REPORT OF
LANDFILL GAS ASSESSMENT

FRANCIS FARM LANDFILL
PERMIT NO. 44-03
HAYWOOD COUNTY, NORTH CAROLINA

JEFFREY R. BISHOP, PE

McGill ASSOCIATES
Engineering • Planning • Finance
Asheville, North Carolina

November 2011

10.00726

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November 15, 2011

Ms. Elizabeth S. Werner
Solid Waste Section – Permitting Branch Hydrogeologist
North Carolina Department of Environment and Natural Resources
Raleigh Regional Office
1601 Mail Service Center
Raleigh, North Carolina 27699-1646

RE: Report of Landfill Gas Assessment
Francis Farm Landfill, Permit Number 44-03
Haywood County, North Carolina

Dear Ms. Werner:

On behalf of Haywood County, McGill Associates is pleased to present to you this Report of Landfill Gas Assessment for the Francis Farm Landfill in Haywood County. The Report highlights the assessment monitoring results and remediation efforts conducted by Haywood County over the past year, in accordance with the Landfill Gas Assessment and Remediation Plan submitted to you in September 2010. Please find enclosed two (2) hard copies and a digital copy of the Report for your review.

As reported to you during the quarterly landfill gas (LFG) monitoring events over the past year, methane gas was not detected in any of the on-site structures throughout the assessment monitoring period. Methane gas was detected above the 100% LEL level on a regular basis at the following LFG monitoring wells: MM's 1, 2, 3, 4, 6, 10, 11 and 12 located at the northern and southwestern periphery of the landfill. Methane gas was not detected above the 100% LEL level at the following LFG monitoring wells MM's 5, 7, 8, 9, 13 and ground water monitoring well MW-12, located at the eastern, southeastern, and northwestern periphery of the landfill.

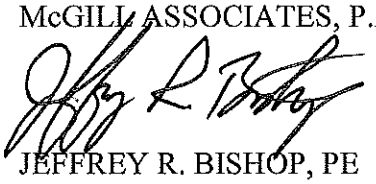
Haywood County has taken steps to control LFG migration at the Francis Farm Landfill by beginning work on the Gas Collection, Combustion, and Electrical Generation System. The project includes the installation of an active gas collection system that will utilize LFG to create electricity. The gas extraction wells were installed in September 2010 and the gas collection and flare system is under construction and scheduled to be completed by the end of 2011. The goal is to have the electrical generator in operation by the end of January 2012. The Project will

control LFG migration by combusting up to 200 scfm of LFG continuously. The results observed during the assessment monitoring period are consistent and will provide an excellent measure of the effectiveness of the Gas Collection System in controlling LFG migration over time. A proposed schedule for future LFG monitoring at the Francis Farm Landfill is included in the Report of Landfill Gas Assessment. It is proposed that monthly monitoring for a 1-year period will commence when the electrical generator comes on line, estimated to be in January 2012. Per our recent discussion, in the interim period prior to the electrical generator becoming operational, the County will conduct quarterly LFG monitoring at the locations outlined in the Report, beginning in the last quarter of 2011.

We would like to take this opportunity to update you on the progress of ground water monitoring at the Francis Farm Landfill. Six additional monitoring wells have been installed and will be sampled during the next regularly scheduled semi-annual ground water monitoring event in the spring of 2012. The locations of the six new wells are included on the Environmental Monitoring Site Plan Record Drawing, Figure 1, in the Report of Landfill Gas Assessment. BLE, Inc. will provide well logs and a well report at the time of the sampling in the spring.

We look forward to working with you during your review of the Report of Landfill Gas Assessment as Haywood County works aggressively to control LFG migration at the Francis Farm Landfill. We will keep you updated on the progress of the construction of the Gas Collection, Combustion, and Electrical Generation System. Please let us know if you have any questions or require additional information regarding the Report of Landfill Gas Assessment.

Sincerely,
McGILL ASSOCIATES, P.A.



JEFFREY R. BISHOP, PE
Director of Solid Waste Services

Enclosures

cc: Marty Stamey, Haywood County Manager, w/digital copy of enc
David Francis, Haywood County Tax Assessor, w/digital copy of enc
Stephen King, Haywood County Solid Waste Director, w/2 hard copies/1 digital copy
Allen Gaither, NCDENR Solid Waste Section, w/digital copy of enc
Andrea Keller, NCDENR Solid Waste Section, w/digital copy of enc
Andy Alexander, BLE, w/digital copy of enc

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Report of
Landfill Gas Assessment
Francis Farm Landfill
Permit No. 44-03

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1.0 Introduction

The North Carolina Department of Environment and Natural Resources (NCDENR), Solid Waste Section (SWS) performed a Facility Compliance Audit Report on July 21, 2010, in which the SWS required that Haywood County prepare and submit a Landfill Gas Assessment and Remediation Plan for the Francis Farm Landfill. The Plan was submitted to the NCDENR on September 13, 2010. Haywood County enlisted the services of McGill Associates, P.A. to carry out the monitoring requirements specified in the Plan and to coordinate implementation of the remediation measures included in the Plan. This report summarizes the findings of the assessment monitoring period and describes the remediation measures undertaken by Haywood County to control landfill gas (LFG) migration at the Francis Farm Landfill.

The Francis Farm Landfill, Permit No. 44-03, is located in Haywood County, North Carolina on Francis Farm Road, (S.R. 1802), Waynesville, North Carolina and was the County's primary MSW landfill from its opening in the early 1970's through 1994. The facility was officially closed per a Closure Certification prepared by RCF, Inc. Hazelwood, North Carolina dated September 14, 1994 and submitted to the North Carolina Department of Environment and Natural Resources (NCDENR). The original Permit for Closure was issued on December 13, 1995. The facility encompasses approximately 33.1 acres as shown on the Environmental Monitoring Site Plan Record Drawing, included as Figure 1. Within the Facility Boundary, in addition to the closed landfill, Haywood County Schools (HCS) operates a maintenance/ bus garage facility. The maintenance facility includes the Maintenance (bus garage) Building, an equipment storage building, and a maintenance storage building. The Maintenance Building consists of offices, carpentry shop and bus maintenance facility. Additionally, the HCS parks school buses at the southern periphery of the property during summer months.

The facility property is bounded by private property utilized for residential and agricultural uses. The closest residential structure is located on the Stephens property, approximately 340 feet to the south of the facility property line.

2.0 Regulatory Compliance

The Francis Farm Landfill operates under the Permit for Closure with a most recent revision dated May 23, 2006. The Landfill Gas Monitoring Plan was developed to comply with the following Methane Gas Remediation Conditions section of the Permit for Closure. This section has been included below:

(8) The owner or operator shall maintain and operate the gas monitoring system to ensure that:
   (a) The concentration of methane gas generated by the facility does not exceed 25 percent of the lower explosive limit for methane in facility structures (excluding gas control or recovery system components); and
   (b) The concentration of methane gas does not exceed 100 percent of the lower explosive limit for methane at the facility property boundary.

(9) If methane gas levels exceeding these limits are detected, the owner or operator must take all steps necessary to meet the standards established in condition 8.

Methane gas remediation plans approved by the Division are described in the List of Approved Documents, Attachment 1, Part C of the Permit for Closure.

"Lower Explosive Limit" (LEL) is defined as the lowest percent by volume of a mixture of explosive gases which will propagate a flame in air at 25° C and atmospheric pressure.

3.0 Landfill Gas Assessment Results

The Landfill Gas Assessment and Remediation Plan outlined a detailed approach to monitor LFG migration at the Francis Farm Landfill. At the beginning of the assessment period, an informed evaluation of LFG migration at the Francis Farm Landfill was difficult because of the lack of available data. Part of the Assessment Plan was to further investigate existing conditions at the landfill. This investigation included an in-depth review of available record data, field surveys and potential field excavations to verify the waste limits at the landfill. The plan also included installation of additional methane monitoring wells and an increase in the gas monitoring frequency during the assessment period from quarterly to monthly monitoring.

The work conducted by Haywood County over the past year pertaining to the assessment of existing conditions at the Francis Farm Landfill, including LFG assessment monitoring, as detailed in the LFG Assessment and Remediation Plan, is described as follows:

3.1 Assessment Monitoring

The compliance monitoring locations were developed based on the relationship of solid waste disposal areas to property lines and adjacent landfill structures. The spacing of the monitoring wells is between 300 and 600 feet. The Francis Farm Landfill was not constructed with an impermeable base liner system and cap system. There may be a chance for landfill gas migration through the permeable *in situ* soils. The migration of landfill gas is induced by pressure gradients. The landfill gas will move from areas of high pressure to those of low pressure following the path of least resistance. The landfill gas generally migrates vertically until it reaches the landfill cap, where it may begin to flow horizontally. This occurs until it finds a pathway out through the permeable *in situ* soils. As the landfill gas migrates it will fill the void created by the monitoring point's gravel backfill whereupon a landfill gas detection device will detect and read the level of gas concentration.

The original gas monitoring system included six (6) methane monitoring wells spaced along the northern, eastern, and southern reaches of the waste area. The wells consist of 1-inch PVC capped pipe. The PVC pipe is equipped with a quick coupler for use with the landfill gas analyzer. The actual construction details for these original wells are not available.

In addition, the County monitors five (5) specific points within the three (3) existing on-site buildings. The five (5) points are identified with a small plastic sign at each location within the buildings. There are three (3) locations within the Maintenance Building, one location in the Equipment Storage Building, and one location in the Maintenance Storage. These eleven monitoring locations define the existing compliance monitoring points for the landfill and are shown on Figure 1, Environmental Monitoring Site Plan Record Drawing.

As part of the Assessment Monitoring Plan, Haywood County installed six (6) new landfill gas monitoring wells along the northern, southern and western reaches of the waste area. These locations of these wells are shown on Figure 1, Environmental Monitoring Site Plan Record Drawings, and well construction details are shown on Figure 2, Environmental Monitoring Miscellaneous Details Record Drawing. Monitoring wells MM-10 through MM-13 were installed in September 2010 and were included in the October 2010 monthly assessment monitoring event. MM's 1 and 2 were installed in late October 2010 and were first included in the November Assessment monitoring. In addition to the new monitoring wells, one of the original methane wells, MM-8, was re-drilled and re-established during the time that MM's 10 – 13 were installed. Table 1 summarizes the location of the methane monitoring wells and methane monitoring locations at the Francis Farm Landfill.

Table 1 –Landfill Gas Compliance Monitoring Locations

Compliance Point	Description
MM-1*	LFG Monitoring Well along northern property line
MM-2*	LFG Monitoring Well along northern property line
MM-3	LFG Monitoring Well along northern property line
MM-4	LFG Monitoring Well along northern property line
MM-5	LFG Monitoring Well along northern property line
MM-6	LFG Monitoring Well along eastern property line
MM-7	LFG Monitoring Well along eastern property line
MM-8*	LFG Monitoring Well along eastern property line
MM-9	LFG Monitoring Well along southern property line
MM-10*	LFG Monitoring Well along southern property line
MM-11*	LFG Monitoring Well along western property line
MM-12*	LFG Monitoring Well along western property line
MM-13*	LFG Monitoring Well along western property line
SM-1a	Monitoring Point in Maintenance/ Bus Garage Building – Bus Garage (base of mezzanine stairs)
SM-1b	Monitoring Point in Maintenance/ Bus Garage Building – Office Area (main hallway)
SM-1c	Monitoring Point in Maintenance/ Bus Garage Building - Carpentry Shop
SM-2	Equipment Storage Building (doorway between garage and storage area)
SM-3	Maintenance Storage Building (middle storage bay at floor drain)

* Indicates well installed during Assessment Period. MM-8 reestablished during this period.

In addition to the compliance monitoring locations noted in Table 1, Haywood County proposed to monitor four (4) additional landfill gas monitoring points, as shown in Table 2 and in Figure 1. The owner of the property listed in Table 2 as "SM-4" passed away at the beginning of the assessment period and it was not possible to gain access to the structure. In lieu of this monitoring location, groundwater monitoring well MW-12 – located between the landfill and the proposed SM-4 location - was added as a monitoring location. These locations were monitored during the assessment monitoring period.

Table 2 – Additional Landfill Gas Monitoring Locations

Monitoring Point	Description
VB-1	Water Valve Box just outside Maintenance/ Bus Garage
MW-4	Existing Groundwater Monitoring Well
MW-5	Existing Groundwater Monitoring Well
SM-4 Replaced with MW-12	Private Residence (crawlspace) – Not Accessible Monitoring well located between the southern margin of the landfill and private residence

Haywood County performed the assessment LFG monitoring on a monthly basis for 12 months in accordance with the Landfill Gas Assessment and Remediation Plan at all of the compliance and additional monitoring locations listed in Tables 1 and 2, beginning in August 2010. A LandTec LandGEM-2000 analytic monitor was utilized to perform the observations. The meter was at the factory for calibration during the October 2010 sampling period, therefore the assessment period was extended to include the August 2011 monitoring event. Additionally, data from the regularly scheduled quarterly monitoring period in September 2011 is included in this report.

3.2 Assessment Monitoring Results

See Appendix 1 for the monthly methane monitoring results observed during the assessment period. A summary of the results is included in Appendix 2. Methane gas was not detected in any of the on-site structures during the assessment monitoring period. Methane gas was observed in excess of the 100% LEL level on a regular basis at the following LFG monitoring wells: MM-1, 2, 3, 4, 6, 10, 11, and 12. MM's 1-6 are located at the northern margin of the landfill property. MM's 10 – 12 are located at the southwest margin of the landfill. Methane gas was not detected at the LFG monitoring wells on the east, southeast, and northwest sides of the landfill. See Figure 3 for a map that illustrates the location of the methane gas exceedences.

Statistical analysis of the results of the methane monitoring is included in Appendix 3. Trend lines for methane observations are shown for each location where the 100% LEL limit was regularly exceeded. Microsoft Excel software was used to create the simple trend lines shown on the graphs. Consistent results (except as described below) were observed for most of the locations. This information will be useful in determining the effectiveness of the Gas Collection, Combustion, and Electrical Generation System (Section 4.1 below) in controlling LFG migration.

Methane gas readings at the following locations were not consistent and will not be useful in determining the effectiveness of any remediation efforts. Monitoring observations at the water valve-box (VB-1) just west of the maintenance building and groundwater monitoring wells MW-4 and MW-5 did not produce reliable stable results:

- The water valve-box is opened to the atmosphere when the cover is removed, and although methane gas was detected at this location, the readings would not stabilize and would quickly move to 0% methane. The results at this location are more qualitative than quantitative. Due to the close proximity to the waste mass (±10' to 12'), one would expect methane gas detection here. The main concern at this location is the potential for

the water pipeline trench to act as a conduit for gas migration to the adjacent maintenance building. See Section 4.2 below for the remediation measure taken to minimize LFG migration to the Maintenance Building.

- Readings at MW-4 were inconsistent throughout most of the assessment period, until it was determined that the quick-connect fitting on the MW was not working properly. This fitting was replaced in June 2011 and there is 4 months of data at this location. MW-4 is located in close proximity to the waste mass and is not near the property boundary or any building and the usefulness of methane gas readings at this location is questionable.
- MW-5 failed to produce consistent stable methane gas readings throughout the assessment period. Although this groundwater monitoring well is close to the property line and storage facility, MM's 8 and 9 are located nearby as well and act as the compliance boundary monitoring locations in the vicinity of MW-5. The monitoring data obtained at this location is not useful for determining the effectiveness of remediation measures.

3.3 Repairs and Determination of Well Construction Details of the Existing LFG Wells

At the beginning of the assessment period, the existing monitoring wells were deficient of metal well covers, sampling ports, labeling, and concrete pads. The County has completed the repairs to the existing landfill gas monitoring wells and also to the groundwater monitoring wells on site.

Although well construction details were not found for the existing LFG monitoring wells, the depths of the existing LFG monitoring wells were measured and the well depths are noted in the Table on Figure 1. The depths noted for MM's 4 & 5 are shallow and there may be gravel in these wells that may have interfered with the measuring tape. These wells will continue to be monitored during the regularly scheduled quarterly monitoring and the proposed additional monitoring period (discussed in Section 5.1 below).

3.4 Evaluation of the LFG Venting and Monitoring Systems at the Maintenance Building

The existing Maintenance/ Bus Garage Building has a continuous gas monitoring system that is operated by Haywood County Schools (HCS) staff. The gas monitoring system is calibrated on a monthly basis and gas observations using the LandTec LandGEM-2000 meter during the assessment monitoring period corresponded to the readings observed by the continuous monitor. The methane gas monitoring system continuously monitors for methane gas at three (3) strategic locations within the building, including the base of the mezzanine stairs, the hallway of the office area, and the Carpentry Shop. The monitoring system sounds an alert horn if the methane gas readings are detected above 25 percent of the lower explosive limit of methane gas.

The Maintenance Building is equipped with a gas ventilation system constructed below the concrete building slab. The system is operated and maintained by the HCS staff. The below-slab ventilation system was installed as part of the original construction of the building. The system consists of a network of pipes tied to the gravel foundation of the building within the bus maintenance portion of the building. The system utilizes four 4-inch pvc intake pipes located approximately 18 inches above the finish floor of the building that vent fresh outside air to the stone area beneath the building slab. The vent locations are spaced apart on the south and west

sides of the maintenance building. At 5 locations, 4-inch pvc piping extends from below the slab to the ceiling area of the facility where the piping is connected to an exhaust fan. The fan runs continuously and exhausts air to the outside of the building on the west side. The operation of the fan is checked periodically by HCS staff. See Figure 4 for a sketch of the Maintenance Building LFG venting system.

There are two additional storage buildings on-site operated by the Haywood County School System. Haywood County has made a recommendation to the HCS to install the appropriate continuous monitoring equipment in each of these buildings and will work with the HCS to insure that the proper monitoring equipment is installed and functions correctly.

3.5 Waste Limits Survey

The Francis Farm Landfill began operation in the early 1970's. Two sets of drawings were obtained from the Asheville office of the NCDENR-SWS pertaining to construction of the Landfill - one set from 1972 and the other from 1987. These drawings are included in Appendix 4. Neither set of drawings shows a waste limits line; however, the information is useful is determining the approximate waste limits. In the 1970's, landfill activities began along the northern margin of the property and extended south towards the current access road that leads to the school bus facility. The 1972 cross-section drawing shows an earthen berm and waste-fill behind the berm. In October and November 2010, Haywood County, with the assistance of McGill Associates, performed excavations in order to define the limits of waste on the property. Approximately 25 test pits were dug around the periphery of the site and additional test pits were dug within the waste mass to verify the depth of cover. The test pits dug along the northern property line confirm the location of the berm shown on the 1972 drawing, with no waste encountered to a depth of 14 feet. Waste is located uphill above the berm with a cover that varies from 3 to 6 feet. The second set of as-built information from 1987 shows the continuation of the landfill in a southerly direction to an area just west of the current school bus maintenance facility. The approximate waste limits were determined, as observed in the test pits, and from the existing as-built documentation and are shown on the Environmental Monitoring Site Plan Record Drawing, Figure 1.

4.0 Landfill Gas Remediation Measures

In conjunction with the assessment monitoring period described in Section 3 above, a portion of the Assessment Plan addressed remediation efforts available to the County in order to control LFG migration off of the property and to the on-site buildings occupied by HCS staff. The Plan noted the installation of LFG extraction wells within the waste mass, the installation of additional monitoring wells (discussed in Section 3.1 above), and the need to control LFG migration to the Maintenance Building. The County has performed these measures and has proceeded with additional measures – the installation of an active gas collection system that will utilize LFG to create electricity. The remediation measures performed by the County are described below.

4.1 Installation of Gas Collection, Combustion, and Electrical Generation Project

Haywood County has already taken a major step in addressing methane gas migration by installing 21 new passive landfill gas extraction wells (September 2010) within the waste mass as

Phase 1 of the Gas Collection, Combustion, and Electrical Generation System. The County is proceeding with the implementation of Phases 2 and 3 of the Project. Phase 2 consists of the installation of gas collection piping, well dewatering pumps, a blower/flare station, and a wastewater pumping station. The project also included the removal of 34 existing shallow vents at the site and the repair of the landfill cap by adding approximately 9 feet of compacted fill material to an area of the cap that has experienced significant subsidence over the years. The County has begun construction of Phase 2 and hopes to complete construction by the end of 2011. The County received a grant to produce electricity from the combustion of landfill gas and Phase 3 of the project – the installation of a 75 KW generator – is under way. Phase 3 will be completed after the necessary Phase 2 items (i.e. flare station, blower, collection piping) are completed. The goal is to have Phase 3 on line and producing electricity by the end of January 2012. The plans for Phases 1 and 2 of the Project were submitted to the NCDENR-SWS on November 6, 2009 and approved on March 17, 2010. Phase 3 of the project obtained NCDENR-SWS approval on April 5, 2011. The proposed locations of the landfill cap repair, gas extraction wells, gas collection piping, flare station, and electrical generator are shown on the construction drawing for Phase 2 of the Project, Landfill Gas Collection System, included as Figure 6. As-built information of the Gas Collection System will be provided to the NCDENR-SWS upon completion of construction.

The Gas Collection, Combustion and Generation System will assist the County with the control of LFG migration by combusting up to 200 scfm of landfill gas continuously. Over time, the gas flow gradient will be diverted from the LFG monitoring wells at the periphery of the property to the extraction wells instead, where the gas will then be collected and used to create electricity. As noted above, the monthly monitoring data collected as part of the LFG Assessment & Remediation Plan has been consistent and will provide a good measure of the effectiveness of the Gas Collection, Combustion and Generation System when it comes on line. In addition to controlling the migration of landfill gas, leachate will be removed from the extraction wells and discharged into the Town of Waynesville Waste Water Treatment system. Within the first few weeks of operation of the dewatering pumps, we anticipate that approximately 200,000 gallons of leachate will be removed from the landfill. After the initial pump down of leachate, leachate removal rates will be lower, with the intent to continuously pump from 5 locations within the landfill. The design of the dewatering pumps is such that if an area of the landfill becomes dry, the pumps can be moved to other extraction wells to allow the County to remove leachate from different areas of the landfill.

4.2 Installation of Clay Seal along Existing Water Line

The landfill gas monitoring point, VB-1 has historically yielded a high methane gas reading. VB-1 is a water valve box located on the west side of the Maintenance/ Bus Garage Building. Haywood County excavated down to the water line and installed a bentonite clay seal around the water line in order to eliminate the migration of landfill gas towards the building along this pipe, as shown in Figure 5. The location of the valve box is routinely covered in gravel and is difficult to access; furthermore, the open air nature of the valve cover (approximately 10" in diameter) does not allow for reliable LFG observations. The County will recommend removing this location from future LFG monitoring.

5.0 Proposed Recommendations for Further Landfill Gas Monitoring and Remediation

Additional methane monitoring and/or remediation measures are available to the County to monitor and control the migration of methane gas off of the property. The County proposes the following continued LFG monitoring schedule and locations (Section 5.1), once the electrical generation system is brought on line, likely in January 2012. A 12-month period of additional LFG monitoring is proposed in order to allow the Gas Collection, Combustion, and Electrical Generation System to begin operation and reach operating efficiency. Potential future remediation options are noted below; however, these and other remediation options should be evaluated after the 12-month monitoring period is completed and the impact that the Gas Collection, Combustion, and Electrical Generation System has on the migration of methane gas is better understood.

5.1 Continued Landfill Gas Monitoring

Haywood County has already taken a major step in addressing methane gas migration at the Francis Farm Landfill by installing the Gas Collection, Combustion, and Electrical Generation System. An important component of determining the effectiveness of this system will be ongoing LFG monitoring at the methane gas monitoring wells around the site and within all on-site structures. The County will monitor the 13 LFG wells, on-site structures, and groundwater MW-12 on a monthly basis for 12 months from the completion of the electrical generation station in order to analyze trends in methane gas observations. In the interim prior to the completion of the electrical generation system, the County will monitor the 13 LFG wells, on-site structures, and MW-12 on a quarterly basis, beginning in the last quarter of 2011. At the end of the 12-month monitoring period, the data will be analyzed and a report of the results will be submitted to the NCDENR. The report will address the effectiveness of the Gas Collection, Combustion, and Electrical Generation System in controlling LFG migration and any additional monitoring and/or remediation measures that may be needed, including a revised monitoring schedule, the need for additional monitoring wells, and the need for additional extraction wells (see 5.2 below).

The proposed methane monitoring locations are noted in Table 3 below. The County will begin monthly monitoring at these locations at the completion of the installation of the electrical generation system, estimated to be in January 2012. A 12-month monitoring period will be observed.

Table 3 – Proposed Methane Gas Monitoring Locations

Compliance Point	Description
MM-1	LFG Monitoring Well along northern property line
MM-2	LFG Monitoring Well along northern property line
MM-3	LFG Monitoring Well along northern property line
MM-4	LFG Monitoring Well along northern property line
MM-5	LFG Monitoring Well along northern property line
MM-6	LFG Monitoring Well along eastern property line
MM-7	LFG Monitoring Well along eastern property line
MM-8	LFG Monitoring Well along eastern property line
MM-9	LFG Monitoring Well along southern property line

MM-10	LFG Monitoring Well along southern property line
MM-11	LFG Monitoring Well along western property line
MM-12	LFG Monitoring Well along western property line
MM-13	LFG Monitoring Well along western property line
MW-12	Groundwater MW near SE periphery of the property
SM-1a	Monitoring Point in Maintenance Building – Bus Garage (base of mezzanine stairs)
SM-1b	Monitoring Point in Maintenance Building – Office Area (main hallway)
SM-1c	Monitoring Point in Maintenance Building - Carpentry Shop
SM-2	Equipment Storage Building - (doorway between garage and storage area)
SM-3	Maintenance Storage Building (middle storage bay at floor drain)

Please note that the following locations that were included in the LFG Assessment Monitoring Plan – MW 4, MW 5, the valve box west of the Maintenance Building, and SM-4 – will not be monitored during the additional 12-month monitoring period due to the fact that these locations are not at a compliance boundary and the monitoring results observed at these locations during the assessment period were not consistent and will not be useful in determining the effectiveness of any remediation measures.

5.2 Installation of Additional Landfill Gas Extraction Wells

In the event the methane gas observation data for the 12-month period following the completion of the electrical generation station shows that the Gas Collection and Combustion System is not facilitating a downward trend in methane gas observations at the monitoring wells, the County may choose to install 4 or 5 additional extraction wells at the northern portion of the landfill, north of EW's 18-21. These wells would be especially useful in the event that the northern monitoring wells (i.e. MM's 1-6) are not trending downward.

5.3 Adjustment of Blower/Flare System

It may take several months following the installation of the electrical generation system to balance the extraction well field such that the County has a thorough understanding of the gas flow at the site. It will be an important aspect of the operation of the blower/flare/generator system to keep monitoring ongoing around the site, in addition to the proposed monthly monitoring. The County will perform spot checks of the methane gas monitoring wells on an as-needed basis beyond the once per month minimum requirement in order to best operate the Gas Collection, Combustion, and Electrical Generation System. The County's procedures for operating the system will be under constant review in order to maximize the efficiency of the system and to minimize or eliminate methane gas migration from the site.

FIGURES

FIGURE 1

Francis Farm Landfill
Environmental Monitoring Site Plan Record Drawing

PLAN

GRAPHIC SCALE 100 0 50 100 200 300 — 1 INCH = 100 FEET

N

LANDFILL GAS MONITORING WELL AS-BUILT INFORMATION

LFG MONITORING WELL	NORTHING	EASTING	TOP OF CASING ELEVATION	GROUND ELEVATION	SCREENED INTERVAL ELEVATION
MM 1	662,564.90	822,217.57	2669.00	2666.14	2661.6-2656.6
MM 2	662,475.77	822,474.72	2655.62	2652.77	2748.3-2743.3
MM 3	662,403.33	822,681.29	2644.27	2641.09	2630.9[1]
MM 4	662,343.89	822,823.83	2644.11	2640.91	2640.6[1]
MM 5	662,149.37	822,899.42	2669.27	2666.09	2663.3[1]
MM 6	661,899.09	823,023.56	2672.93	2670.38	2653.4[1]
MM 7	661,595.86	822,699.27	2740.61	2737.63	2720.6[1]
MM 8	661,342.80	822,426.37	2756.58	2753.35	2750.3-2743.3
MM 9	661,245.11	822,091.01	2806.93	2803.88	2782.9[1]
MM 10	661,362.92	821,814.38	2798.37	2798.47	2795.4-2778.5
MM 11	661,645.69	821,705.77	2793.68	2793.82	2790.8-2773.8
MM 12	661,928.99	821,797.36	2763.45	2763.64	2760.4-2743.6
MM 13	662,216.37	821,886.21	2729.83	2730.11	2727.3-2710.1

NOTES:
1. SCREENED INTERVAL ELEVATIONS UNKNOWN, BOTTOM OF WELL ELEVATION NOTED HERE.
2. MM's 8 AND 10-13 INSTALLED SEPTEMBER 2010, SCREENED INTERVAL ELEVATIONS PROVIDED BY BLE, INC.
3. MM's 1 AND 2 INSTALLED OCTOBER - NOVEMBER 2010. DRILLED HOLES INTERVAL ELEVATIONS PROVIDED BY CONTRACTOR.

PASSIVE LANDFILL GAS EXTRACTION WELLS AS-BUILT INFORMATION

EXTRACTION WELL	NORTHING	EASTING	TOP OF CASING ELEVATION	GROUND ELEVATION	BOTTOM OF WELL ELEVATION
EW 1	661,555.49	821,859.83	2803.72	2801.56	2772
EW 2	661,467.47	822,026.74	2805.52	2803.23	2773
EW 3	661,566.28	822,186.05	2802.37	2800.45	2760
EW 4	661,736.12	821,889.02	2799.96	2798.07	2758
EW 5	661,654.72	822,032.92	2807.22	2805.08	2765
EW 6	661,736.17	822,202.22	2801.41	2799.33	2743
EW 7	661,670.35	822,357.16	2782.66	2780.55	2751
EW 8	661,922.84	821,947.50	2791.01	2789.07	2739
EW 9	661,827.34	822,044.64	2801.52	2799.37	2747
EW 10	661,899.24	822,239.54	2796.45	2794.41	2728
EW 11	661,845.22	822,410.81	2777.83	2775.81	2726
EW 12	662,045.34	822,041.19	2787.56	2785.66	2741
EW 13	662,048.23	822,187.69	2787.65	2785.99	2726
EW 14	662,049.11	822,354.97	2771.01	2769.05	2720
EW 15	662,020.00	822,520.81	2756.87	2755.11	2724
EW 16	662,184.21	822,186.41	2766.32	2764.27	2714
EW 17	661,944.57	822,751.82	2731.57	2729.67	2705
EW 18	662,116.02	822,708.85	2728.07	2726.18	2681
EW 19	662,224.72	822,562.62	2723.86	2721.92	2677
EW 20	662,326.82	822,413.92	2718.25	2716.33	2681
EW 21	662,432.43	822,270.03	2713.00	2710.32	2680

NOTE:
PASSIVE EXTRACTION WELLS INSTALLED AUGUST - SEPTEMBER 2010.
WELL BOTTOM ELEVATIONS PROVIDED BY CONTRACTOR.

NOTES:
1. PROPERTY LINES SHOWN ARE FROM HAYWOOD COUNTY G.I.S. DEPARTMENT, AND ARE APPROXIMATE ONLY.
2. CONTOURS ON FRANCIS FARM LANDFILL PROPERTY SOUTH AND WEST OF PAVED ACCESS ROAD ARE FROM GROUND SURVEY PERFORMED BY McGILL ASSOCIATES, OCTOBER 15, 2009. FARMVIEW DRIVE CONTOURS FROM FEBRUARY 2011 GROUND SURVEY. REMAINING CONTOURS ARE LIDAR CONTOURS PROVIDED BY HAYWOOD COUNTY.
3. SURVEY CONTROL INFORMATION BASED ON NAVD 88 AND NAD83 (NSRS 2007).
4. WASTE LIMITS SHOWN ARE A COMPILATION OF EXISTING DOCUMENTATION AND FIELD INVESTIGATION NOVEMBER 2010, AND ARE APPROXIMATE ONLY.
5. UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE ONLY!

LEGEND

- MW-13 — GROUND WATER MONITORING WELL
- MM-5 — LANDFILL GAS MONITORING WELL
- SM-1a — LANDFILL GAS MONITORING LOCATION IN STRUCTURE
- EW-1 — PASSIVE LANDFILL GAS EXTRACTION WELL
- APPROXIMATE WASTE LIMITS

GROUND WATER MONITORING WELLS AS-BUILT INFORMATION

MONITORING WELL	NORTHING	EASTING	TOP OF CASING ELEVATION	GROUND ELEVATION	SCREENED INTERVAL ELEVATION
MW 1	662,529.13	822,317.14	2666.59	2663.72	U.K.
MW 1A	662,590.73	822,083.15	2690.88	2687.97	U.K.
MW 2A	662,347.08	822,814.69	2643.78	2640.98	2629.0 - 2614.0
MW 3A	661,921.62	823,026.22	2674.29	2671.59	U.K.
MW 4	661,420.29	822,245.39	2789.47	2786.88	U.K.
MW 5	661,286.31	822,167.91	2797.08	2797.37	2724.3 - 2709.3
MW 6	662,941.12	822,167.78	2612.63	2613.03	2610.7 - 2600.7
MW 7	662,800.72	822,584.39	2621.33	2621.48	2617.5 - 2602.5
MW 8	662,619.60	822,989.68	2620.05	2620.25	2617.3 - 2607.3
MW 9	662,309.84	823,295.25	2618.87	2619.19	2517.2 - 2502.2
MW 10	661,947.33	823,365.59	2623.60	2623.96	2622.0 - 2612.0
MW 11	661,509.39	822,572.73	2756.22	2756.46	2685.0 - 2670.7
MW 12	661,078.94	822,142.39	2803.11	2800.28	2735.5 - 2720.5
MW 13	661,377.43	821,791.88	2799.14	2799.51	2725.5 - 2710.5
MW 14	661,894.81	821,755.37	2770.34	2770.64	2676.8 - 2661.8
MW 15	662,338.59	821,896.86	2719.57	2716.89	2641.1 - 2626.1
MW 16	661,203.62	821,457.75	2716.16	2716.29	2661.5 - 2646.5
MW 17	661,739.15	821,178.09	2664.77	2665.07	2615.3 - 2600.3
MW 18	662,150.91	821,256.31	2620.91	2620.93	2595.1 - 2580.1
MW 19	662,965.29	822,624.55	2615.08	2615.29	2609.8 - 2594.8
MW 20	661,973.29	823,503.41	2621.94	2622.13	2616.8 - 2606.8
MW 21	661,424.40	823,203.28	2658.37	2658.72	2639.9 - 2624.9

NOTE: MW's 6-15 INSTALLED SEPTEMBER 2010 AND MW's 16-21 INSTALLED OCTOBER 2011. SCREENED INTERVAL ELEVATIONS FOR THESE WELLS PROVIDED BY BLE, INC.

RECORD DRAWING

This Drawing has been modified to reflect changes made during construction based upon information provided by the Contractor and construction observations made by the Owner's Authorized Representative.

By _____ Date November 14, 2011

NORTH CAROLINA PROFESSIONAL SEAL 23574 ENGINEER JEFFREY R. BISHOP

NO.	DATE	BY	REVISION DESCRIPTION

McGill ASSOCIATES
ENGINEERING · PLANNING · FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH: (828) 253-0575 FIRM LICENSE # C-0459

FRANCIS FARM LANDFILL
ENVIRONMENTAL MONITORING PLAN
HAYWOOD COUNTY
HAYWOOD COUNTY, NORTH CAROLINA

JOB NO.: 10.00726
DATE: NOVEMBER 2011
DESIGNED BY: DP
CADD BY: DP
DESIGN REVIEW: _____
CONST. REVIEW: _____
FILE NAME: Env Monitoring As-Built 11-11-11.dwg

ENVIRONMENTAL MONITORING SITE PLAN

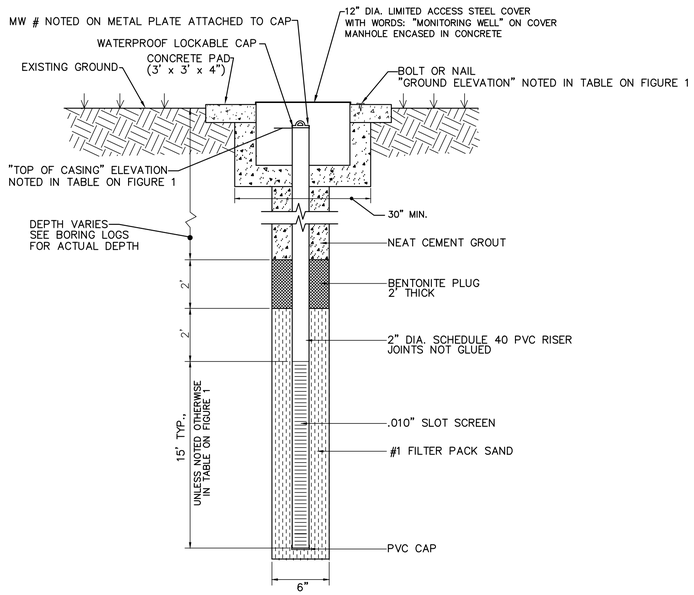
FIGURE 1

Q:\2010\10.00726\Design\Solid Waste\Drawings\Env Monitoring As-Built 11-11-11.dwg 11/15/2011 10:06 AM DAVE

FIGURE 2

Environmental Monitoring
Miscellaneous Details Record Drawing

WELL CONSTRUCTION NOTE: TYPICAL WELL CONSTRUCTION DETAILS SHOWN. REFER TO WELL CONSTRUCTION LOGS AND WELL REPORTS, PREPARED BY BLE, INC., FOR ADDITIONAL WELL INSTALLATION INFORMATION.

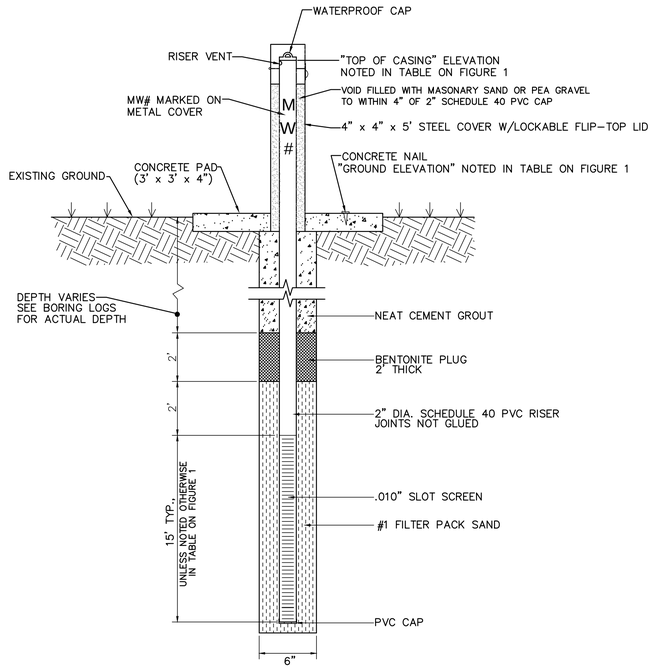


NOTE: THIS INFORMATION PERTAINS ONLY TO MW's 6 – 11, 13, 14, AND 16 – 21. WELL CONSTRUCTION INFORMATION FOR MW'S 1 – 5 IS UNKNOWN. SEE WELL CONSTRUCTION DETAIL WITH UPRIGHT STEEL PROTECTIVE COVER FOR MW's 12 AND 15

GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

WITH FLUSH-MOUNTED STEEL PROTECTIVE COVER

N.T.S.

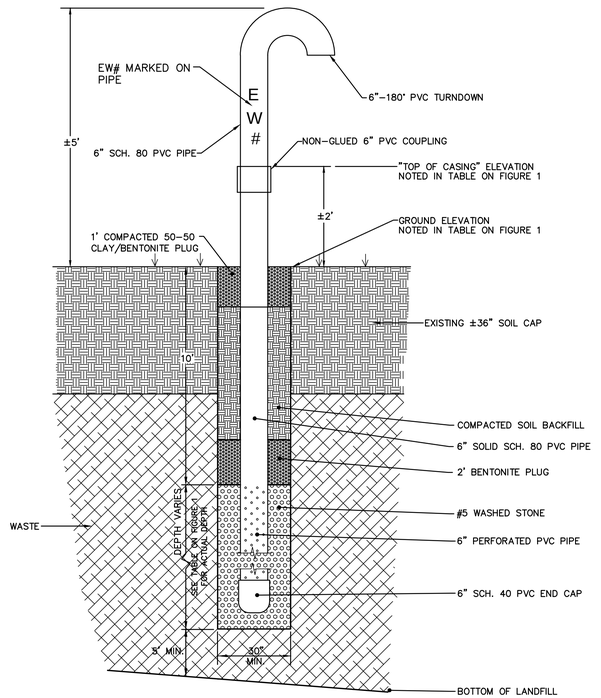


NOTE: THIS INFORMATION PERTAINS ONLY TO MW's 12 AND 15. WELL CONSTRUCTION INFORMATION FOR MW'S 1 – 5 IS UNKNOWN. SEE WELL CONSTRUCTION DETAIL WITH FLUSH-MOUNTED COVER FOR MW's 6–11, 13, AND 14.

GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

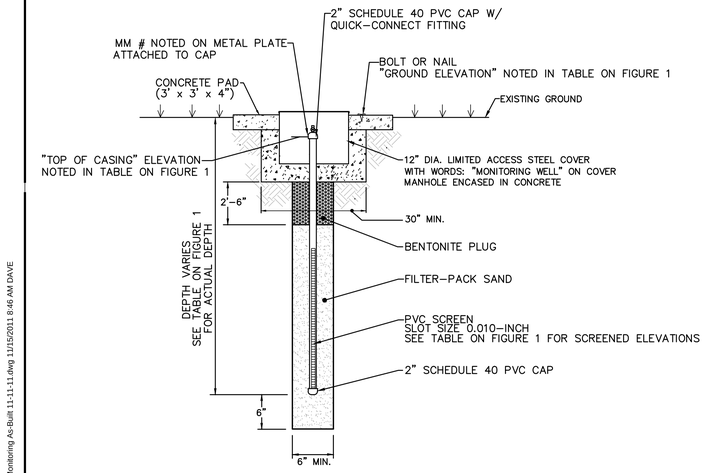
WITH UPRIGHT STEEL PROTECTIVE COVER

N.T.S.



PASSIVE LANDFILL GAS EXTRACTION WELL CONSTRUCTION DETAIL

N.T.S.

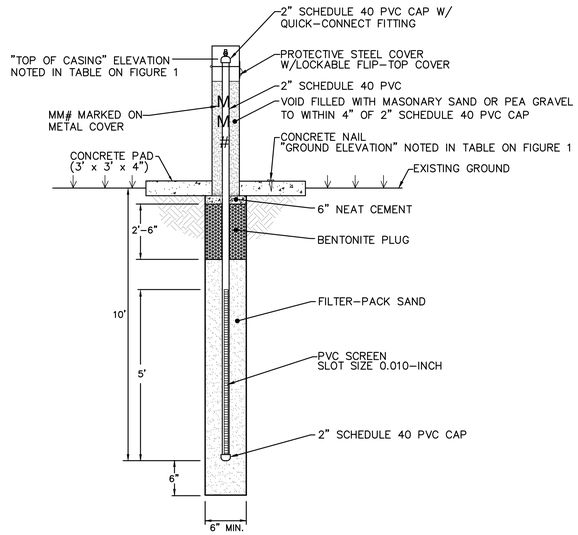


NOTE: THIS INFORMATION PERTAINS ONLY TO MM's 10 – 13. WELL CONSTRUCTION INFORMATION FOR MM'S 3 – 7 AND 9 IS UNKNOWN. SEE WELL CONSTRUCTION DETAIL WITH UPRIGHT COVER FOR MM 8. SEE WELL CONSTRUCTION DETAIL WITH DRILLED HOLES FOR MM's 1 & 2.

LANDFILL GAS MONITORING WELL

WITH FLUSH-MOUNTED STEEL PROTECTIVE COVER

N.T.S.



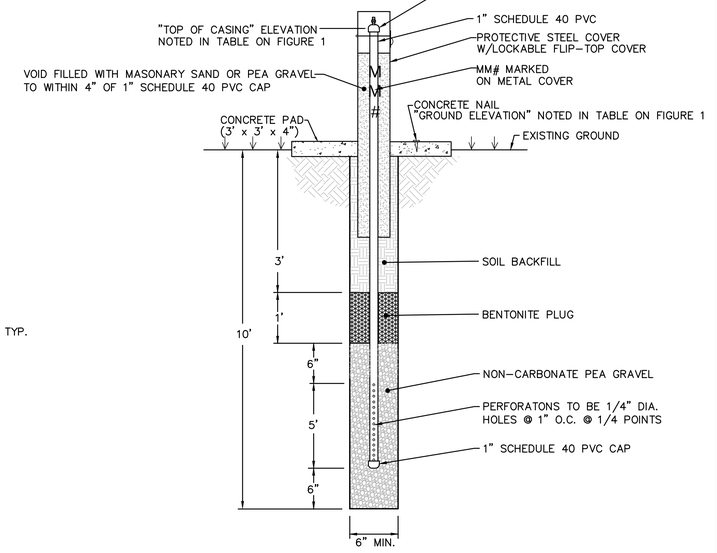
NOTE: THIS INFORMATION PERTAINS ONLY TO MM 8. WELL CONSTRUCTION INFORMATION FOR MM'S 3 – 7 AND 9 IS UNKNOWN. SEE WELL CONSTRUCTION DETAIL WITH FLUSH-MOUNTED COVER FOR MM's 10–13. SEE WELL CONSTRUCTION DETAIL WITH DRILLED HOLES FOR MM's 1 & 2.

LANDFILL GAS MONITORING WELL

WITH UPRIGHT STEEL PROTECTIVE COVER

N.T.S.

NOTE: WELL PIPE JOINTS ARE THREADED, TYP.



NOTE: THIS INFORMATION PERTAINS ONLY TO MM's 1 & 2. WELL CONSTRUCTION INFORMATION FOR MM'S 3 – 7 AND 9 IS UNKNOWN. SEE WELL CONSTRUCTION DETAIL WITH FLUSH-MOUNTED COVER FOR MM's 10–13. SEE WELL CONSTRUCTION DETAIL WITH UPRIGHT COVER FOR MM 8.

LANDFILL GAS MONITORING WELL

WITH DRILLED HOLES

N.T.S.

RECORD DRAWING

This Drawing has been modified to reflect changes made during construction based upon information provided by the Contractor and construction observations made by the Owner's Authorized Representative.

By Jeffrey R. Bishop Date November 14, 2011

NORTH CAROLINA PROFESSIONAL SEAL 23574 ENGINEER JEFFREY R. BISHOP

NO.	DATE	BY	REVISION DESCRIPTION

McGill Associates
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH (828) 252-0575 FIRM LICENSE # C-0459

FRANCIS FARM LANDFILL
ENVIRONMENTAL MONITORING PLAN
HAYWOOD COUNTY
HAYWOOD COUNTY, NORTH CAROLINA

JOB NO.: 10.00726
DATE: NOVEMBER 2011
DESIGNED BY: DP
CADD BY: DP
DESIGN REVIEW: ____
CONST. REVIEW: ____
FILE NAME: Env Monitoring As-Built 12-1-10.dwg

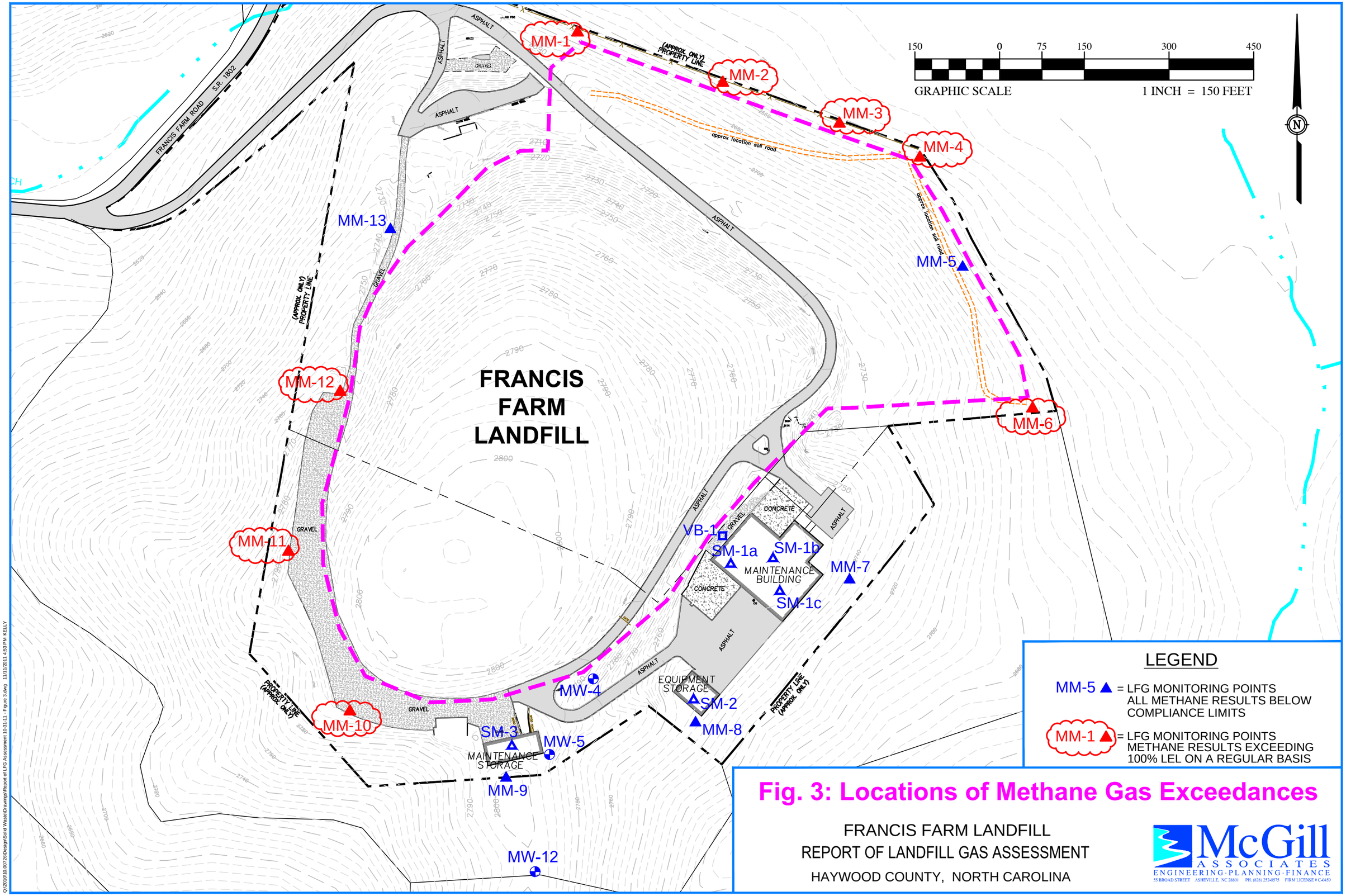
ENVIRONMENTAL MONITORING
MISCELLANEOUS DETAILS

FIGURE
2

Q:\2010\10.00726\Design\Solid Waste\Drawings\Env Monitoring As-Built 11-11-11.dwg 11/15/2011 8:46 AM DAVE

FIGURE 3

Location of Methane Gas Exceedences



LEGEND

MM-5 ▲ = LFG MONITORING POINTS ALL METHANE RESULTS BELOW COMPLIANCE LIMITS

MM-1 ▲ = LFG MONITORING POINTS METHANE RESULTS EXCEEDING 100% LEL ON A REGULAR BASIS

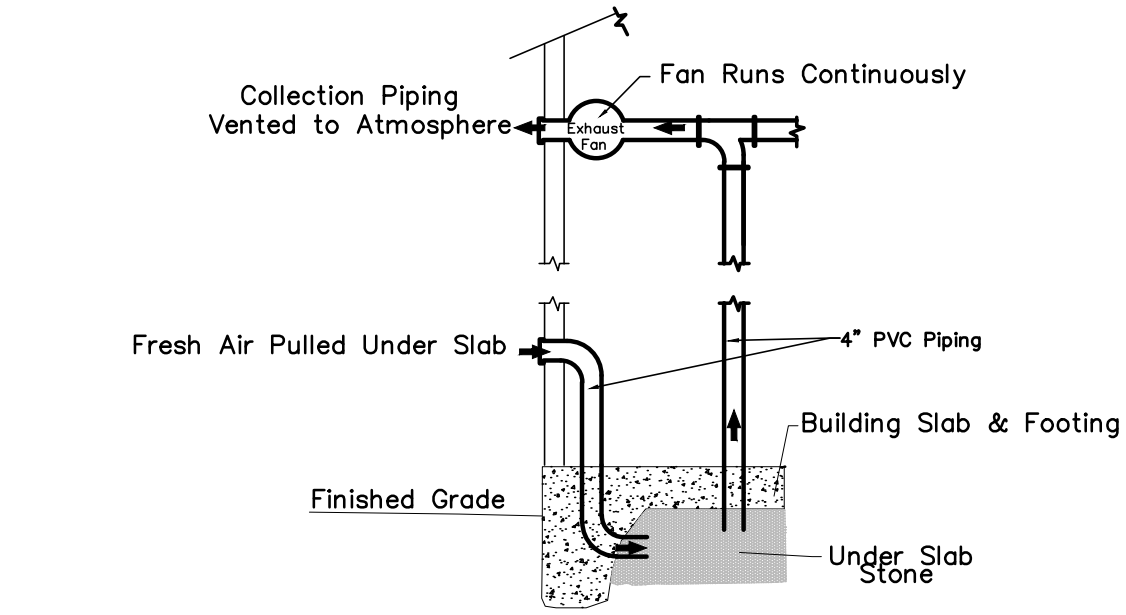
Fig. 3: Locations of Methane Gas Exceedances

FRANCIS FARM LANDFILL
REPORT OF LANDFILL GAS ASSESSMENT
HAYWOOD COUNTY, NORTH CAROLINA

McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

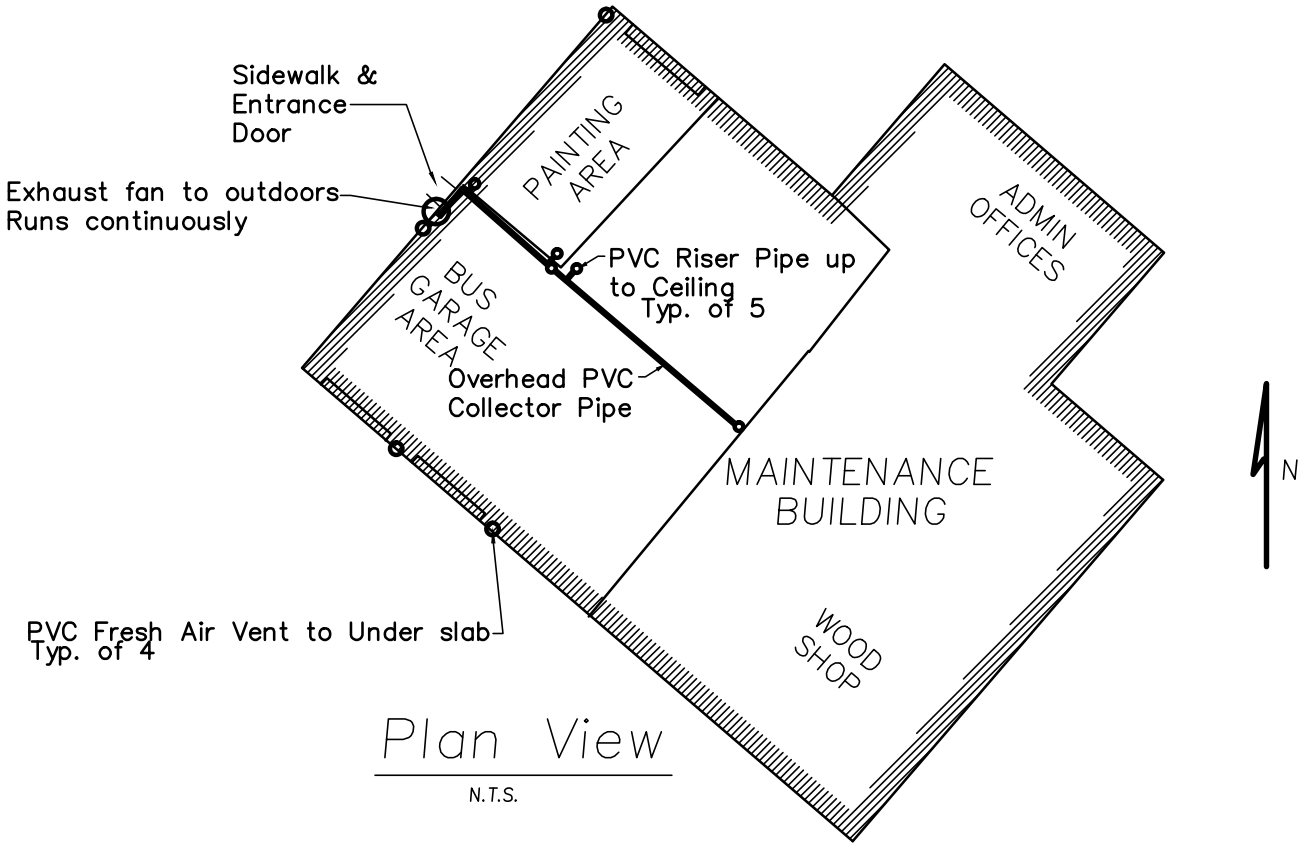
FIGURE 4

Maintenance Building LFG Vent System



Building Section

N.T.S.



Plan View

N.T.S.

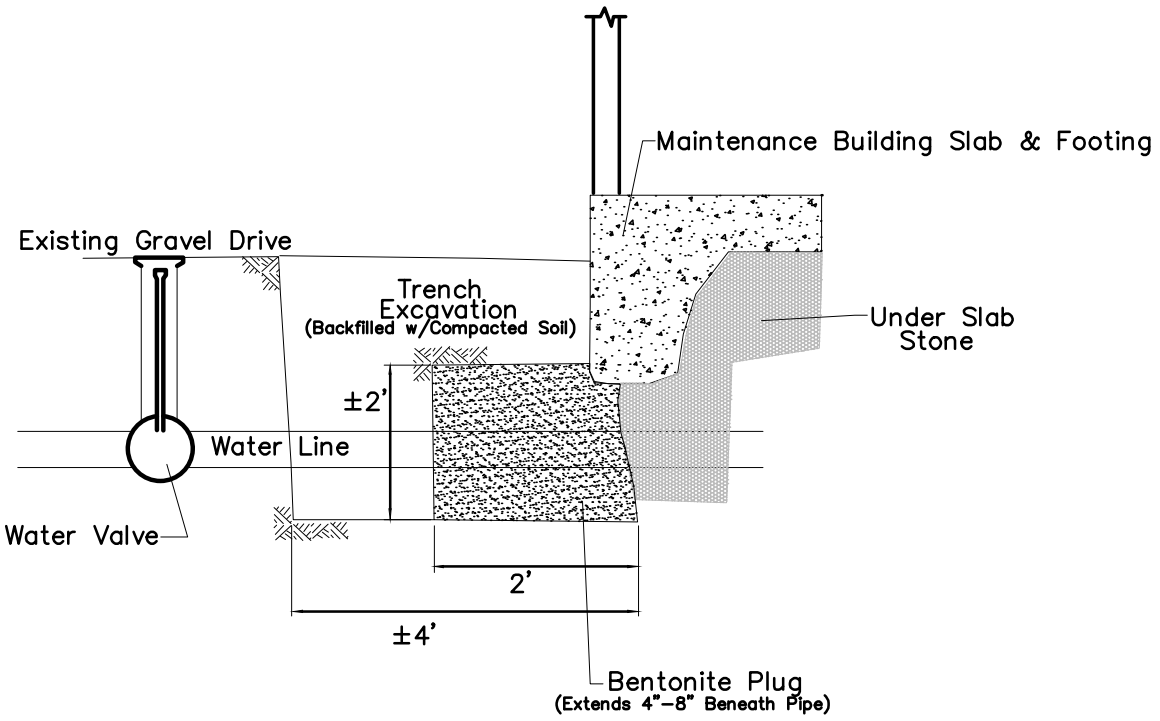
Fig. 4: Maintenance Building LFG Vent System

FRANCIS FARM LANDFILL
REPORT OF LANDFILL GAS ASSESSMENT
HAYWOOD COUNTY, NORTH CAROLINA

McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

FIGURE 5

Trench Repair at Water Line



Section at Trench Repair

N.T.S.

Fig. 5: Trench Repair At Water Line

McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH. (828) 252-0575 FIRM LICENSE # C-0459

FIGURE 6

Landfill Gas Collection System

PROPOSED LEACHATE PUMP STATION
PROPOSED CONDENSATE SUMP
PROPOSED PAVEMENT REPAIR
PROPOSED 8" TEE W/ BLIND FLANGE AND MARKER POST
PROPOSED HDPE LEACHATE COLLECTION PIPE
PROPOSED HDPE METHANE COLLECTION PIPE
PROPOSED 6" x 4" REDUCER
PROPERTY LINE (APPROXIMATE ONLY)
PROPOSED 2" PVC SDR 13.5 FORCE MAIN
PROPOSED PAVEMENT REPAIR
PROPOSED ELECTRICAL GENERATOR
PROPOSED LANDFILL GAS FLARE STATION
PROPERTY LINE (APPROXIMATE ONLY)
EXISTING SEDIMENT CONTROL STRUCTURE TO REMAIN IN SERVICE
EXISTING LANDFILL GAS EXTRACTION WELL
PROPOSED 1 – 8" x 8" x 6" HDPE TEE 1 – 8" x 6" HDPE REDUCER 2– 6" BUTTERFLY VALVES TYP. OF 2 LOCATIONS
PROPOSED HDPE LEACHATE COLLECTION PIPE
PROPOSED REMOVE EXISTING SHALLOW GAS VENTS, FILL EXCAVATED AREA W/COMPACTED 50–50 SOIL/BENTONITE MIXTURE, TYP. OF 45
PROPOSED CAP REPAIR AND DISPOSAL AREA FOR ANY WASTE REMOVED AS A PART OF THIS PROJECT INSTALL REPAIRED CAP PER DETAIL
EXISTING 24" CMP RISER PIPE TOP ELEV.: 2704.62 INV. OUT: 2697.60
EXISTING RIPRAP DITCH
PROPOSED 6"X4" WYE
PROPOSED 6"X4" REDUCER
PROPOSED 6"X4" WYE
EXISTING 3-PHASE POWER
EXISTING O.H. TELEPHONE LINE
EXISTING BURIED F.O.C. (APPROXIMATE LOCATION ONLY)
PROPOSED PAVEMENT REPAIR
PROPOSED HDPE LANDFILL GAS COLLECTION PIPE
PROPOSED MARKER POST, TYP. OF 13 ADDITIONAL MARKER POSTS REQUIRED AT VALVES AT TEES, SEE DETAIL (VALVE MARKER POSTS NOT SHOWN HERE)
PROPOSED RIP–RAP CHECK DAM TYP. OF 10 THIS SHEET
EXISTING GAS VENTS (TO BE REMOVED)
PROPOSED WASTE DISPOSAL AREA
PROPERTY LINE (APPROXIMATE ONLY)

NOTES:

1. PROPERTY LINES SHOWN ARE FROM HAYWOOD COUNTY G.I.S. DEPARTMENT, AND ARE APPROXIMATE ONLY.

2.CONTOURS ON FRANCIS FARM LANDFILL SOUTH AND WEST OF PAVED ACCESS ROAD AND ALONG FARMVIEW DRIVE ARE FROM GROUND SURVEY PERFORMED BY McGILL ASSOCIATES, OCTOBER 2009 & FEBRUARY 2011. REMAINING CONTOURS ARE LIDAR CONTOURS PROVIDED BY HAYWOOD COUNTY.

3. SURVEY CONTROL INFORMATION BASED ON NAVD 88 AND NAD83 (NCRS 2007).

4. PRIOR TO DISPOSING OF WASTE REMOVED DURING LANDFILL GAS COLLECTION SYSTEM CONSTRUCTION, REMOVE AND STOCKPILE EXISTING CAP SYSTEM WITHIN DESIGNATED AREA. PLACE AND COMPACT WASTE. WASTE SHALL BE COVERED AT THE END OF EACH DAY'S OPERATION.

6. INSTALL LANDFILL GAS AND LEACHATE PIPING AT MINIMUM 3% SLOPE.

7. RAISE EXISTING EXTRACTION WELLS (EW'S) AS NECESSARY TO ACCOMMODATE PROPOSED FILL.

LEGEND

- GROUND WATER MONITORING WELL
- LANDFILL GAS MONITORING WELL
- LANDFILL GAS MONITORING LOCATION IN STRUCTURE
- LANDFILL GAS EXTRACTION WELL
- LANDFILL GAS EXTRACTION WELL WITH LEACHATE PUMP
- LANDFILL GAS EXTRACTION WELL WITH LEACHATE PUMP CONNECTION
- SHALLOW GAS VENT
- 4" PROPOSED HDPE LANDFILL GAS COLLECTION PIPE, WITH PIPE SIZE
- 4" PROPOSED HDPE LEACHATE COLLECTION PIPE, WITH PIPE SIZE
- 2800 EXISTING CONTOURS
- 2810 PROPOSED CONTOURS

PLAN

GRAPHIC SCALE 60 0 30 60 120 180 — 1 INCH = 60 FEET

FOR CONSTRUCTION
JULY 2011

NO.	DATE	BY	REVISION DESCRIPTION

McGill ASSOCIATES
ENGINEERING·PLANNING·FINANCE
55 BROAD STREET ASHEVILLE, NC 28801 PH (828) 252-0575 FIRM LICENSE # C-0459

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 024983 MARK D. CATES

FRANCIS FARM LANDFILL
LANDFILL GAS COLLECTION & COMBUSTION SYSTEM
PHASE 2B
HAYWOOD COUNTY
HAYWOOD COUNTY, NORTH CAROLINA

JOB NO.: 09.00721
DATE: MAY, 2011
DESIGNED BY: WHS
CADD BY: KS
DESIGN REVIEW: ____
CONST. REVIEW: ____
FILE NAME: Report of Landfill Gas Assessment Figure 6.dwg

LANDFILL GAS COLLECTION SYSTEM

FIGURE 6

Know what's below. Call before you dig. N.C. One-Call Center Dial 811 or 1-800-632-4949

Q:\2010\10.00728\Design\Solid Waste\Drawings\Report of Landfill Gas Assessment Figure 6.dwg 11/9/2011 1:59 PM KELLY

APPENDICES

APPENDIX 1

Landfill Gas Monthly Monitoring Observations

Francis Farm Landfill
LFG Assessment Period
Monthly Monitoring Results

Values Noted are % Methane Recorded During Monitoring Event

Well or Probe ID	Aug '10	Sep '10	Nov '10	Dec '10	Jan '11	Feb '11	Mar '11	Apr '11	May '11	Jun '11	Jul '11	Aug '11	Sep'11
MM-1	y	y	38.5	29.8	48.4	43.0	0.0	0.5	63.5	30.7	64.1	53.2	63.4
MM-2	y	y	42.3	50.6	50.4	49.3	69.8	55.9	61.9	56.9	55.9	58.2	61.2
MM-3	3.6	0.2	4.0	43.8	45.4	41.1	49.8	45.5	54.9	50.7	54.9	53.1	52.8
MM-4	29.6	63.6	19.0	22.1	21.0	17.6	12.6	13.0	32.2	27.2	28.8	25.4	22.3
MM-5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MM-6	37.7	31.0	14.6	9.9	8.8	10.5	9.5	23.6	24.9	19.3	24.4	20.8	17.6
MM-7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MM-8	y	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MM-9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
MM-10	y	55.9	49.5	n/a	56.4	52.2	54.4	8.7	51.3	52.9	54.9	45.9	56.4
MM-11	y	47.3	41.9	51.5	54.0	51.1	57.7	58.6	49.9	50.5	53.8	41.5	42.9
MM-12	y	60.6	60.9	60.8	61.5	61.3	61.0	59.4	60.1	60.3	61.0	60.4	60.8
MM-13	y	0.0	0.0	n/a	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
SM-1a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM-1b	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM-1c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM-2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SM-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MW-12		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VB-1*	9.7	9.5	2.1	x	8.0	40.0	x	x	x	x	x	x	x
MW-4*	0.2	1.2	45.5	11.0	0.0	45.0	x	x	x	3.7	2.0	1.1	0.6
MW-5*	0.0	0.0	0.3	0.0	0.0	9.0	x	0.0	0.0	0.0	x	x	x

Notes:

1. MW-12 monitored in lieu of SM-4.
2. 'x' denotes readings that were not stable.
3. 'n/a' denotes that LFG monitoring well was not accessible during this monitoring event.
4. 'y' denotes well not installed during this monitoring event.

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: Jeff Bishop **Date:** August 11, 2010

Weather Conditions: 51% Humidity/ Partly Cloudy **Ambient Temp:** 88

Atmospheric Pressure: 30.03" Hg

Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #:** GM05480

Factory Calibration Date: Sept 2009 **Field Calibration 50% Methane:** August 11, 2010

Gas Readings Field Worksheet

Well or Probe ID	Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-3	Stable	13:48	72.0	3.6	2.5	19.1	Cap missing/ Replaced
MM-4	Stable	13:42	>100	29.6	22.7	1.9	
MM-5	Stable	13:38	0.0	0.0	1.0	19.3	
MM-6	Stable	13:35	>100	37.7	21.9	1.8	
MM-7	Stable	13:30	0.0	0.0	4.3	15.7	
MM-9	Stable	13:02	0.0	0.0	3.7	16.9	
SM-1a	Stable	13:22	0.0	0.0	0.0	20.1	
SM-1b	Stable	13:18	0.0	0.0	0.0	20.0	
SM-1c	Stable	13:14	0.0	0.0	0.0	19.9	
SM-2	Stable	13:10	0.0	0.0	0.0	19.9	
SM-3	Stable	14:05	0.0	0.0	0.0	20.4	
VB-1	Stable	13:25	>100	9.7	5.0	17.1	
MW-4	Stable	13:54	4.0	0.2	0.1	20.1	
MW-5	Stable	13:59	0.0	0.0	0.0	20.3	
Vent 1	Stable	13:24	>100	46.1	28.9	5.2	
Vent 2	Stable	13:28	0.0	0.0	0.0	20.0	Vent standpipe cracked
Vent 3	Stable						Vent has been removed

Field Observation Notes:

1. Vent 2 standpipe above ground cracked at the base. Discussed replacement of standpipe with Tracy Hargrove. His staff will replace.
2. Vent 3 had been destroyed during grading activity at Bus Maintenace Facility. Discussed replacement of replacement of vent with Tracy Hargrove. His staff will replace.
3. MM-3 probe cap waas mising. Installed new cap at 12:50. Sampled point at 13:48.

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

SEPTEMBER 2010 EVENT

Name of Person Taking Readings: Jeff Bishop **Date:** October 1, 2010

Weather Conditions: Sunny **Ambient Temp:** 64

Atmospheric Pressure: 27.08"

Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #:** GM05480

Factory Calibration Date: September 2009 **Field Calibration Date :** September 30, 2010

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Stable						Not Installed
MM-2	Stable						Not Installed
MM-3	Stable	14:40	4.0	0.2	0.0	21.0	Replace 1" PVC Cap
MM-4	Stable	14:29	>100	63.6	28.5	0.7	
MM-5	Stable	14:25	0.0	0.0	4.5	16.2	
MM-6	Stable	14:20	620.0	31.0	24.3	0.7	
MM-7	Stable	14:15	2.0	0.1	3.8	17.0	
MM-8	Stable	15:15	0.0	0.0	1.8	18.6	need quick connect
MM-9	Stable	13:34	0.0	0.0	3.2	17.9	
MM-10	Stable	13:26	1118.0	55.9	38.2	0.7	need quick connect
MM-11	Stable	13:10	946.0	47.3	35.4	0.8	need quick connect
MM-12	Stable	12:55	1212.0	60.6	38.9	0.6	need quick connect
MM-13	Stable	12:50	0.0	0.0	15.1	4.6	need quick connect
SM-1a	Stable	14:12	0.0	0.0	0.0	21.1	Need plastic sign
SM-1b	Stable	14:09	0.0	0.0	0.0	21.2	Need plastic sign
SM-1c	Stable	14:00	0.0	0.0	0.0	21.0	Need plastic sign
SM-2	Stable	13:55	0.0	0.0	0.0	21.1	Need plastic sign
SM-3	Stable	13:50	0.0	0.0	0.0	21.2	Need plastic sign
SM-4*	Stable	15:40	0.0	0.0	0.0	20.9	Sampled underdrain at house.
VB-1*	Stable	15:03	190.0	9.5	3.4	17.9	
MW-4*	Stable	13:45	24.0	1.2	0.7	20.5	
MW-5*	Stable	13:38	0.0	0.0	0.0	21.0	

Notes:

1. If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes, contact Haywood County Solid Waste Director immediately.
2. *To be monitored from 11/15/10 to 11/15/11. May be dropped from monitoring after assessment period is complete.

Field Observation Notes:

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: Jeff Bishop **Date:** November 22, 2010

Weather Conditions: Partly Cloudy **Ambient Temp:** 56

Atmospheric Pressure: 27.43"

Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #:** GM05480 NOVEMBER 22, 2010

Factory Calibration Date: August 2010 **Field Calibration Date :** September 30, 2010

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Stable	13:20	770.0	38.5	26.3	1.0	Need lock/ 1" cap with coupler
MM-2	Stable	13:28	846.0	42.3	25.0	0.2	Need lock/ 1" cap with coupler
MM-3	Stable	13:36	80.0	4.0	23.1	0.8	
MM-4	Stable	13:42	380.0	19.0	21.7	5.3	
MM-5	Stable	13:48	0.0	0.0	3.4	18.4	
MM-6	Stable	13:51	292.0	14.6	16.9	4.7	
MM-7	Stable	13:57	0.0	0.0	3.7	17.5	
MM-8	Stable	14:10	0.0	0.0	3.7	17.5	need lock
MM-9	Stable	14:54	0.0	0.0	4.4	17.0	
MM-10	Stable	14:45	990.0	49.5	33.8	0.6	
MM-11	Stable	14:41	838.0	41.9	33.8	0.2	need 1" cap w/ coupler
MM-12	Stable	14:36	1218.0	60.9	36.4	0.3	need 1" cap w/ coupler
MM-13	Stable	14:31	0.0	0.0	14.5	3.7	need 1" cap w/ coupler
SM-1a	Stable	14:02	0.0	0.0	0.1	20.9	Need plastic sign
SM-1b	Stable	14:01	0.0	0.0	0.1	20.8	Need plastic sign
SM-1c	Stable	14:04	0.0	0.0	0.1	20.9	Need plastic sign
SM-2	Stable	14:08	0.0	0.0	0.0	20.9	Need plastic sign
SM-3	Stable	14:50	0.0	0.0	0.1	20.9	Need plastic sign
MW-12	Stable	14:59	0.0	0.0	0.1	19.9	Could not access SM-4
VB-1*	Stable	15:13	42.0	2.1	1.1	20.3	
MW-4*	Stable	15:08	910.0	45.5	35.7	0.7	
MW-5*	Stable	15:02	6.0	0.3	4.2	16.8	

Notes:

1. If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes, contact Haywood County Solid Waste Director immediately.
2. *To be monitored from 11/15/10 to 11/15/11. May be dropped from monitoring after assessment period is complete.

Field Observation Notes:

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

DEC 29, 2010

Name of Person Taking Readings: J Bishop/ D Pasko **Date:** November 22, 2010

Weather Conditions: Clear/ 8" snow **Ambient Temp:** 20°

Atmospheric Pressure: 27.20"

Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #:** GM11944/09

Factory Calibration Date: August 27, 2010 **Field Calibration Date :** December 29, 2010

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Stable	12:00	596.0	29.8	24.3	0.6	Need to replace lock/ label
MM-2	Stable	11:54	1012.0	50.6	35.1	0.1	Need to replace lock/ label
MM-3	Stable	11:49	876.0	43.8	33.0	0.4	
MM-4	Stable	11:44	442.0	22.1	24.2	2.7	
MM-5	Stable	11:41	0.0	0.0	5.5	18.0	
MM-6	Stable	11:37	198.0	9.9	14.9	5.7	
MM-7	Stable	11:33	0.0	0.0	2.7	18.8	
MM-8	Stable	11:23	0.0	0.0	2.7	19.2	need lock
MM-9	Stable	12:43	0.0	0.0	2.8	18.3	
MM-10	Stable	-		-	-	-	covered w/ snow, could not sample
MM-11	Stable	10:31	1030.0	51.5	34.1	0.2	
MM-12	Stable	10:24	1216.0	60.8	38.9	0.2	
MM-13	Stable	-		-	-	-	covered w/ snow, could not sample
SM-1a	Stable	11:25	0.0	0.0	0.2	21.2	Need plastic sign
SM-1b	Stable	11:27	0.0	0.0	0.2	21.2	Need plastic sign
SM-1c	Stable	11:29	0.0	0.0	0.1	21.2	Need plastic sign
SM-2	Stable	11:21	2.0	0.1	0.2	21.1	Need plastic sign
SM-3	Stable	-		-	-	-	could not access building
MW-12	Stable	10:57	0.0	0.0	0.2	21.0	Could not access SM-4
VB-1*	Stable	-		-	-	-	could not access due to snow
MW-4*	Stable	11:15	220.0	11.0	10.0	15.0	
MW-5*	Stable	12:32	0.0	0.0	0.8	20.9	

Notes:

1. If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes, contact Haywood County Solid Waste Director immediately.
2. *To be monitored from 11/15/10 to 11/15/11. May be dropped from monitoring after assessment period is complete.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: DP **Date: January 31, 2011**

Weather Conditions: Overcast **Ambient Temp: 39° @ 10 a.m., 51° @ 1 p.m.**

Atmospheric Pressure: 27.29" Hg

Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #: 11944/09**

Factory Calibration Date: August 27, 2010 **Field Calibration Date : January 31, 2011**

Well or Probe ID	Stable Readings	Time	%LEL	%CH_4	%CO_2	%O_2	Notes:
MM-1	Meter lost battery charge, see 2/1/11 for readings						
MM-2	Meter lost battery charge, see 2/1/11 for readings						
MM-3	Meter lost battery charge, see 2/1/11 for readings						
MM-4	Meter lost battery charge, see 2/1/11 for readings						
MM-5	Y	12:51	2.0	0.1	0.4	20.5	
MM-6	Meter lost battery charge, see 2/1/11 for readings						
MM-7	Y	12:12	0.0	0.0	3.0	17.7	
MM-8	Y	12:30	0.0	0.0	1.3	19.8	
MM-9	Y	11:45	0.0	0.0	3.1	17.3	
MM-10	Y	11:00	1128.0	56.4	35.0	0.2	
MM-11	Meter lost battery charge, see 2/1/11 for readings						
MM-12	Y	10:41	1230.0	61.5	38.1	0.2	
MM-13	Meter lost battery charge, see 2/1/11 for readings						Needs plastic cap & metal cover
SM-1a	Y	12:15	0.0	0.0	0.2	20.8	
SM-1b	Y	12:18	0.0	0.0	0.2	20.7	
SM-1c	Y	12:21	0.0	0.0	0.1	20.8	
SM-2	Y	12:24	0.0	0.0	0.1	20.8	
SM-3	Y	11:30	0.0	0.0	0.2	21.0	
MW12	Y	11:48	0.0	0.0	0.2	20.9	Cap doesn't lock
VB-1*	No	12:35	160.0	8.0	3.5	9.0	Readings not stable
MW-4*	Y	11:50	0.0	0.0	0.2	20.8	
MW-5*	Y	11:35	0.0	0.0	0.4	20.8	Needs metal cover

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: DP
Weather Conditions: Rain
Atmospheric Pressure: 27.25" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000
Factory Calibration Date: August 27, 2010

Date: February 1, 2011
Ambient Temp: 42°

Serial #: 11944/09 JANUARY 2011 EVENT
Field Calibration Date : February 1, 2011

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Y	9:59	968.0	48.4	30.3	0.4	
MM-2	Y	9:55	1008.0	50.4	31.2	0.2	
MM-3	Y	9:51	908.0	45.4	29.8	2.1	
MM-4	Y	9:40	420.0	21.0	21.5	3.1	
MM-5							
MM-6	Y	9:47	176.0	8.8	14.9	3.3	
MM-7							
MM-8	See monitoring results for January 31, 2011 for locations not shown here						
MM-9							
MM-10							
MM-11	Y	9:30	1080.0	54.0	33.4	0.2	
MM-12							
MM-13	Y	9:21	0.0	0.0	7.8	10.6	Needs plastic cap & metal cover
SM-1a							
SM-1b							
SM-1c							
SM-2							
SM-3							
SM-4*							
VB-1*							
MW-4*							
MW-5*							

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: DP **Date: February 28, 2011**
Weather Conditions: Rain **Ambient Temp: 64°**
Atmospheric Pressure: 27.02" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #: 11944/09**
Factory Calibration Date: August 27, 2010 **Field Calibration Date : February 28, 2011**

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Y	12:20	860.0	43.0	23.6	0.6	
MM-2	Y	12:17	986.0	49.3	29.2	3.2	
MM-3	Y	12:15	822.0	41.1	28.4	2.5	
MM-4	Y	12:05	352.0	17.6	15.9	5.4	
MM-5	Y	12:08	0.0	0.0	0.6	19.9	
MM-6	Y	12:10	210.0	10.5	11.5	6.1	
MM-7	Y	11:45	0.0	0.0	2.6	17.6	
MM-8	Y	11:40	0.0	0.0	1.5	19.8	
MM-9	Y	11:50	0.0	0.0	1.4	19.1	
MM-10	Y	10:50	1044.0	52.2	35.0	0.2	
MM-11	Y	10:40	1022.0	51.1	33.3	0.2	
MM-12	Y	10:35	1226.0	61.3	38.4	0.2	
MM-13	Y	10:30	2.0	0.1	11.9	3.8	
SM-1a	Y	11:15	0.0	0.0	0.2	25.0	
SM-1b	Y	11:18	0.0	0.0	0.1	25.0	
SM-1c	Y	11:21	0.0	0.0	0.2	24.9	
SM-2	Y	11:24	0.0	0.0	0.2	25.0	
SM-3	Y	11:05	0.0	0.0	0.1	20.3	
MW-12	Y	11:52	0.0	0.0	0.1	20.6	
VB-1*	No	11:28	800.0	40.0	26.0	6.0	Not stable, readings approx. only
MW-4*	No	Noon	900.0	45.0	32.0	4.0	Not stable, readings approx. only
MW-5*	No	11:55	180.0	9.0	14.8	6.8	Not stable, readings approx. only

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: DP, KS **Date: March 17, 2011**
Weather Conditions: Foggy but clearing **A4mbient Temp: 37°**
Atmospheric Pressure: 27.42" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #: 11944/09**
Factory Calibration Date: August 27, 2010 **Field Calibration Date : March 17, 2011**

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Y	12:19	0.0	0.0	0.5	20.3	Need MM # on metal casing
MM-2	Y	12:16	1396.0	69.8	23.1	1.3	Need MM # on metal casing
MM-3	Y	12:12	996.0	49.8	32.3	1.2	
MM-4	Y	11:56	252.0	12.6	16.7	2.8	
MM-5	Y	12:02	0.0	0.0	0.3	20.3	
MM-6	Y	12:06	190.0	9.5	12.2	5.2	
MM-7	Y	11:30	0.0	0.0	3.9	16.4	
MM-8	Y	11:35	0.0	0.0	1.1	19.6	
MM-9	Y	11:05	2.0	0.1	3.7	16.2	
MM-10	Y	10:53	1088.0	54.4	35.7	0.6	
MM-11	Y	10:51	1154.0	57.7	34.9	0.3	
MM-12	Y	10:47	1220.0	61.0	38.2	0.5	
MM-13	Y	10:41	2.0	0.1	6.1	12.7	
SM-1a	Y	11:25	0.0	0.0	0.1	20.6	
SM-1b	Y	11:26	0.0	0.0	0.1	20.6	
SM-1c	Y	11:28	0.0	0.0	0.1	20.6	
SM-2	Y	11:32	0.0	0.0	0.1	20.5	
SM-3	Y	11:40	0.0	0.0	0.1	20.5	
MW-12	Y	11:08	0.0	0.0	0.2	20.6	
VB-1*	No	11:45					Not stable, invalid readings
MW-4*	No	11:20					Not stable, invalid readings
MW-5*	No	11:15					Not stable, invalid readings

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: DP | **Date: April 28, 2011**
Weather Conditions: Clearing | **Ambient Temp: 68°**
Atmospheric Pressure: 26.98" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000 | **Serial #: 11944/09**
Factory Calibration Date: April 7, 2011 | **Field Calibration Date : April 28, 2011**

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Y	11:34	10.0	0.5	1.5	19.7	Need MM # on metal casing
MM-2	Y	11:29	1118.0	55.9	31.2	2.9	Need MM # on metal casing
MM-3	Y	11:24	910.0	45.5	31.9	2.1	
MM-4	Y	11:10	260.0	13.0	13.0	4.7	
MM-5	Y	11:14	0.0	0.0	0.4	19.1	
MM-6	Y	11:17	472.0	23.6	13.5	3.7	
MM-7	Y	10:51	0.0	0.0	3.1	16.9	
MM-8	Y	10:46	0.0	0.0	1.5	18.9	
MM-9	Y	10:35	0.0	0.0	6.2	11.8	
MM-10	Y	10:21	174.0	8.7	12.3	10.5	
MM-11	Y	10:18	1172.0	58.6	36.4	0.4	
MM-12	Y	10:15	1188.0	59.4	38.6	0.6	
MM-13	Y	10:05	0.0	0.0	0.1	20.5	
SM-1a	Y	10:54	0.0	0.0	0.1	20.4	
SM-1b	Y	10:55	0.0	0.0	0.1	20.5	
SM-1c	Y	10:56	0.0	0.0	0.1	20.5	
SM-2	Y	10:44	0.0	0.0	0.0	20.5	
SM-3	Y	10:29	0.0	0.0	0.1	20.4	
MW-12	Y	10:35	0.0	0.0	1.6	18.6	
VB-1*	No	10:58					Not stable, invalid readings
MW-4*	No	10:42					Not stable, invalid readings
MW-5*	Y	10:32	0.0	0.0	0.6	20.1	

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: KS
Weather Conditions: Overcast, Warm
Atmospheric Pressure: 26.98" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000
Factory Calibration Date: April 7, 2011

Date: June 3, 2011
Ambient Temp: 72°

Serial #: 11944/09 MAY 2011 EVENT
Field Calibration Date : June 3, 2011

Well or Probe ID	Stable Readings	Time	%LEL	%CH_4	%CO_2	%O_2	Notes:
MM-1	Y	12:40	1270.0	63.5	29.9	0.7	Need MM # on metal casing
MM-2	Y	12:25	1238.0	61.9	38.0	0.1	Need MM # on metal casing
MM-3	Y	12:10	1098.0	54.9	37.9	0.2	
MM-4	Y	11:30	644.0	32.2	18.1	1.2	
MM-5	Y	11:40	0.0	0.0	3.2	18.0	
MM-6	Y	11:55	498.0	24.9	15.8	2.2	
MM-7	Y	11:20	0.0	0.0	3.5	16.6	
MM-8	Y	10:55	0.0	0.0	2.8	17.6	
MM-9	Y	10:10	0.0	0.0	4.8	14.8	
MM-10	Y	9:50	1026.0	51.3	37.9	0.2	
MM-11	Y	9:44	998.0	49.9	35.2	0.5	
MM-12	Y	9:36	1202.0	60.1	38.9	0.3	
MM-13	Y	9:26	0.0	0.0	2.3	18.5	
SM-1a	Y	11:00	0.0	0.0	0.0	20.2	
SM-1b	Y	11:05	0.0	0.0	0.0	20.2	
SM-1c	Y	11:10	0.0	0.0	0.0	20.3	
SM-2	Y	10:50	0.0	0.0	0.0	20.2	
SM-3	Y	10:00	0.0	0.0	0.0	20.1	
MW-12	Y	10:15	0.0	0.0	1.6	20.0	
VB-1*	No	10:45					Not stable, invalid readings
MW-4*	No	10:40					Not stable, invalid readings
MW-5	Y	10:20	0.0	0.0	0.6	19.7	

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: KS **Date: June 30, 2011**
Weather Conditions: Sunny, Warm **Ambient Temp: 62°**
Atmospheric Pressure: 27.23" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #: 11944/09**
Factory Calibration Date: April 7, 2011 **Field Calibration Date : June 30, 2011**

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Y	11:45	614.0	30.7	17.0	10.0	Need MM # on metal casing
MM-2	Y	11:30	1138.0	56.9	37.0	0.8	Need MM # on metal casing
MM-3	Y	11:15	1014.0	50.7	36.1	1.7	
MM-4	Y	10:45	544.0	27.2	20.6	1.0	
MM-5	Y	10:55	0.0	0.0	4.2	17.2	
MM-6	Y	11:05	386.0	19.3	14.7	4.0	
MM-7	Y	10:25	0.0	0.0	3.6	16.2	
MM-8	Y	10:00	0.0	0.0	4.1	15.4	
MM-9	Y	9:23	0.0	0.0	4.5	15.6	
MM-10	Y	9:13	1058.0	52.9	38.1	0.5	
MM-11	Y	9:01	1010.0	50.5	35.6	0.8	
MM-12	Y	8:50	1206.0	60.3	39.3	0.2	
MM-13	Y	8:26	0.0	0.0	5.1	14.3	
SM-1a	Y	10:05	0.0	0.0	0.0	20.5	
SM-1b	Y	10:10	0.0	0.0	0.0	20.5	
SM-1c	Y	10:15	0.0	0.0	0.0	20.5	
SM-2	Y	9:50	0.0	0.0	0.0	20.5	
SM-3	Y	10:35	0.0	0.0	0.0	20.4	
MW-12	Y	9:30	0.0	0.0	0.1	20.3	
VB-1*	No	10:30					Not stable, invalid readings
MW-4*	Y	9:40	74.0	3.7	2.8	18.9	Replaced cap stable valid readings
MW-5	Y	9:35	0.0	0.0	0.1	20.4	

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: KS **Date: July 28, 2011**
Weather Conditions: Sunny, Warm **Ambient Temp: 72°**
Atmospheric Pressure: 27.26" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #: 11944/09**
Factory Calibration Date: April 7, 2011 **Field Calibration Date : July 28, 2011**

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Y	12:40	1282.0	64.1	33.4	1.0	Need MM # on metal casing
MM-2	Y	12:35	1118.0	55.9	37.7	0.2	Need MM # on metal casing
MM-3	Y	12:25	1098.0	54.9	37.5	0.9	
MM-4	Y	12:00	576.0	28.8	21.6	1.4	
MM-5	Y	12:10	0.0	0.0	4.3	16.3	
MM-6	Y	12:15	488.0	24.4	16.5	2.2	
MM-7	Y	11:30	0.0	0.0	4.0	16.1	
MM-8	Y	11:20	0.0	0.0	3	17.2	
MM-9	Y	10:40	0.0	0.0	4.4	16.1	
MM-10	Y	10:30	1098.0	54.9	37.9	0.2	
MM-11	Y	10:15	1076.0	53.8	37.4	0.2	
MM-12	Y	10:00	1220.0	61.0	38.6	0.3	Pad damaged - cracked/broken
MM-13	Y	9:40	0.0	0.0	3.4	18.6	Replaced cap
SM-1a	Y	11:15	0.0	0.0	0.0	20.0	
SM-1b	Y	11:20	0.0	0.0	0.0	20.1	
SM-1c	Y	11:25	0.0	0.0	0.0	20.1	
SM-2	Y	11:10	0.0	0.0	0.0	20.1	
SM-3	Y	11:55	0.0	0.0	0.0	20.1	
MW-12	Y	10:45	0.0	0.0	0.0	20.0	
VB-1*	No	11:40					Not stable, invalid readings
MW-4*	Y	11:00	40.0	2.0	1.8	19.0	
MW-5	Y	10:50	0.0	0.0	0.2	19.8	

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.
Field Observation Notes: MM-12, concrete pad damaged, cracked/broken, possibly from construction activity

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: KS
Weather Conditions: Sunny, Warm
Atmospheric Pressure: 27.28" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000
Factory Calibration Date: April 7, 2011

Date: September 2, 2011
Ambient Temp: 70°

Serial #: 11944/09 AUGUST 2011 EVENT
Field Calibration Date : September 2, 2011

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Y	12:20	1064.0	53.2	33.5	1.5	Need MM # on metal casing
MM-2	Y	12:15	1164.0	58.2	37.6	3.8	Need MM # on metal casing
MM-3	Y	12:05	1062.0	53.1	36.5	1.4	
MM-4	Y	11:40	508.0	25.4	23.8	1.6	
MM-5	Y	11:50	0.0	0.0	3.0	17.8	
MM-6	Y	11:55	416.0	20.8	16.4	3.0	
MM-7	Y	11:15	0.0	0.0	3.7	16.7	
MM-8	Y	10:55	0.0	0.0	3	17.9	
MM-9	Y	10:20	0.0	0.0	3.9	17.6	
MM-10	Y	10:15	918.0	45.9	36.1	0.7	
MM-11	Y	10:10	830.0	41.5	34.8	0.8	
MM-12	Y	10:00	1208.0	60.4	39.0	0.4	Pad damaged - cracked/broken
MM-13	Y	9:30	0.0	0.0	1.2	19.1	
SM-1a	Y	11:00	0.0	0.0	0.0	20.0	
SM-1b	Y	11:05	0.0	0.0	0.0	20.0	
SM-1c	Y	11:10	0.0	0.0	0.0	20.1	
SM-2	Y	10:50	0.0	0.0	0.0	20.0	
SM-3	Y	11:20	0.0	0.0	0.0	20.2	
MW-12	Y	10:30	0.0	0.0	0.0	20.1	
VB-1*	No	11:20					not accessable
MW-4*	Y	10:45	22.0	1.1	1.4	19.4	
MW-5	Y	10:40	0.0	0.0	0.1	20.2	

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

ASSESSMENT MONITORING

Landfill Gas Measurements Field Worksheet
Francis Farm Landfill - Permit #44-03
Haywood County, North Carolina

Name of Person Taking Readings: KS **Date: September 29, 2011**
Weather Conditions: Cool, Overcast **Ambient Temp: 58°**
Atmospheric Pressure: 27.03" Hg
Gas Monitoring Equipment: Land-Tec GEM 2000 **Serial #: 11944/09**
Factory Calibration Date: April 7, 2011 **Field Calibration Date : September 29, 2011**

Well or Probe ID	Stable Readings	Time	%LEL	$\%CH_4$	$\%CO_2$	$\%O_2$	Notes:
MM-1	Y	11:50	1268.0	63.4	35.0	1.0	Added MM # on metal casing
MM-2	Y	11:45	1224.0	61.2	36.5	1.0	Added MM # on metal casing
MM-3	Y	11:40	1056.0	52.8	35.7	1.4	
MM-4	Y	11:20	446.0	22.3	25.7	1.2	
MM-5	Y	11:25	0.0	0.0	4.1	17.6	
MM-6	Y	11:30	352.0	17.6	15.9	3.6	
MM-7	Y	11:10	0.0	0.0	4.0	16.6	
MM-8	Y	10:45	0.0	0.0	3	17.8	
MM-9	Y	10:10	0.0	0.0	3.8	17.6	
MM-10	Y	10:05	1128.0	56.4	36.5	0.4	
MM-11	Y	10:00	858.0	42.9	33.5	1.4	
MM-12	Y	9:50	1216.0	60.8	39.0	0.1	Pad damaged - cracked/broken
MM-13	Y	9:40	0.0	0.0	0.3	20.3	
SM-1a	Y	10:55	0.0	0.0	0.0	20.4	
SM-1b	Y	11:00	0.0	0.0	0.0	20.4	
SM-1c	Y	11:05	0.0	0.0	0.0	20.5	
SM-2	Y	10:40	0.0	0.0	0.0	20.4	
SM-3	Y	11:15	0.0	0.0	0.0	20.4	
MW-12	Y	10:15	0.0	0.0	0.0	20.3	
VB-1*	No	11:10					
MW-4*	Y	10:30	12.0	0.6	1.0	19.7	
MW-5	Y	10:20	0.0	0.0	0.1	20.1	

Note: If methane gas readings exceed 25% of LEL in structures or 100% of LEL in probes contact Haywood County Solid Waste Director immediatley at 828-400-3544.

Field Observation Notes:

APPENDIX 2

Summary of Landfill Gas Monitoring Observations

Summary of Landfill Gas Observations

LFG monitoring locations with methane readings *below* compliance limits (i.e. 100% LEL at the property boundary, and 25% LEL within a structure)

At Property Boundary	Within a Structure
-MM-5	-SM-1a
-MM-7	-SM-1b
-MM-8	-SM-1c
-MM-9	-SM-2
-MM-13	-SM-3
-MW-12	

LFG monitoring locations with methane readings *above* compliance limits

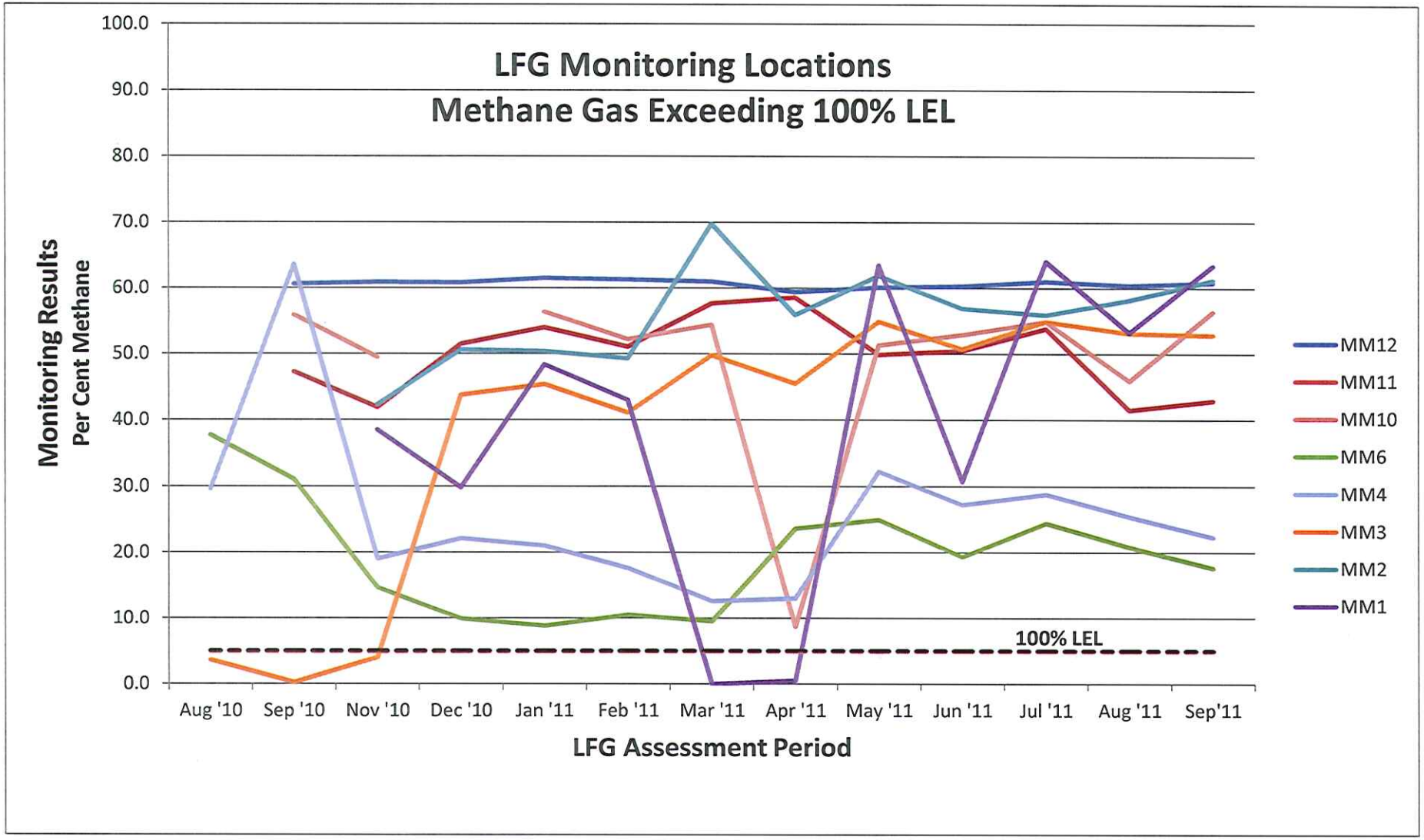
At Property Boundary	
-MM-1	-MM-6
-MM-2	-MM-10
-MM-3	-MM-11
-MM-4	-MM-12

Average Methane Values For LFG Assessment Period

(Values in % Methane)

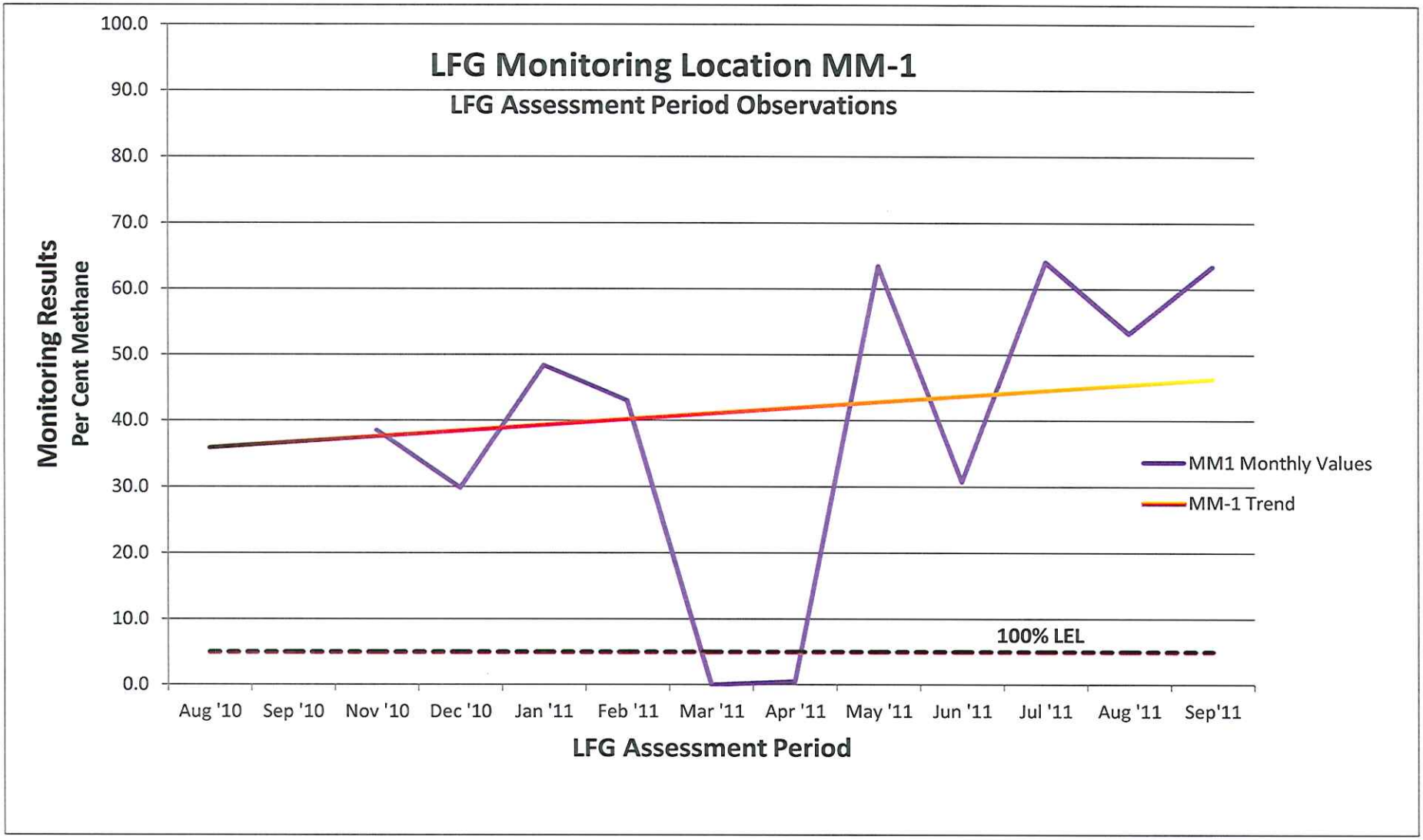
Monitoring Location	% Methane Observed
MM-5, MM-7, MM-8, MM-9, MM-13, MW-12, SM-1a, SM-1b, SM-1c, SM-2, SM-3	0%
MM-1	39.6
MM-2	55.7
MM-3	38.4
MM-4	25.7
MM-6	19.4
MM-10	49.0
MM-11	50.1
MM-12	60.7

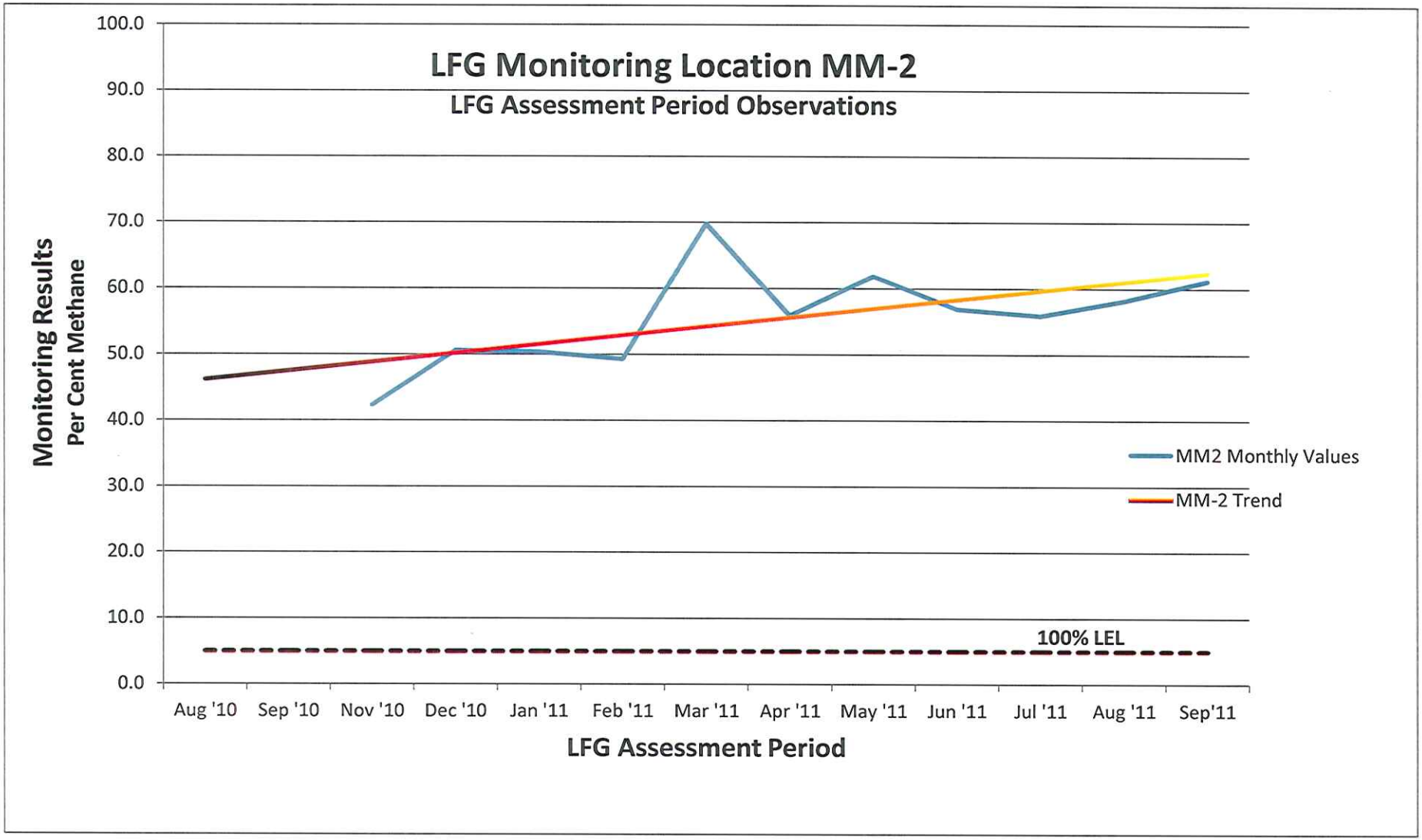
Note: 5% Methane = 100% LEL

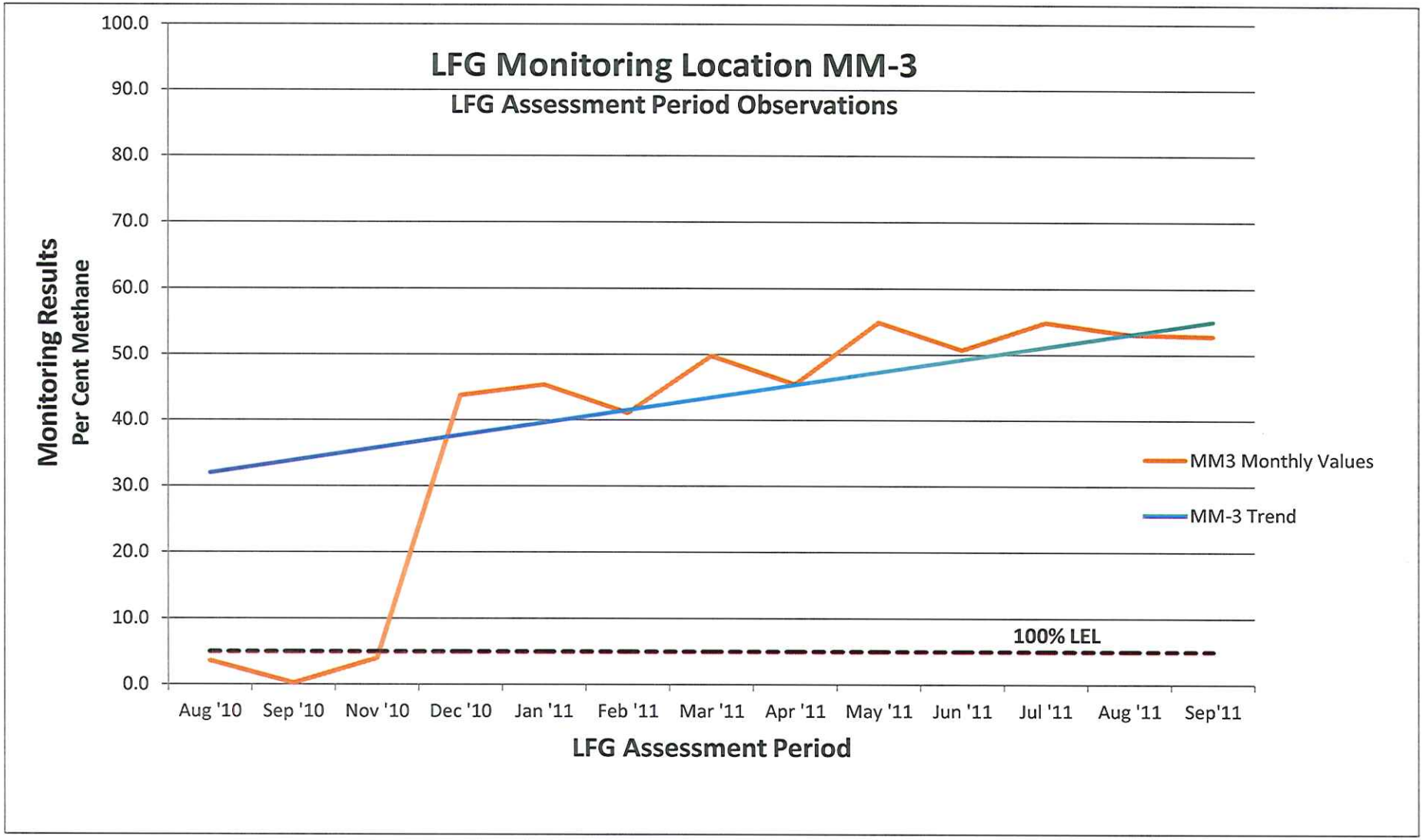

LFG Monitoring Locations
Methane Gas Exceeding 100% LEL
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period
100% LEL
MM12
MM11
MM10
MM6
MM4
MM3
MM2
MM1

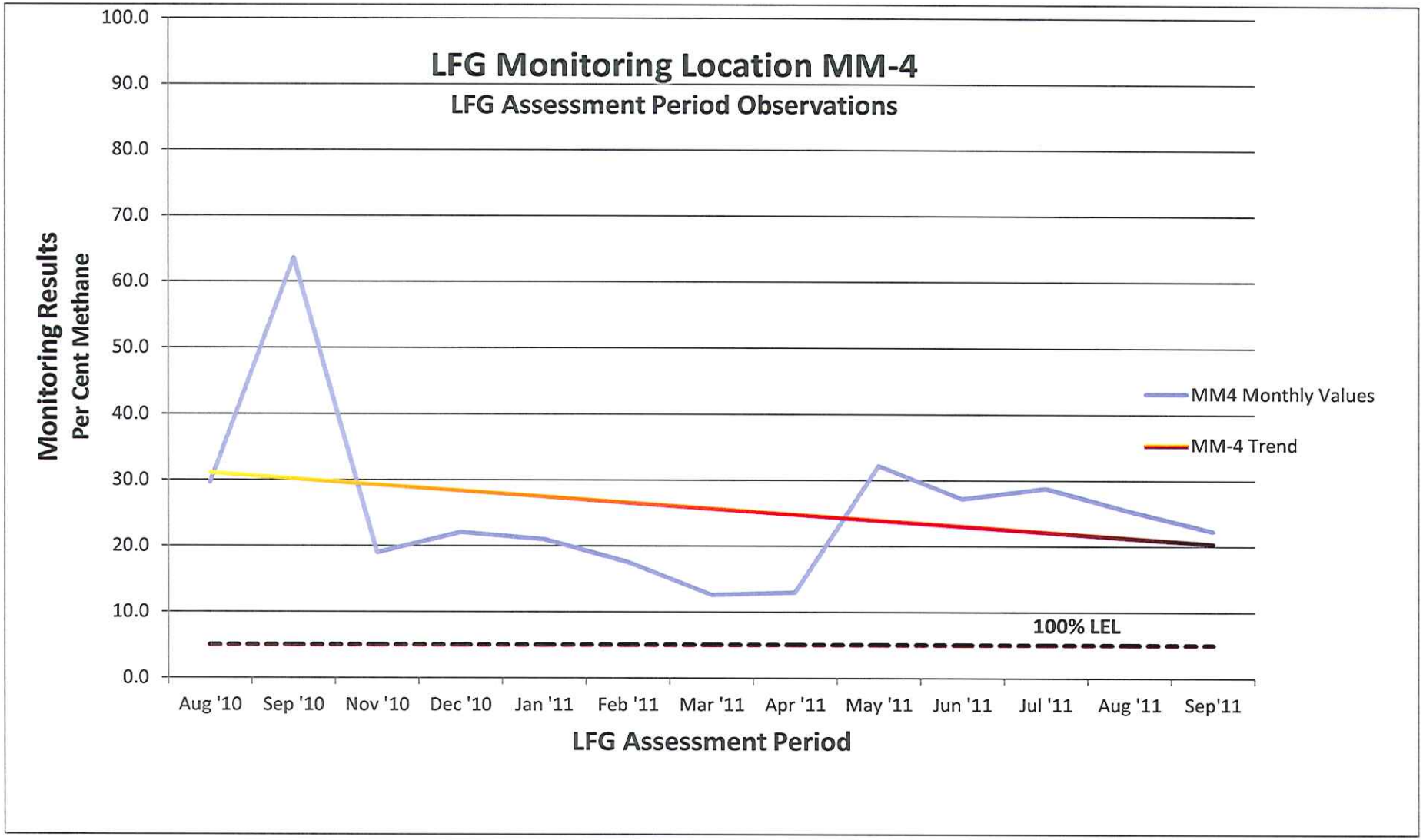
APPENDIX 3

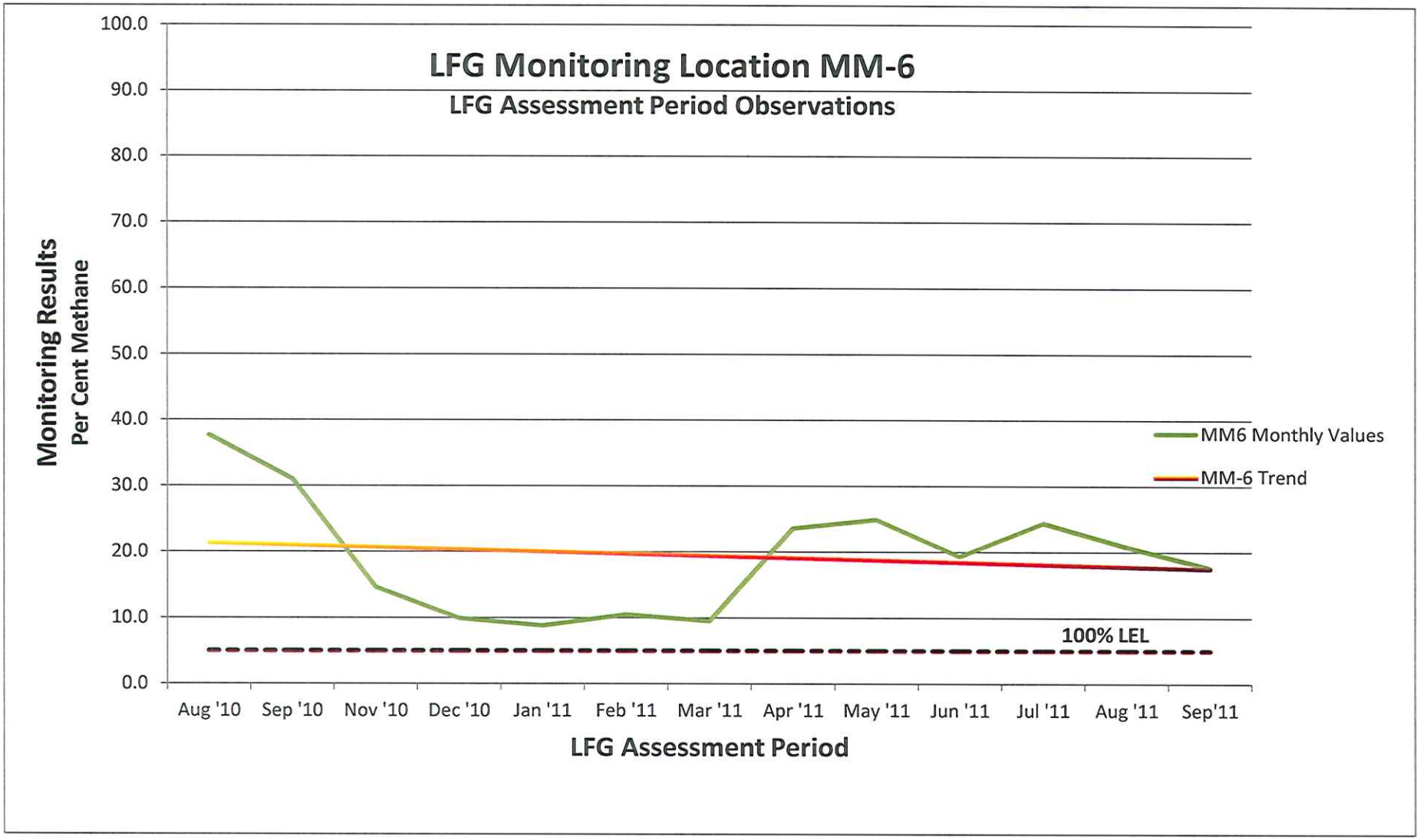
Trend Analysis of Methane Monitoring Locations Exceeding 100% LEL

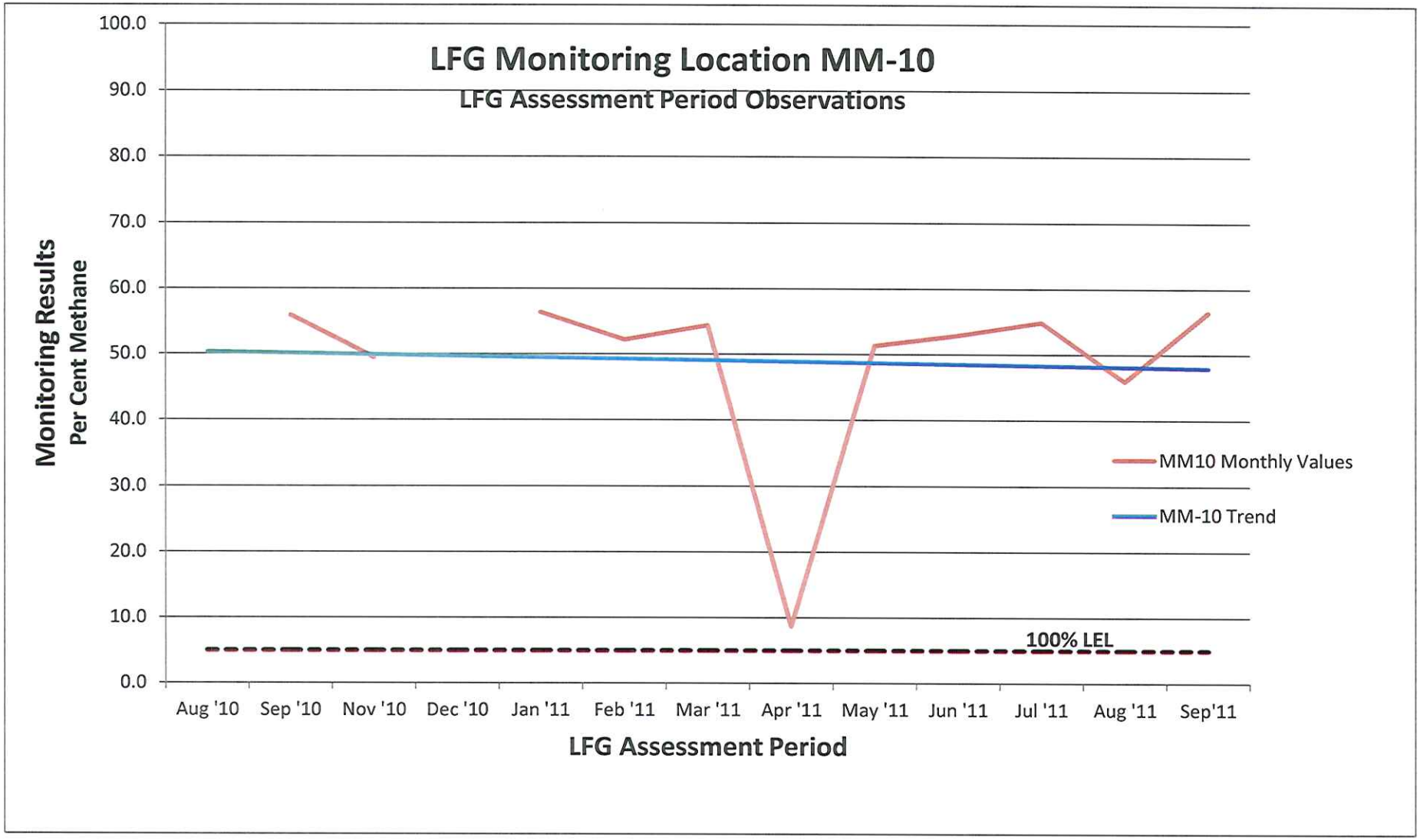

LFG Monitoring Location MM-1
LFG Assessment Period Observations
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period
MM1 Monthly Values
MM-1 Trend
100% LEL

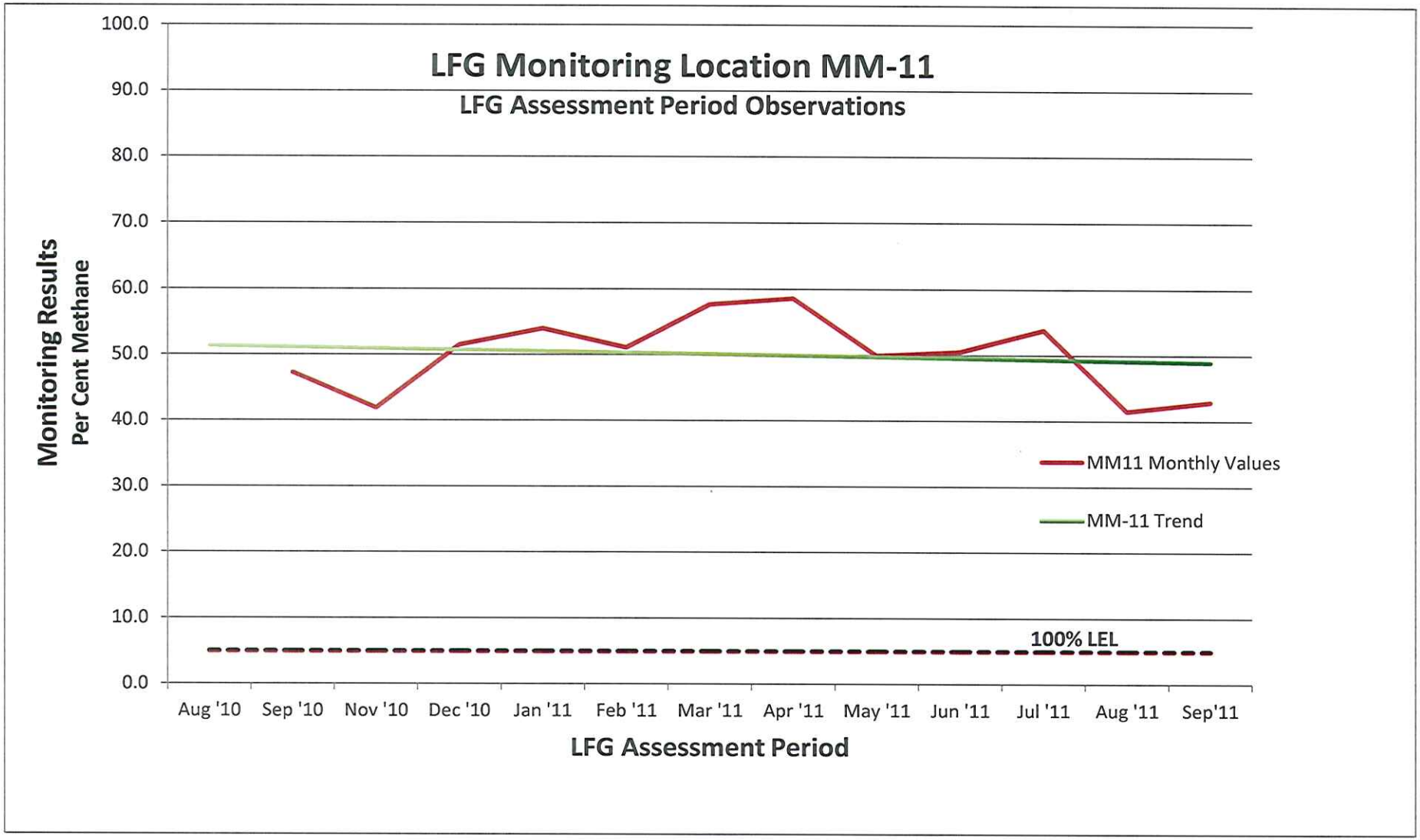

LFG Monitoring Location MM-2
LFG Assessment Period Observations
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
MM2 Monthly Values
MM-2 Trend
100% LEL
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period

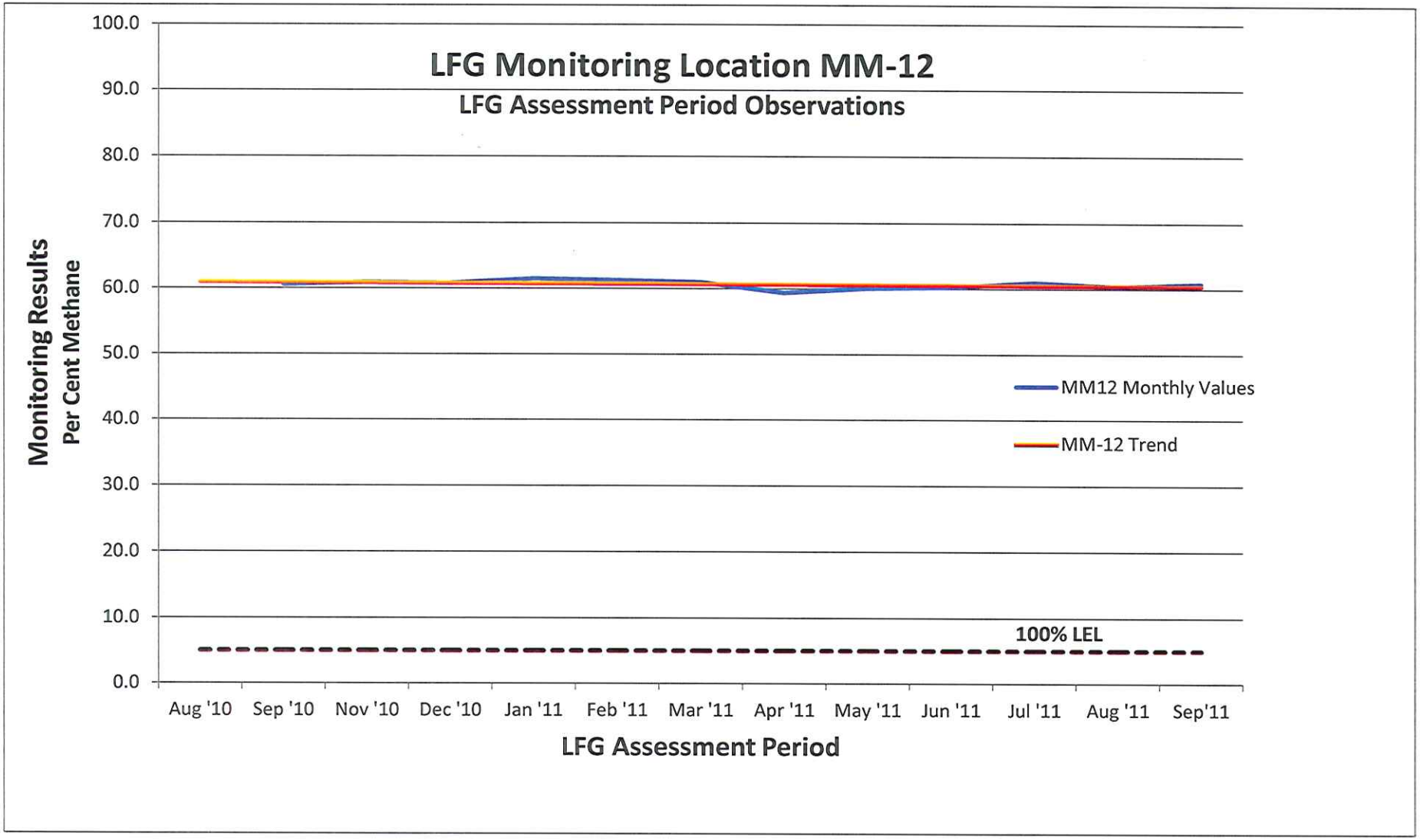

LFG Monitoring Location MM-3
LFG Assessment Period Observations
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period
MM3 Monthly Values
MM-3 Trend
100% LEL


LFG Monitoring Location MM-4
LFG Assessment Period Observations
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
MM4 Monthly Values
MM-4 Trend
100% LEL
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period


LFG Monitoring Location MM-6
LFG Assessment Period Observations
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
MM6 Monthly Values
MM-6 Trend
100% LEL
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period


LFG Monitoring Location MM-10
LFG Assessment Period Observations
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period
MM10 Monthly Values
MM-10 Trend
100% LEL


LFG Monitoring Location MM-11
LFG Assessment Period Observations
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
MM11 Monthly Values
MM-11 Trend
100% LEL
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period

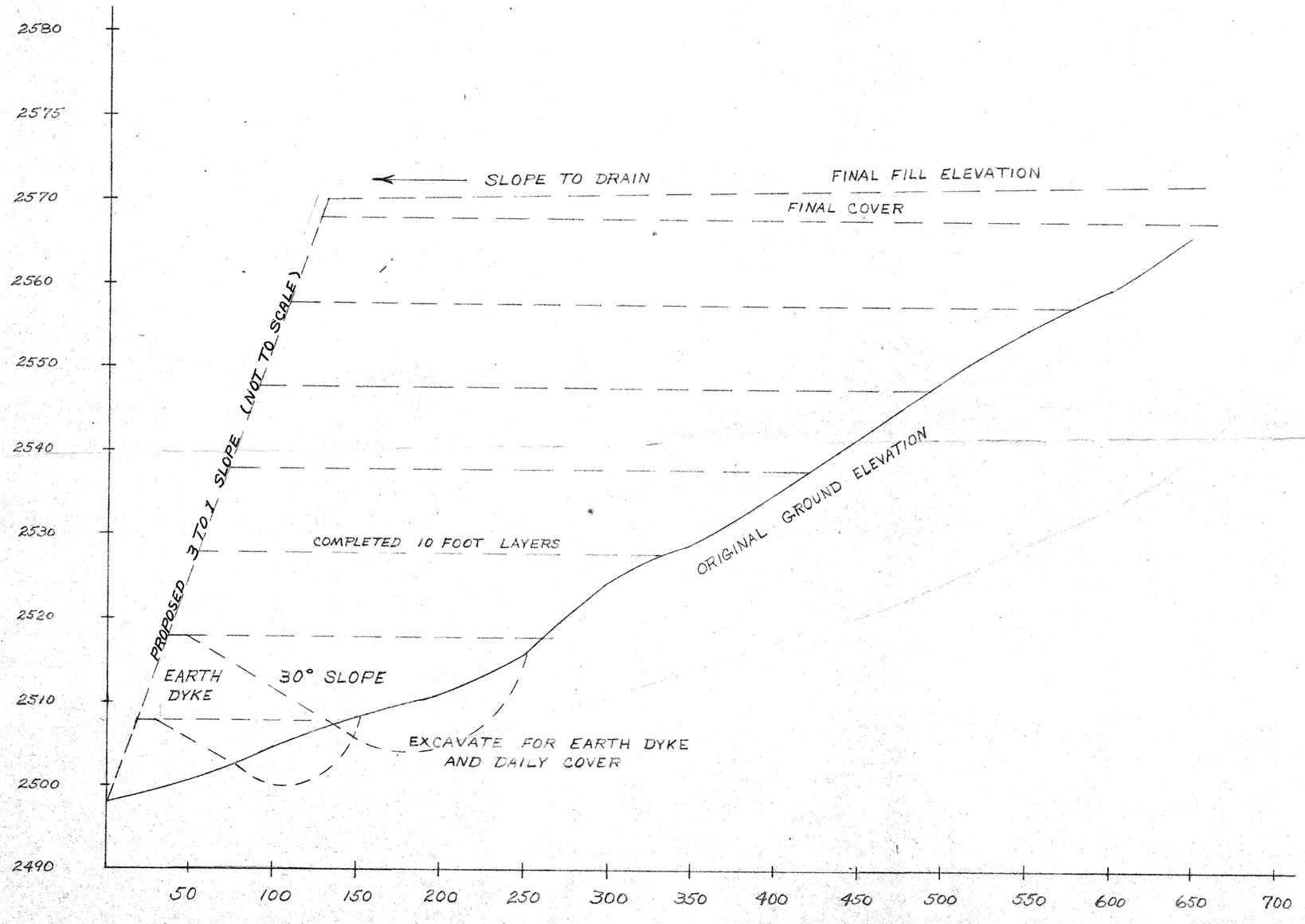

LFG Monitoring Location MM-12
LFG Assessment Period Observations
Monitoring Results
Per Cent Methane
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
MM12 Monthly Values
MM-12 Trend
100% LEL
Aug '10
Sep '10
Nov '10
Dec '10
Jan '11
Feb '11
Mar '11
Apr '11
May '11
Jun '11
Jul '11
Aug '11
Sep'11
LFG Assessment Period

APPENDIX 4

As-built Information Provided by NCDENR-SWS:

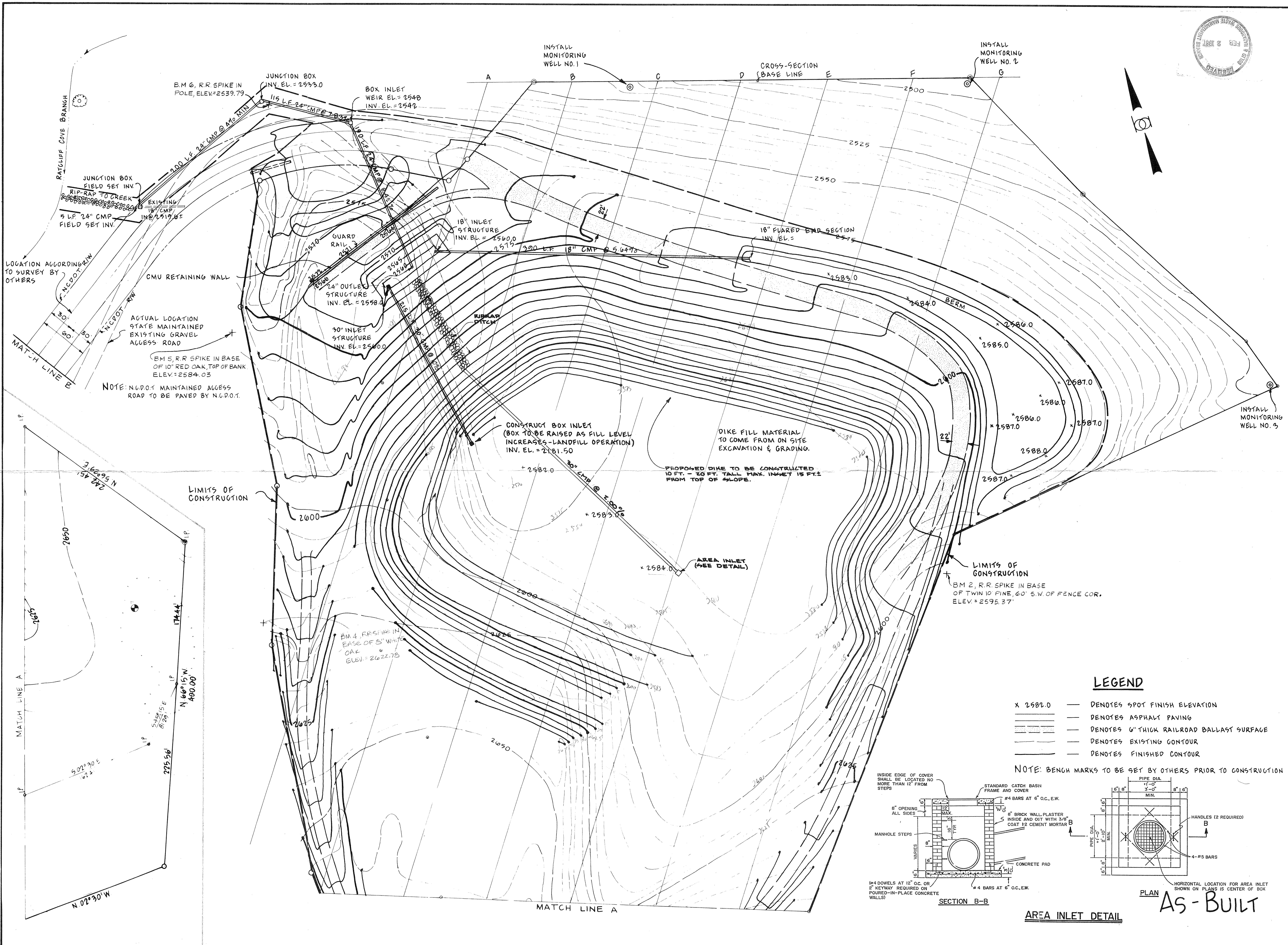
- **Plan View and Cross Section – 6-27-72**
- **As-Built Drawing – 1-27-87**

TOPOGRAPHICAL MAP
J. HARLEY FRANCIS ESTATE
WAYNESVILLE TOWNSHIP
HAYWOOD COUNTY N.C.
SURVEY & MAP BY
EDWARDS & DEITZ
ENGINEERING & LAND SURVEYING
DRAWN BY. J. M. DEITZ
HORZ. SCALE · 1" = INCH 50 FEET
CONTOUR INTERVALS = 5 FEET
DATE OF SURVEY 6— 27— 72
AREA = 20.07 ACRES



SECTION A-A
AREA TYPE LANDFILL
HORIZONAL SCALE 1"=50' VERTICAL SCALE 1"=10'

HAYWOOD COUNTY LANDFILL
FRANCIS ESTATE
SHEET 3 OF 3 DTM


INSTALL MONITORING WELL NO. 1
INSTALL MONITORING WELL NO. 2
INSTALL MONITORING WELL NO. 3
CROSS-SECTION BASE LINE
A B C D E F G
JUNCTION BOX INV. EL. = 2533.0
B.M 6, R.R. SPIKE IN POLE, ELEV.=2539.79
BOX INLET WEIR EL.= 2548 INV. EL.= 2542
RATCLIFF COVE BRANCH
JUNCTION BOX FIELD SET INV.
RIP-RAP TO CREEK
EXISTING 18" CMP INV@2519.6±
5 L.F. 24" CMP FIELD SET INV.
LOCATION ACCORDING TO SURVEY BY OTHERS
NCDOT R/W
CMU RETAINING WALL
GUARD RAIL
18" INLET STRUCTURE INV. EL. = 2560.0
300 L.F. 18" CMP @ 5.64%
18" FLARED END SECTION INV. EL. =
24" OUTLET STRUCTURE INV. EL. = 2558.0
30" INLET STRUCTURE INV. EL.=2560.0
RIPRAP DITCH
BERM
ACTUAL LOCATION STATE MAINTAINED EXISTING GRAVEL ACCESS ROAD
BM 5, R.R SPIKE IN BASE OF 10" RED OAK, TOP OF BANK ELEV.=2584.03
NOTE: N.C.D.O.T. MAINTAINED ACCESS ROAD TO BE PAVED BY N.C.D.O.T.
MATCH LINE B
CONSTRUCT BOX INLET (BOX TO BE RAISED AS FILL LEVEL INCREASES-LANDFILL OPERATION) INV. EL. = 2181.50
DIKE FILL MATERIAL TO COME FROM ON SITE EXCAVATION & GRADING.
PROPOSED DIKE TO BE CONSTRUCTED 10 FT. - 30 FT. TALL MAX. INSET 15 FT.± FROM TOP OF SLOPE.
LIMITS OF CONSTRUCTION
AREA INLET (SEE DETAIL)
BM 2, R.R. SPIKE IN BASE OF TWIN 10" PINE, 60' S.W. OF FENCE COR. ELEV. = 2595.37'
BM 4, R.R. SPIKE IN BASE OF 5" WHITE OAK ELEV.=2622.78
N 56°09'E 242.45'
N 66°15'W 400.00'
N 02°30'W
225.56'
174.44'
MATCH LINE A
2500 2525 2550 2575 2600 2625 2650
x 2582.0 x 2583.0 x 2584.0 x 2585.0 x 2586.0 x 2587.0 x 2588.0
LEGEND
x 2582.0 — DENOTES SPOT FINISH ELEVATION
— DENOTES ASPHALT PAVING
— DENOTES 6" THICK RAILROAD BALLAST SURFACE
— DENOTES EXISTING CONTOUR
— DENOTES FINISHED CONTOUR
NOTE: BENCH MARKS TO BE SET BY OTHERS PRIOR TO CONSTRUCTION
INSIDE EDGE OF COVER SHALL BE LOCATED NO MORE THAN 12" FROM STEPS
STANDARD CATCH BASIN FRAME AND COVER
#4 BARS AT 6" O.C., E.W.
8" OPENING ALL SIDES
8" BRICK WALL, PLASTER INSIDE AND OUT WITH 3/8" COAT 1:2 CEMENT MORTAR
MANHOLE STEPS
VARIES
CONCRETE PAD
(#4 DOWELS AT 12" O.C. OR 2" KEYWAY REQUIRED ON POURED-IN-PLACE CONCRETE WALLS)
#4 BARS AT 6" O.C., E.W.
SECTION B-B
PIPE DIA. +1'-0" 3'-0" MIN.
HANDLES (2 REQUIRED)
4-#5 BARS
HORIZONTAL LOCATION FOR AREA INLET SHOWN ON PLANS IS CENTER OF BOX
PLAN
AREA INLET DETAIL
AS-BUILT

BUTLER ASSOCIATES, P.A.
CONSULTING ENGINEERS
ASHEVILLE AND MORGANTON, N.C.

CONSTRUCTION PLANS FOR
THE HAYWOOD COUNTY LANDFILL
HAYWOOD COUNTY, NORTH CAROLINA

DRAWING NO: 82127
DATE: SEPT., 1982
SCALE: 1"=50'
REVISION: OCT. 20, 1982 1-26-87

GRADING PLAN

SHEET 4 OF 11