



June 7, 2011

Ms. Jaclynne Drummond
NCDENR DWM Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

**RE: Well Re-activation – Field Summary Report
Avery County Closed MSW Landfill
Spruce Pine, North Carolina**

Dear Ms. Drummond:

As you are aware, Richardson Smith Gardner (RSG) is assisting Avery County with landfill gas management at the closed Avery County MSW landfill. This letter report is sent to summarize the field activities performed on April 6-7, 2011 regarding the repair and up-fit of the Landfill Gas Collection and Control System (LFGCCS), as set forth in the *Off-site Landfill Gas Mitigation Plan*¹, approved, via letter, on February 10, 2011 by NCDENR Division of Waste Management².

The Mitigation Plan outlined a phased response to LFG migration off-site. The phased approach included the following tasks:

- Re-activation of the inactive LFG extraction wells;
- Enhancement of the LFGCCS monitoring and maintenance; and
- Evaluation of additional measures and recommendations.

At this time RSG has completed the re-activation of the inactive LFG extraction wells and provided enhancements to the LFGCCS. These activities are summarized below.

Repair and Up-fit of Existing LFG Extraction Wells

In January 2009, four (4) LFG extraction wells (W-5, W-6, W-7 & W-8) were removed from the LFGCCS due to a fire that occurred in/near these wells, destroying the wellheads. During the site visit on April 6-7, 2011, RSG personnel replaced the wellheads at these four (4) locations with Waste Management style wellheads (shown in **Figure 1**), and reconnected these LFG wells to the LFGCCS. These newly installed wellheads were connected to the existing LFG header laterals using the same configuration previously used on-site, provided in **Figure 2**.

The four (4) previously operational LFG wells (W-1, W-2, W-3 & W-4) were up-fit with new hardware including new Kanaflex[®] hose and powerclamps, as well as, wellhead connection extensions with quick-connect ports, where needed, to provide system pressure readings. Each

¹ *Off-Site Gas Mitigation Plan*. Richardson Smith Gardner and Assoc. January 18, 2011

² *Off-Site Gas Mitigation Plan*- Approval. Letter from Jaclynne Drummond, NCDENR, February 10, 2011

of the connections of LFG wells W-1, W-2, W-3 and W-4 to the LFG header laterals were re-worked to match the configuration provided in **Figure 2**. Well locations are shown on **Figure 3**. Photographs of the installed wellheads are provided as **Figures 4** and **5**.

Existing LFG Well Construction and Piping Evaluation

Due to the absence of well construction records for the existing eight (8) LFG wells located on the site, RSG gathered information to perform a “best estimate” of each well’s construction. RSG performed depth sounding and liquid level readings in each of the existing wells utilizing a water level indicator. To further evaluate well construction and screened intervals, RSG performed a downhole video survey. The results of this evaluation are summarized in the attached **Table 1**. RSG will utilize this data as a part of our on-going evaluations of the system. We have also included a well construction diagram by Natural Power (February, 9 2000) with **Table 1** for reference.

No sub-terrain damage or excessive water levels are present in the wells. The general condition of the wells appears to be adequate to provide for LFG capture across the entire landfill.

System piping was uncovered in certain areas to perform connections and to check conditions of valves (**Figures 6, 7, and 8**) during this site visit. All header laterals were determined to be 4”, while it appears that the LFG header pipes are 6”, as shown on **Figure 3**. All valves were determined to be in working condition.

Flare Station and Piping

During this site visit, improvements were made to the flare station including the installation of two quick connect ports to more accurately gauge the performance of the LFG system. One quick connect port was installed on the LFG line between the flame arrester and the flare, shown in **Figure 9**. A second quick connect port as well as a blind flange were installed at the previous greenhouse transmission line connection as shown on **Figure 10**. The flame arrester filter was removed, cleaned, and reinstalled during this site visit.

Conclusions

After the repair and reconnection of the LGCCS as discussed above, the system appears to be operating with vacuum evenly distributed across the eight (8) extraction wells. RSG will continue monthly monitoring and system adjustments for optimal LFG recovery. Monthly reports will be submitted to NCDENR via email.

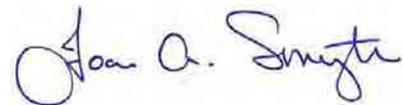
This system upgrade allows for the 12-month evaluation period regarding the effectiveness of the LFGCCS optimization and operation to begin. At the conclusion of this evaluation period, a report will be submitted to NCDENR, summarizing our findings.

If you have any questions, or require additional information, please contact us at your earliest convenience at 919-828-0577 or by e-mail (address below).

Sincerely,
Richardson Smith Gardner and Associates, Inc.



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Project Scientist
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Attachments

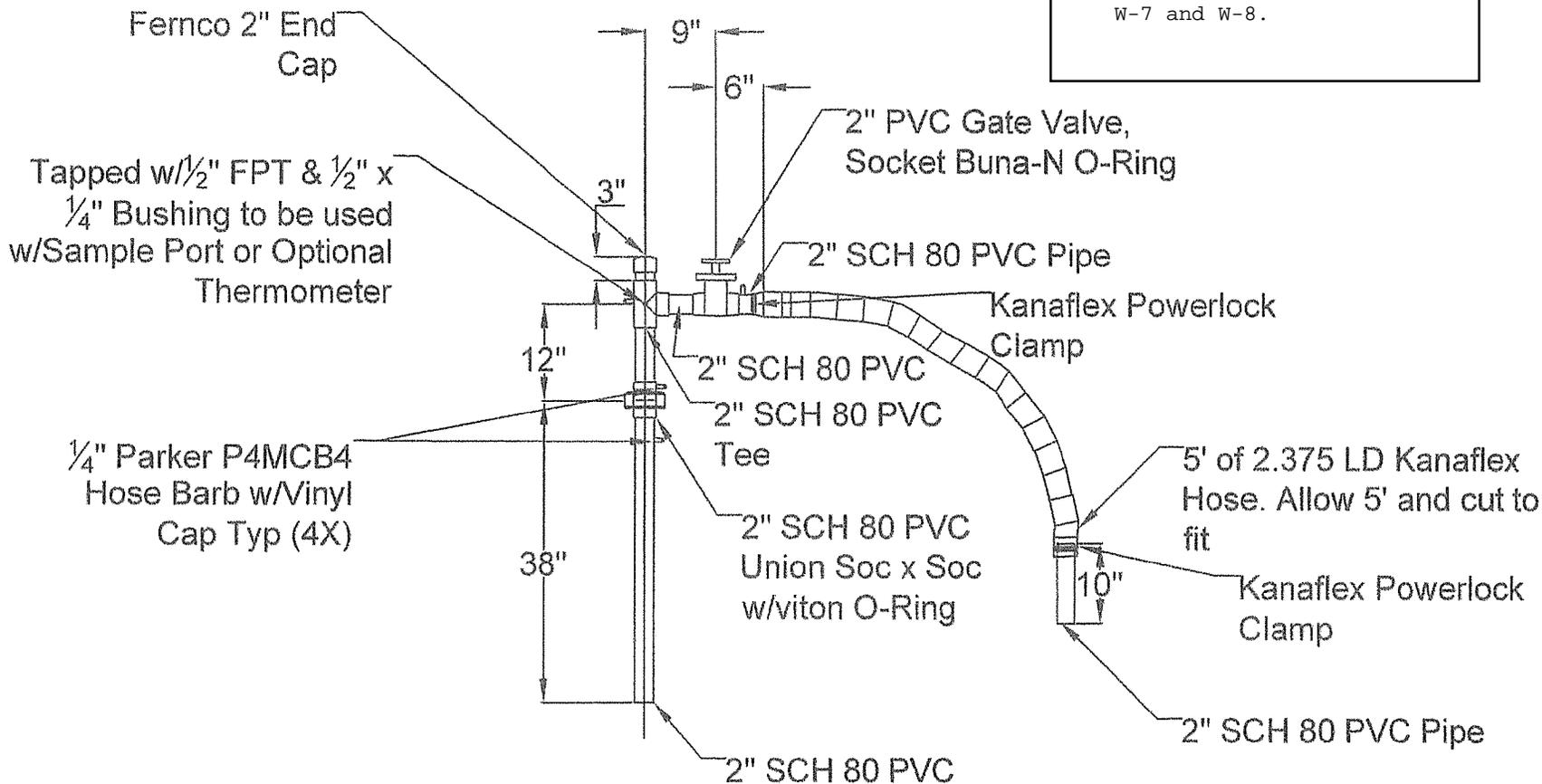
CC: Buddy Norris – Avery County
Bill Wagner – NCDENR
Mark Poindexter – NCDENR
Deb Aja – NCDENR
Stacey Smith, P.E. – RSG
File

Figures

Side View

Figure 1

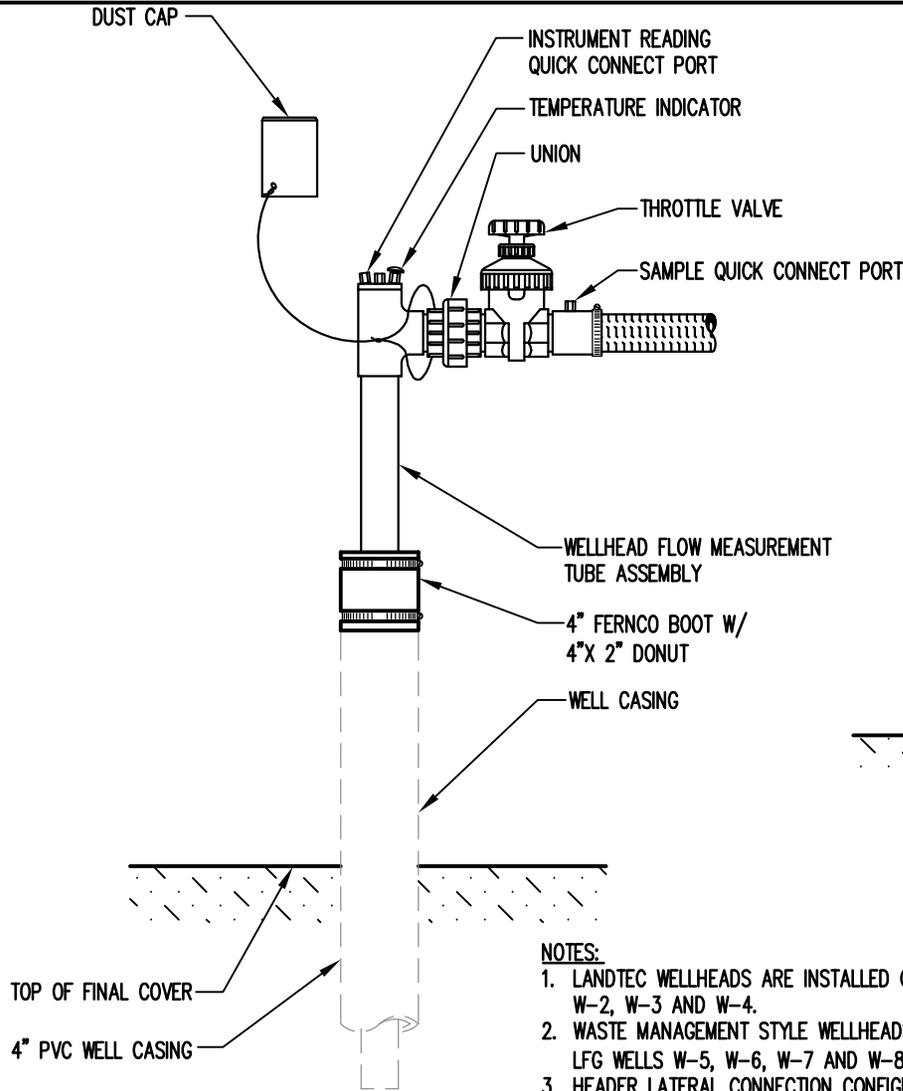
This type wellhead was installed at W-5, W-6 W-7 and W-8.



Orifice Plates Included		Rev. By	Date
.25 Bore, .50 Bore, .75 Bore, 1.0 Bore, 1.25 Bore, 1.50 Bore		Whitey	5/26/09
No.	Description		

WM Style Well Head

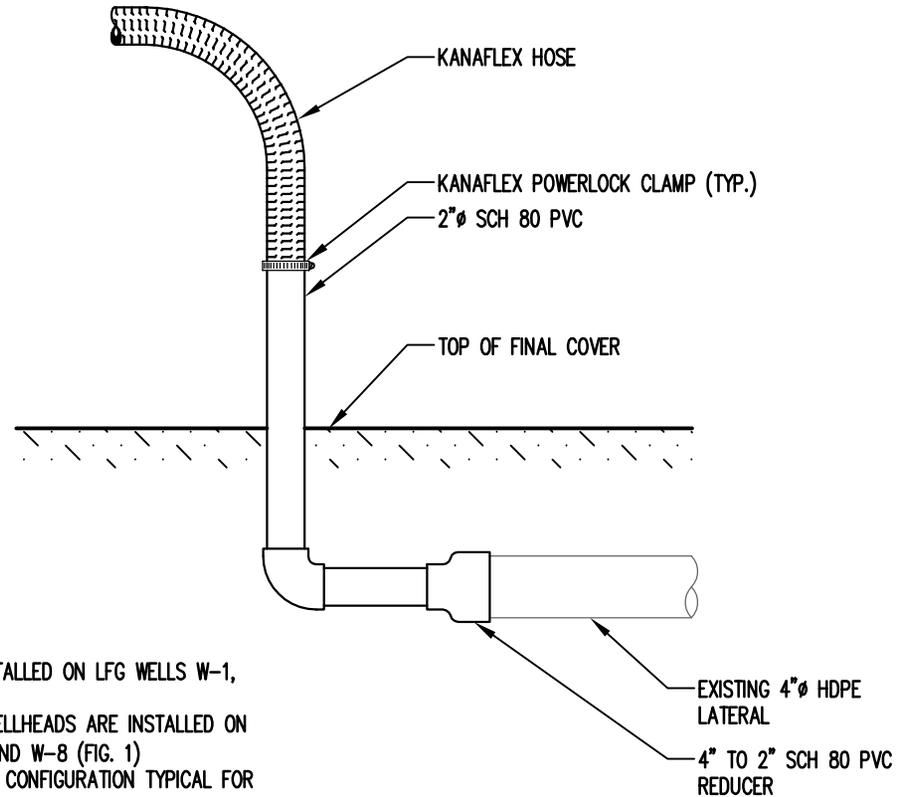
DATE: Whitey	DATE: 5/26/09	SECTION:	REVISED:	REVISED:	REVISED:
52609-007				A	



NOTES:

1. LANDTEC WELLHEADS ARE INSTALLED ON LFG WELLS W-1, W-2, W-3 AND W-4.
2. WASTE MANAGEMENT STYLE WELLHEADS ARE INSTALLED ON LFG WELLS W-5, W-6, W-7 AND W-8 (FIG. 1)
3. HEADER LATERAL CONNECTION CONFIGURATION TYPICAL FOR ALL EIGHT (8) LFG WELLS.

LANDTEC WELLHEAD
(SEE NOTES 1 AND 2)



HEADER LATERAL CONNECTION
(SEE NOTE 3)

LANDFILL GAS EXTRACTION WELLHEAD
AND HEADER LATERAL CONNECTION
AVERY COUNTY MSW LANDFILL
SPRUCE PINE, NC

DRAWN BY:

J.A.L.

CHECKED BY:

D.M.M.

SCALE:

AS SHOWN

FIGURE NO.

2

DATE:

May. 2011

PROJECT NO.

AVERY 11-3

FILE NAME

VERTICAL WELLHEAD



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REFERENCES

1. ADJACENT PROPERTIES ARE FROM AVERY COUNTY GIS MAPPING DEPARTMENT.
2. LANDFILL GAS EXTRACTION WELL LOCATIONS FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS AND CONSULTANTS. PIPING IS APPROXIMATE.
3. PROPERTY LINE FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS.
4. SHOWN PIPE DIAMETERS ARE ASSUMED FROM "AVERY COUNTY LANDFILL - NATURAL GAS-TO-ENERGY PROJECT PROPOSAL", BY NATURAL POWER, INC., FEBRUARY 14, 2000, AND RSG SITE VISIT ON APRIL 6-7, 2011.



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FIGURE NO.	3	FILE NAME	AVERY-B0170
SCALE:	AS NOTED	PROJECT NO.	AVERY 11-3
CHECKED BY:	D.M.M.	DATE:	May, 2011
DRAWN BY:	J.A.L.		

TITLE:
**EXISTING LANDFILL GAS EXTRACTION SYSTEM
 AVERY COUNTY CLOSED MSWLF
 SPRUCE PINE, NC**



Figure 4 – Waste Management style wellhead (W-5, W-6, W-7 & W-8)



Figure 5 – LANDTEC style wellhead (W-1, W-2, W-3 & W-4)



Figure 6 – 6” valve on LFG header (operational).



Figure 7 – 2” valve before blower at flare station (operational).



Figure 8 – 2” valve at flare station before flame arrester and flare (operational).

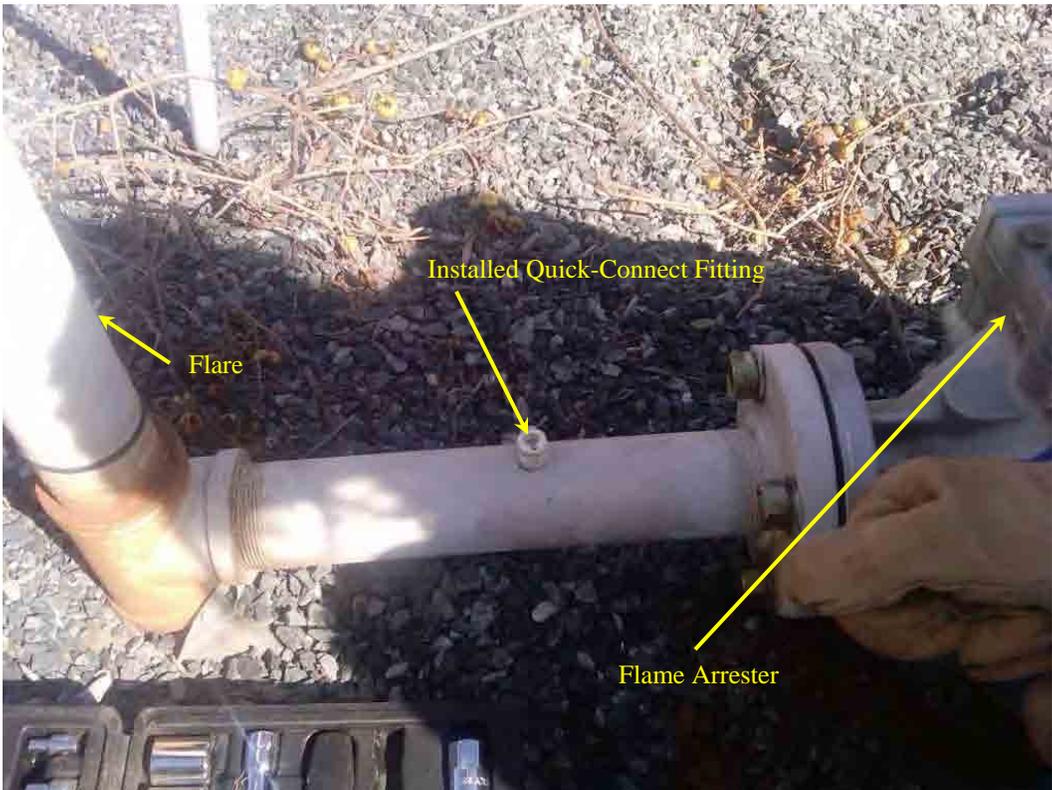


Figure 9 – Flare Station Improvements



Figure 10 – Flare Station Improvements

Tables

Table 1
Avery County MSW Landfill
Landfill Gas Extraction Well Construction Data*
4/6-7/2011

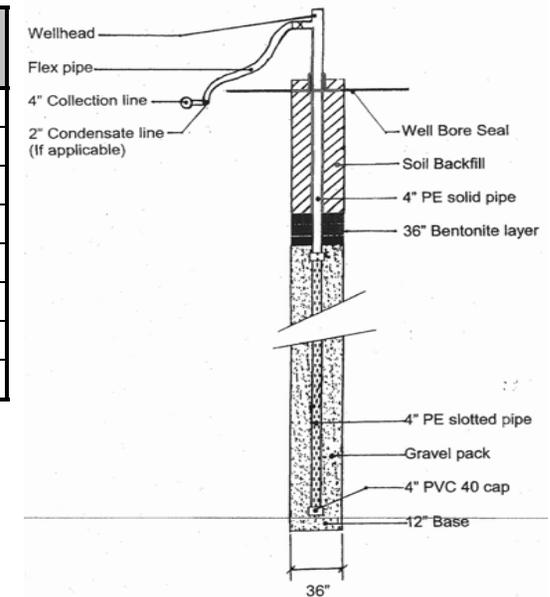
Well	Well ¹ Location Northing	Well ¹ Location Easting	Depth to Water (feet)	Depth to Bottom (feet)	Solid Pipe (feet)	Perforated Pipe (feet)	Assumed Partially Impacted ² (feet)	Assumed Completely Impacted ³ (feet)
W-1	813351.3864	1114313.802	63.5	75	0 - 20	20 - 75	27 - 33	33 - 75
W-2 ⁴	813207.3408	1114229.216	72	88	0 - 15	15 - 88	30 - 62	62 - 88
W-3 ⁴	813252.1912	1114095.673	61	75	0 - 15	15 - 75	40 - 61	61 - 75
W-4 ⁴	813134.1978	1114110.049	53	62	0 - 20	20 - 62	40 - 53	53 - 62
W-5	813065.6697	1114347.228	Dry	36.5	0 - 16.5	16.5 - 36.5	16.5 - 36.5	--
W-6	812975.9401	1114268.297	Dry	36.5	0 - 16.5	16.5 - 36.5	--	--
W-7	812990.7506	1114152.843	19.5	23	0 - 7	16	--	19.5 - 23
W-8	812877.4680	1114119.300	21	22	0 - 7	15	--	--

* All solid and perforated pipe lengths are estimated from downhole camera activities.
 All measurements (footages) are from the ground surface.

Notes:

1. Locations from field survey dated April 9, 2010, by Appalachian Professional Land Surveyors and Consultants.
2. Assumed partially impacted means that the perforations appear to be at least partially blocked causing reduced or no flow of LFG.
3. Assumed completely impacted means that the perforations appear to be completely blocked causing no flow of LFG.
4. Depth to water on these wells was hard to determine because of material build up on the water level indicator. Downhole camera data was combined with water level indicator readings to produce these numbers.

Avery County Landfill
Extraction Well Schematic



CRM # Natural Power, Inc. 02-05-00