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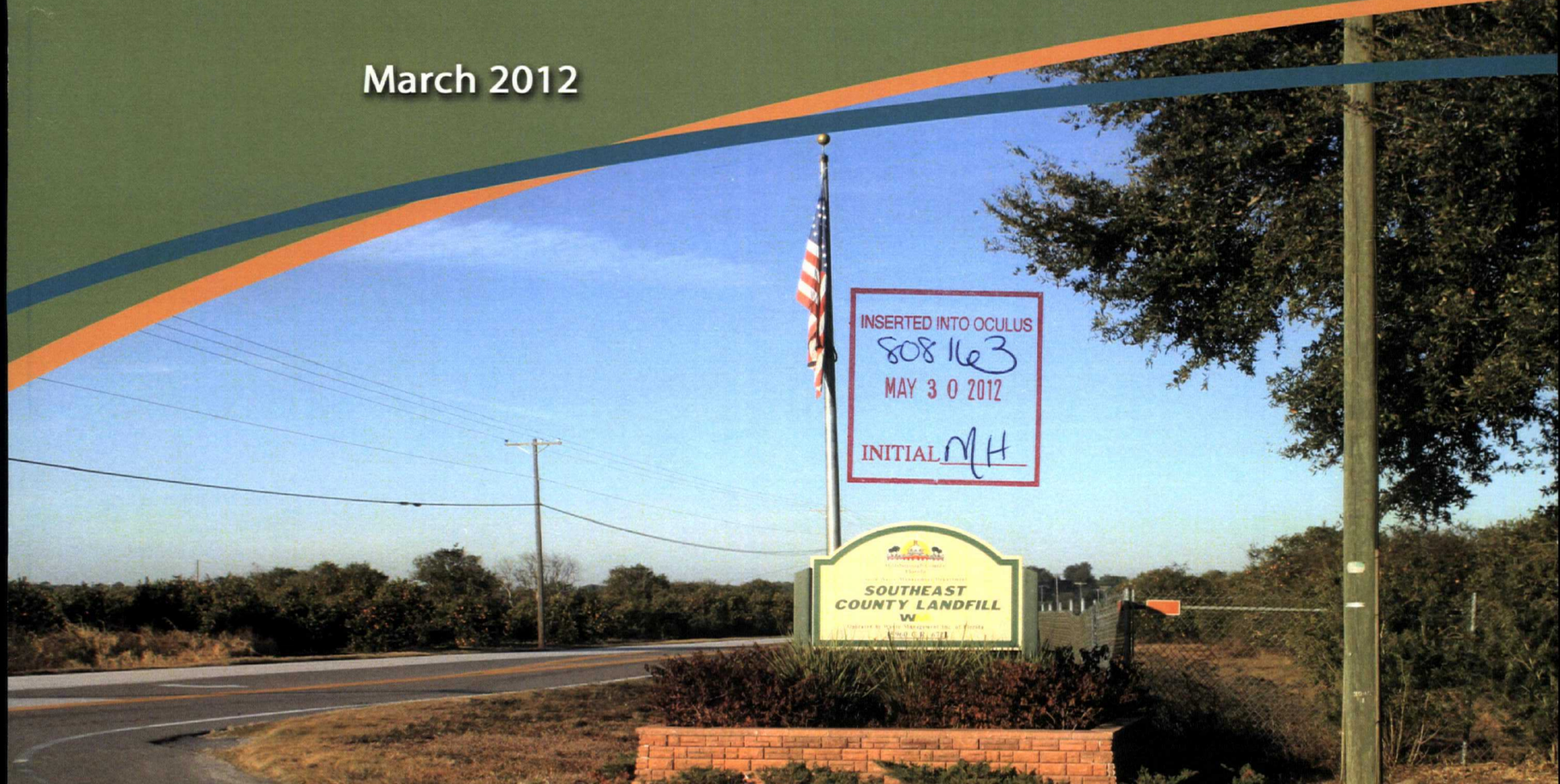
Hillsborough County Public Utilities Department
Solid Waste Management Group

Hillsborough County
Florida

HDR

Sections 7, 8 and 9, Landfill Gas Collection and Control System Expansion Southeast County Landfill

March 2012



May 1, 2012

Steven G. Morgan
Solid Waste Section
Southwest District Office
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

RE: Response to Request for Additional Information
Hillsborough County Southeast County Landfill
Gas Collection and Control System Expansion Construction
Pending Modification No.: 35435-016-SC/IM to
Permit No.: 35435-016-SC/08
WACS No.: SWD/29/41193

Dear Mr. Morgan:

On behalf of Hillsborough County Public Utilities Department, Solid Waste Management Group, HDR Engineering, Inc. is pleased to provide the following information in response to the Florida Department of Environmental Protection's (FDEP) April 4, 2012 Request for Additional Information (RAI) regarding the Southeast County Landfill Gas Collection and Control System Expansion Construction.

All revisions to the narrative reports are shown with deletions struckthrough (~~struckthrough~~) and additions underlined (underlined) along with a change line indicator in the left margin.

Responses to each of the comments in the April 4, 2012 RAI are provided below in the same order presented in RAI. In each case the FDEP request is repeated in italics with the response immediately following in **bold**.

The following attachments are enclosed with the response document and are referenced in the responses to comments:

ATTACHMENT A	PROOF OF PUBLICATION
ATTACHMENT B	REVISED LFGCCS EXPANSION AND ENGINEERING REPORT PAGES
ATTACHMENT C	GCCS DESIGN PLAN BY SCS
ATTACHMENT D	CONDENSATE GENERATION CALCULATIONS
ATTACHMENT E	REVISED SPECIFICATIONS PAGES

HDR Engineering, Inc.
5426 Bay Center Drive
Suite 400
Tampa, FL 33609-3444
Phone: (813) 282-2300
Fax: (813) 282-2430
www.hdrinc.com

GENERAL:

1. *The requested information and comments below do not repeat the information submitted by the applicant. However, every effort has been made to concisely refer to the section, page, drawing detail number, etc. where the information has been presented in the original submittal.*

2. *Please submit **4 copies** of all requested information. Please specify if revised information is intended to supplement, or replace, previously submitted information. Please submit all revised plans and reports as a complete package. For revisions to the narrative reports, deletions may be struckthrough (~~struckthrough~~) and additions may be underlined underlined or similar notation method. This format will expedite the review process. Please include revision date on all revised pages.*

3. *Please provide a summary of all revisions to drawings, and indicate the revision on each of the applicable plan sheets. Please use a consistent numbering system for drawings. If new sheets must be added to the original plan set, please use the same numbering system with a prefix or suffix to indicate the sheet was an addition, e.g. Sheet 1A, 1B, P1-A, etc.*

4. *Please be advised that although some comments do not explicitly request additional information, the intent of all comments shall be to request revised calculations, narrative, technical specifications, QA documentation, plan sheets, clarification to the item, and/or other information as appropriate.*

The following information is needed in support of the solid waste application [Chapter 62-701, Florida Administrative Code (F.A.C.)]:

SECTION E - GENERAL REQUIREMENTS [Rule 62-701.320, F.A.C.]:

Comment 1. ***Section D.13:*** *Please publish the attached Notice of Application and provide proof of publication to the Department.*

Response 1: The Notice of Application for the project was published on April 12, 2012 in the Tampa Tribune. Refer to Attachment A for proof of publication.

SECTION G - LANDFILL CONSTRUCTION REQUIREMENTS [Rule 62-701.400, F.A.C]:

Comment 2. ***Section G.1:*** *Please verify that the reference to Table 1, Section E in this section is actually a table provided in the Engineering Report in Appendix A and revise the reference to the table in this section accordingly.*

Response 2: Section G.1 has been revised to indicate correct reference for the location of Table 1. Table 1 is included in Appendix A, Engineering Report.

SECTION N - GAS MANAGEMENT SYSTEM [Rule 62-701.530, F.A.C.]:

Comment 3. ***Section N.1.b:***

a. Please revise this section to clarify that the department will be notified of proposed modifications "to the landfill or to the gas system design" prior to implementation of the modification to determine whether a permit modification will be required.

Response 3.a: Section N.1.b has been revised to indicate that the department will be notified of proposed modifications to the landfill or to the gas system design. Refer to Attachment B for revised LFGCCS Report pages.

b. Please specifically identify where in the July 11, 2008 FDEP approved GCCS Design Plan it is stated that "horizontal collectors will not be subject to the NSPS pressure and oxygen operating requirements until a minimum of 20 feet of waste are placed on the top of the collector" and revise this section and Section 3.1 of the Engineering Report, if applicable.

Response 3.b: A copy of the FDEP approved July 11, 2008 GCCS Design Plan pages submitted by SCS is included in Attachment C. Section 5.13.1 of the approved GCCS Design Plan states that "To avoid air infiltration into horizontal collectors, the SWMD proposes that horizontal collectors not be subject to the pressure and oxygen operating requirements until a minimum of 20 feet of waste has been placed on top of the collector. Horizontal collectors without at least 20 feet of waste on top of them will not be considered part of the NSPS compliance network".

No changes to Section 3.1 of the Engineering Report are required.

SECTION R - FINANCIAL ASSURANCE [Rule 62-701.630, F.A.C):

Comment 4. *Part R of the application form is checked "N/C", indicating that no change in financial assurance is provided or required as part of this permit modification. Please note that the financial assurance cost estimates provided in support of Permit No. 35435-016-SC/08 only included the cost for construction of the GCCS for Phases I-VI and Sections 7-8, and did not include expansion of the GCCS in Section 9.*

However, in consideration that the GCCS construction for Phase I-VI and Sections 7-8 has been completed and the costs for that construction have not subsequently been removed from the financial assurance currently provided for the facility and the fact that revised cost estimates will be provided as part of the operation permit renewal application for the facility due June 15, 2013, the department has no objection to the permittee deferring an update to the costs for construction of the GCCS to the permit renewal application submittal. Should the permittee submit revised (not-inflation adjusted) cost estimates to the department for approval prior to operation permit renewal, then the cost for construction of the GCCS and long term care monitoring and maintenance of the system should be updated accordingly at that time. This comment is provided for

informational purposes only and does not necessarily require a response, other than acknowledgement of the comment.

Response 4: Comment noted. The County will provide an updated financial assurance costs as part of the operation permit renewal application for the facility due in June 15, 2013, unless a revised (not-inflation adjusted) cost estimate is submitted before the operation permit renewal due date.

APPENDIX A - ENGINEERING REPORT [Rule 62-701.320(7)(d), F.A.C.):

Comment 5. ***Table of Contents:*** *Please verify that the reference to Table 4 in the TOC is actually Table 1 in the Engineering Report and revise the TOC accordingly.*

Response 5: The table of contents has been revised to indicate the correct reference to Table 1. Refer to Attachment B for revised Engineering Report pages.

Comment 6. ***Section 3.1.1****: Please specifically identify where in the current GCCS design plans it is stated that "horizontal collectors typically have a horizontal zone if influence of approximately 75 feet ...".*

Response 6: A copy of the FDEP approved July 11, 2008 GCCS Design Plan pages submitted by SCS is included in Attachment C. Section 2.2.2, Horizontal Collectors, of the approved GCCS Design Plan states that " Horizontal collectors typically have a horizontal zone of influence of approximately 75 feet, which results in a lateral spacing of approximately 150 feet between collectors".

Comment 7. *Please provide supporting condensate generation calculations that demonstrate that the GCCS is capable of managing the additional condensate generated by the section 9 expansion of the system.*

Response 7: Section 3.5 of the Engineering Report has been revised to include information and calculations on gas condensate generated by the Section 9 LFGCCS expansion. Refer to Attachment B for revised Engineering Report pages.

Refer to Attachment D for condensate generation calculations. This calculation is to be included in Attachment A - Design Calculations of the Engineering Report.

APPENDIX B - SPECIFICATIONS [Rules 62-701.400(3), (7), and (8), F.A.C.):

Please revise the Specifications and/or other referenced application documents, as appropriate, to address the following comments and/or inconsistencies.

Comment 8. ***Section 02130 - Vertical Extraction Wells:***

a. Part 3.2.C.1.: This section states that the "Contractor shall fabricate the...PVC well screen in accordance with Contract Drawings and Specifications" while Part 2.2.B.3. of this specification section states "Slots will be factory installed. No slots to be

installed in the field". Please verify this apparent inconsistency and revise the appropriate parts of this specification section, if appropriate. Please also verify a similar inconsistency between Part 2.2.B.3. and Part 3.2.E.1. of Specification Section 02140.

Response 8.a: Parts 3.2.C.1 of Specification 02130 - Vertical Extraction Wells and 3.2.E.1 of Specification 02140 - Horizontal Collector Wells have been revised to indicate that slots and perforations for well screens will be factory installed. Refer to Attachment E for revised specification pages.

Comment 9. ***Section 02140 - Horizontal Collector Wells:***

a. Part 3.2.C.1.: Please verify the reference to the extension of the "casing to no more than 4 feet above the final cover surface elevation" in this part and revise, as appropriate.

Response 9.a: The reference to extend casing to no more than 4 feet above the final cover surface elevation in Part 3.2.C.1 of Specification 02140 - Horizontal Collector Wells has been revised to indicate that riser pipe casings at each wellhead shall extend no more than 4 feet above existing surface grade. Refer to Attachment E for revised specification pages.

b. Part 3.2.F.1.: Specification Section 2221 – Part 3.4.B. states, "At no time shall excavated waste be stockpiled next to the excavation." Please compare the narrative in this section to that in Section 2221-3.4.B. and revise these specification parts, as appropriate.

Response 9.b: Part 3.4.B of Specification 02221 - Trenching, Backfilling, and Compacting for LFG Piping has been revised to indicate that excavated refuse should remain in the close proximity of the location from which it was removed and removed during rain events. Refer to Attachment E for revised specification pages.

Comment 10. ***Section 02221 - Horizontal Collector Wells:***

a. Part 2.1.A.1.: Detail 4 on Sheet C-10 of the construction drawings shows a minimum of 3 feet of backfill above the top of the installed pipe. Please verify and revise this part or Detail 4, as appropriate.

Response 10.a: Part 2.1.A.2 of Specification 02221 - Trenching, Backfilling, and Compacting for LFG Piping has been revised. The reference to backfill at least 6 inches above the top of installed pipe does not apply to this section. Backfill material shall be installed as shown on Detail 4, Sheet C-10 above the bedding layer for header and lateral piping. Part 2.1.A.4. of Specification 02221, provides information for backfilling on Horizontal Collector Wells. Detail 4 on Sheet C-10 does not require modifications.

If you have any questions or concerns regarding the comment responses or attached documents, please contact me at (813) 262-2731.

Sincerely,
HDR Engineering, Inc.

Carlos A. Restrepo, P.E.
Florida PE No. 70208

cc: Patricia V. Berry, PUD
Megan J. Miller, PUD
Larry E. Ruiz, PUD
Ron Cope, EPC

ATTACHMENT A
PROOF OF PUBLICATION

State of Florida
Department of Environmental Protection
Notice of Application

The Department announces receipt of an application for a solid waste construction permit modification from the Hillsborough County Public Utilities Department to construct an expansion of the current gas collection and control system into the Section 9 Class I disposal area, subject to Department rules, at the Hillsborough County Southeast County Landfill located approximately 8.8 miles east of U.S. Highway 301 on County Road 672, Hillsborough County, Florida.

This application is being processed and is available for public inspection during normal business hours, 8:00 a.m. to 5:00 p.m., Monday through Friday, except legal holidays, at the Department of Environmental Protection, Southwest District Office, 13051 Telecom Parkway, Temple Terrace, Florida 33637 0926
#7129 4/12/2012

The Tampa Tribune

Published Daily

Tampa, Hillsborough County, Florida

State of Florida }
County of Hillsborough } SS.

Before the undersigned authority personally appeared C. Pugh, who on oath says that she is the Advertising Billing Analyst of The Tampa Tribune, a daily newspaper published at Tampa in Hillsborough County, Florida; that the attached copy of the

Legal Ads IN THE Tampa Tribune

In the matter of Legal Notices

was published in said newspaper in the issues of

04/12/2012

Affiant further says that the said The Tampa Tribune is a newspaper published at Tampa in said Hillsborough County, Florida, and that the said newspaper has heretofore been continuously published in said Hillsborough County, Florida, each day and has been entered as second class mail matter at the post office in Tampa, in said Hillsborough County, Florida for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that she has neither paid nor promised any person, this advertisement for publication in the said newspaper.

Sworn to and subscribed by me, this 12 day
of April, A.D. 2012

Personally Known ✓ or Produced Identification ___
Type of Identification Produced _____

Notary Public State of Florida
Charlotte A Offner
My Commission DD895783
Expires 06/03/2013

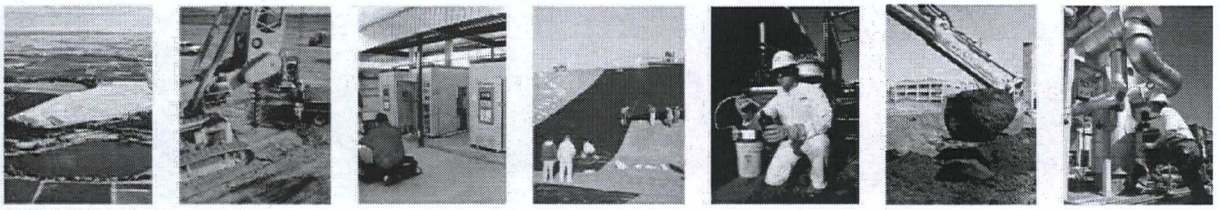
Order # 0003164007

1013564 -- HILLSBOROUGH COUNTY SOLI

ATTACHMENT B
REVISED LFGCCS EXPANSION AND ENGINEERING REPORT PAGES

ATTACHMENT C
GCCS DESIGN PLAN BY SCS

SCS ENGINEERS



Gas Collection and Control System (GCCS) Design Plan

Southeast County Landfill
Hillsborough County, Florida

Presented to:

Hillsborough County

Solid Waste Management Department

601 E. Kennedy Boulevard, 24th Floor
Tampa, Florida 33601

Presented by:

SCS ENGINEERS
4041 Park Oaks Blvd., Suite 100
Tampa, Florida 33610
(813) 621-0080
Fax: (813) 623-6757

July 11, 2008
File No. 09207055.00

Offices Nationwide
www.scsengineers.com

Environmental Consultants
and Contractors

4041 Park Oaks Boulevard
Suite 100
Tampa, FL 33610

813 621-0080
FAX 813 623-6757
www.scsengineers.com

SCS ENGINEERS

July 11, 2008
File No. 09207055.00

Mr. David Zell
Florida Department of Environmental Protection
Division of Air Resource Management - Southwest District
13051 N. Telecom Parkway
Temple Terrace, FL 33637-0926

Subject: Submittal of Gas Collection and Control System (GCCS) Design Plan
Southeast County Landfill, Hillsborough County, Florida
Facility ID No. 0570854

Dear David:

SCS Engineers (SCS) is submitting this landfill gas collection and control system (GCCS) design plan on behalf of the Hillsborough County Solid Waste Management Department.

As you know, per the requirements of 40 CFR Part 60, Subpart WWW, this report is to being submitted because the site-wide non-methane organic compound (NMOC) emissions for the site are above 50 megagrams (Mg) per year as reported in the Tier 2 Sampling report prepared by Jones Edmunds & Associates Inc. dated July 19, 2007.

This plan has been prepared by SCS in accordance with the requirements of the federal New Source Performance Standards (NSPS) for municipal solid waste landfills.

Please call us if you have any questions or need additional information.

Sincerely,

for

David H. Penoyer, P.E.
Project Manager
SCS ENGINEERS

Raymond J. Dever, P.E., BCEE
Vice President
SCS ENGINEERS

DHP/RJD:drc

cc: Patricia V. Berry, Hillsborough County

Enclosures

more appropriate. Typically, approximately the lower two-thirds of the well pipe will be perforated. However, perforations (or, in the case of "caisson" wells, the effective depth of perforations) will not be closer than 15 feet from the landfill surface unless the wells are being installed in an active area and additional refuse will be filled around the wells within a reasonable period of time. Perforations typically will be either 1/2-inch diameter holes spaced at 16 holes per foot, or 3/8-inch wide by 8-inch long slots spaced at approximately four slots per foot. However, alternative slot or perforation designs which provide comparable performance may be considered.

Note that the drawings included with this design plan are conceptual in nature. The exact locations of new wells will be determined during future design phases and may be subject to relocation due to site conditions or filling operations. The appropriateness of GCCS designs and expansions will be demonstrated through compliance with the surface emissions monitoring requirements of the NSPS.

2.2.2 Horizontal Collectors

The initial GCCS design incorporates horizontal collectors for the interior areas of the landfill in order to accommodate ongoing filling activities and keep LFG extraction components such as wellheads away from the active area.

Horizontal collectors typically have a horizontal zone of influence of approximately 75 feet, which results in a lateral spacing of approximately 150 feet between collectors. Horizontal collector lengths will vary depending on site conditions at the time of system expansion, but generally will be less than 1,000 feet long.

Horizontal collectors will be constructed to include the following features:

- Collector pipe will normally be 6- or 8-inch diameter solid or corrugated HDPE pipe with a smooth interior wall with sufficient strength to resist crushing force due to the overburden of the landfill.

- The perforated collector pipe will be installed in a trench filled with appropriate aggregate material such as chipped tires or rock. The permeable backfill material will be sized so as to not pose significant risk of clogging the pipe perforations.

- Perforated pipe will cease at least 100 feet inward from the end of the collector. The remaining length of collector will be solid-wall pipe. This will reduce the potential for air infiltration into the collectors.

- Perforations in the pipe will be sufficiently large to not cause excessive head loss detrimental to LFG collection. Typical perforations will be 1/2 inch diameter.

2.2.3 LCRS Tie-ins for LFG Collection

To provide supplemental LFG collection, the SWMD may install tie-ins to existing and future LCRS riser pipes. These collectors are intended to provide supplemental collection and therefore

performance of the system beyond that required by the Rule. Furthermore, because these devices are installed for purposes other than to meet the requirements of the rule, their design may preclude their ability to meet the stipulated operational requirements.

Additionally, these LCRS risers often operate with oxygen at atmospheric level (approximately 21 percent), which exceeds the 5 percent oxygen limit stipulated in the NSPS. Furthermore, LCRS pipes can be open to the atmosphere to accommodate system inspection and maintenance, or may be obstructed by liquid levels due to pump operations. Therefore, the SWMD is requesting that connections to the LCRS risers not be required to be operated and monitored in compliance with the NSPS.

5.13 HORIZONTAL COLLECTORS

5.13.1 Locations within 20 feet of Ground Surface

The SWMD may elect to install horizontal collectors in relatively close proximity to the interim ground surface prior to resuming waste disposal activities in an area of the landfill. This proactive construction will ensure that the infrastructure is in place to capture LFG from active landfill areas where vertical wells could be damaged and rendered useless. While this approach to LFG collection is desirable in some ways, the disadvantage is that oxygen exceedances are likely to occur until at least 20 feet of refuse is placed on top of the collectors. Horizontal collectors typically have a vertical zone of influence of at least 20 feet; therefore, if there is less than 20 feet of waste on top of them, ambient air can be pulled into the landfill.

To avoid air infiltration into horizontal collectors, the SWMD proposes that horizontal collectors not be subject to the pressure and oxygen operating requirements until a minimum of 20 feet of waste has been placed on top of the collector. Horizontal collectors without at least 20 feet of waste on top of them will not be considered part of the NSPS compliance network. The SWMD will monitor each installed collector on a monthly basis; however, non-negative pressure and oxygen equal to or greater than 5 percent will not be considered exceedances and remedial actions, including wellhead adjustments, will not be performed.

5.13.2 Select Installation of Horizontal Collectors

Due to the potential for air intrusion as describe above and the possibility of some horizontal collectors sitting idle for long periods of time while waste is being placed elsewhere on the site the SWMD may elect to selectively install horizontal collectors HC-01 through HC-13 as shown on Drawing 1 in Appendix A. Those collectors with vertical components will all be installed in the initial construction phase, while the SWMD may elect to delay the installation of some of the additional collectors until such time when surface emissions or wellfield monitoring indicates that additional gas collection in this area is necessary.

ATTACHMENT D
CONDENSATE GENERATION CALCULATIONS

Condensate Generation Calculations

Added May 2012

Job No.	Calc No.

Computation

Project	Southeast County Landfill	Computed	CAR
System	Section 9 LFGCCS Expansion	Date	4/6/2012
Task	Condensate Generation Calculation	Reviewed	CGK
		Date	4/6/2012

Purpose

Solve for the landfill gas condensate generation using vapor pressure and temperature equations.

Find

Description	Variable	Units
Condensate Generation	C_{gen}	gal/day

Given

Description	Value	Source
Total Gas flow (Qg)	2,467	[cfm], LandGEM
Temperature of Landfill at Wellhead (T1)	120	[°F]
Temperature of LFG Extraction piping (T2)	68	[°F]
Vacuum at Blower	60	(in H_2O)

Solution

Description	Value	Units	comments

Calculating the total possible water vapor extracted at the given flow rate and temperature of the landfill and subtracting the water vapor that remains in the gas flow given the lower temperature of the piping system. A Psychrometric chart for high temperatures (developed by Carrier Corporation) was used. Psychrometric chart referenced from "Air Pollution Control: A Design Approach" by C. David Cooper and F.C. Alley, 2nd edition 1994, pages 667-669.

Assumptions

Relative Humidity of Landfill	100	%
Relative Humidity of Gas in Piping	100	%

Concentration of water vapor at 120 °F and 100% rel. Humidity (C1)	0.082	lbs/lbs dry air
	0.082	kg/kg dry air
Concentration of water vapor at 90 °F and 100% rel. Humidity (C2)	0.031	lbs/lbs dry air
	0.031	kg/kg dry air

Net water vapor ($Cnet$) condensed in gas extraction piping (C1 - C2) 0.051 kg/kg dry air

Job No.	Calc No.

Computation

Project	Southeast County Landfill	Computed	CAR
System	Section 9 LFGCCS Expansion	Date	4/6/2012
Task	Condensate Generation Calculation	Reviewed	CGK
		Date	

Equations

Density of landfill gas using Ideal Gas Law; the weight of landfill gas is typically close to the weight of air.

PV = nRT or for this calculation P(MW) = ρRT

MW = Molecular Weight of landfill gas = 30.03 g/mole

MW of landfill gas value from LandGEM, assumes 50% methane

T = Temperature of Gas in Piping (T2) 293 K

R = Universal Gas Constant 0.0821 (L atm/mol K)

P = absolute pressure in Gas Piping 1.4 atm (1.4 atm = approximately 60" water column)

Conversion factor 1000.0 g-mole/kg-mole

Calculation

ρ = air density in gas piping 0.0016844 kg/L

Equations

$\rho Q_g C_{net} = C_{gen}$

ρ = 0.0016844 kg/L

Q_g = 2,467 cfm

C_{net} = 0.051 kg/kg dry air

Conversions: 1440 min/day

28.32 L / Cubic foot

Calculation

C_{gen} = 8,692 Kg per day (1 Kg ≈ 1 L)

Cgen = 2,296 Gal / day

Hillsborough County
Florida

Office of the County Administrator
Michael S. Merrill

January 9, 2012

Ms. Susan J. Pelz, P.E.
Solid Waste Section
Florida Department of Environmental Protection
Southwest District
13051 N. Telecom Pkwy
Temple Terrace, Florida 33637

RE: Southeast County Landfill – Leachate Data Quarterly Report

Dear Ms. Pelz:

In accordance with Specific Condition No. 8 of Permit No. 35435-014-SO, the Solid Waste Management Group (SWMG) is submitting the Quarterly Leachate Water Balance summary for the Southeast County Landfill for the quarter ending January 15, 2012.

The data is being submitted as separate monthly reports for October, November, and December 2011. The information includes the leachate level in Pump Station B (PS-B). PS-B was below the 24-inch normal operation level during this quarter.

Also attached is the top of the phosphatic clay liner elevation at the Pump Station B Sump.

Please advise should you have any questions concerning the attached submittal.

Sincerely,

Larry E. Ruiz
General Manager III
Solid Waste Management Group
Public Utilities Department

Attachment
xc: Rich Siemering, HDR
Ron Cope, EPC
Paul Schipfer, EPC

TABLE 3. LEACHATE BALANCE SUMMARY
SOUTHEAST COUNTY LANDFILL
HILLSBOROUGH COUNTY, FLORIDA
YEAR-2011

		Leachate Arriving at LTRF				Leachate Leaving LTRF			Effluent Disposal			Inflow / Outflow For LTRF		
Month	Rainfall (in.)	Leachate Hauled to LTRF from HHLF/TRLF (gal.)	Leachate from Section 9 Pumped to LTRF (gal.)	Leachate from Section 7-8 Pumped to LTRF (gal.)	Leachate from Phases I-VI Pumped to LTRF (gal.)	Total Leachate Hauled from LTRF (gal.)	Leachate Dust Control (Sprayed) (gal.)	Leachate Treated at LTRF (gal.)	Total Effluent Hauled (gal.)	Effluent Dust Control (Sprayed) (gal.)	Effluent Irrigation (gal.)	Total Inflow to LTRF (gal.)	Total Outflow from LTRF (gal.)	Change in Storage[3] (gal.)
January	3.65	0	24,351	39,496	739,603	894,048	42,104	0	0	0	0	803,450	936,152	-132,702
February	0.76	0	23,363	20,193	624,230	759,786	13,056	0	0	0	20,035	667,786	772,842	-105,056
March	7.69	0	23,662	20,672	684,412	755,806	12,009	0	0	0	27,337	728,746	767,815	-39,069
April	1.69	0	26,362	98,585	786,859	819,210	65,972	0	0	0	0	911,806	885,182	26,624
May	1.10	0	21,789	52,376	705,995	749,220	123,324	0	0	0	0	780,160	872,544	-92,385
June	8.04	0	19,669	61,037	662,771	532,937	117,426	0	0	0	0	743,477	650,363	93,114
July	11.76	0	19,712	200,692	1,034,289	1,201,511	8,710	0	0	0	108,000	1,254,693	1,210,221	44,472
August	7.61	0	24,227	144,022	1,131,091	1,088,781	0	0	0	0	0	1,299,340	1,088,781	210,559
September	3.84	0	21,972	100,605	1,008,537	1,135,216	87,364	0	0	0	0	1,131,114	1,222,580	-91,466
October	5.10	0	16,140	123,784	1,133,809	1,016,279	110,118	0	0	0	0	1,273,733	1,126,397	147,336
November	0.68	0	14,767	31,256	976,953	919,646	132,101	0	0	0	0	1,022,976	1,051,747	-28,771
December	0.30	0	18,806	71,178	932,543	900,650	74,529	0	0	0	0	1,022,527	975,179	47,348
YTD Total	52.22	0	254,819	963,896	10,421,092	10,773,090	786,713	0	0	0	155,372	11,639,807	11,559,803	80,004

Average to LTRF: 31,889 gal/day Average hauled from LTRF: 31,670 gal/day

Note:

1. If the bypass at the effluent pond is ever used to pump effluent back to the LTRF, this table must be modified.
2. Leachate from the Hillsborough Heights and Taylor Road landfills is being hauled to the Faulkenburg Road Wastewater Treatment Facility.
3. Change in storage represents total inflow to LTRF minus total outflow from LTRF.

ATTACHMENT E
REVISED SPECIFICATION PAGES

INSERTED INTO APP B

March 9, 2012

Ms. Susan J. Pelz, P.E.
Program Manager, Solid Waste
Department of Environmental Protection
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

Subject: Intermediate Modification Permit Application
Sections 7, 8, and 9 Landfill Gas Collection and Control System Expansion
Hillsborough County Southeast County Landfill
FDEP Permit No. 35435-014-SO/01
LFGCCS Permit No. 35435-016-SC/08
FDEP ID No. SWD/29/41193

Dear Ms. Pelz:

On behalf of Hillsborough County Public Utilities Department, Solid Waste Management Group, HDR Engineering, Inc. is pleased to submit an Intermediate Modification Permit Application to the current Landfill Gas Collection and Control System (LFGCCS) Construction Permit No. 35435-016-SC/08 for the construction of the Sections 7, 8, 9 LFGCCS expansion into Section 9 at the Southeast County Landfill. The Section 9 LFGCCS expansion will utilize most of the design components of the existing and approved LFGCCS. Enclosed are the permit application documents which include the following:

- Four sets of the Intermediate Modification Permit Application and supporting documentation. The permit application and other parts of the application have been signed and sealed (where required) by a Professional Engineer licensed in the state of Florida.

In addition, as required by Rule 62-701.320(4)(d), enclosed is a check for permit fees in the amount of $500.00 for an intermediate modification – all other solid waste facilities.

If you have any questions or need clarification regarding the enclosed information, please contact me at (904) 476-7345.

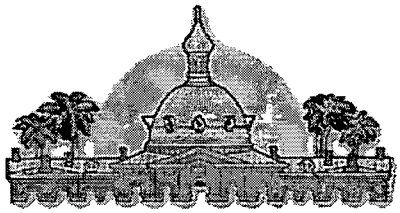
Sincerely,
HDR ENGINEERING, INC.

Cliff Koenig

Cliff Koenig, P.E.
Environmental Engineer

cc: Patricia V. Berry, PUD
Megan J. Miller, PUD
Larry E. Ruiz, PUD
Ron Cope, EPC

HDR Engineering, Inc.
5426 Bay Center Drive
Suite 400
Tampa, FL 33609-3444
Phone: (813) 282-2300
Fax: (813) 282-2430
www.hdrinc.com



Hillsborough County
Public Utilities Department
Solid Waste Management Group

Sections 7, 8, and 9 Landfill Gas Collection and Control System Expansion
Southeast County Landfill
Hillsborough County, Florida

March 2012
Revised May 2012

Prepared for:
Hillsborough County Public Utilities Department
Solid Waste Management Group
925 E. Twiggs Street
Tampa, Florida 33602

Prepared by:
HDR Engineering, Inc.
5426 Bay Center Drive, Suite 400
Tampa, Florida 33609-3444
(813) 282-2300

HDR Project No. 096-171445-002
Florida Certificate of Authorization No. 00004213

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FDEP APPLICATION FORM AND NARRATIVE

APPENDICES

Florida Department of
Environmental Protection
Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

DEP Form # 62-701.900(1), F.A.C.

Form Title: Application to Construct, Operate, Modify, or Close a Solid Waste Management Facility

Effective Date: January 6, 2010

Incorporated in Rule 62-701.330(3), F.A.C.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

APPLICATION TO CONSTRUCT, OPERATE, MODIFY OR CLOSE A SOLID WASTE MANAGEMENT FACILITY

APPLICATION INSTRUCTIONS AND FORMS

Northwest District
160 Governmental Center
Pensacola, FL 32502-5794
850-595-8360

Northeast District
7825 Baymeadows Way, Ste B200
Jacksonville, FL 32256-7590
904-807-3300

Central District
3319 Maguire Blvd., Ste 232
Orlando, FL 32803-3767
407-894-7555

Southwest District
13051 N. Telecom Pkwy
Temple Terrace, FL 33637
813-632-7600

South District
2295 Victoria Ave., Ste. 364
Fort Myers, FL 33901-3881
239-332-6975

Southeast District
400 North Congress Ave.
West Palm Beach, FL 33401
561-681-6600

INSTRUCTIONS TO APPLY FOR A SOLID WASTE MANAGEMENT FACILITY PERMIT

I. General

Solid Waste Management Facilities shall be permitted pursuant to Section 403.707, Florida Statutes,(FS) and in accordanc with Florida Administrative Code (FAC) Chapter 62-701. A minimum of four copies of the application shall be submitted to the Department's District Office having jurisdiction over the facility. The appropriate fee in accordance with Rule 62-701.315, FAC, shall be submitted with the application by check made payable to the Department of Environmental Protection (DEP).

Complete appropriate sections for the type of facility for which application is made. Entries shall be typed or printed in ink. All blanks shall be filled in or marked "not applicable" or "no substantial change". Information provided in support of the application shall be marked "submitted" and the location of this information in the application package indicated. The application shall include all information, drawings, and reports necessary to evaluate the facility. Information required to complete the application is listed on the attached pages of this form.

II. Application Parts Required for Construction and Operation Permits

A. Landfills and Ash Monofills - Submit Parts A through S
B. Asbestos Monofills - Submit Parts A,B,C,D,E,F,I,K,M, O through S
C. Industrial Solid Waste Disposal Facilities - Submit Parts A through S

NOTE: Portions of some Parts may not be applicable.

NOTE: For facilities that have been satisfactorily constructed in accordance with their construction permit, the information required for A, B and C type facilities does not have to be resubmitted for an operation permit if the information has not substantially changed during the construction period. The appropriate portion of the form should be marked "no substantial change".

III. Application Parts Required for Closure Permits

A. Landfills and Ash Monofills - Submit Parts A,B,L, N through S
B. Asbestos Monofills - Submit Parts A,B,M, O through S
C. Industrial Solid Waste Disposal Facilities - Submit Parts A,B, L through S

NOTE: Portions of some Parts may not be applicable.

IV. Permit Renewals

The above information shall be submitted at time of permit renewal in support of the new permit. However, facility information that was submitted to the Department to support the expiring permit, and which is still valid, does not need to be re-submitted for permit renewal. Portions of the application not re-submitted shall be marked "no substantial change" on the application form.

V. Application Codes

S	-	Submitted
LOCATION	-	Physical location of information in application
N/A	-	Not Applicable
N/C	-	No Substantial Change

VI. LISTING OF APPLICATION PARTS

PART A:	GENERAL INFORMATION
PART B:	DISPOSAL FACILITY GENERAL INFORMATION
PART C:	PROHIBITIONS
PART D:	SOLID WASTE MANAGEMENT FACILITY PERMIT REQUIREMENTS, GENERAL
PART E:	LANDFILL PERMIT REQUIREMENTS
PART F:	GENERAL CRITERIA FOR LANDFILLS
PART G:	LANDFILL CONSTRUCTION REQUIREMENTS
PART H:	HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS
PART I:	GEOTECHNICAL INVESTIGATION REQUIREMENTS
PART J:	VERTICAL EXPANSION OF LANDFILLS
PART K:	LANDFILL OPERATION REQUIREMENTS
PART L:	WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS
PART M:	SPECIAL WASTE HANDLING REQUIREMENTS
PART N:	GAS MANAGEMENT SYSTEM REQUIREMENTS
PART O:	LANDFILL CLOSURE REQUIREMENTS
PART P:	OTHER CLOSURE PROCEDURES
PART Q:	LONG-TERM CARE
PART R:	FINANCIAL ASSURANCE
PART S:	CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
APPLICATION FOR A PERMIT TO CONSTRUCT, OPERATE, MODIFY OR CLOSE A SOLID WASTE MANAGEMENT FACILITY

Please Type or Print

PART A. GENERAL INFORMATION

1. Type of disposal facility (check all that apply:

☐ Class I Landfill
☐ Class III Landfill
☐ Industrial Solid Waste
☒ Other Describe:
Expansion of the existing Landfill Gas Collection and Control System at the Capacity Expansion Area (Section 7,8) into Section 9 at the Southeast County Landfill.

☐ Ash Monofill
☐ Asbestos Monofill

NOTE: Waste Processing Facilities should apply on Form 62-701.900(4), FAC;
Land Clearing Disposal Facilities should notify on Form 62-701.900(3), FAC;
Compost Facilities should apply on Form 62-701.900(10), FAC; and
C&D Disposal Facilities should apply on Form 62-701.900(6), FAC

2. Type of application:
☒ Construction
☐ Operation
☐ Construction/Operation
☐ Closure
☐ Long-term Care Only

3. Classification of application:
☐ New
☐ Renewal
☐ Substantial Modification
☒ Intermediate Modification **(Section 9 LFGCCS Expansion)**
☐ Minor Modification

4. Facility Name: Southeast County Landfill (Permit No. 35435-016-SC/08)

5. DEP ID number: SWD/29/41193 County: Hillsborough

6. Facility location (main entrance):
8.8 miles east of US Highway 301 on CR 672

7. Location coordinates:

Section: 13,14,15,18,19,22,23,24 Township: 31 S Range: 21 E, 22 E

Latitude: 27° 46' 26" Longitude: 82° 11' 01" **(Phases I-VI)**

Latitude: 27° 46' 37" Longitude: 82° 10' 38" **(Sections 7, 8 and 9)**

Datum: WGS 84 Coordinate Method: Electronic Mapping, Internet GIS

Collected by: HDR Company/Affiliation: HDR

8. Applicant name (operating authority): Hillsborough County Public Utilities Department

Mailing address: 925 East Twiggs Street | Tampa | FL | 33602
Street or P.O. Box | City | State | Zip

Contact person: Ms. Patricia V. Berry Telephone: (813) 272-5977 ext 43338

Title: Solid Waste Management Group Manager

berryp@hillsboroughcounty.org
E-Mail address (if available)

9. Authorized agent/Consultant: HDR Engineering, Inc

Mailing address: 200 W. Forsyth St., Suite 800 | Jacksonville | FL | 32202
Street or P.O. Box | City | State | Zip

Contact Person: Cliff Koenig, P.E. Telephone: (904) 476-7345

Title: Environmental Engineer

cliff.koenig@hdrinc.com
E-Mail address (if available)

10. Landowner (if different than applicant): Same as Applicant

Mailing address:
Street or P.O. Box | City | State | Zip

Contact person: Telephone:

E-Mail address (if available)

11. Cities, towns and areas to be served:
City of Tampa, Temple Terrace, and unincorporated Hillsborough County

12. Population to be served:

Current: 1,138,150 Five-Year Projection 1,247,040

13. Date site will be ready to be inspected for completion: N/A

14. Expected life of the facility: 25.9 years* **(Phases I-VI)**, 10.8 years* **(Section 7, 8, and 9)** *** Per Annual Capacity Update Submitted to FDEP on 9/1/2011**

15: Estimated costs:

Total Construction: $ $750,000 **(Sequence 1 only)** Closing Costs: $ N/A

16. Anticipated construction starting and completion dates:

From: January 2013 To: April 2013

Expected volume or weight of waste to be received:

Yds^3/day 2,200 (3,000 max) tons/day gallons/day

PART B. DISPOSAL FACILITY GENERAL INFORMATION

1. Provide brief description of disposal facility design and operations planned under this application:

This Intermediate Modification Application presents information supporting the application for the construction of the expansion of the existing Landfill Gas Collection and Control System (LFGCCS) at the Capacity Expansion Area (Sections 7, 8) into Section 9 at the Southeast County Landfill facility in Hillsborough County, Florida. The landfill gas will continue to be collected from the landfill and sent to the existing candlestick flare for destruction.

2. Facility site supervisor: Mr. Larry E. Ruiz, AIA

Title: General Manager Telephone: (813) 671-7707

ruizle@hillsboroughcounty.org
E-Mail address (if applicable)

3. Disposal area: Total 162.4 acres; Used 162.4 acres; Available 162.4 acres. **(Phases I-VI)**

Disposal area: Total 34.5 acres; Used 34.5 acres; Available 34.5 acres. **(Sections 7, 8, and9)**

4. Weighing scales used: ☒ Yes ☐ No

5. Security to prevent unauthorized use: ☒ Yes ☐ No

6. Charge for waste received: _____ $/yds3 $30.60 (yard waste) to $124.20 (mixed load) $/ton

7. Surrounding land use, zoning:

☒ Residential
☒ Agricultural
☐ Commercial
☐ Industrial
☐ None
☐ Other Describe

8. Types of waste received:

☒ Household
☒ Commercial
☒ Incinerator/WTE ash
☐ Treated Biomedical
☒ Water treatment sludge
☒ C & D debris
☒ Shredded/cut tires
☐ Yard trash
☐ Septic tank
☒ Industrial

☒ Air treatment sludge
☒ Agricultural
☒ Asbestos
☒ Industrial sludge
☐ Domestic sludge
☐ Other Describe

9. Salvaging permitted: ☐Yes ☒ No

10. Attendant: ☒Yes ☐ No Trained operator: ☒Yes ☐ No

11. Trained Spotters: ☒Yes ☐ No Number of spotters used: 1 minimum

12. Site located in: ☐Floodplain ☐ Wetlands ☒ Other:

Upland, closed phosphate mine

13. Days of operation: Monday - Saturday

1. Hours of operation: 7:30 AM – 5:30 PM

15: Days working face covered: Monday - Saturday

16: Elevation of water table: 123.72 SHGWT ft. Datum used: NGVD 1929

17. Number of monitoring wells: 14 (Phases I-VI), 8 (Sections 7 and 8), 3 (Section 9)

18. Number of surface monitoring points: 5 (Phases I-VI), 6 (sections 7, 8, and 9)

19. Gas controls used: ☒Yes ☐ No Type controls: ☒Active ☐ Passive

Gas flaring: ☒Yes ☐ No Gas recovery: ☐Yes ☒ No

20. Landfill unit liner type:

☐ Natural soils
☐ Single clay liner
☐ Single geomembrane
☐ Single composite
☐ Slurry wall
☒ Double geomembrane **(Section 7, 8, and 9 only)**
☐ Geomembrane & composite
☒ Double composite **(Section 7, 8, and 9 only)**
☐ None
☒ Other Describe:

Phosphatic Clay, 4-18 feet in thickness (Phases I-VI only)

21. Leachate collection method:

- ☒ Collection pipes
- ☒ Geonets **(Section 7, 8, and 9 only)**
- ☐ Well points
- ☐ Perimeter ditch
- ☒ Other Describe:

Pump Station and Chip Tire Layer

- ☒ Sand layer
- ☒ Gravel layer
- ☒ Interceptor trench
- ☐ None

22. Leachate storage method:

- ☒ Tanks
- ☐ Other Describe:
- ☐ Surface impoundments

23. Leachate treatment method:

- ☐ Oxidation
- ☐ Secondary
- ☐ Advanced
- ☒ Other

Biological Treatment System On-Site

- ☐ Chemical treatment
- ☐ Settling
- ☐ None

24. Leachate disposal method:

- ☐ Recirculated
- ☒ Transported to WWTP
- ☐ Injection well
- ☒ Evaporation
- ☒ Other

Storage pond evaporation or spray irrigation after treatment at the on-site treatment facility

- ☐ Pumped to WWTP
- ☐ Discharged to surface water/wetland
- ☐ Percolation ponds
- ☐ Spray Irrigation

25. For leachate discharged to surface waters:

Name and Class of receiving water:
Leachate is not discharged to surface waters

26. Stormwater:

Collected: ☒ Yes ☐ No

Type of treatment:
Detention / Filtration

Name and Class of receiving water:
A tributary of Long Flat Creek

27. Environmental Resources Permit (ERP) number or status:

Permit No.: 29-0270881-007

PART C. PROHIBITIONS (62-701.300, FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Provide documentation that each of the siting criteria will be satisfied for the facility; (62-701.300(2), FAC)
☐	_____	☐	☒	2. If the facility qualifies for any of the exemptions contained in Rules 62-701.300(12) through (18), FAC, then document this qualification.
☐	_____	☐	☒	3. Provide documentation that the facility will be in compliance with the burning restrictions; (62-701.300(3), FAC)
☐	_____	☐	☒	4. Provide documentation that the facility will be in compliance with the hazardous waste restrictions; (62-701.300(4), FAC)
☐	_____	☐	☒	5. Provide documentation that the facility will be in compliance with the PCB disposal restrictions; (62-701.300(5), FAC)
☐	_____	☐	☒	6. Provide documentation that the facility will be in compliance with the biomedical waste restrictions; (62-701.300(6), FAC)
☐	_____	☐	☒	7. Provide documentation that the facility will be in compliance with the Class I surface water restrictions; (62-701.300(7), FAC)
☐	_____	☐	☒	8. Provide documentation that the facility will be in compliance with the special waste for landfills restrictions;(62-701.300(8), FAC)
☐	_____	☐	☒	9. Provide documentation that the facility will be in compliance with the liquid restrictions; (62-701.300(10), FAC)
☐	_____	☐	☒	10. Provide documentation that the facility will be in compliance with the used oil and oily waste restrictions; (62-701.300(11), FAC)

PART D. SOLID WASTE MANAGEMENT FACILITY PERMIT REQUIREMENTS, GENERAL (62-701.320, FAC)

S	LOCATION	N/A	N/C	
☒	Part D.1	☐	☐	1. Four copies, at minimum, of the completed application form, all supporting data and reports; (62-701.320(5)(a), FAC)

S	LOCATION	N/A	N/C	PART D CONTINUED
☑	Part D.2	☐	☐	2. Engineering and/or professional certification (signature, date and seal) provided on the applications and all engineering plans, reports and supporting information for the application; (62-701.320(6),FAC)
☒	Part D.3	☐	☐	3. A letter of transmittal to the Department; (62-701.320(7)(a),FAC)
☒	Part D.4	☐	☐	4. A completed application form dated and signed by the applicant; (62-701.320(7)(b),FAC)
☒	Part D.5	☐	☐	5. Permit fee specified in Rule 62-701.315, FAC in check or money order, payable to the Department; (62-701.320(7)(c),FAC)
☒	Part D.6	☐	☐	6. An engineering report addressing the requirements of this rule and with the following format: a cover sheet, text printed on 8 1/2 inch by 11 inch consecutively numbered pages, a table of contents or index, the body of the report and all appendices including an operation plan, contingency plan, illustrative charts and graphs, records or logs of tests and investigations, engineering calculations; (62-701.320(7)(d),FAC)
☒	Part D.7	☐	☐	7. Operation Plan and Closure Plan; (62-701.320(7)(e)1,FAC)
☐		☐	☒	8. Contingency Plan; (62-701.320(7)(e)2,FAC)
☑	Part D.9	☐	☐	9. Plans or drawings for the solid waste management facilities in appropriate format (including sheet size restrictions, cover sheet, legends, north arrow, horizontal and vertical scales, elevations referenced to NGVD 1929) showing; (62-701.320(7)(f),FAC)
☐		☐	☒	a. A regional map or plan with the project location in relation to major roadways and population centers;
☐		☐	☒	b. A vicinity map or aerial photograph no more than 1 year old showing the facility site and relevant surface features located within 1000 feet of the facility;
☐		☐	☒	c. A site plan showing all property boundaries certified by a Florida Licensed Professional Surveyor and Mapper; and
☐		☐	☒	d. Other necessary details to support the engineering report, including referencing elevations to a consistent, nationally recognized datum and identifying the method used for collecting latitude and longitude data.

S	LOCATION	N/A	N/C	PART D CONTINUED
☐		☐	☒	10. Documentation that the applicant either owns the property or has legal authority from the property owner to use the site; (62-701.320(7)(g),FAC)
☐		☐	☒	11. For facilities owned or operated by a county, provide a description of how, if any, the facilities covered in this application will contribute to the county's achievement of the waste reduction and recycling goals contained in Section 403.706,FS; (62-701.320(7)(h),FAC)
☐		☐	☒	12. Provide a history and description of any enforcement actions taken by the Department against the applicant for violations of applicable statutes, rules, orders or permit conditions relating to the operation of any solid waste management facility in this state; (62-701.320(7)(i),FAC)
☒	Part D.13	☐	☐	13. Proof of publication in a newspaper of general circulation of notice of application for a permit to construct or substantially modify a solid waste management facility; (62-702.320(8),FAC)
☐		☐	☒	14. Provide a description of how the requirements for airport safety will be achieved including proof of required notices if applicable. If exempt, explain how the exemption applies; (62-701.320(13),FAC)
☐		☐	☒	15. Explain how the operator and spotter training requirements and special criteria will be satisfied for the facility; (62-701.320(15), FAC)

PART E. LANDFILL PERMIT REQUIREMENTS (62-701.330, FAC)

S	LOCATION	N/A	N/C	
☐		☐	☒	1. Regional map or aerial photograph no more than 5 years old showing all airports that are located within five miles of the proposed landfill; (62-701.330(3)(a),FAC)
☒	Part E.2	☐	☐	2. Plot plan with a scale not greater than 200 feet to the inch showing; (62-701.330(3)(b),FAC)
☐		☐	☒	a. Dimensions;
☐		☐	☒	b. Locations of proposed and existing water quality monitoring wells;
☐		☐	☒	c. Locations of soil borings;

S	LOCATION	N/A	N/C	PART E CONTINUED
☐		☐	☒	d. Proposed plan of trenching or disposal areas;
☐		☐	☒	e. Cross sections showing original elevations and proposed final contours which shall be included either on the plot plan or on separate sheets.
☐		☐	☒	f. Any previously filled waste disposal areas;
☐		☐	☒	g. Fencing or other measures to restrict access.
☒	Part E.3	☐	☐	3. Topographic maps with a scale not greater than 200 feet to the inch with 5-foot contour intervals showing; (62-701.330(3)(c),FAC)
☐		☐	☒	a. Proposed fill areas;
☐		☐	☒	b. Borrow areas;
☐		☐	☒	c. Access roads;
☐		☐	☒	d. Grades required for proper drainage;
☐		☐	☒	e. Cross sections of lifts;
☐		☐	☒	f. Special drainage devices if necessary;
☐		☐	☒	g. Fencing
☐		☐	☒	h. Equipment facilities;
☒	Part E.4	☐	☐	4. A report on the landfill describing the following; (62-701.330(3)(d),FAC)
☐		☐	☒	a. The current and projected population and area to be served by the proposed site;
☐		☐	☒	b. The anticipated type, annual quantity, and source of solid waste, expressed in tons;
☒	Part E.4.c	☐	☐	c. Planned active life of the facility, the final design height of the facility and the maximum height of the facility during its operation;

S	LOCATION	N/A	N/C	PART E CONTINUED
☐	_____	☐	☒	d. The source and type of cover material used for the landfill.
☐	_____	☐	☒	5. Provide evidence that an approved laboratory shall conduct water quality monitoring for the facility in accordance with Chapter 62-160, FAC;; (62-701.330(3)(g),FAC)
☐	_____	☐	☒	6. Provide a statement of how the applicant will demonstrate financial responsibility for the closing and long-term care of the landfill; (62-701.330(3)(h), FAC)

PART F. GENERAL CRITERIA FOR LANDFILLS (62-701.340, FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Describe (and show on a Federal Insurance Administration flood map, if available) how the landfill or solid waste disposal unit shall not be located in the 100-year floodplain where it will restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain unless compensating storage is provided, or result in a washout of solid waste; (62-701.340(3)(b),FAC)
☐	_____	☐	☒	2. Describe how the minimum horizontal separation between waste deposits in the landfill and the landfill property boundary shall be 100 feet, measured from the toe of the proposed final cover slope; (62-701.340(3)(c),FAC)

PART G. LANDFILL CONSTRUCTION REQUIREMENTS (62-701.400, FAC)

S	LOCATION	N/A	N/C	
☒	Part G.1	☐	☐	1. Describe how the landfill shall be designed so that solid waste disposal units will be constructed and closed at planned intervals throughout the design period of the landfill and shall be designed to achieve a minimum factor of safety of 1.5 using peak strength values to prevent failures of sideslopes and deep-seated failures; (62-701.400(2),FAC)
☐	_____	☐	☒	2. Landfill liner requirements; (62-701.400(3),FAC)
☐	_____	☐	☒	a. General construction requirements; (62-701.400(3)(a), FAC):;
☐	_____	☐	☒	(1) Provide test information and documentation to ensure the liner will be constructed of materials that have appropriate physical, chemical, and mechanical properties to prevent failure;

S	LOCATION	N/A	N/C	PART G CONTINUED
☐	_____	☐	☒	(2) Document foundation is adequate to prevent liner failure;
☐	_____	☐	☒	(3) Constructed so bottom liner will not be adversely impacted by fluctuations of the ground water;
☐	_____	☐	☒	(4) Designed to resist hydrostatic uplift if bottom liner located below seasonal high ground water table;
☐	_____	☐	☒	(5) Installed to cover all surrounding earth which could come into contact with the waste or leachate.
☐	_____	☐	☒	b. Composite liners; (62-701.400(3)(b), FAC
☐	_____	☐	☒	(1) Upper geomembrane thickness and properties;
☐	_____	☐	☒	(2) Design leachate head for primary LCRS including leachate recirculation if appropriate;
☐	_____	☐	☒	(3) Design thickness in accordance with Table A and number of lifts planned for lower soil component.
☐	_____	☐	☒	c. Double liners; (62-701.400(3)(c), FAC)
☐	_____	☐	☒	(1) Upper and lower geomembrane thicknesses and properties;
☐	_____	☐	☒	(2) Design leachate head for primary LCRS to limit the head to one foot above the liner;
☐	_____	☐	☒	(3) Lower geomembrane sub-base design;
☐	_____	☐	☒	(4) Leak detection and secondary leachate collection system minimum design criteria ($k \geq 10$ cm/sec, head on lower liner ≤ 1 inch, head not to exceed thickness of drainage layer);
☐	_____	☐	☒	d. Standards for geosynthetic components; (62-701.400(3)(d), FAC)

S	LOCATION	N/A	N/C	PART G CONTINUED
☐	_____	☐	☒	(1) Factory and field seam test methods to ensure all geomembrane seams achieve the minimum specifications;
☐	_____	☐	☒	(2) Geomembranes to be used shall pass a continuous spark test by the manufacturer;
☐	_____	☐	☒	(3) Design of 24-inch thick protective layer above upper geomembrane liner;
☐	_____	☐	☒	(4) Describe operational plans to protect the liner and leachate collection system when placing the first layer of waste above 24-inch-thick protective layer.
☐	_____	☐	☒	(5) HDPE geomembranes, if used, meet the specifications in GRI GM13 and LLDPE geomembranes, if used, meet the specifications in GRI GM-17.
☐	_____	☐	☒	(6) PVC geomembranes, if used, meet the specifications in PGI 1104;
☐	_____	☐	☒	(7) Interface shear strength testing results of the actual components which will be used in the liner system;
☐	_____	☐	☒	(8) Transmissivity testing results of geonets if they are used in the liner system;
☐	_____	☐	☒	(9) Hydraulic conductivity testing results of geosynthetic clay liners if they are used in the liner system;
☐	_____	☐	☒	e. Geosynthetic specification requirements; (62-701.400(3)(e),FAC)
☐	_____	☐	☒	(1) Definition and qualifications of the designer, manufacturer, installer, QA consultant and laboratory, and QA program;
☐	_____	☐	☒	(2) Material specifications for geomembranes, geocomposites, geotextiles, geogrids, and geonets;

S	LOCATION	N/A	N/C	PART G CONTINUED
☐	_____	☐	☒	(3) Manufacturing and fabrication specifications including geomembrane raw material and roll QA, fabricationpersonnel qualifications, seaming equipment and procedures, overlaps, trial seams, destructive and nondestructive seam testing, seam testing location, frequency, procedure, sample size and geomembranerepairs;
☐	_____	☐	☒	(4) Geomembrane installation specifications including earthwork, conformance testing, geomembrane placement, installation personnel qualifications, field seaming and testing, overlapping and repairs, materials in contact with geomembrane and procedures for lining system acceptance;
☐	_____	☐	☒	(5) Geotextile and geogrid specifications including handling and placement, conformance testing, seams and overlaps, repair, and placement of soil materials and any overlying materials;
☐	_____	☐	☒	(6) Geonet and geocomposite specifications including handling and placement, conformance testing, stacking and joining, repair, and placement of soil materials and any overlying materials;
☐	_____	☐	☒	(7) Geosynthetic clay liner specifications including handling and placement, conformance testing, seams and overlaps, repair, and placement of soil material and any overlying materials;
☐	_____	☐	☒	f. Standards for soil liner components (62-710.400(3)(f),FAC):
☐	_____	☐	☒	(1) Description of construction procedures including overexcavation and backfilling to preclude structural inconsistencies and procedures for placing and compacting soil component in layers;
☐	_____	☐	☒	(2) Demonstration of compatibility of the soil component with actual or simulated leachate in accordance with EPA Test Method 9100 or an equivalent test method;
☐	_____	☐	☒	(3) Procedures for testing in-situ soils to demonstrate they meet the specifications for soil liners;

S	LOCATION	N/A	N/C		PART G CONTINUED
☐	_____	☐	☒	(4)	Specifications for soil component of liner including at a minimum:
☐	_____	☐	☒	(a)	Allowable particle size distribution, Atterberg limits, shrinkage limit;
☐	_____	☐	☒	(b)	Placement moisture and dry density criteria;
☐	_____	☐	☒	(c)	Maximum laboratory-determined saturated hydraulic conductivity using simulated leachate;
☐	_____	☐	☒	(d)	Minimum thickness of soil liner;
☐	_____	☐	☒	(e)	Lift thickness;
☐	_____	☐	☒	(f)	Surface preparation (scarification);
☐	_____	☐	☒	(g)	Type and percentage of clay mineral within the soil component;
☐	_____	☐	☒	(5)	Procedures for constructing and using a field test section to document the desired saturated hydraulic conductivity and thickness can be achieved in the field.
☐	_____	☐	☒		g. If a Class III landfill is to be constructed with a bottom liner system, provide a description of how the minimum requirements for the liner will be achieved.
☒	Part G.3	☐	☐	3.	Leachate collection and removal system (LCRS); (62-701.400(4),FAC)
☐	_____	☐	☒		a. The primary and secondary LCRS requirements; (62-701.400(4)(a),FAC)
☐	_____	☐	☒	(1)	Constructed of materials chemically resistant to the waste and leachate;
☐	_____	☐	☒	(2)	Have sufficient mechanical properties to prevent collapse under pressure;

S	LOCATION	N/A	N/C	PART G CONTINUED
☐	_____	☐	☒	(3) Have granular material or synthetic geotextile to prevent clogging;
☐	_____	☐	☒	(4) Have method for testing and cleaning clogged pipes or contingent designs for rerouting leachate around failed areas;
☐	_____	☐	☒	b. Other LCRS requirements; (62-701.400(4)(b) and (c),FAC)
☐	_____	☐	☒	(1) Bottom 12 inches having hydraulic conductivity ≥ 1 x 10-3 cm/sec;
☐	_____	☐	☒	(2) Total thickness of 24 inches of material chemically resistant to the waste and leachate;
☐	_____	☐	☒	(3) Bottom slope design to accommodate for predicted settlement and still meet minimum slope requirements;
☐	_____	☐	☒	(4) Demonstration that synthetic drainage material, if used, is equivalent or better than granular material in chemical compatibility, flow under load and protection of geomembrane liner.
☐	_____	☐	☒	4. Leachate recirculation; (62-701.400(5),FAC)
☐	_____	☐	☒	a. Describe general procedures for recirculating leachate;
☐	_____	☐	☒	b. Describe procedures for controlling leachate runoff and minimizing mixing of leachate runoff with storm water;
☐	_____	☐	☒	c. Describe procedures for preventing perched water conditions and gas buildup;
☐	_____	☐	☒	d. Describe alternate methods for leachate management when it cannot be recirculated due to weather or runoff conditions, surface seeps, wind-blown spray, or elevated levels of leachate head on the liner;
☐	_____	☐	☒	e. Describe methods of gas management in accordance with Rule 62-701.530, FAC;

S	LOCATION	N/A	N/C	PART G CONTINUED
☐	_____	☐	☒	f. If leachate irrigation is proposed, describe treatment methods and standards for leachate treatment prior to irrigation over final cover and provide documentation that irrigation does not contribute significantly to leachate generation.
☐	_____	☐	☒	5.Leachate storage tanks and leachate surface impoundments; (62-701.400(6),FAC)
☐	_____	☐	☒	a. Surface impoundment requirements; (62-701.400(6)(b),FAC)
☐	_____	☐	☒	(1) Documentation that the design of the bottom liner will not be adversely impacted by fluctuations of the ground water;
☐	_____	☐	☒	(2) Designed in segments to allow for inspection and repair as needed without interruption of service;
☐	_____	☐	☒	(3) General design requirements;
☐	_____	☐	☒	(a) Double liner system consisting of an upper and lower 60-mil minimum thickness geomembrane;
☐	_____	☐	☒	(b) Leak detection and collection system with hydraulic conductivity ≥ 1 cm/sec;
☐	_____	☐	☒	(c) Lower geomembrane placed on subbase ≥ 6 inches thick with k ≤ 1 10 -5 cm/sec or on an approved geosynthetic clay liner with k ≤ 1 10 -7 cm/sec;
☐	_____	☐	☒	(d) Design calculation to predict potential leakage through the upper liner;
☐	_____	☐	☒	(e) Daily inspection requirements and notification and corrective action requirements if leakage ratesexceed that predicted by design calculations;
☐	_____	☐	☒	(4) Description of procedures to prevent uplift, if applicable;
☐	_____	☐	☒	(5) Design calculations to demonstrate minimum two feet of freeboard will be maintained;
☐	_____	☐	☒	(6) Procedures for controlling vectors and off-site odors.

S	LOCATION	N/A	N/C	PART G CONTINUED
☐	_____	☐	☒	b. Above-ground leachate storage tanks; (62-701.400(6)(c),FAC)
☐	_____	☐	☒	(1) Describe tank materials of construction and ensure foundation is sufficient to support tank;
☐	_____	☐	☒	(2) Describe procedures for cathodic protection if needed for the tank;
☐	_____	☐	☒	(3) Describe exterior painting and interior lining of the tank to protect it from the weather and the leachate stored;
☐	_____	☐	☒	(4) Describe secondary containment design to ensure adequate capacity will be provided and compatibility of materials of construction;
☐	_____	☐	☒	(5) Describe design to remove and dispose of stormwater from the secondary containment system;
☐	_____	☐	☒	(6) Describe an overfill prevention system such as level sensors, gauges, alarms and shutoff controls to prevent overfilling;
☐	_____	☐	☒	7) Inspections, corrective action and reporting requirements;
☐	_____	☐	☒	(a) Overfill prevention system weekly;
☐	_____	☐	☒	(b) Exposed tank exteriors weekly;
☐	_____	☐	☒	(c) Tank interiors when tank is drained or at least every three years;
☐	_____	☐	☒	(d) Procedures for immediate corrective action if failures detected;
☐	_____	☐	☒	(e) Inspection reports available for department review.
☐	_____	☒	☐	c. Underground leachate storage tanks; (62-701.400(6)(d),FAC)

S	LOCATION	N/A	N/C	PART G CONTINUED
☐	_____	☒	☐	(1) Describe materials of construction;
☐	_____	☒	☐	(2) A double-walled tank design system to be used with the following requirements;
☐	_____	☒	☐	(a) Interstitial space monitoring at least weekly;
☐	_____	☒	☐	(b) Corrosion protection provided for primary tank interior and external surface of outer shell;
☐	_____	☒	☐	(c) Interior tank coatings compatible with stored leachate;
☐	_____	☒	☐	(d) Cathodic protection inspected weekly and repaired as needed;
☐	_____	☒	☐	(3) Describe an overfill prevention system such as level sensors, gauges, alarms and shutoff controls to prevent overfilling and provide for weekly inspections;
☐	_____	☒	☐	(4) Inspection reports available for department review.
☐	_____	☐	☒	d.Schedule provided for routine maintenance of LCRS; (62-701.400(6)(e),FAC)
☐	_____	☐	☒	6.Liner systems construction quality assurance (CQA); (62-701.400(7),FAC)
☐	_____	☐	☒	a. Provide CQA Plan including:
☐	_____	☐	☒	(1) Specifications and construction requirements for liner system;
☐	_____	☐	☒	(2) Detailed description of quality control testing procedures and frequencies;
☐	_____	☐	☒	(3) Identification of supervising professional engineer;
☐	_____	☐	☒	(4) Identify responsibility and authority of all appropriate organizations and key personnel involved in the construction project;

S	LOCATION	N/A	N/C	PART G CONTINUED
☐	_____	☐	☒	(5) State qualifications of CQA professional engineer and support personnel;
☐	_____	☐	☒	(6) Description of CQA reporting forms and documents;
☐	_____	☐	☒	b. An independent laboratory experienced in the testing of geosynthetics to perform required testing;
☐	_____	☐	☒	7. Soil Liner CQA (62-701.400(8)FAC)
☐	_____	☐	☒	a. Documentation that an adequate borrow source has been located with test results or description of the field exploration and laboratory testing program to define a suitable borrow source;
☐	_____	☐	☒	b. Description of field test section construction and test methods to be implemented prior to liner installation;
☐	_____	☐	☒	c. Description of field test methods including rejection criteria and corrective measures to insure proper liner installation.
☐	_____	☐	☒	8. Surface water management systems; (62-701.400(9),FAC)
☐	_____	☐	☒	a. Provide a copy of a Department permit for stormwater control or documentation that no such permit is required;
☐	_____	☐	☒	b. Design of surface water management system to isolate surface water from waste filled areas and to control stormwater run-off;
☐	_____	☐	☒	c. Details of stormwater control design including retention ponds, detention ponds, and drainage ways;
☒	Part G.9	☐	☐	9. Gas control systems; (62-701.400(10),FAC)
☐	_____	☐	☒	a. Provide documentation that if the landfill is receiving degradable wastes, it will have a gas control system complying with the requirements of Rule 62-701.530, FAC;
☐	_____	☒	☐	10. For landfills designed in ground water, provide documentation that the landfill will provide a degree of protection equivalent to landfills designed with bottom liners not in contact with ground water; (62-701.400(11),FAC)

PART H. HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS (62-701.410(1), FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Submit a hydrogeological investigation and site report including at least the following information:
☐	_____	☐	☒	a. Regional and site specific geology and hydrogeology;
☐	_____	☐	☒	b. Direction and rate of ground water and surface water flow including seasonal variations;
☐	_____	☐	☒	c. Background quality of ground water and surface water;
☐	_____	☐	☒	d. Any on-site hydraulic connections between aquifers;
☐	_____	☐	☒	e. Site stratigraphy and aquifer characteristics for confining layers, semi-confining layers, and all aquifers below the landfill site that may be affected by the landfill;
☐	_____	☐	☒	f. Description of topography, soil types and surface water drainage systems;
☐	_____	☐	☒	g. Inventory of all public and private water wells within a one-mile radius of the landfill including, where available, well top of casing and bottom elevations, name of owner, age and usage of each well, stratigraphic unit screened, well construction technique and static water level;
☐	_____	☐	☒	h. Identify and locate any existing contaminated areas on the site;
☐	_____	☐	☒	i. Include a map showing the locations of all potable wells within 500 feet of the waste storage and disposal areas;
☐	_____	☐	☒	2. Report signed, sealed and dated by PE and/or PG.

PART I. GEOTECHNICAL INVESTIGATION REQUIREMENTS (62-701.410(2),FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Submit a geotechnical site investigation report defining the engineering properties of the site including at least the following:
☐	_____	☐	☒	a. Description of subsurface conditions including soil stratigraphy and ground water table conditions;
☐	_____	☐	☒	b. Investigate for the presence of muck, previously filled areas, soft ground, lineaments and sink holes;
☐	_____	☐	☒	c. Estimates of average and maximum high water table across the site;
☐	_____	☐	☒	d. Foundation analysis including:
☐	_____	☐	☒	(1) Foundation bearing capacity analysis;
☐	_____	☐	☒	(2) Total and differential subgrade settlement analysis;
☐	_____	☐	☒	(3) Slope stability analysis;
☐	_____	☐	☒	e. Description of methods used in the investigation and includes soil boring logs, laboratory results, analytical calculations, cross sections, interpretations and conclusions;
☐	_____	☐	☒	f. An evaluation of fault areas, seismic impact zones, and unstable areas as described in 40 CFR 258.13, 40 CFR 258.14 and 40 CFR 258.15.
☐	_____	☐	☒	2. Report signed, sealed and dated by PE and/or PG.

PART J. VERTICAL EXPANSION OF LANDFILLS (62-701.430,FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Describe how the vertical expansion shall not cause or contribute to leachate leakage from the existing landfill, shall not cause objectionable odors, or adversely affect the closure design of the existing landfill;
☐	_____	☐	☒	2. Describe how the vertical expansion over unlined landfills will meet the requirements of Rule 62-701.400, FAC with the exceptions of Rule 62-701.430(1)(c),FAC;
☐	_____	☐	☒	3. Provide foundation and settlement analysis for the vertical expansion;
☐	_____	☐	☒	4. Provide total settlement calculations demonstrating that the final elevations of the lining system, that gravity drainage, and that no other component of the design will be adversely affected;
☐	_____	☐	☒	5. Minimum stability safety factor of 1.5 for the lining system component interface stability and deep stability;
☐	_____	☐	☒	6. Provide documentation to show the surface water management system will not be adversely affected by the vertical expansion;
☐	_____	☐	☒	7. Provide gas control designs to prevent accumulation of gas under the new liner for the vertical expansion.

PART K. LANDFILL OPERATION REQUIREMENTS (62-701.500,FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Provide documentation that landfill will have at least one trained operator during operation and at least one trained spotter at each working face; (62-701.500(1),FAC)
☒	Part K.2	☐	☐	2. Provide a landfill operation plan including procedures for: (62-701.500(2), FAC)
☐	_____	☐	☒	a. Designating responsible operating and maintenance personnel;
☐	_____	☐	☒	b. Emergency preparedness and response, as required in subsection 62-701.320(16), FAC;
☐	_____	☐	☒	c. Controlling types of waste received at the landfill;
☐	_____	☐	☒	d. Weighing incoming waste;
☐	_____	☐	☒	e. Vehicle traffic control and unloading;
☐	_____	☐	☒	f. Method and sequence of filling waste;
☐	_____	☐	☒	g. Waste compaction and application of cover;
☒	Part K.2.h	☐	☐	h. Operations of gas, leachate, and stormwater controls;
☐	_____	☐	☒	i. Water quality monitoring.
☐	_____	☐	☒	j. Maintaining and cleaning the leachate collection system;
☐	_____	☐	☒	3. Provide a description of the landfill operation record to be used at the landfill; details as to location of where various operational records will be kept (i.e. FDEP permit, engineering drawings, water quality records, etc.) (62-701.500(3),FAC)
☐	_____	☐	☒	4. Describe the waste records that will be compiled monthly and provided to the Department annually; (62-701.500(4),FAC)
☐	_____	☐	☒	5. Describe methods of access control; (62-701.500(5),FAC)

S	LOCATION	N/A	N/C	PART K CONTINUED
☐	_____	☐	☒	6. Describe load checking program to be implemented at the landfill to discourage disposal of unauthorized wastes at the landfill; (62-701.500(6),FAC)
☐	_____	☐	☒	7. Describe procedures for spreading and compacting waste at the landfill that include: (62-701.500(7),FAC)
☐	_____	☐	☒	a. Waste layer thickness and compaction frequencies;
☐	_____	☐	☒	b. Special considerations for first layer of waste placed above liner and leachate collection system;
☐	_____	☐	☒	c. Slopes of cell working face and side grades above land surface, planned lift depths during operation;
☐	_____	☐	☒	d. Maximum width of working face;
☐	_____	☐	☒	e. Description of type of initial cover to be used at the facility that controls:
☐	_____	☐	☒	(1) Vector breeding/animal attraction
☐	_____	☐	☒	(2) Fires
☐	_____	☐	☒	(3) Odors
☐	_____	☐	☒	(4) Blowing litter
☐	_____	☐	☒	(5) Moisture infiltration
☐	_____	☐	☒	f. Procedures for applying initial cover including minimum cover frequencies;
☐	_____	☐	☒	g. Procedures for applying intermediate cover;
☐	_____	☐	☒	h. Time frames for applying final cover;
☐	_____	☐	☒	i. Procedures for controlling scavenging and salvaging.

S	LOCATION	N/A	N/C	PART K CONTINUED
☐	_____	☐	☒	j. Description of litter policing methods;
☐	_____	☐	☒	k. Erosion control procedures.
☒	Part K.8	☐	☐	8. Describe operational procedures for leachate management including; (62-701.500(8),FAC)
☐	_____	☐	☒	a. Leachate level monitoring, sampling, analysis and data results submitted to the Department;
☐	_____	☐	☒	b. Operation and maintenance of leachate collection and removal system, and treatment as required;
☐	_____	☐	☒	c. Procedures for managing leachate if it becomes regulated as a hazardous waste;
☐	_____	☐	☒	d. Identification of treatment or disposal facilities that may be used for off-site discharge and treatment of leachate;
☐	_____	☐	☒	e. Contingency plan for managing leachate during emergencies or equipment problems;
☐	_____	☐	☒	f. Procedures for recording quantities of leachate generated in gal/day and including this in the operating record;
☐	_____	☐	☒	g. Procedures for comparing precipitation experienced at the landfill with leachate generation rates and including this information in the operating record;
☐	_____	☐	☒	h. Procedures for water pressure cleaning or video inspecting leachate collection systems.
☒	Part K.9	☐	☐	9. Describe how the landfill receiving degradable wastes shall implement a gas management system meeting the requirements of Rule 62-701.530, FAC; (62-701.500(9),FAC)
☐	_____	☐	☒	10. Describe procedures for operating and maintaining the landfill stormwater management system to comply with the requirements of Rule 62-701.400(9); (62-701.500(10),FAC)

S	LOCATION	N/A	N/C	PART K CONTINUED
☐	_____	☐	☒	11. Equipment and operation feature requirements; (62-701.500(11),FAC)
☐	_____	☐	☒	a. Sufficient equipment for excavating, spreading, compacting and covering waste;
☐	_____	☐	☒	b. Reserve equipment or arrangements to obtain additional equipment within 24 hours of breakdown;
☐	_____	☐	☒	c. Communications equipment;
☐	_____	☐	☒	d. Dust control methods;
☐	_____	☐	☒	e. Fire protection capabilities and procedures for notifying local fire department authorities in emergencies;
☐	_____	☐	☒	f. Litter control devices;
☐	_____	☐	☒	g. Signs indicating operating authority, traffic flow, hours of operation, disposal restrictions.
☐	_____	☐	☒	12. Provide a description of all-weather access road, inside perimeter road and other roads necessary for access which shall be provided at the landfill; (62-701.500(12),FAC)
☐	_____	☐	☒	13. Additional record keeping and reporting requirements; (62-701.500(13),FAC)
☐	_____	☐	☒	a. Records used for developing permit applications and supplemental information maintained for the design period of the landfill;
☐	_____	☐	☒	b. Monitoring information, calibration and maintenance records, copies of reports required by permit maintained for at least 10 years;
☐	_____	☐	☒	c. Maintain annual estimates of the remaining life of constructed landfills and of other permitted areas not yet constructed and submit this estimate annually to the Department;
☐	_____	☐	☒	d. Procedures for archiving and retrieving records which are more than five year old.

PART L. WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS (62-701.510, FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Water quality and leachate monitoring plan shall be submitted describing the proposed ground water, surface water and leachate monitoring systems and shall meet at least the following requirements;
☐	_____	☐	☒	a. Based on the information obtained in the hydrogeological investigation and signed, dated and sealed by the PG or PE who prepared it; (62-701.510(2)(a),FAC)
☐	_____	☐	☒	b. All sampling and analysis preformed in accordance with Chapter 62-160, FAC; (62-701.510(2)(b),FAC)
☐	_____	☐	☒	c. Ground water monitoring requirements; (62-701.510(3),FAC)
☐	_____	☐	☒	(1) Detection wells located downgradient from and within 50 feet of disposal units;
☐	_____	☐	☒	(2) Downgradient compliance wells as required;
☐	_____	☐	☒	(3) Background wells screened in all aquifers below the landfill that may be affected by the landfill;
☐	_____	☐	☒	(4) Location information for each monitoring well;
☐	_____	☐	☒	(5) Well spacing no greater than 500 feet apart for downgradient wells and no greater than 1500 feet apart for upgradient wells unless site specific conditions justify alternate well spacings;
☐	_____	☐	☒	(6) Well screen locations properly selected;
☐	_____	☐	☒	(7) Monitoring wells constructed to provide representative ground water samples;
☐	_____	☐	☒	(8) Procedures for properly abandoning monitoring wells;
☐	_____	☐	☒	(9) Detailed description of detection sensors if proposed.
☐	_____	☐	☒	d. Surface water monitoring requirements; (62-701.510(4),FAC)

S	LOCATION	N/A	N/C	PART L CONTINUED
☐	_____	☐	☒	(1) Location of and justification for all proposed surface water monitoring points;
☐	_____	☐	☒	(2) Each monitoring location to be marked and its position determined by a registered Florida land surveyor;
☐	_____	☐	☒	e. Leachate sampling locations proposed; (62-701.510(5),FAC)
☐	_____	☐	☒	f. Initial and routine sampling frequency and requirements; (62-701.510(6),FAC)
☐	_____	☐	☒	(1) Initial background ground water and surface water sampling and analysis requirements;
☐	_____	☐	☒	(2) Routine leachate sampling and analysis requirements;
☐	_____	☐	☒	(3) Routine monitoring well sampling and analysis requirements;
☐	_____	☐	☒	(4) Routine surface water sampling and analysis requirements.
☐	_____	☐	☒	g. Describe procedures for implementing evaluation monitoring, prevention measures and corrective action as required; (62-701.510(7),FAC)
☐	_____	☐	☒	h. Water quality monitoring report requirements;(62-701.510(9),FAC)
☐	_____	☐	☒	(1) Semi-annual report requirements (see paragraphs 62 701.510(6)(c),(d)and (e) for sampling frequencies);
☐	_____	☐	☒	(2) Documentation that the water quality data shall be provided to the Department in an electronic format consistent with requirements for importing into Department databases, unless an alternate form of submittal is specified in the permit.
☐	_____	☐	☒	(3) Two and one-half year report requirements, or every five years if in long-term care, signed, dated and sealed by PG or PE.

PART M. SPECIAL WASTE HANDLING REQUIREMENTS (62-701.520, FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Describe procedures for managing motor vehicles; (62-701.520(1),FAC)
☐	_____	☐	☒	2. Describe procedures for landfilling shredded waste; (62-701.520(2),FAC)
☐	_____	☐	☒	3. Describe procedures for asbestos waste disposal; (62-701.520(3),FAC)
☐	_____	☐	☒	4. Describe procedures for disposal or management of contaminated soil; (62-701.520(4), FAC)
☐	_____	☐	☒	5. Describe procedures for disposal of biological wastes; (62-701.520(5), FAC)

PART N. GAS MANAGEMENT SYSTEM REQUIREMENTS (62-701.530,FAC)

S	LOCATION	N/A	N/C	
☒	Part N.1	☐	☐	1. Provide the design for a gas management system that will (62-701.530(1), FAC):
☐	Part N.1.a	☐	☐	a. Be designed to prevent concentrations of combustible gases from exceeding 25% the LEL in structures and 100% the LEL at the property boundary;
☒	Part N.1.b	☐	☐	b. Be designed for site-specific conditions;
☒	Part N.1.c	☐	☐	c. Be designed to reduce gas pressure in the interior of the landfill;
☒	Part N.1.d	☐	☐	d. Be designed to not interfere with the liner, leachate control system or final cover.
☒	Part N.2	☐	☐	2. Provide documentation that will describe locations, construction details and procedures for monitoring gas at ambient monitoring points and with soil monitoring probes; (62-701.530(2), FAC):
☒	Part N.3	☐	☐	3. Provide documentation describing how the gas remediation plan and odor remediation plan will be implemented; (62-701.530(3), FAC):
☒	Part N.4	☐	☐	4. Landfill gas recovery facilities; (62-701.530(5), FAC):

S	LOCATION	N/A	N/C	PART N CONTINUED
☒	Part N.4.a	☐	☐	a. Information required in Rules 62-701.320(7) and 62-701.330(3), FAC supplied;
☒	Part N.4.b	☐	☐	b. Information required in Rule 62-701.600(4), FAC supplied where relevant and practical;
☒	Part N.4.c	☐	☐	c. Estimate of current and expected gas generation rates and description of condensate disposal methods provided;
☒	Part N.4.d	☐	☐	d. Description of procedures for condensate sampling, analyzing and data reporting provided;
☒	Part N.4.e	☐	☐	e. Closure plan provided describing methods to control gas after recovery facility ceases operation and any other requirements contained in Rule 62-701.400(10), FAC;
☐		☐	☒	f. Performance bond provided to cover closure costs if not already included in other landfill closure costs.

PART O. LANDFILL FINAL CLOSURE REQUIREMENTS (62-701.600,FAC)

S	LOCATION	N/A	N/C	
☐		☐	☒	1. Closure permit requirements; (62-701.600(2),FAC)
☐		☐	☒	a. Application submitted to Department at least 90 days prior to final receipt of wastes;
☐		☐	☒	b. Closure plan shall include the following:
☐		☐	☒	(1) Closure design plan;
☐		☐	☒	(2) Closure operation plan;
☐		☐	☒	(3) Plan for long-term care;
☐		☐	☒	(4) A demonstration that proof of financial responsibility for long-term care will be provided.

S	LOCATION	N/A	N/C	PART O CONTINUED
☒	Part O.2	☐	☐	2. Closure design plan including the following requirements: (62-701.600(3),FAC)
☐		☐	☒	a. Plan sheet showing phases of site closing;
☐		☐	☒	b. Drawings showing existing topography and proposed final grades;
☐		☐	☒	c. Provisions to close units when they reach approved design dimensions;
☐		☐	☒	d. Final elevations before settlement;
☐		☐	☒	e. Side slope design including benches, terraces, down slope drainage ways, energy dissipaters and discussion of expected precipitation effects;
☐		☐	☒	f. Final cover installation plans including:
☐		☐	☒	(1) CQA plan for installing and testing final cover;
☐		☐	☒	(2) Schedule for installing final cover after final receipt of waste;
☐		☐	☒	(3) Description of drought-resistant species to be used in the vegetative cover;
☐		☐	☒	(4) Top gradient design to maximize runoff and minimize erosion;
☐		☐	☒	(5) Provisions for cover material to be used for final cover maintenance.
☐		☐	☒	g. Final cover design requirements:
☐		☐	☒	(1) Protective soil layer design;
☐		☐	☒	(2) Barrier soil layer design;

S	LOCATION	N/A	N/C	PART O CONTINUED
☐	_____	☐	☒	(3) Erosion control vegetation;
☐	_____	☐	☒	(4) Geomembrane barrier layer design;
☐	_____	☐	☒	(5) Geosynthetic clay liner design if used;
☐	_____	☐	☒	(6) Stability analysis of the cover system and the disposed waste.
☐	_____	☐	☒	h. Proposed method of stormwater control;
☐	_____	☐	☒	i. Proposed method of access control;
☒	Part O.2.j	☐	☐	j. Description of the proposed or existing gas management system which complies with Rule 62-701.530, FAC.
☐	_____	☐	☒	3. Closure operation plan shall include:(62-701.600(4),FAC)
☐	_____	☐	☒	a. Detailed description of actions which will be taken to close the landfill;
☐	_____	☐	☒	b. Time schedule for completion of closing and long-term care;
☐	_____	☐	☒	c. Describe proposed method for demonstrating financial assurance for long-term care;
☐	_____	☐	☒	d. Operation of the water quality monitoring plan required in Rule 62-701.510, FAC.
☐	_____	☐	☒	e. Development and implementation of gas management system required in Rule 62-701.530, FAC.
☐	_____	☐	☒	4. Certification of closure construction completion including: (62-701.600(6),FAC)
☐	_____	☐	☒	a. Survey monuments; (62-701.600(6)(a),FAC)
☐	_____	☐	☒	b. Final survey report; (62-701.600(6)(b),FAC)

S	LOCATION	N/A	N/C	PART O CONTINUED
☐	_____	☐	☒	5. Declaration to the public; (62-701.600(7),FAC)
☐	_____	☐	☒	6. Official date of closing; (62-701.600(8),FAC)
☐	_____	☐	☒	7. Justification for and detailed description of procedures to be followed for temporary closure of the landfill, if desired; (62-701.600(9),FAC)

PART P. OTHER CLOSURE PROCEDURES (62-701.610,FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Describe how the requirements for use of closed solid waste disposal areas will be achieved;(62-701.610(1),FAC)
☐	_____	☐	☒	2. Describe how the requirements for relocation of wastes will be achieved; (62-701.610(2), FAC)

PART Q. LONG-TERM CARE (62-701.620,FAC)

S	LOCATION	N/A	N/C	
☒	Part Q.1	☐	☐	1. Maintaining the gas collection and monitoring system; (62-701.620(5), FAC)
☐	_____	☐	☒	2. Stabilization report requirements; (62-701.620(6),FAC)
☐	_____	☐	☒	3. Right of access;(62-701.620(7),FAC)
☐	_____	☐	☒	4. Requirements for replacement of monitoring devices; (62-701.620(8),FAC)
☐	_____	☐	☒	5. Completion of long-term care signed and sealed by professional engineer (62-701.620(9), FAC).

PART R. FINANCIAL ASSURANCE (62-701.630,FAC)

S	LOCATION	N/A	N/C	
☐	_____	☐	☒	1. Provide cost estimates for closing, long-term care, and corrective action costs estimated by a PE for a third party performing the work, on a per unit basis, with the source of estimates indicated; (62-701.630(3)&(7), FAC).
☐	_____	☐	☒	2. Describe procedures for providing annual cost adjustments to the Department based on inflation and changes in the closing, long-term care, and corrective action plans; (62-701.630(4)&(8), FAC).
☐	_____	☐	☒	3. Describe funding mechanisms for providing proof of financial assurance and include appropriate financial assurance forms;(62-701.630(5),(6),&(9), FAC).
☐	_____	☐	☒	4. Provide documentation and the appropriate forms for delaying submitting proof of financial assurance for solid waste disposal units that qualify; (62-701.630(2)(c), FAC).

PART S. CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

1. Applicant:

The undersigned applicant or authorized representative of Hillsborough County Public Utilities Department Solid Waste Management Group is aware that statements made in this form and attached information are an application for a Intermediate Modification Permit from the Florida Department of Environmental Protection and certifies that the information in this application is true, correct and complete to the best of his/her knowledge and belief. Further, the undersigned agrees to comply with the provisions of Chapter 403, Florida Statutes, and all rules and regulations of the Department. It is understood that the Permit is not transferable, and the Department will be notified prior to the sale or legal transfer of the permitted facility.

Signature of Applicant or Agent

for Ms. Patricia V. Berry, Manager
Name and Title (please type)

berryp@hillsboroughcounty.org
E-Mail address (if available)

925 East Twiggs Street
Mailing Address

Tampa, FL 33602
City, State, Zip Code

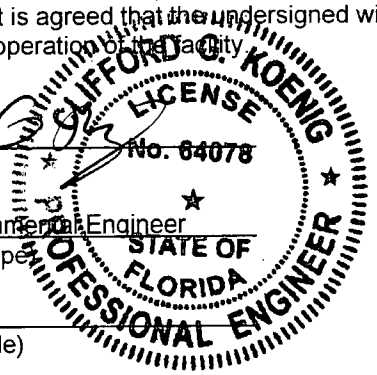
(813) 272-5977 x43338
Telephone Number

Date: 3/7/12

Attach letter of authorization if agent is not a governmental official, owner, or corporate officer.

2. Professional Engineer registered in Florida (or Public Officer if authorized under Sections 403.707 and 403.7075, Florida Statutes):

This is to certify that the engineering features of this solid waste management facility have been designed/examined by me and found to conform to engineering principles applicable to such facilities. In my professional judgment, this facility, when properly maintained and operated, will comply with all applicable statutes of the State of Florida and rules of the Department. It is agreed that the undersigned will provide the applicant with a set of instructions of proper maintenance and operation of the facility.



Signature

Cliff Koenig, P.E., Environmental Engineer
Name and Title (please type)

Cliff.koenig@hdrinc.com
E-Mail address (if available)

FL PE # 64078 HDR CA #4213
Florida Registration Number
(please affix seal)

5426 Bay Center Drive, Suite 400
Mailing Address

Tampa, FL 33609-3444
City, State, Zip Code

(904) 598-8931
Telephone Number

Date: 3-5-2012

SECTION A
FDEP SOLID WASTE MANAGEMENT FACILITY
PERMIT APPLICATION FORM

The completed Florida Department of Environmental Protection (FDEP) Application form for a Permit to Construct, Operate, Modify or Close a Solid Waste Management Facility is attached.

SECTION B
DISPOSAL FACILITY GENERAL INFORMATION

General information about the Hillsborough County Southeast County Landfill is described on pages 4 through 8 of the permit application form included in Section A.

SECTION C
PROHIBITIONS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the Southeast County Landfill (SCLF). Expansion of the Landfill Gas Collection and Control System (LFGCCS) on Section 9 of the Capacity Expansion Area (CEA) will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to any prohibitions requirements as part of this Intermediate Permit Application. For additional information refer to the Operations Permit Renewal Application-Phases I-VI and the Capacity Expansion Area (Sections 7 and 8), dated January 16, 2007 and subsequent responses, and Construction Permit Application Capacity Expansion Area (Section 9), dated March 22, 2006 and subsequent responses.

SECTION D
SOLID WASTE MANAGEMENT FACILITY
PERMIT REQUIREMENTS

D.1 APPLICATION FORM AND SUPPORTING DOCUMENTS

Four copies of the application form, supporting data, and reports have been included with this submittal.

D.2 ENGINEERING CERTIFICATION

This Permit Application Form, Engineering Report and Engineering Design Plans included in this permit application have been signed, dated and sealed by the Registered Professional Engineer in responsible charge of their preparation.

D.3 TRANSMITTAL LETTER

A transmittal letter is included at the beginning of this document.

D.4 APPLICATION FORM

FDEP Form No. 62-701.900(1) effective 01-06-10, dated and signed by the applicant, is included with this submittal.

D.5 PERMIT FEE

Per Rule 62-701.315 FAC, provided with this submittal is a check for the following permit fee:

- $500 Construction Permit - All Other Solid Waste Facilities (Intermediate Modification)

D.6 ENGINEERING REPORT

An Engineering Report meeting the requirements of FAC 62-701.320(7)(d) detailing plans for the construction of the LFGCCS expansion is included in Appendix A of this submittal.

D.7 OPERATION AND CLOSURE PLAN

The Operations and Maintenance Plan for the LFGCCS is included in Section L.9 of the Operations Plan for Phases I-VI and the Capacity Expansion Area (Sections 7, 8, and 9) dated May 2011. A separate submittal to FDEP will include updated Operations and Maintenance Plan to include the LFGCCS expansion.

D.9 DRAWINGS

Engineering drawings meeting the requirements of FAC 62-701.320(7)(f)(6) are provided in Appendix C, Drawings.

D.13 PROOF OF PUBLICATION

Upon submittal of this permit application to the FDEP, the County will publish a Notice of Application in a newspaper of general circulation, as required by 62-701.320(8), FAC.

SECTION E
LANDFILL PERMIT REQUIREMENTS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to landfill permit requirements as part of this Intermediate Permit Application.

E.2 PLOT PLAN

A plot plan showing the proposed LFGCCS expansion on Section 9 of the CEA is included in Appendix C of this submittal.

E.3 TOPOGRAPHIC MAPS

A topographic plan showing the proposed LFGCCS expansion is included in Appendix C (Sheets C-03 and C-04) of this submittal. The LFGCCS expansion will be constructed on Section 9 of the CEA, which is the current active Class I disposal area. The construction of the LFGCCS expansion will not affect the fill areas, borrow areas, access roads, grading of storm water controls, fencing or equipment facilities. Areas disturbed during the construction of the LFGCCS expansion components, such as trenching for the collection pipelines, will be repaired to pre-existing or approved grades after construction.

E.4 LANDFILL REPORT

E.4.c Site Life Estimate

The remaining volume within Sections 7, 8, and 9 was calculated by using AutoCAD software to compare existing grades within anticipated closure grades. The existing grades were obtained from the semi-annual aerial topographic survey, dated July 5, 2011 and monthly survey updates through February 1, 2012, provided by Pickett and Associates, Inc. The anticipated Sections 7, 8 and 9 closure grades were obtained by generating a three dimensional model of the permitted closure grades as shown in fill sequence 18 of the CEA Sections 7, 8, and 9 Operating Sequence Drawings. Refer to the Engineering Report, Attachment A, for additional information.

The calculated volume difference from comparing the existing grades to the anticipated Sections 7, 8 and 9 closure grades is **1,696,279 cy**. This is the gross volume remaining within Sections 7, 8, and 9 as of February 1, 2012 that is available for waste disposal and cover placement.

The net remaining waste disposal capacity within Sections 7, 8, and 9 was determined by subtracting the estimated airspace occupied by final cover. The net volume within Sections 7, 8, and 9 available for waste disposal after these quantities are subtracted is approximately **1,520,223 cy**.

In order to estimate the remaining Sections 7, 8, and 9 site life, the net remaining Sections 7, 8, and 9 waste disposal capacity was divided by the projected annual waste disposal rate and accounting for a fifty percent of waste being diverted to Phases I-VI starting on January 2013.

SECTION F
GENERAL CRITERIA FOR LANDFILLS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to general criteria for landfills as part of this Intermediate Permit Application.

SECTION G
LANDFILL CONSTRUCTION REQUIREMENTS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to landfill construction requirements as part of this Intermediate Permit Application.

G.1 CONSTRUCTION AND CLOSURE AT PLANNED INTERVALS

The Overall Site Plan (Sheet C-01, Appendix C) show that the SCLF consists of Phases I-VI and Sections 7, 8 and 9 of the Capacity Expansion Area. Currently, waste is disposed of in Section 9 and it is estimated that waste disposal will resume in Phases I-VI starting in January 2013. Future applications will be submitted for future Sections of the CEA as the need for additional airspace develops.

Portions of the SCLF that will not receive additional waste will be closed as sufficient closure area becomes available to make it practical to prepare and bid a closure contract. Slopes that will eventually receive additional waste will be temporarily closed in accordance with the regulations. Closure of Sections 7, 8 and 9 of the CEA is not expected to occur until 2021 as presented in Table 1~~, Section E~~ of Appendix A, Engineering Report.

The effect of LFGCCS expansion on the operations at the facility should be minimal. There will be three sequences as part of the LFGCCS expansion as shown on Sheets C-03, C-04, and C-05, Appendix C. The first sequence includes the installation of a header line, air supply line, and dewatering discharge line extensions along the south side slope of Section 9 and a header line and air supply line extensions along the north slope. These line extensions will connect to blind flanges located after the existing header isolation valve (southwest corner of Section 7) and to the blind flange located on the north slope of Section 8. Horizontal collectors, installed across Section 9 in a north-south direction, will be connected to the header line extensions on the north and south slopes of Section 9. The second sequence of the LFGCCS expansion will begin following placement of additional waste on Section 9 when Sections 7, 8, and 9 have reached near final permitted grade. The second sequence will include vertical gas extraction wells that will connect to the header line extensions installed during the first sequence and to lateral extension lines connecting to existing vertical gas extraction well laterals. A third sequence, to be completed after final build-out of Sections 7, 8, and 9, may be required only if vertical extraction wells installed during the second sequence are not efficient in collecting landfill gas. The third sequence will include re-drilling adjacent to the affected well. New wells installed during this third sequence will utilize existing lateral connections.

G.3 LEACHATE COLLECTION AND REMOVAL SYSTEM (LCRS)

Condensate from the gas collection system in Section 9 will drain into the existing leachate collection system. The operation of the existing leachate collection and storage system will not be affected by the discharge of condensate from Section 9 since landfill gas condensate is piped separately to the existing

Condensate Sump CS-1, Condensate Traps CT-4 and CT-5, and the Leachate Cleanouts LCO 9-1 and LCO 9-2 on the south and north slope of Section 9 respectively. Any condensate discharged to LCO 9-2 will drain via gravity to the leachate collection sump on the south side of Section 9. Additional condensate flow from the LFGCCS expansion will not affect the operation of existing pumps in the condensate sumps, traps, and cleanouts since these pumps do not operate all the time and are triggered independently by fluid levels in each sump. Leachate and condensate from the sumps are then pumped to the existing on-site 575,000 gallon leachate storage tank or the 575,000 gallon effluent/leachate storage tank. For additional information on leachate processing refer to the Leachate Management Plan Phases I-VI and the Capacity Expansion Area, dated May 2011.

G.9 GAS CONTROL SYSTEMS

Hillsborough County is proposing to expand and operate the existing LFGCCS on Section 9 of the CEA. The gas collected from Section 9 will be collected and destroyed at the existing flare/blower control unit. The existing flare/blower control unit has a capacity of 4,700 scfm. The current flow rate of LFG for Phases I-VI and Sections 7 and 8 is in the range of 2,200-2,700 cfm. The current flare/blower control unit has sufficient capacity to collect and combust gas from Section 9. The design of the LFGCCS expansion is described in detail in the Engineering Report, Appendix A, and shown on the Drawings, Appendix C.

SECTION H
HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to hydrogeological investigation requirements as part of this Intermediate Permit Application.

SECTION I
GEOTECHNICAL INVESTIGATION REQUIREMENTS

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to geotechnical investigation requirements as part of this Intermediate Permit Application.

SECTION J
VERTICAL EXPANSION OF LANDFILLS

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to vertical expansions as part of this Intermediate Permit Application.

SECTION K
LANDFILL OPERATION REQUIREMENTS

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to landfill operation requirements as part of this Intermediate Permit Application.

K.2 LANDFILL OPERATION PLAN

K.2.h Operation of gas, leachate, and stormwater controls

No changes are proposed to the existing and approved stormwater management system at the facility as part of the LFGCCS expansion on Section 9 of the CEA.

The project described in this application is for the expansion of the existing LFGCCS into Section 9 of the CEA, which will include a header line extension on the north and south slopes of Section 9, horizontal collectors, and vertical extraction wells that will convey the gas from the Section 9 disposal area to the existing flare/blower control unit.

K.8 LEACHATE MANAGEMENT

Condensate from the gas collection system in Section 9 will be drained or pumped into the existing leachate collection system. The operation of the existing leachate collection and storage system will not be affected by the discharge of condensate from Section 9 since landfill gas condensate is piped separately to the existing Condensate Sump CS-1, Condensate Traps CT-4 and CT-5, and the Leachate Cleanouts LCO 9-1 and LCO 9-2 on the south and north slope of Section 9 respectively. Any condensate discharged to LCO 9-2 will drain via gravity to the leachate collection sump on the south side of Section 9. The small amount of condensate flow from the gas system will not affect the operation of the pumps in the condensate sumps, traps, and cleanouts since these pumps do not operate all the time and are triggered independently by fluid levels in each sump. Leachate and condensate from the sumps are then pumped to the existing on-site 575,000 gallon leachate storage tank or the 575,000 gallon effluent/leachate storage tank. For additional information on leachate processing refer to the Leachate Management Plan Phases I-VI and the Capacity Expansion Area, dated May 2011.

K.9 GAS MANAGEMENT

Refer to Section N of this permit application.

SECTION L
WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to water quality and leachate monitoring requirements as part of this Intermediate Permit Application.

SECTION M
SPECIAL WASTE HANDLING REQUIREMENTS

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. No changes are proposed to special waste handling requirements as part of this Intermediate Permit Application.

SECTION N
GAS MANAGEMENT SYSTEM

N.1 GAS MANAGEMENT SYSTEM DESIGN

N.1.a Designed to prevent exceedance of combustible gases

Currently, landfill gas on Section 9 is allowed to vent passively to the atmosphere. The LFGCCS expansion will prevent migration of landfill gas from Section 9 by maintaining a vacuum within the landfill. By actively collecting gas from Section 9, the proposed LFGCCS expansion will decrease the possibility that gas concentrations will exceed 25 percent of the lower explosive limit (LEL) in structures and 100 percent LEL at the property boundary.

N.1.b Designed for site-specific conditions

The design of the LFGCCS expansion has been prepared with consideration of site specific conditions, such as existing and future landfill elevations, leachate management system locations, and existing landfill gas collection. Some field changes to the design, however, may be required due to conditions at the time of construction to allow the proper performance of the LFGCCS expansion. At locations where the actual conditions of the landfill vary significantly from what is shown in the plans, the County will be notified and corrective actions will be implemented, which may include modification to the landfill or to the gas system design. If modifications to the gas system design are proposed as a corrective action, the FDEP will be notified to determine if a permit modification is necessary. No changes to the layout of the gas system or the design in general will be made without first consulting the FDEP. As-built drawings of the LFGCCS expansion submitted to FDEP with the certification documentation will include any field changes made during the construction of the LFGCCS expansion.

Gas collection on Section 9 will be completed in three sequences. The first sequence will include installation of horizontal collectors that will connect to new header line extensions on the north and south slopes of Section 9. The proposed header line extension along the south side of Section 9 will be installed on the lower terrace. This header line extension will be provided with blind flanges allowing for future expansion of the LFGCCS to remaining Sections of the CEA. Horizontal collectors in Section 9 will be installed in relatively close proximity of the interim grade surface prior to resuming waste disposal activities. Horizontal collectors will provide constant landfill gas extraction since vertical wells are not effective due to current landfill elevation. The first sequence is estimated to begin in January 2013.

Horizontal collectors to be installed in Section 9 will not be subject to the New Source Performance Standard pressure and oxygen operating requirements until a minimum of 20 feet of waste are placed on top of the collector as stated in the FDEP approved Gas Collection and Control System (GCCS) Design Plan, by SCS Engineers dated July 11, 2008.

The second sequence of the LFGCCS expansion will begin following placement of additional waste on Section 9 when Sections 7, 8, and 9 have reached near final permitted grade. The second sequence will

include vertical gas extraction wells that will connect to the header line extension on the north and south slopes of Section 9 installed during the first sequence. Due to additional waste to be placed on Sections 7, 8, and 9 after installation of the second sequence of the LFGCCS expansion, vertical gas extraction wells will be fitted as Caisson wells. The caisson wells allows for the wells to be raised as the filling of waste in the area around the wells occurs in order to maintain the greatest area of influence by adding additional perforated pipe. The second sequence is estimated to begin in June 2018.

A third sequence, to be completed after final build-out of Sections 7, 8, and 9, may be required only if caisson wells installed during the second sequence are not efficient in collecting landfill gas. The third sequence will include re-drilling adjacent to the affected well. New wells installed during this sequence will utilize existing lateral connections. The third sequence, if required, is estimated to begin in July 2021

N.1.c Designed to reduce gas pressure in the interior of the landfill

The design, location, and number of horizontal collectors and extraction wells proposed on Section 9 were carefully considered to provide an active gas collection system that could adequately collect the gas generated as the waste decomposes. Engineering and design calculations are provided in the Engineering Report, Appendix A.

The gas is collected by applying a vacuum to the horizontal collectors, vertical extraction wells and into the landfill, thus reducing the pressure in the waste and drawing out the gas. Care must be taken to "balance" the system and not allow air to infiltrate into the waste while applying the vacuum. Balancing the system includes adjusting the vacuum at each horizontal collector, thus regulating the quality of the gas collected.

N.1.d Designed not to interfere with liner, leachate control system or final cover

Horizontal collectors have been design to be installed to a depth between 5 feet and 7 feet and vertical gas extraction wells to a depth of approximately two-thirds of the waste depth. Vertical components of the horizontal collectors and vertical gas extraction wells will maintain at least 15 feet offset from the base liner system. Therefore, horizontal collectors and vertical gas extraction wells will not interfere with the liner or leachate collection system in Section 9. The header line will be installed near the surface of Section 9 and will also not interfere with the existing base liner and leachate collection system.

When the final cover is installed over Section 9, geomembrane boots will be installed around the wells to minimize the chance of air and water infiltrating into the landfill.

N.2 MONITORING REQUIREMENTS

A landfill gas monitoring program is currently implemented at the SCLF. The existing gas monitoring locations and frequency will be maintained as set forth in the current Operations and Maintenance Plan for the facility.

N.3 REMEDIATION PLANS

If the results of the monitoring show that combustible gas concentrations exceed 25 percent LEL in structures and 100 percent LEL at the property boundary Hillsborough County will:

- immediately take all necessary steps to ensure protection of human health and notify FDEP;
- within 7 days of detection, submit to FDEP for approval a gas remediation plan for the gas releases which describes the nature and extent of the problem and the proposed remedy; and,
- complete the remedy within 60 days of detection unless otherwise approved by FDEP.

If gas concentrations cause objectionable odors beyond the landfill property boundary, Hillsborough County will:

- implement a routine odor monitoring program to determine the timing and extent of any off-site odors;
- if the monitoring program confirms the existence of objectionable odors, submit to FDEP for approval an odor remediation plan for the gas releases that describes the nature and extent of the problem and the proposed remedy; and,
- initiate the remedy within 30 days of approval.

N.4 LANDFILL GAS RECOVERY FACILITIES

N.4.a Application Information

Information required by Rules 62-701.320(7) and 62-701.330(3) FAC are included in the permit form and engineering report.

N.4.b Closure Information

Section 9 of the CEA is not being proposed for closure at this time. A detailed closure design report satisfying the requirements of Rule 62-701.600(4) FAC will be included as part of the closure permit application.

N.4.c Estimate of current and expected gas generation rates and description of condensate disposal methods

The EPA LandGEM was used to estimate the potential quantity of gas that may be generated by the landfill. The model uses past waste disposal data and predicted waste disposal data based on population estimations to determine the gas generation potential for the life of the SCLF. The past waste disposal data for the landfill used in the model run for this project was obtained from the County.

The AP-42 default values were determined by analyzing gas characteristics at landfills throughout the country and creating a best fit average. These values give a more realistic result for potential gas emissions from a landfill. However, conditions at the location of the landfill must be taken into account. Special considerations can be made within the model for arid areas (less than 25 inches rain per year), as

well as for bioreactor landfills. Since the landfill is neither in an arid area, nor is it a bioreactor landfill, the conventional default AP-42 parameters were used in this model.

The fraction of degradable waste is another factor in estimating the gas generation potential for the SCLF. As of 2010, the SCLF has accepted and placed more ash waste than Municipal Solid Waste (MSW) in the active disposal areas than in previous years. Ash waste is mostly inert and will not contribute to gas generation in the future. Currently, the SCLF accepts 80% ash and 20% MSW. HDR has conservatively estimated future waste composition as 50% ash and 50% MSW. For design purposes, the results from the LandGEM were conservatively designed to use the k_o and L_o values in AP-42, 0.04 year and 100 m^3/Mg respectively. These regulatory default values were developed for regulatory compliance to estimate gas generation. Results from the model, although a good indicator of potential gas production, have been known to vary from site to site. The LandGEM results are included in the Engineering Report, Appendix A. In the event that the SCLF continues to receive more ash waste than MSW, future LFGCCS expansion designs for the remainder of the CEA will be adjusted in order to correctly size the LFG piping.

As estimated in the pipe sizing calculations, Attachment A of the Engineering Report, the maximum gas generation for the CEA is 1,790 cubic feet per minute (cfm). The pipe sizing calculations are a conservative estimate on gas generation for the master plan build-out of the approved GCCS plan for the CEA as 50% of the waste placed in the CEA is anticipated to be ash which yields a much lower gas generation rate than a typical 100% MSW unit of this size. Based on results from the LandGEM, the peak flow for the CEA and Phases I-VI is 2,468 cfm in 2049.

Condensate from Section 9, which is generated as the saturated landfill gas cools in the collection pipelines, will be conveyed through the condensate force main and the header pipeline system and collected at the condensate traps/sumps located at low points in the header line. Condensate is then drained or pumped into the existing leachate collection system for disposal. Condensate from Section 9 will be collected either in Condensate Sump CS-1, LCO 9-1, LCO 9-2, Condensate Traps CT-4 or CT-5.

N.4.d Procedures for condensate sampling, analyzing and data reporting

Condensate from the LFGCCS drains into the existing leachate management system for the landfill and will be handled along with the current Leachate Management Plan.

N.4.e Closure Plan

The proposed LFGCCS expansion will treat the gas in accordance with Rule 62-701.400(10), F.A.C. The gas collected will be treated in the existing landfill gas control unit, which includes a blower unit and candlestick flare. Section 9 of the Capacity Expansion Area is not being proposed for closure at this time. A detailed closure design report will be included as part of the closure permit application which will address any integration of the LFGCCS with the intended end use.

SECTION O
LANDFILL FINAL CLOSURE REQUIREMENTS

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. Section 9 of the CEA is not being proposed for closure at this time. A detailed closure design report satisfying the requirements of Rule 62-701.600(4) FAC will be included as part of the closure permit application. No changes are proposed to landfill closure requirements as part of this Intermediate Permit Application.

O.2 CLOSURE DESIGN PLAN

O.2.j Description of the proposed or existing gas management system

The proposed LFGCCS expansion on Section 9 of the CEA complies with the requirements of Rule 62-701.530, FAC. The proposed system will utilize horizontal collectors, vertical extraction wells, and pipelines to convey the gas to the existing flare control unit. The gas will continue to be flared at the control unit. A full-description of the design and operation of the LFGCCS expansion has been provided in the Engineer Report, Appendix A.

SECTION P
OTHER CLOSURE PROCEDURES

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. Closure of permitted disposal areas at the SCLF is not being proposed at this time. No changes are proposed to other closure procedures as part of this Intermediate Permit Application.

SECTION Q
LONG TERM CARE REQUIREMENTS

Disposal areas at the landfill have been permitted by FDEP and are located within the property boundaries of the SCLF. Expansion of the LFGCCS on Section 9 of the CEA will not require additional cells (disposal units) at the SCLF in order to operate. Closure of permitted disposal areas at the SCLF is not being proposed at this time. No changes are proposed to long term care requirements as part of this Intermediate Permit Application.

Q.1 GAS MONITORING

The gas collection and monitoring system required in FAC 62-701.600(4)(f) will be maintained for the long-term care period of the landfill. Hillsborough County may apply to the Southwest District Office of FDEP for a permit modification to reduce the long-term care schedule. FDEP will grant such a modification if Hillsborough County demonstrates that the landfill has stabilized to the point where there is no significant production of combustible gases or objectionable odors.

APPENDIX A
ENGINEER REPORT

Hillsborough County
Florida

Hillsborough County
Public Utilities Department
Solid Waste Management Group

Sections 7, 8, and 9 Landfill Gas Collection and Control System Expansion
Southeast County Landfill
Hillsborough County, Florida
Engineering Report

March 2012
Revised May 2012

Prepared for:
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Solid Waste Management Group
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HDR Project No. 096-171445-002
Florida Certificate of Authorization No. 00004213

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1.0 INTRODUCTION

1.1 Project Scope and Objectives

HDR Engineering Inc. (HDR), on behalf of Hillsborough County Solid Waste Management Group (SWMG), has prepared this engineering report for the design of the Landfill Gas Collection and Control System (LFGCCS) Expansion on Section 9 of the Capacity Expansion Area (CEA) at the Southeast County Landfill (SCLF). This Engineering Report is submitted in accordance with rule 62-701.320(7)(d) F.A.C. to document that the proposed LFGCCS expansion design system complies with the regulatory requirements of the Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP). This Engineering Report details the site specific components for the successful gas collection and control system.

1.2 Facility Description

The SCLF is permitted by the FDEP as a Class I Landfill consisting of the 162.4 acre Phases I-VI and 147 acre CEA of which 34.4 acres Sections 7, 8, and 9 are currently permitted. The existing LFGCCS for the facility was originally installed on Phases I-VI and Sections 7 and 8 and was completed on February 16, 2010. The existing LFGCCS includes 77 vertical landfill gas extraction wells, 25 horizontal collectors, header and lateral piping of various sizes, condensate traps/sumps, isolation valves for airlines, condensate, and landfill gas, and a skid mounted flare station for the efficient combustion of the collected gas.

Expansion of the existing LFGCCS will be constructed on Section 9 of the CEA. Section 9 is a 15.2 acre double-lined Class I landfill cell located immediately west of Sections 7 and 8. Construction of Section 9 disposal area was completed on June 2008 and began accepting waste on February 2009. Presently, Section 9 has not met its maximum design capacity; however the perimeter of Section 9 at the current fill sequence elevation is at or near final grade. Sections 7, 8 and 9 are expected to reach final grades on the top deck in the year 2021.

To provide compliance with the New Source Performance Standards (NSPS) for the SCLF, the SWMG intends to proceed with planning, permitting, design and construction of the Section 9 LFGCCS expansion such that it will be available for operation before the deadline of the current LFGCCS construction permit (No. 35435-016-SC/08) in February 2014.

2.0 DESIGN APPROACH

The basic principal of gas collection systems is to collect landfill gas (LFG) in an economical and efficient manner thereby reducing potential harmful effects that landfill gas presents. In order to appropriately design the LFGCCS expansion, accurate estimates of future waste disposal rates, gas generation rates, and an efficient strategy must be developed. HDR conducted a review of the existing LFGCCS and the design plan for the final build-out of Phases I-VI and the CEA as submitted in the Gas Collection and Control System (GCCS) Design Plan, dated July 11, 2008, by SCS Engineers. Figure 1 shows the conceptual final build-out landfill gas extraction system for the CEA. A revised final build-out delineating the correct landfill limits and proposed changes to the CEA LFGCCS final build-out is included in Figure 2.

After the LFGCCS was revised for the final build-out of the CEA, it was required to estimate the remaining volume and site life for Sections 7, 8 and 9 to determine the fill sequence in which the construction for the LFGCCS expansion will occur.

2.1 Remaining Sections 7, 8, and 9 Volume Estimate

The remaining volume within Sections 7, 8, and 9 was calculated by using AutoCAD software to compare existing grades within anticipated closure grades. The existing grades were obtained from the semi-annual aerial topographic survey, dated July 5, 2011 and monthly survey updates through February 1, 2012, provided by Pickett and Associates, Inc. The anticipated Sections 7, 8 and 9 closure grades were obtained by generating a three dimensional model of the permitted closure grades as shown in fill sequence 18 of the CEA Sections 7, 8, and 9 Operating Sequence Drawings.

The calculated volume difference from comparing the existing grades to the anticipated Sections 7, 8 and 9 closure grades is **1,696,279 cy**. This is the gross volume remaining within Sections 7, 8, and 9 as of February 1, 2012 that is available for waste disposal and cover placement.

The net remaining waste disposal capacity within Sections 7, 8, and 9 was determined by subtracting the estimated airspace occupied by final cover. The net volume within Sections 7, 8, and 9 available for waste disposal after these quantities are subtracted is approximately **1,520,223 cy**.

2.2 Remaining Sections 7, 8, and 9 Life Estimate

In order to estimate the remaining Sections 7, 8, and 9 site life, the net remaining Sections 7, 8, and 9 waste disposal capacity was divided by the projected annual waste disposal rate and accounting for fifty percent of waste being diverted to Phases I-VI starting on January 2013.

Table 1 lists the calculated number of years of remaining capacity in Sections 7, 8, and 9 as of February 1, 2012 for the various annual tonnages and diversions to Phase I-VI. Current conditions estimate an apparent waste density of 1,900 lbs/cy.

From Table 1, the remaining site life within Sections 7, 8, and 9 was estimated to be 9.5 years from February 1, 2012 where current disposal rates and in-place waste densities are maintained. It was estimated that 100 percent of waste will continue to be disposed of in Section 9 until late December 2012 and a 50 percent waste diversion to Phases I-VI will begin on January 2013.

In order to provide that the Section 9 LFGCCS expansion is available for operation before February 2014, the first sequence is estimated to begin construction in January 2013. From the waste volume report, the remaining volume to complete fill sequence 12 is 52,335 cy and from fill sequence 12 through fill sequence 13 is 170,316.93 cy for a total of **222,651.93 cy**. Table 1 show that waste to be placed in Section 9 for the remainder of 2012 is **245,087.72 cy**. Therefore, during construction of the first sequence in January 2013, approximately 16% of fill sequence 14 (approximately one month) should be completed. The LFGCCS expansion has been designed based on completion of fill sequence 13 since the amount of waste received after fill sequence 13 is completed is minimal and should not impact the LFGCCS expansion construction.

The second sequence of the LFGCCS expansion will begin during fill sequence 16 when Sections 7, 8, and 9 have reached near final permitted grade. From the waste volume report, the remaining volume to complete fill sequence 12 is 52,335 cy and from fill sequence 12 through fill sequence 16 is 1,045,476.45 cy for a total of **1,097,811.45 cy**. Table 1 estimates that waste placed in Section 9 from the remainder of 2012 through 2017 is **944,196.11 cy**. Therefore, construction of the second sequence is estimated to begin in June 2018 assuming a monthly disposal rate of 22,000 cy for 2018.

2.3 LFGCCS Expansion Design

The design, location, and number of horizontal collectors and gas extraction wells proposed on Section 9 were considered to provide an active gas collection system that adequately collects the peak flow rate of gas generated as the waste decomposes. The proposed LFGCCS expansion system for Section 9 consists of three sequences.

The first sequence includes installing a header line, air supply line, and dewatering discharge line extensions along the south slope of Section 9 and a header line and air supply line extensions along the north slope. These line extensions will connect to blind flanges located after the existing header isolation valve V-9 (Southwest corner of Section 7) and to the blind flange located at the end of the existing header line on the north slope of Section 8. Seven horizontal collectors, installed across Section 9 in a north-south direction, will be connected to the header line extensions installed on the north and south slopes of Section 9. The horizontal collectors will include vertical boring sections for additional gas extraction. Based on the estimated remaining site life of sections 7, 8 and 9, construction of the first LFGCCS expansion sequence is estimated to begin in January 2013 when fill sequence 13 has been completed.

The second sequence of the LFGCCS expansion will begin following placement of additional waste on Section 9 to complete fill sequence 16 when Sections 7, 8, and 9 have reached near final permitted grade. Based on the estimated remaining site life of Sections 7, 8 and 9, construction of the second LFGCCS expansion sequence is estimated to begin in June 2018. The second sequence will include 9 vertical gas extraction wells that will connect to the header line extensions on the north and south slopes of Section 9,

installed during the first LFGCCS expansion sequence, and to lateral extension lines connecting to existing vertical gas extraction well laterals on Sections 7 and 8.

A third sequence, to be completed after final build-out of Sections 7, 8, and 9, may be required only if Caisson wells installed during the second sequence are not efficient in collecting landfill gas. The third sequence will include re-drilling adjacent to the affected well. New wells installed during this sequence will utilize existing lateral connections.

The proposed LFGCCS expansion design incorporates new wellheads and existing valves to provide flexibility and control in the application of vacuum to the new horizontal collectors and vertical gas extraction wells. The vacuum can be selectively applied and controlled at each horizontal collector or well based upon actual gas generation. Wellheads for each horizontal collector will be installed on the north and south slopes of Section 9. Once the future Sections 10 and 11 of the CEA are built on the north side of Sections 8 and 9, the remote wellheads located on the north slope of Section 9 will be abandoned while the remote wellheads on the south slope of Section 9 remain in place to continue providing control of vacuum. Gas collected from extraction wells and horizontal collectors will be conveyed through a network of lateral and header pipes to the existing landfill gas control unit. The design of the horizontal collectors, gas extraction wells and pipelines is further described in the following sections of this engineering report.

The existing landfill gas control unit includes a condensate knockout pot to reduce moisture in the gas, blowers to create the necessary vacuum to collect the gas from the landfill, and a candle stick flare to reduce air pollutant emissions. The condensate generated in the LFGCCS will travel through the gas collection pipelines to condensate sumps / traps located prior to the condensate knock-out pot at the landfill gas control unit. Condensate from the control unit drains via gravity line to existing condensate sump CS-1.

The LFGCCS expansion pipelines are designed to have a minimum of five percent slope within the landfill, allowing the condensate to flow by gravity toward existing and proposed condensate collection structures. A minimum slope of five percent slope for header and lateral pipes within the landfill is required to minimize the occurrence of localized low points in the pipelines due to waste settlement. Horizontal collectors are not required to have a minimum slope of five percent. Perforations on horizontal collectors allow for any condensate build-up to drain back into the landfill. The solid pipe connecting the horizontal collector has been design with a minimum 2.5 percent slope due to slope restrictions at the time of construction. A minimum slope of 2.5 percent for the solid pipe of the horizontal collector will not affect flow of condensate since the majority of condensate will drain back to the landfill through the perforated section.

3.0 GAS EXTRACTION SYSTEM COMPONENTS

Primary components for the LFGCCS expansion on Section 9 of the CEA include the following:

- Horizontal collectors (first sequence);
- Vertical gas extraction wells (second sequence); and
- Gas header and lateral piping.

3.1 Horizontal Collector

During the first sequence of the LFGCCS expansion, horizontal collectors are the primary collection method in relatively close proximity to the interim ground surface prior to resuming waste disposal. Horizontal collectors will provide an infrastructure to capture landfill gas from the active disposal area where vertical gas extraction wells could be damaged or rendered useless due to minimal waste depth. Horizontal collectors are intended to be utilized as interim gas collection components until sufficient waste is in place for vertical well installation or Caisson well installation. The advantage of horizontal wells is the ability to place significant layers of waste on top of the installed collectors which would otherwise require vertical wells to be raised several times to maintain access to the wellhead controls.

Design lengths are based on the depth of the landfill at each horizontal collector using current fill grades and permitted base grades. During construction of the first LFGCCS expansion sequence, after completion of fill sequence 13, the south portion of Section 9 will have approximately 40 feet of waste in place and the north portion of Section 9 will have approximately 60 feet of waste in place. Vertical components will be installed for each horizontal collector in order to extract landfill gas from deeper waste in Section 9. Vertical components will be designed to maintain a minimum buffer of 15 feet from the bottom liner system.

Oxygen exceedances are likely to occur until at least 20 feet of waste are placed over the horizontal collectors. Horizontal collectors have a vertical zone of influence of at least 20 feet; therefore, if there is less than 20 feet of waste over the collectors, ambient air has a greater potential of being pulled into the landfill. Horizontal collectors to be installed in Section 9 will not be subject to the pressure and oxygen operating requirements until a minimum of 20 feet of waste are placed on top of the collector as stated in the Gas Collection and Control System (GCCS) Design Plan, by SCS Engineers dated July 11, 2008.

3.1.1 Horizontal Collector - Radius of Influence

The spacing or horizontal distance between horizontal collectors is determined by a calculated Radius of Influence (ROI). The ROI defines an area from which gas can be extracted without inducing excessive air into the landfill. The current GCCS design plan states "horizontal collectors typically have a horizontal zone of influence of approximately 75 feet, which results in a lateral spacing of approximately 150 feet between collectors."

After fill sequence 13 is completed, the horizontal collectors will be installed across Section 9 in a north-south direction. The horizontal collectors will be installed 100 feet apart starting 75 to 100 feet from the

terrace on the western edge of Section 9 which is more conservative than the GCCS plan. It has been assumed that each horizontal collector will have a horizontal zone of influence of approximately 50 ft.

3.1.2 Horizontal Collector - Construction

Horizontal collectors are designed using an HDPE SDR 11 six-inch diameter pipe. Each horizontal collector consists of the following:

- A six-inch diameter perforated SDR-11 HDPE (high density polyethylene) perforated pipe section, joined to a six-inch diameter solid SDR-11 HDPE pipe;
- Perforated pipe will end at least 100 feet inward from the end of each collector to reduce the potential for air infiltration into the collectors;
- Four-inch nominal size tire chips placed around the perforated pipe to minimum of two-foot above the top of the perforated pipe (non calcareous stone may be used instead of tire chips);
- A 6 oz. non woven geotextile will be placed over the tire chips (or calcareous stone) to create a separation between the tire chips and cover soil; and
- Minimum of 3 feet of cover placed above the tire chips or stone.

Refer to Drawings, Appendix C, for additional details regarding the construction of the horizontal collectors.

3.2 Vertical Gas Extraction Wells

The second sequence of the LFGCCS expansion includes 9 vertical gas extraction wells. The vertical gas extraction wells shown on the Drawings will be utilized to extract gas from the landfill under a steady vacuum. The design, location, and number of gas extraction wells is consistent with the GCCS Plan and provides for a system that adequately collects the peak gas flow during the active and post closure periods of the landfill as the waste decomposes.

Design well depths are based on the depth of the landfill at each well using final fill grades and permitted base grades as provided in the topographic survey of protective cover by Southeastern Surveying, Inc., dated May 8, 2008 (Refer to Attachment B for copy of the base grade survey). A minimum buffer of 15 ft from the bottom liner system and a maximum depth equivalent to two-thirds of the waste depth is included in the design of the wells. Each well is designed with a certain length of solid pipe near the surface of the landfill and perforated pipe deeper in the landfill. This is implemented to help minimize the potential for air infiltration into the landfill and gas system.

Perimeter vertical gas extraction wells have been designed along the perimeter of Section 9 to collect gas generated by waste at the outer edges of the landfill. The perimeter wells are intended to reduce the potential for lateral migration of landfill gas beyond the landfill footprint. Additional deeper gas extraction wells have been designed in the interior of Section 9 to collect gas generated from areas containing the largest volumes of waste. Both perimeter and interior wells have been designed as Caisson wells due to additional waste to be placed on Sections 7, 8, and 9 after installation of the second sequence of the LFGCCS expansion.

The vertical gas extraction wells have been designed as Caisson wells to allow for the wells to be raised as the filling of waste in the area around the wells occurs in order to maintain the greatest area of influence. The external Caisson housing will be lifted vertically while additional filter pack (stone or tire chips) and perforated pipe is added to the top of the well. The length of perforated pipe for Caisson wells is not fixed as a typical vertical extraction well. Caisson wells can be extended more than once as required until the waste reaches final design elevation in the area surrounding the well. At this point, the perforated section will terminate 10 feet below grade surface. The Caisson wells integrate seamlessly into the LFGCCS design without having to drill a new well.

Together, the perimeter and interior wells function as an integral part of the active gas extraction system. The active gas extraction system will help minimize pressure build-up that could result in lateral sub-surface gas migration and /or venting of landfill gas to the atmosphere. The locations and schedule of the wells are shown on the Drawings included in Appendix C of the permit application.

3.2.1 Vertical Well - Radius of Influence

Expansion of the LFGCCS on Section 9 was based on the approved GCCS Design Plan as submitted by SCS Engineers on July 11, 2008. The conceptual plan provided in the GCCS design plan included all extraction wells that will be required based on the final build-out and ROI. HDR revised the CEA landfill limits (Refer to Figure 2) to delineate current approved limits. Conceptual extraction wells that were close or outside of the current limits of waste were removed or relocated per the revised design.

Spacing of vertical gas extraction wells on Section 9 was consistent with the GCCS Design Plan. The well spacing at the SCLF was maintained between 100 to 200 feet.

3.2.2 Vertical Well - Construction

The vertical gas extraction wells are designed using a six-inch SCH 80 pipe with an effective well diameter of three feet. To construct each extraction well, a three-foot diameter boring is drilled into the waste to the design well depth with a drill rig using 3 foot diameter auger or bucket type drilling equipment. Once the boring is complete, installation of the gas extraction well is performed. Each extraction well consists of the following:

- A six-inch diameter SCH 80 slotted pipe section, with a bottom end cap;
- Four-inch nominal size tire chips placed around the perforated pipe up to two-feet below existing surface (non calcareous stone may be used instead of tire chips);
- A 24-inch diameter SDR 17 HDPE open end Caisson well housing to protect the perforated pipe;
- A 6 oz. non woven geotextile will be placed over the tire chips to create a separation between the tire chips and bentonite;
- A 2-foot layer of bentonite above the geotextile to reduce the potential for air intrusion into the well;
- A 2-foot layer of clean backfill to fill the remainder of the bore hole.
- Lift plates located in the Caisson housing will allow the well to be raised as elevation around the well increases.

As the Caisson wells are extended vertically by lifting the 24-inch external Caisson housing and adding perforated pipe and tire chips, additional waste is then placed around the wells while the well is protected. Once the new layer of waste is in place around the well, it will immediately begin to provide vacuum to the area.

Riser pipes for lateral lines will also require extension following placement of additional waste around the wells. Riser pipes will have approximately two feet of pipe extension after final cover surface is completed. Refer to Drawings, Appendix C, for additional details regarding the construction of the extraction wells.

3.3 Wellhead Assembly

Wellhead assemblies will be installed for each well, as indicated on the Drawings provided in Appendix C of the permit application. The wellhead assemblies will include the following:

- A Fernco adapter coupling connecting a two inch to a six inch lateral riser or to the Forrer wellhead assembly;
- The Forrer wellhead assembly contains quick connect instrument ports compatible with a Landtec GEM-2000 landfill gas monitoring instrument or equivalent for measuring gas flow and gas quality;
- A dust cap to cover the instrument reading ports and temperature indicator from dust or debris;
- A valve to regulate the gas extraction rate from the well; and
- A flexible hose attached from the valve to the HDPE lateral piping via Fernco coupler.

The wellheads will be used to monitor the quality of the gas being extracted from each well on the landfill and to regulate gas flow through the LFG System as conditions dictate.

3.4 Gas Extraction Header and Lateral Piping

The proposed pipelines for this design have been sized to convey the gas and condensate anticipated for future Sections of the CEA throughout the life of the entire permitted landfill. The proposed pipelines will be constructed near the surface of the landfill as shown on the Drawings included in Appendix C of the permit application.

3.4.1 Design Methodology

The CEA has begun receiving less Municipal Solid Waste (MSW) and more ash waste. Currently, the facility receives approximately 80% ash and 20% MSW. This section reviews the pipe sizing methodology to account for this decrease in biodegradable waste and thus reduced gas generation potential for the CEA. The header pipe can therefore be reduced in size and still provide sufficient gas transmission capability.

The sizing of the header line begins by taking the revised gas system layout and dividing the header line into individual segments. Each segment consists of the header and lateral lines for the respective vertical gas extraction wells within that segment. Each segment contributes to the LFG flow from the zero point to the existing header line. Refer to Figure 3 for additional information.

The zero point for the main header line is the location in the header system in which the pressure drop is equal in both directions. Alternatively, it is the point at which a molecule of gas in the header line would be as likely to travel in one direction towards the source of vacuum as another. The zero point for the CEA final build-out is located at the high point on the north slope of the CEA.

From the zero point of header line, LFG flow runs in one of the two directions and travels along the header line towards the source of vacuum. The estimated length of each segment of the header line along this direction of travel is measure in feet and is input into the spreadsheet.

The incremental increase in flow from the wells connected to each individual header segment is calculated. Flow volumes from vertical gas extraction wells were selected based on HDR experience with GCCS design. There will be a cumulative increase in the flow volume as the gas moves from segment to segment towards the vacuum source. The expected flow volume for each segment of header pipe is entered into the spreadsheet.

Last, pressure drops and velocities are calculated for different pipe diameters (in inches for inner diameter). A respective pipe size for each segment found to meet the pressure and velocity criteria is selected.

Results for the header pipe calculations and pipe sizes are provided in Attachment A. As shown in the calculations, the LFGCCS expansion will include a 12-inch diameter header line on the south slope of Section 9 (Refer to Segment G in Figure 3 and pipe size calculations in Attachment A). The header line on the north slope of Section 9 was designed as a 10-inch diameter line since only 2 vertical gas extraction wells and the horizontal collectors will be connected to this extension. No additional lateral connections will be required for this extension.

3.4.2 Section 9 Header and Laterals

Landfill gas from Section 9 will be collected from the horizontal collectors and vertical gas extraction wells and conveyed to the existing landfill gas control unit through a network of header and lateral pipelines connected to the existing landfill gas system. The proposed layout of the header and lateral pipelines for Section 9 LFGCCS expansion is presented in the Drawings in Appendix C.

Condensate flowing in the drain pipelines from horizontal collectors and vertical gas extraction wells for the LFGCCS expansion will drain either to Condensate Sump CS-1, Condensate Traps CT-4 and CT-5, or Leachate Cleanouts LCO 9-1 and LCO 9-2 (located on the south and north slope of Section 9 respectively). The condensate is then drained or pumped into the existing leachate collection system. A minimum slope of 5 percent for header and lateral lines on the landfill footprint are provided to minimize surging and blockage problems due to condensate buildup and landfill settling.

It is not practical to create pipe profiles for each of the gas collection pipelines since the conditions of the landfill will vary from the conditions shown on the Drawings, due to settlement and operations on the landfill. The location and alignment of the pipelines shown on the Drawings may need to be adjusted somewhat during construction in response to these varying site conditions. However, the pipelines will be installed according to the design criteria described in this report to provide proper operation of the system. At locations where the actual conditions of the landfill vary significantly from what is shown on the Drawings, the County will be notified and corrective actions will be implemented, which may include modification to the landfill, or to the gas system design. No significant changes to the layout of the system or the design in general will be made without first consulting the FDEP.

The pipes will be joined by heat fusion wherever practical, which produces a joint stronger than the pipe itself. Electro-fusion coupling and branch saddle fittings may be utilized as needed. Flange connections are proposed at valves and other fittings since the valves specified typically come with flange connections on either side. The use of flange connections also makes replacing the valves less difficult, when required. Materials resistant to corrosion, such as PVC, HDPE, and stainless steel will be used for the valves and flange connections (back-up rings, nut and bolts, valve stem, etc.). The header and lateral pipelines will be pressure tested with air at 10 psi for one hour to document the integrity of the installation.

As previously explained in Section 3.4.1, sizing of the LFGCCS expansion pipe network was determined by projecting the gas flow rate and calculating gas velocities and losses due to friction loss from gas flow in individual sections of pipe throughout the entire CEA. Gas velocities in header pipes are generally designed not to exceed 35 feet per second (ft/s) in pipes where gas flows in the same direction as condensate, and 20 ft/s in pipes where gas flows in the opposite direction from condensate.

The optimum diameter of the header pipe is determined after the layout design has been completed and the calculations have been performed for collecting LFG flow from each vertical gas extraction well. The diameter of the header pipe varies in size, depending on the volume of LFG it will be expected to convey and ash acceptance rate. If waste composition changes from the assume waste/ash tonnage ratio during the design, additional header pipe can be installed in the future running parallel to the proposed header alignment in the Section 9 LFGCCS expansion. Header and lateral pipe sizing for the Section 9 LFGCCS expansion are based on a 50 % waste/ash ratio.

Overburden load calculations to determine ring deflection and wall buckling are included in Attachment A. Wall crushing, calculated using the allowable compressive strength of the pipe material, is usually not critical when using solid wall HDPE pipe, as ring deflection and wall buckling are predominant modes of failure.

3.5 Gas Condensate Control

As landfill gas is extracted from a landfill, a change in temperature and pressure occurs that results in the precipitation of moisture from the gas and the production of condensate in the LFG system piping. A minimum of five percent slope on landfill areas for the pipelines is required to effectively drain the condensate. The five percent minimum slope in pipelines on the landfill helps reduce the effects of landfill settlement on the pipelines, minimizing the potential for low points occurring in the pipes.

The condensate from the gas collection system will travel through the LFG system into existing condensate collection devices where the liquid is drained or pumped into the existing leachate collection system.

A calculation performed to estimate the amount of condensate that can be expected from the LFG system during the landfill's peak generation rate estimated in year 2049 (LandGEM report, Attachment A) resulted in a peak generation of approximately 2,296 gallons per day (1.59 gallons per minute). This peak generation accounts for all condensate generated from a final build-out of the Capacity Expansion Area (including future Sections 10 through 12). The condensate generation calculation assumes the temperature of the gas drops from 120 degrees F to 68 degrees F prior to reaching the condensate collection devices. Typically the temperature in the LFG system will be above 90 degrees F, resulting in lower condensate generation than indicated in the calculations for the SCLF. Refer to Attachment A for gas condensate generation calculation.

The capacity of the existing leachate collection system has been evaluated to determine the impacts due to the additional condensate burden. Leachate generated from the LFGCCS condensate and from the Class I disposal areas is pumped from the Main Leachate Pump Station (MLPS) to the Leachate Treatment and Reclamation Facility (LTRF) for treatment or hauled off site for treatment at a wastewater treatment facility. The LTRF consists of a 575,000-gallon leachate storage tank and a 575,000-gallon effluent/leachate storage tank (emergency use only). The leachate from the leachate storage tank is periodically pumped and/or treated offsite. From the 2011 leachate balance summary report submitted to FDEP, Attachment A, an average of 31,889 gallons per day of leachate was produced from the Phases I-VI and Sections 7,8, and 9 and sent to the LTRF, and an average of 31,670 gallons per day was hauled from the LTRF. The existing MLPS is equipped with dual submersible pumps (i.e. one operating and one stand-by). Each submersible pump is rated to pump a maximum discharge of 240 gallons per minute with an on and off cycle based on leachate levels. The estimated leachate generation of 31,889 gallons per day equates to 22.14 gallons per minute; therefore, the existing MLPS is adequate to handle the additional condensate flow. Additionally, the capacity of the LTRF tanks will not be affected by the additional condensate generation from the LFGCCS. For additional information on leachate management, refer to the Leachate Management Plan, dated May 2011.

3.6 Landfill Gas Control Device

The existing landfill candlestick flare station is located south of Section 7 and collects and controls the gas generated in the landfill. The control device is capable of handling 4,700 scfm of gas, which is higher than the GCCS plan flow of 4,000 scfm of landfill gas and the revised EPA LandGEM Model (50% Ash and 50% MSW) for the Landfill for the year 2049. The current flow rate of LFG for Phases I-VI and Sections 7 and 8 is in the range of 2,200 to 2,700 cfm. Operations at the flare station will continue to be conducted in accordance with manufacturer recommendations.

4.0 SYSTEM CONSTRUCTION

4.1 Documentation

Careful documentation must be maintained by the contractor during construction and verified by an experienced construction inspector. The information that must be recorded as the system is constructed includes the following:

- Well location and construction detail, including borehole logs and well construction diagrams for all gas extraction wells;
- Pipeline sizes and types;
- As-built pipelines and appurtenance locations, elevations, and slope verifications;
- Pressure testing of header and lateral pipelines at 10 psi for one hour;
- Documentation of installation, operation, and maintenance procedures for all items supplied by the contractor; and
- As-built drawings for all material installed

At the completion of the construction phase of the project, a professional engineer's certification will be submitted to the FDEP in accordance with Rule 62-701.320(9)(a) F.A.C.

4.2 System Lifespan

The SCLF is subject to the requirements of NSPS for landfills. The existing landfill gas collection system was designed to be active for a period of 15 years from the time of construction. After this time, according to the NSPS, the LFG System could be shut down and decommissioned if gas production from the landfill is no longer adequate to support collection and combustion. However, Florida Solid Waste Rules require that the LFG System be monitored and maintained for a minimum of 30 years after the landfill is closed (62-701.620(1) and (5)).

The long-term care schedule can be reduced with the permission of the FDEP if the owner of operator of the LFG System can effectively demonstrate that the landfill has stabilized to the point where there is minimal generation of combustible gases or objectionable odors. Once closure of LFG System is approved and the active system is decommissioned, as described below, the extraction well could be converted to passive gas vents. Monitoring and maintenance of the gas probes around the perimeter of the landfill and the gas vents of the landfill will continue for 30 years after landfill closure.

4.3 System Decommissioning

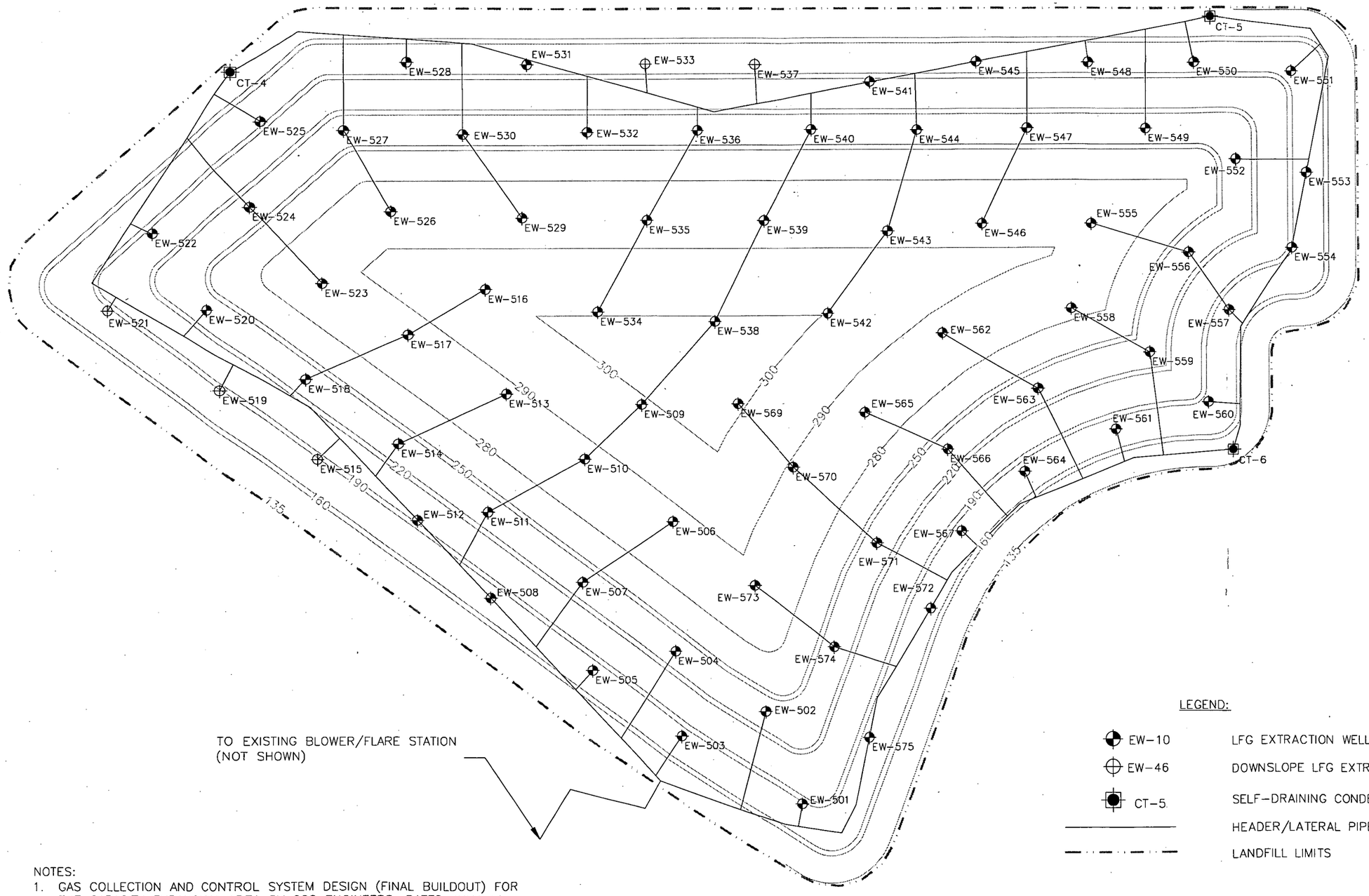
The LFG System can be relatively easily decommissioned if the system sustains irreparable damage or the system is no longer needed to manage gas from the landfill. When the landfill gas collection system is decommissioned, condensate will no longer be generated. Therefore, no collection of the condensate will be necessary. At the time of decommissioning, the gas extraction wells will be modified to allow venting of the remaining gas to the atmosphere. The wells will no longer be connected to the gas collection pipelines, which will either be removed or abandoned. Once the wells are modified, any remaining

condensate in the pipelines will drain through the system and will be conveyed off-site for treatment and disposal. Since no other condensate will be generated in the system, the condensate collection equipment can be removed or abandoned at this time.

To safely and properly decommission the facility, the following tasks will be performed.

- Shut down the landfill gas control device and appurtenant equipment;
- Disconnect the wellheads at each gas well to allow gases still within the collection system to passively vent to the atmosphere and relieve residual pressure in the system. Any remaining condensate in the pipelines will drain through the system and will be conveyed off-site for treatment and disposal. Also any condensate remaining in the bottom of condensate drop-out structure will be drained to the main leachate pump station;
- Locate the inlet pipe to the blower / flare control unit. Once located, this pipe will be cut and sealed. Measurements will be taken to be sure the location can be re-established in the future;
- Disassemble and remove the blower / flare control unit equipment;
- Disassemble yard piping at the blower / flare control unit. Remove the blower / flare control unit as needed for salvage or disposal. Excavate and remove the underground condensate equipment;
- Remove the disassembled equipment from the site for salvage or disposal; and
- If gas collection is no longer necessary, reconstruct gas wellhead assemblies to allow passive venting.

The above steps can be performed in a reasonable period of time and should not require specialty contractors.



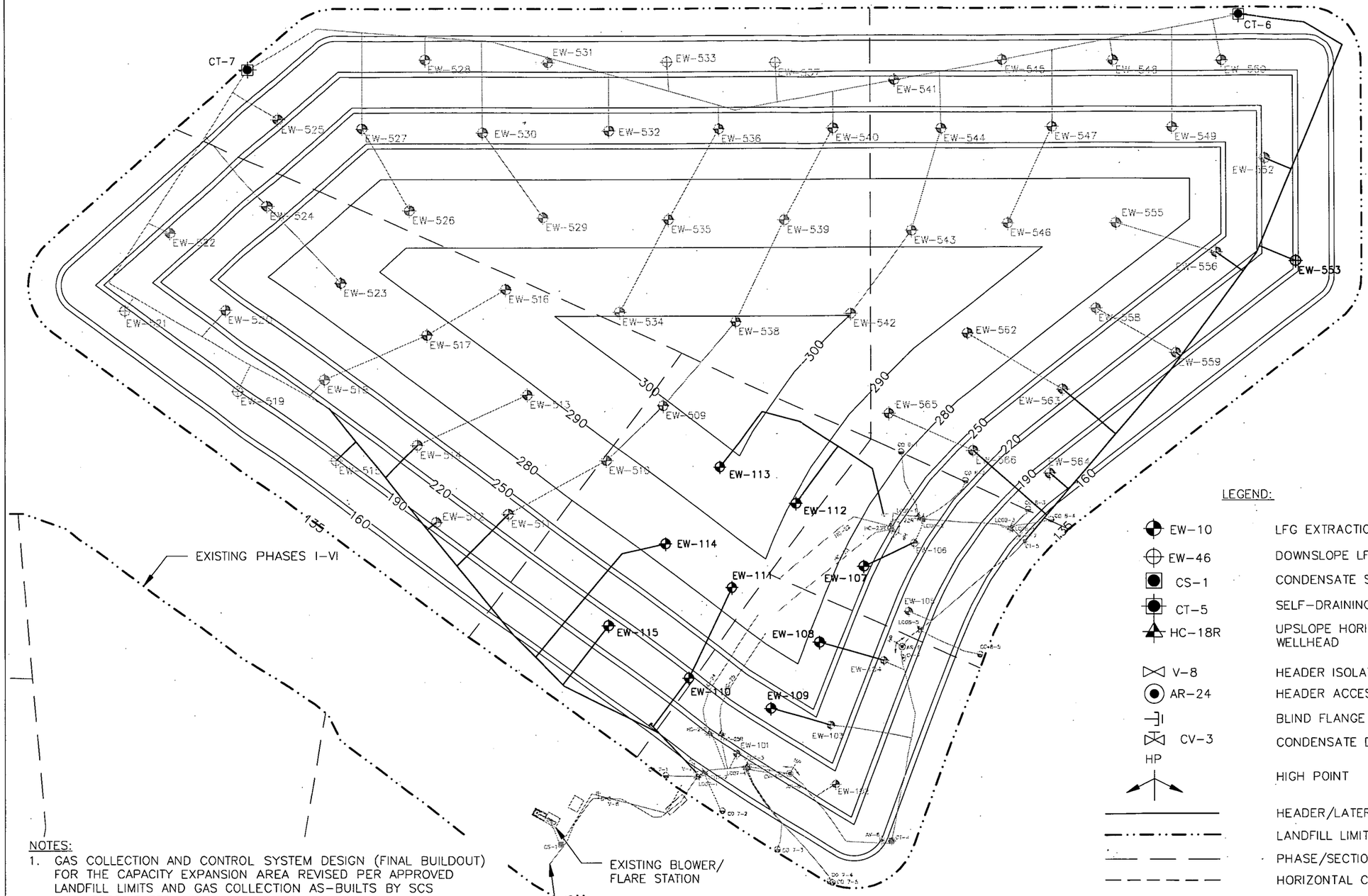
NOTES:
1. GAS COLLECTION AND CONTROL SYSTEM DESIGN (FINAL BUILDOUT) FOR THE CAPACITY EXPANSION AREA BY SCS ENGINEERS, DATED JULY 11, 2008.
2. EW-568 NOT INCLUDED IN CONCEPTUAL DESIGN.

HDR

SCS CONCEPTUAL DESIGN
SECTION 9 LANDFILL GAS SYSTEM EXPANSION
SOUTHEAST COUNTY LANDFILL

DATE
3/2012

FIGURE
1



N

SCALE: 1"=300'

LEGEND:

EW-10	LFG EXTRACTION WELL
EW-46	DOWNSLOPE LFG EXTRACTION WELL
CS-1	CONDENSATE SUMP WITH PUMP
CT-5	SELF-DRAINING CONDENSATE TRAP
HC-18R	UPSLOPE HORIZONTAL COLLECTOR WELLHEAD
V-8	HEADER ISOLATION VALVE
AR-24	HEADER ACCESS RISER
	BLIND FLANGE FOR FUTURE EXPANSION
CV-3	CONDENSATE DRAIN LINE ISOLATION VALVE
HP	HIGH POINT
	HEADER/LATERAL PIPE
	LANDFILL LIMITS
	PHASE/SECTION LIMIT
	HORIZONTAL COLLECTOR PERFORATED PIPE

NOTES:

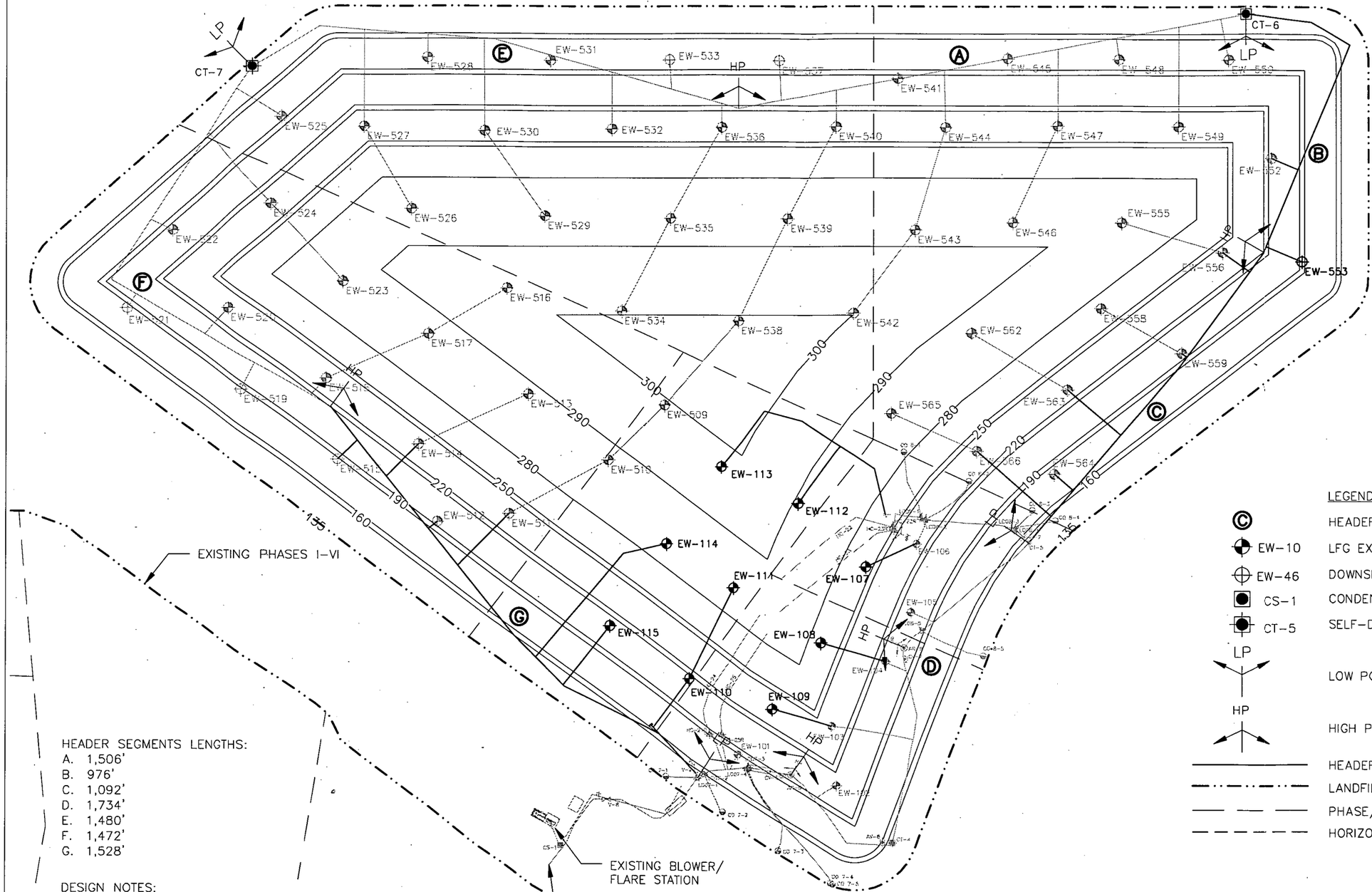
1. GAS COLLECTION AND CONTROL SYSTEM DESIGN (FINAL BUILDOUT) FOR THE CAPACITY EXPANSION AREA REVISED PER APPROVED LANDFILL LIMITS AND GAS COLLECTION AS-BUILTS BY SCS ENGINEERS, DATED OCTOBER 8, 2008.
2. GAS COLLECTION AND CONTROL SYSTEM SHOWN SCREENED BACK WERE PREPARED BY SCS ENGINEERS ON JULY 11, 2008 AND AS-BUILTS ON OCTOBER 8, 2008. ALL LINE WORK SHOWN IN BOLD IS PROPOSED BY HDR ENGINEERING, INC.
3. WELLS EW-501 THROUGH 508, 551, 554, 557, 560, 561, 567 THROUGH 575 WERE DELETED FROM REVISED CONCEPTUAL DESIGN.
4. WELL NUMBER ASSIGNMENTS WILL DIFFER FORM EXISTING CONDITIONS.

HDR

HDR REVISED CONCEPTUAL DESIGN SECTION 9 LANDFILL GAS SYSTEM EXPANSION SOUTHEAST COUNTY LANDFILL

DATE
3/2012

FIGURE
2



N

SCALE: 1"=300'

LEGEND:

Ⓒ	HEADER SEGMENT DESIGNATION
EW-10	LFG EXTRACTION WELL
EW-46	DOWNSLOPE LFG EXTRACTION WELL
CS-1	CONDENSATE SUMP WITH PUMP
CT-5	SELF-DRAINING CONDENSATE TRAP
LP	LOW POINT
HP	HIGH POINT
	HEADER/LATERAL PIPE
	LANDFILL LIMITS
	PHASE/SECTION LIMIT
	HORIZONTAL COLLECTOR PERFORATED PIPE

HEADER SEGMENTS LENGTHS:
A. 1,506'
B. 976'
C. 1,092'
D. 1,734'
E. 1,480'
F. 1,472'
G. 1,528'

DESIGN NOTES:
- MAXIMUM ELEVATION = 285 FT.
- MINIMUM OFSET FROM BOTTOM LINER = 15 FT.
- MINIMUM WELL DEPTH = 40 FT.
- ASSUME BOTTOM LINER DRAINS NORTH AND SOUTH STARTING AT MIDDLE OF CAPACITY EXPANSION AREA
- BOTTOM LINER AT CENTER OF LANDFILL = 131 FT.
- BOTTOM LINER AT PERIMETER OF LANDFILL = 124 FT.

HDR

HEADER SEGMENTS
SECTION 9 LANDFILL GAS SYSTEM EXPANSION
SOUTHEAST COUNTY LANDFILL

DATE
3/2012

FIGURE
3

Table 1

Projected Remaining Capacity and Site Life
Phase I-VI and Capacity Expansion Area (Sections 7, 8, and 9)

Phases I - VI Remaining Gross Air Space[4] =	7,377,092	CY	Phases I - VI Estimated Final Cover Soils =	718,015	CY
CEA Sections 7-9 Remaining Gross Air Space[4] =	**1,696,279**	CY	CEA Section 7-9 Estimated Final Cover Soils =	176,056	CY
Total Gross Remaining Air Space =	9,073,371	CY			

Design Life Estimates from Table Below:			Total Remaining Net Air Space (Gross Air Space - Final Cover Soils) =	8,179,300	CY
CEA Sections 7-9 =	**9.5**	years	Annual Disposal Rate Increase =	1.5%	
Phases I-VI =	25.5	years	Apparent Waste Density =	1,900	lbs/CY

Year	Projected Disposal Rates[1,2]	Diversion to Section 7-9	Diversion to Phases I-VI	Waste to Phases I-VI	Waste to Phases I-VI	Waste to Sections 7-9	Waste to Sections 7-9	Remaining Capacity for Phases I-VI[5]	Remaining Capacity for Sections 7-9[5]
	Tons	%	%	Tons	CY[3]	Tons	CY[3]	CY	CY
2012					Beginning Capacity as of February 1, 2012			6,659,077.00	1,520,223.00
2012	232,833.33	100%	0%	0.00	0.00	232,833.33	245,087.72	6,659,077.00	1,275,135.28
2013	257,810.00	50%	50%	128,905.00	135,689.47	128,905.00	135,689.47	6,523,387.53	1,139,445.81
2014	261,677.15	50%	50%	130,838.58	137,724.82	130,838.58	137,724.82	6,385,662.71	1,001,720.99
2015	265,602.31	50%	50%	132,801.15	139,790.69	132,801.15	139,790.69	6,245,872.02	861,930.30
2016	269,586.34	50%	50%	134,793.17	141,887.55	134,793.17	141,887.55	6,103,984.47	720,042.75
2017	273,630.14	50%	50%	136,815.07	144,015.86	136,815.07	144,015.86	5,959,968.61	576,026.89
2018	277,734.59	50%	50%	138,867.29	146,176.10	138,867.29	146,176.10	5,813,792.51	429,850.79
2019	281,900.61	50%	50%	140,950.30	148,368.74	140,950.30	148,368.74	5,665,423.77	281,482.05
2020	286,129.12	50%	50%	143,064.56	150,594.27	143,064.56	150,594.27	5,514,829.50	130,887.78
2021	290,421.05	43%	57%	166,077.67	174,818.60	124,343.39	**130,887.78**	5,340,010.90	0.00
2022	294,777.37	0%	100%	294,777.37	310,291.97	0.00	0.00	5,029,718.94	0.00
2023	299,199.03	0%	100%	299,199.03	314,946.35	0.00	0.00	4,714,772.59	0.00
2024	303,687.02	0%	100%	303,687.02	319,670.54	0.00	0.00	4,395,102.05	0.00
2025	308,242.32	0%	100%	308,242.32	324,465.60	0.00	0.00	4,070,636.45	0.00
2026	312,865.96	0%	100%	312,865.96	329,332.58	0.00	0.00	3,741,303.86	0.00
2027	317,558.94	0%	100%	317,558.94	334,272.57	0.00	0.00	3,407,031.29	0.00
2028	322,322.33	0%	100%	322,322.33	339,286.66	0.00	0.00	3,067,744.62	0.00
2029	327,157.16	0%	100%	327,157.16	344,375.96	0.00	0.00	2,723,368.66	0.00
2030	332,064.52	0%	100%	332,064.52	349,541.60	0.00	0.00	2,373,827.06	0.00
2031	337,045.49	0%	100%	337,045.49	354,784.73	0.00	0.00	2,019,042.34	0.00
2032	342,101.17	0%	100%	342,101.17	360,106.50	0.00	0.00	1,658,935.84	0.00
2033	347,232.69	0%	100%	347,232.69	365,508.09	0.00	0.00	1,293,427.75	0.00
2034	352,441.18	0%	100%	352,441.18	370,990.72	0.00	0.00	922,437.03	0.00
2035	357,727.80	0%	100%	357,727.80	376,555.58	0.00	0.00	545,881.45	0.00
2036	363,093.71	0%	100%	363,093.71	382,203.91	0.00	0.00	163,677.54	0.00
2037	368,540.12	0%	42%	155,493.66	**163,677.54**	0.00	0.00	0.00	0.00
2038	374,068.22	0%	0%	0.00	0.00	0.00	0.00	0.00	0.00

Notes:

1 Projected disposal rate tonnages based on historical tonnage received and annual increase based on Hillsborough County Planning Commission Population Estimates of 1.5% average annual increases for 2004 - 2025.

2 Disposal rate for 2012 based on 11 months remaining (February 1 - December 31) = 254,000 tons x 11 months / 12 months = 232,833.33 tons.

3 Cubic yard conversion from tons based on 1,900 lbs/cy apparent waste density based on typical waste densities calculated using monthly surveys and tonnage reports by the County.

4 Remaining estimated air space based on Pickett's July 5, 2011 aerial, monthly topographic survey updates through February 1, 2012 and permitted final buildout contours.

5 Remaining volumes and site life calculations based on gross remaining air space. Final cover soil for Phases I-VI has been deducted from the available air space. The total remaining air space for Phases I-VI is 7,377,092.19 cubic yards. From the financial assurance cost estimates, it was estimated that 718,015 cubic yards of final cover soil would be needed for closure of Phases I-VI. Therefore, the total available net remaining air space for waste and daily cover soil is 7,377,092.19 - 718,015 cubic yards = 6,659,077.19 cubic yards. Remaining volumes and site life calculations based on gross remaining air space. Final cover soil for CEA has been deducted from the available air space. The total remaining air space for the CEA (Sections 7-9) is 1,696,279.31 cubic yards. From the financial assurance cost estimates, it was estimated that 176,056 cubic yards of final cover soil would be needed for closure of the CEA (Sections 7-9). Therefore, the total available net remaining air space for waste and daily cover soil is 1,696,279.31 - 176,056 cubic yards = 1,520,223.31 cubic yards.

HDR | ONE COMPANY *Many Solutions*℠

Memo

To: Carlos Restrepo	
From: Braden Johnson	Project: Hillsborough County
CC:	
Date: February 29, 2012	Job No: 171445-002

RE: Waste Volumes for LFG Expansion

Carlos, below are the volumes requested between a compiled surface from Pickett's semi-annual topographic survey dated 7/05/2011, Pickett's previous monthly surveys up to February 1, 2012, and changes to sequences 13, 14, and 15 requested by the County.

The results of the volumes are as follows:

Volume Surface: Volume - 2-1-12 Existing topo vs Sequence 12
Description: Volume in Cubic Yards
Volume Fill: **52,335 (Volume within boundaries of Sequences 10, 11, and 12)**
Compare Surface: CEA_SEQ-12
Base Surface: Monthly Volume Base - Capacity Expansion - 7-5-2011 Topo

Volume Surface: Volume - New Sequence 14
Description: Volume in Cubic Yards
Volume Fill: 132,981.36
Compare Surface: New SEQ - 14x
Base Surface: Existing SEQ13

Volume Surface: Volume - 2-1-12 Existing topo vs Sequence 18
Description: Volume in Cubic Yards
Volume Fill: **1,696,279.31**
Compare Surface: CEA_SEQ-18_FULLBUILD
Base Surface: Monthly Volume Base - Capacity Expansion - 7-5-2011 Topo

Volume Surface: Volume - Sequence 12 vs Sequence 16
Description: Volume in Cubic Yards
Volume Fill: **1,045,476.45**
Compare Surface: CEA_SEQ-16
Base Surface: CEA_SEQ-12

Volume Surface: Volume - Sequence 12 vs Sequence 13
Description: Volume in Cubic Yards
Volume Fill: **170,316.93**
Compare Surface: New_SEQ-13x
Base Surface: Existing_SEQ-12

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Suite 400
Tampa, FL 33609-3444

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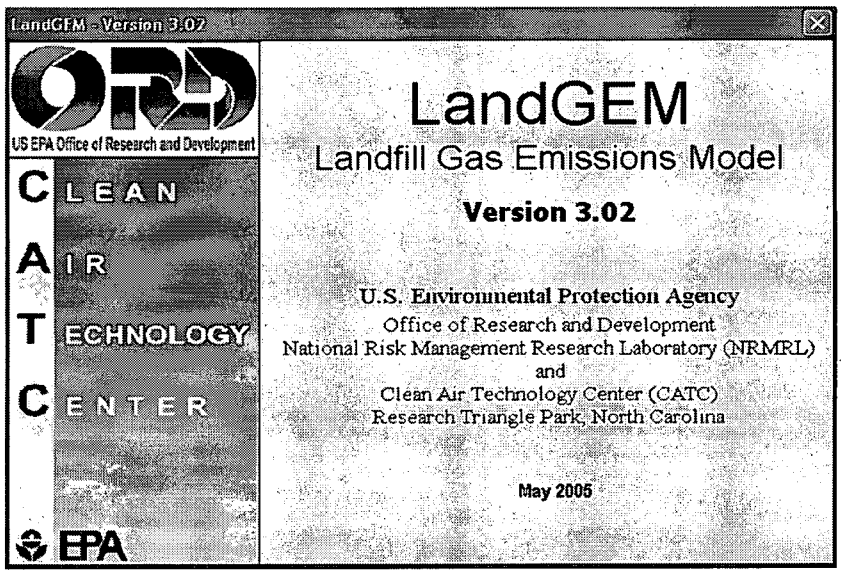
www.hdrinc.com

ATTACHMENT A
DESIGN CALCULATIONS

LandGEM Summary Report



Summary Report

Landfill Name or Identifier: SCLF to Final Build Out - 50% Ash

Date: Wednesday, March 07, 2012

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

Q_{CH_4} = annual methane generation in the year of the calculation (m^3/year)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_o = potential methane generation capacity (m^3/Mg)
M_i = mass of waste accepted in the i^{th} year (Mg)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (decimal years, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**1984**	
Landfill Closure Year (with 80-year limit)	**2048**	
Actual Closure Year (without limit)	***2048***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	$year^{-1}$
Potential Methane Generation Capacity, L_o	**100**	m^3/Mg
NMOC Concentration	**495**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1984	95,057	104,563	0	0
1985	601,024	661,126	95,057	104,563
1986	572,625	629,888	696,081	765,689
1987	379,593	417,552	1,268,706	1,395,577
1988	215,661	237,227	1,648,299	1,813,129
1989	182,767	201,044	1,863,960	2,050,356
1990	155,556	171,112	2,046,727	2,251,400
1991	83,567	91,924	2,202,284	2,422,512
1992	51,386	56,525	2,285,851	2,514,436
1993	57,528	63,281	2,337,237	2,570,961
1994	83,415	91,757	2,394,765	2,634,242
1995	88,364	97,200	2,478,181	2,725,999
1996	113,365	124,701	2,566,545	2,823,199
1997	152,790	168,069	2,679,909	2,947,900
1998	186,911	205,602	2,832,699	3,115,969
1999	275,259	302,785	3,019,610	3,321,571
2000	322,319	354,551	3,294,869	3,624,356
2001	331,295	364,424	3,617,188	3,978,907
2002	244,181	268,599	3,948,483	4,343,331
2003	275,878	303,466	4,192,664	4,611,930
2004	312,875	344,163	4,468,542	4,915,396
2005	350,235	385,259	4,781,417	5,259,559
2006	347,450	382,195	5,131,653	5,644,818
2007	365,576	402,134	5,479,103	6,027,013
2008	298,848	328,733	5,844,679	6,429,147
2009	178,906	196,797	6,143,527	6,757,880
2010	51,829	57,012	6,322,434	6,954,677
2011	118,245	130,069	6,374,263	7,011,689
2012	120,610	132,671	6,492,508	7,141,758
2013	123,022	135,324	6,613,117	7,274,429
2014	125,482	138,031	6,736,139	7,409,753
2015	127,992	140,791	6,861,622	7,547,784
2016	130,552	143,607	6,989,614	7,688,575
2017	133,163	146,479	7,120,166	7,832,182
2018	135,826	149,409	7,253,329	7,978,662
2019	138,543	152,397	7,389,155	8,128,070
2020	141,314	155,445	7,527,698	8,280,467
2021	144,140	158,554	7,669,011	8,435,912
2022	147,023	161,725	7,813,151	8,594,466
2023	149,963	164,959	7,960,174	8,756,191

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2024	152,962	168,259	8,110,137	8,921,151
2025	156,022	171,624	8,263,099	9,089,409
2026	159,142	175,056	8,419,121	9,261,033
2027	162,325	178,557	8,578,263	9,436,089
2028	165,571	182,129	8,740,588	9,614,647
2029	168,883	185,771	8,906,159	9,796,775
2030	172,260	189,487	9,075,042	9,982,546
2031	175,706	193,276	9,247,302	10,172,033
2032	179,220	197,142	9,423,008	10,365,309
2033	182,804	201,085	9,602,228	10,562,451
2034	186,460	205,106	9,785,032	10,763,535
2035	190,189	209,208	9,971,492	10,968,642
2036	193,993	213,393	10,161,682	11,177,850
2037	197,873	217,660	10,355,675	11,391,243
2038	201,831	222,014	10,553,548	11,608,903
2039	205,867	226,454	10,755,379	11,830,917
2040	209,985	230,983	10,961,246	12,057,371
2041	214,184	235,603	11,171,231	12,288,354
2042	218,468	240,315	11,385,415	12,523,956
2043	222,837	245,121	11,603,883	12,764,271
2044	227,294	250,023	11,826,720	13,009,392
2045	231,840	255,024	12,054,014	13,259,416
2046	236,477	260,124	12,285,854	13,514,440
2047	241,206	265,327	12,522,331	13,774,564
2048	246,030	270,633	12,763,537	14,039,891
2049	0	0	13,009,568	14,310,524
2050	0	0	13,009,568	14,310,524
2051	0	0	13,009,568	14,310,524
2052	0	0	13,009,568	14,310,524
2053	0	0	13,009,568	14,310,524
2054	0	0	13,009,568	14,310,524
2055	0	0	13,009,568	14,310,524
2056	0	0	13,009,568	14,310,524
2057	0	0	13,009,568	14,310,524
2058	0	0	13,009,568	14,310,524
2059	0	0	13,009,568	14,310,524
2060	0	0	13,009,568	14,310,524
2061	0	0	13,009,568	14,310,524
2062	0	0	13,009,568	14,310,524
2063	0	0	13,009,568	14,310,524

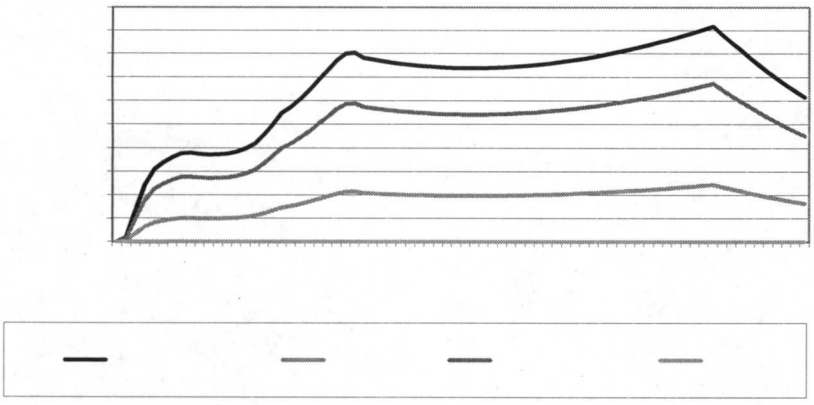
Pollutant Parameters

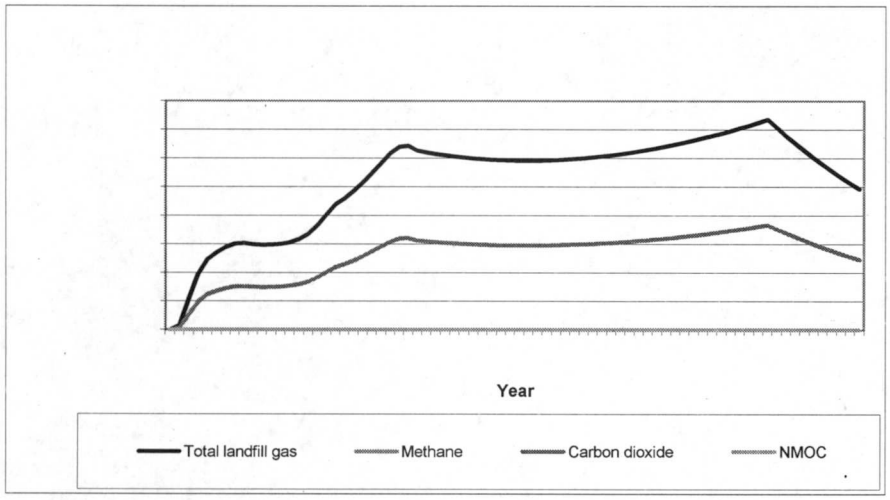
		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

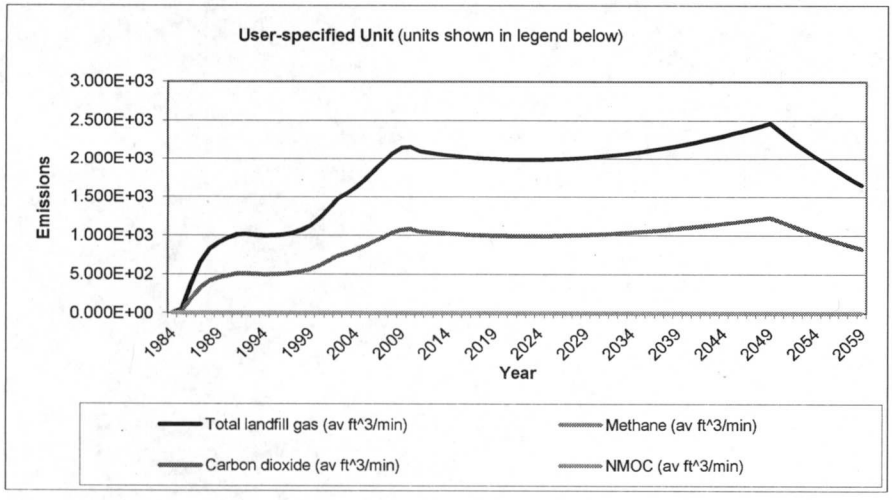
Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs




Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
1984
1989
1994
1999
2004
2009
2014
2019
2024
2029
2034
2039
2044
2049
2054
2059
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1984	0	0	0	0	0	0
1985	9.328E+02	7.469E+05	5.019E+01	2.492E+02	3.735E+05	2.509E+01
1986	6.794E+03	5.440E+06	3.655E+02	1.815E+03	2.720E+06	1.828E+02
1987	1.215E+04	9.727E+06	6.535E+02	3.245E+03	4.863E+06	3.268E+02
1988	1.540E+04	1.233E+07	8.283E+02	4.112E+03	6.164E+06	4.142E+02
1989	1.691E+04	1.354E+07	9.097E+02	4.516E+03	6.770E+06	4.549E+02
1990	1.804E+04	1.444E+07	9.705E+02	4.818E+03	7.222E+06	4.853E+02
1991	1.886E+04	1.510E+07	1.015E+03	5.037E+03	7.550E+06	5.073E+02
1992	1.894E+04	1.517E+07	1.019E+03	5.059E+03	7.583E+06	5.095E+02
1993	1.870E+04	1.497E+07	1.006E+03	4.995E+03	7.487E+06	5.031E+02
1994	1.853E+04	1.484E+07	9.970E+02	4.950E+03	7.420E+06	4.985E+02
1995	1.862E+04	1.491E+07	1.002E+03	4.974E+03	7.456E+06	5.010E+02
1996	1.876E+04	1.502E+07	1.009E+03	5.011E+03	7.511E+06	5.047E+02
1997	1.914E+04	1.532E+07	1.030E+03	5.112E+03	7.662E+06	5.148E+02
1998	1.989E+04	1.592E+07	1.070E+03	5.312E+03	7.962E+06	5.350E+02
1999	2.094E+04	1.677E+07	1.127E+03	5.593E+03	8.384E+06	5.633E+02
2000	2.282E+04	1.827E+07	1.228E+03	6.096E+03	9.137E+06	6.139E+02
2001	2.509E+04	2.009E+07	1.350E+03	6.701E+03	1.004E+07	6.749E+02
2002	2.736E+04	2.191E+07	1.472E+03	7.307E+03	1.095E+07	7.359E+02
2003	2.868E+04	2.297E+07	1.543E+03	7.661E+03	1.148E+07	7.715E+02
2004	3.026E+04	2.423E+07	1.628E+03	8.083E+03	1.212E+07	8.141E+02
2005	3.215E+04	2.574E+07	1.730E+03	8.586E+03	1.287E+07	8.648E+02
2006	3.432E+04	2.748E+07	1.847E+03	9.168E+03	1.374E+07	9.233E+02
2007	3.639E+04	2.914E+07	1.958E+03	9.719E+03	1.457E+07	9.788E+02
2008	3.855E+04	3.087E+07	2.074E+03	1.030E+04	1.543E+07	1.037E+03
2009	3.997E+04	3.200E+07	2.150E+03	1.068E+04	1.600E+07	1.075E+03
2010	4.016E+04	3.216E+07	2.161E+03	1.073E+04	1.608E+07	1.080E+03
2011	3.909E+04	3.130E+07	2.103E+03	1.044E+04	1.565E+07	1.052E+03
2012	3.872E+04	3.100E+07	2.083E+03	1.034E+04	1.550E+07	1.042E+03
2013	3.838E+04	3.074E+07	2.065E+03	1.025E+04	1.537E+07	1.033E+03
014	3.809E+04	3.050E+07	2.049E+03	1.017E+04	1.525E+07	1.025E+03
2015	3.782E+04	3.029E+07	2.035E+03	1.010E+04	1.514E+07	1.017E+03
2016	3.760E+04	3.011E+07	2.023E+03	1.004E+04	1.505E+07	1.011E+03
2017	3.740E+04	2.995E+07	2.012E+03	9.991E+03	1.498E+07	1.006E+03
2018	3.724E+04	2.982E+07	2.004E+03	9.948E+03	1.491E+07	1.002E+03
2019	3.712E+04	2.972E+07	1.997E+03	9.914E+03	1.486E+07	9.985E+02
2020	3.702E+04	2.964E+07	1.992E+03	9.888E+03	1.482E+07	9.959E+02
2021	3.696E+04	2.959E+07	1.988E+03	9.871E+03	1.480E+07	9.941E+02
2022	3.692E+04	2.956E+07	1.986E+03	9.862E+03	1.478E+07	9.932E+02
2023	3.692E+04	2.956E+07	1.986E+03	9.861E+03	1.478E+07	9.931E+02
2024	3.694E+04	2.958E+07	1.987E+03	9.867E+03	1.479E+07	9.937E+02
2025	3.699E+04	2.962E+07	1.990E+03	9.881E+03	1.481E+07	9.951E+02
2026	3.707E+04	2.969E+07	1.995E+03	9.903E+03	1.484E+07	9.973E+02
2027	3.718E+04	2.977E+07	2.000E+03	9.931E+03	1.489E+07	1.000E+03
2028	3.732E+04	2.988E+07	2.008E+03	9.967E+03	1.494E+07	1.004E+03
2029	3.748E+04	3.001E+07	2.016E+03	1.001E+04	1.501E+07	1.008E+03
2030	3.767E+04	3.016E+07	2.026E+03	1.006E+04	1.508E+07	1.013E+03
2031	3.788E+04	3.033E+07	2.038E+03	1.012E+04	1.517E+07	1.019E+03
2032	3.812E+04	3.052E+07	2.051E+03	1.018E+04	1.526E+07	1.025E+03
2033	3.838E+04	3.073E+07	2.065E+03	1.025E+04	1.537E+07	1.033E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2034	3.867E+04	3.097E+07	2.081E+03	1.033E+04	1.548E+07	1.040E+03
2035	3.898E+04	3.122E+07	2.097E+03	1.041E+04	1.561E+07	1.049E+03
2036	3.932E+04	3.149E+07	2.116E+03	1.050E+04	1.574E+07	1.058E+03
2037	3.968E+04	3.178E+07	2.135E+03	1.060E+04	1.589E+07	1.068E+03
2038	4.007E+04	3.209E+07	2.156E+03	1.070E+04	1.604E+07	1.078E+03
2039	4.048E+04	3.241E+07	2.178E+03	1.081E+04	1.621E+07	1.089E+03
2040	4.091E+04	3.276E+07	2.201E+03	1.093E+04	1.638E+07	1.101E+03
2041	4.137E+04	3.313E+07	2.226E+03	1.105E+04	1.656E+07	1.113E+03
2042	4.185E+04	3.351E+07	2.252E+03	1.118E+04	1.675E+07	1.126E+03
2043	4.235E+04	3.391E+07	2.279E+03	1.131E+04	1.696E+07	1.139E+03
2044	4.288E+04	3.433E+07	2.307E+03	1.145E+04	1.717E+07	1.153E+03
2045	4.343E+04	3.477E+07	2.336E+03	1.160E+04	1.739E+07	1.168E+03
2046	4.400E+04	3.523E+07	2.367E+03	1.175E+04	1.762E+07	1.184E+03
2047	4.459E+04	3.571E+07	2.399E+03	1.191E+04	1.785E+07	1.200E+03
2048	4.521E+04	3.620E+07	2.433E+03	1.208E+04	1.810E+07	1.216E+03
2049	4.585E+04	3.672E+07	2.467E+03	1.225E+04	1.836E+07	1.234E+03
2050	4.406E+04	3.528E+07	2.370E+03	1.177E+04	1.764E+07	1.185E+03
2051	4.233E+04	3.389E+07	2.277E+03	1.131E+04	1.695E+07	1.139E+03
2052	4.067E+04	3.257E+07	2.188E+03	1.086E+04	1.628E+07	1.094E+03
2053	3.907E+04	3.129E+07	2.102E+03	1.044E+04	1.564E+07	1.051E+03
2054	3.754E+04	3.006E+07	2.020E+03	1.003E+04	1.503E+07	1.010E+03
2055	3.607E+04	2.888E+07	1.941E+03	9.635E+03	1.444E+07	9.703E+02
2056	3.466E+04	2.775E+07	1.865E+03	9.257E+03	1.388E+07	9.323E+02
2057	3.330E+04	2.666E+07	1.791E+03	8.894E+03	1.333E+07	8.957E+02
2058	3.199E+04	2.562E+07	1.721E+03	8.545E+03	1.281E+07	8.606E+02
2059	3.074E+04	2.461E+07	1.654E+03	8.210E+03	1.231E+07	8.269E+02
2060	2.953E+04	2.365E+07	1.589E+03	7.888E+03	1.182E+07	7.944E+02
2061	2.837E+04	2.272E+07	1.527E+03	7.579E+03	1.136E+07	7.633E+02
2062	2.726E+04	2.183E+07	1.467E+03	7.282E+03	1.091E+07	7.334E+02
2063	2.619E+04	2.097E+07	1.409E+03	6.996E+03	1.049E+07	7.046E+02
2064	2.517E+04	2.015E+07	1.354E+03	6.722E+03	1.008E+07	6.770E+02
2065	2.418E+04	1.936E+07	1.301E+03	6.458E+03	9.680E+06	6.504E+02
2066	2.323E+04	1.860E+07	1.250E+03	6.205E+03	9.301E+06	6.249E+02
2067	2.232E+04	1.787E+07	1.201E+03	5.962E+03	8.936E+06	6.004E+02
2068	2.144E+04	1.717E+07	1.154E+03	5.728E+03	8.586E+06	5.769E+02
2069	2.060E+04	1.650E+07	1.109E+03	5.503E+03	8.249E+06	5.543E+02
2070	1.980E+04	1.585E+07	1.065E+03	5.288E+03	7.926E+06	5.325E+02
2071	1.902E+04	1.523E+07	1.023E+03	5.080E+03	7.615E+06	5.116E+02
2072	1.827E+04	1.463E+07	9.832E+02	4.881E+03	7.316E+06	4.916E+02
2073	1.756E+04	1.406E+07	9.446E+02	4.690E+03	7.029E+06	4.723E+02
2074	1.687E+04	1.351E+07	9.076E+02	4.506E+03	6.754E+06	4.538E+02
2075	1.621E+04	1.298E+07	8.720E+02	4.329E+03	6.489E+06	4.360E+02
2076	1.557E+04	1.247E+07	8.378E+02	4.159E+03	6.235E+06	4.189E+02
2077	1.496E+04	1.198E+07	8.049E+02	3.996E+03	5.990E+06	4.025E+02
2078	1.437E+04	1.151E+07	7.734E+02	3.840E+03	5.755E+06	3.867E+02
2079	1.381E+04	1.106E+07	7.431E+02	3.689E+03	5.530E+06	3.715E+02
2080	1.327E+04	1.063E+07	7.139E+02	3.544E+03	5.313E+06	3.570E+02
2081	1.275E+04	1.021E+07	6.859E+02	3.405E+03	5.104E+06	3.430E+02
2082	1.225E+04	9.809E+06	6.590E+02	3.272E+03	4.904E+06	3.295E+02
2083	1.177E+04	9.424E+06	6.332E+02	3.144E+03	4.712E+06	3.166E+02
2084	1.131E+04	9.054E+06	6.084E+02	3.020E+03	4.527E+06	3.042E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2085	1.086E+04	8.699E+06	5.845E+02	2.902E+03	4.350E+06	2.923E+02
2086	1.044E+04	8.358E+06	5.616E+02	2.788E+03	4.179E+06	2.808E+02
2087	1.003E+04	8.031E+06	5.396E+02	2.679E+03	4.015E+06	2.698E+02
2088	9.636E+03	7.716E+06	5.184E+02	2.574E+03	3.858E+06	2.592E+02
2089	9.258E+03	7.413E+06	4.981E+02	2.473E+03	3.707E+06	2.490E+02
2090	8.895E+03	7.122E+06	4.786E+02	2.376E+03	3.561E+06	2.393E+02
2091	8.546E+03	6.843E+06	4.598E+02	2.283E+03	3.422E+06	2.299E+02
2092	8.211E+03	6.575E+06	4.418E+02	2.193E+03	3.287E+06	2.209E+02
2093	7.889E+03	6.317E+06	4.244E+02	2.107E+03	3.159E+06	2.122E+02
2094	7.580E+03	6.069E+06	4.078E+02	2.025E+03	3.035E+06	2.039E+02
2095	7.282E+03	5.831E+06	3.918E+02	1.945E+03	2.916E+06	1.959E+02
2096	6.997E+03	5.603E+06	3.764E+02	1.869E+03	2.801E+06	1.882E+02
2097	6.722E+03	5.383E+06	3.617E+02	1.796E+03	2.692E+06	1.808E+02
2098	6.459E+03	5.172E+06	3.475E+02	1.725E+03	2.586E+06	1.738E+02
2099	6.206E+03	4.969E+06	3.339E+02	1.658E+03	2.485E+06	1.669E+02
2100	5.962E+03	4.774E+06	3.208E+02	1.593E+03	2.387E+06	1.604E+02
2101	5.729E+03	4.587E+06	3.082E+02	1.530E+03	2.294E+06	1.541E+02
2102	5.504E+03	4.407E+06	2.961E+02	1.470E+03	2.204E+06	1.481E+02
2103	5.288E+03	4.234E+06	2.845E+02	1.413E+03	2.117E+06	1.423E+02
2104	5.081E+03	4.068E+06	2.734E+02	1.357E+03	2.034E+06	1.367E+02
2105	4.882E+03	3.909E+06	2.626E+02	1.304E+03	1.954E+06	1.313E+02
2106	4.690E+03	3.756E+06	2.523E+02	1.253E+03	1.878E+06	1.262E+02
2107	4.506E+03	3.608E+06	2.424E+02	1.204E+03	1.804E+06	1.212E+02
2108	4.330E+03	3.467E+06	2.329E+02	1.156E+03	1.733E+06	1.165E+02
2109	4.160E+03	3.331E+06	2.238E+02	1.111E+03	1.665E+06	1.119E+02
2110	3.997E+03	3.200E+06	2.150E+02	1.068E+03	1.600E+06	1.075E+02
2111	3.840E+03	3.075E+06	2.066E+02	1.026E+03	1.537E+06	1.033E+02
2112	3.689E+03	2.954E+06	1.985E+02	9.855E+02	1.477E+06	9.925E+01
2113	3.545E+03	2.838E+06	1.907E+02	9.468E+02	1.419E+06	9.536E+01
2114	3.406E+03	2.727E+06	1.832E+02	9.097E+02	1.364E+06	9.162E+01
2115	3.272E+03	2.620E+06	1.761E+02	8.740E+02	1.310E+06	8.803E+01
2116	3.144E+03	2.517E+06	1.691E+02	8.398E+02	1.259E+06	8.457E+01
2117	3.021E+03	2.419E+06	1.625E+02	8.068E+02	1.209E+06	8.126E+01
2118	2.902E+03	2.324E+06	1.561E+02	7.752E+02	1.162E+06	7.807E+01
2119	2.788E+03	2.233E+06	1.500E+02	7.448E+02	1.116E+06	7.501E+01
2120	2.679E+03	2.145E+06	1.441E+02	7.156E+02	1.073E+06	7.207E+01
2121	2.574E+03	2.061E+06	1.385E+02	6.875E+02	1.031E+06	6.924E+01
2122	2.473E+03	1.980E+06	1.331E+02	6.606E+02	9.902E+05	6.653E+01
2123	2.376E+03	1.903E+06	1.278E+02	6.347E+02	9.513E+05	6.392E+01
2124	2.283E+03	1.828E+06	1.228E+02	6.098E+02	9.140E+05	6.141E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1984	0	0	0	0	0	0
1985	6.836E+02	3.735E+05	2.509E+01	1.325E+00	3.697E+02	2.484E-02
1986	4.979E+03	2.720E+06	1.828E+02	9.653E+00	2.693E+03	1.809E-01
1987	8.902E+03	4.863E+06	3.268E+02	1.726E+01	4.815E+03	3.235E-01
1988	1.128E+04	6.164E+06	4.142E+02	2.187E+01	6.102E+03	4.100E-01
1989	1.239E+04	6.770E+06	4.549E+02	2.402E+01	6.702E+03	4.503E-01
1990	1.322E+04	7.222E+06	4.853E+02	2.563E+01	7.150E+03	4.804E-01
1991	1.382E+04	7.550E+06	5.073E+02	2.679E+01	7.475E+03	5.022E-01
1992	1.388E+04	7.583E+06	5.095E+02	2.691E+01	7.507E+03	5.044E-01
1993	1.371E+04	7.487E+06	5.031E+02	2.657E+01	7.412E+03	4.980E-01
1994	1.358E+04	7.420E+06	4.985E+02	2.633E+01	7.345E+03	4.935E-01
1995	1.365E+04	7.456E+06	5.010E+02	2.646E+01	7.382E+03	4.960E-01
1996	1.375E+04	7.511E+06	5.047E+02	2.665E+01	7.436E+03	4.996E-01
1997	1.403E+04	7.662E+06	5.148E+02	2.719E+01	7.585E+03	5.097E-01
1998	1.457E+04	7.962E+06	5.350E+02	2.825E+01	7.882E+03	5.296E-01
1999	1.535E+04	8.384E+06	5.633E+02	2.975E+01	8.300E+03	5.577E-01
2000	1.672E+04	9.137E+06	6.139E+02	3.242E+01	9.045E+03	6.078E-01
2001	1.839E+04	1.004E+07	6.749E+02	3.565E+01	9.944E+03	6.682E-01
2002	2.005E+04	1.095E+07	7.359E+02	3.887E+01	1.084E+04	7.285E-01
2003	2.102E+04	1.148E+07	7.715E+02	4.075E+01	1.137E+04	7.638E-01
2004	2.218E+04	1.212E+07	8.141E+02	4.300E+01	1.200E+04	8.059E-01
2005	2.356E+04	1.287E+07	8.648E+02	4.567E+01	1.274E+04	8.561E-01
2006	2.515E+04	1.374E+07	9.233E+02	4.876E+01	1.360E+04	9.141E-01
2007	2.667E+04	1.457E+07	9.788E+02	5.170E+01	1.442E+04	9.690E-01
2008	2.825E+04	1.543E+07	1.037E+03	5.477E+01	1.528E+04	1.027E+00
2009	2.929E+04	1.600E+07	1.075E+03	5.679E+01	1.584E+04	1.064E+00
2010	2.943E+04	1.608E+07	1.080E+03	5.705E+01	1.592E+04	1.069E+00
2011	2.865E+04	1.565E+07	1.052E+03	5.554E+01	1.549E+04	1.041E+00
2012	2.838E+04	1.550E+07	1.042E+03	5.501E+01	1.535E+04	1.031E+00
2013	2.813E+04	1.537E+07	1.033E+03	5.453E+01	1.521E+04	1.022E+00
014	2.791E+04	1.525E+07	1.025E+03	5.411E+01	1.510E+04	1.014E+00
2015	2.772E+04	1.514E+07	1.017E+03	5.374E+01	1.499E+04	1.007E+00
2016	2.755E+04	1.505E+07	1.011E+03	5.342E+01	1.490E+04	1.001E+00
2017	2.741E+04	1.498E+07	1.006E+03	5.314E+01	1.483E+04	9.961E-01
2018	2.730E+04	1.491E+07	1.002E+03	5.291E+01	1.476E+04	9.919E-01
2019	2.720E+04	1.486E+07	9.985E+02	5.273E+01	1.471E+04	9.885E-01
2020	2.713E+04	1.482E+07	9.959E+02	5.260E+01	1.467E+04	9.859E-01
2021	2.708E+04	1.480E+07	9.941E+02	5.251E+01	1.465E+04	9.842E-01
2022	2.706E+04	1.478E+07	9.932E+02	5.246E+01	1.463E+04	9.833E-01
2023	2.706E+04	1.478E+07	9.931E+02	5.245E+01	1.463E+04	9.831E-01
2024	2.707E+04	1.479E+07	9.937E+02	5.248E+01	1.464E+04	9.838E-01
2025	2.711E+04	1.481E+07	9.951E+02	5.256E+01	1.466E+04	9.852E-01
2026	2.717E+04	1.484E+07	9.973E+02	5.267E+01	1.469E+04	9.873E-01
2027	2.725E+04	1.489E+07	1.000E+03	5.283E+01	1.474E+04	9.902E-01
2028	2.735E+04	1.494E+07	1.004E+03	5.302E+01	1.479E+04	9.938E-01
2029	2.747E+04	1.501E+07	1.008E+03	5.325E+01	1.486E+04	9.981E-01
2030	2.760E+04	1.508E+07	1.013E+03	5.351E+01	1.493E+04	1.003E+00
2031	2.776E+04	1.517E+07	1.019E+03	5.382E+01	1.501E+04	1.009E+00
2032	2.794E+04	1.526E+07	1.025E+03	5.416E+01	1.511E+04	1.015E+00
2033	2.813E+04	1.537E+07	1.033E+03	5.453E+01	1.521E+04	1.022E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2034	2.834E+04	1.548E+07	1.040E+03	5.494E+01	1.533E+04	1.030E+00
2035	2.857E+04	1.561E+07	1.049E+03	5.539E+01	1.545E+04	1.038E+00
2036	2.882E+04	1.574E+07	1.058E+03	5.587E+01	1.559E+04	1.047E+00
2037	2.908E+04	1.589E+07	1.068E+03	5.638E+01	1.573E+04	1.057E+00
2038	2.937E+04	1.604E+07	1.078E+03	5.693E+01	1.588E+04	1.067E+00
2039	2.967E+04	1.621E+07	1.089E+03	5.751E+01	1.604E+04	1.078E+00
2040	2.998E+04	1.638E+07	1.101E+03	5.813E+01	1.622E+04	1.090E+00
2041	3.032E+04	1.656E+07	1.113E+03	5.878E+01	1.640E+04	1.102E+00
2042	3.067E+04	1.675E+07	1.126E+03	5.946E+01	1.659E+04	1.115E+00
2043	3.104E+04	1.696E+07	1.139E+03	6.017E+01	1.679E+04	1.128E+00
2044	3.142E+04	1.717E+07	1.153E+03	6.092E+01	1.700E+04	1.142E+00
2045	3.183E+04	1.739E+07	1.168E+03	6.170E+01	1.721E+04	1.157E+00
2046	3.225E+04	1.762E+07	1.184E+03	6.251E+01	1.744E+04	1.172E+00
2047	3.268E+04	1.785E+07	1.200E+03	6.336E+01	1.768E+04	1.188E+00
2048	3.314E+04	1.810E+07	1.216E+03	6.424E+01	1.792E+04	1.204E+00
2049	3.361E+04	1.836E+07	1.234E+03	6.515E+01	1.818E+04	1.221E+00
2050	3.229E+04	1.764E+07	1.185E+03	6.259E+01	1.746E+04	1.173E+00
2051	3.102E+04	1.695E+07	1.139E+03	6.014E+01	1.678E+04	1.127E+00
2052	2.981E+04	1.628E+07	1.094E+03	5.778E+01	1.612E+04	1.083E+00
2053	2.864E+04	1.564E+07	1.051E+03	5.552E+01	1.549E+04	1.041E+00
2054	2.751E+04	1.503E+07	1.010E+03	5.334E+01	1.488E+04	9.998E-01
2055	2.644E+04	1.444E+07	9.703E+02	5.125E+01	1.430E+04	9.606E-01
2056	2.540E+04	1.388E+07	9.323E+02	4.924E+01	1.374E+04	9.230E-01
2057	2.440E+04	1.333E+07	8.957E+02	4.731E+01	1.320E+04	8.868E-01
2058	2.345E+04	1.281E+07	8.606E+02	4.545E+01	1.268E+04	8.520E-01
2059	2.253E+04	1.231E+07	8.269E+02	4.367E+01	1.218E+04	8.186E-01
2060	2.164E+04	1.182E+07	7.944E+02	4.196E+01	1.171E+04	7.865E-01
2061	2.079E+04	1.136E+07	7.633E+02	4.031E+01	1.125E+04	7.557E-01
2062	1.998E+04	1.091E+07	7.334E+02	3.873E+01	1.081E+04	7.260E-01
2063	1.920E+04	1.049E+07	7.046E+02	3.721E+01	1.038E+04	6.976E-01
2064	1.844E+04	1.008E+07	6.770E+02	3.575E+01	9.975E+03	6.702E-01
2065	1.772E+04	9.680E+06	6.504E+02	3.435E+01	9.584E+03	6.439E-01
2066	1.703E+04	9.301E+06	6.249E+02	3.301E+01	9.208E+03	6.187E-01
2067	1.636E+04	8.936E+06	6.004E+02	3.171E+01	8.847E+03	5.944E-01
2068	1.572E+04	8.586E+06	5.769E+02	3.047E+01	8.500E+03	5.711E-01
2069	1.510E+04	8.249E+06	5.543E+02	2.927E+01	8.167E+03	5.487E-01
2070	1.451E+04	7.926E+06	5.325E+02	2.813E+01	7.846E+03	5.272E-01
2071	1.394E+04	7.615E+06	5.116E+02	2.702E+01	7.539E+03	5.065E-01
2072	1.339E+04	7.316E+06	4.916E+02	2.596E+01	7.243E+03	4.867E-01
2073	1.287E+04	7.029E+06	4.723E+02	2.494E+01	6.959E+03	4.676E-01
2074	1.236E+04	6.754E+06	4.538E+02	2.397E+01	6.686E+03	4.493E-01
2075	1.188E+04	6.489E+06	4.360E+02	2.303E+01	6.424E+03	4.316E-01
2076	1.141E+04	6.235E+06	4.189E+02	2.212E+01	6.172E+03	4.147E-01
2077	1.096E+04	5.990E+06	4.025E+02	2.126E+01	5.930E+03	3.984E-01
2078	1.053E+04	5.755E+06	3.867E+02	2.042E+01	5.698E+03	3.828E-01
2079	1.012E+04	5.530E+06	3.715E+02	1.962E+01	5.474E+03	3.678E-01
2080	9.725E+03	5.313E+06	3.570E+02	1.885E+01	5.260E+03	3.534E-01
2081	9.344E+03	5.104E+06	3.430E+02	1.811E+01	5.053E+03	3.395E-01
2082	8.977E+03	4.904E+06	3.295E+02	1.740E+01	4.855E+03	3.262E-01
2083	8.625E+03	4.712E+06	3.166E+02	1.672E+01	4.665E+03	3.134E-01
2084	8.287E+03	4.527E+06	3.042E+02	1.607E+01	4.482E+03	3.011E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2085	7.962E+03	4.350E+06	2.923E+02	1.544E+01	4.306E+03	2.893E-01
2086	7.650E+03	4.179E+06	2.808E+02	1.483E+01	4.137E+03	2.780E-01
2087	7.350E+03	4.015E+06	2.698E+02	1.425E+01	3.975E+03	2.671E-01
2088	7.062E+03	3.858E+06	2.592E+02	1.369E+01	3.819E+03	2.566E-01
2089	6.785E+03	3.707E+06	2.490E+02	1.315E+01	3.670E+03	2.466E-01
2090	6.519E+03	3.561E+06	2.393E+02	1.264E+01	3.526E+03	2.369E-01
2091	6.263E+03	3.422E+06	2.299E+02	1.214E+01	3.387E+03	2.276E-01
2092	6.018E+03	3.287E+06	2.209E+02	1.167E+01	3.255E+03	2.187E-01
2093	5.782E+03	3.159E+06	2.122E+02	1.121E+01	3.127E+03	2.101E-01
2094	5.555E+03	3.035E+06	2.039E+02	1.077E+01	3.004E+03	2.019E-01
2095	5.337E+03	2.916E+06	1.959E+02	1.035E+01	2.887E+03	1.939E-01
2096	5.128E+03	2.801E+06	1.882E+02	9.941E+00	2.773E+03	1.863E-01
2097	4.927E+03	2.692E+06	1.808E+02	9.551E+00	2.665E+03	1.790E-01
2098	4.734E+03	2.586E+06	1.738E+02	9.177E+00	2.560E+03	1.720E-01
2099	4.548E+03	2.485E+06	1.669E+02	8.817E+00	2.460E+03	1.653E-01
2100	4.370E+03	2.387E+06	1.604E+02	8.471E+00	2.363E+03	1.588E-01
2101	4.198E+03	2.294E+06	1.541E+02	8.139E+00	2.271E+03	1.526E-01
2102	4.034E+03	2.204E+06	1.481E+02	7.820E+00	2.182E+03	1.466E-01
2103	3.876E+03	2.117E+06	1.423E+02	7.513E+00	2.096E+03	1.408E-01
2104	3.724E+03	2.034E+06	1.367E+02	7.219E+00	2.014E+03	1.353E-01
2105	3.578E+03	1.954E+06	1.313E+02	6.936E+00	1.935E+03	1.300E-01
2106	3.437E+03	1.878E+06	1.262E+02	6.664E+00	1.859E+03	1.249E-01
2107	3.303E+03	1.804E+06	1.212E+02	6.402E+00	1.786E+03	1.200E-01
2108	3.173E+03	1.733E+06	1.165E+02	6.151E+00	1.716E+03	1.153E-01
2109	3.049E+03	1.665E+06	1.119E+02	5.910E+00	1.649E+03	1.108E-01
2110	2.929E+03	1.600E+06	1.075E+02	5.678E+00	1.584E+03	1.064E-01
2111	2.814E+03	1.537E+06	1.033E+02	5.456E+00	1.522E+03	1.023E-01
2112	2.704E+03	1.477E+06	9.925E+01	5.242E+00	1.462E+03	9.826E-02
2113	2.598E+03	1.419E+06	9.536E+01	5.036E+00	1.405E+03	9.440E-02
2114	2.496E+03	1.364E+06	9.162E+01	4.839E+00	1.350E+03	9.070E-02
2115	2.398E+03	1.310E+06	8.803E+01	4.649E+00	1.297E+03	8.715E-02
2116	2.304E+03	1.259E+06	8.457E+01	4.467E+00	1.246E+03	8.373E-02
2117	2.214E+03	1.209E+06	8.126E+01	4.292E+00	1.197E+03	8.045E-02
2118	2.127E+03	1.162E+06	7.807E+01	4.123E+00	1.150E+03	7.729E-02
2119	2.044E+03	1.116E+06	7.501E+01	3.962E+00	1.105E+03	7.426E-02
2120	1.963E+03	1.073E+06	7.207E+01	3.806E+00	1.062E+03	7.135E-02
2121	1.886E+03	1.031E+06	6.924E+01	3.657E+00	1.020E+03	6.855E-02
2122	1.812E+03	9.902E+05	6.653E+01	3.514E+00	9.803E+02	6.586E-02
2123	1.741E+03	9.513E+05	6.392E+01	3.376E+00	9.418E+02	6.328E-02
2124	1.673E+03	9.140E+05	6.141E+01	3.244E+00	9.049E+02	6.080E-02

Pipe Sizing Calculations

Landfill Gas Pipe Sizing Program Version 1.0

Pipe Description A

General Design Assumptions:

1. Design flow from each well head is	405	cfm
2. Length of Pipe	1506.0	feet
3. Absolute roughness for HDPE	0.00007	feet
4. Number of wells contributing flow	1	
5. Vacuum available @ downstream point	-40	in w.c.
6. SDR 17 HDPE		
7. Absolute Roughness	0.00007	feet

General LFG Assumptions:

1. Absolute viscosity of LFG	8.14E-06	lbm/feet-second
2. Specific Gravity of LFG=Air	1	
3. MW of LFG =Air	28.9625	
4. Vapor Density	0.065	lb/ft^3

Calculations

Pipe Dia. Nominal	Pipe ID	Flow cfm	Velocity ft/sec	Reynolds Number	Darcy Fric. Fact	Delta P Dar-Weis	E/d	Mueller
2	2.095	405	282.12	393296.7	0.0158	2106.1	0.000401	1749.86
3	3.088	405	129.85	266825.3	0.0158	302.7	0.000272	278.29
4	3.97	405	78.56	207545.7	0.0149	81.3	0.000212	84.60
6	5.845	405	36.24	140967.8	0.0135	10.6	0.000144	13.53
8	7.981	405	19.44	103239.8	0.0128	2.1	0.000105	3.09
10	9.486	405	13.76	86860.27	0.0125	0.9	0.000089	1.36
12	11.25	405	9.78	73240.58	0.0124	0.4	0.000075	0.61
14	12.352	405	8.12	66706.33	0.0128	0.2	0.000068	0.39
16	14.118	405	6.21	58362.13	0.0129	0.1	0.000059	0.21

EW	Well Depth (ft)	Assumed cfm
537	50	20
538	155	35
539	141	35
540	110	35
541	50	20
542	155	35
543	142	35
544	110	35
545	48	20
546	144	35
547	106	30
548	49	20
549	108	30
550	50	20
	Total cfm	405

Landfill Gas Pipe Sizing Program Version 1.0

Pipe Description B

General Design Assumptions:

1. Design flow from each well head is	450	cfm
2. Length of Pipe	976.0	feet
3. Absolute roughness for HDPE	0.00007	feet
4. Number of wells contributing flow	1	
5. Vacuum available @ downstream point	-40	in w.c.
6. SDR 17 HDPE		
7. Absolute Roughness	0.00007	feet

General LFG Assumptions:

1. Absolute viscosity of LFG	8.14E-06	lbm/feet-second
2. Specific Gravity of LFG=Air	1	
3. MW of LFG =Air	28.9625	
4. Vapor Density	0.065	lb/ft^3

Calculations

Pipe Dia. Nominal	Pipe ID	Flow cfm	Velocity ft/sec	Reynolds Number	Darcy Fric. Fact	Delta P Dar-Weis	E/d	Mueller
2	2.095	450	313.46	436996.3	0.0158	1685.1	0.000401	1362.09
3	3.088	450	144.28	296472.6	0.0158	242.2	0.000272	216.62
4	3.97	450	87.29	230606.4	0.0149	65.0	0.000212	65.86
6	5.845	450	40.27	156630.8	0.0135	8.5	0.000144	10.53
8	7.981	450	21.60	114710.8	0.0128	1.7	0.000105	2.41
10	9.486	450	15.29	96511.42	0.0125	0.7	0.000089	1.06
12	11.25	450	10.87	81378.43	0.0124	0.3	0.000075	0.47
14	12.352	450	9.02	74118.14	0.0128	0.2	0.000068	0.30
16	14.118	450	6.90	64846.81	0.0129	0.1	0.000059	0.16

EW	Well Depth (ft)	Assumed cfm
552	83	25
553	41	20
	Total cfm	45

Landfill Gas Pipe Sizing Program Version 1.0

Pipe Description C

General Design Assumptions:

1. Design flow from each well head is	695	cfm
2. Length of Pipe	1092.0	feet
3. Absolute roughness for HDPE	0.00007	feet
4. Number of wells contributing flow	1	
5. Vacuum available @ downstream point	-40	in w.c.
6. SDR 17 HDPE		
7. Absolute Roughness	0.00007	feet

General LFG Assumptions:

1. Absolute viscosity of LFG	8.14E-06	lbm/feet-second
2. Specific Gravity of LFG=Air	1	
3. MW of LFG =Air	28.9625	
4. Vapor Density	0.065	lb/ft^3

Calculations

Pipe Dia. Nominal	Pipe ID	Flow cfm	Velocity ft/sec	Reynolds Number	Darcy Fric. Fact	Delta P Dar-Weis	E/d	Mueller
2	2.095	695	484.13	674916.5	0.0158	4497.2	0.000401	3245.4742
3	3.088	695	222.83	457885.4	0.0158	646.4	0.000272	516.1389
4	3.97	695	134.82	356158.7	0.0149	173.6	0.000212	156.9151
6	5.845	695	62.20	241907.6	0.0135	22.7	0.000144	25.0911
8	7.981	695	33.36	177164.5	0.0128	4.5	0.000105	5.7338
10	9.486	695	23.61	149056.5	0.0125	1.9	0.000089	2.5286
12	11.25	695	16.79	125684.5	0.0124	0.8	0.000075	1.1268
14	12.352	695	13.93	114471.4	0.0128	0.5	0.000068	0.7236
16	14.118	695	10.66	100152.3	0.0129	0.3	0.000059	0.3841

EW	Well Depth (ft)	Assumed cfm
555	142	35
556	107	35
558	127	35
559	47	15
562	141	35
563	76	20
564	45	15
565	139	35
566	94	20
	Total cfm	245

Landfill Gas Pipe Sizing Program Version 1.0

Pipe Description D (Existing 16-inch Header Line)

General Design Assumptions:

1. Design flow from each well head is	915	cfm
2. Length of Pipe	1734	feet
3. Absolute roughness for HDPE	0.00007	feet
4. Number of wells contributing flow	1	
5. Vacuum available @ downstream point	-40	in w.c.
6. SDR 17 HDPE		
7. Absolute Roughness	0.00007	feet

General LFG Assumptions:

1. Absolute viscosity of LFG	8.14E-06	lbm/feet-second
2. Specific Gravity of LFG=Air	1	
3. MW of LFG =Air	28.9625	
4. Vapor Density	0.065	lb/ft^3

Calculations

Pipe Dia. Nominal	Pipe ID	Flow cfm	Velocity ft/sec	Reynolds Number	Darcy Fric. Fact	Delta P Dar-Weis	E/d	Mueller
2	2.095	915	637.37	888559.2	0.0158	12377.6	0.000401	8314.19
3	3.088	915	293.36	602827.6	0.0158	1779.0	0.000272	1322.23
4	3.97	915	177.49	468899.6	0.0149	477.7	0.000212	401.98
6	5.845	915	81.88	318482.7	0.0135	62.6	0.000144	64.28
8	7.981	915	43.92	233245.4	0.0128	12.5	0.000105	14.69
10	9.486	915	31.09	196239.9	0.0125	5.1	0.000089	6.48
12	11.25	915	22.10	165469.5	0.0124	2.2	0.000075	2.89
14	12.352	915	18.34	150706.9	0.0128	1.4	0.000068	1.85
16	14.118	915	14.04	131855.2	0.0129	0.7	0.000059	0.98
18	15.882	915	11.09	117210.1	0.0129	0.4	0.000053	0.56
20	17.648	915	8.98	105481.2	0.0130	0.2	0.000048	0.34

EW	Well Depth (ft)	Assumed cfm
113	62	20
112	62	20
109	66	20
108	71	20
107	66	20
106	75	25
105	66	20
104	67	20
103	94	20
102	71	20
101	51	15
	Total cfm	220

Landfill Gas Pipe Sizing Program Version 1.0

Pipe Description E

General Design Assumptions:

1. Design flow from each well head is	320	cfm
2. Length of Pipe	1480	feet
3. Absolute roughness for HDPE	0.00007	feet
4. Number of wells contributing flow	1	
5. Vacuum available @ downstream point	-40	in w.c.
6. SDR 17 HDPE		
7. Absolute Roughness	0.00007	feet

General LFG Assumptions:

1. Absolute viscosity of LFG	8.14E-06	lbm/feet-second
2. Specific Gravity of LFG=Air	1	
3. MW of LFG =Air	28.9625	
4. Vapor Density	0.065	lb/ft^3

Calculations

Pipe Dia. Nominal	Pipe ID	Flow cfm	Velocity ft/sec	Reynolds Number	Darcy Fric. Fact	Delta P Dar-Weis	E/d	Mueller
2	2.095	320	222.91	310752.9	0.0158	1292.1	0.000401	1141.61
3	3.088	320	102.60	210824.9	0.0158	185.7	0.000272	181.55
4	3.97	320	62.07	163986.8	0.0149	49.9	0.000212	55.20
6	5.845	320	28.64	111381.9	0.0135	6.5	0.000144	8.83
8	7.981	320	15.36	81572.16	0.0128	1.3	0.000105	2.02
10	9.486	320	10.87	68630.34	0.0125	0.5	0.000089	0.89
12	11.25	320	7.73	57869.1	0.0124	0.2	0.000075	0.40
14	12.352	320	6.41	52706.23	0.0128	0.1	0.000068	0.25
16	14.118	320	4.91	46113.29	0.0129	0.1	0.000059	0.14

EW	Well Depth (ft)	Assumed cfm
526	139	35
527	90	30
528	41	20
529	140	35
530	101	30
531	42	20
532	101	30
533	42	20
534	154	35
535	140	35
536	102	30
	Total cfm	320

Landfill Gas Pipe Sizing Program Version 1.0

Pipe Description F

General Design Assumptions:

1. Design flow from each well head is	575	cfm
2. Length of Pipe	1472	feet
3. Absolute roughness for HDPE	0.00007	feet
4. Number of wells contributing flow	1	
5. Vacuum available @ downstream point	-40	in w.c.
6. SDR 17 HDPE		
7. Absolute Roughness	0.00007	feet

General LFG Assumptions:

1. Absolute viscosity of LFG	8.14E-06	lbm/feet-second
2. Specific Gravity of LFG=Air	1	
3. MW of LFG =Air	28.9625	
4. Vapor Density	0.065	lb/ft^3

Calculations

Pipe Dia. Nominal	Pipe ID	Flow cfm	Velocity ft/sec	Reynolds Number	Darcy Fric. Fact	Delta P Dar-Weis	E/d	Mueller
2	2.095	575	400.54	558384.2	0.0158	4149.4	0.000401	3146.32
3	3.088	575	184.35	378826.1	0.0158	596.4	0.000272	500.37
4	3.97	575	111.54	294663.7	0.0149	160.1	0.000212	152.12
6	5.845	575	51.46	200139.4	0.0135	21.0	0.000144	24.32
8	7.981	575	27.60	146575	0.0128	4.2	0.000105	5.56
10	9.486	575	19.54	123320.1	0.0125	1.7	0.000089	2.45
12	11.25	575	13.89	103983.5	0.0124	0.7	0.000075	1.09
14	12.352	575	11.52	94706.51	0.0128	0.5	0.000068	0.70
16	14.118	575	8.82	82859.81	0.0129	0.2	0.000059	0.37
18	15.882	575	6.97	73656.65	0.0129	0.1	0.000053	0.21
20	17.648	575	5.64	66285.97	0.0130	0.1	0.000048	0.13
24	21.176	575	3.92	55242.49	0.0130	0.0	0.000040	0.05
28	24.706	575	2.88	47349.42	0.0131	0.0	0.000034	0.03

EW	Well Depth (ft)	Assumed cfm
516	149	35
517	141	35
518	104	30
519	50	20
520	94	25
521	50	20
522	50	20
523	141	35
524	92	20
525	44	15
	Total cfm	255

Landfill Gas Pipe Sizing Program Version 1.0

Pipe Description G

General Design Assumptions:

1. Design flow from each well head is	875	cfm
2. Length of Pipe	1528	feet
3. Absolute roughness for HDPE	0.00007	feet
4. Number of wells contributing flow	1	
5. Vacuum available @ downstream point	-40	in w.c.
6. SDR 17 HDPE		
7. Absolute Roughness	0.00007	feet

General LFG Assumptions:

1. Absolute viscosity of LFG	8.14E-06	lbm/feet-second
2. Specific Gravity of LFG=Air	1	
3. MW of LFG =Air	28.9625	
4. Vapor Density	0.065	lb/ft^3

Calculations

Pipe Dia. Nominal	Pipe ID	Flow cfm	Velocity ft/sec	Reynolds Number	Darcy Fric. Fact	Delta P Dar-Weis	E/d	Mueller
2	2.095	875	609.51	849715.1	0.0158	9974.4	0.000401	6778.48
3	3.088	875	280.54	576474.4	0.0158	1433.6	0.000272	1078.01
4	3.97	875	169.73	448401.3	0.0149	384.9	0.000212	327.73
6	5.845	875	78.30	304560	0.0135	50.4	0.000144	52.41
8	7.981	875	42.00	223048.9	0.0128	10.1	0.000105	11.98
10	9.486	875	29.73	187661.1	0.0125	4.1	0.000089	5.28
12	11.25	875	21.14	158235.8	0.0124	1.8	0.000075	2.35
14	12.352	875	17.53	144118.6	0.0128	1.1	0.000068	1.51
16	14.118	875	13.42	126091	0.0129	0.6	0.000059	0.80

EW	Well Depth (ft)	Assumed cfm
110	62	20
111	137	35
114	138	35
115	66	20
509	155	35
510	142	35
511	104	25
512	50	20
513	141	35
514	94	20
515	50	20
	Total cfm	300

Cumulative cfm	
Segements A-D	915
Segements E-G	875
Total estimate	**1790**

Selected Header Line for Section 9 LFGCCS Expansion is 12-inch

Overburden Load Over Pipes

Job No.	Calc No.

Computation

HDR

Project	Southeast County Landfill	Computed	CR
System	Section 9 LFGCCS Expansion	Date	1/9/2012
Component	Overburden Load over Horizontal Collector Pipe	Reviewed	Cliff Hong
Task	Determine Ring Deflection and Wall Buckling	Date	2/15/2012

Purpose

Calculate the overburden load for a 6-inch collector / lateral pipe.

Assumptions

1) Standard Dimension Ratio of pipe to be used for horizontal collector / lateral pipe is SDR 11.

2) Assume an 836G Compactor

Calculation

To determine the pipe wall crushing, pipe wall buckling, and pipe deflection the "buried polyethylene pipe" model was used. The following are parameters for a 6" SDR11 HDPE Header Pipe:

Using Equation 2 and the Pipe Sizing Chart
DR = D/t = 6.625/0.602 = 11

Assume backfill gravel and soils fine to medium sands

Using Table 7 - Densities of Typical Soils
W = 114 lb/cubic ft

Using Table 10 - Modulus of Soil Reaction, E' with slightly compacted Type B soils
E' = 1,000 psi

Using Table 11 - Defection Lag Factor with granular backfill and assumed trench loading
D_L = 1.5

Using 836G Compactor (113,348 lbs), the load per wheel was determined
W_L = 33,337 lb

Using Equation 23, acceptable ranges for I_i are 2.0 through 4.5.
I_i = 3.0

Results

There are two loading calculations necessary when designing below ground applications. These applications are ring deflection and wall buckling. Wall crushing, calculated using the allowable compressive strength of the pipe material, is usually not critical when using solid wall HDPE pipe, as ring defection and wall buckling are predominant parameters. WLPipe Calc calculation sheet is provided in the subsequent pages and the summary of the results is listed below. Acceptable range and values are referenced in the supplement materials.

Parameter	Value	Acceptable Range/Value
Bulkling SF	7.89	> 1
% Defection	1.97%	≤ 8%

Job No.	Calc No.

Computation

HDR

Project	Southeast County Landfill	Computed	CR
System	Section 9 LFGCCS Expansion	Date	1/9/2012
Component	Overburden Load over Header Pipe	Reviewed	
Task	Determine Ring Deflection and Wall Buckling	Date	2/15/2012

Purpose

Calculate the overburden load for a 12-inch header pipe.

Assumptions

1) Standard Dimension Ratio of pipe to be used for horizontal collector / lateral pipe is SDR 17.

2) Assume a D6H LGP Series II Tractor

Calculation

To determine the pipe wall crushing, pipe wall buckling, and pipe deflection the "buried polyethylene pipe" model was used. The following are parameters for a 12" SDR17 HDPE Header Pipe:

Using Equation 2 and the Pipe Sizing Chart
DR = D/t = 12.750/0.750 = 17

Assume backfill soils fine to medium sands

Using Table 7 - Densities of Typical Soils
W = 110 lb/cubic ft

Using Table 10 - Modulus of Soil Reaction, E' with slightly compacted Type B soils
E' = 1,000 psi

Using Table 11 - Defection Lag Factor with granular backfill and assumed trench loading
$D_L = 1.5$

Using D6H LGP Tractor (45,400 lbs), the load per track was determined
$W_L = 22,700$ lb

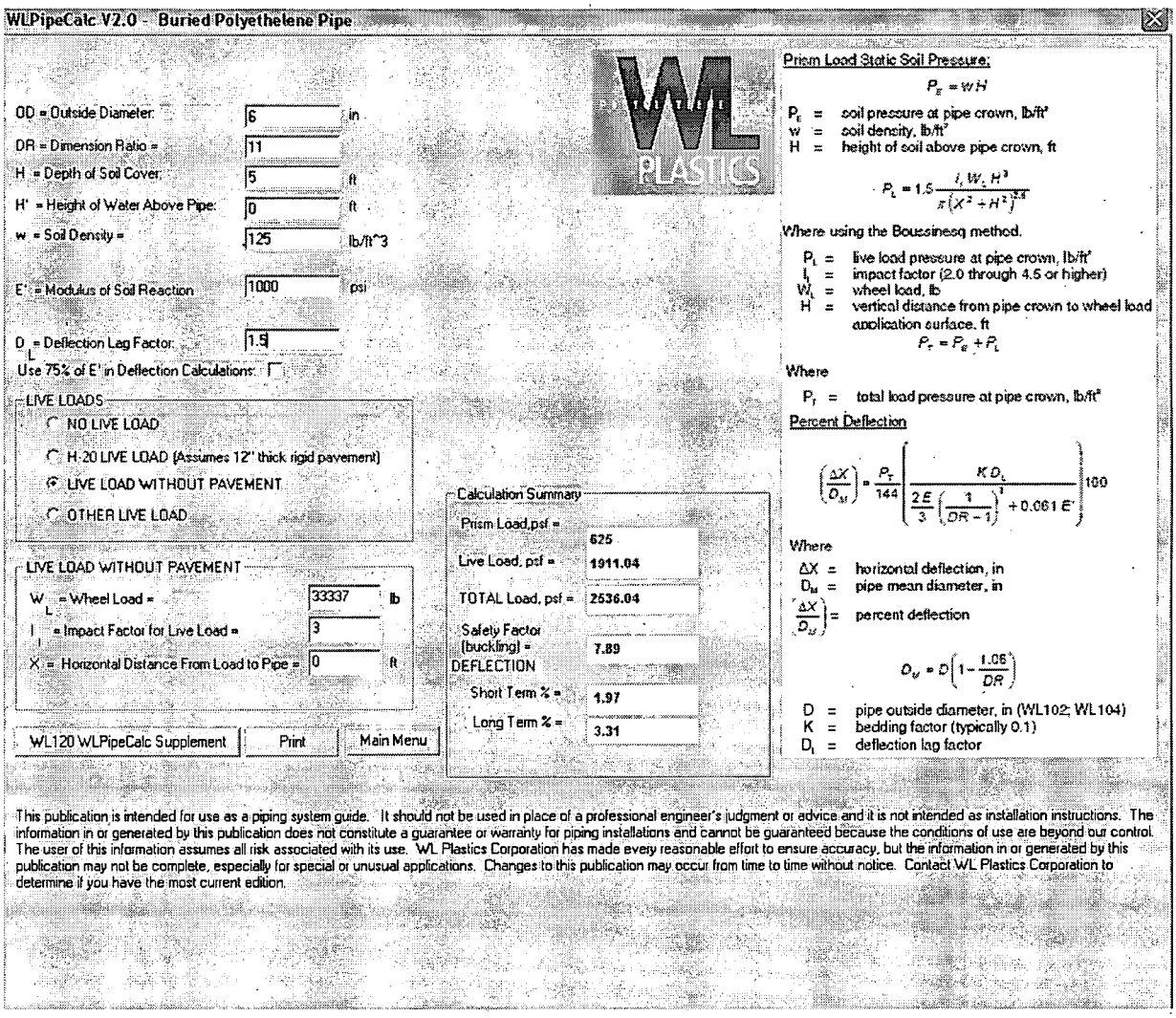
Using Equation 23, acceptable ranges for I_I are 2.0 through 4.5.
$I_I = 3.0$

Results

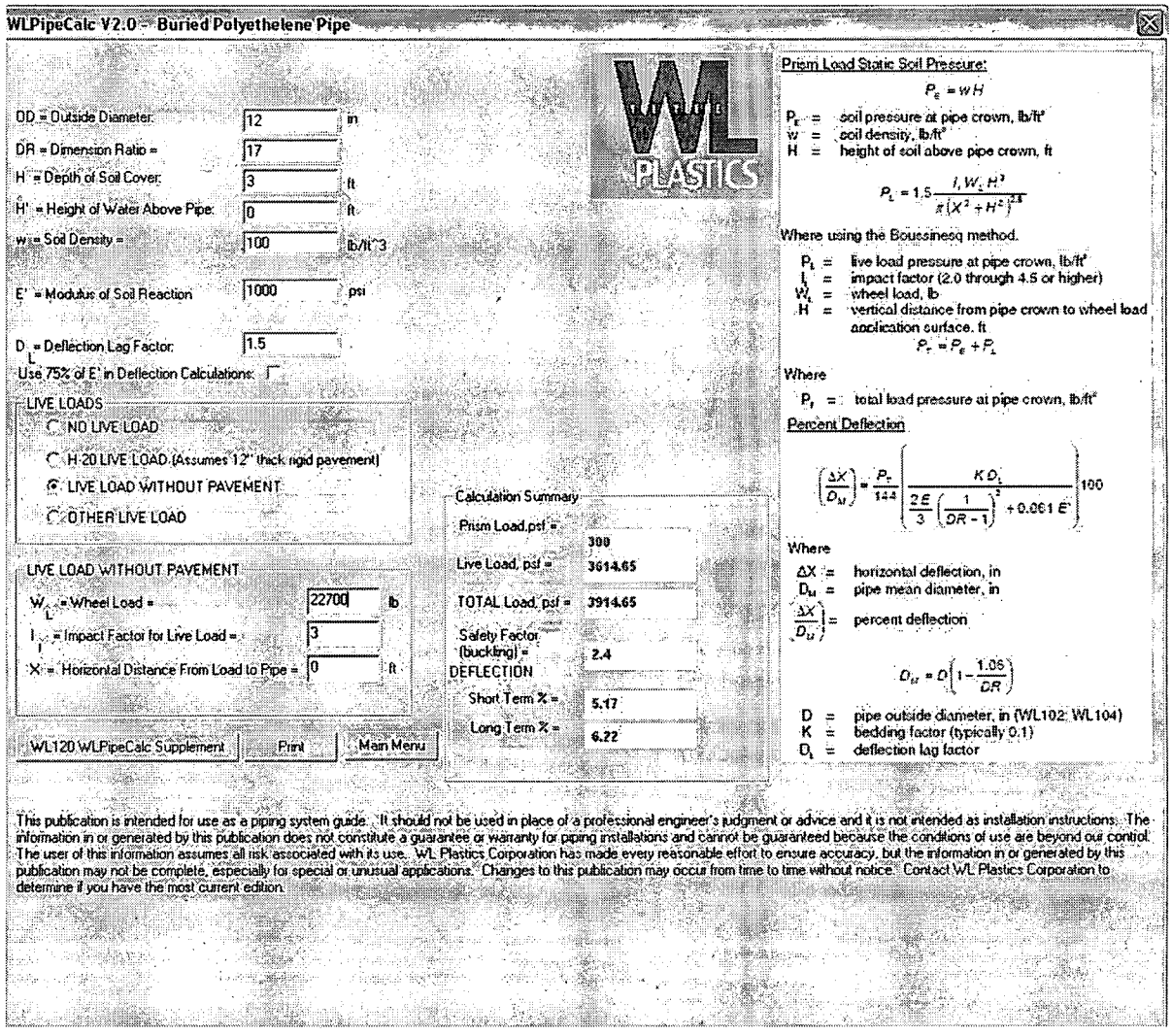
There are two loading calculations necessary when designing below ground applications. These applications are ring deflection and wall buckling. Wall crushing, calculated using the allowable compressive strength of the pipe material, is usually not critical when using solid wall HDPE pipe, as ring defection and wall buckling are predominant parameters. WLPipe Calc calculation sheet is provided in the subsequent pages and the summary of the results is listed below. Acceptable range and values are referenced in the supplement materials.

Parameter	Value	Acceptable Range/Value
Bulkling SF	2.4	> 1
% Defection	5.17%	≤ 8%

Horizontal Collector / Lateral Pipes



Header Pipe



WLPipeCalc V2.0 - Buried Polyethelene Pipe

OD = Outside Diameter: 12 in

DR = Dimension Ratio = 17

H = Depth of Soil Cover: 3 ft

H' = Height of Water Above Pipe: 0 ft

w = Soil Density = 100 lb/ft^3

E' = Modulus of Soil Reaction: 1000 psi

D_L = Deflection Lag Factor: 1.5

Use 75% of E' in Deflection Calculations: ☐

LIVE LOADS

- ○ NO LIVE LOAD
- ○ H-20 LIVE LOAD (Assumes 12" thick rigid pavement)
- ◉ LIVE LOAD WITHOUT PAVEMENT
- ○ OTHER LIVE LOAD

LIVE LOAD WITHOUT PAVEMENT

W_L = Wheel Load = 22700 lb

I_L = Impact Factor for Live Load = 3

X = Horizontal Distance From Load to Pipe = 0 ft

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Calculation Summary

Prism Load,psf =	300
Live Load, psf =	3614.65
TOTAL Load, psf =	3914.65
Safety Factor (buckling) =	2.4
DEFLECTION	
Short Term % =	5.17
Long Term % =	6.22

Prism Load Static Soil Pressure:

$$P_E = wH$$

P_E = soil pressure at pipe crown, lb/ft²
w = soil density, lb/ft³
H = height of soil above pipe crown, ft

$$P_L = 1.5\frac{I_L W_L H^3}{\pi\left(X^2 + H^2\right)^{2.5}}$$

Where using the Boussinesq method.

P_L = live load pressure at pipe crown, lb/ft²
I_L = impact factor (2.0 through 4.5 or higher)
W_L = wheel load, lb
H = vertical distance from pipe crown to wheel load application surface, ft

$$P_T = P_E + P_L$$

Where

P_T = total load pressure at pipe crown, lb/ft²

Percent Deflection

$$\left(\frac{\Delta X}{D_M}\right) = \frac{P_T}{144}\left(\frac{K D_L}{\frac{2E}{3}\left(\frac{1}{DR-1}\right)^3 + 0.061\,E'}\right)100$$

Where

ΔX = horizontal deflection, in
D_M = pipe mean diameter, in
$\left(\frac{\Delta X}{D_M}\right)$ = percent deflection

$$D_M = D\left(1 - \frac{1.06}{DR}\right)$$

D = pipe outside diameter, in (WL102, WL104)
K = bedding factor (typically 0.1)
D_L = deflection lag factor

WLPipeCalc™ Supplement

WLPipeCalc™ Supplement – Equations & Information

Contents

Notice

The WLPipeCalc™ CD-ROM and this supplement are intended for use as piping system guides. These publications should not be used in place of a professional engineer's judgment or advice and they are not intended as installation instructions. The information in or generated by the WLPipeCalc™ CD-ROM and this supplement does not constitute a guarantee or warranty for piping installations and cannot be guaranteed because the conditions of use are beyond our control. The user of the information assumes all risk associated with its use. WL Plastics Corporation has made every reasonable effort to ensure accuracy, but the information in or generated by the WLPipeCalc™ CD-ROM and this supplement may not be complete, especially for special or unusual applications. Changes to the WLPipeCalc™ CD-ROM and this supplement may occur from time to time without notice. Contact WL Plastics Corporation to determine if you have the most current edition.

The WLPipeCalc™ CD-ROM allows the user to enter values for variables and determine a result using the equations in the CD-ROM publication. This publication, WL120, provides equations used for WLPipeCalc™ CD-ROM calculation screens, and related information.

Other equations and methods for determining piping system design may be applicable. As part of piping system design, the user should determine the design equations and methods that are appropriate for the intended use.

1 – Pipe Pressure Rating

See publications WL102, WL104 and WL118, and "Working Pressure Rating for Water" for additional information.

$$PR = \frac{2\,HDB f_T\, f_E}{(DR-1)} \qquad (1)$$

Where

PR = pressure rating, psi.
HDB = hydrostatic design basis at 73°F (Table 1)
f_T = operating temperature multiplier (Table 2)
f_E = environmental design factor (table 3)
DR = pipe dimension ratio

$$DR = \frac{D}{t} \qquad (2)$$

D = pipe outside diameter, in (WL102; WL104)
t = pipe minimum wall thickness, in

Table 1 HDB – WL Plastics PE3408 HDPE

	HDB at 73°F	*HDB at 140°F*
WL Plastics PE3408	1600 psi	800 psi

Table 2 Operating Temperature Multiplier, f_T

Maximum Operating Temperature °F	Maximum Operating Temperature °C	Multiplier, f_T
≤ 40*	≤ 4	1.3
> 40 ≤ 60*	> 4 ≤ 16	1.1
> 60 ≤ 80	> 16 ≤ 27	1.0
> 80 ≤ 90	> 27 ≤ 32	0.9
> 90 ≤ 100	> 32 ≤ 38	0.8
> 100 ≤ 110	> 38 ≤ 43	0.71
> 110 ≤ 120	> 43 ≤ 49	0.64
> 120 ≤ 130	> 49 ≤ 54	0.57
> 130 ≤ 140	> 54 ≤ 60	0.50

* For water distribution and transmission applications, multipliers for 60°F (16°C) and lower temperatures are not used.

Table 3 Environmental Design Factor, f_E

Factor, f_E	Environmental and Applications Conditions,
0.50*	Liquids that are chemically benign to polyethylene such as potable and process water, municipal sewage, wastewater, reclaimed water, salt water, brine solutions, glycol/antifreeze solutions, alcohol; Buried pipes for gases that are chemically benign to polyethylene such as dry natural gas (in Class 1 or 2 locations where Federal Regulations (49 CFR Part 192) do not limit pressure), methane, propane, butane, carbon dioxide, hydrogen sulfide.
0.32	Buried pipes for compressed air at ambient temperature; Buried pipes for fuel gases such as natural gas, LP gas, propane, butane in distribution systems and Class 3 or 4 locations where Federal Regulations limit pipe pressure to the lesser of 100 psi or the design pressure rating.
0.25	Permeating or solvating liquids in the pipe or the surrounding soil such as gasoline, fuel oil, kerosene, crude oil, diesel fuel, liquid hydrocarbon fuels, vegetable and mineral oils.

* The maximum design factor, 0.50, is a cumulative factor based on variability in materials, testing and processing, handling and installation abuse, and variability in operating conditions. It is widely accepted for thermoplastic pressure pipe design in North America.

2 – Hazen-Williams Pressure Water Flow

Hazen and Williams developed an empirical formula for friction (head) loss for water flow at 60° F that can be applied to liquids having a kinematic viscosity of 1.130 centistokes (0.00001211 ft^2/sec), or 31.5 SSU. Some error can occur at other temperatures because the viscosity of water varies with temperature,

Hazen-Williams formula for friction (head) loss in feet:

$$h_f = \frac{0.002083\,L}{d^{4.8655}}\left(\frac{100\,Q}{C}\right)^{1.85} \quad (3)$$

Hazen-Williams formula for friction (head) loss in psi:

$$p_f = \frac{0.0009015\,L}{d^{4.8655}}\left(\frac{100\,Q}{C}\right)^{1.85} \quad (4)$$

Where

h_f = friction (head) loss, ft
L = pipe length, ft
Q = flow, gal/min
d = pipe inside diameter, in (WL102; WL104)
C = Hazen-Williams Friction Factor, dimensionless
p_f = friction (head) loss, lb/in^2

Table 4 Hazen-Williams Friction Factor, C

Pipe Material	Values for C: Range High / Low	Values for C: Average Value	Values for C: Typical Design Value
Butt fused polyethylene pipe with internal beads	160 / 130	155	150
Cement or mastic lined iron or steel pipe	160 / 130	148	140
Copper, brass, lead, tin or glass pipe or tubing	150 / 120	140	130
Wood stave	145 / 110	120	110
Welded and seamless steel	150 / 80	130	100
Cast and ductile iron	150 / 80	130	100
Concrete	152 / 85	120	100
Corrugated steel	–	60	60

Full Pipe Flow Velocity

Water flow velocity in a full, circular pipe:

$$V = 0.40853\frac{Q}{d^2} \quad (5)$$

Where

V = water flow velocity, ft/sec
Q = flow, gal/min
d = pipe inside diameter, in (WL102; WL104)

3 – Manning Gravity Water Flow

The Manning equation is limited to water or liquids with a kinematic viscosity equal to water. A derived version of the Manning equation for circular pipes flowing full or half full is:

$$Q = 0.275\frac{d^{8/3}S^{1/2}}{n} \quad (6)$$

or $$Q_{CFS} = \left(6.136\times10^{-4}\right)\frac{d^{8/3}S^{1/2}}{n} \quad (7)$$

Where

Q = flow, gal/min
Q_{CFS} = flow, ft^3/sec
d = pipe inside diameter, in (WL102; WL104)
S = hydraulic slope, ft/ft

$$S = \frac{h_1 - h_2}{L} \quad (8)$$

h_1 = upstream pipe elevation, ft
h_2 = downstream pipe elevation, ft
n = roughness coefficient, dimensionless

Table 5 Manning Equation n Values

Surface	*n, range*	*n, typical design*
Polyethylene pipe	0.008 – 0.011	0.009
Uncoated cast or ductile iron pipe	0.012 – 0.015	0.013
Corrugated steel pipe	0.021 – 0.030	0.024
Concrete pipe	0.012 – 0.016	0.015
Vitrified clay pipe	0.011 – 0.017	0.013
Brick and cement mortar sewers	0.012 – 0.017	0.015
Wood stave	0.010 – 0.013	0.011
Rubble masonry	0.017 – 0.030	0.021

Circular pipes will carry more liquid when slightly less than full compared to completely full because there is a slight reduction in flow area compared to a significant reduction in the wetted surface of the pipe. Maximum flow occurs at about 93% of full pipe flow, and maximum velocity at about 78% of full pipe flow.

4 – Low Pressure Gas Flow

Caution – To minimize the risk of mechanical damage, pressure gas piping is buried, installed at heights and in areas where moving equipment cannot contact or damage piping, and encased in shatter resistant materials. Pressure gas piping is restrained to prevent movement in case of mechanical damage.

Where inlet and outlet gas pressures are less than 1 psig (27.7 in H_2O) the Mueller low pressure gas flow equation may be used.

$$Q_h = \frac{2971d^{2.725}}{S_g^{0.425}}\left(\frac{h_1 - h_2}{L}\right)^{0.575} \quad (9)$$

Where

S_g = gas specific gravity (Table 6)
h_1 = inlet pressure, in H_2O
h_2 = outlet pressure, in H_2O
L = pipe length, ft
d = pipe inside diameter, in (WL102; WL104)

Table 6 Approximate Specific Gravity (14.7 psi & 68°F)

Gas	*Specific Gravity, S_g*
Acetylene (ethylene), C_2H_2	0.907
Air	1.000
Ammonia, NH_3	0.596
Argon, A	1.379
Butane, C_4H_{10}	2.067
Carbon Dioxide, CO_2	1.529
Carbon Monoxide, CO	0.967
Ethane, C_2H_6	1.049
Ethylene, C_2H_4	0.975
Helium, He	0.138
Hydrogen Chloride, HCl	1.286
Hydrogen, H	0.070
Hydrogen Sulfide, H_2S	1.190
Methane, CH_4	0.554
Methyl Chloride, CH_3Cl	1.785
Natural Gas	0.667
Nitric Oxide, NO	1.037
Nitrogen, N_2	0.967
Nitrous Oxide, N_2O	1.530
Oxygen, O_2	1.105
Propane, C_3H_8	1.562
Propene (Propylene), C_3H_6	1.451
Sulfur Dioxide, SO_2	2.264
Landfill Gas (approx. value)	1.00
Carbureted Water Gas	0.63
Coal Gas	0.42
Coke-Oven Gas	0.44
Refinery Oil Gas	0.99
"Wet" Gas (approximate value)	0.75

5 – Working Pressure Rating for Water

Working Pressure Rating (WPR) for water at ≤ 80°F (≤ 27°C) has application pressure components for steady long-term internal pressure and momentary surge pressure from sudden water velocity change. WPR

application pressure components are compared to pipe capabilities, pressure class, PC, which includes allowances for recurring or occasional surge, P_{RS} or P_{OS}.

The pipe's capacity for internal water pressure at ≤ 80°F is its pressure class, PC. PC includes components for long-term steady pressure and momentary pressure surge.

$$PC_S = \frac{2HDBf_E}{(DR-1)} \quad (10)$$

Where

PC_S = Steady pressure for water at ≤ 80°F, psi
HDB = hydrostatic design basis, psi
= 1600 psi
f_E = environmental design factor for water
= 0.50
DR = pipe dimension ratio

The pipe's allowance for momentary surge pressure is for either recurring or occasional surge pressure, and it is applied above the steady pressure. Recurring surge pressures occur frequently and are inherent in system design and operation. The recurring surge pressure allowance is:

$$P_{RS} = 0.5PC \quad (11)$$

Where

P_{RS} = Recurring surge pressure allowance, psi

Occasional surge pressures are caused by emergency operations. The occasional surge pressure allowance is:

$$P_{OS} = 1.0PC \quad (12)$$

Where

P_{OS} = Occasional surge pressure allowance, psi

The maximum pressure in the pipe depends on the operating condition. For steady pressure conditions, the surge allowance is not used. For a momentary surge event, the maximum pressure is the steady pressure plus the applicable surge allowance.

For steady pressure conditions:

$$PC = PC_S \quad (13)$$

For a momentary recurring surge event:

$$PC = PC_S + P_{RS} \quad (14)$$

For a momentary occasional surge event:

$$PC = PC_S + P_{OS} \quad (15)$$

Application requirements are determined using working pressure rating, WPR, which has steady pressure and surge pressure components. The steady internal water pressure component, working pressure, WP, is determined by the designer, who also determines if the potential for surge pressure is recurring or occasional.

Surge pressure magnitude is dependent on sudden velocity change.

$$P_S = a\left(\frac{\Delta v}{2.31g}\right) \quad (16)$$

Where

P_S = Surge pressure, psi
a = Surge pressure wave velocity (celerity), ft/sec

$$a = \frac{4660}{\sqrt{1+\frac{K}{E_d}(DR-2)}} \quad (17)$$

K = bulk modulus of water, psi
= 300,000 psi
E_d = Dynamic instantaneous effective modulus of pipe material, psi
= 150,000 psi
DR = Pipe dimension ratio
Δv = Sudden velocity change*, ft/sec
g = gravitational acceleration, ft/sec^2
= 32.2 ft/sec^2

* Pressure surge does not occur unless the sudden velocity change occurs within the Critical Time

$$Critical\ Time, \sec = \frac{2L}{a} \quad (18)$$

Where

L = Pipe length, ft

WLPipeCalc assumes Δv occurs within the Critical Time, but does not calculate Critical Time.

WLPipeCalc calculates celerity within the surge pressure calculation, but not as a separate value.

WLPipeCalc determines the sustained pressure and surge pressure components of WPR separately using the following relationships.

During steady pressure operation, WP never exceeds WPR and never exceeds PC_S for steady pressure conditions (Equation 13).

$$WP \le WPR \le PC_S \quad (19)$$

During a momentary surge event, the maximum pressure in the pipe, WPR, never exceeds PC plus the applicable surge allowance (Equations 14 or 15).

$$WP + P_s \le WPR \le PC_S + P_{RS} \quad (20)$$

or $$WP + P_S \le WPR \le PC_S + P_{OS} \quad (21)$$

If the potential for surge pressure, P_s, exceeds the surge pressure allowance, P_{OS} or P_{RS}, allowable steady pressure, WP is reduced and the difference allocated to surge pressure so that Equations 19, 20 and 21 are maintained. Surge pressure allowance is never applied to steady pressure.

WLPipeCalc determines WPR in terms of its steady pressure and surge pressure components. A negative steady pressure value indicates an unsuitable application.

6 – Buried Polyethylene Pipe

For typical burial cover depths of 1½ pipe diameters (minimum 4 ft (1.9 m)) to approximately 50 ft (23.6 m), static earthloads and surface live loads on buried (constrained) pipe can result in pipe wall crushing, pipe wall buckling, and pipe deflection. Static (prism) loads and live loads are compared to the pipe's resistance properties. Safety factors against compressive crushing and wall buckling are calculated. Deflection is controlled by installation quality and embedment material quality. Long-term and short-term percent deflections are calculated for comparison to industry standard deflection criteria.

Prism Load Static Soil Pressure:

$$P_E = w H \quad (22)$$

Where

P_E = soil pressure at pipe crown, lb/ft²
w = soil density, lb/ft³
H = height of soil above pipe crown, ft

Use 3

Table 7 Densities of Typical Soils

Type of Soil	*Dry Density, lb/ft³*	*Saturated Density, lb.ft³*
Organic silts, clays	31-94	81-112
Crushed rock	94-125	119-137
Glacial tills	106-144	131-150
Silts; clays	37-112	87-131
Sands; gravels	93-114	118-150

Saturated soil has greater density because of the liquid it contains; however, the effective unit weight of flooded soil is reduced by groundwater floatation of soil particles. If appropriate, soil density should be adjusted to compensate for flooding conditions.

Live Load Pressure:.

Live load pressure results from intermittently applied loads on the surface such as from various kinds of traffic. Live loads may be applied directly to the surface or through rigid pavement. AISI H20 and HS20 truck and semi-trailer truck live loads simulate a 20-ton truck through 12-in thick rigid pavement and include a 1.5 impact factor.

Table 8 H20 & HS20 Highway Live Load

Height Above Pipe Crown, ft	*Live Load, lb/ft²*
1	1800
2	800
3	600
4	400
5	250
6	200
7	175
8	100

Live load pressure without pavement, such as for heavy off-highway vehicles on unpaved surfaces, are determined using the Boussinesq method.

$$P_L = 1.5 \frac{I_I W_L H^3}{\pi \left(X^2 + H^2\right)^{2.5}} \quad (23)$$

Where

P_L = live load pressure at pipe crown, lb/ft²
I_I = impact factor (2.0 through 4.5 or higher)
W_L = wheel load, lb
H = vertical distance from pipe crown to wheel load application surface, ft
X = horizontal distance from center of pipe crown to center of wheel load, ft

Railroad live loads are typically described using AISI Cooper E80 values which are applied as three, 80,000 lb loads over three, 2ft x 8 ft areas spaced 5 ft apart.

Table 9 E80 Cooper Railroad Live Loading

Height Above Pipe Crown, ft	*Live Load, lb/ft²*
2	3800
5	2400
8	1600
10	1100
12	800
15	600
20	300
30	100

Live loads may be determined using other appropriate methods.

Total Load Pressure:

$$P_T = P_E + P_L \quad (24)$$

Where

P_T = total load pressure at pipe crown, lb/ft²

Wall Crushing Resistance:

$$N_C = \frac{460800}{P_T\, DR} \quad (25)$$

Where

N_C = safety factor against wall crushing

Wall Buckling Resistance

$$N_B = \frac{144\, P_{WC}}{P_T} \quad (26)$$

Where

N_B = safety factor against wall buckling

$$P_{WC} = 5.65\sqrt{\frac{R\,B'\,E'\,E}{12\,(DR-1)^3}} \quad (27)$$

Where

P_{WC} = constrained buckling pressure, psi

R = reduction factor for buoyancy

$$R = 1 - 0.33\frac{H'}{H} \quad (28)$$

H' = height of groundwater above pipe, ft

H = soil cover above pipe, ft

B' = elastic support factor

$$B' = \frac{1}{1 + 10.87312^{(-0.065\,H)}} \quad (29)$$

E' = modulus of soil reaction, psi (Table 10)

E = modulus of elasticity, psi (Table 17)

= 28,200 psi for long-term at 73°F

= 110,000 psi for short-term at 73°F

Table 10 Modulus of Soil Reaction, E'

Degree of Bedding Compaction,	*Soil Type Pipe Bedding Material (Unified Classification System[a])* A	B	C	D	E
	Average Value for E', psi (MPa)				
Dumped	1000 (6.89)	200 (1.38)	100 (0.69)	50 (0.34)	
Slight, <85% Proctor, 40% Relative Density	3000 (20.68)	1000 (6.89)	400 (2.76)	200 (1.38)	No data available; consult a competent soils engineer; otherwise use E'= 0
Moderate, 85-95% Proctor, 40-70% Relative Density	3000 (20.68)	2000 (13.79)	1000 (6.89)	400 (2.76)	
High, >95% Proctor, >70% Relative Density	3000 (20.68)	3000 (20.68	2000 (13.79)	1000 (6.89)	

A – Crushed rock

B – Coarse grained soils; little or no fines GW, GP, SW, SP[c] contains less than 12% fines

C – Fine grained soils (LL<50); soils with medium to no plasticity, CL, ML, ML-CL, with less than 25% coarse grained particles. Coarse grained soils with fines GM, GC, SM, SC contains more than 12% fines

D – Fine grained soils (LL<50); soils with medium to no plasticity, CL, ML, ML-CL, with less than 25% coarse grained particles

E – Fine-grained soils (LL[b]>50) Soils with medium to high plasticity, CH, MH, CH-MH

Note – Standard Proctors in accordance with ASTM D 698 are used with this table. Values applicable only for fills less than 50 ft (15 m). Table does not include a safety factor. For use in predicting initial deflections only; appropriate Deflection Lag Factor must be applied for long-term deflections

[a] ASTM D2487; USBR E-3. [b] LL = liquid limit [c] Or any borderline soil beginning with one of these symbols (i.e., GM-GC, GC-SC).

Percent Deflection

$$\left(\frac{\Delta X}{D_M}\right) = \frac{P_T}{144}\left(\frac{K\,D_L}{\frac{2E}{3}\left(\frac{1}{DR-1}\right)^3 + 0.061\,E'}\right)100 \quad (30)$$

Where

ΔX = horizontal deflection, in

D_M = pipe mean diameter, in

$\left(\frac{\Delta X}{D_M}\right)$ = percent deflection

$$D_M = D\left(1 - \frac{1.06}{DR}\right) \quad (31)$$

D = pipe outside diameter, in (WL102; WL104)
K = bedding factor (typically 0.1)
D_L = deflection lag factor (Table 11)

Table 11 Deflection Lag Factor

D_L	*Typical Value*
1.0	Minimum value for use only with granular backfill and if the full soil prism load is assumed to act on the pipe.
1.5	Minimum value for use with granular backfill and assumed trench loadings
2.5	Minimum value for use with CL, ML backfills, for conditions where the backfill can become saturated, etc.

Safe deflection for non-pressure PE3408 piping generally depends on ring bending wall strain, which is typically limited to 8%.

$$\left(\frac{\Delta X}{D_M}\right) \le \frac{\varepsilon (DR - 1.06)}{1.06 f_D} \quad (32)$$

Where

ε = wall strain percent
≤ 8.0% for non-pressure PE3408
f_D = deformation shape factor
= 6.0 for typical non-elliptical pipe deformation

Wall strain in pressurized PE3408 pipes is more complex because internal pressure increases wall strain.

Table 12 Safe % Deflection for PE3408 Pressure Pipe

Safe % Deflection	*DR*
2.5	≤9
3.0	11
4.0	13.5
5.0	17
6.0	21
7.0	26
8.5	32.5

7 – Submerged Pipe Ballast

Ballast weights are attached to or placed over the pipe for submergence. Ballast weights are typically bottom heavy and shaped to prevent pipe rolling. Design incorporates pipe and ballast weight and displacement, the fluids inside and outside the pipe, and environmental conditions.

$$V_P = \frac{\pi D^2}{576} \quad (33)$$

Where

V_P = displaced volume of pipe, ft^3/ft
π = Pi (approximately 3.1416)
D = pipe outside diameter, in (WL102; WL104)

$$B_P = V_P K \omega_{LO} \quad (34)$$

Where

B_P = pipe displacement uplift force, lb/ft
K = submerged environment factor
ω_{LO} = specific weight of liquid outside pipe, lb/ft^3

Table 13 Submerged Environment Factor

Submerged Environment	*Factor, K*
Significant tidal flows, roving currents, stream currents	1.5
Low tidal flows or slow moving stream , river, lake or pond currents	1.3
Neutral buoyancy condition	1.0

Table 14 Specific Weights at 60°F (15°C)

Fluid	*Specific Weight, ω, lb/ft^3*
Air and other gases	0.0
Fresh water	62.4
Seawater	64.0
Gasoline	42.5
Kerosene	50.2
Crude oil	53.1
Brine, 6% NaCl	65.1
Brine, 24% NaCl	73.8
Brine, 12% CaCl	69.0
Brine, 30% CaCl	80.4
Concrete	110 to 150
Steel	490
Brick	112 – 137
Sand, Gravel	100 – 109
Cast iron	440 – 480
Brass	511 – 536
Bronze	548

$$V_B = \frac{\pi d^2}{576} \quad (35)$$

Where

V_B = pipe ID volume, ft^3/ft
d = inside diameter of pipe, in (WL102; WL104)

WL102A – IPS PIPE SIZES & PRESSURE RATINGS – *PE3608/PE3408*

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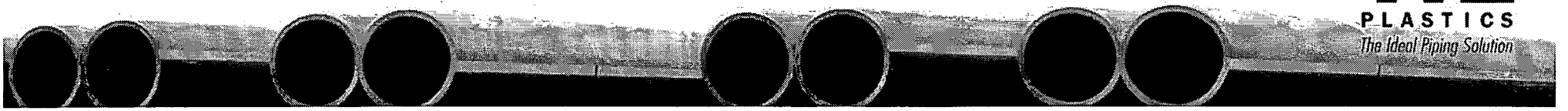


CONTACT WL PLASTICS CUSTOMER SERVICE TO CONFIRM AVAILABILITY AND FOR SIZES AND DR'S NOT SHOWN. SEE FOOTNOTES ON PAGE 2.

IPS SIZE	AVG OD, in	DR[A]	7	7.3	9	11	13.5	15.5	17	19	21	26	32.5
		PR[B], psi	267	254	200	160	128	110	100	89	80	64	51
		Min wall, in	0.188	0.180	0.146	0.120							
1	1.315	Avg ID[C], in	0.917	0.933	1.005	1.062							
		Weight, lb/ft	0.288	0.278	0.232	0.195							
		Min wall, in	0.237	0.227	0.184	0.151							
1 1/4	1.660	Avg ID[C], in	1.157	1.178	1.269	1.340							
		Weight, lb/ft	0.459	0.442	0.369	0.310							
		Min wall, in	0.271	0.260	0.211	0.173							
1 1/2	1.900	Avg ID[C], in	1.325	1.348	1.452	1.534							
		Weight, lb/ft	0.600	0.580	0.485	0.406							
		Min wall, in	0.339	0.325	0.264	0.216	0.176	0.153	0.140				
2	2.375	Avg ID[C], in	1.656	1.685	1.816	1.917	2.002	2.050	2.079				
		Weight, lb/ft	0.939	0.906	0.758	0.634	0.526	0.462	0.425				
		Min wall, in	0.411	0.394	0.319	0.261	0.213	0.185	0.169				
2 ½	2.875	Avg ID[C], in	2.004	2.040	2.198	2.321	2.424	2.482	2.516				
		Weight, lb/ft	1.377	1.329	1.109	0.928	0.771	0.677	0.622				
		Min wall, in	0.500	0.479	0.389	0.318	0.259	0.226	0.206	0.184	0.167		
3	3.500	Avg ID[C], in	2.440	2.484	2.676	2.825	2.950	3.021	3.064	3.109	3.147		
		Weight, lb/ft	2.040	1.968	1.646	1.376	1.141	1.006	0.923	0.830	0.757		
		Min wall, in	0.643	0.616	0.500	0.409	0.333	0.290	0.265	0.237	0.214	0.173	0.138
4	4.500	Avg ID[C], in	3.137	3.193	3.440	3.633	3.793	3.885	3.939	3.998	4.046	4.133	4.206
		Weight, lb/ft	3.372	3.253	2.720	2.275	1.887	1.660	1.526	1.374	1.247	1.018	0.819
		Min wall, in	0.795	0.762	0.618	0.506	0.412	0.359	0.327	0.293	0.265	0.214	0.171
5	5.563	Avg ID[C], in	3.878	3.947	4.253	4.491	4.689	4.802	4.869	4.942	5.001	5.109	5.200
		Weight, lb/ft	5.154	4.975	4.156	3.479	2.886	2.540	2.328	2.100	1.909	1.557	1.254
		Min wall, in	0.946	0.908	0.736	0.602	0.491	0.427	0.390	0.349	0.315	0.255	0.204
6	6.625	Avg ID[C], in	4.619	4.701	5.064	5.348	5.585	5.719	5.799	5.886	5.956	6.085	6.193
		Weight, lb/ft	7.305	7.059	5.894	4.930	4.095	3.599	3.307	2.978	2.703	2.209	1.781
		Min wall, in							0.419	0.375	0.339	0.274	0.219
7	7.125	Avg ID[C], in							6.236	6.330	6.406	6.544	6.660
		Weight, lb/ft							3.821	3.442	3.128	2.553	2.057
		Min wall, in	1.232	1.182	0.958	0.784	0.639	0.556	0.507	0.454	0.411	0.332	0.265
8	8.625	Avg ID[C], in	6.013	6.120	6.593	6.963	7.271	7.445	7.549	7.663	7.754	7.922	8.062
		Weight, lb/ft	12.385	11.963	9.988	8.359	6.939	6.100	5.597	5.044	4.591	3.744	3.012
		Min wall, in	1.536	1.473	1.194	0.977	0.796	0.694	0.632	0.566	0.512	0.413	0.331
10	10.750	Avg ID[C], in	7.494	7.628	8.218	8.678	9.062	9.280	9.409	9.551	9.665	9.873	10.049
		Weight, lb/ft	19.245	18.581	15.515	12.983	10.774	9.490	8.695	7.838	7.128	5.805	4.689
		Min wall, in	1.821	1.747	1.417	1.159	0.944	0.823	0.750	0.671	0.607	0.490	0.392
12	12.750	Avg ID[C], in	8.889	9.047	9.747	10.293	10.748	11.006	11.160	11.327	11.463	11.710	11.918
		Weight, lb/ft	27.062	26.138	21.837	18.267	15.155	13.348	12.238	11.021	10.023	8.169	6.587
		Min wall, in	2.000	1.918	1.556	1.273	1.037	0.903	0.824	0.737	0.667	0.538	0.431
14	14.000	Avg ID[C], in	9.760	9.934	10.702	11.302	11.801	12.085	12.254	12.438	12.587	12.858	13.087
		Weight, lb/ft	32.635	31.511	26.329	22.030	18.279	16.082	14.763	13.292	12.093	9.848	7.952

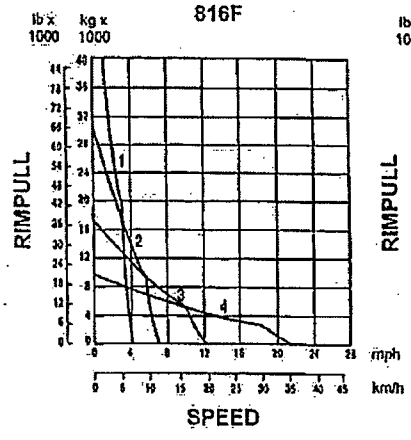
Source: Caterpillar Performance Handbook, Edition 33

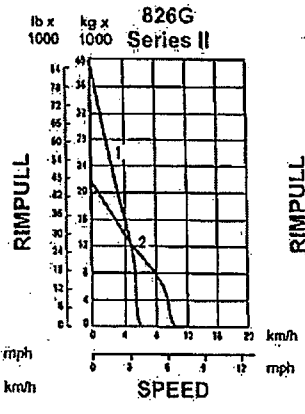


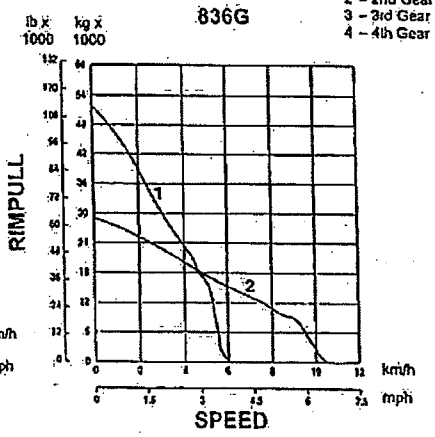
MODEL	816F	826G Series II	836G
Flywheel Power	164 kW 220 hp	253 kW 340 hp	358 kW 480 hp
Operating Weight*	23 946 kg 52,793 lb	36 967 kg 81,498 lb	53 682 kg 113,348 lb
Engine Model	3176 DITA	3406E DITA	3456 DITA
Rated Engine RPM	2100	2000	1900
No. Cylinders	6	6	6
Displacement	10.3 L 628 in³	16.4 L 893 in³	15.8 L 966 in³
Speeds:			
Forward	2	2	2
Reverse	2	2	2
Turning Radius with Straight Blade			
Inside Blade Corner	3.5 m 11'6"	3.2 m 10'6"	4.3 m 14'11"
Outside Blade Corner	6.7 m 21'9"	7.3 m 23'9"	9.0 m 29'6"
Fuel Tank Refill Capacity	464 L 122.6 U.S. gal	640 L 169.1 U.S. gal	795 L 210 U.S. gal
WHEELS:	PLUS TIP	PLUS TIP	PLUS TIP
Each Drum Width	1.02 m 3'4"	1.2 m 3'11"	1.4 m 4'7"
Diameters, over Tips	1.7 m 5'10"	1.9 m 6'6"	2.0 m 6'9"
Drum only	1.3 m 4'3"	1.53 m 5'0"	1.62 m 5'8"
Tips per Wheel	20	25	35
Tip Height	158 mm 6.5"	158 mm 6.5"	158 mm 6.5"
Chopper Blades per Wheel	20	24	28
Blade Height	152 mm 6"	158 mm 6"	158 mm 6"
Width of Two Pass Coverage	4.5 m 14'9"	4.78 m 15'8"	5.67 m 18'7"
GENERAL DIMENSIONS:			
Height (Overall)	3.8 m 12'6"	4.2 m 13'7"	4.5 m 14'9"
Height (Top of Cab)	3.4 m 11'3"	3.8 m 12'6"	4.1 m 13'5"
Wheel Base	3.35 m 11'0"	3.7 m 12'2"	4.55 m 14'11"
Overall Length with Dozer	7.85 m 25'7"	8.27 m 27'2"	10.18 m 33'5"
Width over Drums	3.33 m 10'11"	3.8 m 12'8"	4.18 m 14'1"
Ground Clearance	456 mm 1'5"	489 mm 1'6"	697 mm 2'3"
LANDFILL BULLDOZER:			
Width	3.65 m 12'0"	4.5 m 14'9"	5.19 m 17'0"
Height**	1.91 m 6'3"	1.91 m 6'3"	2.22 m 7'3"

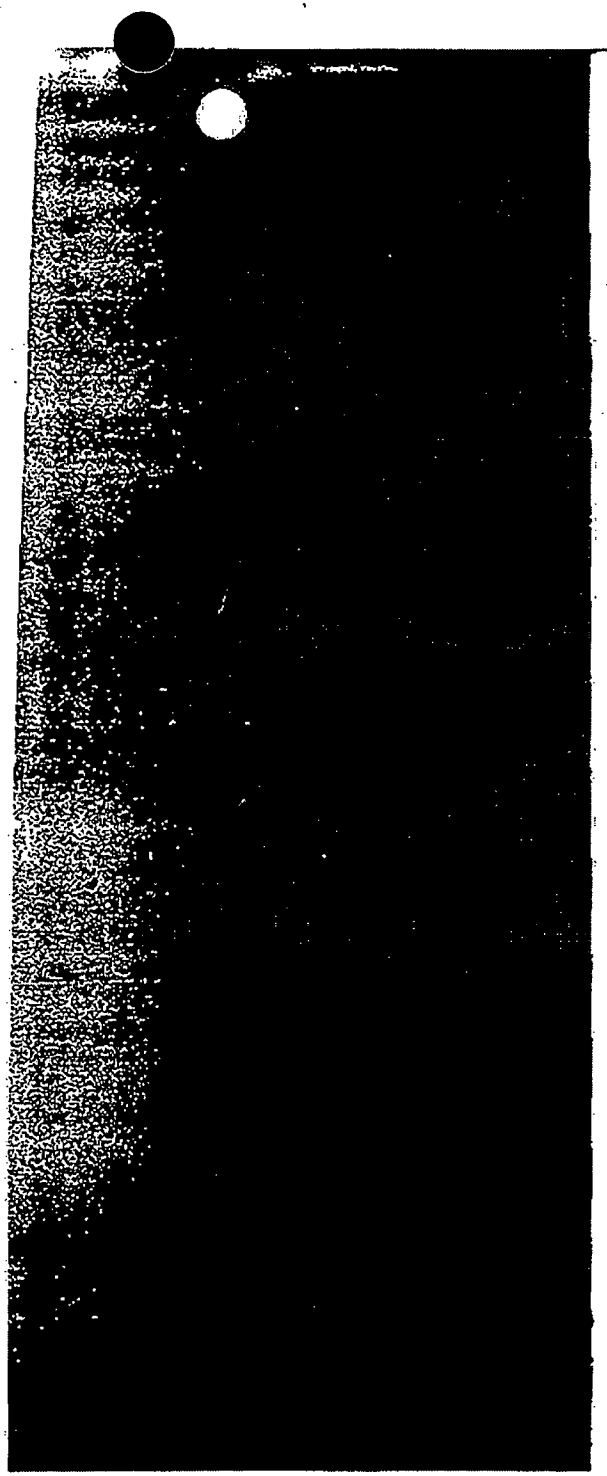
*Operating Weight includes coolant, bulldozer, hydraulics, ROPS cab, full fuel tank, and 82 kg (180 lb) operator.
**Height (stripped top) — without ROPS cab, exhaust, seat back or other easily removed encumbrances.

KEY
1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear









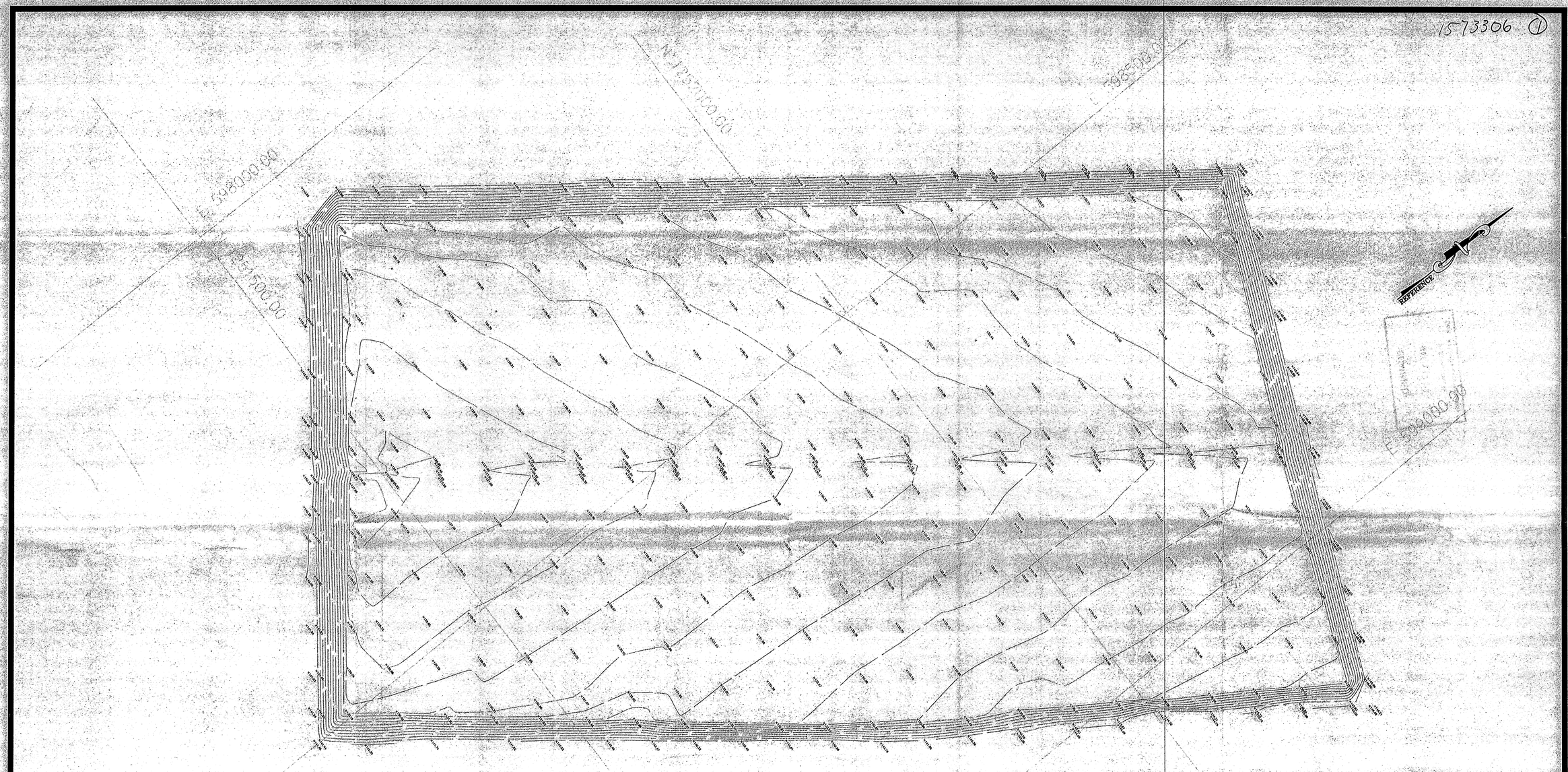



MODEL	D6H LGP Series II		D7G		D7H Series II		D7H XR Series II	
Flywheel Power	134 kW	180 hp	149 kW	200 hp	171 kW	230 hp	171 kW	230 hp
Operating Weight*								
(Power Shift)	20 503 kg	45,200 lb	20 094 kg	44,300 lb	24 778 kg	54,600 lb	25 193 kg	55,500 lb
(Direct Drive)	20 548 kg	45,300 lb	20 502 kg	45,200 lb	—	—	—	—
(Power Shift Differential Steer)	20 593 kg	45,400 lb	—	—	25 077 kg	55,300 lb	25 492 kg	55,200 lb
Engine Model	3306		3306		3306		3906	
Rated Engine RPM	1900		2000		2100		2100	
No. of Cylinders	6		6		6		6	
Bore	121 mm	4.75"	121 mm	4.75"	121 mm	4.75"	121 mm	4.75"
Stroke	152 mm	6"	152 mm	6"	152 mm	6"	152 mm	6"
Displacement	10.5 L	638 in³	10.5 L	638 in³	10.5 L	638 in³	10.5 L	638 in³
Track Rollers (Each Side)	6		6		7		8	
Width of Standard Track Shoe	915 mm	36"	508 mm	20"	560 mm	22"	610 mm	24"
Length of Track on Ground	3.25 m	128"	2.72 m	107"	2.89 m	114"	3.05 m	120"
Ground Contact Area (W/Std. Shoe)	5.97 m²	9254 in²	2.76 m²	4280 in²	3.24 m²	5016 in²	3.72 m²	5760 in²
Track Gauge	2.21 m	87"	1.98 m	78"	1.98 m	78"	1.98 m	78"
GENERAL DIMENSIONS:								
Height (Stripped Top)**	2.32 m	7'7"	2.27 m	7'5"	2.58 m	8'5"	2.56 m	8'5"
Height (To Top of ROPS)	3.16 m	10'5"	3.20 m	10'6"	3.35 m	11'0"	3.35 m	11'0"
Height (To Top of Cab ROPS)	3.16 m	10'5"	—	—	3.50 m	11'6"	3.50 m	11'6"
Height (To Top of ROPS Canopy)	3.16 m	10'5"	—	—	—	—	—	—
Overall Length (With P Blade)	5.18 m	17'0"	—	—	—	—	—	—
(Without Blade)	4.49 m	14'9"	—	—	—	—	—	—
Overall Length (With S Blade)	—	—	5.28 m	17'4"	5.82 m	19'1"	5.82 mm	19'1"
(Without Blade)	—	—	4.19 m	13'9"	4.73 m	15'6"	4.73 m	15'6"
Width (Over Trunnion)	3.43 m	11'3"	—	—	2.87 m	9'5"	2.87 m	9'5"
Width (W/O Trunnion — Std. Shoe)	3.14 m	10'3.6"	2.55 m	8'5"	2.54 m	8'4"	2.54 m	8'1"
Ground Clearance	382 mm	15"	347 mm	13.7"	414 mm	16"	414 mm	16"
Blade Types and Widths:								
Straight	3.99 m	13'1"	3.66 m	12'0"	3.90 m	12'10"	3.91 m	12'10"
Angle	—	—	4.27 m	14'0"	—	—	—	—
Angle Straight	—	—	—	—	4.49 m	14'9"	4.49 m	14'9"
Full Angle	—	—	—	—	4.08 m	13'5"	4.08 m	13'5"
Universal	—	—	3.81 m	12'6"	3.98 m	13'1"	3.98 m	13'1"
Semi-U	—	—	—	—	3.68 m	12'1"	3.68 m	12'1"
Fuel Tank Refill Capacity	397 L	105 U.S. gal	435 L	115 U.S. gal	479 L	127 U.S. gal	479 L	127 U.S. gal

*Operating Weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluid, straight dozer with tilt, horn, back-up alarm, retrieval hitch and front pull hook.
— D7G includes end track guiding guards.
**Height (stripped top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

ATTACHMENT B
SUPPLEMENTAL INFORMATION

15733306 ①



1. HORIZONTAL AND VERTICAL CONTROL PROVIDED TO SURVEYOR BY JONES EDMUNDS, 730 NE WALDO RD, GAINESVILLE, FL 32641

2. ANY NATIONAL GEODETIC VERTICAL DATUM 1929 (NGVD29) MONUMENT WITHIN THE LIMITS OF CONSTRUCTION SHALL BE PROTECTED. IF IN DANGER OF DAMAGE, THE CONTRACTOR SHALL NOTIFY:

FLORIDA STATE GEODETIC ADVISOR

RONNIE L. TAYLOR
NOAA, NATIONAL GEODETIC SURVEY
NATIONAL OCEAN SERVICE ADVISOR
C/O BUREAU OF SURVEYS AND MAPPING, FLDEP
3900 COMMONWEALTH BLVD, MAIL STOP 105
TALLAHASSEE, FL 32399

TELEPHONE: (850)245-2610
FAX: (850)245-2545
E-MAIL: Ronie.Taylor@noaa.gov

IN THE EVENT THAT MR TAYLOR IS UNAVAILABLE, CONTACT:

ASSISTANT GEODETIC ADVISOR

RANDY WEGNER
NOAA, NATIONAL GEODETIC SURVEY
ASSISTANT NATIONAL OCEAN SERVICE ADVISOR
BUREAU OF SURVEYS AND MAPPING
3900 COMMONWEALTH BLVD, MAIL STOP 105
TALLAHASSEE, FL 32399

TELEPHONE: (850)245-2606
E-MAIL: Randy.Wegner@dep.state.fl.us

100 0 100 200
GRAPHIC SCALE: 1 INCH = 100 FT.

Southeastern Surveying, Inc.
601 N. St. Augustine Rd. Telephone: 229-259-9455
Valdosta, GA 31601 Fax: 229-259-9926
E-mail: bherring@sesurveying.com

THIS MAP IS NOT VALID WITHOUT THE SIGNATURE AND THE ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER

BARBARA L. HERRING, PLS #6194
PERFORMING LAND SURVEYING SERVICES
UNDER THE LICENSE BUSINESS NUMBER LB-0007091

HILLSBOROUGH COUNTY
SOLID WASTE MANAGEMENT DEPARTMENT
SOUTHEAST COUNTY LANDFILL

TOPOGRAPHIC SURVEY OF
PROTECTIVE COVER

DATE: MAY 8, 2008

SHEET 6 OF 8

(2)

APPENDIX B
SPECIFICATIONS

TABLE OF CONTENTS

SECTION 02130
VERTICAL EXTRACTION WELLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: The Contractor shall provide all labor, equipment, materials, and appurtenances necessary to drill, install and make ready landfill gas (LFG) extraction wells and wellheads as specified herein and as indicated on the Contract Drawings.

B. The slotted pipe, bentonite seals, filter pack (stone or tire chips to be used as alternate material), geotextile and soil backfill packs shall be set at depths shown on the Contract Drawings or as designated in the field by the Engineer. It is expected that combustible, asphixiant, and hazardous gases will be venting from boreholes drilled to install LFG extraction wells. The Contractor's bid price shall include provision for all equipment and procedures necessary to safely install wells under this condition. All work shall be performed by qualified workers in accordance with the best standards and practices available.

C. Upon completion of each extraction well, Contractor is responsible for the physical hauling and drop-off of all construction and drilling waste materials as directed by the Owner, at the landfill working face during normal operating hours.

D. Related Sections include but are not necessarily limited to:
   1. Section 15060 – Pipe and Pipe Fittings: Basic Requirements
   2. Section 15067 – Pipe: Polyethylene Section 15075 – Pipe: Polyvinyl Chloride (PVC)

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates
      b. C702, Standard Practice for Reducing Field Samples of Aggregate to Testing Size
      c. D2487, Standard Test Method for Classification of Soils for Engineering Purposes
      d. D2487, Standard Practice for Description for Soils (Visual-Manual Procedure)
      e. D2922, Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)
      f. D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
      g. D1693 - Test Method for Environmental Stress Cracking of Ethylene Plastics.
      h. D1784, Rigid Vinyl Compounds.
      i. D1785, PVC Plastic Pipe, Schedule 80.
      j. D2467, PVC Plastic Fittings, Schedule 80.
      k. D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
      l. D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
      m. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter - Controlled Polyethylene Pipe and Tubing.
      n. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
      o. D3350 - Specification for Polyethylene Plastic Pipe and Fittings Material.
      p. D421, Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.
      q. D422, Standard Test Method for Particle-Size Analysis of Soils.
      r. D4220, Standard Practices for Preserving and Transporting Soil Samples.

s. F480, Standard Specification for Thermoplastic Water Well Casing Pipe and Couplings Made in Standard Dimension Ratio (SDR).
t. F1248 - Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.
u. F1668, Standard Guide for Construction Procedures for Buried Plastic Pipe.

B. Qualifications:
1. The driller and installer of the landfill gas extraction wells shall have completed at least one hundred successful vertical landfill gas extraction wells of similar type and depth within the last 2 years.
2. All LFG collection wells shall be installed under the direction of a Civil Engineer, Engineering Geologist, or Geologist if so required by local or state jurisdictions. All final LFG collection well drilling logs and construction diagrams shall be signed by a registered professional or person of responsible charge. Field supervision of drilling, logging and installation activities shall be performed by trained, experienced technical personnel.

C. Miscellaneous:
1. Contractor's personnel Health and Safety Plan shall be available for informational purposes.
2. Retain a professional experienced in installation of LFG wells to be responsible for observing and documenting information related to all installation activities.
3. Inspect well materials for cleanliness, deformations, and imperfections, and to ensure conformance with specifications prior to use.

1.3 SUBMITTALS

A. The Contractor shall prepare and submit to the Engineer, for review and approval, Certificates of Compliance on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of pipe and appurtenances furnished.

B. The Contractor shall submit a health and safety plan (HASP) for information purposes only and not for review to the Engineer before any construction starts.

C. The Contractor shall prepare and submit to the Engineer for review and approval Shop Drawings showing dimensions, materials, and manufacturer's information for backfill materials, pipe, pipe perforations, fittings, bentonite, and wellhead components.

D. One week prior to well drilling, Contractor shall submit an example well boring log and construction log. The example log shall be completed with all of the required descriptions and pertinent information required under Part 3.3 of this Section.

E. At least two weeks prior to construction, the Contractor shall submit to the Engineer for review and approval, results of the sieve analysis and calcium carbonate content for the stone backfill, samples of all well backfill materials (if requested), the name of the vendor(s) and source of materials furnished. Note that tire chips may be used as alternate material.

F. At the end of each day, Contractor shall provide the Engineer copies of the handwritten well boring and completion logs for each well drilled on that day. Information to be included on the well logs is listed in Part 3.3 of this Section.

G. Final boring logs, based on field information shall be typewritten and submitted with the Record Documents.

H. As-Built drawings shall be submitted to the Engineer including, northing, easting and elevation data for all required points of the gas collection system in the state plane coordinate system. Top of casing and ground surface elevation shall be surveyed for all well points.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers of HDPE casing, PVC screen, and accessories are acceptable:
   1. CSR/Polypipe
   2. ISCO
   3. Lee Supply
   4. Ferguson Industrial Plastics
   5. U.S. Plasctic Corp.
   6. Harvel Piping.
   7. Charlotte Pipe and Foundry Company.
   8. Or acceptable others

2.2 MATERIALS

A. HDPE Casing as specified in Section 15067:
   1. 24 inch nominal diameter for Caisson and 8-inch nominal diameter for top of well sleeve.
   2. ASTM F480.
   3. High Density Polyethylene Pipe (HDPE) PE 3408/3608 SDR 17 or approved equal with ASTM D3350 Cell Classification 345464C.

B. PVC Well Screen (Slotted pipe) as specified in 15075:
   1. 6 inch nominal diameter.
   2. Perforation pattern(s) as shown on Contract Drawings.
   3. Slots to be factory installed. No slots to be installed in the field.
   4. 20 foot lengths or as needed. Field cutting will be allowed as long as cuts are clean, perpendicular to the pipe, and do not affect the integrity of the well screen.

C. HDPE Jointing:
   1. All joints shall be butt fused per ASTM D3261.
   2. 24 inch Blind Flange shall be extrusion welded and gusseted to 8 inch pipe sleeve.

D. PVC Jointing:
   1. All joints and bottom cap of screen shall be with solvent cement and secured with lag screws.

E. Filter Pack as specified in Section 02221:
   1. Clean washed, non-calcareous gravel with no fines.
   2. 1-inch to 3-inch diameter size so as not to impair flow to perforations/slots.
   3. Tire chips, if used, shall be free of foreign materials, and be in 4 inches nominal size. Tire Chips to be supplied by County.

F. Bentonite Seal:
   1. Pellet or chip form of sodium bentonite that shall consist of clay greater than 85% sodium montmorillonite, without additives.
   2. Bentonite shall be hydrated per manufacturer's instructions prior to backfilling with soil. Bentonite shall be hydrated in 6-inch lifts as per Paragraph 3.2.C.15 of this Section.
   3. Under no circumstances will the use of granular bentonite be permitted.

G. Backfill Material:
   1. Soil backfill material shall be granular material free of clay, sticks, roots organic material from the on-site borrow area.

H. Top and Bottom Cap:
   1. Bottom end cap shall be SCH 80 PVC connected with solvent cement and secured with lag screws.

2. Contractor shall supply temporary SCH 40 PVC cap on the top secured with at least three (3) set screws and silicone sealant as per Contract Drawings and Specifications until installation of wellhead is completed.

I. Wellhead materials
   1. Wellheads shall be 2-inch diameter Forrer wellheads by Forrer Supply.
   2. Vertical wellhead models shall be used for all wells.
   3. Wellheads to be provided with 0.25", 0.50", 0.75", 1.0", 1.25", and 1.5" thick orifice plates.

J. Monitoring ports
   1. Monitoring ports shall be ¼" inch NPT polypropylene male barb monitoring port, Parker P4MCB4 Tubing barb, with McMaster Carr 9753K38 vinyl cap or equivalent.

K. Well Identification
   1. Upon completion of well drilling, Contractor shall promptly label the well identification number on the well casing to match existing gas wells. Lettering by hand or by any other means shall not be permitted.

L. Spare Parts
   1. Two wellheads
   2. 100' Kanaflex Hose
   3. 2 Dozen Power Clamps for Kanaflex Hose
   4. 2 Dozen Quick Connect Adaptors – Female
   5. 1 Dozen Thermometer Quick Connects – Female
   6. 4 Thermometers (to go with connect assembly)
   7. 6 Dozen Caps
   8. 4 Wellhead Valve Handles

M. LFG Collection Wells:
   1. The Contractor shall install the landfill gas collection wells at the locations noted on the Contract Drawings and/or where staked in the field, or as approved by the Owner or Engineer.
   2. The LFG well boring will be as noted in the Contract Drawings. The drilled boring shall be specified by the Engineer or Owner, and shall extend to no more than 15 feet of the landfill base liner system elevations. In no instance will well bores be advanced and/or completed into the native soils beneath the landfill. Wells shall be constructed in accordance with the details shown on the Contract Drawings and as noted in the Specifications.

N. Geotextile:
   1. 6 oz non-woven geotextile.

PART 3 - EXECUTION

3.1 PREPARATION

A. All materials necessary to complete the installation of the gas extraction well shall be on-site prior to drilling start-up.

B. Contractor shall follow his Health and Safety Plan at all times.

C. The Contractor shall survey and stake the well locations prior to drilling. Well layout surveying shall be done by a Florida Licensed Professional Surveyor. Contractor shall notify the Engineer of any discrepancies between the elevations shown on the Contract Drawings and actual field measurement elevations, and any other conflicts that may be evident.

D. Contractor shall supply surveyed ground elevations to Engineer electronically in AutoCAD format so that the design depths may be confirmed at least one week prior to drilling.

E. Well locations must be approved and may be adjusted by the Engineer prior to beginning drilling. Final well schedule to be used for construction of the vertical wells will be provided by the Engineer after reviewing the survey provided by the Contractor.

3.2 INSTALLATION

A. General:
1. All wells will be installed in the general locations shown in the Contract Drawings. The well schedule shows the estimated design depths of the wells along with the associated screen lengths. All field changes regarding the locations, depth, or dimensions specified in the Contract Drawings shall be approved by the Engineer and documented in the record drawings by the Contractor.
2. The Contractor shall provide at all times a thoroughly experienced, competent driller during all operations at the drill site.
3. The Contractor must use dry drilling equipment.

B. Well Hole Construction:
1. Drill wells using a minimum 36 in. OD core-grab bucket auger. Alternate drilling methods must be pre-approved by the Engineer.
2. If a layer of sand or the liner is encountered while boring, drilling shall immediately cease and the Engineer shall be contacted immediately.
3. All gas extraction well borings shall extend to the depth indicated in the Contract Drawings. Under no circumstances are the drilling depths from the well schedule on the Contract Drawings to be exceeded unless approved by the Engineer in advance.
   a. Wet Borings:
      1) The Engineer shall be notified of wet boring conditions.
      2) If water is encountered in a boring, the Contractor may be directed by the Engineer to drill beyond the point at which it was encountered. If wet conditions remain, at the direction of the Engineer, the boring may be terminated (after driller has attempted to advance boring for 3 hours) and the length of perforated pipe adjusted by the Engineer. If wet conditions cease (e.g. due to perched water layer), then drilling will continue to the design depth.
      3) If water is encountered in a boring at a shallow depth, the Engineer may decrease the well depth and length of perforated pipe, or relocate the well.
   b. Abandoned Borings:
      1) If in the opinion of the Engineer, the borehole has not reached a sufficient depth to function as an effective extraction well, the Contractor shall abandon this borehole by backfilling it with cuttings removed during drilling. Soil shall be backfilled and compacted to ground surface. Contractor shall supply additional soil backfill to refill any settlement within the abandoned borehole, as approved by the Owner and Engineer.
      2) If cuttings are unsuitable as backfill (for example, box springs, tires, etc.) the Contractor shall use soil backfill material.
      3) Compensation for abandoned borings shall be at the unit price for boring refusal.
   c. As soon as drilling is completed, a safety screen shall be placed over the top of the bore. This screen shall stay in place until backfilling is within 4 feet of the surface. Safety screen size should be large enough to accommodate all backfill materials and any tools used during backfill yet not large enough for any human to accidentally fall through.
   d. All bore holes that are not completed at the end of the day are to be covered with a metal well cover capable of preventing any persons from falling into the hole. The hole must then be covered with a piece of plywood to substantially cover the entire hole. Soil must be placed on top of the plywood to completely cover the plywood to further prevent gas emissions. Substitute safety measure may be used if approved by the Engineer.

C. Well Installation:
1. Contractor shall ~~fabricate the~~provide HDPE well casing and PVC well screen in accordance with Contract Drawings and Specifications. ~~The~~ Slots for PVC well screen shall be factory installed~~slotted~~ in accordance with the Details and Specifications. Well screen shall be capped or blind-flanged at the surface connection prior to installation to prevent gas from escaping and to prevent backfill material from entering the pipe.
2. No pressure tests are required for the collection well screens.

3. Measure depth of boring. The bore for the well shall be straight and the well pipe shall be installed in the center of the borehole.
4. Connect the well screen of sufficient length including bottom cap.
5. Place 12 inches of filter pack (stone or tire chips) in the bottom of the boring prior to installing well screen.
6. Lower well screen into the borehole . In no instance, drive or force into position. The Contractor shall take all necessary precautions to maintain the well pipe vertically plumb during the entire backfill operation of the borehole to the satisfaction of the Engineer.
7. If the pipe is installed out of plumb, as determined by the Engineer, the Contractor, at his own expense shall correct the alignment.
8. Join additional well screen sections for a single interval by securing with lag screws and solvent cement.
9. Install HDPE casing and join additional sections for a single interval by butt fusion methods per ASTM D3261. 24 inch Blind Flange shall be extrusion welded and gusseted to 8 inch pipe sleeve.
10. Extend PVC well screen and HDPE casing to no more than 2 feet above existing grade elevation.
11. At the end of each day, Contractor shall cap the ends of all joined pipes longer than 20 feet to prevent entry by animals and debris.
12. Continue placement of filter pack (stone or tire chips) into the annulus between the HDPE casing and the borehole wall until the filter pack is 4 feet below existing surface . filter pack must be placed between the HDPE casing and PVC well screen until the filter pack is 2 feet below existing surface. All filter pack materials shall be placed by methods approved by Engineer.
13. Take periodic depth soundings to monitor the level of the filter pack and detect any bridging. Soundings shall be taken at no more than 5-foot intervals.
14. Place 6 ounce non-woven geotextile or approved equal on top of the filter pack between the HDPE casing and borehole wall.
15. After ensuring that the HDPE casing and PVC well screens are centered in the borehole, place 2 foot minimum bentonite seal on top of the geotextile between the HDPE casing and borehole wall in maximum 6-inch lifts.
    a. Hydrate bentonite chips/pellet in the bore hole per supplier's recommendations for a minimum 1 hour after placement and prior to installing clean backfill. The bentonite must be thoroughly hydrated,
    b. Measure depth of bentonite seal after tamping each lift.
16. Fill the remainder of the bore hole between the HDPE casing and borehole wall to grade with clean backfill by means pre-approved by the Engineer in maximum 18-inch lifts.
    a. Soil backfill shall be rodded in the boring to provide even distribution and compaction.
17. The grate over the borehole that is used to keep the well casing plumb shall not be removed until the borehole is backfilled to within 1 foot of ground surface and sufficiently compacted.
18. Collect and clean up drilling debris, cuttings around the work areas. Dispose in active landfill.
19. Mound shall be installed around the well riser to drain stormwater away from the well.
20. Contractor shall be responsible for any grading, leveling, towing and/or restoration that may be necessary for movement of the drill rig on the landfill property

D. Refuse Disposal:
1. Contractor shall dispose of cuttings at the working face of the landfill by the end of each working day. Refuse should remain within close proximity of the location from which it was removed. Excavated refuse must be removed immediately during any rain event to prevent stormwater from contacting the refuse.
2. Contractor is responsible for weighing cuttings at landfill scale in highway legal trucks and paying tipping fees. Contractor shall be responsible for all other costs.

E. Temporary Cap:
   1. The Contractor shall temporarily cap the riser pipe of the vertical extraction well immediately after well pipe installation to prevent venting of LFG into the atmosphere. The Contractor shall remove this cap during the installation of the wellheads. Lag screws may be necessary to secure the cap due to the internal gas pressure within the well.

F. Wellhead Installation:
   1. Wellheads shall be installed in accordance with manufacturer's recommendations. Pipe sections of the wellhead shall be air-tight. Any leaks shall be repaired by Contractor at no additional cost to the Owner.
   2. Install flexible hose so that hose has no sags, as show on the Contract Drawings. However, flexible hose shall not be taut. Provide enough slack to accommodate minor pipe settlement, as approved by the Engineer.
   3. Wellhead to lateral connection shall be made with a 2 inch flexible hose fastened with stainless steel pipe clamps (or equal).

G. Asbestos Handling:
   1. If asbestos is encountered during drilling operations, the following waste handling procedures must be implemented:
      a. If any waste appearing to possibly contain asbestos is uncovered, all asbestos handling procedures will be immediately placed into effect.
      b. All persons within 25 feet of the drilling operations will be required to wear the appropriate respirators.
      c. The use of Tyvek suits will be optional. However, if Tyvek suits are not worn, all employee uniforms must be laundered and the launderers notified of possible contamination with asbestos. All Tyvek suits will be considered to be contaminated with asbestos and will be disposed of accordingly.
      d. A water truck equipped with the appropriate spraying equipment to keep the drill cuttings wet will be required at all times.
      e. An area of appropriate size will be prepared to contain the cuttings by one of the following methods.
         1) A waste container lined with 6 mil polyethylene will be placed as close as reasonably possible to the well being drilled. A small area next to the drill rig where drill cuttings will be handled will also be lined with 6 mil polyethylene and covered with clean soil to protect the polyethylene. A small earthen berm will be made to help contain the cuttings and facilitate loading into the container. The polyethylene and soil cover will be considered to be part of the waste.
         2) An area next to the drill rig that is appropriately sized to accommodate all of the drill cuttings will be surrounded by a small soil berm approximately 30" high. This area will then be lined with 6 mil polyethylene and covered with clean soil to protect the polyethylene. This area will be positioned in a way such that all handling of cuttings will be in the protected area. The polyethylene and soil will be considered to be part of the waste.
      f. All cuttings that are not already damp upon removal from the well bore will be immediately wetted.
      g. After wetting, all cuttings will be immediately placed into the container or moved to a different part of the storage area (if needed).
      h. All cuttings will be kept damp and covered.
      i. After the container is filled, the well is completed, or at the end of the workday, a representative sample will be taken of the waste. The waste sample will be tested by a certified testing laboratory for asbestos using the polarizing light microscopy method. While waiting for the test results, all waste will be kept damp and covered.
      j. If test results indicate greater than one (1) percent asbestos, the waste will be handled and disposed as asbestos waste. This will include keeping the waste wetted and covered as it is transported to another portion of the landfill. If asbestos waste is handled, all equipment that contacted the waste must be decontaminated in an acceptable manner prior to leaving the landfill site.

k. If test results indicate less than one (1) percent asbestos, the waste will be tested as normal MSW and disposed of at the normal working face of the landfill.
l. An alternative to sampling and testing the waste will be to assume that the waste contains asbestos and to handle and dispose of accordingly.
m. The cost of all laboratory testing will be the responsibility of the Contractor. The exact drilling procedure that will be followed must be included in the Contractor's Health and Safety Plan. Additionally, both the selected testing laboratory and testing protocol (should asbestos be encountered during drilling) must be submitted by the Contractor in writing and approved by the Owner prior to beginning any well drilling activities.
n. Contractor shall be responsible for safely transporting asbestos in highway legal trucks to landfill scales for weighing prior to disposal at active face. Contractor is responsible for paying all associated tipping fees.

H. Settlement
1. Any settlement around the completed wells, or over abandoned boreholes, shall be backfilled within 3 weeks after placement of backfill from the level of the subsidence to 6 inches above existing grade with the appropriate cover materials.

I. Obstruction
1. If there is a drilling obstruction encountered in the landfill that, despite the best reasonable efforts of the Contractor, cannot be penetrated, the Contractor shall request relief from the Owner or Engineer from completion of the well. The Owner or Engineer shall be the sole authority for deciding on one of the following:
a. Additional drilling efforts are needed at no additional compensation.
b. The hole shall be abandoned. The Contractor shall backfill the well to the predrilled condition or to the satisfaction of the Owner or Engineer. The Contractor shall be compensated for the drilling and backfilling of the well, but not its completion.
c. The well shall be accepted at the obstructed depth. The well shall be completed at this new depth. Compensation shall be for the modified footage of the well.

3.3 FIELD QUALITY CONTROL

A. Submit the following to the Engineer after each day's work.

B. Project Record Documents:
1. Daily driller's report: During the drilling of the well, maintain daily driller's report that includes:
a. Date
b. Location
c. Boring Identification Number
d. Weather Conditions
e. Daily Activities
f. Equipment Used
g. Materials Used
h. Well construction (materials used, type, quantity, etc.)
i. The number of feet drilled.
j. The number of hours on the job (rig time, down time, stand-by, etc.).
k. Names of contract personnel on the job.
l. The foot of casing set.
m. Other pertinent data as may be requested by the Engineer.
2. Driller's log: During the drilling of the well, prepare and maintain a complete log that includes:
a. Logger's Name
b. Date
c. Location
d. Boring Identification Number
e. Equipment Used
f. Drill Crew

g. Time
h. The reference point for all depth measurements.
i. The depth at which each soil to refuse change occurs.
j. The thickness of each soil or refuse stratum.
k. The depth at which the leachate is encountered, if applicable.
l. Depth to refuse and depth of undisturbed soil.
m. Visual description of refuse at 5-foot intervals:
    1) Type of waste encountered including the estimated percentage of the following components (by volume) on visual inspection:
        a) Plastic/Cardboard
        b) Plastic
        c) Yard waste
        d) Construction debris
        e) Textiles
        f) Tires
        g) Sludge
        h) Dirt
    2) Temperature of excavated refuse.
n. Depth of location of any lost drilling material, tools, or any other unusual occurrences.
o. The total depth of completed extraction well.
p. The total depth of boring.
q. Well screen interval.
r. HDPE casing interval.
s. Length of above ground riser stick-up pipe.
t. Filter pack (stone or tire chip) depth interval.
u. Bentonite seal depth interval.

3. Typed final copies of the well logs shall be submitted with the Record Drawings. Handwritten logs will not be acceptable for submittal with the Record Drawings.

END OF SECTION

SECTION 02140
HORIZONTAL COLLECTOR WELLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: The Contractor shall provide all labor, equipment, materials, and appurtenances necessary to trench, install and make ready horizontal landfill gas (LFG) extraction wells and wellheads as specified herein and as indicated on the Contract Drawings.

B. The perforated pipe, filter pack (stone or tire chips to be used as alternate material), geotextile and soil backfill packs shall be set at depths shown on the Contract Drawings or as designated in the field by the Engineer. It is expected that combustible, asphixiant, and hazardous gases will be venting from trenches and boreholes drilled to install LFG extraction wells. The Contractor's bid price shall include provision for all equipment and procedures necessary to safely install wells under this condition. All work shall be performed by qualified workers in accordance with the best standards and practices available.

C. Upon completion of each extraction well, Contractor is responsible for the physical hauling and drop-off of all construction and drilling waste materials as directed by the Owner, at the landfill working face during normal operating hours.

D. Related Sections include but are not necessarily limited to:
1. Section 02221 – Trenching, Backfilling, and Compacting for LFG Piping
2. Section 15060 – Pipe and Pipe Fittings: Basic Requirements

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. ASTM International (ASTM):
   a. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates
   b. C702, Standard Practice for Reducing Field Samples of Aggregate to Testing Size
   c. D2487, Standard Test Method for Classification of Soils for Engineering Purposes
   d. D2487, Standard Practice for Description for Soils (Visual-Manual Procedure)
   e. D2922, Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)
   f. D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
   g. D1693 - Test Method for Environmental Stress Cracking of Ethylene Plastics.
   h. D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
   i. D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
   j. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter - Controlled Polyethylene Pipe and Tubing.
   k. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
   l. D3350 - Specification for Polyethylene Plastic Pipe and Fittings Material.
   m. D421, Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.
   n. D422, Standard Test Method for Particle-Size Analysis of Soils.
   o. D4220, Standard Practices for Preserving and Transporting Soil Samples.

p. F480, Standard Specification for Thermoplastic Water Well Casing Pipe and Couplings Made in Standard Dimension Ratio (SDR).

B. Qualifications:
1. The driller and installer of the landfill gas extraction wells shall have completed at least one hundred successful vertical landfill gas extraction wells of similar type and depth within the last 2 years.
2. All LFG collection wells shall be installed under the direction of a Civil Engineer, Engineering Geologist, or Geologist if so required by local or state jurisdictions. All final LFG collection well drilling logs and construction diagrams shall be signed by a registered professional or person of responsible charge. Field supervision of drilling, logging and installation activities shall be performed by trained, experienced technical personnel.

C. Miscellaneous:
1. Contractor's personnel Health and Safety Plan shall be available for informational purposes.
2. Retain a professional experienced in installation of LFG wells to be responsible for observing and documenting information related to all installation activities.
3. Inspect well materials for cleanliness, deformations, and imperfections, and to ensure conformance with specifications prior to use.

1.3 SUBMITTALS

A. The CONTRACTOR shall prepare and submit to the Engineer, for review and approval, Certificates of Compliance on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of pipe and appurtenances furnished.

B. The Contractor shall submit a health and safety plan (HASP) for information purposes only and not for review to the Engineer before any construction starts.

C. The Contractor shall prepare and submit to the Engineer for review and approval Shop Drawings showing dimensions, materials, and manufacturer's information for backfill materials, pipe, pipe perforations, fittings, geotextile, and wellhead components.

D. One week prior to well drilling the vertical component of the horizontal collector, Contractor shall submit an example well boring log and construction log. The example log shall be completed with all of the required descriptions and pertinent information required under Part 3.3.A.2 of this Section.

E. At least two weeks prior to construction, the Contractor shall submit to the Engineer for review and approval, results of the sieve analysis and calcium carbonate content for the stone backfill (if tire chips are not used), samples of all well backfill materials (if requested), the name of the vendor(s) and source of materials furnished.

F. At the end of each day, Contractor shall provide the Engineer copies of the handwritten well completion logs for each horizontal collector well installed on that day. For vertical components of the horizontal collector, Contractor to include well log information as listed in Part 3.3.A.2 of this Section.

G. Final well completion logs, based on field information shall be typewritten and submitted with the Record Documents.

H. As-Built drawings shall be submitted to the Engineer including, northing, easting and elevation data for all required points of the gas collection system in the state plane coordinate system. Top of casing and ground surface elevation shall be surveyed for all horizontal well collectors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers of HDPE casing, screen, protective casing and accessories are acceptable:
   1. CSR/Polypipe
   2. ISCO
   3. Lee Supply
   4. Ferguson Industrial Plastics
   5. Or acceptable others

2.2 MATERIALS

A. Well Casing as specified in Section 15060:
   1. 6 inch nominal diameter.
   2. ASTM F480.
   3. High Density Polyethylene Pipe (HDPE) PE 3408/3608 SDR 11 or approved equal with ASTM D3350 Cell Classification 345464C.

B. Well Screen (Perforated pipe):
   1. Same material and dimensions as casing.
   2. 3/4-inch diameter perforation as shown on Contract Drawings.
   3. Holes to be factory installed. No holes or slots to be installed in the field.
   4. 20 foot lengths, or as needed. Field cutting will be allowed as long as cuts are clean, perpendicular to the pipe, and do not affect the integrity of the well screen.

C. HDPE Jointing:
   1. All joints shall be butt fused per ASTM D3261.
   2. Bottom cap of screen shall be butt fused per ASTM D3261.

D. Filter Pack as specified in Section 02221:
   1. Clean washed non-calcareous gravel with no fines.
   2. 1 to 3-inch diameter size so as not to impair flow to perforations/slots.
   3. Tire chips, if used, shall be free of foreign materials, and be in 4 inches nominal size. Tire Chips to be supplied by County.

E. Backfill Material:
   1. Soil backfill material shall be granular material free of clay, sticks, roots organic material from the on-site borrow area. .

F. Bottom cap for vertical component:
   1. Bottom end cap shall be HDPE butt-fusion welded.

G. Wellhead materials
   1. Wellheads shall be 2-inch diameter Forrer wellheads by Forrer Supply.
   2. Vertical wellhead models shall be used for all wells.
   3. Wellheads to be provided with 0.25", 0.50", 0.75", 1.0", 1.25", and 1.5" thick orifice plates.

H. Monitoring ports
   1. Monitoring ports shall be ¼" inch NPT polypropylene male barb monitoring port, Parker P4MCB4 Tubing barb, with McMaster Carr 9753K38 vinyl cap or equivalent.

I. Well Identification
   1. Upon completion of well installation, Contractor shall promptly label the well identification number on the well casing to match existing gas wells. Lettering by hand or by any other means shall not be permitted.

J. Spare Parts
   1. Two wellheads
   2. 20' Kanaflex Hose
   3. 2 Dozen Power Clamps for Kanaflex Hose
   4. 2 Dozen Quick Connect Adaptors – Female
   5. 1 Dozen Thermometer Quick Connects – Female
   6. 4 Thermometers (to go with connect assembly)
   7. 6 Dozen Caps
   8. 4 Wellhead Valve Handles

K. Vertical Component of Horizontal Collectors:
   1. The Contractor shall install the vertical component of the horizontal collector wells at the locations noted on the Contract Drawings and/or where staked in the field, or as approved by the Owner or Engineer.
   2. The vertical component boring will be as noted in the Contract Drawings. The drilled boring shall be specified by the Engineer or Owner, and shall extend to no more than 15 feet of the landfill base liner system elevations. In no instance will the well bores be advanced and/or completed into the native soils beneath the landfill. Wells shall be constructed in accordance with the details shown on the Contract Drawings and as noted in the Specifications.

L. Geotextile:
   1. 6oz non-woven geotextile.

PART 3 - EXECUTION

3.1 PREPARATION

A. All materials necessary to complete the installation of the gas extraction well shall be on-site prior to trenching or drilling start-up.

B. Contractor shall follow his Health and Safety Plan at all times.

C. The Contractor shall survey and stake the length of the horizontal well and location of the vertical components prior to trenching and drilling. A stake shall also be placed in the locations of tie-in to the lateral. Well layout surveying shall be done by a Florida Licensed Professional Surveyor. Contractor shall notify the Engineer of any discrepancies between the elevations shown on the Contract Drawings and actual field measurement elevations, and any other conflicts that may be evident.

D. Contractor shall supply surveyed ground elevations to Engineer electronically in AutoCAD format so that the design depths may be confirmed at least one week prior to trenching.

E. Well locations must be approved and may be adjusted by the Engineer prior to beginning trenching and drilling. Final well schedule to be used for construction of the vertical component of the horizontal collector wells will be provided by the Engineer after reviewing the survey provided by the Contractor.

3.2 INSTALLATION

A. General:
   1. All wells will be installed in the locations shown in the Contract Drawings. The well schedule shows the estimated design depth of the vertical component along with the associated perforated lengths. All field changes regarding the location, depth, or dimensions specified in the Contract Drawings shall be approved by the Engineer and documented in the record drawings by the Contractor.

2. The Contractor shall provide at all times a thoroughly experienced, competent trencher and driller during all operations at the site.
3. The Contractor must use dry trenching and drilling equipment.

B. Horizontal Collector Construction:
1. All horizontal collectors shall extend to the depth indicated in the Contract Drawings. Under no circumstances, are the trenching depths from the Contract Drawings to be exceeded unless approved by the Engineer in advance.
2. The Contractor shall cease construction activities if it rains and shall continue once the excavation has no standing water.

C. Horizontal Collector Installation:
1. Extend riser pipe casing at each wellhead to no more than 4 feet above ~~final~~ existing cover surface elevation.
2. At the end of each day, Contractor shall cap the ends of all joined pipes longer than 20 feet to prevent entry by animals and debris.
3. Continue placement of filter pack into the trench as shown on the Contract Drawings until the filter pack is approximately 3 feet into the solid pipe of the horizontal collector.
4. After ensuring that filter pack is approximately 3 feet into the solid pipe, place the 6 OZ non-woven geotextile covering the filter pack.
5. Collect and clean up debris around the work areas. Dispose in active working face of the landfill.

D. Vertical Component Well Hole Construction:
1. Drill wells using a minimum 36 in. OD core-grab bucket auger. Alternate drilling methods must be pre-approved by the Engineer.
2. If a layer of sand or the liner is encountered while boring, drilling shall immediately cease and the Engineer shall be contacted immediately.
3. All gas extraction well borings shall extend to the depth indicated in the Contract Drawings. Under no circumstances, are the drilling depths from the well schedule on the Contract Drawings to be exceeded unless approved by the Engineer in advance.
   a. Wet Borings:
      1) The Engineer shall be notified of wet boring conditions.
      2) If water is encountered in a boring, the Contractor may be directed by the Engineer to drill beyond the point at which it was encountered. If wet conditions remain, at the direction of the Engineer, the boring may be terminated (after driller has attempted to advance boring for 3 hours) and the length of perforated pipe adjusted by the Engineer. If wet conditions cease (e.g. due to perched water layer), then drilling will continue to the design depth.
      3) If water is encountered in a boring at a shallow depth, the Engineer may decrease the well depth and length of perforated pipe, or relocate the well.
   b. Abandoned Borings:
      1) If in the opinion of the Engineer, the borehole has not reached a sufficient depth to function as an effective extraction well, the Contractor shall abandon this borehole by backfilling it with cuttings removed during drilling. Soil shall be backfilled and compacted to ground surface. Contractor shall supply additional soil backfill to refill any settlement within the abandoned borehole, as approved by the Owner and Engineer.
      2) If cuttings are unsuitable as backfill (for example, box springs, tires, etc.) the Contractor shall use soil backfill material.
      3) Compensation for abandoned borings shall be at the unit price for boring refusal.

c. As soon as drilling is completed, a safety screen shall be placed over the top of the bore. This screen shall stay in place until backfilling is within 4 feet of the surface. Safety screen size should be large enough to accommodate all backfill materials and any tools used during backfill yet not large enough for any human to accidentally fall through.

d. All bore holes that are not completed at the end of the day are to be covered with a metal well cover capable of preventing any persons from falling into the hole. The hole must then be covered with a piece of plywood to substantially cover the entire hole. Soil must be placed on top of the plywood to completely cover the plywood to further prevent gas emissions. Substitute safety measure may be used if approved by the Engineer.

E. Vertical Component Installation:

1. Contractor shall ~~fabricate the~~provide well casings in accordance with Contract Drawings and Specifications. The well casing perforations shall be ~~perforated~~ factory installed in accordance with the Details and Specifications. Well casings shall be capped or blind-flanged at the surface connection prior to connecting to the horizontal collector in order to prevent gas from escaping and to prevent backfill material from entering the pipe.
2. No pressure tests are required for the collection well casings.
3. Measure depth of boring. The bore for the well shall be straight and the well pipe shall be installed in the center of the borehole.
4. Connect the well screen and a sufficient length of well casing including bottom plug or cap.
5. Place 12 inches of filter pack (stone or tire chips) in the bottom of the boring prior to installing well casing.
6. Lower screen into the well with the casing. In no instance, drive or force into position. The Contractor shall take all necessary precautions to maintain the well pipe vertically plumb during the entire backfill operation of the borehole to the satisfaction of the Engineer.
7. If the pipe is installed out of plumb, as determined by the Engineer, the Contractor, at his own expense shall correct the alignment.
8. Join screen and riser sections for a single interval by butt fusion methods per ASTM D3261 for HDPE.
9. Vertical component will be connected to the horizontal component.
10. At the end of each day, Contractor shall cap the ends of all joined pipes longer than 20 feet to prevent entry by animals and debris.
11. Continue placement of filter pack (stone or tire chips) into the annulus between the well screen and the borehole wall until the filter pack reaches the horizontal component. All filter pack materials shall be placed by methods approved by Engineer.
12. Take periodic depth soundings to monitor the level of the filter pack and detect any bridging. Soundings shall be taken at no more than 5-foot intervals.
13. Contractor shall be responsible for any grading, leveling, towing and/or restoration that may be necessary for movement of the drill rig on the landfill property.

F. Refuse Disposal:

1. Contractor shall dispose of debris at the working face of the landfill at the end of each working day. Refuse should remain within close proximity of the location from which it was removed. Excavated refuse must be removed immediately during any rain event to prevent stormwater from contacting the refuse.
2. Contractor is responsible for weighing cuttings at landfill scale in highway legal trucks and paying tipping fees. Contractor shall be responsible for all other costs.

G. Temporary Cap:

1. The Contractor shall temporarily cap the riser pipe of the extraction well immediately after well pipe installation to prevent venting of LFG into the atmosphere. The Contractor shall remove this cap during the installation of the wellheads. Lag screws may be necessary to secure the cap due to the internal gas pressure within the well.

H. Wellhead Installation:

1. Wellheads shall be installed in accordance with manufacturer's recommendations. Pipe sections of the wellhead shall be air-tight. Any leaks shall be repaired by Contractor at no additional cost to the Owner.
2. Install flexible hose so that hose has no sags, as show on the Contract Drawings. However, flexible hose shall not be taught. Provide enough slack to accommodate minor pipe settlement, as approved by the Engineer.
3. Wellhead to lateral connection shall be made with a 2 inch flexible hose fastened with stainless steel pipe clamps (or equal).

I. Asbestos Handling;

1. If asbestos is encountered during drilling operations, the following waste handling procedures must be implemented:
   a. If any waste appearing to possibly contain asbestos is uncovered, all asbestos handling procedures will be immediately placed into effect.
   b. All persons within 25 feet of the drilling operations will be required to wear the appropriate respirators.
   c. The use of Tyvek suits will be optional. However, if Tyvek suits are not worn, all employee uniforms must be laundered and the launderers notified of possible contamination with asbestos. All Tyvek suits will be considered to be contaminated with asbestos and will be disposed of accordingly.
   d. A water truck equipped with the appropriate spraying equipment to keep the drill cuttings wet will be required at all times.
   e. An area of appropriate size will be prepared to contain the cuttings by one of the following methods.
      1) A waste container lined with 6 mil polyethylene will be placed as close as reasonably possible to the well being drilled. A small area next to the drill rig where drill cuttings will be handled will also be lined with 6 mil polyethylene and covered with clean soil to protect the polyethylene. A small earthen berm will be made to help contain the cuttings and facilitate loading into the container. The polyethylene and soil cover will be considered to be part of the waste.
      2) An area next to the drill rig that is appropriately sized to accommodate all of the drill cuttings will be surrounded by a small soil berm approximately 30" high. This area will then be lined with 6 mil polyethylene and covered with clean soil to protect the polyethylene. This area will be positioned in a way such that all handling of cuttings will be in the protected area. The polyethylene and soil will be considered to be part of the waste.
   f. All cuttings that are not already damp upon removal from the well bore will be immediately wetted.
   g. After wetting, all cuttings will be immediately placed into the container or moved to a different part of the storage area (if needed).
   h. All cuttings will be kept damp and covered.
   i. After the container is filled, the well is completed, or at the end of the workday, a representative sample will be taken of the waste. The waste sample will be tested by a certified testing laboratory for asbestos using the polarizing light microscopy method. While waiting for the test results, all waste will be kept damp and covered.
   j. If test results indicate greater than one (1) percent asbestos, the waste will be handled and disposed as asbestos waste. This will include keeping the waste wetted and covered as it is transported to another portion of the landfill. If asbestos waste is handled, all equipment that contacted the waste must be decontaminated in an acceptable manner prior to leaving the landfill site.
   k. If test results indicate less than one (1) percent asbestos, the waste will be tested as normal MSW and disposed of at the normal working face of the landfill.

l. An alternative to sampling and testing the waste will be to assume that the waste contains asbestos and to handle and dispose of accordingly.
m. The cost of all laboratory testing will be the responsibility of the Contractor. The exact drilling procedure that will be followed must be included in the Contractor's Health and Safety Plan. Additionally, both the selected testing laboratory and testing protocol (should asbestos be encountered during drilling) must be submitted by the Contractor in writing and approved by the Owner prior to beginning any well drilling activities.
n. Contractor shall be responsible for safely transporting asbestos in highway legal trucks to landfill scales for weighing prior to disposal at active face. Contractor is responsible for paying all associated tipping fees.

J. Obstruction
1. If there is a drilling obstruction encountered in the landfill that, despite the best reasonable efforts of the Contractor, cannot be penetrated, the Contractor shall request relief from the Owner or Engineer from completion of the well. The Owner or Engineer shall be the sole authority for deciding on one of the following:
a. Additional drilling efforts are needed at no additional compensation.
b. The hole shall be abandoned. The Contractor shall backfill the well to the predrilled condition or to the satisfaction of the OWNER or Engineer. The Contractor shall be compensated for the drilling and backfilling of the well, but not its completion.
c. The well shall be accepted at the obstructed depth. The well shall be completed at this new depth. Compensation shall be for the modified footage of the well.

3.3 FIELD QUALITY CONTROL

A. Submit the following to the Engineer after each day's work.

B. Project Record Documents:
1. Daily trencher's report: During the trenching of the well, maintain daily report that includes:
a. Date
b. Location
c. Horizontal collector well identification
d. Weather conditions
e. Daily activities
f. Equipment used
g. Materials used
h. The number of feet trenched.
i. The number of hours on the job.
j. Names of contract personnel on the job.
k. Down time due to breakdown.
l. The foot of casing set.
m. Other pertinent data as may be requested by the Engineer.
2. Driller's log: During the drilling of the vertical component, prepare and maintain a complete log that includes:
a. Logger's Name
b. Date
c. Location
d. Boring Identification Number
e. Equipment Used
f. Drill Crew
g. Time
h. The reference point for all depth measurements.
i. The depth at which each soil to refuse change occurs.
j. The thickness of each soil or refuse stratum.
k. The depth at which the leachate is encountered, if applicable.

l. Depth to refuse and depth of undisturbed soil.
m. Visual description of refuse at 5-foot intervals:
    1) Type of waste encountered including the estimated percentage of the following components (by volume) on visual inspection:
        a) Plastic/Cardboard
        b) Plastic
        c) Yard waste
        d) Construction debris
        e) Textiles
        f) Tires
        g) Sludge
        h) Dirt
    2) Temperature of excavated refuse.
n. Depth of location of any lost drilling material, tools, or any other unusual occurrences.
o. The total depth of completed extraction well.
p. The total depth of boring.
q. Well screen interval.
r. Solid pipe casing interval.

3. Typed final copies of the well logs shall be submitted with the Record Drawings. Handwritten logs will not be acceptable for submittal with the Record Drawings.

END OF SECTION

SECTION 02221
TRENCHING, BACKFILLING, AND COMPACTING FOR LFG PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work: CONTRACTOR shall provide all labor, materials, soils, equipment and incidentals to excavate and trench designated areas, install pipe and appurtenances, install bedding and backfill material, compact backfill, regrade, and re-vegetate disturbed areas as shown on the Contract Drawings and described in the Section.

B. The work specified in this Section includes the trenching and trench backfilling activities associated with installation of the landfill gas (LFG) extraction wells, horizontal collectors, lateral pipe, air supply and dewatering discharge line; and any other Work requiring drilling, excavation, trenching, trench backfilling, grading, re-grading, or re-vegetating disturbed areas as shown on the Contract Drawings and described in this Section.

C. Work under this Section includes trenching and grading activities inside of the limits of municipal solid waste (MSW).

D. No classification of type of excavated materials will be made for piping excavation and trenching. Soil excavation includes all soil regardless of type, character, composition, moisture, or condition thereof.

E. Related Sections include but are not necessarily limited to:
   1. Hillsborough County Government Bidding Requirements.
   2. Section 02485 - Sodding

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway & Transportation Officials (AASHTO):
      a. T99, The Moisture-Density Relations of Soils Using a 5.5 LB Rammer and a 12 IN Drop.
      b. T180, Moisture-Density Relations of Soils Using a 10 LB Rammer and an 18 IN Drop.
   2. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
      c. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN-m/m)).
      d. D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
      e. D4253, Standard Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
      f. D4254, Minimum Index Density of Soils and Calculation of Relative Density.
   3. Florida Erosion and Sediment Control Planning and Design Manual, current edition.
   4. Florida Department of Transportation Standard Specification for Road and Bridge Construction, current edition.

B. Safety
   1. All work shall be performed in strict accordance with all local, State, U.S. Occupational Safety and Health Administration (OSHA) and other applicable Federal regulations regarding trenching operations and trench safety.
   2. All Work shall be performed in strict accordance with the Health and Safety requirements set forth in the General Conditions of the Contract Documents.

3. Excavation may be made without sheeting and bracing within the limitations and requirements of the governmental agencies having jurisdiction. Failure of the Engineer to order the use of bracing or sheeting and shoring or direct changes to systems in place, shall not in any way or to any extent relieve the Contractor of any responsibility concerning the condition of excavations or of his obligations under the Contract. The Contractor shall be responsible for the condition of all excavations. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstances that they may occur.
4. All excavation shall comply with the applicable requirements as stated in the following:
   a. OSHA excavation safety standards 29 CFR, 1926-650, subpart P.
   b. Trench safety guidelines as specified by the Landfill Gas Division of the Solid Waste Association of North America (SWANA).
5. Contractor shall monitor the ambient air concentrations within and around excavations and take appropriate safety measures as needed.
6. Tests will be conducted by the Engineer or Owner in accordance with this Section. Test results will be recorded by the Engineer or Owner.
7. Use adequate numbers of skilled workers who are trained and experienced in the necessary crafts and who are familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
8. Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.
9. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the Owner and Engineer.

1.3 DEFINITIONS

A. Excavation:
   1. All piping excavation and trenching will be defined as unclassified except for excavation of waste for which there is a separate bid item.

1.4 SUBMITTALS

A. Product technical data including:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.

B. Trench Safety Plan and/or trench shoring drawings including current certification of trench shields (trench boxes) if required by OSHA regulations.

C. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.

D. Pipe slope calculations and survey notes for pre-construction layout.

E. Pipe survey notes for installed pipe pursuant to Part 3.10 of this Section and proposed stationing and pipeline identification procedures. Prior to the start of any pipe installation, Contractor shall supply an example layout drawing showing how the header, horizontal collectors, and laterals will be marked with stations for the conformance surveys. The example layout and stations must be consistent with the requirements of Section 15060.

F. Contractor daily logs detailing length of trench excavated and backfilled, with reference to pipe stationing and details sufficient to properly describe the work completed to date.

G. If using stone for filter pack, submit sieve analysis reports on all granular materials (one per source or pit run). Tire chips, to be provided by the County, may be used as alternate material.

H. Submit test reports and fully document each with specific location or stationing information, date, and other pertinent information.

I. Submit Contractor's site-specific Health and Safety Plan for information purposes only and not review.

1.5 PROJECT CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
   1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to facility as designated by Owner to prevent serious interruption of travel.

C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.

D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material:
   ~~1.~~ As approved by Engineer.
   ~~2.~~1. ~~Backfill at least 6 inches above the top of the installed pipe shall conform to Part 2.1 A and B of this specification.~~
   ~~3.~~2. Backfill and bedding material free of rock cobbles, roots, sod or other organic matter, frozen material, and stones larger than 1 inch in any dimension.
   ~~4.~~3. For horizontal collectors, backfill material to be placed on top of the geotextile.
   ~~5.~~4. The Contractor shall obtain pipe bedding and soil backfill material from the County borrow area in areas designated in the Contract Drawings.

B. Bedding Materials:
   1. As approved by Engineer.
   2. Pipe bedding material shall be appropriate for spreading with hand tools and compaction with a bucket auger to provide a level and stable surface for pipe placement.
   3. Granular bedding materials:
      a. Clean dry coarse-grained sand shall be used for pipe bedding and backfill to midway to the top of the installed pipe.

C. Non-Calcareous Stone for Landfill Gas Extraction Wells:
   1. Stone backfill shall be hard, durable non-calcareous rock. Stone shall be washed as a component of the manufacturing process and be free of organics, lumps or balls of clay, and other deleterious materials.

Sieve Size	3 IN	2 IN	1 IN	¾ IN	3/8
Percent Passing by Weight	100	90	35	0	0

D. Tire chips for Landfill Gas Extraction Wells:
   1. Tire chips will be provided by the County. The Contractor shall use care when retrieving the tire chips from the stockpile so that soil is not mixed with the tire chips. Tire chips for use in the backfilling vertical extraction wells and horizontal collectors shall be free of organics, lumps of clay, silt, sand, or other deleterious materials.
   2. Tire chips to be 4-inch nominal in size. Acceptance of tire chips shall be at the discretion of the Engineer.

E. Bentonite:
   1. Refer to vertical well specification.

PART 3 - EXECUTION

3.1 GENERAL

A. Remove and dispose of unsuitable materials, as directed by Engineer, at the active face of the landfill or at locations as provided by Owner.

3.2 PREPARATION

A. Work shall be performed so as to not block or hinder site access, except as authorized by the Owner.

B. Identify required lines, levels, contours, and datum locations.

C. Locate, identify, and protect utilities from damage.

D. Protect benchmarks, survey control points, monitoring wells, geomembrane (where present), existing structures and fences from excavating equipment and vehicular traffic.

E. Prior to trenching and pipe installation, Contractor shall stake out the entire proposed trench alignment within the limits of waste. The proposed alignment must be approved by the Engineer prior to the Contractor beginning excavation activities. This pipeline route staking need not be completed by a licensed surveyor, but the routes for both header and lateral pipes must meet the minimum pipe slopes listed in this Section and on the Contract Drawings.

F. Survey notes with proposed pipe slope calculations shall be submitted to the Engineer for approval prior to pipe installation. Notes of pre-construction survey shall identify conflicts between the proposed Work and existing features.

G. Contractor shall use appropriate survey/level instrumentation during excavation to ensure proper trench slope. Verification of installed pipe slope shall be as specified in Part 3.11.

3.3 PROCEDURES

A. Protection of Existing Utilities:
   1. Unless shown to be abandoned or removed, protect utility lines and other pipes shown on the Contract Drawings or otherwise made known to the Contractor prior to excavating. Contractor is required to perform all utility clearances, including interviewing on-site personnel to inquire about existing utilities in areas of proposed excavations. If a utility is damaged by the Contractor, the utility shall be repaired or replaced at no additional cost to the Owner.
   2. If utility lines are encountered that are not shown on the Contract Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
   3. If service is interrupted as a result of work under this Section, Engineer shall be notified, and Contractor shall immediately restore service by repairing the damaged utility at no additional cost to the Owner.
   4. If existing utilities are found to interfere with the facilities being constructed under this Section, immediately notify the Owner and Engineer and request their instructions. Maintain a minimum 12" horizontal and vertical separation from existing utilities and the LFG transmission pipe.
   5. Do not proceed with permanent relocation of the work until written instructions are received from the Owner and Engineer.
   6. Exposed utilities shall be properly supported at all times if undermined.

B. Protection of Persons and Property:
   1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
   2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

C. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.

D. Maintain access to adjacent areas at all times.

3.4 EXCAVATION

A. Contractor should not excavate more trench daily within the landfill waste limits than can be completely backfilled after installation of the pipe the same day. The maximum allowable length of open trench that can be left overnight is 100 ft. In no case shall waste be exposed overnight in an excavation or trench.

B. Contractor shall dispose of excavated refuse at the active face of the landfill. The Owner will charge Contractor a tipping fee and Contractor shall be responsible for all other costs. Excavated refuse shall be direct-loaded into transport vehicles and hauled by Contractor to the landfill scales for weighing prior to disposal at the active working face of the landfill. Refuse shall remain in close proximity of the location from which it was removed. Excavated refuse must be removed immediately during any rain event to prevent stormwater from contacting the waste. ~~At no time, shall excavated waste be stockpiled next to the excavations.~~ All waste to be disposed at the landfill working face shall be transported no later than 5:00PM each day.

C. Excavation for Appurtenances:
1. 12 inches (minimum) clear distance between outer surface and embankment.
2. Excavate as shown on the Contract Drawings and details.
3. Trench width as shown on details .
4. Provide gas monitoring in trench as required by Health and Safety Plan.
5. Dispose of excavated refuse at landfill active face.

D. Trench Excavation:
1. Excavate trenches by open cut method to depth shown on Contract Drawings and necessary to accommodate work.
   a. Support existing utility lines where proposed work crosses at a lower elevation.
      1) Stabilize excavation to prevent undermining of existing utility.
2. Excavate as shown on the Contract Drawings and details.
3. Trench width as shown on details.
4. Provide gas monitoring in trench as required by Health and Safety Plan and 1.2.B.5 of this section.
5. Satisfactory Excavated Materials shall be transported to, and placed in stockpiles or fill areas within the limits of the Work designated by the Owner and Engineer.
6. If unsatisfactory materials are encountered above or at the design depth of the excavation, excavate the unsatisfactory materials as directed by the Owner and Engineer, and replace with satisfactory materials. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.
7. Dispose of unsatisfactory excavated material, and surplus satisfactory excavated material, away from the work area as directed by the Owner and Engineer.
8. Obtain material required for fill in excess of that produced within the grading limits of the Work from County borrow area at locations shown on the Contract Drawings.
9. Unauthorized Excavation:
   a. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific instruction from the Owner and Engineer.
   b. Backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the Owner and Engineer.
10. Stability of Excavations:
   a. Slope sides of excavations shall be cut back to 1.5H:1V or flatter, in accordance with 29 CFR 1926.

b. Shore and brace excavations where slope cut backs are not practical because of space restrictions or stability of the materials being excavated.
Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

11. Shoring and Bracing:
a. Provide all labor and materials for shoring and bracing as may be necessary for safety of personnel, protection of work, and compliance with requirements of governmental agencies having jurisdiction.
b. Maintain shoring and bracing in excavations regardless of the time period excavations will be open.
c. Remove shoring and bracing as excavation progresses.

E. Asbestos Handling:
1. If asbestos is encountered during excavation operations, the following waste handling procedures must be implemented:
a. If any waste appearing to possibly contain asbestos is uncovered, all asbestos handling procedures will be immediately placed into effect.
b. All persons within 25 feet of the excavation operations will be required to wear the appropriate respirators.
c. The use of Tyvek suits will be optional. However, if Tyvek suits are not worn, all employee uniforms must be laundered and the launderers notified of possible contamination with asbestos. All Tyvek suits will be considered to be contaminated with asbestos and will be disposed of accordingly.
d. A water truck equipped with the appropriate spraying equipment to keep the excavation cuttings wet will be required at all times.
e. An area of appropriate size will be prepared to contain the cuttings by one of the following methods.
1) A waste container lined with 6 mil polyethylene will be placed as close as reasonably possible to the excavation activities. A small area next to the excavation activities where excavated materials will be handled will also be lined with 6 mil polyethylene and covered with clean soil to protect the polyethylene. A small earthen berm will be made to help contain the materials and facilitate loading into the container. The polyethylene and soil cover will be considered to be part of the waste.
2) An area next to the excavation activities that is appropriately sized to accommodate all of the excavated materials will be surrounded by a small soil berm approximately 30" high. This area will then be lined with 6 mil polyethylene and covered with clean soil to protect the polyethylene. This area will be positioned in a way such that all handling of cuttings will be in the protected area. The polyethylene and soil will be considered to be part of the waste.

3.5 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over-Excavation:
1. Backfill and compact to maximum attainable density.
2. Backfill with granular bedding material as option.

B. Subgrade Stabilization:
1. Stabilize the subgrade when directed by the Owner.
2. Observe the following requirements when unstable trench bottom materials are encountered.
a. Notify Owner when unstable materials are encountered.
1) Define by drawing station locations and limits.
b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
1) Replace with subgrade stabilization with no additional compensation.

C. In-Place Intermediate Cover Soils
1. Backfill and compact to maximum attainable density.

3.6 BACKFILLING METHODS

A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.

B. Contractor shall notify the Engineer prior to beginning backfilling. The Engineer shall inspect all pipe, fittings, connections, and slopes prior to approving backfilling. If Contractor backfills pipe without inspection of the pipe while pipe is installed in the open trench, Contractor shall uncover all un-inspected buried pipe so that it may be properly inspected. This shall be done at no additional cost to the Owner or Engineer.

C. Place bedding material in trench to the lines and grades shown on the Contract Drawings.

D. Backfilling procedures shall be modified as necessary as approved by the Engineer in order to not displace (either horizontally or vertically) piping installed in the trench during backfill or bedding placement.

E. Contractor shall re-grade and return to their original condition, as determined by the Owner and the Engineer, all areas disturbed by Contractor's work. This includes, but is not limited to ruts caused by construction equipment, soil stockpile areas, and landfill benches and terraces used for access.

F. Common Backfill-trenches, utilities, appurtenances:
   1. Perform in accordance with the following:
      a. The bedding shall be poured into place, not pushed, and shall be raked by hand and then compacted, using a mechanical compaction device such as walk-behind vibratory compactor, in a loose lift not to exceed six (6) inches (loose thickness) above the top of the pipe.
      b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
      c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

G. Water flushing for consolidation is not permitted.

H. For all gas collection pipe trenches, a clean backfill shall be used or a material otherwise approved by the Engineer or the Owner.

I. Warning tape to be installed as shown on the Contract Drawings.

3.7 COMPACTION

A. General:
   1. Place and assure bedding, backfill, and fill materials achieve an equal or "higher" degree of compaction than undisturbed materials adjacent to the work.
   2. In no case shall degree of compaction below "Minimum Compaction" specified be accepted.

B. Compaction Requirements: Unless noted otherwise on the Contract Drawings or more stringently by other sections of these Specifications, comply with following compaction criteria:
   1. Header and Lateral Pipes
      a. None required for pipe bedding material.
      b. Tamp waste with track hoe bucket to consolidate waste to Engineer's satisfaction.
   2. Road Crossings within the landfill footprint
      a. None required for pipe bedding material.
      b. Tamp waste with track hoe bucket to consolidate waste to Engineer's satisfaction.
   3. Gas Extraction System Appurtenances
      a. Tamp waste with track hoe bucket to consolidate to Engineer's satisfaction.
      b. Compact to maximum attainable density if pipe rests on intermediate cover material.
      c. None required for granular materials

3.8 FINISH GRADING

A. Grade all areas disturbed by construction operations.

B. Grade to smooth, uniformly sloping surfaces to existing elevations or to finish elevations shown on the Contract Drawings.

C. Grading shall be to a tolerance of plus or minus 0.1 FT

D. Evenly slope finished grade away from structures as shown on the Contract Drawings to provide drainage.

E. Ensure a surface free of debris, roots, or angular stones larger than 1/2 IN.

F. Ensure rutting or raveling is not caused by installation equipment or weather.

3.9 DEWATERING

A. Water that enters excavations into refuse shall be considered landfill leachate and shall not be discharged to the ground or other means that are typical for stormwater. Water in trench excavations that come in contact with refuse shall be pumped into sealed tanks, hauled to the leachate collection system, and discharged appropriately as directed by the Owner.

B. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove water entering excavations. Contractor shall keep such excavations dry so as to obtain a satisfactory foundation condition for all work.

C. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottom, and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, "quick," or otherwise unsatisfactory for support of structure as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone or gravel as required by the Engineer at the Contractor's expense. The bottom of excavations shall be firm and without standing water before placing structures or pipes. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

D. For excavations not in refuse, establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

E. Disposal of Water Removed by Dewatering System:
   1. Water conveyed away from excavations which has not contacted refuse materials shall be discharged to areas approved by the Engineer.
   2. Dispose of water by procedures approved by the Engineer in such a manner as to cause no inconvenience to the Owner, the Engineer, or others involved in work about the site.
   3. Water conveyed away from excavations which has contacted refuse materials shall be pumped into spill-proof containers and discharged into the leachate treatment pond as directed by the Owner.

F. If the pipe trench becomes watered-in after placement of pipe, but before backfilling, Contractor shall dewater the trench, demonstrate that the pipe Bedding and pipe slope remain satisfactory, and upon approval by the Engineer, backfill the pipe with clean dry soil in accordance with Part 2.1 of this Section.

3.10 ROAD CROSSING

A. Contractor shall schedule and coordinate all road crossings with the Owner to minimize disruption of waste disposal operations.

3.11 FIELD QUALITY CONTROL

A. Pipe Survey
   1. Contractor shall verify that pipe slope meets the requirements specified in this Section and on the Contract Drawings at 25-foot intervals along LFG laterals, header, and horizontal collectors and record such information in the project notes. Station numbering shall be used and marked on the pipe, as approved by the Engineer.
      a. Contractor shall measure each length of installed pipe and mark the 25-foot stations. Stationing of laterals shall begin with 0+00 at the well, ending at the tee at the tie-in to the header.
      b. Stationing of the header and horizontal collectors shall begin with 0+00 at a location approved by the Engineer. Station numbering for pipe installed each day shall be consecutive with pipe installed on previous days. The Contractor shall not restart station numbering at 0+00 for any header segment without advance approval from the Engineer.
      c. The surveyed elevations and calculated change in elevation and slope for each 25-foot section shall be recorded in the Contractor's project notes.
      d. A trench laser will not be considered acceptable survey equipment for the purpose of verifying pipe slope.
   2. The project notes detailing the required pipe slope confirmation shall be provided daily to the Engineer and shall be checked by the Owner or Engineer prior to proceeding with backfilling.
   3. A conformance survey shall be conducted on all installed pipe prior to backfilling the trench.
      a. Contractor may utilize survey tubes if backfilling the LFG piping before a conformance survey is performed. If conformance survey after LFG piping is buried demonstrates that LFG piping slopes do not meet specified requirements, the Contractor shall uncover buried pipe so that it may be properly installed at the required slopes. This shall be done at no additional cost to the Owner or Engineer.
      b. Survey tubes for equipment shall be used to measure the change in relative elevation between each 50-foot stations. Contractor shall be responsible for minimizing landfill gas emissions from survey tubes (e.g. seal top of survey tubes).
      c. The survey shall document the horizontal and vertical location of the top of the landfill gas header, horizontal collectors, laterals, air supply lines, and condensate discharge line, at minimum 50-foot intervals and at each change in pipe direction, grade break, change in pipe grade, fitting, connection, pipe crossover, and tie-in along the entire pipeline routes.
      d. If a run of pipe is 100 feet or less in length, Contractor shall provide survey shots at a 20-foot interval or less. For a run of pipe of 50 feet or less, at least three survey shots of the top of the pipe must be used to document the pipe as-built conditions.
      e. The survey shall also document the type of pipe, location (horizontal and vertical coordinate) of structures and appurtenances such as, but not limited to, valves, pipe crossing, and tie-ins.
      f. This conformance surveying shall be sealed by a licensed Florida Professional Land Surveyor as described in Section 01050, Survey.

B. The proof-rolling shall be reformed under the observation of the CQA Inspector. Subgrade shall be compacted in accordance with Section 3.7.

3.12 MAINTENANCE

A. Protection of Newly Graded Areas:
   1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
   2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

3.13 SEEDING AND SODDING

A. Provide temporary seeding and mulching in disturbed areas where further construction activities will not take place within 30 days.

B. Install sod within disturbed areas in accordance with Section 02485 – Sodding.

3.14 SPECIAL REQUIREMENTS

A. Erosion Control: Conduct work to minimize erosion of site. Construct stilling areas to settle and detain eroded material. Remove eroded material washed offsite. Clean streets daily of any spillage of dirt, rocks, or debris from equipment entering or leaving site.

END OF SECTION

SECTION 02270
SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil erosion and sediment control.

B. Related Sections include but are not necessarily limited to:
   1. Division 1 - General Requirements.
   2. Section 02221 - Trenching, Backfilling, and Compacting for LFG Piping.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Florida Erosion and Sediment Control Planning Handbook, or current edition.
   2. Florida Department of Transportation Standard Specifications for Roads and Structures Construction, Latest edition.

1.3 SITE CONDITIONS

A. The Owner has installed sediment control features for their current operations.

   The Contractor may use these existing features with the Owner's prior approval, provided the Contractor maintains said features.

B. The contractor shall prevent damage to properties outside the construction limits from siltation due to construction of the project and assume all responsibilities to the affected property owners for correction of damages which may incur. Erosion-control measures shall be performed conforming to the requirements of and in accordance with plans approved by the applicable state and local agencies and as specified by the erosion-control portion shown on the Contract Drawings and as required by the Specifications. The Contractor shall not allow mud and debris to accumulate in the streets or enter drainage ditches, canals, or waterways.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Stone: Manufacturer's certification that materials supplied meet project requirements.
   2. Silt Fence: Product information demonstrating materials supplied meet project requirements including installation instructions.
   3. Erosion and Sediment Control Plan.

1.5 EROSION AND SEDIMENT-CONTROL DEVICES AND FEATURES

A. The Contractor shall construct all devices (silt fences, retention areas, etc.) for sediment control at the locations required to protect federal, state, and local water bodies and water courses and drainage systems before beginning to excavate the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.

B. The Contractor shall use mulch to temporarily stabilize areas subject to excessive erosion and to protect seed beds after planting where applicable.

C. Filter fabric, hay bales, or other approved methods shall be placed and secured over grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.

D. The Contractor shall use silt fences or hay bales, as shown on the Contract Drawings or as directed by the Owner or Owner's Representative to restrict movement of sediment from the site.

E. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stone for temporary ditch blocks and construction entrances constructed as per the Contract Drawings.

B. Sod shall be in accordance with Section 02485, Sodding.

C. Fertilizer shall conform to FDOT Section 982.
   1. Fertilizer shall be granulated so that 80 percent is held on a 16-mesh screen, uniform in composition, dry, and free flowing. The Contractor shall test screen one bag of fertilizer per source and per shipment.

D. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.), in accordance with FDOT Section 985, wired to galvanized wire mesh fencing and supported by wood or metal posts.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to Disturbance:
   1. Install silt fence, ditches, channels, ditch blocks, and temporary construction entrances.
   2. Refer to the construction sequence on the Contract Drawings for further detail.

3.2 DURING CONSTRUCTION PERIOD

A. Maintain silt fence, ditches, channels, ditch blocks, and temporary construction entrances:
   1. Inspect regularly especially after rainstorms.
   2. Repair or replace damaged or missing items within 5 days of discovery or notification by the Owner or Engineer.

B. After rough grading, sow temporary grass cover and mulch over all exposed earth areas not draining into sediment basin or trap.

C. Provide necessary swales, dikes and temporary culverts to control erosion. Contractor shall provide all erosion protection measures at no additional cost to the Owner to prevent off-site sediment/erosion. Although there are stormwater ponds on-site, the Contractor shall take all reasonable precautions to reduce sediment transport to the ponds.

D. Do not disturb existing vegetation (grass and trees) to the extent possible.

E. Excavate sediment out of basins and traps when capacity has been reduced by 40 percent.
   1. Remove sediment from silt fence to prevent overtopping.

F. Topsoil and Fine Grade Slopes and Swales, Etc.:
   1. Seed and mulch or sod as soon as areas become ready.

G. The erosion control features shown on the Contract Drawings are performance based. If the feature does not adequately control erosion and sediment control to the satisfaction of the Project Manager, the Contractor will be required to install additional erosion and sediment control features. The Project Manager will work with the Contractor to determine the extent of the additional measures.

H. After fine grading, sod all areas receiving final cover.

I. Remove accumulated mud and soil from roadways on a daily basis.

3.3 NEAR COMPLETION OF CONSTRUCTION

A. Removed accumulated sediment from erosion and sediment control devices.

B. Eliminate temporary basins, dikes, traps, etc.

C. Grade to finished or existing grades.

D. Fine grade all remaining earth areas, then seed and mulch or sod in accordance with the Contract Drawings.

E. Erosion and sediment control devices are to remain in place until sod is established.

END OF SECTION

SECTION 02485
SODDING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section covers the work necessary to provide for sodding.

1.2 RELATED WORK

A. The General and Supplementary Conditions of these specifications are a part of this section as if incorporated herein.

1.3 REFERENCES

A. The latest edition of the Florida Department of Transportation (DOT) Standard Specifications for Road Bridge Construction (Standard Specifications) shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified herein with exceptions, as noted herein.

B. The latest edition of DOT Roadway and Traffic Design Standards.

1.4 SUBMITTALS

A. Soil Analysis: The Contractor shall furnish a soil analysis for each borrow source or distinct on-site soil type used as topsoil for the final cover. The analysis shall be made by a qualified independent soil-testing agency, to be approved by the Engineer. The analysis shall state percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of the soils. The analysis shall state recommended quantities of nitrogen, phosphorus, and potash nutrients and any soil amendments to be added to produce satisfactory topsoil. The Contractor shall perform soil test 30 days prior to mobilizing for landscape construction.

PART 2 - PRODUCTS

2.1 FERTILIZER

A. Fertilizer for grassing shall conform to Section 982 of the Standard Specifications.

B. Fertilizer shall be granulated so that 80 percent is held on a 16-mesh screen, uniform in composition, dry, and free flowing. The Contractor shall test screen one bag of fertilizer per source and per shipment.

2.2 SODDING

A. The following sections of the Standard Specifications shall apply:
   1. Section 575-1, Description
   2. Section 981-2 and 981-4, Materials

2.3 WATER

A. Water for sodding shall conform to Section 983 of the Standard Specifications.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All areas within the limits of work and all areas disturbed by the Contractor's operations with the exception of borrow areas shall be sodded unless otherwise indicated on the Contract Drawings.

B. The period of sod establishment shall begin immediately after the completion of sodding in an area and shall continue for a period of 1 year after the completion of sodding on the entire project unless the desired sod cover is established in a shorter period of time and shortening of the sod-establishment period is authorized by the Engineer.

C. Areas to be sodded shall be graded to remove construction debris, litter, depressions, undulations, and irregularities in the surface before sodding and in accordance with the Contract Drawings. Grading activities shall be conducted such that the minimum required thickness of topsoil is maintained.

3.2 SODDING

A. Sodding shall be placed within disturbed areas unless shown otherwise on the Contract Drawings.

B. The following sections of the Standard Specifications shall apply:
   1. Section 575-3, Construction Methods

C. Exceptions:
   1. Section 575-3.3, replace phrase "a suitable length of roadway" with "an area."
   2. Section 575-3.3, Placing Sod; do not plant dormant sod or if ground is frozen. Rolled sod shall be placed parallel to contours. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. The offsets of individual staggered strips shall not exceed 6 inches. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass. On areas where sod may slide due to the slope gradient, may be displaced by flowing water or may otherwise move, the sod must be pegged using suitable wooden pegs and netting or other approved means. The pegs should be driven through the sod strips into firm earth, at suitable intervals. Contractor will apply at least 1.00 inch of water to new sod within 24 of sod placement and as frequently thereafter in order to maintain a healthy and uniform stand of grass. Water sod thoroughly with a fine spray. Roll sod within 24 hours of placement to ensure contact between sod and subgrade.
   3. Section 575-3.4, watering shall conform to requirements previously specified herein. Replace the word "Department" with the Word "County" in the last sentence. The cost of resodding shall be borne exclusively by the Contractor.
   4. Section 575-3.5, Maintenance shall be performed as specified herein.

D. Sod installed within drainage swales, terraces, and near drainage inlets shall be adequately anchored using pegs, netting, or other means to ensure that the sod is not displaced by the flow of water.

3.3 CLEANUP

A. All excess sod materials, stones, and other waste shall be removed from the site weekly and shall not be allowed to accumulate.

3.4 MAINTENANCE

A. Maintenance shall begin immediately following the last operation of sodding and continue until conclusion of the sod-establishment period specified herein. Maintenance shall include watering, mowing every two weeks (or as needed) during construction and until final acceptance of the project, resodding, repair of erosion, and all other work necessary to produce a uniform stand of grass.

B. Sod will be considered for final acceptance when the sod roots are firmly anchored to underlying soil and the permanent grass is healthy and growing on 97 percent of the area with no bare areas wider than 12 inches, as determined by the Engineer.

C. The Contractor shall maintain the sodded areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include the filling, leveling, and repairing of any washed or eroded areas, as may be necessary. If the planted areas must be resodded, reshaped, or otherwise repaired, regardless of cause, the Contractor shall perform such work at the Contractor's expense. The Engineer, at any time, may require replanting of any areas in which the establishment of the grass stand does not appear to be developing satisfactorily at no additional cost to Owner.

D. The period of sod establishment for areas that are resodded shall extend to 1 year after the completion of resodding unless otherwise authorized by Engineer.

END OF SECTION

SECTION 02778
GEOTEXTILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-woven geotextile material for use in drainage layer as shown on the Contract Drawings.

B. Related Sections:
   1. Section 02130 Vertical Extraction Wells
   2. Section 02140 Horizontal Collector Wells
   3. Section 02221 Trenching, Backfilling, and Compacting for LFG Piping

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. D1987, Biological Clogging of Geotextile or Soil/Geotextile Filters.
      b. D3786, Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.
      c. D4354, Sampling of Geosynthetics for Testing.
      d. D4355, Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
      e. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
      f. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
      g. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
      h. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
      i. D4759, Standard Practice for Determining the Specification Conformance of Geosynthetics.
      j. D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
      k. D4873, Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
      l. D4884, Strength of Sewn or Thermally Bonded Seams of Geotextiles
      m. D5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
      n. D6193, Standard Practice for Stitches and Seams.

B. Qualifications:
   1. Each manufacturing, fabricating firm shall demonstrate 5 years continuous experience of geotextile production.

1.3 DEFINITIONS

A. Manufacturer: Manufacturer producing geotextile sheets from resin and additives.

B. Installer: The Installers are the individuals actually performing the hands-on work in the field.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Manufacturer's documentation that raw materials and roll materials comply with required geotextile physical properties.
   2. Original test results for resins, roll material and factory seam tests at frequency specified in respective quality control manuals.

a. Results shall include or bracket the rolls delivered for use in the Work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Label, handle, and store geotextiles in accordance with ASTM D4873 and as specified herein.

B. Wrap each roll in an opaque and waterproof layer of plastic during shipment and storage.
   1. Do not remove the plastic wrapping until deployment.

C. Label each roll with the manufacturer's name, geotextile type, lot number, roll number, and roll dimensions (length, width, gross weight).

D. Repair or replace geotextile or plastic wrapping damaged as a result of storage or handling, as directed.

E. Do not expose geotextile to temperatures in excess of 71 Deg C (160 Deg F) or less than 0 Deg C (32 Deg F) unless recommended by the manufacturer.

F. Do not use hooks, tongs or other sharp instruments for handling geotextile.
   1. Do not lift rolls lifted by use of cables or chains in contact with the geotextile.
   2. Do not drag geotextile along the ground.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   1. GSE Lining Technology.
   2. Mirafi (TenCate Geosynthetics)
   3. Propex.
   4. SKAPS Industries.
   5. Tenax Corp.
   6. Or approved equal

2.2 MATERIALS AND MANUFACTURE

A. Geotextile:
   1. Non-woven sheet of polymeric material.
   2. Geotextile fibers:
      a. Long-chain synthetic polymer composed of at least 85 percent by weight polyolefins, polyesters, or polyamides.
      b. Filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure.
      c. Do not add reclaimed or recycled fibers or polymer to the formulation.
   3. Form geotextile into a network such that the filaments or yarns retain dimensional stability relative to each other, including the selvages.
   4. The geotextile physical properties shall equal or exceed the minimum average roll values listed below.
      a. Values shown are for the weaker principal direction unless both values are shown.
      b. Acceptance of geotextile shall be in accordance with ASTM D4759.

Non-woven Geotextile: Used in drainage layer as shown on the Contract Drawings.

PROPERTY	TEST METHOD	MARV	MIN. MQC TEST FREQUENCY
Mass per Unit Area, (oz/sy)	ASTM D5261	6	1 per 90,000 ft^2
Grab Tensile Strength (lbs)	ASTM D4632	170	1 per 90,000 ft^2
Puncture Strength (lbs)	ASTM D4833	90	1 per 90,000 ft^2
AOS, US sieve (mm)	ASTM D4751	70	1 per 540,000 ft^2

Permittivity, (sec^{-1})	ASTM D4491	1.5	1 per 540,000 ft^2
Flow Rate, gpm/ft^2	ASTM D4491	110	1 per 540,000 ft^2
Ultraviolet Degradation, % retained @ 500 HRS	ASTM D4355	70	1per formulation

B. Thread:
   1. High-strength polyester, nylon, or other approved thread type.
   2. Equivalent chemical compatibility and ultraviolet light stability as the geotextile.
   3. Contrasting color with the geotextile.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure the filter pack (tire chips or stone) is placed to the elevations indicated on the Contract Drawings before placing the geotextile.

3.2 INSTALLATION

A. Install geotextiles in accordance with manufacturer's written recommendations.

B. Deploy the geotextile ensuring that the underlying materials are not damaged. Replace or repair faulty or damaged goetextile as directed by the Engineer.

C. Unroll geotextile downslope keeping in slight tension to minimize wrinkles and folds.

D. Protect geotextiles from clogging, tears, and other damage during installation.

E. For vertical extraction wells geotextile installation, cut the geotextile to the proper diameter of the drilled vertical extraction well and well casing.

F. For horizontal collector geotextile installation, overlap adjacent panels a minimum of 6 IN.

G. Place geotextile on top of the filter pack. See Sections 02130 Vertical Extraction Well and 02140 Horizontal Collector Well.

3.3 FIELD QUALITY CONTROL

A. The CQA Consultant shall confirm that the identification, storage, and handling of geotextiles is in accordance with ASTM D4873. Any deviation from this requirement will be reported to the Engineer.

B. The CQA Consultant will examine all manufacturer certifications to ensure that the property values listed on the certifications meet or exceed these specifications. Any deviations will be reported to the Engineer.

C. The CQA Consultant will observe placement of the geotextiles to confirm that the panel overlaps are in accordance with these specifications. Any deviations will be reported to the Engineer.

END OF SECTION

SECTION 15060

PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope of Work: The Contractor shall supply all materials, equipment, and labor needed to install complete and make ready for use all pipe, pipe fittings, and valves as specified herein and as indicated on the Contract Drawings.

B. Related Sections include but are not necessarily limited to:
   1. Division 1 – General Requirements
   2. Section 02130 – Vertical Extraction Wells
   3. Section 02140 - Horizontal Collector Wells
   4. Section 02221 – Trenching, Backfilling, and Compacting for LFG piping
   5. Section 15067 – Pipe: High Density Polyethylene
   6. Section 15075 – Pipe: Polyvinyl Chloride (PVC)

1.2 QUALITY ASSURANCE

A. Referenced Standards:

B. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Use of the most recent version is required.
   1. American National Standards Institute (ANSI):
      a. B16.5, Pipe Flanges and Flanged Fittings.
      b. B31.8, Code for Pressure Piping, Appendix N
   2. ASTM International (ASTM):
      a. D1784, Rigid Vinyl Compounds.
      b. D1785, PVC Plastic Pipe, SCH 80
      c. D1248 Specification for Polyethylene Plastics Molding and Extrusion Materials
      d. D2467, PVC Plastic Fittings, SCH 80.
      e. D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
      f. D2564, Solvent Cements for PVC Pipe and Fittings.
      g. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter- Controlled Polyethylene Pipe and Tubing.
      h. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
      i. D3350, Specification for Polyethylene Plastics Pipe and Fittings Materials
      j. D4101, Standard Specification for Propylene Plastic Injection and Extrusion Materials.
   3. Plastics Piping Institute (PPI)
      a. PPI TR-31/9-79, Technical Report

C. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.3 DEFINITIONS

A. SDR – Standard Dimension Ratio.

B. SCH - Schedule

C. ESCR – Environmental Stress Crack Resistance.

D. HDPE – High Density Polyethylene Pipe

E. PVC – Polyvinyl Chloride Pipe

F. LFG – Landfill gas

1.4 SUBMITTALS

A. The Contractor shall prepare and submit to the Engineer, for review and approval prior to commencement of construction, certificates of compliance on materials furnished and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance and repair of each type of pipe, and pipe fitting furnished.

B. Provide manufacturing test specification data listing resin type, cell classification, stock density, melt flow, flexural modulus, tensile strength, and coloration as appropriate for each type of pipe specified. Include results of tests with shipment of materials, with two (2) additional copies of test results furnished to Engineer.

C. The Contractor shall prepare and submit Shop Drawings to the Engineer for review and approval. The Shop Drawings shall show the following:
   1. Fabrication and/or layout drawings:
      a. Piping drawings (minimum scale 1 IN equals 10 FT) with information including:
         1) Pipe Dimensions, schedule, fittings, and supports.
         2) Invert or centerline elevations of piping crossings.
         3) Acknowledgement of bury depth and location requirements.
         4) Details of fittings, tapping locations, and related appurtenances.
         5) Line slopes.
      b. Schedule of interconnections to existing piping and method of connection.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
      c. Separate schedule sheet for each piping system scheduled in this Section showing compliance of all system components. Attach technical product data on gaskets, pipe, fittings, and other components.

D. Test Report:
   1. Copies of pressure test results on all landfill gas piping systems and corrective actions taken if test failed.
   2. Notification of time and date of piping pressure tests.

E. As-Built Drawings:
   1. As work progresses and again when work is complete, submit "As-Recorded" drawings of piping systems including project items and pre-existing items. Identify complete location, elevation, and description of piping systems. Relate piping systems to identified structures and appurtenances.

F. Operation and Maintenance Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

C. Protect materials from direct exposure to rain or sunlight until installation.

D. Pipe Storage:
   1. Store or stack pipe to prevent damage from marring, crushing or puncture. Limit maximum stacking height to 6 feet or manufacturer's maximum recommended height, whichever is less.

2. Store in accordance with manufacturer's recommendations.

E. Pipe handling:
1. Protect pipe from excessive heat or harmful chemicals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers of PE pipe are acceptable for landfill gas applications:
1. Driscoplex.
2. CSR/Polypipe
3. ISCO
4. Lee Supply
5. Ferguson Industrial Plastics
6. Plexco

B. Subject to compliance with the Contract Documents, the following manufacturers of PVC pipe are acceptable for landfill gas applications:
1. U.S Plastic Corp.
2. Harvel Piping.
3. Charlotte Pipe and Foundry Company.

2.2 HIGH DENSITY POLYETHYLENE (HDPE/PE 3408/3608) PIPING AND FITTINGS

A. General:
1. All HDPE pipe used must be in conformance with the documentation set forth in the Contract Drawings. The SDR of each specific pipe can be found on the Contract Drawings themselves or on the general notes page.
2. Pipe shall be extruded from a Type III, Class C, Category 5, Grade P34 compound as described in ASTM D 1248. It shall be classified as cell 345464C according to ASTM D 3350 and have the material designation of PE 3408/3608. The pipe shall be manufactured to meet the requirements of ASTM D 2513. Manufacturer's literature shall be adhered to when "manufacturer's recommendations" are specified. All pipe and fittings shall be provided by one of the manufacturers specified in Section 2.1 of this specification.

B. HDPE Fittings
1. Fittings shall be manufactured from polyethylene compound having cell classification equal to or exceeding the compound used in the pipe.
2. All fittings 12 inches and smaller shall be molded (excluding gas header pipe), unless approved by the Engineer. Extrusion welds on fittings will not be allowed, except for addition of gussets. The ends of the fabricated fittings shall not be trimmed to match the pipe section to which they are going to be joined. All polyethylene fittings shall have the same or higher pressure rating as the pipe when installed in accordance with the latest technical specifications. All landfill gas tie-ins to the header may be shop fabricated branch saddle fittings. Field fabricated branch saddle fittings will not be accepted.
3. Flanges for HDPE Pipe
    1) Flanges for HDPE pipe shall be convoluted ductile iron back-up rings with a minimum thickness of 1-inch.
    2) The studs, nuts and washers for the flanges shall be 316 stainless steel hardware . Below grade flanges shall be wrapped in 5-mil polyethylene sheeting just after installation and prior to backfilling to help prevent corrosion.
    3) Flange gaskets shall be full-face Neoprene, or approved equal.
    4) Flanges and bolt patterns consistent with ANSI B16.5/AWWA C207/ASTM A536, as recommended by manufacturer.

4. Reducers:
   a. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections. Connection size requirements may change from those shown on the Contract Drawings depending on equipment furnished.

C. All pipe and fittings must be supplied by the same manufacturer.

D. Identify each length of pipe clearly at intervals of 5 FT or less with the following markings:
   1. Manufacturer's name and trademark.
   2. Nominal size of pipe,
   3. Type of plastic (e.g. PE 3408/3608)
   4. Standard dimension ratio (SDR) value
   5. ASTM designations (i.e., ASTM D 2513)

2.3 POLYVINYL CHLORIDE (PVC 12454) PIPING AND FITTINGS

A. General:
   1. All PVC pipe used must be in conformance with the documentation set forth in the Contract Drawings. The SCH of each specific pipe can be found on the Contract Drawings themselves or on the general notes page.
   2. Pipe shall be extruded from a Type I, Grade I compound as described in ASTM D1784. It shall be classified as 12454. The pipe shall be manufactured to meet the requirements of ASTM D1785. Manufacturer's literature shall be adhered to when "manufacturer's recommendations" are specified. All pipe and fittings shall be provided by one of the manufacturers specified in Section 2.1 of this specification.

B. PVC Fittings
   1. Fittings shall be manufactured from polyvinyl compound having classification equal to or exceeding the compound used in the pipe.
   2. All fittings 12 inches and smaller shall be molded, unless approved by the Engineer. The ends of the fabricated fittings shall not be trimmed to match the pipe section to which they are going to be joined. All fittings shall have the same or higher pressure rating as the pipe when installed in accordance with the latest technical specifications.

C. All pipe and fittings must be supplied by the same manufacturer.

D. Identify each length of pipe clearly at intervals of 5 FT or less with the following markings:
   1. Manufacturer's name and trademark.
   2. Nominal size of pipe,
   3. Type of plastic
   4. Schedule (SCH) value
   5. ASTM designations

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to Specifications, or for:
   1. Fractures or cracks passing through pipe wall, except single crack not exceeding two (2) inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment will be rejected if defects exist in more than 5% of shipment or delivery.
   2. Cracks sufficient to impair strength, durability, or serviceability of pipe.
   3. Defects indicating improper proportioning, mixing, and molding.
   4. Damaged ends, where such damage would prevent making satisfactory joints.

B. Acceptance of fittings, stubs, or other specifically fabricated pipe sections shall be based on visual observation by the Owner or Engineer at the Project site and documentation that they conform to these Specifications.

3.2 PVC PIPE INSTALLATION

A. Refer to Specification 02130.

3.3 HPDE PIPE INSTALLATION

A. Perform trenching, backfilling, and compaction in accordance with Section 02221.

B. Install pipe as indicated on the Contract Drawings. Pipe installation shall comply with the requirements of ASTM D 2321, PPI TR31/9-79, and the manufacturer's recommendations.

C. Remove standing water in trench before installation.

D. Lengths of fused pipe to be handled as one segment shall not exceed 400 feet.

E. The Owner and Engineer shall be notified prior to any pipe being installed in the trench in order to have an opportunity to inspect the following items:
   1. All butt and saddle fusions
   2. Pipe integrity.
   3. Trench excavation and bedding material for rocks and foreign material.
   4. Proper trench slope.
   5. Trench contour to ensure the pipe will have uniform and continuous support.
   6. Proposed backfill sand and soil or stone or chip tires for horizontal collectors.

F. Any irregularities found by the Engineer during this inspection must be corrected before lowering the pipe into the trench. Pipe shall be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins, and/or backfilling.

G. Pipes and fittings shall be carefully lowered into trench to limit stress to pipes, fittings, and joints.

H. Pipe and fittings shall be installed so that there will be no deviation at the joints and so that inverts present a smooth surface. Pipe and fittings that do not fit together to form a tight fitting joint are not permitted.

I. Tie-ins shall be made out of the trench whenever possible. When tie-ins are to be made only in the trench, a bell hole shall be excavated large enough to ensure an adequate and safe work area.

J. The Contractor shall ensure that kinking or excessive bend diameters of the pipe do not occur during the installation process.

K. The Contractor shall insure that the pipe installed in the trench is firmly supported. The Contractor shall follow the minimum length and type of backfill specified in the Contract Drawings.

L. Cap pipe sections longer than single joint (usually 40 feet) on both ends during placement, except during fusing operations.

M. The Contractor shall cap all open pipe ends at the end of the work day.

N. HDPE pipe and fittings shall be by the same manufacturer. The minimum strength of the fittings shall not be less than that of the pipe.

O. Changes in direction of HDPE Pipe:
   1. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade.

P. The Contractor shall remove cuttings. Shavings shall not be left on the ground.

Q. HDPE shall not be field threaded and such threaded joints shall not be used in gas distribution systems.

R. Except as indicted on the Contract Drawings, landfill gas pipe fittings shall be butt fusion type, meeting the requirements of ASTM D-3261 and this specification. All fittings shall be pressure rated to match the system piping to which they are fused. The side slope riser fittings shall be factory fabricated and shall have a smooth interior surface.

S. All perforated pipes shall be perforated by the Manufacturer as shown on the Contract Drawings.

T. Workmanship: Exterior and interior surfaces shall be smooth with no sharp projections. The surfaces shall be free of foreign inclusions and major surface defects. Polyethylene pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties. The product function shall be considered when judging external defects.

U. All installed HDPE pipe shall be marked in 25-foot intervals corresponding to the stationing required for slope confirmation and conformance surveying. Each joint shall be marked at header and lateral joints. For main pipeline, station numbering shall be continuous and sequential. Station numbering shall be referenced in daily logs to document pipe installation progress. Survey data shall be submitted in the state plane coordinate system. Top of pipe and cover soil elevation shall be included for all points unless piping is designed to be above grade.

3.4 HEAT FUSION OF HDPE PIPING:

A. HDPE pipe shall be joined by butt-fusion methods, having a uniform and monolithic pipe interior according to the fusion joining procedures as instructed by the manufacturer, except within the structures, as shown in the Construction Drawing.

B. Each individual performing fusion joining shall have at least one (1) year of experience in the use of the fusion procedure.

C. Join pipe sections at ground level to a maximum length of 400 feet, or a length recommended by the manufacturer such that maximum allowable stress, when pulling the pipe into position alongside the trench, is not exceeded. Use appropriate materials and equipment, as recommended by the HDPE pipe manufacturer, when pulling butt-fused pipe sections alongside the trench to prevent pipe damage.

D. For summertime installations it may be necessary to provide a slightly longer length of HDPE pipe when connections are to be made between two fixed points or structures to compensate for contraction of the pipe in a cooler trench bottom. The additional pipe length requirements shall be in accordance with the HDPE pipe manufacturer's instructions.

E. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with manufacturer's recommendations.

F. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade.

G. Do not subject pipe to strains that will overstress or buckle pipe or impose excessive stress on joints.

H. Branch saddle fusions shall be joined in accordance with manufacturer's recommendations and procedures. Branch saddle fusion equipment will be of the size to facilitate saddle fusion within the trench.

I. Before butt fusing pipe, each length shall be observed for presence of dirt, sand, mud, shavings, and other debris or animals. Remove all materials from the inside of the pipe.

J. At end of each working day, cover open ends of fused pipe. Cap to prevent entry by animals or debris.

K. Use compatible fusion techniques when polyethylene pipes of different melt indexes are fused together. Refer to manufacturer's specifications for compatible fusion.

3.5 FLANGED CONNECTIONS

A. For flanged connections in virgin soil, the Contractor shall wrap and tape the flanges and bolts in 5 mil polyethylene sheeting prior to backfilling to help protect the assembly from corrosion.

B. Flanges shall be joined with 316 stainless steel studs and nuts. Stud lengths shall accommodate the required distance between flanges including spacers, if necessary.

C. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint. Provide tightening torque in accordance with manufacturer's recommendations. CAUTION: Do not over-torque bolts.

D. For flanged connections within the limits of refuse, all below grade back-up rings, studs, nuts and washers shall be thoroughly coated with a rubberized emulsion undercoating spray, or approved substitute.

E. The Contractor shall wrap and tape the flanges and bolts in 5 mil polyethylene sheeting prior to backfilling.

3.6 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Contractor to notify Owner or Engineer to shut down the flare station before proceeding to connect to existing gas system.

C. Undertake connections in fashion which will disturb existing gas system as little as possible.

D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to existing gas system.

E. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.7 SEGMENT TESTING

A. The HDPE laterals and connections to LFG header shall be subjected to pneumatic pressure tests as described herein to detect any leaks in the piping. Testing shall only be performed below grade (inside the trench). The Contractor shall accept the responsibility for locating, uncovering (if previously backfilled), and repairing any leaks detected during testing.

B. Polyethylene piping shall be butt welded together into testing segments. Segments shall be connected to a testing apparatus on one end and fitted with fusion-welded caps on all openings.

C. The segment to be tested shall be allowed time to reach constant and/or ambient temperature before initiating the test.

D. The test must be performed during a period when the pipe segment will be out of direct sunlight; i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes which will occur during temperature fluctuations.

E. The pneumatic test pressure for LFG header pipe and laterals shall be 10 psig with a maximum of 5% loss. Failing pipe sections will be inspected for any visible leaks and re-tested. Engineer will determine protocol for any additional failures. Solid section of horizontal collectors are also required to be tested.

F. Pressure drop during the test shall not exceed five percent of the testing gauge pressure over a period of one hour. The pressure drop shall be corrected for temperature changes before determining pass or failure. (See Section 3.8 for test failures).

G. The Engineer shall be notified 1 week prior to commencement of the testing procedure and shall be present during the test.

H. All equipment for this testing procedure, including an adequately sized air compressor, fittings, caps/pipe plugs, etc. shall be furnished by the Contractor. Other necessary equipment includes a pressure gauge with a scale that spans the test pressure range with increments equal to 0.1 percent of the test pressure, an appropriate valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Pipe reducers shall be utilized to adapt test flange to size of pipe being tested.

3.8 TEST FAILURE

A. The following steps shall be performed when a pipe segment fails the five percent/one hour test described in Section 3.7. F.
   1. The pipe and all fusions shall be inspected for cracks, pinholes, or perforations.
   2. All blocked risers and capped ends shall be inspected for leaks.
   3. Leaks shall be located and/or verified by applying a soapy water solution and observing soap bubble formation.

B. All pipe and fused joint leaks shall be repaired by cutting out the leaking area and re-fusing the pipe.

C. After all leaks are repaired, a retest shall be performed in accordance with Section 3.7.

3.9 TEST REPORTING

1. Each test (pass or failure) shall be reported in writing on a form approved by the Engineer.
   a. Test report to include, date, size of pipe, length, description, and stationing,
2. If failure occurs, Contractor shall note the following:
   a. Location of failure segment.
   b. Nature of leaks.
   c. Repairs performed
   d. Results of test.

END OF SECTION

SECTION 15067
PIPE - HIGH DENSITY POLYETHYLENE (HDPE)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. High density polyethylene (HDPE) pipe, fittings, and appurtenances.

B. Related Sections include but are not necessarily limited to:
   1. Hillsborough County Government Bidding Requirements.
   2. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. Polyethylene (PE) materials:
         1) D2104, (PE) Plastic Pipe, Schedule 40.
         2) D2239, (PE) Plastic Pipe (SDR-PR).
         3) D2447, (PE) Plastic Pipe, Schedule 40 and 80 Based on Outside Diameter.
         4) D2513, Standard Specification for Thermoplastic Gas Pressure Pipe.
         5) D2609, Plastic Inserts Fittings for (PE) Plastic Pipe.
         6) D2657 Heat Joining Polyolefin Pipe and Fittings.
         7) D2837 Obtaining Hydrostatic Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
         8) D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
         9) D3350 (PE) Plastic Pipe and Fittings Materials
         10) F1290, Standard Practice for Electrofusion joining PE and Fittings
         11) F2620, Standard Practice for Heat Fusion of PE pipe and Fittings

      b. Installation:
         1) D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
         2) D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
   2. American Water Works Association (AWWA):
      a. Polyethylene (PE) materials:
         1) C901, Polyethylene (PE) Pressure Pipe Tubing and Fittings, 1/2 through 3 IN for Water.
         2) C906,Polyethylene (PE) Pressure Pipe and Fittings 4 IN through 63 IN for Water Distribution and Transmission.

1.3 SUBMITTALS

A. See Section 15060.

B. Pipe schedule identifying:
   1. Style, type, size.
   2. Quantity.
   3. Location to be used.

C. Perforation pattern(s).

D. Schedule of fittings.

E. Pipe data.

F. Installer certification.

G. Field quality control documents.

1.4 DEFINITIONS

A. SDR – Standard Dimension Ratio.

B. IPS – Iron Pipe Size.

C. CTS – Copper Tube Size.

D. DIPS – Ductile Iron Pipe Size.

E. ESCR – Environmental Stress Crack Resistance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers of PE pipe are acceptable:
   a. See Section 15060.

SDR	PRESSURE RATING (psi)
17	100
11	160
9	200

2.2 HIGH DENSITY POLYTHELYENE (HDPE) PIPING

A. General:
   1. Provide PE 3408/3608 piping with fittings and appurtenances to locations shown on the Contract Drawings.
   2. Furnish materials in accordance with ASTM D2513 and full compliance to the following material specifications:
      a. Material description: ASTM D1248, Type III, Class C, Category 5, Grade P34.
      b. Cell classification: ASTM D3350, PE 345464C.
      c. ESCR: ASTM D1693, condition C, F_o>5,000 HRS.
      d. ESCR: ASTM D1693, condition A, B, C, F_o>5,000 HRS.
   3. Modulus of elasticity: ASTM D638, 130,000 psi.
   4. Hardness: ASTM D2240, 65 Shore D.
   5. SDR: 9.0, 11.0, and 17.0 as specified in the Contract Drawings.
   6. IPS for line size greater than 1 IN.

B. Fittings:
   1. ASTM D2513.
   2. SDR: 9.0, 11.0, and 17.0
   3. 1/2 to 3 IN: ASTM D2683.
   4. 4 to 10 IN: ASTM D3261.
   5. End connections:
      a. Socket fused ends for fittings 1 IN and under.
      b. Butt-fused ends for fitting 1-1/2 IN and greater.
   6. Use IPS reducers on the service mains.
   7. Use tapping tees or straight outlet service saddles to join service lines to the main.

8. Mitered or field fabricated fittings are not allowed.

C. Installation: Install pipe and fittings in accordance with ASTM 2513 and as recommended by the manufacturer.
   1. Provide for a maximum deflection of not more than 5 percent.
   2. HDPE pipe shall not be field threaded and such threaded joints shall not be used in gas distribution systems.

D. Deflection:
   1. See Section 15060.

2.3 PIPE MARKING

A. During extrusion production, the HDPE pipe shall be continuously marked in accordance with AWWA 906 with durable printing including the following information:
   1. Nominal size.
   2. Dimension ratio.
   3. Pressure class.
   4. Manufacturer name or trademark and product series.
   5. Standard material code designation (ex: PE 3408).
   6. Plant identification.
   7. Production date.

2.4 PRESSURE PIPING (UNDERGROUND)

1. Materials: Furnish materials in full compliance with following requirements:
   a. Materials and workmanship in accordance with ASTM F714.
   b. Pipe type and size as shown on the Contract Drawings.
   c. Joints for polyethylene pipe shall be fusion type in accordance with AWWA C901.
   d. Installation: Perform installation procedures, handling, thrust blocking, connections, and other appurtenant operations in full compliance to the manufacturer's printed recommendations and in full observance to plan details when more stringent.
2. Uniformity: Ensure that all piping and fittings are integrated into components of the finished system. Utilize products of a single manufacturer.

2.5 PERFORATED PIPE

A. HDPE pipe requiring perforations shall conform to specified pattern size and spacing shown on the Contract Drawings. The Contractor may not alter hole patterns or spacing shown on the Contract Drawings.

B. Perforations not authorized to be performed in the field

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less. Include manufacturer's name and trademark.
   1. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications, and "NSF" approvals when applicable.

3.2 INSTALLATION

A. See Section 15060.

B. General:
   1. Install buried pipe as indicated on the Contract Drawings.

2. The Contractor shall insure that kinking or excessive bend diameters of the pipe do not occur during the installation process.
3. The Contractor shall insure that the pipe installed in the trench is firmly supported.
4. The Contractor shall cap all open pipe ends at the end of the work day.
5. Contractor shall remove any cave-in portions of the trench prior to placing sand bagging around the pipe.
6. HDPE pipe and fittings shall be by the same manufacturer.
   a. The minimum strength of the fittings shall not be less than that of the pipe.
7. Service taps shall be installed as shown on the Contract Drawings.
8. Changes in direction of PE Pipe:
   a. Pipe may be cold-bent to minimum radius of 20 times the pipe diameter as it is installed.
   b. If fittings or fusions are present in the bend, the minimum recommended cold bending radius is 125 times the outside diameter of the pipe.
9. Remove cutting and threading burrs.

C. Joining Procedures:
1. HDPE pipe joints shall be fused on the surface prior to installation into the trench.
   a. Alternative methods of fusing shall be approved by the Engineer.
   b. PE pipe 1 IN and under shall be socket fused.
   c. PE pipe joints 1-1/2 IN and over shall be butt fused.
2. Fusion joiner must be qualified by type of fusion (i.e., butt fusion, socket fusion or sidewall fusion) and fuse pipe only as qualified.
3. Each joint must be visually inspected inside and outside for damage, dirt, moisture, or any other abnormalities prior to fusing.
4. All joint fusion shall be performed in strict accordance with the manufacturer's specifications.
5. All fusion equipment must be approved by the manufacturer and operated by qualified and certified operators.
   a. Cost for testing and certifying personnel shall be born by the Contractor.

END OF SECTION

SECTION 15075
PIPE: POLYVINYL CHLORIDE (PVC)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Polyvinyl chloride (PVC)pipe, fittings and appurtenances.

B. Related Sections include but are not necessarily limited to:
   1. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. D1784, Rigid Vinyl Compounds.
      b. D1785, PVC Plastic Pipe, Schedule 80.
      c. D2467, PVC Plastic Fittings, Schedule 80.
      d. D2564, Solvent-Cements for PVC Pipe and Fittings.
      e. F1668, Standard Guide for Construction Procedures for Buried Plastic Pipe.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 15060.
   2. Fabrication and/or layout drawings:
      a. Submit complete layout drawings showing type of fittings, and connections to be used at each location.
      b. Submit detail of jointing methods and step-by-step procedures to be used on this Project.
   3. Pipe schedule identifying:
      a. Style, type, size.
      b. Quantity.
      c. Location to be used.
      d. Slot pattern(s)
      e. Schedule of fittings.
      f. Pipe data.
      g. Installer certification.
      h. Field quality control documents.
   4. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Submit certificate secured from the manufacturer acknowledging compliance to Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   a. See Section 15060

SCH	PRESSURE RATING (psi)
80	280

2.2 POLYVINYL CHLORIDE (PVC) PIPING

A. General:
   1. Provide PVC piping with fittings and appurtenances to location shown on the Contract Drawings.
   2. Furnish materials in accordance with ASTM D1785 and full compliance to the following material specifications:
      a. Material description: Type I, Grade I.
      b. Cell classification: ASTM D1784, PVC 12454.
   3. SCH: 80 as specified in the Contract Drawings.
   4. IPS for line size greater than 1 IN.

B. Fittings:
   1. ASTM D2467

C. Installation: Install pipe and fittings in accordance with ASTM F1688 and as recommended by the manufacturer.
      a. PVC pipe shall not be field threaded and such treaded joints shall not be used in gas distribution systems.

2.3 PIPE MARKING

A. During extrusion production, the PVC pipe shall be continuously marked in accordance with ASTM D1785 with durable printing including the following information:
   1. Nominal size.
   2. Schedule
   3. Pressure class.
   4. Manufacturer name or trademark and product series.
   5. Plant identification.
   6. Production date.

2.4 SLOTTED PIPE

A. SCH 80 PVC pipe requiring slots shall conform to specified pattern size and spacing shown on the Contract Drawings. The Contractor may not alter slot pattern or spacing shown on the Contract Drawings.

B. Slots not authorized to be performed in the field.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 FT or less. Include manufacturer's name and trademark.
   1. Nominal size of pipe, appurtenant information regarding polymer cell classification and critical identifications regarding performance specifications, and "NSF" approvals when applicable.

3.2 INSTALLATION

A. See Section 02130.

B. General:
   1. Install buried pipe as indicated on the Contract Drawings.
   2. The Contractor shall insure that kinking or excessive bend diameters of the pipe do not occur during the installation process.
   3. The Contractor shall insure that the pipe installed in the boring is firmly supported.
   4. The Contractor shall cap all open pipe ends at the end of the work day.
   5. Contractor shall remove any cave-in portions of the boring prior to placing pipe.
   6. PVC pipe and fittings shall be by the same manufacturer.
      a. The minimum strength of the fittings shall not be less than that of the pipe.

C. Joining Procedures:
   1. PVC pipe joints shall be connected on the surface prior to installation into the borehole.
   2. Connect PVC sections with solvent cement and secure with lag screws.

END OF SECTION

APPENDIX C
DRAWINGS

Full size drawings are provided as a separate bound document