.

- Conduit Seal-Offs – these are used in hollow electrical conduits when they are installed within an area with methane gas present in the subsurface. The seal offs are used to stop methane gas from traveling through the conduit into a structure or electrical junction box.

- Methane Sensors – these may be installed in structures located in areas with high concentrations of methane gas in the subsurface. The sensors will be designed with an alarm to alert people in the building if methane gas is detected above 10 percent of the LEL within the building.

Details of these miscellaneous engineering controls are shown in Appendix A.

2.1.4 Pre-Occupancy Monitoring

Pre-occupancy monitoring will be conducted in all structures after installation of the methane mitigation components to document that the engineered systems are functioning properly and that the structures are safe for occupancy.

Methane monitoring will be conducted at least four times for each structure prior to occupancy. Each monitoring round will include measuring methane concentrations beneath the slab, above the slab, at each vent riser pipe, and at points where gas would enter and accumulate in structures. At least two rounds of monitoring will be performed inside the structures (ground floor) after drywall has been installed. Monitoring rounds will be separated by at least two weeks.

For each round of monitoring, the following procedure will be followed.

1. The instrument to be used shall be capable of measuring methane concentrations to the nearest tenth of a percent by volume or better. Landtec's GEM500 and GEM 2000 are examples of such an instrument.

2. Prior to the start of each day's monitoring, calibrate the instrument in accordance with the manufacturer's instructions. Record calibration results in the field log.

3. Record the date, time, temperature, barometric pressure, barometric trend (rising, falling, steady), and weather conditions in the field log.

4. Record the location (lot number or street address) of the system being monitored, and indicate whether the monitoring is for the upper vent layer, the interior of the structure, or both. Measure the methane concentration at the monitoring points for that location. Record the time and any unusual conditions noted.

5. Proceed to the other structures or locations to be monitored, and repeat step 4.

At the conclusion of each day's monitoring, the calibration of the instrument will be checked in accordance with the manufacturer's instructions, and the results recorded in the field log. The weather conditions such as ambient temperature, barometric pressure, barometric trend, and weather conditions should also be recorded in the field log.

2.1.5 Institutional Controls

Engineering controls installed as part of the methane mitigation program will be constructed in accordance with design plans and specifications included herein, applicable provision in the BFA, and in accordance with appropriate building permits obtained through the Town. Future new construction, remodeling, or additions that would expand the footprint of any structure on the property, or replace any structure that has been demolished, must be approved by the Town in advance, and appropriate building permits must be obtained to complete such work. The Town has identified the Elk Mountain Landfill property as having special engineering requirements for methane mitigation, and final approved design plans and specifications will be maintained at the Town permit offices for future reference and used in approving and inspecting plans for construction, remodeling, or additions that would disturb engineering controls or require expansion of such controls.

2.2 Design and Implementation Considerations

Individually or cumulatively, the tasks required under this Plan are considered to be readily implementable and typical of standard engineering design and construction methods in the building industry. Overall success for the project will be a result of tasks being performed properly and concluding with final inspections and monitoring to thoroughly document that the engineering controls are functioning properly.

Each task, such as installation of vent systems, impermeable membranes, or utility dams, will be conducted by appropriately licensed and experienced construction professionals. The services of an independent engineer experienced in design and construction of methane mitigation systems

will be retained to periodically observe installation of system components and conduct pre-occupancy monitoring generally as described in this Plan. Based upon periodic observations and pre-occupancy monitoring, the independent engineer will certify for each dwelling that system components have been installed generally in accordance with this Plan.

SECTION 3

CONSTRUCTION QUALITY ASSURANCE AND ENGINEER'S CERTIFICATIONS

Construction Quality Assurance (CQA) activities and engineering certifications from a professional engineer will be used to verify that the engineering controls contained herein have been designed, constructed, and are properly operating to control the migration of methane gas from the waste containing areas.

3.1 Construction Quality Assurance

CQA for implementation of this remedy will include observations and evaluations of materials and workmanship to verify the quality of the engineering controls to be constructed. Field quality control for the installation of the methane mitigation systems to be installed at the site will be maintained through a series of inspections during construction and final certification for occupancy. The purpose of the inspections is to insure the methane mitigation systems are installed generally in accordance with this Plan and any subsequent final designs.

CQA activities will be provided under the direct supervision of a qualified professional engineer experienced in the LFG field and will include, but not limited to, the following:

- Attendance at pre-construction meeting,
- On-site observations during trench construction,
- Testing of materials (geomembrane liner and trench backfill) to determine if they meet the required specifications,
- Preparation of weekly progress report and photo-documentation,
- Reviewing and approving contractor invoices, and
- Preparation of a "Landfill Gas Control Systems Implementation Report" (Implementation Report) in accordance with Section V, paragraph 16 of the BFA.

3.2 Engineering Certifications

In addition to the engineering certification prepared for this report (page ii), an engineering certification prepared by SCS (or another independent gas consultant) will also be prepared for each Landfill Gas Control Systems Implementation Report. Certification language for the Implementation Report is shown in Exhibit 3.

3.3 Landfill Gas Control Systems Implementation Report

In accordance with Section V, paragraph 16 of the BFA, Implementation Reports are required following the construction of methane gas engineering controls. Because the development of the entire site will occur in phases, possibly over a 2 to 3 year period, several Implementation Reports and engineering certifications will be needed as the project progresses. The initial Implementation Report will be prepared within 30 days following the installation of the LFG Cutoff Trench. Additional Implementation Reports will be prepared and submitted to NCDENR for approval following construction and testing of any required secondary engineering controls (i.e., membrane barriers under structures). These additional Implementation Reports may address more than one structure.

No residential or commercial structure may be occupied at the site until this Plan has been approved in writing by NCDENR and recorded at the Buncombe County Register of Deeds office, and NCDENR has approved in writing an Implementation Report demonstrating that all measures deemed necessary by NCDENR to eliminate LFG-related risks to public health at the structure in question has been implemented.

SECTION 4

LONG-TERM MONITORING AND CORRECTIVE MEASURES

4.1 Long-Term Monitoring

Long-term monitoring is an important element of this Plan to confirm ongoing control of methane migration from the waste areas and infiltration into structures. Long-term monitoring will be used to collect information in the subsurface to track conditions there that may give early indication of changes warranting investigation.

SCS Engineers (or another independent gas consultant) will provide long-term monitoring of the perimeter probes adjacent to the LFG Cutoff Trench. Long-term monitoring will be performed quarterly for two years, and semi-annual monitoring thereafter, as warranted by the data being collected. Portable instrumentation employed for this monitoring will include an infrared gas analyzer (such as a Landtec GEM 500 or GEM 2000) for the perimeter probes.

SCS Engineers (or another independent gas consultant) will prepare reports of monitoring results periodically (e.g., monthly, quarterly, or semi-annually), together with recommendations for any corrective measures. The reports will be submitted to the Town and property developer and/or future homeowners association. Building owners will be responsible for notifying tenants of any methane concerns.

4.2 Corrective Measures

As described earlier, pre-occupancy monitoring will be conducted during the construction of the residential structures to identify areas of potential concern early on in the development process. This will include initial monitoring of vent systems well ahead of completion to identify conditions that may require contingency response. Final monitoring for pre-occupancy certification will also be conducted to verify that installed controls have been installed properly and are functioning as designed.

If methane is detected above 0.1 percent by volume within a structure, the management team will initiate contingency responses immediately. Initial phases of the response will include, but not necessarily be limited to, the following:

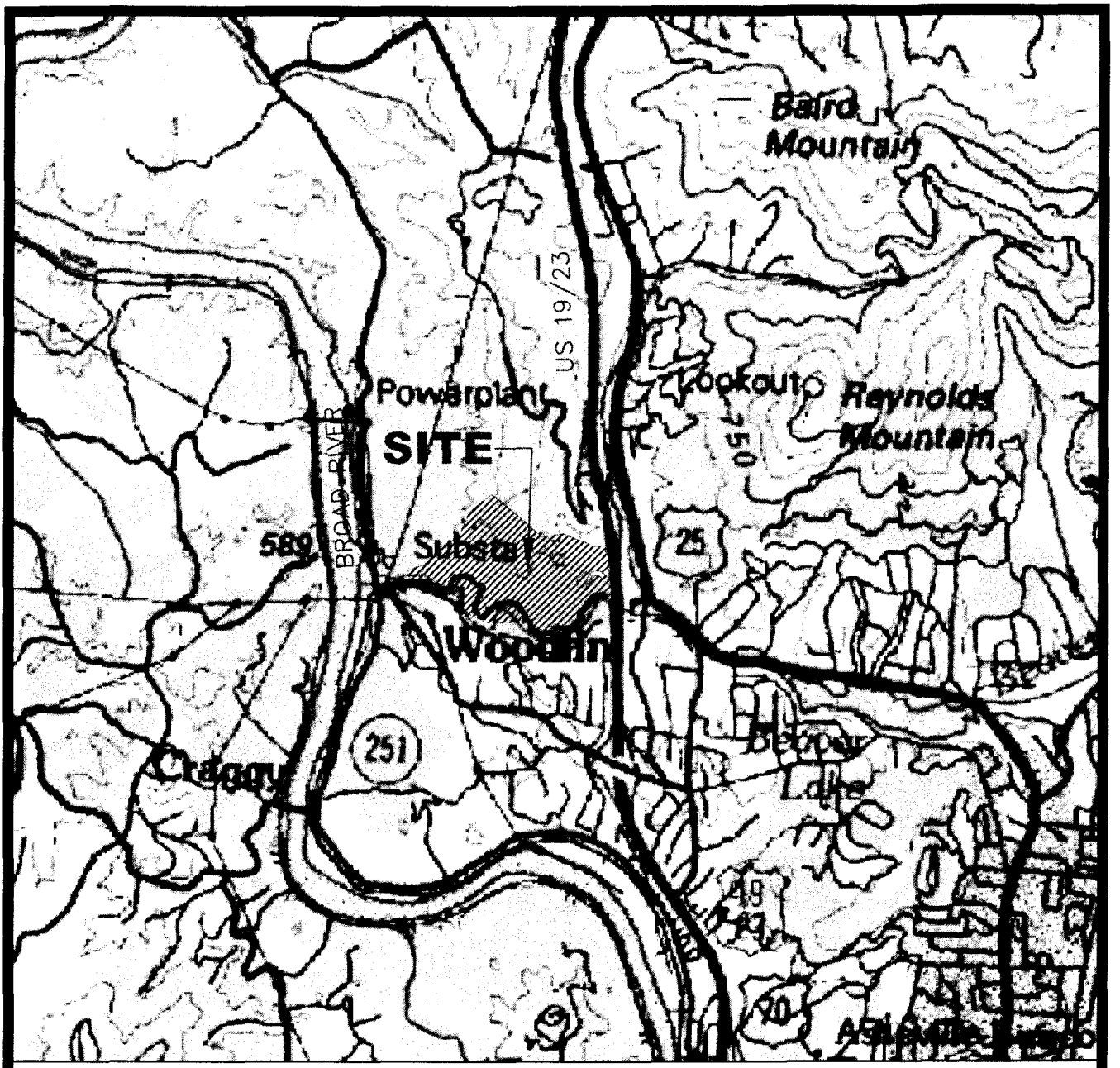
- File review of geotechnical and methane inspection field reports and logs to verify and re-evaluate conditions in the immediate vicinity of the structure and the construction inspection history for methane mitigation systems;

- Visual survey of construction aspects of the structure to mitigate any readily identifiable deficiencies; and

- Additional monitoring of the structure and ventilation systems pending full assessment of potential deficiencies and final resolution of the satisfaction of the Town.

If after additional engineering review, monitoring, and resolution of identifiable deficiencies, methane continues to be present in the structure; additional corrective measures will be required prior to occupancy. Such measures may include installation of temporary monitoring points at locations near the perimeter to assess shallow methane conditions in the immediate area of the structure, or installation of supplemental ventilation systems or membranes.

After construction of any supplemental engineering controls, if required, pre-occupancy monitoring would again be conducted to re-evaluate overall protectiveness of the final engineered systems. Additional documentation and information will be provided to the Town prior to occupancy of the structure to summarize the contingency responses and provide appropriate data and analysis supportive of any problem resolution.



NOTE:
1. IMAGE COURTESY OF TERRASERVER; WOODFIN, NC, USA; DECEMBER 9, 2004.

APPROXIMATE SCALE 1"=2000'

N

DRAWN BY: JLM DATE: 9/29/06 FILE NAME: 02204303.02

SCS ENGINEERS

FIGURE 1 - SITE VICINITY MAP
ELK MOUNTAIN LANDFILL BROWNFIELDS PROJECT

DRAWN BY: JLM DATE: 9/29/06 FILE NAME: 02204303.02

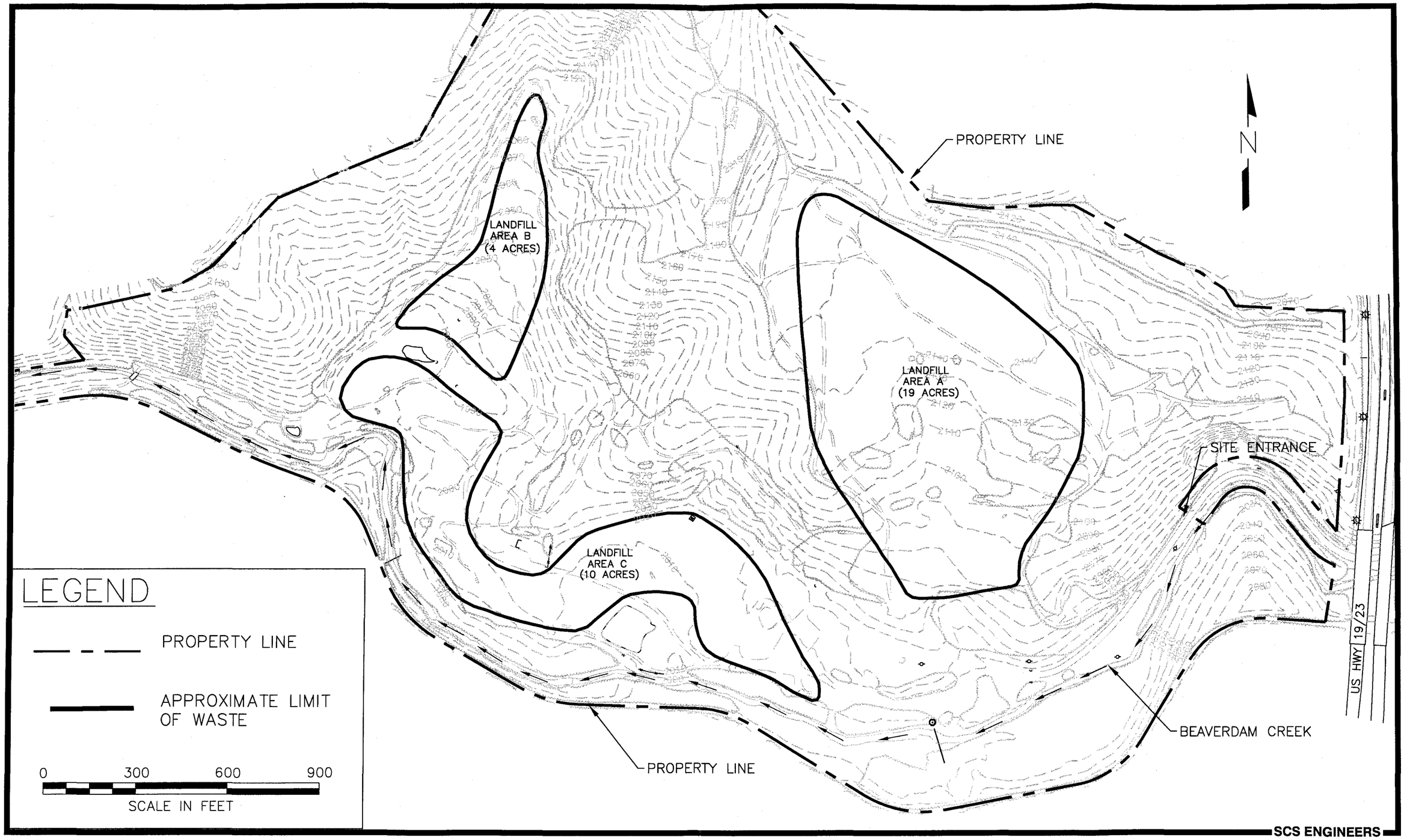


FIGURE 2 - SITE PLAN

ELK MOUNTAIN LANDFILL BROWNFIELDS PROJECT

DRAWN BY: JLM DATE: 9/29/06 FILE NAME: 02204303.02

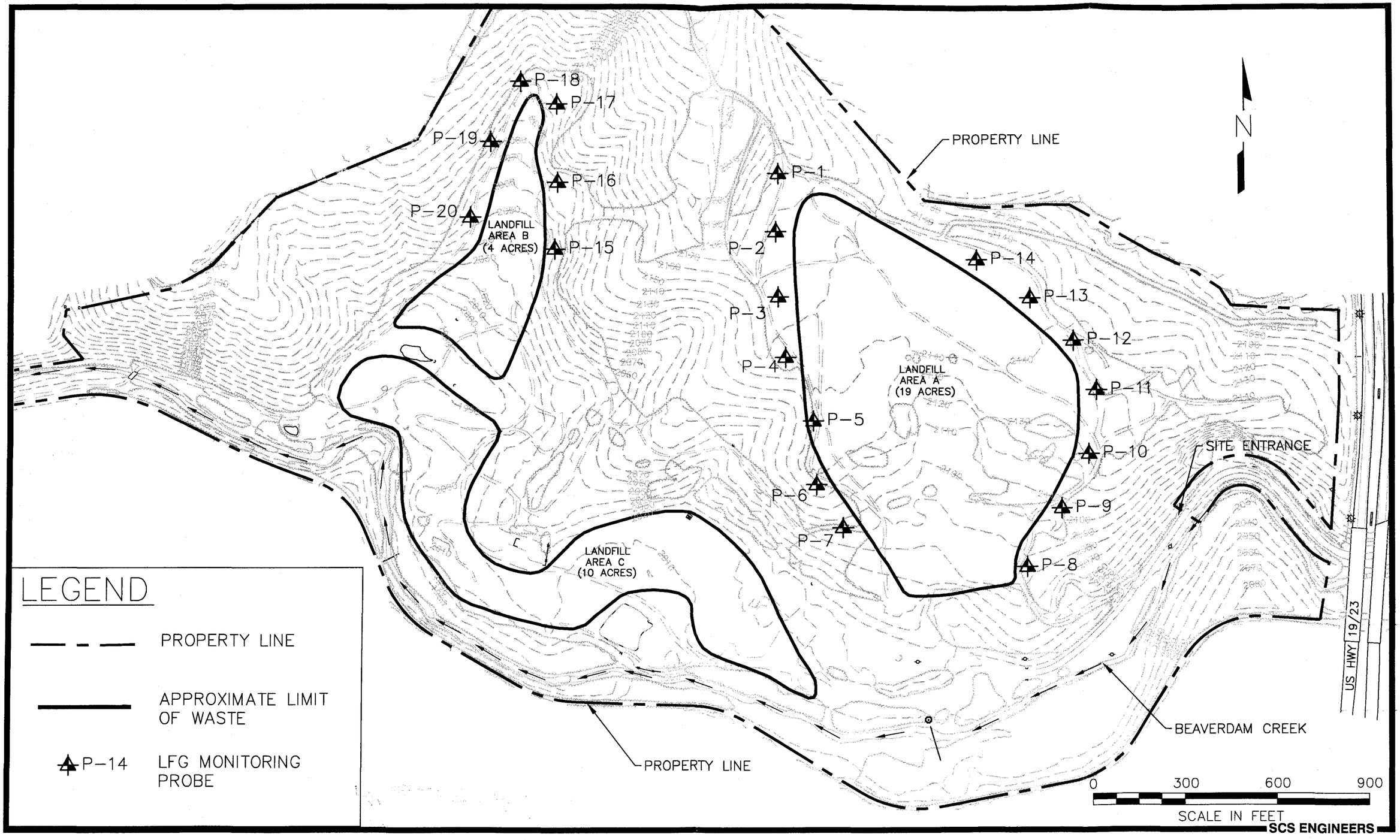


FIGURE 3 - LFG MONITORING PROBE LOCATION PLAN
ELK MOUNTAIN LANDFILL BROWNFIELDS PROJECT

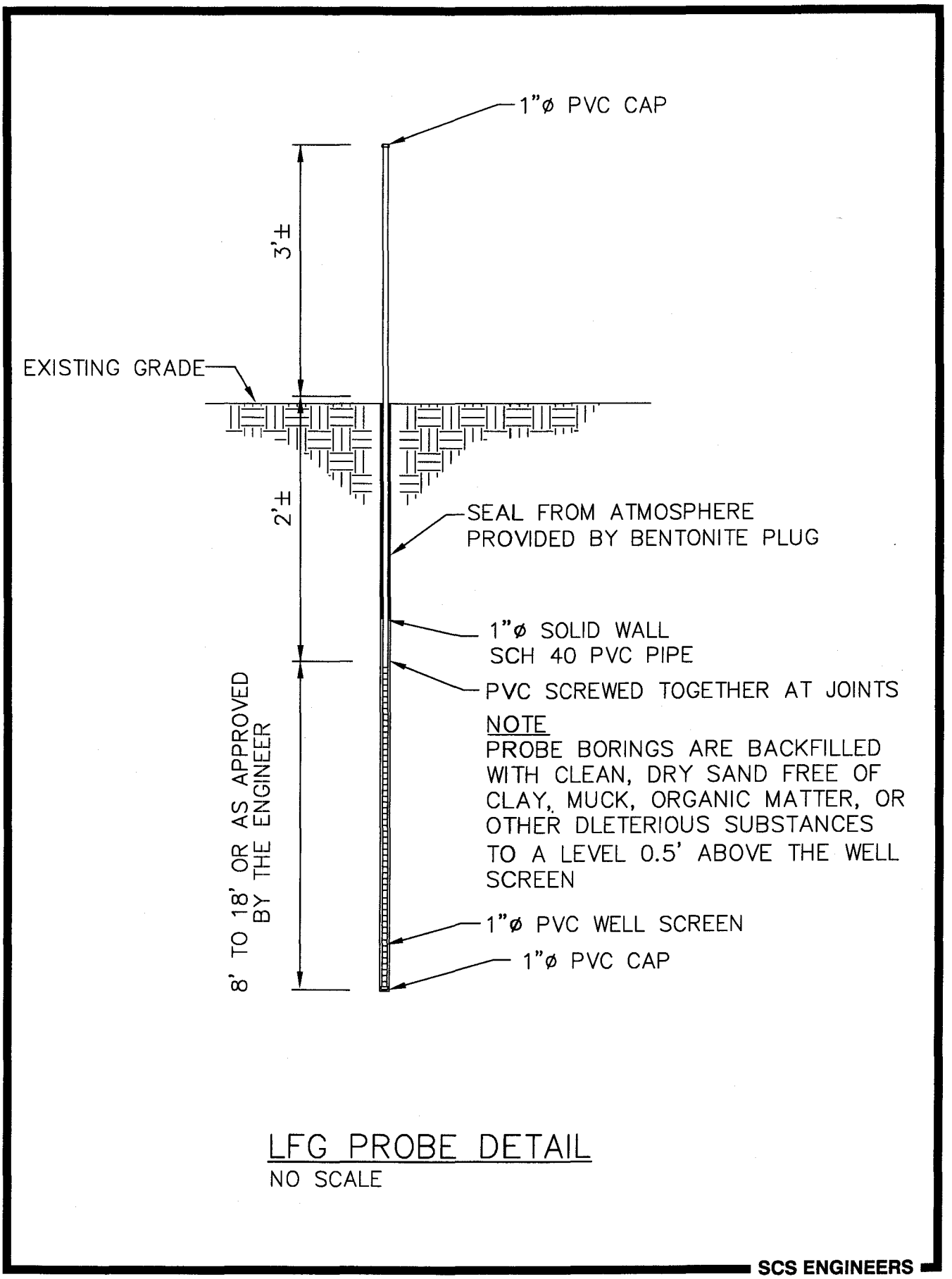


FIGURE 4 - LFG MONITORING PROBE DETAIL
ELK MOUNTAIN LANDFILL BROWNFIELDS PROJECT

TABLE

TABLE 1. LFG MONITORING PROBE DATA
ELK MOUNTAIN LANDFILL BROWNFIELDS PROJECT- WOODFIN, NORTH CAROLINA

Probe ID	9/23/2004	10/13/2004	11/10/2004		12/23/2004		6/8/2005	
	Methane (%)	Methane (%)	Methane (%)	Pressure (in-w.c.)	Methane (%)	Pressure (in-w.c.)	Methane (%)	Pressure (in-w.c.)
P-1	0.0	0.1	0.2	0.0	22.5	-0.1	0.1	0.0
P-2	30.1	43.1	65.2	0.0	64.5	-0.1	46.1	0.0
P-3	60.7	61.5	63.7	0.2	64.1	-0.5	57.7	0.0
P-4	60.5	61.6	63.5	0.2	62.5	-0.1	58.3	0.0
P-5	57.9	59.0	61.2	0.2	58.5	-0.3	58.5	0.0
P-6	4.7	4.2	49.5	0.2	38.8	0.0	53.2	0.0
P-7	0.1	0.1	0.2	0.0	0.0	0.0	NM	NM
P-8	0.1	8.9	59.9	0.0	58.3	0.1	58.9	0.0
P-9	61.9	61.5	63.4	0.5	60.8	0.9	58.1	0.0
P-10	0.6	4.8	36.7	0.0	52.7	0.0	54.0	0.0
P-11	59.2	58.8	62.7	0.2	56.2	-0.2	56.8	0.0
P-12	27.3	47.0	60.0	0.2	12.6	0.0	58.3	0.0
P-13	58.6	59.3	54.5	0.0	58.8	0.0	57.3	0.0
P-14	12.6	18.8	64.2	0.0	63.5	0.0	46.5	0.0
P-15	0.1	0.1	0.3	0.0	1.7	0.0	0.0	0.0
P-16	0.1	0.1	0.3	0.1	0.0	0.3	0.0	0.0
P-17	10.1	15.8	64.7	0.1	70.1	-0.1	51.4	0.0
P-18	2.6	0.7	41.4	0.0	59.4	-0.1	30.9	0.0
P-19	52.0	47.5	45.8	0.0	36.8	-0.1	31.2	0.0
P-20	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0

EXHIBITS

EXHIBIT 1

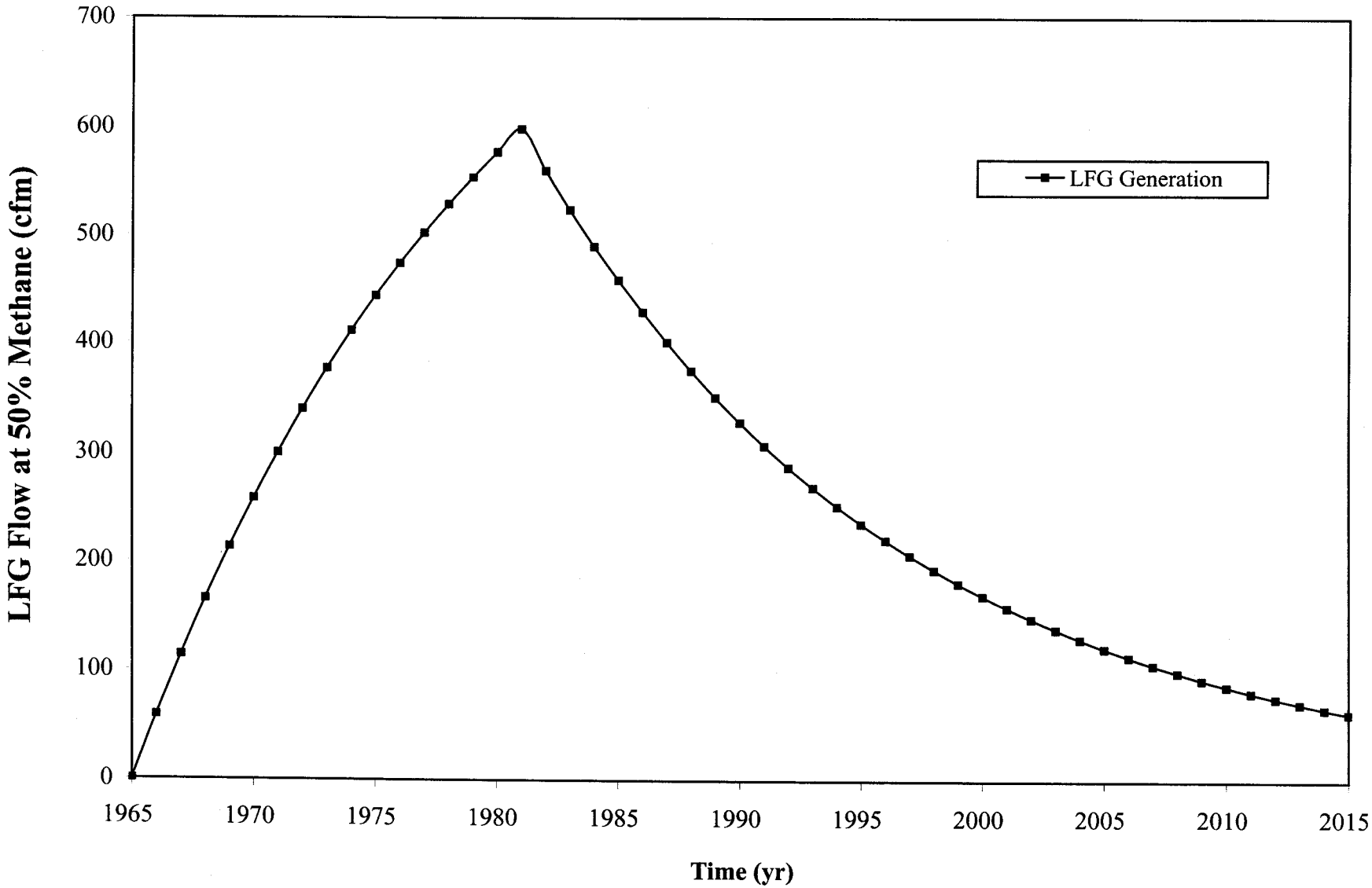
LFG GENERATION MODELING

EXHIBIT 1. LFG GENERATION
ELK MOUNTAIN LANDFILL BROWNFIELDS PROJECT - WOODFIN, NORTH CAROLINA

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	LFG Generation (scfm)	(mmcf/day)	(mmBtu/yr)
1965	82,764	82,764	0	0.00	0
1966	82,764	165,528	59	0.08	15,635
1967	82,764	248,292	114	0.16	30,263
1968	82,764	331,056	165	0.24	43,951
1969	82,764	413,820	213	0.31	56,757
1970	82,764	496,584	258	0.37	68,740
1971	82,764	579,348	301	0.43	79,952
1972	82,764	662,112	340	0.49	90,443
1973	82,764	744,876	377	0.54	100,259
1974	82,764	827,640	412	0.59	109,443
1975	82,764	910,404	444	0.64	118,036
1976	82,764	993,168	474	0.68	126,076
1977	82,764	1,075,932	502	0.72	133,600
1978	82,764	1,158,696	529	0.76	140,639
1979	82,764	1,241,460	554	0.80	147,225
1980	82,764	1,324,224	577	0.83	153,387
1981	0	1,324,224	598	0.86	159,153
1982	0	1,324,224	560	0.81	148,914
1983	0	1,324,224	524	0.75	139,333
1984	0	1,324,224	490	0.71	130,369
1985	0	1,324,224	459	0.66	121,981
1986	0	1,324,224	429	0.62	114,133
1987	0	1,324,224	402	0.58	106,790
1988	0	1,324,224	376	0.54	99,920
1989	0	1,324,224	352	0.51	93,491
1990	0	1,324,224	329	0.47	87,476
1991	0	1,324,224	308	0.44	81,848
1992	0	1,324,224	288	0.41	76,583
1993	0	1,324,224	269	0.39	71,655
1994	0	1,324,224	252	0.36	67,045
1995	0	1,324,224	236	0.34	62,732
1996	0	1,324,224	221	0.32	58,696
1997	0	1,324,224	207	0.30	54,920
1998	0	1,324,224	193	0.28	51,386
1999	0	1,324,224	181	0.26	48,080
2000	0	1,324,224	169	0.24	44,987
2001	0	1,324,224	158	0.23	42,092
2002	0	1,324,224	148	0.21	39,384
2003	0	1,324,224	139	0.20	36,850
2004	0	1,324,224	130	0.19	34,480
2005	**0**	**1,324,224**	**121**	**0.17**	**32,261**
2006	0	1,324,224	113	0.16	30,186
2007	0	1,324,224	106	0.15	28,244
2008	0	1,324,224	99	0.14	26,427
2009	0	1,324,224	93	0.13	24,726
2010	0	1,324,224	87	0.13	23,136
2011	0	1,324,224	81	0.12	21,647
2012	0	1,324,224	76	0.11	20,254
2013	0	1,324,224	71	0.10	18,951
2014	0	1,324,224	67	0.10	17,732
2015	0	1,324,224	62	0.09	16,591

Methane Content of LFG Adjusted to: 50%
Selected Decay Rate Constant (k): 0.0665
Selected Ultimate Methane Recovery Rate (Lo): 3,000

Exhibit 1. LFG Generation
Elk Mountain Landfill Brownfields Project - Woodfin, North Carolina



10/2/2006

EXHIBIT 2

ENGINEER'S CERTIFICATION

ENGINEER'S CERTIFICATION

The following certification (or similar) shall be used following construction of the methane mitigation controls at the Elk Mountain Landfill project.

Based upon observations made by me and/or members of my staff during construction, and based upon monitoring results following installation of the landfill gas control systems described in the attached DENR-approved Landfill Gas Control Plan ("Plan"), October 9, 2006 for the Elk Mountain Landfill brownfields redevelopment project, I hereby certify that the landfill gas control systems described in the attached Landfill Gas Control Systems Implementation Report have been installed in accordance with said Plan, and are functioning as designed to control migration of landfill gas from the Waste-Containing Portion of the Property, in accordance with said Plan. I further believe that these systems are appropriate for the land uses specified in the Brownfields Agreement for said project and are accomplishing their purpose of protecting public health and the environment at the site of this redevelopment project.

_____

Signature of North Carolina Registered Professional Engineer

Name and Affiliation _____

Date _____

[PE SEAL]

APPENDIX