STARTUP/SHUTDOWN/MALFUNCTION PLAN
MANATEE COUNTY
LENA ROAD LANDFILL

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
JUN 20 2008
SOUTHWEST DISTRICT
TAMPA

Pursuant to state and federal regulations (CFR 40-63.6(e)(3)) Manatee County has developed a startup, shutdown, malfunction (SSM) Plan for the Lena Road Landfill flare system.

SYSTEM EQUIPMENT

The LFG&E Triton CF-3000 Candle Flare has been designed and constructed for the controlled combustion of landfill gas. During this process, the combustion temperature is controlled to ensure the efficient removal of pollutants and prevent their release in the atmosphere. The major components of the flare system are listed below.

Control Panels

The LFG&E Triton CF-3000 Candle Flare is equipped with a *Main Control Panel* and a *Main Power Panel*. The main control and the main power panels are mounted together on a pedestal on one side of the flare operation skid.

- The **main control panel** houses the components that control the operation of the flare and provides the signaling capability to other areas as to the status of the flare operation.
- The **main power panel** houses the disconnect switch along with high voltage electrical connections, protection and control devices.

Programmable Logic Controller (PLC)

The PLC monitors the parameters of the process and automatically controls the operation of the flare system. Sensors and instruments within the flare system are attached to the input modules of the PLC while the control devices and actuators are attached to the output modules of the PLC. The PLC has been programmed to safely operate the flare system based on operator selections and process input parameters as measured by the sensing instruments.

Flame Safeguard System

The Flame Safeguard System is programmed to safely operate the flare system based on process input parameters as measured by the sensing instruments. The flame safeguard system consists of the flame safeguard control in conjunction with a flame detection sensor. The flame safeguard controls the ignition system, pilot fuel solenoid valve(s) and landfill gas valve(s). The flame detection sensor detects the presence of flame and provides this signal to the flame safeguard for safe operation of the combustion process.

Alarm Annunciator

An alarm annunciator is mounted to the swing-out panel behind the glass window on the door of the main control panel. It serves to inform system operators of conditions which may lead to an automatic shutdown of the system.

Pilot Assembly

The pilot assembly provides a fuel source to ignite the burner during flare start-up. The pilot assembly consists of fuel tanks, instrumentation, spark generator and igniter.

Landfill Gas Inlet Valve

The landfill gas inlet valve is pneumatically and electronically controlled and controls the flow of landfill gas to the burner. It operates in a fail-safe manner to close and prevent the release of landfill gas upon loss of power or other shutdown conditions.

Thermocouple

A thermocouple is installed at the upper part of the stack to provide temperature-indicating signals to the temperature controller, via a temperature transmitter within the ignition enclosure mounted lower on the candle supports.

Blower

The blower provides the means to extract, under negative pressure, the LFG from the field.

Knockout Pot (KO Pot)

The KO Pot provides moisture and particulate separation and collection of the incoming LFG from the field.

Flow Meter

The flow rate of the flare is monitored by an orifice flow meter and the data is transmitted to the chart recorder for display and data storage.

OPERATION

- The LFG&E Triton CF-3000 Candle flare system is electronically activated and automatically enters a standby mode when the main disconnect switch is turned on.
- The flare system is designed for ***manual*** or ***automatic*** start.
- Selection of manual or automatic start is made via the "TIME-OFF-AUTO" selector switch.

- At the Lena Road Landfill the default condition for the LFG&E Triton CF-3000 Candle Flare system is for ***automatic start.***

STARTUP PROCEDURE

For the purpose of this SSM Plan, a *"Startup"* will be defined *as the setting in operation of the flare system.*

The manual start-up process is initiated by momentarily pressing the "PUSH TO START" button on the main control panel. The automatic startup is initiated via an electronic start-up signal. Upon startup initiation the flare system executes the following sequences prior to switching to its normal mode of operation.

- Pilot Ignition Cycle
  - The pilot solenoid valve and the igniter are automatically and simultaneously activated in order to establish a pilot flame inside the stack.
  - There is a 10 second window in which the pilot flame has to be established by its detection by the flame detection sensor.
  - If the flame detection sensor does not detect a flame, the system enters a "Start-up Flame Failure" mode and automatically shuts down.

  Once the "Start-Up Flame Failure" mode is entered, the pilot is automatically turned off after the expiration of the programmed time period.

- Landfill Gas Inlet Valve Opening and Blower Activation
  - Once the pilot flame is established the landfill gas valve is automatically opened and the blower motor is started.
  - The tripping of the limit switch within the pneumatic actuator is a sign of proper operating conditions.
  - The flare enters normal operating mode once the blower has started.

NORMAL OPERATION

- The flame detection sensor continuously monitors the presence of flame.
- The thermocouple monitors the flame temperature.
- The paperless chart recorder continuously records operating parameters (temperature, flow rate, etc.)
- The flare system will continue to operate normally until abnormal conditions are encountered. Abnormal conditions include loss of flame, high or low temperature, or system component failure.
- Abnormal operating conditions will cause the system to automatically execute a shutdown procedure and will activate the alarm annunciator.

SHUTDOWN PROCEDURE

For the purpose of this SSM Plan, a "Shutdown" will be defined *as the cessation of operation of the flare system for any purpose.*

- *Manual* system shutdown can be accomplished by
  - Pushing the emergency shutdown switch.
  - Changing the position of the "Time-Off-Auto" switch to "off."

- *Automatic* system shutdown occurs when the system encounters and senses abnormal operating conditions.

- During system shutdown the following actions occur:
  - The gas inlet valve is closed
  - The gas pilot valve is closed
  - The alarm annunciator panel will display the reason for the shutdown.

MALFUNCTION PROCEDURES

For the purposes of this SSM Plan, a "Malfunction" will be defined *as any sudden, infrequent and not reasonably preventable failure of the flare system. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.*

All malfunction events must be recorded (see: the SSM event form) and reporting requirements must be followed. Reporting requirements differ based on whether the actions taken to correct a malfunction were consistent with the SSM Plan. Reference the reporting section of the SSM Plan for these requirements.

SSM EVENT 1	
SSM Event	Power spiking of the flare electrical system.
SSM Event Description	Power supply to the flare system is interrupted due to lightening or electrical system surges that cause the flare system to sense abnormal operating conditions. This event will cause an automatic shutdown of the flare system.
Corrective Action	Once the flare system has completely executed the automatic shutdown process and system parameters (i.e., temperature) have returned to acceptable values, the flare system will enter automatic startup mode. If the automatic startup process is unable to re-initiate operation of the flare, the system will enter the "Startup Flame Failure Mode." Once the system enters this mode a manual restart of the system is required (see Startup Procedure of this SSM Plan.)

SSM EVENT 2	
SSM Event	Condensate buildup in the flare system components.
SSM Event Description	Condensate buildup in the flare system components or the landfill gas line leading to the flare system. Buildup of condensate in the Knockout Pot or the landfill gas line or sump leading to the flare system will prevent landfill gas from reaching the flare for combustion.
Corrective Action	Initiate a shutdown of the flare system. Investigate the liquid levels via the sight-glass in the water trap and KO Pot that trap and collect condensate from the landfill gas collection system. If the liquid levels are significant, open the drain valves and allow the fluid to drain from the system components. Initiate the flare startup procedure and determine whether corrective action was successful. If the flare system does not ignite, this is an indication of the condensate buildup (or other blockage) in the sump and/or the landfill gas line leading to the flare system. With the flare system shutdown, the sump pump(s) should be investigated for their operational status. Malfunctioning pumps should be replaced and the collected leachate in the sump discharged to the leachate collection system. If pumps are operating normally, the landfill gas line leading to the flare system may be blocked. The line should be cleaned to remove the obstruction and clear the line for normal landfill gas flow. The manual flare startup procedure should be initiated.

SSM EVENT 3	
SSM Event	Air compressor failure.
SSM Event Description	Air compressor malfunction leading to pneumatic failure of the gas inlet valve remaining in the open position. An automatic or manual shutdown following this failure can result in an improper flare system shutdown and cause excess emissions. This condition may also result in a "Startup Flame Failure" condition preventing automatic or manual startup of the flare system.
Corrective Action	The system should be shutdown and the air compressor motor and components evaluated for the cause of failure. Malfunctioning or failed components are to be replaced with new operating components and compressor maintenance performance to ensure proper operation of the air compressor. Once completed, the system should be manually started and the air compressor checked for proper operation.

SSM EVENT 4	
SSM Event	Blower failure.
SSM Event Description	Blower failure will lead to a vacuum not being pulled on the system. Unless significant positive pressure exists in the landfill gas collection system or the flare combustion is able to entrain significant flow from within the system, combustion at the flare will not be supported.
Corrective Action	The system should be shutdown and the blower motor and components evaluated for the cause of failure. Malfunctioning or failed components are to be replaced with new, operating components and blower maintenance performed to ensure proper operation of the unit. Once completed, the system should be manually started and the blower checked for proper operation.

SSM EVENT 5	
SSM Event	Adverse weather conditions, specifically high wind and rain.
SSM Event Description	High wind and rain may prevent re-ignition of the flare.
Corrective Action	Appropriate modifications to the flare will be made, where possible, to prevent adverse weather from affecting operation of the flare. If the flare re-ignition is still not possible, the flare will enter "Startup Flame Failure" mode. In this case, the weather should be allowed to pass and the flare be restarted manually.

SSM EVENT 6	
SSM Event	Automatic pneumatic valve fails to close automatically when flare goes out.
SSM Event Description	Valve failure or instrumentation failure.
Corrective Action	The flare should be shutdown and the valve and components evaluated for the cause of failure. Malfunctioning or failure components are to be replaced with new operating components and maintenance performed to ensure proper operation of the valve and control system. Once completed, the system should be manually started and the automatic valve checked for proper operation.

SSM EVENT 7	
SSM Event	General Flare System Maintenance
SSM Event Description	General maintenance duties are routinely performed on the flare system and components. Examples are but not limited to repairs on manholes, well heads, gauges, change oil, change desiccant balls, change air filters.
Corrective Action	The system will be shutdown while general maintenance duties are performed. Once completed, the system will be manually started and checked for proper operation.

SSM EVENT 8	
SSM Event	Pilot Thermocouple failure.
SSM Event Description	Failed restarts and inaccurate temperature recordings are generated from faulty pilot thermocouple.
Corrective Action	The system should be shutdown and the pilot thermocouple and components evaluated for the cause of the failure. Malfunctioning or failed pilot thermocouple is to be replaced with new, operating pilot thermocouple. Once completed, the system should be reset to normal operating mode and the pilot thermocouple checked for proper operation.

SSM EVENT 9	
SSM Event	Gas Collection System Construction
SSM Event Description	Making new tie-ins to existing system, balancing all wellheads and blower RPM's of existing collection system, debris in system due to construction.
Corrective Action	Balancing of system.

SSM EVENT 10	
SSM Event	Sludge Driers
SSM Event Description	Flare outage due to balancing of gas drier and flare demands.
Corrective Action	Balancing of system.

REPORTING PROCEDURES

SSM Events

For each SSM event, a SSM event form (see Appendix) must filled out. The event form should remain "active" until the SSM event has been concluded. At conclusion of the SSM event, the event form should be fully completed and filed. The event forms should

be complied on a monthly basis into an electronic spreadsheet suitable for incorporation into an official report (see below, Semi-Annual Report).

Actions taken that are inconsistent with the SSM Plan will trigger immediate reporting requirements (see below).

Semi-Annual Report

A semi-annual report must be submitted to the Administrator documenting all SSM events (whether consistent or inconsistent with the SSM Plan) over the previous 6-month period. The report is to include a list of the SSM events that occurred, the duration and a description of each. The report will consist of a letter with name, title and the signature of the owner or authorized operator. The semi-annual SSM report is due 30-days following the end of the calendar half-year (or other calendar reporting period, as appropriate). The report is to include the name, title and signature of the designated responsible official. A transmittal letter accompanying the report should include a statement that, based on the information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate and complete.

The semi-annual report is required *only* if an SSM event occurred during the reporting period.

Immediate Reports

Immediate reports are required for SSM events that require actions to be taken that are inconsistent with the SSM Plan. Following the taking of action inconsistent with the SSM Plan, the Administrator must be notified within two (2) working days. A letter report to the Administrator must follow this initial notification within seven (7) working days of the end of the SSM event. The letter report must contain a description of the SSM event and the surrounding circumstances, the reasons for not following the SSM Plan, and an explanation of whether any excess emission or parameter monitoring exceedances are believed to have occurred. The letter should contain the name, title and signature of the designated responsible official. A transmitted letter accompanying the report should include a statement that, based on the information and belief formed after reasonable inquiry, the statements and information in the documentation are true, accurate and complete.

SSM PLAN REVISION PROCEDURES

The SSM Plan must be revised for malfunctions that are not adequately addressed in the SSM Plan.

You must modify your current SSM Plan in the following situations:

- To reflect changes to your MACT operations or SSM procedures since your prepared last SSM Plan (§63.6(e)(viii)); and

- If your current SSM Plan:
  - Does not include instructions for a SSM that has occurred (§63.6(e)(3)(vii)(A)).
  - Does not include instructions for what you will do during a SSM that are safe procedures and are good air pollution control practices that minimize emissions to the greatest extent (§63.6(e)(3)(vii)(B)).
  - Does not include enough instructions for correcting/repairing the malfunctioning process, air pollution control or monitoring equipment as quickly as practical (§63.6(e)(3)(vii)(C)).
  - Includes instructions for anything that is a SSM, as defined above (§63.6(e)(3)(vii)(D)).

Note:

If your current SSM Plan leaves out or does not include enough instructions to correctly handle any incident that occurs that can be called a malfunction, you must revise your current SSM Plan within 45 days after the incident. You must add to the revised SSM Plan what you will do in case this type of incident happens again (§63.6(e)(3)(vii)). Depending on what your SSM Plan revisions are, the permitting authority and/or EPA may ask to see a copy of your revised SSM Plan.

STARTUP / SHUTDOWN / MALFUNTION (SSM) EVENT FORM

Complete this form if a startup , shutdown, or malfunction (SSM) event occurred.

FACILITY INFORMATION	
Title V Permit No.	0810055-004-AV
Name	Manatee County Lena Road Landfill
Identification No.	0810055
Street Address	3333 Lena Road
City, State, Zip	Bradenton, Florida 34211
Contact Person	Mr. Mike Gore
Contact Phone	(941) 748-5543

EVENT INFORMATION			
Date Started		Date Ended	
Time Started		Time Ended	
SSM Event Number: (circle one)	1 2 3 4 5 6 7 8 9 10		
SSM Event Name:			
Circumstances leading to the SSM event:			

ACTION TAKEN			
Action **CONSISTENT** with SSM Plan		Action **INCONSISTENT** with SSM Plan	
	Reporting Requirement	Check	Date
	2-Day Notification		
	7-Day Notification		
	45-Day SSM Plan Modification		
Description of action taken:			
If SSM Plan was not followed, provide explanation here			

FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION

JUN 20 2008

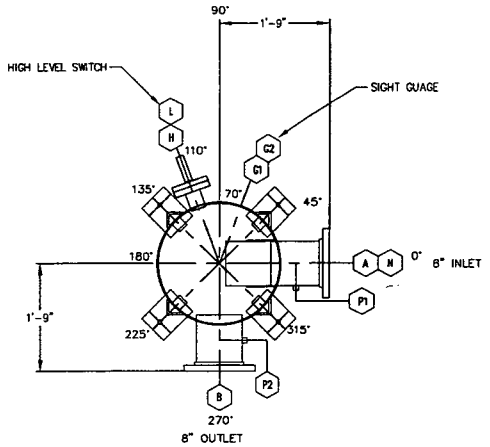
SOUTHWEST DISTRICT
TAMPA

Manatee County
Biosolids Drier System

Additional Information for Submittal to FDEP
Related to Landfill Gas System for
Supplying Landfill Gas to Biosolids Drier

June 18, 2008

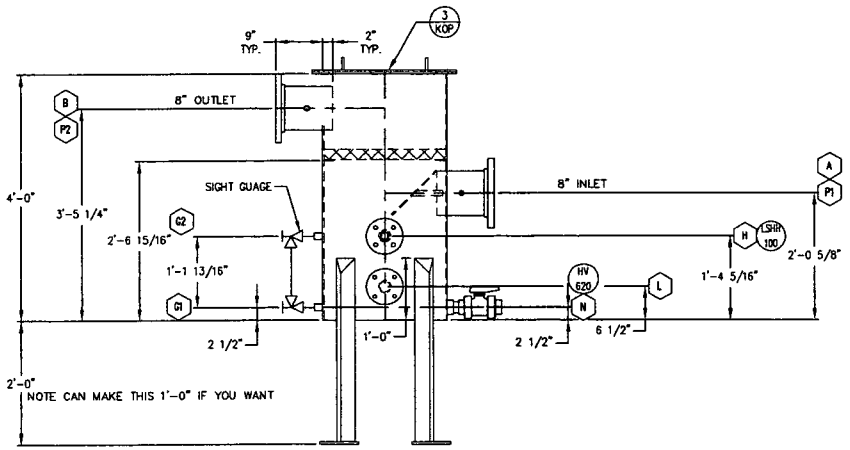
- "24 inch Dia. X 48" LG Knock Out Pot Assembly" Shop Drawing by Shaw LFG Specialties, L.L.C.
- "SDR 17 HDPE Condensate Sump" Shop Drawing by Shaw LFG Specialties, L.L.C.
- Photograph 1 of Condensate Sump
- Photograph 2 of Condensate Sump
- Cut Sheet for Vector Pneumatic Piston Pump for Condensate Sump



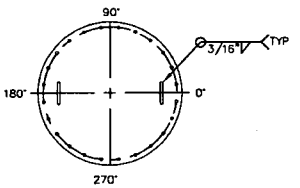
PLAN – NOZZLE ORIENTATION

NOZZLE SCHEDULE

MARK	SIZE	SIZE	EXT	PROJ	RATING	MATL	DESCRIPTION
A	1	8	9	2	150 RFSO	CS	GAS INLET
B	1	8	9	2	150 RFSO	CS	GAS OUTLET
N	11	2	–	–	H.CPLG.	SS	CONDENSATE DRAIN
G1	10	1/2	–	–	F.CPLG.	SS	GAGE
G2	10	1/2	–	–	F.CPLG.	SS	GAGE
H	9	2 1/2	4	–	150 RFSO	CS	HIGH LEVEL ALARM SWITCH
L	9	2 1/2	4	–	150 RFSO	CS	INSPECTION PORT
P1	23	1/2	–	–	H.CPLG.	CS	PLUG
P2	23	1/2	–	–	H.CPLG.	CS	PLUG



ELEVATION VIEW
NOT TRUE ORIENTATION



3 KOP LID DETAIL

REV	DESCRIPTION / ISSUE	DATE	BY

THIS DRAWING REPRESENTS INTELLECTRIAL PROPERTY OF LFG SPECIALTIES, L.L.C. ANY MODIFICATION TO THE ORIGINAL BY OTHER THAN LFG SPECIALTIES, L.L.C. PERSONNEL VIOLATES ITS ORIGINAL PURPOSE AND AS SUCH IS RENDERED VOID. LFG SPECIALTIES, L.L.C. WILL NOT BE HELD LIABLE FOR ANY CHANGES MADE TO THIS DOCUMENT WITHOUT THE EXPRESS WRITTEN CONSENT OF THE ORIGINATOR.

Shaw LFG Specialties, L.L.C.

24" DIA x 48" LG KNOCK OUT POT ASSEMBLY

DRAWN BY:	CHECKED:	APPROVED BY:	SIZE:
*	*	*	D

SCALE	DATE	PROJECT NO.
1"=1'-0"	11/06/07	*

PROJECT NAME: *

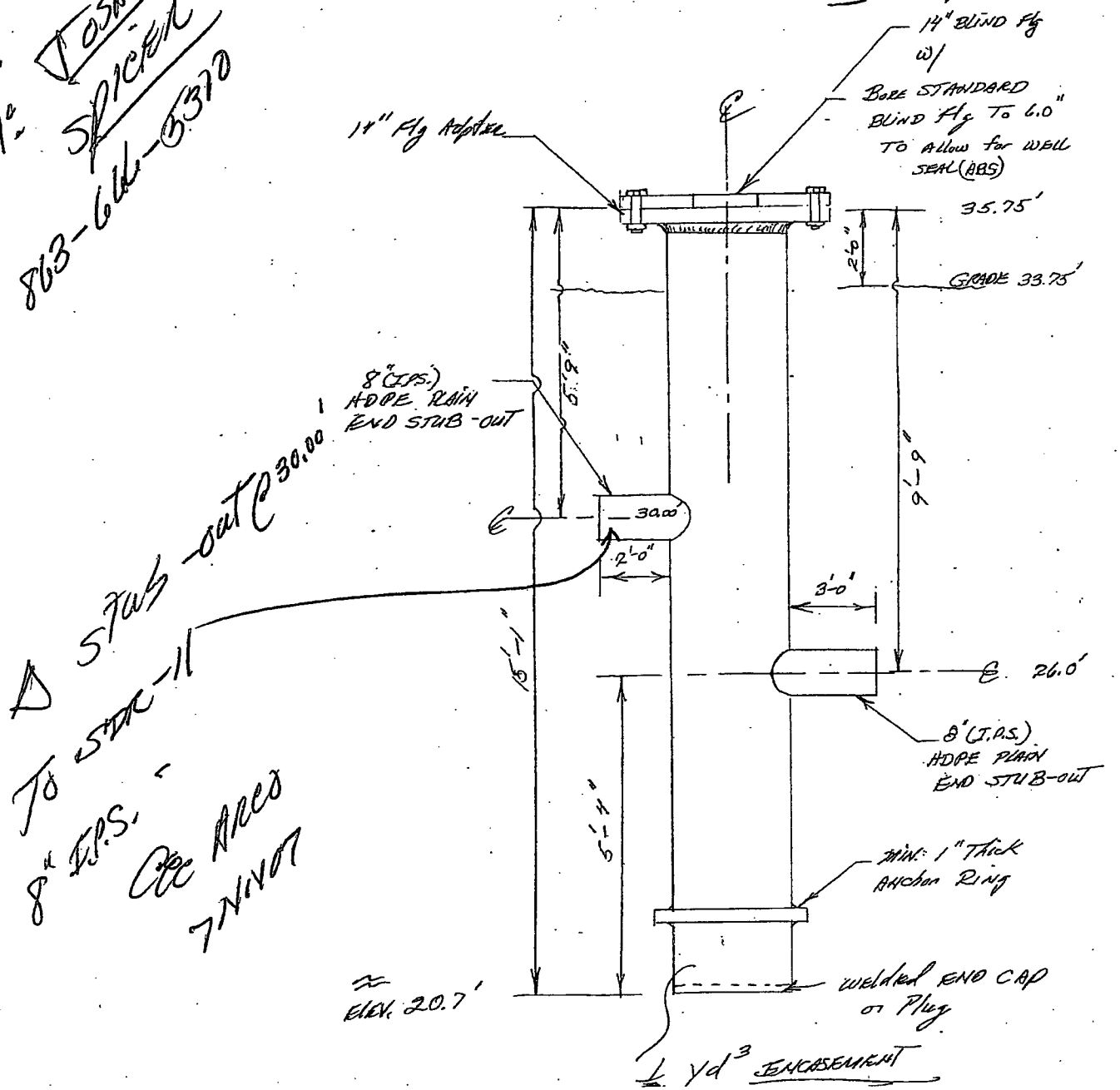
CUSTOMER: *

SERIAL NO.: * | DWG NO.: * | REV.: 1

File: K:\QUOTE DRAWINGS\24INKOPWITHLEGS.dwg Layout: Model User: KevinMasson Nov 06, 2007 - 1:51pm

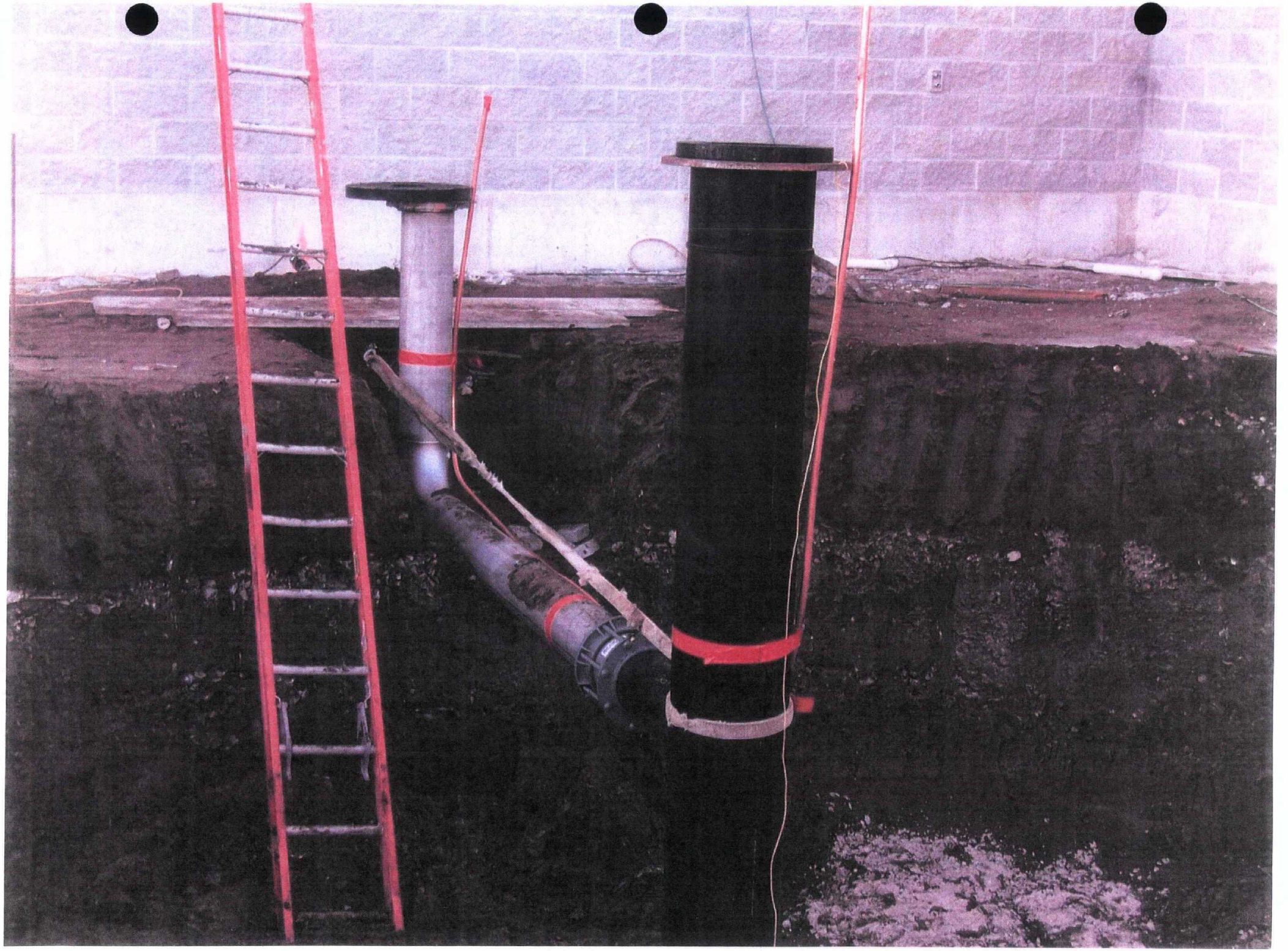
NW FEI # 1238
GNOV 07
ATTN: Joshua Spicer
@ 863-646-6370

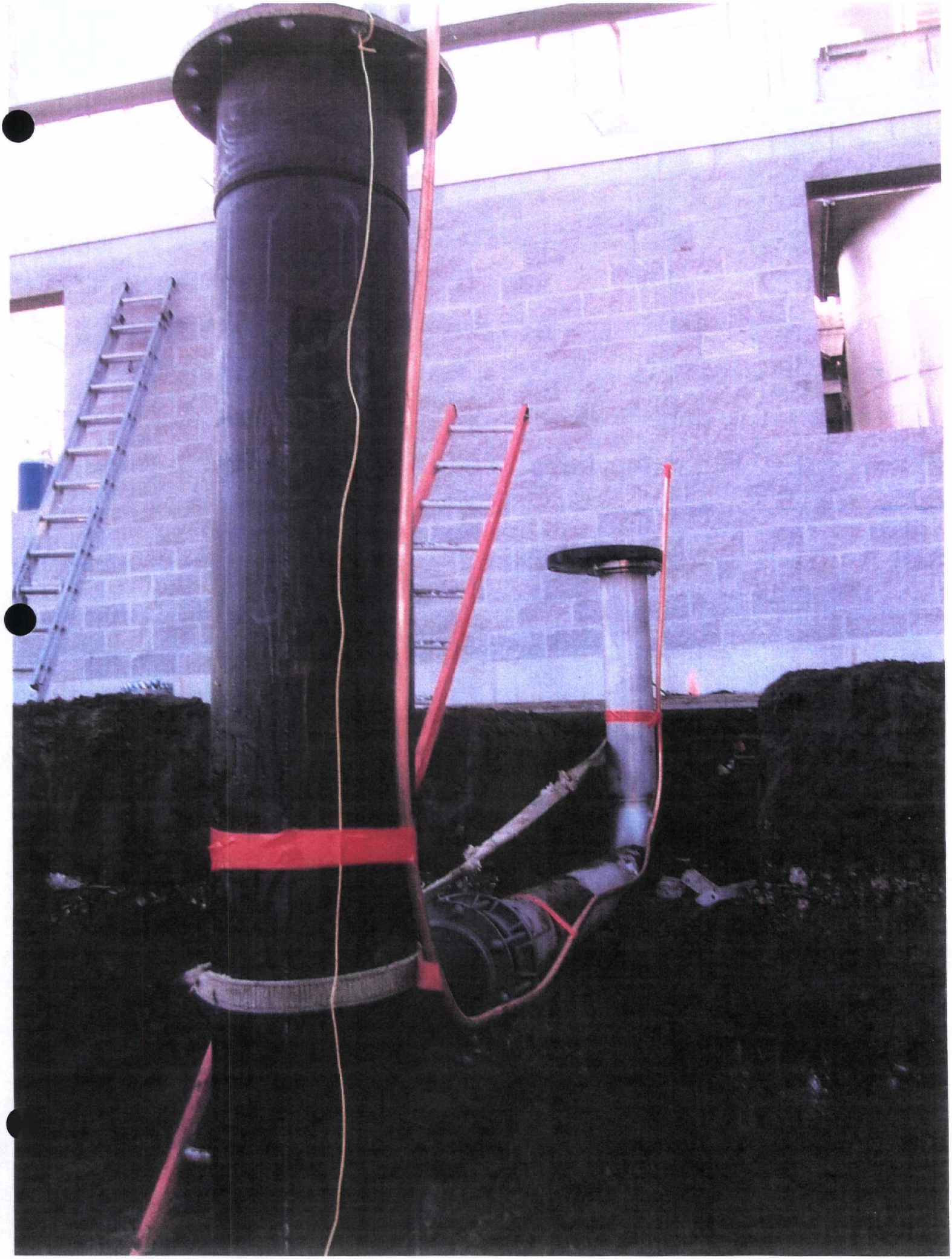
14" I.D.S. HDPE SUMP (SDR 17) except as noted
Pressure Rated @ ≤ 10 psi
By Cec 7/11/07



Δ Stub-out @ 30.00' To stub-11 8" I.P.S. - Cec Revs 7/11/07

1 wk Del. Revd

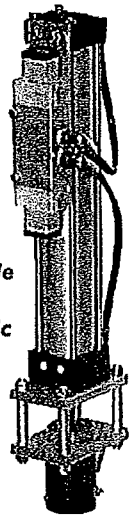




Vector Pneumatic Piston Pump®

Patented Top-Head-Drive Piston Pump

Model 102V



Patented, Repairable Vector Pneumatic Drive Motor

Flow Range
0-5 US GPM 18.9 LPM
Operational Depth
Up to 285 Ft. 86 M
Well Casing Size
Minimum 3 In. 7.62 CM

Description

The Vector Pneumatic Piston Pump Model 102V is powered by compressed air. The control motor is located at surface grade for easy installation and maintenance. Industrial-quality air pressure is used to power the pump motor. Power to the pump is direct from grade through the sucker rod assembly. The pump removes water and product (e.g. leachate) from a three (3) inch (7.62 cm) diameter well casing or greater to depths of 285 feet (86 meters). The fluid inlet is located at the bottom of the pump intake cylinder and removes water or product to 0 submergence depth.

Customizable Downhole Pump

Performance and Technical Data

Performance

Operational Depth	285'
Flow Range	0 to 5 US GPM/ 18.9 LPM 7,200 US GPD/ 27,000 LPD
Discharge per Stroke	.125 US Gallons per stroke Note: flow does not vary with depth
Strokes per Minute	5 - 40
Maximum Operating Pressures	120 psig (operating pressure based on 120 psi air supply)
Maximum Lift	285 feet of water or 120 psig
Maximum Strokes per Minute	40 (Variable speed (stroke) control adjusts to well conditions; liquid drawn down to top of strainer.)

Technical

Stroke Length	12" (30.48 cm)
Maximum External Diameter	2.9" (7.37 cm)
Total Cylinder Length	30" (76.2 cm)
Connection of Riser Pipe	2" (4.85 cm)
Connection to Sucker Rod	7/16" - 20
Recommended Internal Diameter of Bore Hole	3-4" (7.62 cm - 10.16 cm) or greater diameter.
Weight of Cylinder	10 lbs.
Discharge Size	2" NPT
Installation	Unit can be installed vertically or horizontally
Driver Weight	6 lbs.
Driver Rod Weight	12 lbs./100'
Foot Valve Assembly Weight	10 lbs.
Minimum Well Casing Size	3"
Pneumatic Air Connection	3/8" NPT 3/8" OD Tubing

* Up to 1000 feet.

BLACKHAWK TECHNOLOGY COMPANY • 21W161 HILL AVE., GLEN ELLYN, IL 60137 • P: 630.469.4916 • F: 630.469.4896

www.blackhawkco.com

Scoop

Vector Pneumatic Piston Pump®

Model 102V

Materials of Construction:

(Materials of construction can be modified to meet specific applications)

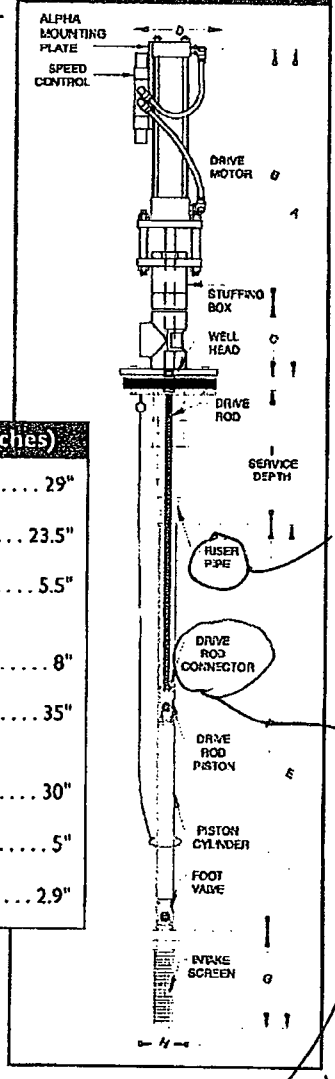
Above Ground

Drive Motor	Stainless Steel/ Aluminum
Stuffing Box Seal	Nitrile/Viton
Stuffing Box	Delrin®
Discharge Tee	Stainless Steel
Well Head	PVC/ABS

Downhole

Drive Rod	Fiberglass
Drive Rod Connector	Stainless Steel
Drive Piston Seal	Nitrile/Viton
Drive Piston Check Ball	Stainless Steel
Drive Piston	Delrin®
Piston Cylinder	Stainless Steel/PVC
Foot Valve Check Ball	Stainless Steel
Foot Valve	Delrin® with Stainless seat
Intake Screen	Stainless Steel/PVC

Pump Dimensions



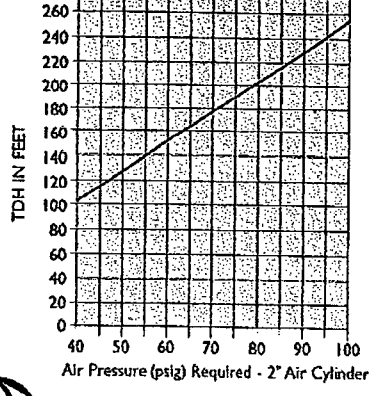
Dimensions (in inches)

A	Above Well Height	29"
B	Driver Height	23.5"
C	Discharge Tee & Well Seal Height	5.5"
D	Driver Diameter	8"
E	Foot Valve Assembly Length	35"
F	Foot Valve Length	30"
G	Intake Screen Length	5"
H	Downhole Diameter	2.9"

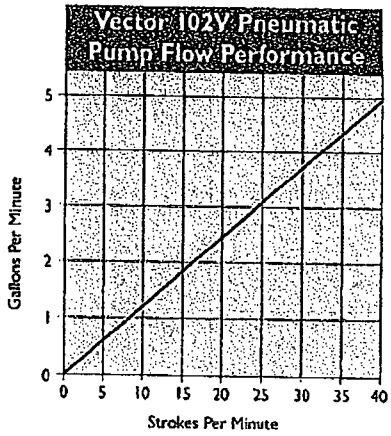
Supply INTied to Length

20 ft of Coiled Steel Like a Hula Hoop One End Screws into piston Cut the other End to fit

Vector 102V Pneumatic Motor Air Pressure Requirements



Vector 102V Pneumatic Pump Flow Performance



* Up to 1000 feet

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www.blackhawkco.com

FILE

PBS&J

An employee-owned company

June 24, 2008

INSERTED INTO OCULUS
JUL 25 2008
INITIAL

Susan J. Pelz, P.E.
Solid Waste Manager
Southwest District
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

Dept. of Environmental Protection
JUN 25 2008
Southwest District

Re: Lena Road Landfill, Manatee County
GMS ID No.: 4041C02025
Stage III Landfill Gas Recovery System Construction
Pending Permit No.: 39884-016-SC/08
Response to RFI #2 dated May 21, 2008

Dear Ms. Pelz:

This letter is in response to your Request for Information #2 regarding the above referenced permit application. Your requests are typed in italics followed by our responses in normal type. Four copies of this response with each revision, replacement, or additional new document are included.

1. ***Application form, Rule 62-701.320(7), F.A.C.***
   a. *Part O.4. Response #1.a. indicates that the application form was revised to reference the appropriate information. The revised application form references the 2004 Operation Permit renewal application. However, the gas recovery system was not approved by the Department as part of the operation permit application, and the information regarding the gas recovery system is "not relevant" for that application (as stated in Part O of that application). Please provide a revised application form that includes the information for the gas recovery system.*

   Response: Part O.4 was revised and the information included with this response.

2. ***Landfill Gas Recovery System; Rule 62-701.530(5), F.A.C.***
   a. *As previously requested, please provide construction plans and design information for the "gas processing points or flares" (i.e., gas conditioning system, radiators, gas piping and connections for the sludge drying system and gas engines and building shown on the Site Plan, Sheet C-2 submitted as part of the pending operations permit modification request (#39884-015-SO/MM).*

   Response: The information for the sludge drying system requested here was submitted as part of the operation permit modification application, and is on file with the Department. The additional information requested here was submitted as part of the Response #2 to the request for additional information for the minor permit application

for the Landfill Operation Permit. The construction drawings requested for the gas engines, radiators and buildings is not available since Siemens, the contractor for the project, has not completed final design. This information will be submitted when it is complete. Please do not delay our request for the Stage III Landfill gas expansion system permit for this information on the landfill gas to electricity project. The Title V air permit requires the landfill gas system installation completed by February of 2009.

b. *Please provide all information required by Rule 62-701.530, F.A.C., for gas recovery systems. See Comment #2.a., above.*

Response: See response to Comment #2.a., above.

c. *No additional information is requested concerning the bottom elevation of the boring/gas wells. Please provide one full-sized set of drawings. See Comment #2.g.*

Response: One complete full-size set of drawings is included with this response.

d. *Tables 1, 2, 3, 4.* Landfill Gas Estimates ....

Response: We included with this response a copy of the calculations for the methane emission rate for the Manatee County Lena Road Landfill using the U.S. EPA LANDGEM model. These calculations were submitted to the Department in Part O of Volume 2 of 2 of the Application and Engineering Report for Renewal of the Landfill Operation Permit for the Manatee County Lena Road Landfill dated April 2004. They were also submitted to the Department with the renewal of the Stage I Landfill Closure Permit in 2005.

e. *Section 2, Part O.*

1) *Please provide calculations that demonstrate that the lateral and header piping will not collapse under the expected loading.*

Response: The previously submitted calculations for the Stage I landfill gas system as part of the Stage I Landfill Closure Permit renewal were copied, resigned and sealed and included with this response.

f. *Section 3, Specifications.*

1) *Please provide specifications for the gas conditioning system, radiators, gas piping and connections for the sludge drying system and gas engines and building shown on the Site Plan, Sheet C-2 submitted as part of the pending operations permit modification request (#39884-015-SO/MM).*

Response: This response is the same as the response to Number 2.

2) *Section 01015. No additional information is requested for this item.*

3) *Section 01030. The revised information changed the pagination such that some information was not included on the revised pages. Please provide a complete Section 01030.*

Response: Included with this response is a complete copy of Section 01030.

4) *Section 02610. Response #2.f (4) states, "Section 2.01.A has the gradation for the gas well aggregate. It is graded between 1-inch to 3-inch diameter size." While "3-inch to 1-inch diameter" describes the size range for the aggregate, the Department disagree that this is the gradation of the material since it does not specify the percentage of each size that is expected for the material. Please provide the gradation requirement for the gas well aggregate (2.01.A.). The revised information changed the pagination such that some information was not included on the revised pages. Please provide a complete Section 02610.*

Response: Section 2.01.A was revised to add gradations, and revised Section 02610 is included with this response.

g. *Section 4, Drawings. Reduced size plan sheets are acceptable however; please provide at least one set of full-sized, signed and sealed drawings, in addition to reduced-size drawings for the Department's file.*

Response: One full-sized set and four reduced sized plan sheets are included with this response.

1) *Please provide construction drawings for the gas conditioning system, radiators, gas piping and connections for the sludge drying system and gas engines and building shown on the Site Plan, Sheet C-2 submitted as part of the pending operations permit modification request (#39884-015-SO/MM).*

Response: The drawings for the sludge drying system were submitted with the application and responses for the permit modification for the Landfill Operations Permit. The drawings for the landfill gas to electricity project are not available.

2) *Sheet C-2, General Site Plan. No additional information is requested for this item.*

3) *Sheet C-3. No additional information is requested for this item.*

4) *Sheets C-3A and 3B. Please verify the location of Section A referenced to Sheet C-4 in the northwestern portion of this plan view sheet.*

Response: The reference was verified. The drawing was revised and the revised drawing included with this response.

5) *Sheet C-4. No additional information is requested for this item.*

6) *Sheet C-5. A new Detail B ("Typical Pipe section") referenced to Sheet C-4 and C-3 was added to this sheet. Since there is also a Detail B referenced to Sheets C-3 and C-4 shown on Sheet C-4, please identify the locations of these different configurations on the plan view sheets.*

Response: This detail was deleted and the revised drawing included with this response.

7) *Sheet C-6. No additional information is requested for this item.*

3. ***Notice of Application, Rule 62-701.320(8), F.A.C.*** *Proof of publication of Application was received by the Department on May 19, 2008. No additional information is requested for this item.*

Sincerely,

Joseph L. Miller, P.E. #39177
Project Engineer

Cc: Gus DiFronzo, Manatee County Solid Waste w/2 copies
U:\SO\Projects\Manatee County\SW-33 Stage III LFG\Permit Application\Response to RFI 2.doc

Dept. of Environmental Protection

JUN 25 2008

Southwest District

Attachments

- Application Part O Page 34 of 40 and attachments
- Engineering Report – Information requested in Part O of the Application
- Pipe Strength Calculations for Landfill Gas Collection Pipe
- Application Section 3 - Specifications Section 01030
- Application Section 3 - Specifications Section 02610
- Section 4 - One full-sized set and four reduced-sized sets of the Permit/Construction Drawings C-1, C-2, C-3, C-3A, C-3B, C-4, C-5 and C-6.

PBS&J

Subject: Manatee County Lena Road Landfill		
Comp by: JLM	Date: 9/5/06	Sheet Number: 1/18
Check by: RGC	Job Number: 120498	

Pipe strength Calculations for Landfill gas collection Pipe

Assume HDPE pipe

SDR 17

8"ø & 18"ø pipe

Pipe envelop is ~~pea gravel~~ FDOT #7 or 57 coarse aggregate

E' of soil is 1000 psi worst case

E' of soil is 3000 psi

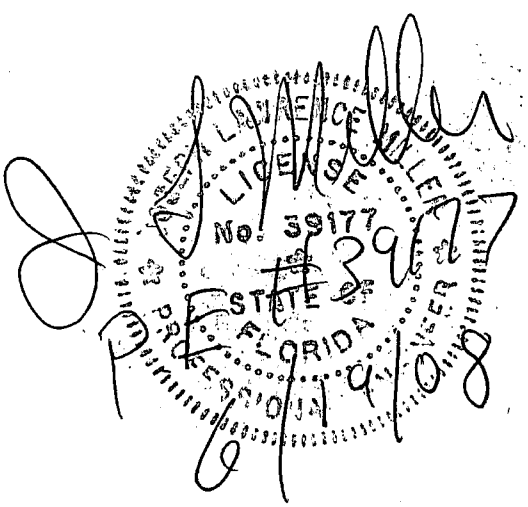
check pipe burial design by

- Wall crushing
- Wall buckling
- Ring deflection

Dept. of Environmental Protection

JUN 25 2008

Southwest District



PBS&J

Subject:	Manatee County Lena Road Landfill		
Comp by: JLM	Date: 4/5/06	Sheet Number: 2/18	
Check by: RGC	Job Number: 120498		

* Revised 5/30/06

Calculate P_t - total external ~~soil~~ pressure on the pipe *

$P_t = P_s + P_L + P_i = 8.33\text{psi} + 27.78\text{psi} + 3.44\text{psi}$

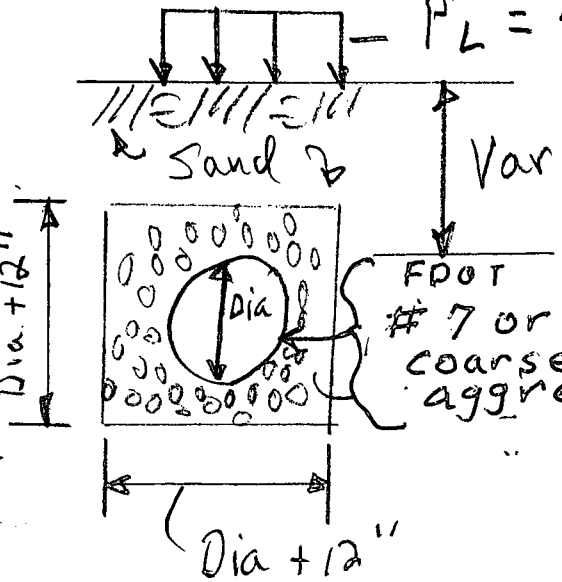
$P_t = 39.55\text{psi} \cong \underline{40\text{psi}}$

P_s = Total static load pressure

P_L = Total live load pressure

P_i = Total effective external pressure due to negative internal pressure (vacuum) of max. 48 in of H_2O. use Factor of Safety of 2. So assume 8 ft of H_2O vacuum at 0.43 psi/ft H_2O = 3.44 psi

$P_L^* = 4000\text{ lbs/ft}^2 / 144\text{ in}^2/\text{ft}^2 = \underline{27.78\text{ psi}}$



$P_s = 10' \times 120\text{ lbs/ft}^3$

$P_s = 1200\text{ lbs/ft}^2 / 144\text{ in}^2/\text{ft}^2$

$P_s = \underline{8.33\text{ psi}}$

* See page 45 of Driscopipe System Design Manual.

PBS&J

Subject:	Manatee County Lena Road Landfill		
Comp by: JLM	Date: 4/5/06	Sheet Number: 3/18	
Check by: RGC	Job Number: 120498		

Check Wall Crushing

Ref. see pages 36 & 37 of Driscopipe Systems Design Manual (Attached to these calculations)

$$S_A = \frac{(SDR-1)}{2} P_T$$

S_A = Actual compressive stress, psi

SDR = Standard Dimension Ratio

P_T = External Pressure, psi = 40psi

$$S_A = \frac{(17-1)}{2} 40\,psi = 320\,psi$$

Safety factor = 1500 psi / S_A

where 1500 psi is the compressive yield strength of HDPE pipe

Safety factor = 1500 psi / 320 psi = 4.69

OK

Subject:	Manatee County Lena Road Landfill		
Comp by: JLM	Date: 4/5/06	Sheet Number: 4/18	
Check by: RGC	Job Number: 120498		

Check Design by Wall Buckling

Ref. page 37 of Driscopipe Design (attached)

$P_T = 40$ psi

Design by Wall Buckling: Local wall buckling is a longitudinal wrinkling of the pipe wall. Tests of *non-pressurized* Driscopipe show that buckling and collapse do not occur when the soil envelope is in full contact with the pipe and is compacted to a dense state. However, it can be forced to occur over the long term in *non-pressurized* pipe if the total external soil pressure, P_t, is allowed to exceed the pipe-soil system's critical buckling pressure, P_{cb}. If $P_t > P_{cb}$, gradual collapse may occur over the long term. A calculated, conservative value for the critical buckling pressure may be obtained by the following approximate formula. All pipe diameters with the same SDR in the same burial situation have the same critical collapse and critical buckling endurance

$$P_{cb} = 0.8\sqrt{E' \times P_c}$$

Where:

P_t = Total vertical soil pressure at the top of the pipe, psi

P_{cb} = Critical buckling soil pressure at the top of the pipe, psi

E' = Soil modulus in psi calculated as the ratio of the vertical soil pressure to vertical soil strain at a specified density

P_C = Hydrostatic, critical-collapse differential pressure, psi

$$P_C = \frac{2E\,(t/D)^3\,(D_{MIN}/D_{MAX})^3}{(1-\mu^2)}$$

$$P_c = \frac{2.32\,E}{(SDR)^3}$$

Where: $(D_{MIN}/D_{MAX}) = .95$

μ = Poission's Ratio

$\mu = .45$ for Driscopipe

E = stress and time dependent tensile modulus of elasticity, psi

In a direct burial pressurized pipeline, the internal pressure is usually great enough to exceed the external critical-buckling soil pressure. When a pressurized line is to be shut down for a period, wall buckling should be examined.

$P_{cb} = 0.8\sqrt{E' \times P_c}$

E' = Soil Modulus in psi

Assume $E' = 1000$ psi see Table on page 36 of reference. Assume worst case of no compaction on pea gravel.

$$P_c = \frac{2.32\,E}{(SRD)^3}$$

$E = 33{,}000$ psi see Chart 25 on page 37.

$$P_c = \frac{2.32\,(33{,}000\text{ psi})}{(17)^3}$$

$P_c = 15.58$

$P_{cb} = 0.8\sqrt{1000 \times 15.58}$

$P_{cb} = 99.87$ psi

$F.S. = P_{cb}/P_T = \frac{99.87}{40} \approx 2$ OK

PBS&J

Subject:	Manatee County Lena Road Landfill		
Comp by: JLM	Date: 4/5/06	Sheet Number: 5/18	
Check by: RGC	Job Number: 120498		

Check by Design by Ring Deflection

6. Calculate pipe deflection based upon the principle that its deflection will be the same as the backfill surrounding the pipe under the influence of the soil pressure at the top of the pipe:

$$\% \text{ Soil Strain} = \xi_S = \frac{P_t}{E'_{MIN}} \times 100$$

page 46 of Driscopipe

P_t = Total External pressure

$P_t = 40 psi$

$E'_{min} = 1000 psi$ (Worst case)

For $E'_{min} = 1000 psi$

$$\xi_S = \frac{40 psi}{1000 psi} \times 100$$

$\xi_S = 4\%$

For $E'_m = 3000 psi$

$$\xi_S = \frac{40 psi}{3000 psi} \times 100 = 1.33\%$$

Values of E'

Based on Soil Type (ASTM D2321) and Degree of Compaction

Soil Type of Initial Backfill Embedment Material	Description	E' (psi) for Degree of Compaction (Proctor Density, %) Loose	Slight (70-85%)	Moderate (85-95%)	High (95%)
I	Manufactured angular, granular materials (crushed stone or rock, broken coral, cinders, etc.)	1,000	3,000	3,000	3,000
II	Coarse grained soils with little or no fines	N.R.	1,000	2,000	3,000
III	Coarse grained soils with fines	N.R.	N.R.	1,000	2,000
IV	Fine-grained soils	N.R.	N.R.	N.R.	N.R.
V	Organic soils (peat, muck, clay, etc.)	N.R.	N.R.	N.R.	N.R.

N.R. = Not Recommended for use by ASTM D2321 for pipe wall support

from page 36 of Driscopipe

Chart 27 SDR	Allowable Ring Deflection
32.5	8.1%
26.0	6.5%
21.0	5.2%
19.0	4.7%
17.0	4.2%
15.5	3.9%
13.5	3.4%
11.0	2.7%

Page 38

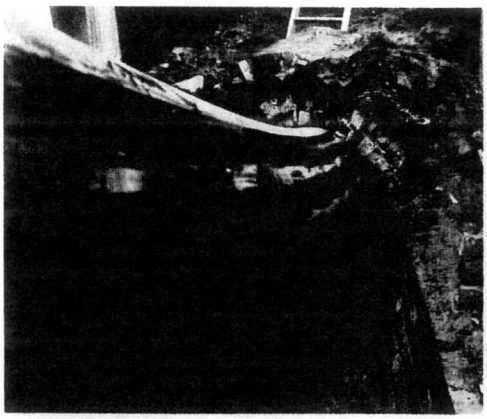
$4.2\% > 4\%$

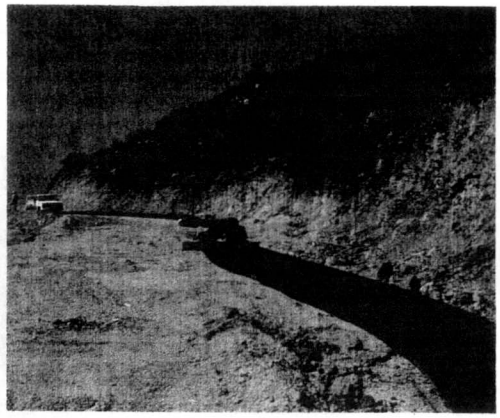
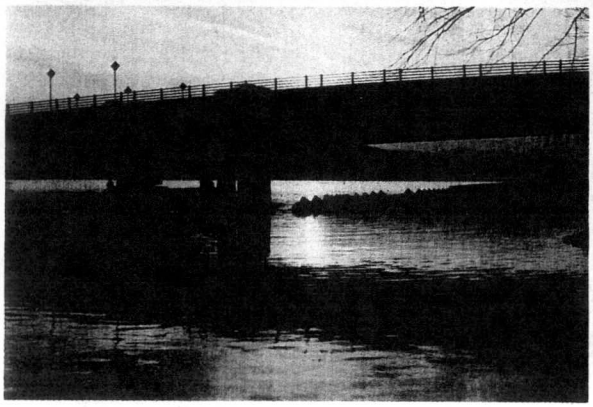
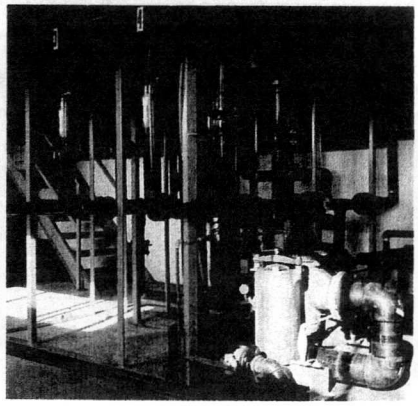
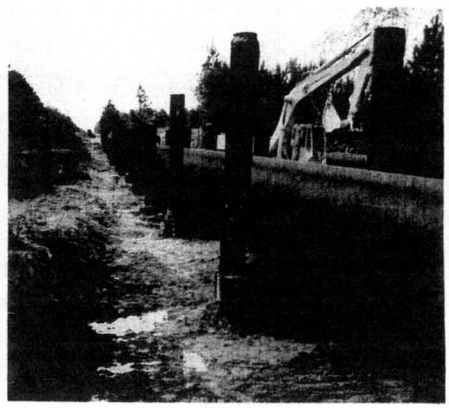
OK for worst condition

DRISCOPIPE®

6/18.

Systems Design



PHILLIPS 66

Contents

Photographs shown are typical Driscopipe installations.

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Simplified Burial Design: A conservative estimate of the ability of Driscopipe pipelines to perform in a buried environment is found in Chart 24. It is based on a minimum 2:1 safety factor and 50 year design service life. A detailed burial design starts on page 37. The detailed design should be used for critical or marginal applications or whenever a more precise solution is desired.

Detailed Burial Design:
Design by Wall Crushing: Wall crushing would theoretically occur when the stress in a pipe wall, due to the external vertical pressure, exceeded the long-term compressive strength of the pipe material. To ensure that the Driscopipe wall is strong enough to endure the external pressure the following check should be made:

$$S_A = \frac{(SDR - 1)}{2} P_T$$

Values of E'

Based on Soil Type (ASTM D2321) and Degree of Compaction

Soil Type of Initial Backfill Embedment Material	Description	E' (psi) for Degree of Compaction (Proctor Density, %)			
		Loose	Slight (70-85%)	Moderate (85-95%)	High (95%)
I	Manufactured angular, granular materials (crushed stone or rock, broken coral, cinders, etc.)	1,000	3,000	3,000	3,000
II	Coarse grained soils with little or no fines	N.R.	1,000	2,000	3,000
III	Coarse grained soils with fines	N.R.	N.R.	1,000	2,000
IV	Fine-grained soils	N.R.	N.R.	N.R.	N.R.
V	Organic soils (peat, muck, clay, etc.)	N.R.	N.R.	N.R.	N.R.

N.R. = Not Recommended for use by ASTM D2321 for pipe wall support

Chart 24

SDR	Maximum Burial Depth, ft. in dry soil of 100 lbs/cu. ft.			Maximum External Pressure psi			Maximum Deflection, % after installation		
	Soil Modulus, psi*			Soil Modulus, psi*			Soil Modulus, psi*		
	1000	2000	3000	1000	2000	3000	1000	2000	3000
32.5	25	32	37	17	22	26	1.7	0.9	0.6
26	33	45	52	23	31	36	2.3	1.2	0.8
21	46	61	71	32	42	49	3.2	1.6	1.1
19	52	69	81	36	48	56	3.6	1.8	1.2
17	61	121	181	42	84	126	4.2	2.1	1.4
15.5	56	112	168	39	78	117	3.9	2.0	1.3
13.5	49	98	147	34	68	102	3.4	1.7	1.1
11	39	78	117	27	54	81	2.7	1.4	0.9
9.3	33	68	101	23	47	70	2.3	1.2	0.8
8.3	30	61	89	21	42	62	2.1	1.1	0.7
7.3	26	52	79	18	36	55	1.8	0.9	0.6

*assumes no external loads

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Where: S_A = Actual compressive stress, psi
SDR = Standard Dimension Ratio
P_T = External Pressure, psi

Safety Factor = 1500 psi ÷ S_A where 1500 psi is the Compressive Yield Strength of Driscopipe.

Design by Wall Buckling: Local wall buckling is a longitudinal wrinkling of the pipe wall. Tests of *non-pressurized* Driscopipe show that buckling and collapse do not occur when the soil envelope is in full contact with the pipe and is compacted to a dense state. However, it can be forced to occur over the long term in *non-pressurized* pipe if the total external soil pressure, P_t, is allowed to exceed the pipe-soil system's critical buckling pressure, P_{cb}. If $P_t > P_{cb}$, gradual collapse may occur over the long term. A calculated, conservative value for the critical buckling pressure may be obtained by the following approximate formula. All pipe diameters with the same SDR in the same burial situation have the same critical collapse and critical buckling endurance

$$P_{cb} = 0.8\sqrt{E' \times P_c}$$

Where:

P_t = Total vertical soil pressure at the top of the pipe, psi

P_{cb} = Critical buckling soil pressure at the top of the pipe, psi

E' = Soil modulus in psi calculated as the ratio of the vertical soil pressure to vertical soil strain at a specified density

P_C = Hydrostatic, critical-collapse differential pressure, psi

$$P_C = \frac{2E\,(t/D)^3\,(D_{MIN}/D_{MAX})^3}{(1-\mu^2)}$$

$$P_c = \frac{2.32\,E}{(SDR)^3}$$

Where: $(D_{MIN}/D_{MAX}) = .95$
μ = Poission's Ratio
μ = .45 for Driscopipe
E = stress and time dependent tensile modulus of elasticity, psi

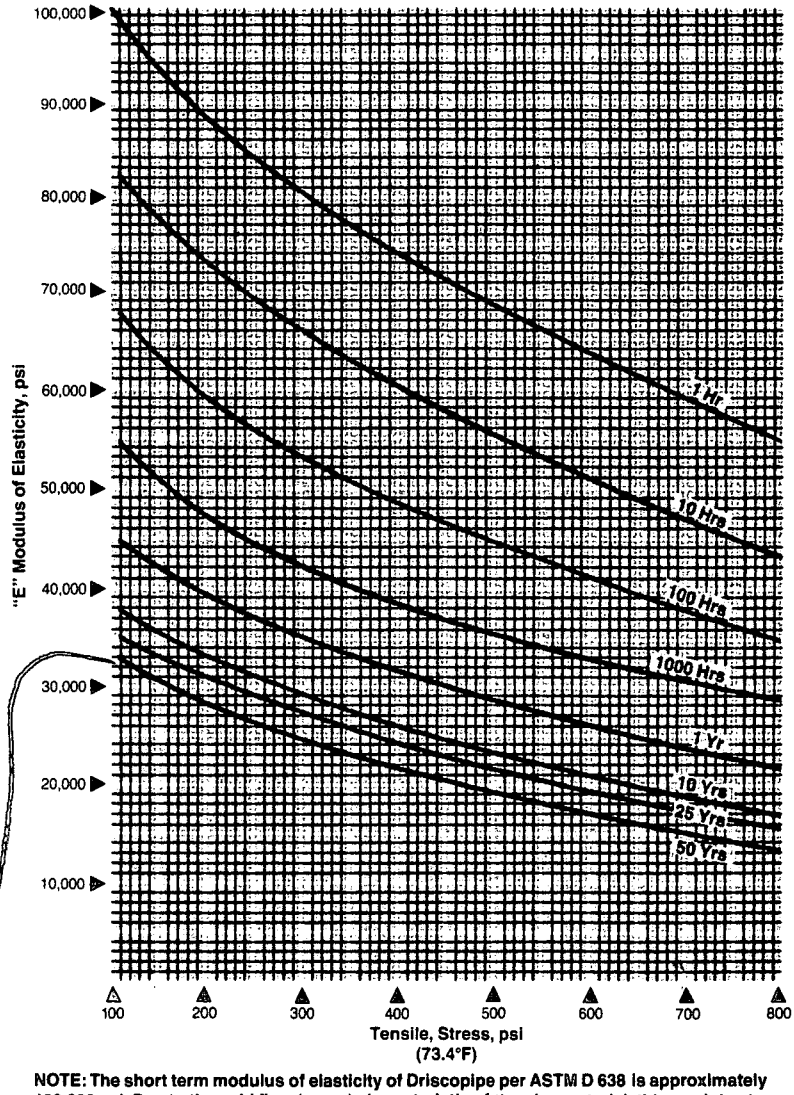
In a direct burial pressurized pipeline, the internal pressure is usually great enough to exceed the external critical-buckling soil pressure. When a pressurized line is to be shut down for a period, wall buckling should be examined.

Design by Wall Buckling Guidelines:
Although wall buckling is seldom the limiting factor in the design of a Driscopipe system, a check of non-pressurized pipelines can be made according to the following steps to insure $P_t < P_{cb}$.

1. Calculate or estimate the total soil pressure, P_t, at the top of the pipe.
2. Calculate the stress "S_A" in the pipe wall according to the formula:
$$S_A = \frac{(SDR - 1)\,P_t}{2}$$
3. Based upon the stress "S_A" and the estimated time duration of non-pressurization, use Chart 25 to find the value of the pipe's modulus of elasticity, E, in psi.

Chart 25

Time Dependent Modulus of Elasticity for Polyethylene Pipe vs. Stress Intensity (73.4°F)



NOTE: The short term modulus of elasticity of Driscopipe per ASTM D 638 is approximately 100,000 psi. Due to the cold flow (creep) characteristic of the pipe material, this modulus is dependent upon the stress intensity and the time duration of the applied stress.

Use 33,000 for 50 year life

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4. Based upon the pipe SDR and the value of the polyethylene modulus of elasticity, E, calculate the pipe's hydrostatic, critical-collapse differential pressure, P_C:

$$P_C = \frac{2.32\,(E)}{(SDR)^3}$$

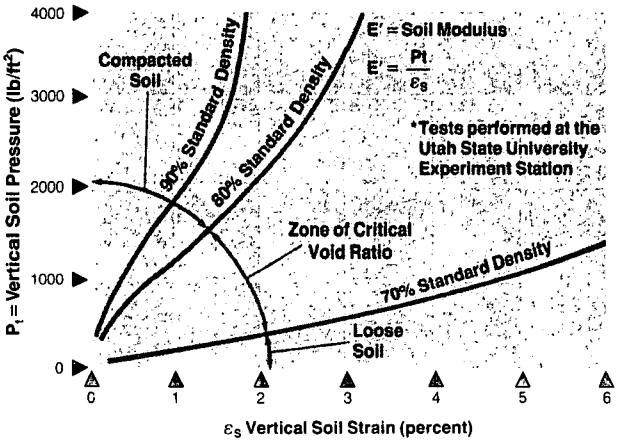
5. Calculate the soil modulus, E', by plotting the total external soil pressure, P_t, against a specified soil density to derive the soil strain as shown in the example problem on Chart 26.
6. Calculate the critical buckling pressure at the top of the pipe by the formula:

$$P_{cb} = 0.8\sqrt{E' \times P_c}$$

7. Calculate the Safety Factor: S.F. $= P_{CB} \div P_t$
   In burial applications, a safety factor of 1.0 may be considered a minimum because of the margin of safety provided by the arching action of the soil. However, Driscopipe endorses using a more conservative value approaching or exceeding a 2.0 safety factor.
8. The above procedures could be reversed to derive the minimum pipe SDR required for a given soil pressure and an estimated soil density. However, this procedure should permit the engineer to optimize the system design quickly by examining several combinations.

Chart 26

Plot of Vertical Stress-Strain Data for Typical Trench Backfill (Except Clay) from Actual Tests*



EXAMPLE

Find: E' @ 2000 PSF and 80% Density
Formula: $E' = P_t/\varepsilon_s$
Calculations: E' = 2000 PSF / .018 = 111111 PSF = 771 psi

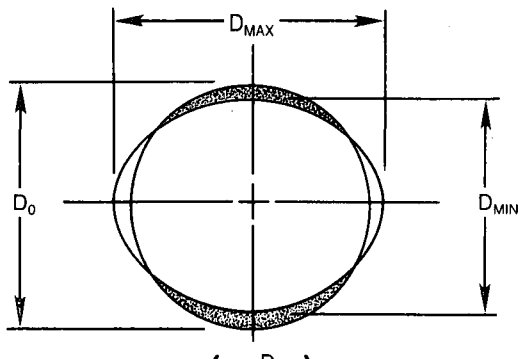
Note: The curves shown on this chart are sample curves for a granular soil. If other types of soil are used for backfill, such as clay or clay loam, curves should be developed from laboratory test data for the material used. Soil pressures greater than 4000 psf may be examined by extrapolating the slope of the curve or by generating curves by testing at those higher soil pressures. Probable error of curves is about half the distance between adjacent lines.

Design by Ring Deflection: Ring deflection is defined as the ratio of the vertical change in diameter to the original diameter. It is often expressed as a percentage. Ring deflection for buried Driscopipe is conservatively the same as (no more than) the vertical compression of the soil envelope around the pipe. Design by ring deflection matches the ability of Driscopipe to accommodate, without structural distress, the vertical compression of the soil enveloping the buried pipeline. *Design by ring deflection comprises a calculation of vertical soil strain to ensure it will be less than the allowable ring deflection of the pipe.* See Chart 27. The tabulation shows that with lower values of SDR, the allowable deflection is less. For installations which require this thicker wall to resist the external soil pressure, actual ring deflection can easily be limited to the tabular values by proper compaction of the backfill around the pipe. The recommended allowable deflection for the various SDR s are:

Chart 27

SDR	Allowable Ring Deflection
32.5	8.1%
26.0	6.5%
21.0	5.2%
19.0	4.7%
17.0	4.2%
15.5	3.9%
13.5	3.4%
11.0	2.7%

The allowable ring deflection of polyethylene pipe is a function of the allowable tangential strain in the outer surface of the pipe wall. A conservative limit of 1-1½% tangential strain in the outer surface of the pipe wall due to vertical deflection of the pipe "ring" by soil compression can be understood by comparing two pipes of the same diameter but different wall thickness.



$$\% \text{ Ring Deflection} = \left(1 - \frac{D_{MIN}}{D_0}\right) \times 100\%$$

NOTE: 5% deflection decreases flow-area by ¼%. 10% deflection decreases flow-area by 1%.

Assume each of the pipes is equally deflected under loads required to achieve that result. The tangential surface strain developed in the thickwall pipe is much greater than the surface strain in the thinwall pipe. The tangential strain varies directly as the wall thickness (i.e.: distance from the neutral axis) and is proportional to the amount of ring deflection. For a given ring deflection, the thicker the wall, the higher the strain.

Alternately, assume that each of the pipes is subjected to loads such that the tangential surface strain in the pipe's wall surface is equal for both pipes. For equal surface strain, the degree of vertical deflection of the pipe ring is different for the two pipes. Under these circumstances, the degree of deflection would be less for the thickwall pipe and greater for the thinwall pipe.

The percentage ring deflection based upon strain for a given SDR pipe can be calculated as follows:

$$\frac{\Delta Y}{D} = (0.25)(\varepsilon)(\frac{D}{t})$$

$$\frac{\Delta Y}{D} = (0.25)(\varepsilon)(SDR)$$

$$\frac{\Delta Y}{D} = (.0025)(SDR)$$

Where: ε = Tangential strain in the surface of the pipe ring due to deflection (conservatively 0.01 for Driscopipe)
D = Pipe OD, inches
t = Pipe wall thickness, inches
SDR = Standard Dimension Ratio, D/t
ΔY = Vertical deflection, inches

Driscopipe recognizes a tangential surface strain value of 0.01 due to ring deflection as a conservative yet responsible design parameter. This value is based upon the following:

- Most of the deflection of a flexible pipe occurs within a few hours or a few days after final backfilling and increases very little thereafter. This results in the development of the soil arch over the pipe which relieves the pipe of much of the vertical soil load by the arching action of the soil envelope and by the development of soil restraint at the sides of the pipe.
- With an allowable long term stress of 800 psi and a time of approximately four days (100 hours) to reach the maximum allowable ring deflection, the tangential strain would be 2% to 2½% (See Chart 25 for time and load dependent modulus of elasticity to calculate: strain = stress ÷ modulus.) Therefore, the use of 800 psi incorporates an additional margin of safety of over 2.0.
- An allowable strain value of 0.01 will allow for reasonable additional deflection due to disturbance of the backfill by earthquake, fluctuations of the water table, etc.
- An allowable design strain value of 0.01 allows for the normal deviation of temperature encountered during installation.

In summary, a soil density can be specified for the bedding and initial backfill so that the vertical strain of the sidefill soil under the total soil pressure, P_t, at the top of the pipe will be no greater than the maximum allowable ring deflection for a given SDR pipe.

Test Performance of Direct Burial Driscopipe: The density of the bedding and soil envelope determines the performance capability of the pipe-soil system with regard to ring deflection. Tests conducted on Driscopipe at Utah State University by Dr. Reynold K. Watkins show that Driscopipe will not buckle under ordinary conditions if the soil envelope is compacted and is in full contact with the pipe. A virtual fail-safe installation can be assured if soil density is generally over 85% of Standard Proctor (AASHTO T-99) Density. With the backfill compacted to 90% of standard density, the depth of laying for Driscopipe is almost unlimited. However, in the thinner wall series, due to the flexibility of the pipe, it is difficult to achieve the desired high soil density without buckling of the pipe cross-section, particularly when using backfill material other than sand or gravel.

Soil densities less than 90% are certainly adequate if depth of soil cover is in the range of most installations. Compaction to 75% standard density is relatively easy to achieve even in poor soils. This would cover a large percentage of all installations. However, 85% Standard Proctor Density (AASHTO T-99) should be considered a conservative minimum.

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ASTM D-2321, Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe should be used as a guide for determining the method of placing and compacting the backfill.

Soil Density and Compaction: Standard tests are available for determining the density of the compacted soil. However, an experienced engineer can usually tell approximate density by his footmarks in the soil. If he has to backkick the soil with a corner of his heel to leave an impression, then the density is probably greater than 95%. A corner heel impression while walking probably indicates a soil density of 90%. A full heel print may indicate a density above 80%. A full footprint may indicate a density of 70%.

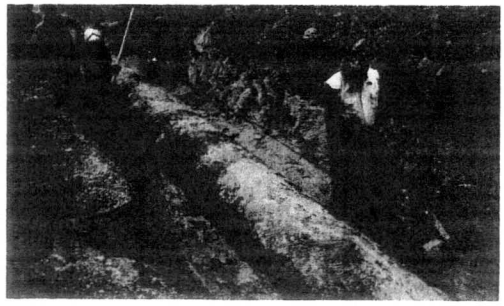
Various methods of compacting soil may be used, depending upon circumstances. All soils can be compacted mechanically at optimum moisture content. ASTM and AASHTO publications describe how this can be done. If the soil is granular, and if it drains quickly, it can be flushed into place using a water jet. The soil should actually be moved into place by the jet. Using this method with coarse sand the density is well over 90%. Finer, granular soils are usually denser than 80%. Granular soils that drain slower can be placed about the pipe, then flooded with water and allowed to drain. This usually accomplishes at least 80% density even in fine sand. If the backfill soil will not drain overnight then it is probably too fine to be compacted in this manner. Very dry sand or gravel can be vibrated into place at a density over 90% if there is little or no silt in it. Clean select aggregate will usually achieve 90% density or better just by dumping it around the pipe. The decision as to compaction technique is usually a decision in economics whereby the cost of the soil is weighed against the cost of compacting it. If the soil envelope requires mechanical compaction, economy may be realized by laying the pipe in a ditch only slightly wider than the pipe and specifying sand as the soil envelope material, provided the sand can be washed under the pipe haunches to offer proper support.

Soil bedding under the pipe requires attention. Pressure concentrations, as caused by large rocks, should be avoided. If the native soil is of very poor quality, the trench should be overexcavated about ⅛ the diameter or 3 inches, whichever is greater, and backfilled with sand. Flushing of the soil into place assures adequate support under the haunches. Ponding of the soil is usually adequate. If backfill soil which requires mechanical tamping is used at the sides of the pipe, it may be necessary to use select fill under the haunches to assure adequate density.

The effects of vibration or shock waves on soil compaction are much more complex than the effects of static loads and should be given careful and expert analysis. In some cases, vibration or shock may result in increased density in some backfill soils, resulting in increased stiffness of the pipe-soil system. However, if the pipe is installed below the water table, vibration may result in liquefaction of the backfill and adjacent soil, subjecting the pipe to hydrostatic loading which may result in possible hydrostatic failure of an apparently stable system.

Minimum Cover: There are no firm rules regarding minimum burial depth suitable for every installation. However, the following guidelines may be helpful:

- Consider a burial depth below the local frost line.
- Where there will be no overland traffic, the designer may wish to consider a cover of 18″ or one diameter, whichever is greater.
- Where truck traffic may be expected, the designer may wish to consider a burial depth of 36″ or one diameter, whichever is greater.
- Where heavy off-the-road truck or locomotive traffic is expected, the designer may wish to consider a minimum cover of 5 feet or more.
- Pavements designed for heavy truck traffic substantially reduce the pressure transmitted through a wheel to the subgrade and, consequently, to the underlying pipe. The pressure reduction is so great that, generally, the live load can be neglected. The pressure intensity, however, can be estimated, as will be discussed.
- For heavy duty asphalt or flexible pavements, the reduction in intensity will be comparable to that for concrete pavements.
- For intermediate thicknesses of asphalt or flexible pavements, there is no generally accepted theory for estimating load distribution effects.
- Relatively thin pavements do not reduce the pressure transmitted from the wheel to the subgrade to any significant degree. Such



pavements are generally considered as unsurfaced roadways for determination of the effect of live loads on buried pipe.

- In each case, the designer should check the installation to design for wall crushing, wall buckling and ring deflection. For a select fill soil envelope, the above cover values may be decreased.

Calculation of Total Soil Pressure by Components:
Proper design of the polyethylene "pipe-soil" system balances the response of the pipe and surrounding soil against the total external soil pressure. Burial design by wall crushing, wall buckling and ring deflection as performance limits requires the accurate calculation of the total soil pressure, P_t, at the top of the pipe. Since there are many sources of soil pressure above the pipe, it is helpful to examine the total soil pressure as the sum of its components.

$$P_t = P_S + P_L + P_i$$

The total external soil pressure at the top of the pipe includes the sum of:

P_S: Total "Static Load" Pressure, often called dead-load pressure.

P_L: Total "Live Load" Pressure.

P_i: Total effective external pressure due to negative internal operating pressure (vacuum).

Each of these soil pressure components is discussed and examples are calculated for use in a typical design problem.

P_S: Total Static Load Pressure

There are three sources of static load pressure. The sum of these three pressure components constitutes the total static load pressure:

$$P_S = P_{DE} + P_{WE} + P_B$$

Where: P_{DE} is the static load pressure of dry or slightly moist earth.
P_{WE} is the static load pressure of saturated soil under the maximum, long term variable water table.
P_B is the static load pressure due to stationary surface structures such as buildings or foundations.

P_{DE}, Dry Soil Pressure

The weight of dry (or slightly moist) soil is approximately 100 lbs. per cu. ft. Every foot of depth of "dry" soil above the pipe exerts a pressure of 100 lbs. per square foot. Thus, the dry soil component of the total static load pressure is the product of the density of the dry soil times the depth of the soil (in feet) from the ground surface to the top of the water table over the pipe.

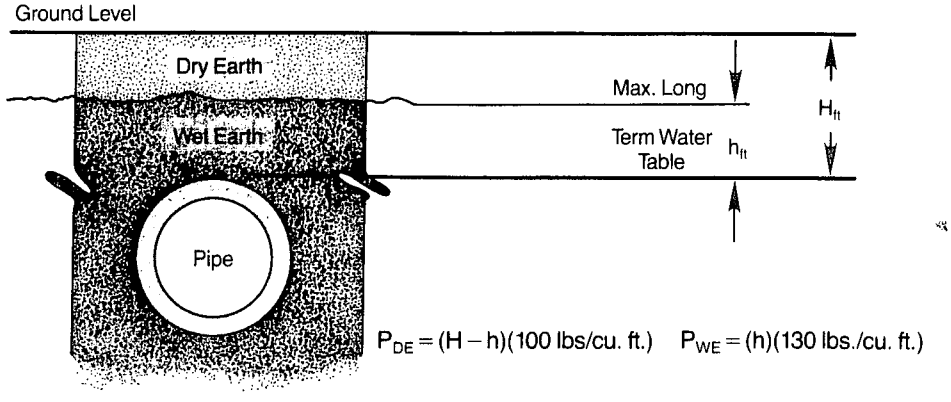
P_{WE}, Water Saturated Soil Pressure

The water saturated soil component of the static load pressure is the product of the density of the water saturated earth, approximately 130 lbs. per cu. ft., times the depth of the wet soil above the pipe.

Note: The density of water saturated soil is nearly 125-140 lbs./cu. ft. The density of virtually dry soil is nearly 100-120 lbs./cu. ft.

P_B, Static Structure Soil Pressure

In some applications, Driscopipe may be installed directly under or near a building foundation, an equipment foundation or some other sort of stationary structure. If the structure is located over the pipeline, the pressure due to the weight of the structure is more concentrated and intense than if the structure is located at some distance away. The distribution of vertical pressure into the soil below a static load is represented by a bell or bulb shaped surface. Refer to Chart 28. The maximum pressure exerted by the static structure is located at the centerline of the bulb. The pressure decreases downwards in all directions and outwards from the center. The external soil pressure which a ground structure will exert on Driscopipe is greater when the pipe is buried near the structure and fairly shallow, and is less when the pipe is buried deeper or farther away. A uniformly distributed load on the surface, such as a bearing pad, will also distribute the static load into the underground over a larger area and effectively reduce the soil pressure on a pipeline.



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The Boussinesq theory is recommended for determining P_B for a concentrated load, W (See figure). By this theory, the load at the top of the pipe caused by a superimposed static load is evaluated as:

$$P_B = \frac{3WZ^3}{2\pi R^5}$$

Where: W = Superimposed surface load, pounds.
Z = Vertical distance from the point of load to the top of the pipe, feet.
R = Straight line distance from point of load to the top of the pipe, feet.

$R = \sqrt{X^2 + Y^2 + Z^2}$

X and Y = Horizontal distances at 90° to each other from point of load to the top of the pipe, feet.

Using this theory, a simplified chart can be used to show the underground pressure distribution caused by a 1000 lb. superimposed surface load (Chart 28). The underground pressure for other superimposed surface loads can be calculated by multiplying the chart value by the load ratio per the example on Chart 28, page 43.

If the pressure on the pipe is caused by a uniformly distributed surface load (as opposed to a point load) such as a foundation, spread footing or bearing pad, the soil pressure on the pipe due to this uniform load can be determined by dividing the loaded area into a group of smaller individual areas so that each small area essentially becomes a point load. Then calculate the load for each incremental area and add the results to obtain the total soil pressure on the pipe caused by the foundation as a whole. This technique is illustrated in the following example. A further discussion of this method is found in *Soil Mechanics in Engineering Practice* by Terzaghi and Peck.

Example: Total Static Load Pressure: P_S

Data: A 24" diameter sewer line is to be laid through a plant area with the top of the pipe being 10 ft. below grade. The maximum seasonal water table rises to within 7 ft. of the surface. At one point, the pipeline is buried four feet from and parallel to the long side of an equipment foundation which is 6 ft. × 10 ft. and has a load bearing of 3000 psf at a depth of 3 ft. below grade. Determine the total static load pressure on the pipe at point "A".

Given: Density of dry soil = 100 lbs./ft.^{3}
Density of saturated soil = 130 lbs./ft.^{3}
Depth of burial = H = 10 ft.
Depth of saturated soil = (h) = 3 ft.
Depth of dry soil = (H – h) = 7 ft.
Foundation bearing load = 3000 psf @ 3 ft. deep

Formula: $P_S = P_{DE} + P_{WE} + P_B$

Where: $P_{DE} = (H - h)(\rho_{DE})$

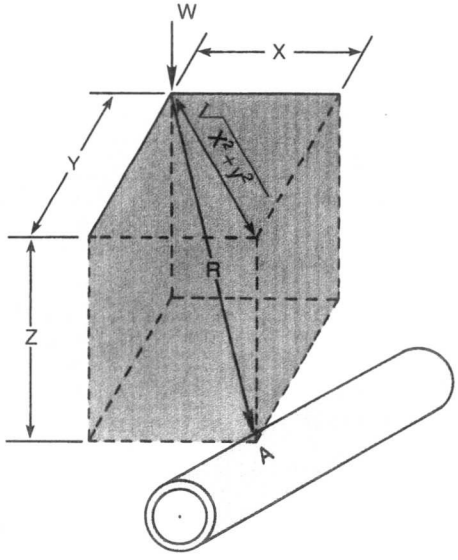
$P_{WE} = (h)(\rho_{WE})$

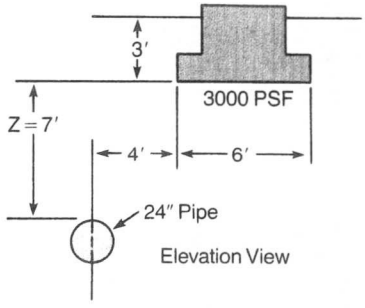
$P_B = \sum_{O}^{i} \frac{3WZ^3}{2\pi R^5}$

Z = Vertical height

$R = \sqrt{X^2 + Y^2 + Z^2}$

Note: For Simplified Calculation of P_B, use Chart 28.





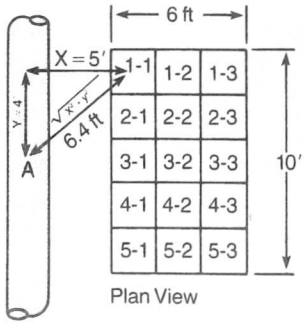


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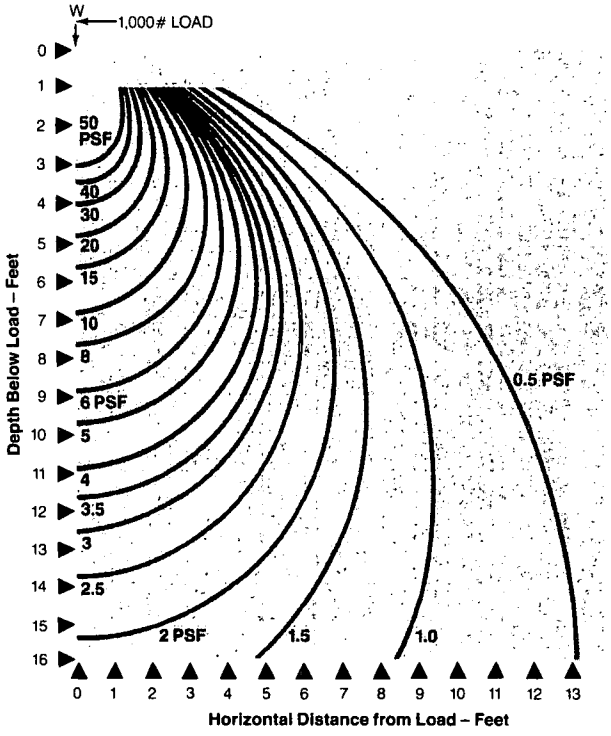
Chart 28

Unit Underground Soil Pressure Exerted by 1000 lb. Load



Example:

Find static soil pressure of 72,000 lb. weight on a pipeline buried 10 ft. deep and 6.5 feet away:

$P_B = \frac{72000}{1000} \times 2.0$ psf

P_B = 144 psf = 1 psi

Calculations:

P_{DE} = (10 – 3 ft.)(100 lbs./cu. ft.) = 700 psf

P_{WE} = (3 ft.)(130 lbs./cu. ft.) = 390 psf

P_B = 300 psf (See chart 29)

P_B = Sum of pressure contribution of each square calculated using Chart 28; divide foundation into 2 ft. × 2 ft. squares @ 3000 psf. (2 ft. × 2 ft. × 3000 psf = 12000 lbs. per square)

Summary: $P_S = P_{DE} + P_{WE} + P_B$

P_S = 700 + 390 + 300 = 1390 psf

P_S = 9.6 psi at point "A" on the pipe

P_t: Total Live Load Pressure:

Driscopipe may be buried in a variety of applications which may require it to pass below a plowed field, a highway, a railroad track or a plant road. Traffic operating over buried pipelines (or even near a pipeline) causes the earth to move slightly under its weight. This ever so slight movement is a dynamic load transfer from the vehicle into the ground. Although this might be considered a short-term loading, there will be those instances where the plant truck will be parked near the pipeline or the field tractor may end a day's work and shut down over the pipe or the train could end its travels over the pipeline. Where live loads are expected from traffic, rolling equipment, vibrations from operating machinery and impact, the following procedure and charts will provide for design of the required performance into those sections of the pipeline. Live loads are also evaluated by the Boussinesq theory, the same as superimposed static loads. However, the

Chart 29

Square	Weight	"Z" Vertical Depth	$\sqrt{X^2+Y^2}$ Horizontal Distance	Chart 28 Pressure Per 1000# Load	Soil Pressure on Pipe for 12000# Load Per Square
1-1	12,000	7 ft.	6.4	2.1 psf × 12 =	25.2 psf
1-2	12,000	7 ft.	8.1	1.2 psf × 12 =	14.4 psf
1-3	12,000	7 ft.	9.8	.6 psf × 12 =	7.2 psf
2-1	12,000	7 ft.	5.4	3.0 psf × 12 =	36.0 psf
2-2	12,000	7 ft.	7.3	1.5 psf × 12 =	18.0 psf
2-3	12,000	7 ft.	9.2	.8 psf × 12 =	9.6 psf
3-1	12,000	7 ft.	5.0	4.0 psf × 12 =	48.0 psf
3-2	12,000	7 ft.	7.0	1.7 psf × 12 =	20.4 psf
3-3	12,000	7 ft.	9.0	.9 psf × 12 =	10.8 psf
4-1	12,000	7 ft.	5.4	3.0 psf × 12 =	36.0 psf
4-2	12,000	7 ft.	7.3	1.5 psf × 12 =	18.0 psf
4-3	12,000	7 ft.	9.2	.8 psf × 12 =	9.6 psf
5-1	12,000	7 ft.	6.4	2.1 psf × 12 =	25.2 psf
5-2	12,000	7 ft.	8.1	1.2 psf × 12 =	14.4 psf
5-3	12,000	7 ft.	9.8	.6 psf × 12 =	7.2 psf
					P_B = Total ... 300 psf

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wheel or axle weight should be increased by 50% to provide a pipe design with extra strength and endurance against the impact of these dynamic forces. The load at the top of the pipe caused by a superimposed dynamic load at point "A" is evaluated as:

$$P_B = \frac{3WZ^3}{2\pi R^5}$$

Where: W = 1½ times the superimposed dynamic load, pounds.

Z = Vertical distance from the point of load to the top of the pipe, feet.

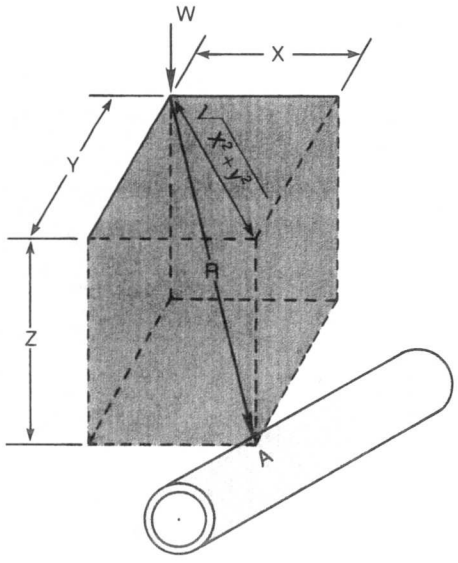
R = Straight line distance from point of load to the top of the pipe, feet.

$R = \sqrt{X^2 + Y^2 + Z^2}$

X and Y = Horizontal distances at 90° to each other from point of load to the top of the pipe, feet.

Unit underground pressures caused by a 1000 pound superimposed dynamic load is shown in Chart 28. Unit pressures for superimposed live loads can be obtained by multiplying the chart value by 1½ times the load ratio. Alternately, for heavy truck or railroad traffic, Charts 30 and 31 summarize the total pressure due to the weight of the soil alone together with the weight of the rolling vehicle. An allowance for impact is included in each of these two charts.

These graphs show that, beyond an optimum depth, the total pressure on the pipe increases due primarily to soil pressure. At shallower depths the load intensifies because it is nearer the rolling equipment and the live load is not as well distributed.



Note: If the live load pressure exceeds the capability of a specific SDR pipe for a specific traffic situation, the designer may want to consider the use of a steel or reinforced concrete casing to protect the pipeline.

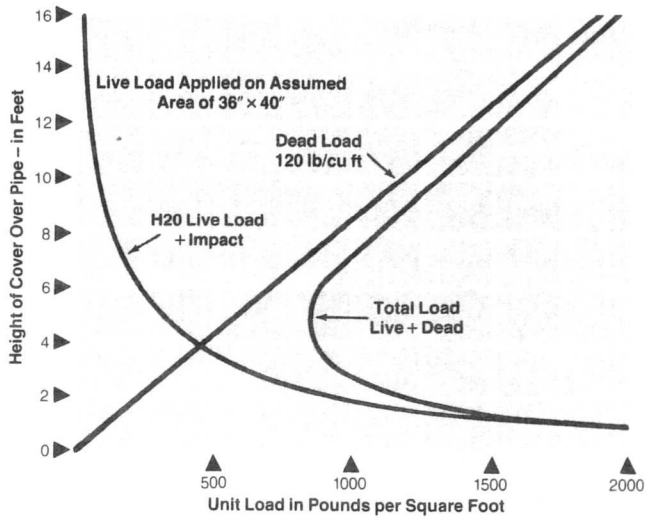
P_i: Apparent External Pressure Due to Internal Vacuum:

Positive pressure generates a tensile hoop stress in the pipe wall. Under its influence the pipe will be trying to expand. The pressure of the soil around the pipe will be trying to crush the pipe as shown in this illustration.

In a positive pressure situation, the value of P_i is negative and theoretically should be subtracted from the other two external pressure components of P_t because it is counteracting the external soil pressure. However, a pipeline should not be designed such that internal pressure is required to support the pipeline to prevent collapse from soil pressure. At some point in the system's operations, the pipeline will be shut down. The support offered by positive pressure against collapse by external soil pressure should be viewed as a means of adding additional

Chart 30

H20 Highway Loading



Note: The H20 live load assumes two 16,000 lb. concentrated loads applied to two 18" × 20" areas, one located over the point in question, and the other located at a distance of 72" away. In this manner, a truckload of 20 tons is simulated.

Source: American Iron and Steel Institute, Washington, D.C.

safety factors into the pipeline to eliminate any possibility of buckling. In certain instances when using thinner wall pipe, the system can be hydrostatically pressurized during soil backfilling, compacting or grouting operations to make the pipe perfectly round and concurrently to inspect the integrity of the joints.

Alternately, a negative pressure (vacuum) generates a compressive hoop stress in the wall of the pipe and assists in trying to collapse the pipeline. Thus, the value of P_i under vacuum conditions is positive and is added to the other two external pressure components of P_t. An internal vacuum generates pressure (expressed in P.S.F.) equal in magnitude to the absolute value of the vacuum in P.S.F. The maximum apparent external pressure (P_i) due to a vacuum inside the pipe is 14.7 psi or approximately 2100 psf.

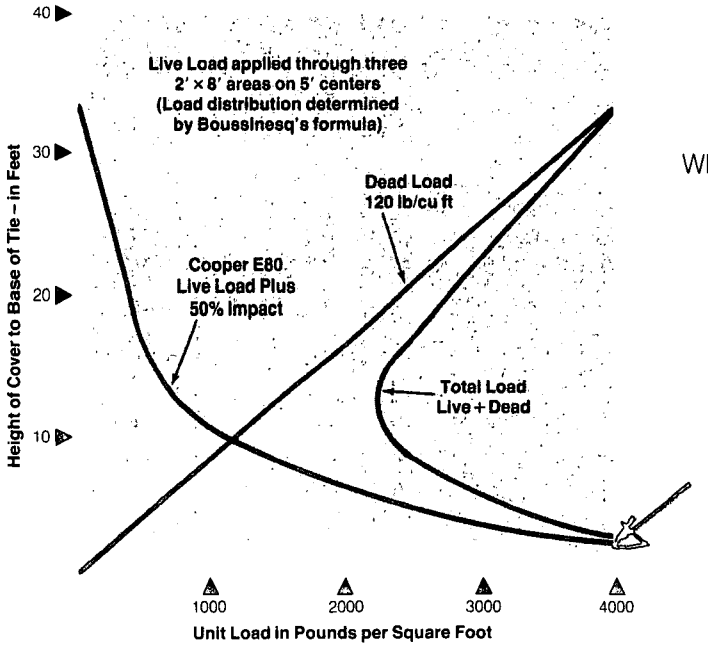
Summary: The calculation of the total external soil pressure, P_t, is simple and direct. It is composed of three components: pressure due to static loads, pressure due to live dynamic loads and apparent pressure due to any internal vacuum.

Example:

Assume a 24" diameter industrial sewer line is to be laid through a hilly plant area 10 feet below grade. The maximum seasonal water table rises to within 7 ft. of the surface. At one point the pipeline is buried 4 ft. from and parallel to the long side of an equipment foundation which is 10 ft. long by 6 ft. wide and has a load bearing of 3000 psf at a depth of 3 ft. below grade. A plant access road adjacent to the equipment foundation passes parallel to the pipeline 4 ft. away. Trucks using this access road have a maximum axle load of 32,000 lbs. (16,000 lbs. wheel load – H_{20} design load). Due to the hilly terrain, a gravity induced siphon effect develops a partial vacuum of (minus) 3 psi. Calculate the total external pressure, P_t, on the pipe at point "A".

Chart 31

Cooper E-80 Live Loading



Note: The Cooper E-80 live load assumes 80,000 pounds applied to three 2' x 8' area on 5' centers such as might be encountered through live loading from a locomotive with three 80,000 pound axle loads.

Source: American Iron and Steel Institute, Washington, D.C.

Formula: $P_t = P_S + P_L + P_i$

Calculations:

P_S: Static load Pressure Component

Referring to the problem illustrated earlier in this section, the total static load pressure was calculated as follows:

$P_S = P_{DE} + P_{WE} + P_B$

$P_S = ((H-h)\rho_{DE}) + ((h)\rho_{WE}) + (\sum_0^i \frac{3WZ^3}{2\pi R^5})$

P_S = 700 psf + 390 psf + 300 psf

P_S = 1390 psf

P_L: Dynamic Load Pressure Component:

Referring to Chart 30, the soil pressure exerted by the truck's weight can be estimated by reading the H_{20} live load curve at a 10 ft. depth. However, it can be more accurately calculated using the Boussinesq Equation,

$$P_{L_1} = \frac{3WZ^3}{2\pi R_1^5} \qquad P_{L_2} = \frac{3WZ^3}{2\pi R_2^5}$$

$$P_{L_1} = \frac{3 \cdot 24000 \cdot (10)^3}{2 \cdot \pi \cdot 10.8^5} \qquad P_{L_2} = \frac{3 \cdot 24000 \cdot 10^3}{2 \cdot \pi \cdot 14.14^5}$$

P_{L_1} = 78 psf $\qquad$ P_{L_2} = 21 psf

Where: W = wt. of vehicle wheel load times 150%

= 16000 lbs. × 150%

= 24000 lbs.

Z = 10 ft.

$R_1 = \sqrt{X^2 + Y^2 + Z^2}$

$R_1 = \sqrt{4^2 + 10^2}$

$R_1 = \sqrt{116 \text{ ft.}}$

R_1 = 10.8 ft. inside wheel

$R_2 = \sqrt{X^2 + Y^2 + Z^2}$

$R_2 = \sqrt{10^2 + 10^2}$

$R_2 = \sqrt{200 \text{ ft.}^2}$

R_2 = 14.14 outside wheel

Note: P_L can also be obtained from Chart 28 using W (total impact loading = 24,000 lbs.), Z (depth below load, 10 ft.), $\sqrt{X^2 + Y^2}$ (horizontal distance from load) = $\sqrt{4^2 + 0^2}$ = 4 for one wheel and $\sqrt{X^2 + Y^2}$ = 10 ft. for the other wheel.

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P_i: Apparent External Pressure Due To Vacuum:

3 psi × 144 = 432 psf

TOTAL EXTERNAL PRESSURE: $P_t = P_S + P_L + P_i$

$P_t = 1390 \text{ psf} + 99 \text{ psf} + 432 \text{ psf} = 1921 \text{ psf} = 13.34 \text{ psi}$

Burial Design Guidelines: By combining the Burial Design Considerations with the Total External Soil Pressure, calculated by components, the designer can select the proper pipe SDR and specify the soil density to engineer into the pipeline the desired performance of the "pipe-soil" system. The following guidelines are presented for evaluation when designing a specific Driscopipe system. Because various parameters are available, in different situations, the guidelines may be approached in a mixed order or the equations may require mathematical rearrangement. These guidelines, along with the following notes and sample problem, should be helpful:

1. Calculate by components the total external soil pressure, P_t, at the top of the pipe.
2. Examine Short Term Wall Crushing by calculating the compressive stress in the wall of the pipe at the springline:

$$S_A = \frac{(SDR - 1)\, P_t}{2}$$

(a) If $S_A < 1500$ psi proceed to #3
(b) If $S_A > 1500$ psi consider a heavier pipe wall

3. Calculate the critical-collapse pressure, P_C, from this formula using the time dependent modulus of elasticity, E, rated at the stress level calculated above in #2 (see Chart 25).

$$P_C = \frac{2.32\, E}{(SDR)^3}$$

4. Examine Wall Buckling of the pipe-soil system. By assuming the critical buckling pressure, P_{cb}, equals the pressure at the top of the pipe, P_t (see #1), and by using the critical pressure, P_C, calculated in #3, the basic soil modulus, E′, required to resist buckling can be calculated by:

$$E' = \frac{(P_{cb})^2}{.64\,(P_C)}$$

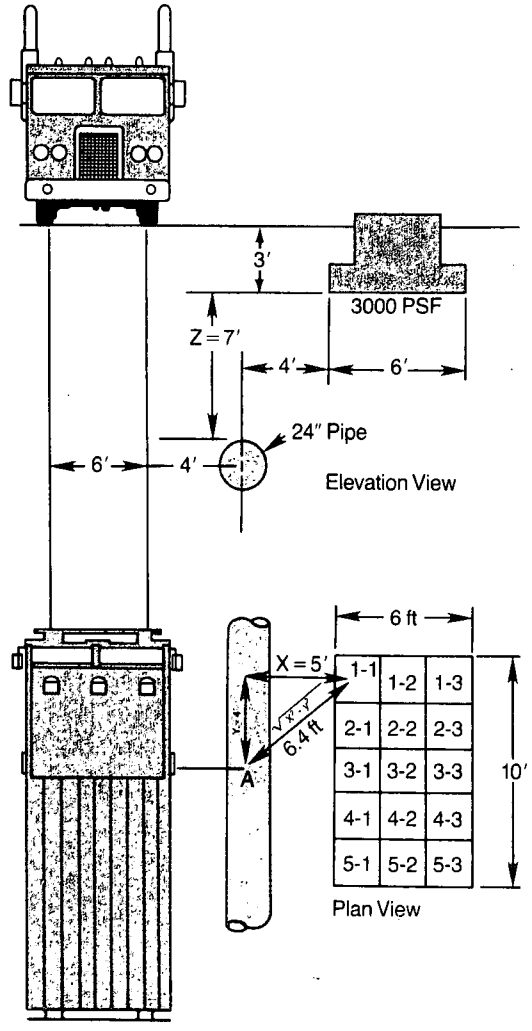
5. To safeguard against wall buckling, multiply E′ by a reasonable safety factor (S.F.) equal to or greater than 2.0.

$$E'_{MIN} = (E')(S.F.)$$

6. Calculate pipe deflection based upon the principle that its deflection will be the same as the backfill surrounding the pipe under the influence of the soil pressure at the top of the pipe:

$$\%\ \text{Soil Strain} = \xi_S = \frac{P_t}{E'_{MIN}} \times 100$$

7. Examine allowable Ring Deflection for the specific SDR under consideration to insure the pipe deflection (#6) is less than the allowable deflection for that SDR (See Chart 27).
   - If the actual deflection exceeds the permissible value, increase E′, the soil strength modulus, and recalculate #6. The other alternative is to consider another SDR at #1.
   - If the predicted deflection is less than the allowable value, proceed to #8.
8. Specify the primary backfill soil density matched to the soil pressure, P_t, and the calculated soil strain, ξ_S, by using soil stress/strain curves developed from field specimens or from Chart 26 on page 38.



Landfill Gas & Environmental Products, Inc.
TRITON CF - 3000 CANDLE FLARE
300-3000 SCFM

Manatee County, Lena Rd. Landfill

OPERATION & MAINTENANCE MANUAL
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76" max at 3000 CFM

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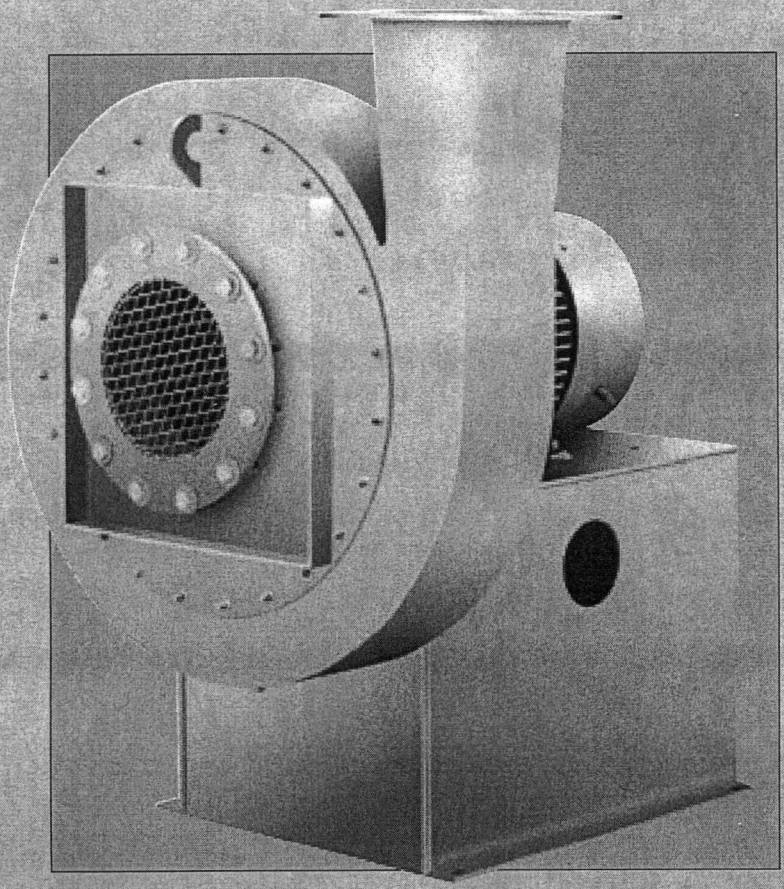
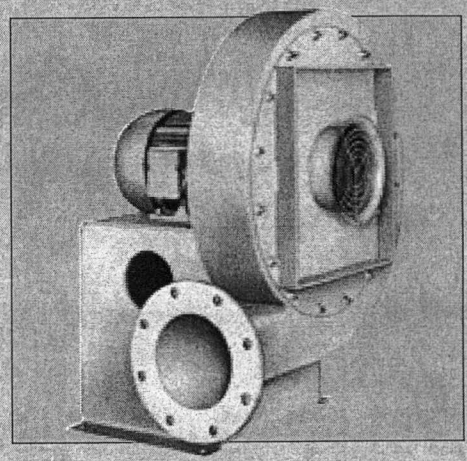
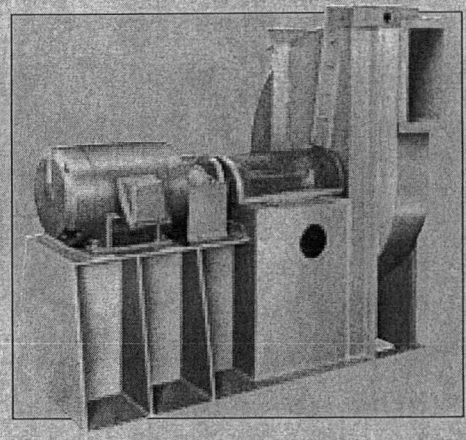
TYPE HP PRESSURE BLOWERS



- Static pressures to 128″WG
- Capacities to 20,000 CFM
- Temperatures to 600°F.



PRESSURE BLOWERS
- Static pressures to 58″WG
- Capacities to 5,200 CFM



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- Capacities to 66,600 CFM

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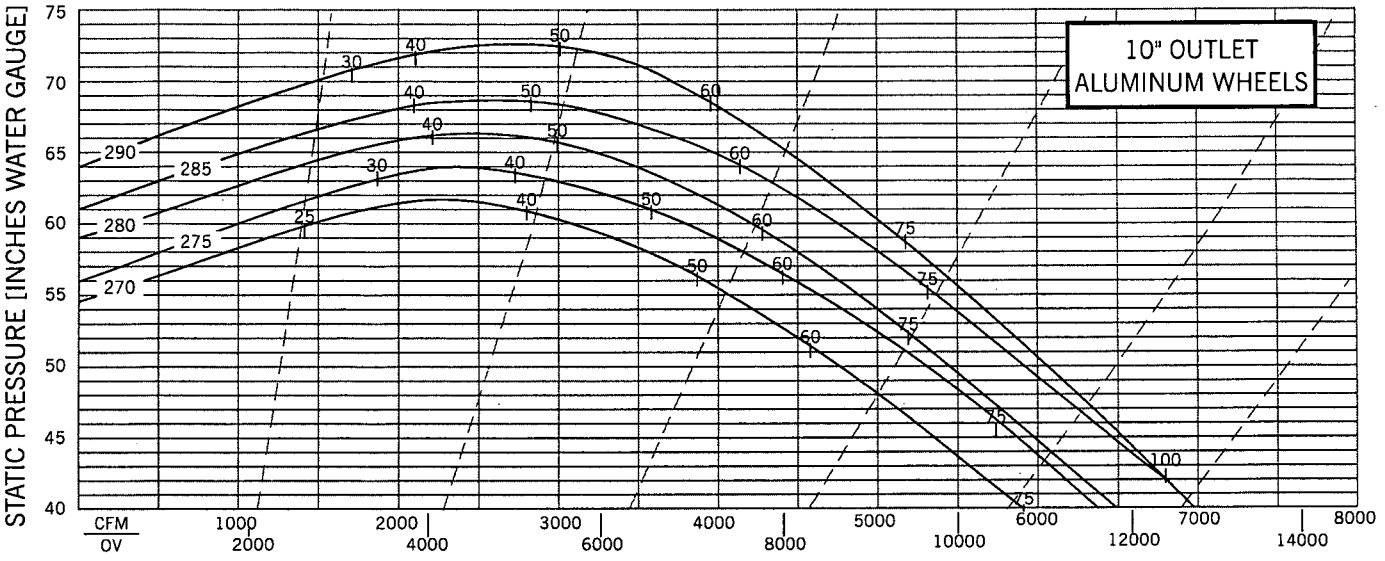

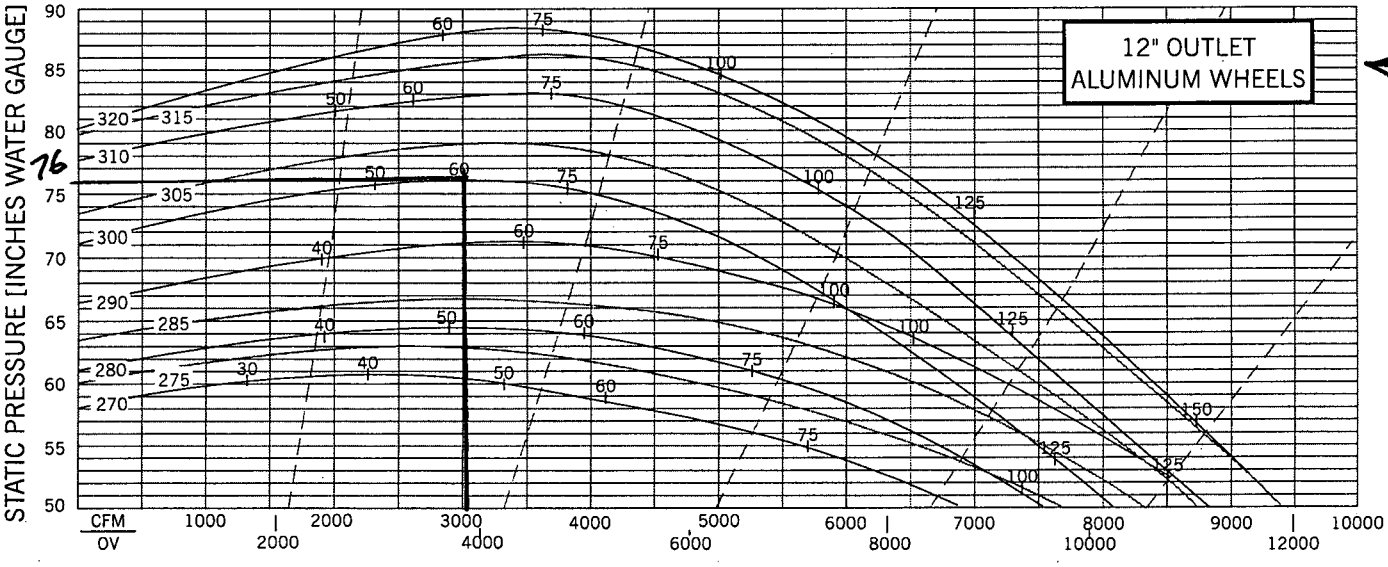

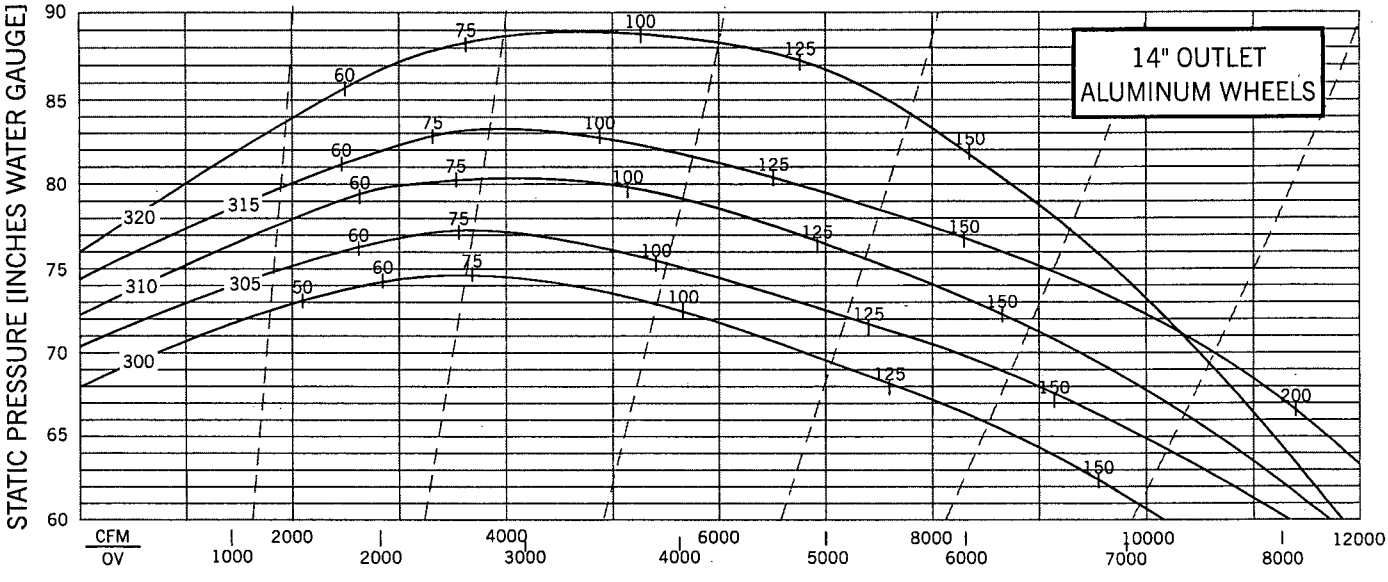

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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
APR 22 2008
SOUTHWEST DISTRICT
TAMPA

Susan J. Pelz, P.E.
Solid Waste Manager
Southwest District
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

Re: Lena Road Landfill, Manatee County
GMS ID No.: 4041C02025
Stage III Landfill Gas Recovery System Construction
Pending Permit No.: 39884-016-SC/08
Response 1 to RFI #1 dated March 6, 2008

Dear Ms. Pelz:

This letter is in response to your Request for Information #1 regarding the above referenced permit application. Your requests are typed in italics followed by our responses in normal type. Four copies of this response with each revision, replacement, or additional new document are included.

1. ***Application form, Rule 62-701.320(7), F.A.C.***
   a. *Part O.4. Since a gas recovery system is part of the proposed construction, please provide a revised application form that includes this information.*

   Response: Part O.4 was revised from "Not applicable" to "No change" with a reference to the previous permit application which included this information.

2. ***Landfill Gas Recovery System; Rule 62-701.530(5), F.A.C.***
   a. *Please provide construction plans and design information for the gas conditioning system, radiators, gas piping and connections for the sludge drying system and gas engines and building shown on the Site Plan, Sheet C-2 submitted as part of the pending operations permit modification request (#39884-015-SO/MM).*

   Response: The rule cited for this request is Landfill Gas Recovery System; Rule 62-701.530(5), F.A.C. Chapter 62-701.200 Definitions defines a gas recovery facility as:

   "(43) "Gas recovery facility" means a system of wells, trenches, pipes, and other related ancillary structures such as manholes, compressors, and monitoring installations that collect and transport the gas produced in a waste disposal unit to one or more gas processing points or flares. The flow of gas through such a system may be produced by naturally occurring gas pressure gradients or may be aided by an induced draft generated by mechanical means."

The sludge drying system and engines are not considered a "gas recovery facility" as defined in Chapter 701. The Department has already issued construction permits for these projects through the Air Section. Our application did not request construction permits for these facilities. Our application was only for the expansion of the landfill gas recovery system to the Stage III Landfill.

b. *Please provide all information required by Rule 62-701.530, F.A.C., for gas recovery systems.*

Response: This response should provide all the information required by Rule 62-701.530, F.A.C. for the Department to issue the construction permit for the Stage III Landfill gas recovery system.

c. *Although the Stage III landfill does not have a traditional bottom liner system, the design is based on the slurry wall being keyed into an in-situ clay layer that underlines the landfill. Please provide information that demonstrates that the gas extraction wells will not penetrate or adversely impact the underlying clay layer.*

Response: The Table on Sheet C-6 was revised to include the top of landfill elevation at each borehole, the length of the boring and the bottom elevation of the boring. The Stage III Landfill is permitted for solid waste above Elevation +29. The separation between the bottom of the boring and Elevation 29.0 is a minimum of five feet. The in-situ clay is well below Elevation +29. So as long as the borings are within the solid waste the Department should not be concerned that the borings will penetrate or adversely impact the underlying in-situ clay layer.

d. *Tables 1, 2, 3, 4. Please provide sample calculations and supporting references, basis and assumptions used to determine the values presented in these tables.*

Response: This calculation uses a different procedure than the Landgem method of calculations submitted in Part O of the application submitted in April 2004 for renewal of the landfill operation permit. This procedure gives estimates that agree with landfill gas collected and burned in the flare. The calculation procedure is the same for all four tables. Table 1 is for all the solid waste going into Landfill Stages I, II and III. Table 2 is for only the solid waste going into the Stage I Landfill. Table 3 is for only the solid waste going into the Stage III Landfill. Table 4 is for only the solid waste going into the Stage II Landfill.

The calculations are based on a procedure recommended in a MSW Management article from the March/April 2006 magazine. Daniel P. Duffy is the author. A copy of the article is included with this response for reference.

Each table has five columns.
Column 1 gives the year because we estimate gas flow per year.
Column 2 gives the Annual Disposal of solid waste in tons. Note 3 of each table explains that the annual disposal in tons landfilled after 2006 is based on an assumption that the solid waste in tons landfilled each year will grow at a rate of 2%. From 1979 until 2006 the annual disposal in tons is based on landfill records.

Column 3 is a calculation of the in-place waste in tons. Each year the in place tonnage is calculated by adding up all the previous years plus the current years to give an estimate of the total tonnage of solid waste in the landfill.

Column 4 is an estimate of the Decomposed Waste in tons. This is calculated based on the assumption in note 1 that landfill gas is produced at the rate of 0.1 cubic foot per pound of waste per year less decomposed waste. The value is as recommended by Mr. Duffy. The number is empirical and based on field observations. The decomposed waste in tons in Column 4 is calculated by subtracting the solid waste that decomposed in the previous year based on the estimated conversion of mass to gas. It is calculated as follow:

> Decomposed Waste in tons = [Landfill Gas Flow in Column 5 in SCFM * 525,600 minutes per year] divided by [2000 pounds per ton * 4.49]

The 525,600 minutes per year is calculated as follows: 365 days per year * 24 hours per day * 60 minutes per hour. It is used to calculate the flow rate in SCFM to an annual average flow rate. This number is divided by 2000 pounds per ton and the factor of 4.49. This factor comes from the MSW article. "The factor of 4.49 converts the cubic feet of LFG into lbs of decomposed waste. Its value is based on laboratory studies and is an average value subject to change according to local waste characteristics."

Column 5 is an estimate of the average annual landfill gas flow for the year in Column 1. It is calculated using the average flow rate of 0.1 cubic foot per pound of waste per year less the decomposed waste given in Column 4 from the previous year.

> Landfill Gas in SCFM = [(In place Waste in Tons) – (Decomposed Waste in Tons from the previous year)] * 2000 pounds per ton * 0.1 cubic feet of LFG per pound of in place waste Divided by 525,600 minutes per year.

The 525,600 minutes per year is calculated as follows: 365 days per year * 24 hours per day * 60 minutes per hour. This calculation is used to convert the annual flow rate to standard cubic feet per minute (SCFM) because we are use to thinking in flow rates in SCFM.

This procedure gives realistic estimates. For example from "Table 2 – Estimated Landfill Gas Production Rates for Manatee County Class I Landfill Stage I Landfill Only" for the year 2008 the estimated flow rate is 1915 SCFM. Each month we record the actual LFG flow rate from the Stage I Landfill using two methods. We check the flow rate as measured by the flow meter at the flare station, and we sum the flow measured at each of the well heads. In January 2008 the flow meter at the flare read 1455 SCFM, and the summation of the wells heads totaled 2319 SCFM. We believe the flare flow meter under reports the actual flow of LFG, and the summation of well heads over reports the flow. The average of the two methods is 1887 SCFM. This is close to the 2008 estimate in Table 2 of 1915 SCFM for LFG flow from the Stage I Landfill. Since this procedure for estimating the flow of LFG is validated by closely matching the actual reading, we believe this procedure is accurate for estimating future LFG flows.

e. *Section 2, Part O.*

1) Please provide calculations that demonstrate that the lateral and header piping will not collapse under the expected loading.

Response: These calculations were submitted for the renewal of the Stage I Landfill Closure Permit which included the Stage I Landfill gas collection system expansion. The calculations were included in Section 9 of that application. There is no change in the pipe or design. The calculations are still valid.

f. *Section 3, Specifications.*

1) Please provide specifications for the gas conditioning system, radiators, gas piping and connections for the sludge drying system and gas engines and building shown on the Site Plan, Sheet C-2 submitted as part of the pending operations permit modification request (#39884-015-SO/MM).

Response: This response is the same as the response to Number 2.

2) Section 01015. Please provide a revised specification that includes procedures that will be followed if waste is encountered during excavation of pipelines. Please clarify where geomembrane and geocomposite will be used in this project (1.11.B), or provide revised specifications that delete this reference. Please provide specifications that include protection of groundwater and gas monitoring wells.

Response: Section 01015 was revised to include procedures that will be followed if waste is encountered during excavations of pipelines. The reference to geomembranes and geocomposites was deleted. Section 1.11

was expanded to include requiring the contractor to provide protection for groundwater and gas monitoring wells when working near these wells. The wells are already protected with bollards.

3) *Section 01030. Since this project is not a roadway construction project, please explain why FDOT Standards and Specifications are referenced for suspension of work (Section 1.05). All dewatering liquids removed from inside the slurry wall are considered to be leachate and shall be managed appropriately. Please revise Section 1.09 to specify the required disposal for this water.*

Response: FDOT Standards and Specifications are generally accepted references know and understood by contractors. We deleted the reference. The contractor will be responsible to make the final decision to suspend work due to weather. Section 1.09 was revised to specify disposal of this water in the leachate collection system.

4) *Section 02610. Please provide the gradation requirements for this gas well aggregate (Section 2.01.A). Please revise Section 3.01.A. to clarify that the "invert elevation" of the landfill is the elevation of the bottom clay layer that shall not be impacted.*

Response: Section 2.01.A has the gradation for the gas well aggregate. It is graded between 1-inch to 3-inch diameter size. Section 3.01.A was revised to change the word "landfill" to "solid waste."

g. *Section 4, Drawings.*

1) *Please provide construction drawings for the gas conditioning system, radiators, gas piping and connections for the sludge drying system and gas engines and building shown on the Site Plan, Sheet C-2 submitted as part of the pending operations permit modification request (#39884-015-SO/MM).*

Response: This response is the same as the response to Number 2.

2) *Sheet C-2, General Site Plan. Please provide a revised Sheet C-2 that is consistent with the Site Plan Sheet C-2 submitted as part of the pending operations permit modification request (#39884-015-SO/MM).*

Response: Sheet C-2 was revised to show the landfill gas to electricity project and the sludge drier.

3) *Sheet C-3. Please provide invert elevations for the condensate laterals and header piping.*

Response: Sheet C-3 was revised to include the invert elevations for the condensate, laterals and header piping.

4) *Sheets C-3A and 3B. Please verify the references to section D/C-5, Detail D1/C-5, Detail D/C-5, Detail 1/C-5 and Detail 1/C-6. Please provide revised sheets as appropriate. Please verify the position of the leader line for Detail 1/C-5.*

Response: Sheet C-3A and 3B were revised to clarify the section references and leader line.

5) *Sheet C-4. Please verify the pipe size and type. Section B indicates the pipe is SDR 17, but Specification 02610 does not appear to include SDR 17 piping. Please revise Detail A on this sheet to correctly reference the location of the borehole depth table. Please specify the minimum distance required between the bottom of the landfill (el. +29 ft. NGVD) and the bottom of the boreholes.*

Response: Specification 02610 Landfill Gas Well and Wellhead pertains to the landfill gas wells. Section B pertains to the landfill gas collection system lateral pipe. This pipe is covered in Section 15051 High density Polyethylene (HDPE) Pipe and Fittings. The minimum distance required between the bottom of the borehole and El. +29 was added to Detail A.

6) *Sheet C-5. Please explain the purpose and function of the "U" piping shown in Section B. Please show the piping and valves associated with the sludge dryer part of this project (Detail 2).*

Response: The "U" piping shown in Section B has the same purpose and function as the trap in a toilet. It allows condensate to drain into the manhole while preventing the loss of vacuum in the extraction system. It acts as a seal. Condensate is held in the "U" so with vacuum on the system no air will be pulled into the extraction system from the manholes. Condensate can enter the manhole because as condensate drains into the "U" from the landfill side the liquid pressure builds up until the liquid on the manhole side flows into the manhole.

The piping and valves associated with the sludge drier tie-in at the flare were added to Detail 2.

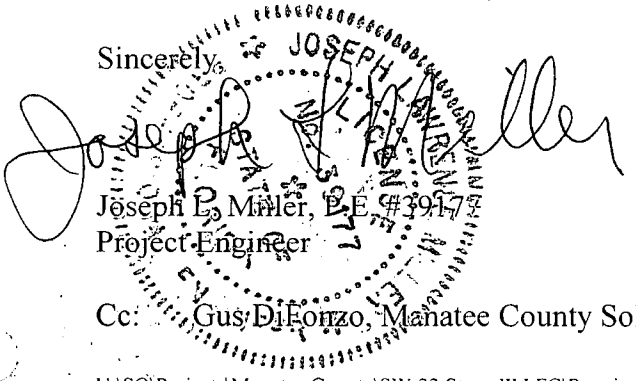
7) *Sheet C-6. To ensure that the bottom liner is not adversely impacted by the construction, please specify the bottom of each boring elevation on this table.*

Response: The Table on Sheet C-6 was revised to include the top of landfill elevation at each borehole, the length of the boring and the bottom elevation of the boring.

3. ***Notice of Application, Rule 62-701.320(8), F.A.C.*** *Please publish the attached Notice of Application and provide proof of publication to the Department.*

Response: Manatee County will send the proof of publication directly to the Department.

Sincerely,



Joseph L. Miller, P.E. #39177
Project Engineer

Cc: Gus DiLonzo, Manatee County Solid Waste w/2 copies

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Attachments

- Application Part O Page 34 of 40
- Section 2 – MSW Magazine article "Landfill Gas Development and Control" by Daniel P. Duffy, March/April 2006.
- Specifications Page 01015-4
- Specifications Page 01030-2
- Specifications Page 01030-3
- Specifications Page 02610-3
- Construction Drawings C-1, C-2, C-3, C-3A, C-3B, C-4, C-5 and C-6.

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MSW Management
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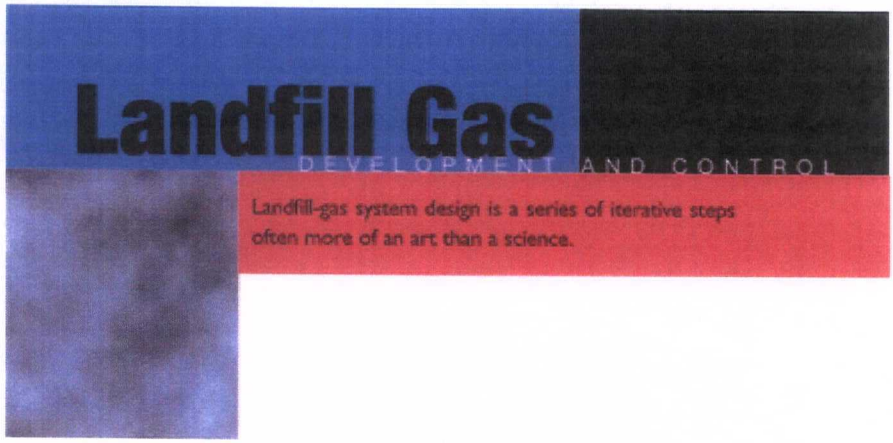
Feature



Landfill-gas system design is a series of iterative steps often more of an art than a science.

By Daniel P. Duffy

The very nature of disposed solid waste, with its varying characteristics and inconsistencies, makes it impossible to precisely predict the amount and rate of landfill gas (LFG) production. Therefore, the design of a LFG system should have a built-in flexibility to allow for field changes and layout modifications.

Predicting Production

Waste arrives at a landfill with a typical density of 33 pounds per cubic foot or 900 pounds per cubic yard. This waste is usually compacted to an in-place density twice that of its delivered density, about 67 pounds per cubic foot or 1,800 pounds per cubic yard. The in-place waste is assumed to have typical "soil characteristics" for municipal solid waste. These characteristics are the same characteristics used to predict leachate formation and precipitation percolation rates as well as LFG production. Waste is assumed to have a typical field capacity (the amount of water in a "soil" which remains after extensive gravity drainage) of 30% by volume and a total porosity (volume of voids/total volume) of 67%. In certain areas of the landfill, liquid content

may reach total porosity, leading to a saturated condition and contributing to leachate outbreaks.

In a completely saturated landfill strata, little if any LFG is produced. Therefore the moisture content of the waste can greatly affect the projected gas volumes.

These characteristics determine the LFG production potential of the in-place waste. Since these can vary significantly from landfill to landfill and even within the same landfill, these assumed characteristics can only be used as a rough average for planning purposes. All subsequent computations and predictions derived from these assumed characteristics represent a "best guess" only. The LFG management system design will almost certainly have to be modified to accommodate actual field conditions.

The single most important factor in predicting LFG production rates is the rate of decomposition of the organic components of the waste.

The available decomposable mass of refuse for any year is given by the following equation:

$V_1 = V_0 + D_1$

where,

V_1 = available decomposable mass for the year (cubic yards converted to lbs)

V_0 = remaining decomposable mass from the previous year (cubic yards converted to lbs)

D_1 = refuse disposed for the year (cubic yards converted to lbs)

The amount of LFG produced per year is estimated by the following:

$P_1 = V_1 * (0.10$ cubic feet per lbs)

where,

Subscribe

P_1 = annual LFG production rate (cubic feet per year)

V_1 = available decomposable mass for the year (cubic yards converted to lbs)

The value of 0.1 cubic feet of LFG per pound of in place waste is empirical and based on field observations.

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But since the waste characteristics even within a landfill can vary widely, this remains a rough average for planning purposes. Further dividing P_1 by 525,600 minutes per year gives the average LFG production rate per minute.

The annual amount of waste mass decomposed by the LFG production process is given by the following:

$dV_1 = P_1 / 4.49$

where,

Comment On This

dV_1 = the amount of waste converted to LFG (lbs)

P_1 = annual LFG production rate (cubic feet per year)

The factor of 4.49 converts the cubic feet of LFG into lbs of decomposed waste. Its value is based on laboratory studies and is an average value subject to change according to local waste characteristics. The remaining decomposable waste carried over to the next year's LFG product estimate is given by the following:

$V_2 = V_1 - dV_1$

where,

V_2 = decomposable waste mass available for next year (lbs)

V_1 = available decomposable mass for the year (lbs)

dV_1 = the amount of waste converted to LFG (lbs)

A hypothetical landfill with a total disposal capacity of 1,850,000 cubic yards (equivalent to about 1,150 acre-feet) might utilize an average of 92,500 cubic yards of airspace per year over a 20-year operational lifetime.

With an average in-place density of 1,800 lbs per cubic yard, the landfill would receive an average of 82,750 tons per year (or 230 tons per day, typical for a moderate-size landfill). The maximum in-place waste volume is achieved at the end of year 20, when disposal operations cease.

Initial LFG production from the first year of waste disposal would be a relatively small 32 cubic feet per minute.

LFG production also peaks at the end of year 20 with a production rate of 516 cubic feet per minute. It then declines over the course of the site's 30-year, post-closure care period to a rate of 216 cubic feet per minute.

The annual average rate of LFG production is shown in Table 1.

Table 1 - Estimated LFG Production Rates

Yr	Disposal (tons)	In Place Waste (tons)	Decomposed (tons)	LFG (cfm)
1	83250	83250	1854	32
5	83250	398117	8867	151
10	83250	75831	16789	287
15	83250	1071660	23868	408
20	83250	1355638	30192	516

25	0	1211252	26977	461
30	0	1082244	24103	412
35	0	966977	21536	368
40	0	863987	19242	329
45	0	771966	17193	294
50	0	689746	15362	262

Final Cap and Cover

The efficiency of the LFG extraction system is primarily dependent on the permeability of the cap. The amount of gas that can be extracted per well, and the spacing between the wells, can be greatly increased with an impermeable cap.

The greater the spacing between the wells, the fewer wells that are required to ensure complete coverage of the landfill. This results in significant capital cost savings and long-term savings in maintenance costs.

For our hypothetical landfill we will assume the following final cover system (from top to bottom):

- 6 inches of topsoil (soil type SM, silty sands with a permeability of 5.2 x 10-4 cm/sec)
- 24 inches of soil cover (soil type SM, gravelly sands with a permeability of 1.7 x 10-3 cm/sec)
- 0.24 inches thick geocomposite lateral drainage net (thick factory bonded geotextile-geonet-geotextile)
- 40 mil high-density polyethylene geomembrane (HDPE) on the top. The HDPE is factory-bonded to the underlying GCL. The edges of the HDPE geomembrane panels may not be seamed during installation, and therefore it is assumed the geomembrane's liner leakage fraction is greatly increased.
- 0.20-inches-thick composite barrier layer. A geosynthetic clay liner (GCL) consisting of a bentonite layer (permeability of 5.0 x 10-9 cm/sec) sandwiched between a geotextile layer on the bottom and
- 12 inches of grading soil (soil type SW, well graded gravelly sands with a permeability of 5.8 x 10-3 cm/sec)

Each hydraulic conductivity results in an equivalent relative cover factor (Ms). This factor and the thickness of the layer are used to determine the final cap's overall impermeability to gas.

Table 2 summarizes the relationship between the cover material's vertical hydraulic conductivities and the relative cover factor, Ms. Table 3 summarizes the configuration and material characteristics of the final cover system.

Table 2 - Relative Cover Premeability Factors	
Material Vertical Hydraulic Conductivity (cm/sec)	Relative Cover Factor, MS
1.00×10^{3}, or more	0.10
1.00×10^{-4}	0.40
1.00×10^{-5}	0.70
1.00×10^{-6}	0.90
1.00×10^{-7}	1.00
1.00×10^{-8}	1.10
1.00×10^{-9}	1.20

Table 3 - Final Cover Configuration and Material Characteristics

Layer	Thickness (fee)	Vertical Hydraulic Conductivity (cm/sec)
Topsoil	0.50	5.2×10^{-4}
Protective Cover Soil	2.00	1.7×10^{-3}
Drainage Layer	0.24	NA
40 ml HDPE	0.0025	2.0×10^{-13}
GCL	0.20	5.0×10^{-9}
Grading Soil	12.00	5.8×10^{-3}

Extraction Wells Depths and Zones of Control

Active landfill gas extraction wells are typically located within the limits of waste and set at depths of approximately 75% of the waste thickness at the well locations. The deeper wells are located in the center, with shallower wells around the waste perimeter. Since the well's zone of influence (ZOI) changes with depth, and depth changes with location, several trial iterations using different well locations and depths may be required before the design can ensure complete coverage of the limits of waste. Once the well length has been determined, usually two thirds of its length is kept solid while the bottom one third of its length is slotted to allow inflow of the LFG.

Table 4 summarizes the relationship between the hypothetical depths of waste, the total lengths of the LFG extraction wells and the slotted and solid pipe segments of the wells.

Table 4 - Waste Depth and WEll Length Relationships		
Item	Formula	Length (feet)

Depth of Waste at Well Location, Dw		40
LFG Well Length, Lw	= Dw * 75%	30
Solid Pipe Length of the LFG Well, Sp	= Lw * 67%	20
Slotted Pipe Length of theLFG Well, Sl	= Lw * 33%	10

Tables 5, 6, and 7 depict equivalent thickness of the geomembrane, relative cover permeability, and LFG well Zone of Influence (ZOI), respectively.

Table 5 - Equivalent Thickness of the Geomembranes

Item	Value
Vertical Hydraulic Conductivity of compacted clay layer (cm/sec), K_C =	0.000001
Vertical Hydraulic Conductivity of the Geomembrane(cm/sec), K_H =	0.0000000000002
Thickness of the 30 mil Geomembrane (feet) , Cd_H =	0.0025
Liner Leakage Fraction (dimensionless), LLF =	0.004
Equivalent Geomembrane (feet), Cd_E = (K_C/K_H)*(Cd_H*LLF)=	5.00

Table 6 - Relative Cover Permeability

Layer	Cover Depth (feet), Cd	Vertical Hydraulic Conductivity, K	Permeability Factor, Ms	Relative Cover, Ms'=Ms*Cd
1	0.50	0.00052	0.40	0.20
5	2.00	0.0017	0.10	0.25
10	NA	NA	NA	0.00
15	5.00	0.000000000002	1.20	6.00
20	0.20	0.000000005	1.20	0.24
25	1.0	0.0058	0.10	0.10
30	8.70			6.79

Table 7 - LFG Well Z01

Item	Value
Refuse Permeability Factor, F_S =	4.00
Solid Pipe Length of the LFG Well, Sp =	20.00
Relative Cover Permeability Factor, Ms =	6.79
Total Cover Depth, Cd =	8.70
LFG Well Zone of Influenc (feet),ZOI =Fs*	316.29

(Sp+[Ms*Cd]) =	

LFG well ZOIs are estimated by the following formula:
ZOI = Fs * (Sp+[Ms * Cd])
where,
ZOI = LFG extraction well zone of influence (feet)
Fs = Refuse permeability factor (dimensionless, range from 3.5 to 6.5)
Sp = Length of the solid pipe section of the LFG well (feet)
Ms = Relative cover permeability factor (dimensionless)
Cd = Cover depth (feet)

If the final cover system consists of multiple layers of soil and geosynthetics, the relative cover permeability factor for the cover system as a whole is determined by the following:
$Ms = (Ms_1 * Cd_1) + (Ms_2 * Cd_2) +$
$\ldots + (Ms_N * Cd_N)$

The equivalent thickness of a geomembrane portion of a composite cap is determined in relation to the clay component of a composite cap, and is calculated by the following:

$Cd_E = (K_C / K_H) * (Cd_H * LLF)$
where,
Cd_E = Equivalent thickness of the geomembrane (feet)
K_C = Vertical hydraulic conductivity of the clay (cm/sec)
K_H = Vertical hydraulic conductivity of the geomembrane (cm/sec)
Cd_H = Thickness of the geomembrane (mils, converted to feet)
LLF = Liner leakage fraction (dimensionless, from HELP Model analyses)

(Note: for the purposes of determining ZOI, the equivalent thickness of the geomembrane assumes that the edges of the geomembrane are not welded and therefore significantly increase the geomembrane's liner leakage fraction.)

The thickness of a geocomposite (factory bonded geotextile-geonet-geotextile) drainage blanket in the final cover system is not included in the analysis. The equivalent thickness of the geomembrane portion of the hypothetical cap is computed as follows.

For the purposes of design, a conservative ZOI of 300.0 feet will be used for each proposed LFG extraction well set in waste having a thickness of 40 feet or less. Note that if the final cover system did not use a geomembrane cap in its cover layer, its

relative cover permeability factor would be reduced from 6.79 to 0.79, a reduction of 88%.

This should illustrate the importance of a geomembrane cap to an efficient LFG extraction system. A geomembrane acts to ensure the maintenance of pressure within a landfill and to prevent air infiltration into the landfill as a result of suction pressure from the wells.

Without the geomembrane, the resulting ZOI per well would be much smaller and require many more wells to provide full coverage.

Now that the wells have been properly spaced for maximum coverage, we need to determine the reduction in their areas of influence resulting form overlapping, adjacent ZOIs. Each overlap area is determined by the following formula:

$Sx = [R^2 * COS^{-1} (d/R)]$
$- [d * (R^2 - d^2)\_]$
where,
Sx = the overlap area (square feet)
R = LFG well ZOI (feet)
d = half the distance between the adjacent gas wells (feet)
The flow reduction factor is determined by the following formula:
$Rf = (Sx_1 + Sx_2 + ... + Sx_n) / (pi * R^2)$

Since each LFG extraction well ZOI will be overlapped by up to six adjacent ZOIs, each overlap area (Sx) cannot exceed 2.5% of the total well area of influence to ensure the maximum allowable Rf of 15% is not exceeded. If a well is located in a corner of a landfill or along its perimeter (and does not have six adjacent wells) the overlap per adjacent well can be proportionally higher, just so long as the 15% total is not exceeded. In our hypothetical example, well spacing of 530 feet for wells having ZOIs of 300 feet will provide sufficient coverage without excessive overlap.

LFG Pipe Flows, Velocities and Head Losses
After the wells have been properly spaced, the amount of gas extracted by each well can be determined.

This is done by first estimating the volume of in-place waste within the reduced ZOI of each well.

Each LFG extraction well influences a cylindrical volume of in-place waste. It is from this volume that the LFG is extracted. The volume of this cylinder is determined by the following formula:

$V = pi * (ZOI^2) * Dw * (100\% - Rf)$
where,
V = Volume of influence (cubic feet)
ZOI = Zone of influence (feet)
Dw = Depth of waste (feet)
Rf = Flow reduction factor (percent)
The extraction rate from this volume of influence is a function of the gas generation rate of the in-place waste:
$Qu = V * (dg / dt) * dw$
where,
Qu = LFG extraction rate (cfm)
V = Volume of Influence (cubic feet)
dg/dt = LFG generation rate per lbs of in-place waste (cubic feet/ [lbs * minute])
dw = in-place density of waste (lbs/cubic feet)

For our hypothetical example, each LFG extraction well is estimated to have an extraction flow rate of approximately 90 cfm. Dividing the estimated peak LFG production rate (previously calculated) by this value will provide the minimum number of wells required.

An examination of the design plan showing the well locations derived from the required well spacing will determine if the proposed design has the minimum number of required wells.

In order to function properly, each LFG extraction wellhead needs a minimum pressure head of 10 inches of water column. Since the pressure is applied by a single, central blower, the pressure-head losses in the lateral pipelines connecting the wells to the blower need to be determined. These lateral pipes are usually solid, high density polyethylene (HDPE) with diameters varying from 6 inches to 24 inches.

There are two ways of installing lateral and header pipelines, either above or below the geosynthetic components of the final cover system.

Installation above the geosynthetics is a more difficult construction effort, the components of the final cover all have to be graded and trenched along the alignment of the pipelines well before they are installed.

Furthermore, the need to pre-align the pipelines severely restricts operational flexibility and field modifications to the system.

However, it makes repair and maintenance of the pipelines much easier. Installation below the geosynthetics has the reverse characteristics, ease of construction and operational flexibility,

but with later difficulty (due to the need to slice through the overlaying geosynthetics) with repair and maintenance.

Of the two, the below-the-geosynthetic installation is preferred since all LFG estimates are best guesses only, and operational flexibility allowing for field changes must be retained.

Pressure drops for gaseous pipeline flows are approximated by the Spitzglass equation for relatively low pressure flows:

$P = G * L * (Q/[59.167 * K])^2$
where,
P = Pressure drop (inches of water column)
G = Specific gravity of the LFG (0.98, dimensionless)
L = Length of pipe segment (feet)
Q = Volumetric flow rate (cfm)
K = Spitzglass Constant (dimensionless)

When determining head losses along a header pipeline, each wellhead connected to the main header pipeline by a lateral pipe is considered a node at a point along the header. The header itself is usually circular so that if blockage occurs at a point along its length, LFG can still be extracted in the opposite direction. Though this will not occur at the same pressure head or with the same efficiencies, it is better than completely blocked gas flows. That can result in a disastrous and potentially dangerous expansion of the geomembrane cap (blowing up like a balloon) as the gas accumulates behind the blockage.

Though minor head losses from pipe bends, tees, flanges, and other fixtures is insignificant and usually ignored, there is an additional pressure-head loss in the flare stack used to flare off the extracted gas. This head loss is typically 12 inches of water column. As a safety factor, an additional 10% is added to the minimum required head. So if a maximum pipeline head loss of 4 inches occurs between the blower and the farthest extraction well, a minimum 28 inches of water column will be required for the system with the factor of safety. This is equal to 145 psf or over 1 psi. The blower should be rated for this pressure and the maximum gaseous flow rate.

The pipe diameters should be checked to ensure that the gaseous flow velocities do not exceed the maximum allowable. The maximum allowable gas flow velocity in a direction concurrent with condensate flows is 40 feet per second. For counter concurrent flows, the maximum velocity is 20 feet per second.

Condensate Collection and Control
Condensate flows are liquid flows that follow the slope gradient

of the pipeline. Gas extracted by pressure follows the pressure gradient of the pipeline. Often the two are in opposing directions.

Should the pipe diameters need adjusting, the head losses in the pipeline must be recalculated. Then the velocities are checked again. This iterative process continues until an acceptable design is achieved.

Condensate is a particularly nasty and concentrated form of leachate that condenses out of the landfill gas as it cools while traveling along the pipeline. It is important to remove this accumulated liquid, as it can cause pipeline blockage. Condensate blockages are evidenced by a "sloshing" sound and indicated by rapid fluctuations in gas flow rate, temperature and increasing negative pressure.

Condensate accumulates and must be removed from low elevation points along the header pipeline.

While the condensate itself has a typical pH range of 3.5 to 7.5, it contains highly acidic compounds (at concentrations as high as 4,000 ppm). The acidic compounds that are captured by the condensate can give rise to relatively high rates of corrosion of carbon-steel pipe and fittings. Typical condensate also includes relatively high proportions of chlorides, ammonia nitrogen and phenols. Some states require the condensate to be collected and treated separately.

This would require an additional system of pipelines to convey the condensate from the low collection points in the header pipeline to an onsite pretreatment facility.

Most states however, allow the condensate to be recycled back into the landfill. Compared with the amount of leachate collected from the bottom of the landfill the amount of condensate collected from the LFG system is relatively small. The small quantities of condensate get diffused in the leachate and have there constituents mitigated by percolating through the waste.

Environmental engineer Daniel P. Duffy, PE, lives and works in Cincinnati, OH

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PBS&J

An employee-owned company

Dept. of Environmental Protection
FEB 07 2008
Southwest District

January 31, 2008

Susan J. Pelz, P.E.
Solid Waste Manager
Southwest District
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

Re: Lena Road Landfill, Manatee County
GMS ID No.: 4041C02025
Stage III Landfill Gas Collection System
Construction Permit Application

INSERTED INTO OCULUS
FEB 22 2008
INITIAL MK

Dear Ms Pelz:

Enclosed please find for the above referenced permit application:

- Check for construction permit application fee in the amount of $1000.
- Four complete applications with engineering report, specifications and drawings.

The purpose of this application is to obtain a construction permit for the Stage III Landfill gas collection system. This is an expansion of the existing system that serves the Stage I Landfill. The Stage III design is consistent with the design for the Stage I Landfill gas system. The Stage III Landfill gas collection system will be connected to the existing gas collection system, and the gas burned in the flare, or utilized in either the Manatee County sludge drier or the landfill gas to electricity project. Concurrent with this application, we are submitting an application for a minor permit modification to the Lena Road Landfill Operation permit with information on the sludge drier and landfill gas to electricity project. We are also requesting a modification to the landfill operation permit to include operation of the Stage III Landfill gas system.

If you have any questions, please call me at 407-806-4153, or e-mail me at jlmiller@pbsj.com.

Sincerely,

Joe Miller

Joseph L. Miller, P.E.
Project Engineer

Cc: Gus DiFonzo, Manatee County Solid Waste w/2 copies

U:\SO\Projects\Manatee County\SW-33 Stage III LFG\Permit Application\Susan Pelz Ltr January 31 2008.doc

Manatee County Lena Road Landfill

STAGE III LANDFILL GAS COLLECTION SYSTEM

CONSTRUCTION PERMIT APPLICATION

January 31, 2008

Table of Contents

* The drawings are in two sizes: 11" x 17" for easy reference and 24" x 36" which are signed and sealed, folded and inserted in the clear plastic folder.

PBS&J

An employee-owned company

5300 West Cypress St., Suite 200
Tampa, Florida 33607

Bank of America, N.A.
Atlanta, Georgia
64-1278/611

1075511

CHECK DATE
January 24, 2008

PAY One Thousand Dollars And 00 Cents**********

AMOUNT $1,000.00

TO FDEP (Florida Dept of Env Protection)
2600 Blairstone Rd.
Tallahassee, FL 32399-2400
United States

PBS&J OPERATIONAL ACCOUNT

VOID AFTER 90 DAYS *AUTHORIZED SIGNATURE*

SAMPLE

PBS&J 5300 West Cypress St., Suite 200 Tampa, Florida 33607

EMILY BUSINESS FORMS 800.392.6018 ADVANTAGE

1075511

Invoice #	Date	Description	Discounts	Net Amount
Fee for St	01/16/08	0007 Fee for stage III landfill	0.00	1,000.00

SECTION
1

DEP Form # 62-701.900(1)
Form Title Solid Waste Management Facility Permit
Effective Date 05-27-01

DEP Application No.
(Filled by DEP)

Florida Department of Environmental Protection
Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, FL 32399-2400

Dept. of Environmental Protection
FEB 07 2008
Southwest District

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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

APPLICATION INSTRUCTIONS AND FORMS

Manatee County Solid Waste Management Facility
Lena Road Class I Landfill
WACS ID No: SWD-41-44795

Stage III Landfill Gas Collection System

January 31, 2008

U:\SO\Projects\Manatee County\SW-33 Stage III LFG\Permit Application\62-701.900.1.DOC

Northwest District
160 Governmental Center
Pensacola, FL 32501-5794
850-595-8360

Northeast District
7825 Baymeadows Way, Ste. B200
Jacksonville, FL 32256-7590
904-448-4300

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

Southwest District
3804 Coconut Palm Dr.
Tampa, FL 33619
813-744-6100

South District
2295 Victoria Ave., Ste. 364
Fort Myers, FL 33901-3881
941-332-6975

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 accordance 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,B, D through T
B. Asbestos Monofills - Submit parts A,B,D,E,F,G,J,L,N, P through S, and T
C. Industrial Solid Waste Facilities - Submit parts A,B, D through T
D. Non-Disposal Facilities - Submit parts A,C,D,E,J,N,S and T

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,C and D 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,M, O through T
B. Asbestos Monofills - Submit parts A,B,N, P through T
C. Industrial Solid Waste Facilities - Submit parts A,B, M through T
D. Non-Disposal Facilities - Submit parts A,C,N,S and T

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 - Submitted

PART B: DISPOSAL FACILITY GENERAL INFORMATION - Submitted

PART C: NON-DISPOSAL FACILITY GENERAL INFORMATION - **Not Applicable**

PART D: PROHIBITIONS - **Not Applicable**

PART E: SOLID WASTE MANAGEMENT FACILITY PERMIT REQUIREMENTS, GENERAL - **Not Applicable**

PART F: LANDFILL PERMIT REQUIREMENTS - **Not Applicable**

PART G: GENERAL CRITERIA FOR LANDFILLS - **Not Applicable**

PART H: LANDFILL CONSTRUCTION REQUIREMENTS - **Not Applicable**

PART I: HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS - **Not Applicable**

PART J: GEOTECHNICAL INVESTIGATION REQUIREMENTS - **Not Applicable**

PART K: VERTICAL EXPANSION OF LANDFILLS - **Not Applicable**

PART L: LANDFILL OPERATION REQUIREMENTS - **Not Applicable**

PART M: WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS - **Not Applicable**

PART N: SPECIAL WASTE HANDLING REQUIREMENTS - **Not Applicable**

PART O: GAS MANAGEMENT SYSTEM REQUIREMENTS - Submitted

PART P: LANDFILL CLOSURE REQUIREMENTS - **Not Applicable**

PART Q: CLOSURE PROCEDURES - **Not Applicable**

PART R: LONG TERM CARE REQUIREMENTS - **Not Applicable**

PART S: FINANCIAL RESPONSIBILITY REQUIREMENTS - **Not Applicable**

PART T: CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER - Submitted

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

A. GENERAL INFORMATION

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

[X] Disposal
- [ ] Class I Landfill
- [ ] Class II Landfill
- [ ] Class III Landfill
- [X] Other Describe: Stage III Landfill Gas Collection System
- [ ] Ash Monofill
- [ ] Asbestos Monofill
- [ ] Industrial Solid Waste

[ ] Non-Disposal
- [ ] Incinerator For Non-biomedical Waste
- [ ] Waste to Energy Without Power Plant Certification
- [ ] Other Describe: _____

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:
- [X] Construction
- [ ] Operation
- [ ] Construction/Operation
- [ ] Closure

3. Classification of application:
- [X] New
- [ ] Renewal
- [ ] Substantial Modification
- [ ] Intermediate Modification
- [ ] Minor Modification

4. Facility name: Lena Road Class I Landfill

5. DEP ID number: SWD-41-44795 County: Manatee

6. Facility location (main entrance): 3333 Lena Road, Bradenton, FL 34202

7. Location coordinates:

Section: 1 Township: 35S Range: 18E and Section: 31 Township: 34S Range: 19E
Section: 6 & 7 Township: 35S Range: 19E

Latitude: 27 ^{0} 28' 10" Longitude: 82 ^{0} 26' 35"

8. Applicant name (operating authority): Manatee County Government

Mailing address: 4410 66th Street West Bradenton, FL 34210
Street or P.O. Box City State Zip

Contact person: Daniel T. Gray Telephone: (941) 792-8811

Title: Utility Operations Director

dan.gray@co.manatee.fl.us
E-Mail address (if available)

9. Authorized agent/Consultant: PBS&J

Mailing address: 482 South Keller Road Orlando, Florida 32810-6101
Street or P.O. Box City State Zip

Contact person: Joseph L. Miller, P.E. Telephone: (407) 806-4153

Title: Project Manager

jlmiller@pbsj.com
E-Mail address (if available)

10. Landowner (if different than applicant): N/A

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: All of Manatee County, both incorporated and unincorporated, Long Boat Key and small portions of neighboring counties.

12. Population to be served:

Current: 292,000 Five-Year Projection: 328,000

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

14. Expected life of the facility: Landfill Stages I, II and III - 65 years

15. Estimated costs:

Total Construction: $ 2,000,000 Closing Costs: $ N/A

16. Anticipated construction starting and completion dates:

From: May 2008 To: March 2014

17. Expected volume or weight of waste to be received:

N/A yds^3/day Received 1280 tons/day N/A gallons/day
Landfilled 1100 tons/day

B. DISPOSAL FACILITY GENERAL INFORMATION

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

   This application is for the construction permit to construct the Stage III Landfill Gas Collection System and connect it to the existing landfill gas collection system and burn. The gas system will be installed in three phases as shown on the construction drawings.

2. Facility site supervisor: Mike Gore

   Title: Superintendent - Landfill Division Telephone: (941) 708-8562

   mike.gore@co.manatee.fl.us
   E-Mail address (if available)

3. Disposal area: Total 316 acres; Used 206 acres; Available 110 acres.

4. Weighing scales used: [X] Yes [ ] No

5. Security to prevent unauthorized use: [X] Yes [ ] No

6. Charge for waste received: N/A $/yds^3 36 $/ton

7. Surrounding land use, zoning:

   [X] Residential
   [X] Agricultural
   [ ] Commercial
   [ ] Industrial
   [ ] None
   [X] Other Describe: Transportation & Utilities

8. Types of waste received:

   [X] Residential
   [X] Commercial
   [ ] Incinerator/WTE ash
   [ ] Treated biomedical
   [X] Water treatment sludge
   [ ] Air treatment sludge
   [X] Agricultural
   [X] Asbestos
   [ ] Other Describe: _____
   [X] C & D debris
   [X] Shredded/cut tires
   [X] Yard trash
   [ ] Septic tank
   [ ] Industrial
   [ ] Industrial sludge
   [X] Domestic sludge

9. Salvaging permitted: [ ] Yes [X] No

10. Attendant: [X] Yes [ ] No Trained operator: [X] Yes [ ] No

11. Spotters: Yes [X] No [ ] Number of spotters used: 16

12. Site located in: [ ] Floodplain [ ] Wetlands [X] Other Uplands

13. Property recorded as a Disposal Site in County Land Records: [ ] Yes [X] No

14. Days of operation: Monday through Saturday

15. Hours of operation: 8:00 a.m. to 5:00 p.m.

16. Days Working Face covered: Monday through Saturday

17. Elevation of water table: 29 Ft. (NGVD 1929)

18. Number of monitoring wells: 18

19. Number of surface monitoring points: 2

20. Gas controls used: [X] Yes [ ] No Type controls: [X] Active [ ] Passive

Gas flaring: [X] Yes [ ] No Gas recovery: [ ] Yes [X] No

21. Landfill unit liner type:

[X] Natural soils
[ ] Single clay liner
[ ] Single geomembrane
[ ] Single composite
[X] Slurry wall
[ ] Other Describe: _____
[ ] Double geomembrane
[ ] Geomembrane & composite
[ ] Double composite
[ ] None

22. Leachate collection method:

[X] Collection pipes
[ ] Geonets
[ ] Well points
[ ] Perimeter ditch
[ ] Other Describe: _____
[ ] Sand layer
[ ] Gravel layer
[ ] Interceptor trench
[ ] None

23. Leachate storage method:

[ ] Tanks
[ ] Surface impoundments
[X] Other Describe: None

24. Leachate treatment method:

[ ] Oxidation
[ ] Secondary
[ ] Advanced
[X] None
[ ] Other _____
[ ] Chemical treatment
[ ] Settling

25. Leachate disposal method:

[ ] Recirculated
[ ] Transported to WWTP
[ ] Injection well
[ ] Evaporation
[ ] Other _____
[X] Pumped to WWTP
[ ] Discharged to surface water
[ ] Percolation ponds

26. For leachate discharged to surface waters:

Name and Class of receiving water: N/A

27. Storm Water:

Collected: [X] Yes [ ] No

Type of treatment: Sand filter and/or mechanical filter

Name and Class of receiving water: Cypress Strand, Gates Creek via on-site wetlands Class III.

28. Environmental Resources Permit (ERP) number or status: MSSW Permit #403143.01 _

FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION
JUN 25 2008
SOUTHWEST DISTRICT
TAMPA

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

S	Location	N/A	N/C		
				1.	Provide the design for a gas management systems that will (62-701.530(1), FAC):
X	Section 2 O 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;
X	Section 2 O 1.b.			b.	Be designed for site-specific conditions;
X	Section 2 O 1.c.			c.	Be designed to reduce gas pressure in the interior of the landfill;
X	Section 2 O 1.d.			d.	Be designed to not interfere with the liner, leachate control system or final cover.
			X*	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):
			X*	3.	Provide documentation describing how the gas remediation plan and odor remediation plan will be implemented; (62-701.530(3), FAC):
				4.	Landfill gas recovery facilities; (62-701.530(5), FAC):
X	Section 2 O. 4.a.			a.	Information required in Rules 62-701.320(7) and 62-701.330(3), FAC supplied;
X	Section 2 O. 4.b.			b.	Information required in Rule 62-701.600(4), FAC supplied where relevant and practical;
X	Section 2 Appendix A & O. 4.c.			c.	Estimate of current and expected gas generation rates and description of condensate disposal methods provided;
X	Section 2 O. 4.d.			d.	Description of procedures for condensate sampling, analyzing and data reporting provided;
X	Section 2 O. 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;
X	Section 2 O. 4.f.			f.	Performance bond provided to cover closure costs if not already included in other landfill closure costs.

*** "No change" means no change from the Application and Engineering Report submitted in April 2004 for the renewal of Lena Road Class I Landfill Facility Operation Permit No: 39884-010-SO/01. (Revised April 17, 2008)**
**** Revise June 23, 2008**

S

T. CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

1. Applicant:

The undersigned applicant or authorized representative of Manatee County Government Utility Operations Department is aware that statements made in this form and attached information are an application for a Construction 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.

Dan T. Gray

Signature of Applicant or Agent

Daniel T. Gray
Utility Operations Director
Name and Title (please type)

dan.gray@co.manatee.fl.us
E-Mail address (if available)

4410 66th Street West
Mailing Address

Bradenton, FL 34210
City, State, Zip Code

(941) 792-8811
Telephone Number

Date: 2/7/08

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.

Joseph L. Miller

Signature

Joseph L. Miller, P.E. Project Manager
Name and Title (please type)

39177
Florida Registration Number
(please affix seal)

482 South Keller Road
Mailing Address

Orlando, Florida 32810-6101
City, State, Zip Code

jlmiller@pbsj.com
E-Mail address (if available)

(407) 806-4153
Telephone Number

Date: January 31, 2008

SECTION
2

LENA ROAD LANDFILL
Stage III Landfill Gas Collection System
Construction Permit Application

Engineering Report

Part O

June 23, 2008

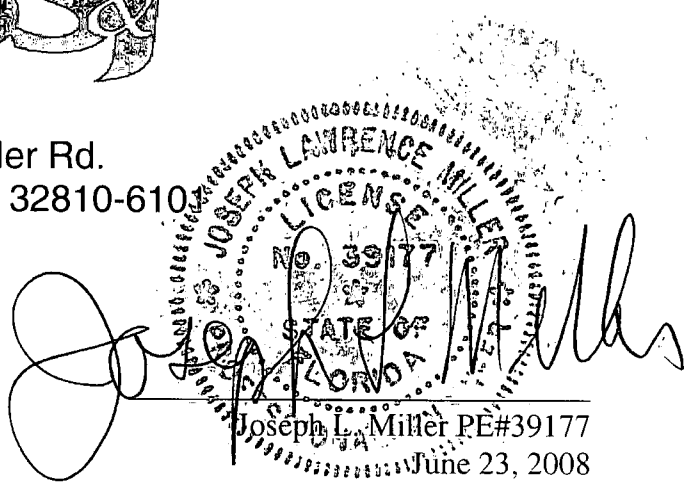
Prepared for

Manatee County Government
Utility Operations Department
Solid Waste Division
3333 Lena Road
Bradenton, Florida 34202

Dept. of Environmental Protection
JUN 25 2008
Southwest District

Prepared by

PBS&J
482 S. Keller Rd.
Orlando, Florida 32810-610



Joseph L. Miller PE#39177
June 23, 2008

Dept. of Environmental Protection
FEB 07 2008
Southwest District

LENA ROAD LANDFILL
Stage III Landfill Gas Collection System
Construction Permit Application

Part O

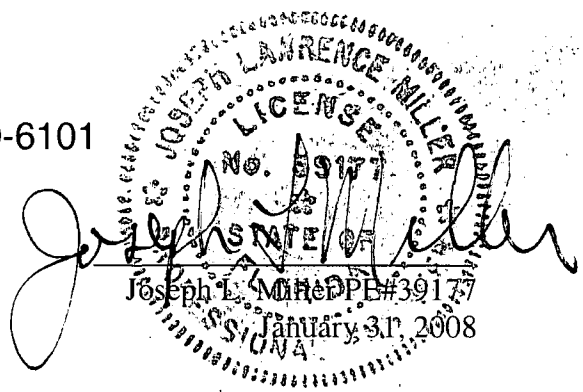
January 31, 2008

Prepared for

Manatee County Government
Utility Operations Department
Solid Waste Division
3333 Lena Road
Bradenton, Florida 34202

Prepared by

482 S. Keller Rd.
Orlando, Florida 32810-6101



Joseph L. Miller PE#39177
January 31, 2008

FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION
JUN 25 2008
SOUTHWEST DISTRICT
TAMPA

Part O Gas Management System Requirements

GAS MANAGEMENT SYSTEM REQUIREMENTS (62-701.530, FAC)

1. Provide the design for a gas management system that will (62-701.530(1), FAC):

a. Prevent concentrations of combustible gases from exceeding 25% of the LEL in structures and 100% of the LEL at the property boundary. - The Stage III Landfill gas extraction system will prevent the migration of landfill gas from the landfill by maintaining a vacuum within the landfill. Landfill gas will be sucked to the extraction wells by the blower, and sent to the flare for destruction or a landfill gas utilization project.

b. For site-specific conditions. - The landfill gas extraction system was designed for the site-specific conditions. The Stage III Landfill gas collection drawings are included in Section 4 of this application. The specifications are included in Section 3 of this application. The drawings were submitted as 11" x 17" size for ease of review. The full size drawings are 24"x36" size and are folded and included in the clear plastic folder. The Stage III Landfill design follows the same criteria for the Stage I Landfill design. The main header pipe is an 18" diameter HDPE pipe on a minimum slope of 2%. At low points in the header pipe, landfill gas condensate will be trapped and drained to the leachate collection system. The lateral pipes are 8" diameter HDPE pipe that connects the vertical extraction wells to the main header pipe. The lateral pipes are also designed to have a minimum slope of 2%. The header pipe is looped around the Stage III Landfill to help maintain equal vacuum on the extraction wells. Each extraction well has a well head with a valve that can be used to adjust the flow. Negative vacuum will be maintained on each well at all times. Each well is checked monthly and the valve adjusted as needed depending on the gas production of the well. The vertical extraction wells are 6" diameter HDPE pipe perforated along the bottom 1/3 of the well. The Stage III Landfill gas extraction system header will be connected to the existing landfill gas blower and flare station as shown on the drawings. The system will be installed in three phases. The projected start date for each phase is shown on the cover sheet of the construction drawings. There is a plan sheet for each phase of the landfill gas collection system construction.

c. Reduce gas pressure in the interior of the landfill. – The vertical landfill gas extraction wells are perforated along the bottom 1/3 of the well. The wells are located approximately at a rate of one per acre. The landfill gas blower will maintain a vacuum on the extraction wells and create a vacuum in the interior of the landfill so that landfill gas will be captured and sent to the flare or a landfill gas utilization project. The well spacing and perforation pattern follow the design for the Stage I landfill gas collection system which has proven effective in capturing the landfill gas and eliminating surface emissions of landfill gas. The blower and flare were sized for 3000 SCFM which is the estimated maximum landfill gas flow rate for the Stage I and Stage III landfills. The vacuum on the well heads will be kept negative at all times. The system will reduce the gas

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pressure in the interior of the landfill and prevent landfill gas from migrating through the foundation or the landfill surface.

d. Not to interfere with the liner, leachate control system or final cover. - This is a slurry wall landfill. There is no bottom synthetic liner with a leachate control system for the landfill gas extraction well to interfere with. The extraction wells were designed to penetrate the solid waste to a depth of 90%. There is no final cover system in-place. The intermediate soil cover is in place. The extraction wells were designed to be a minimum or four feet above the intermediate soil cover to allow space for installation of the final landfill cap.

2. Provide documentation that will describe locations, construction details and procedures for monitoring gas at ambient monitoring points and with soil monitoring probes;

Response: There is no change from the Application and Engineering Report submitted in April 2004 for the renewal of the Lena Road Class I Landfill Facility Operation Permit No.: 3988-010-SO-01.

3. Provide documentation describing how the gas remediation plan and odor remediation plan will be implemented;

Response: There is no change from the Application and Engineering Report submitted in April 2004 for the renewal of the Lena Road Class I Landfill Facility Operation Permit No.: 3988-010-SO-01.

4. Landfill gas recovery facilities; (62-701.530(5), FAC):

a. Information required in Rules 62-701.320(7) and 62-701.330(3), FAC supplied;

Rule 62-701.320 (7) Application content and format. Applications for permits to construct, operate, modify, or close a solid waste management facility shall include in the following sequence:

(a) A letter of application transmittal;

Response: A letter of application transmittal was included with the application submitted dated January 31, 2008. The letter was located before the Table of Contents.

(b) A completed application form dated and signed by the applicant;

Response: A completed application form dated and signed by the applicant was included with the application submitted dated January 31, 2008. The application was included in Section 1 of the application.

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(c) The permit fee specified in Rule 62-701.314, F.A.C., in check or money order, payable to the Department.

Response: A check for $1,000 payable to the Department was included with the application submitted dated January 31, 2008 as the permit application fee.

(d) An engineering report addressing the requirements of this rule which shall:

1. **Contain a cover sheet stating the project title, location, applicant's name, and the engineer's name, address, signature, date of signature and seal;**
2. **Have the text printed on 8 ½ inch by 11 inch consecutively numbered pages;**
3. **Contain a table of contents or index describing the body of the report and the appendices; and**
4. **Include the body of the report and all appendices.**

Response: The engineering report was submitted in Section 2 of the application. This response includes a replacement engineering report. The report includes a cover page, followed by Part O of the application which serves as a table of contents. The report is printed on 81/2 inch by 11 inch pages which are consecutively numbered. The report includes a body of the report and all appendices.

(e) Appendices submitted as part of an engineering report to support a permit application shall contain, where required under applicable sections of this rule;

1. **An operation plan and closure plan appropriate for the type of facility;**

Response: This permit application is for an expansion of the existing landfill gas collection system. There will be no change in the operation of the system except for the additional wells which will be operated like the exiting wells. The operation of the landfill gas collection system is described in the revised operation plan submitted with the Application for a minor modification to the landfill operation permit dated January 23, 2008.

2. **A contingency plan appropriate for the type of facility to cover operations interruptions and emergencies such as fires, explosions, or natural disasters;**

Response: This permit application is for an expansion of the existing landfill gas collection system. There will be no change in the contingency plan for the landfill gas collection system. The contingency plan for the landfill gas collection system is described in the revised operation plan submitted with the Application for a minor modification to the landfill operation permit dated January 23, 2008.

3. **Illustrative charts and graphs;**

Response: These documents as applicable are included in this engineering report.

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4. **Records or logs of tests, soil borings, hydrogeological information, geochemical surveys, water quality analyses; and**

Response: There are no records or logs of tests, soil borings, hydrogeological information, geochemical surveys or water quality analyses applicable to this project.

5. **Engineering calculations, including literature citations.**

Response: The relevant engineering calculations are included in the engineering report and the permit application.

(f) **Plans or drawings for all solid waste management facilities shall;**

1. **Use sheets 22 inches by 34 inches or 24 inches by 36 inches, and include title blocks;**
2. **Have a cover sheet that includes the project title, applicant's name, sheet index, legend of symbols, and the engineer's name, address, signature, date of signature and seal;**
3. **Include a regional map or plan showing the project location;**
4. **Include a current vicinity map, or aerial photograph taken within one year preceding the application;**
5. **Have a site plan containing the location of all property boundaries certified by a registered Florida land surveyor; and**
6. **Clearly show all necessary details and be numbered, titled, and referenced to the narrative report. Drawings shall contain a north arrow and horizontal and vertical scales, and shall specify drafting or origination dates. All elevations shall be referenced to National Geodetic Vertical Datum.**

Response: The drawings were included in Section 4 of the application. There has been no change in the landfill property boundaries from the drawing submitted as Drawing #3 in Appendix B of the Application dated December 31, 1997, prepared by HDR for renewal of the landfill operation permit No. 39884-001-SO issued July 28, 1999.

(g) **Documentation that the applicant either owns the property or has legal authorization from the property owner to use the site for a solid waste management facility; and**

Response: Documentation that Manatee County owns the property was submitted to the Department in the Operation Permit renewal application dated December 31, 1997 prepared and submitted by HDR for renewal of the landfill operation permit No. 39884-001-SO issued July 28, 1999.

(h) **For facilities owned or operated by a county, a description of the existing or proposed recycling facilities or activities, if any, at the site and a description of whether, and the extent to which, these recycling facilities or activities will**

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contribute to the county's achievements of the waste reduction and recycling goals contained in Section 403.706, F.S.

Response: This information is not applicable to this application for an expansion of the landfill gas collection system. There has been no change in the information submitted to the Department in the renewal of the Landfill Operation Permit in Part E 11 of Volume 1 of 2 of the application dated April 2004.

(i) For purposes of the evaluation required in subsection (3) of this section, a history and description of any enforcement actions described in subsection (3) of this section relating to solid waste management facilities in this state.

Response: There has been one enforcement action, Case #00-1305, related to an action taken by the Department because the Stage I landfill gas collection system was completed approximately two months late. The consent agreement required the applicant to complete an in-kind project with an estimated expenditure of $81,942. This project was completed, and is described in a November 27, 2002 letter to FDEP's Ms. Sheila Schneider, Air Program Enforcement Coordinator. The applicant has satisfied all the activities and reporting requirements of the consent agreement with the understanding that there will be four calendar years of monitoring and maintenance performed after completing of the project.

FAC Rule 62-701.330 Landfill Permit Requirements (3) Permit Applications. Permit applications for landfills shall meet the requirements of Rule 62-701.320, F.A.C., and shall also include the following specific requirements:

(a) A vicinity map or aerial photograph not more than one year old which shows land use and zoning within one mile of the landfill and is of sufficient scale to show all homes or other structures, water bodies, roads, and other significant features of the vicinity. All significant features shall be labeled.

(b) A vicinity map or aerial photograph not more than one year old which shows all airports that are located within five miles of the proposed landfill.

Response: There has been no change in the landfill location or the airports since this information was submitted in the renewal of the Landfill Operation Permit in Part F 2 of Volume 1 of 2 of the application dated April 2004. This information is shown on Figure F-3 of that application.

(c) A plot plan of the site showing dimensions, locations of proposed and existing water quality monitoring wells or points, locations of soil borings, proposed plan of trenching or disposal areas, original elevations, proposed final contours, any previously filled waste disposal area, and fencing. Cross sections shall be included on the plot plan or separate sheets showing both the original and proposed fill elevations. The scale of the plot plan shall not be greater than 200 feet to the inch.

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(d) Topographic maps at a scale of not greater than 200 feet to the inch with 5-foot contour intervals. These maps shall show the proposed fill area, any borrow area, access roads, grades required for proper drainage and cross sections of lifts, special drainage devices if necessary, fencing, and equipment facilities.

Response: This information as relevant is shown on the construction drawings in Section 4.

(e) A report on the:

1. Current and projected population and area to be served by the proposed site;

Response: This information was provided in the application form in Part A 12.

2. Anticipated type, annual quantity, and source of solid waste, expressed in tons;

Response: The type of anticipated wastes was given in the application form in Part B 8. The daily quantity of solid waste was given in the application form in Part A 17 as 1280 tons per day. The annual quantity in 2008 is estimated at 399,360 tons. The source of the solid waste was given in the application form in Part A 11.

3. Anticipated life of the facility; and

Response: The anticipated life of the facility was given in the application form in Part A 14.

4. Source and type of cover material.

Response: This application is for an expansion of the landfill gas collection system. There is no change in the source and type of cover material for the solid waste landfill from the information submitted in renewal of the Landfill Operation Permit in Part F 5 d) of Volume 1 of 2 of the application dated April 2004.

(f) The hydrogeological and geotechnical investigations required by Rule 62-701.410, F.A.C.

Response: For the expansion of the landfill gas collection system, there is no hydrogeological and geotechnical investigation required.

(g) The ground water monitoring plan required by Rule 62-701.510, F.A.C.

Response: This permit application is for an expansion of the landfill gas collection system. There is no change from the groundwater plan submitted in Part M of the Landfill Operation Permit renewal application in Volume 1 of 2 dated April 2004.

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(h) Evidence of an approved laboratory to do water quality monitoring in accordance with Chapter 62-160, F.A.C.

Response: This permit application is for an expansion of the landfill gas collection system. There is no change from the information submitted in Part M of the Landfill Operation Permit renewal application in Volume 1 of 2 dated April 2004.

(i) A statement of how the applicant will demonstrate financial responsibility for the closing and long-term care of the landfill.

Response: This permit application is for an expansion of the landfill gas collection system. There is no change from the information submitted in Part S of the Landfill Operation Permit renewal application in Volume 2 of 2 dated April 2004.

(j) Operational plan and drawings as required in Rule 62-701.500(2), (6), (7), (8), (9), (10), and (11), F.A.C.

Response: This permit application is for an expansion of the existing landfill gas collection system. There will be no change in the operation of the system except for the additional wells which will be operated like the exiting wells. The operation of the landfill gas collection system is described in the revised operation plan submitted with the Application for a minor modification to the landfill operation permit dated January 23, 2008.

b. Information required in Rule 62-701.600(4), FAC supplied where relevant and practical;

Response: Rule 62-701.600(4), FAC states: "(4) Closure report. A report on the final closure of the landfill shall address the following requirements, or shall contain explanation of why the requirement is not applicable." The Stage III Landfill gas collection system is not related to final closure of the landfill. We do not believe that the information required by this rule for final landfill closure is relevant or practical.

c. Estimate of current and expected gas generation rates and description of condensate disposal methods provided;

Response: The estimate of current and expected gas generation rates are given in Appendix A. The gas generation rates were calculated using the U.S. EPA LANDGEM model. These are the same calculations that were submitted as part of the application for renewal of the landfill operation permit in 2004, and the application for renewal of the Stage I Landfill closure permit which was submitted in May 2005. The Stage I and Stage III Landfill gas methane generation rate for 2009 is estimated by the LANDGEM model at 3.962 E+07 cubic meters per year. For 2015, the landfill gas methane generation rate is estimated at 4.402 E+07 cubic meters per year. The annual rates are converted to landfill gas flow rates at 50% methane of 5,324 Standard Cubic Feet per Minute (SCFM) in 2009 and 5,915 SCFM in 2015. These are theoretical generation rates. The capture rates for the landfill gas

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collection system at the Manatee County Landfill are less than the theoretical rates estimated by the LANDGEM model. The theoretical generation rates have to be calibrated based on the actual rates measured at the landfill gas flare, and the percent methane in the landfill gas. The June 2008 reading recorded at the landfill gas flare meter was 1314 SCFM at 55.1% methane. This is equivalent to a landfill gas flow rate of 1448 SCFM at 50% methane. The quarterly measurement of methane gas surface emissions shows no landfill gas leaking from the landfill thought the landfill surface. So there is no indication of the loss of landfill gas through the landfill surface. The quarterly measurement of the perimeter landfill gas monitoring probes indicates that no landfill gas is leaking through the soil. So there is no indication of the loss of landfill gas through the landfill invert either. Some methane gas generated in the landfill is broken down by other bacteria in the landfill, and is not captured in the landfill gas collection system. This explains some of the difference. Also the generation rate is affected by moisture. The Stage I Landfill is capped by 18 inches of soil and a layer of sod. This has decreased the rate of rainfall infiltration and reduced the landfill gas generation rate. The theoretical 2009 methane generation rate for the Stage I landfill as estimated by the LANDGEM model is 4900 SCFM. Since landfill gas collection system is capturing an estimated 1448 SCFM at 50% methane at the flair, we estimate that about 30% of the theoretical generation rate is actually being captured. So we estimate that the actual flow of landfill gas to the flare from the combined Stage I and Stage III Landfill will average 1597 SCFM in 2009 and 1775 SCFM in 2015 The flare is designed to burn a maximum of 3000 SCFM. Manatee County has two landfill gas utilization projects planned. The landfill gas will be utilized for the generation of electricity and the drying of biosolids. The flare will be used only if the two projects are down. So we believe the flare at 3000 SCFM is adequately sized for the flow of landfill gas from the Stage I and Stage III Landfill. Both the Stage I and Stage III Landfill gas collection systems have 18 inch diameter looped header pipes to convey the landfill gas to the flare. Each landfill is served by a separate 18" header pipe. We estimate the 18" diameter header pipe at a gas velocity of 20 feet per second has a capacity of 2120 SCFM. This is a total flow capacity of 4240 SCFM for both header pipes. We believe the header pipe has adequate capacity based on the current gas collection system readings.

The condensate collected in the landfill gas collection system will be drained to the leachate collection system.

d. Description of procedures for condensate sampling, analyzing and data reporting provided;

Response: The condensate from the Stage III Landfill gas collection system is collected at the low points in the header pipe and drained to the leachate collection system. The condensate collection and disposal for the Stage III Landfill is as currently done at the Stage I Landfill. There is no separate requirement for condensate sampling, analyzing and data reporting.

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;**

Response: Rule 62-701.400(10), FAC states: "(10) Gas control systems. Landfills that receive degradable wastes shall be designed and constructed with a gas management system that complies with the requirements of Rule 62-701.530, FAC." This engineering report and the application explain how the Stage III Landfill gas recovery system complies with Rule 62-701.530 FAC. The Stage III Landfill gas recovery system will be operated until there is no longer any biodegradation in the Stage III Landfill. When there is no longer any gas generated by the landfill, the wells will be capped or converted to vents.

f. **Performance bond provided to cover closure costs if not already included in other landfill closure costs.**

Response: The closure costs for the Stage III Landfill are already included in the other landfill closure costs.

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Appendix A

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METHANE.TXT

TABLE 0-1 LENA ROAD LANDFILL EXPECTED LANDFILL GAS GENERATION RATES

Source: C:\MANATE~1\MANATEE.PRM

Model Parameters

Lo : 170.00 m^3 / Mg
k : 0.0500 1/yr
NMOC : 4000.00 ppmv
Methane : 50.0000 % volume
Carbon Dioxide : 50.0000 % volume

Landfill Parameters

Landfill type : No Co-Disposal
Year Opened : 1978 Current Year : 2002 Closure Year: 2034
Capacity : 16070000 Mg
Average Acceptance Rate Required from
Current Year to Closure Year : 324912.00 Mg/year

Model Results

Year	Refuse In Place (Mg)	Methane Emission Rate (Mg/yr)	(Cubic m/yr)
1979	8.811E+04	4.997E+02	7.489E+05
1980	1.882E+05	1.043E+03	1.563E+06
1981	3.004E+05	1.628E+03	2.441E+06
1982	4.299E+05	2.283E+03	3.422E+06
1983	5.770E+05	3.006E+03	4.506E+06
1984	7.914E+05	4.075E+03	6.108E+06
1985	1.008E+06	5.105E+03	7.652E+06
1986	1.205E+06	5.973E+03	8.953E+06
1987	1.428E+06	6.946E+03	1.041E+07
1988	1.674E+06	8.002E+03	1.200E+07
1989	1.940E+06	9.121E+03	1.367E+07
1990	2.210E+06	1.021E+04	1.530E+07
1991	2.479E+06	1.123E+04	1.684E+07
1992	2.765E+06	1.231E+04	1.845E+07
1993	3.058E+06	1.337E+04	2.004E+07
1994	3.342E+06	1.433E+04	2.148E+07
1995	3.668E+06	1.548E+04	2.320E+07
1996	3.994E+06	1.657E+04	2.484E+07
1997	4.322E+06	1.762E+04	2.642E+07
1998	4.648E+06	1.861E+04	2.790E+07
1999	4.982E+06	1.960E+04	2.938E+07
2000	5.288E+06	2.038E+04	3.055E+07
2001	5.546E+06	2.085E+04	3.125E+07
2002	5.871E+06	2.167E+04	3.249E+07
2003	6.196E+06	2.246E+04	3.366E+07
2004	6.521E+06	2.321E+04	3.478E+07
2005	6.846E+06	2.392E+04	3.585E+07
2006	7.171E+06	2.459E+04	3.686E+07
2007	7.495E+06	2.524E+04	3.783E+07
2008	7.820E+06	2.585E+04	3.874E+07
2009	8.145E+06	2.643E+04	3.962E+07
2010	8.470E+06	2.698E+04	4.045E+07
2011	8.795E+06	2.751E+04	4.123E+07
2012	9.120E+06	2.801E+04	4.199E+07

2013	9.445E+06	2.849E+04	4.270E+07
2014	9.770E+06	2.894E+04	4.338E+07
2015	1.009E+07	2.937E+04	4.402E+07
2016	1.042E+07	2.978E+04	4.464E+07
2017	1.074E+07	3.017E+04	4.522E+07
2018	1.107E+07	3.054E+04	4.578E+07
2019	1.139E+07	3.090E+04	4.631E+07
2020	1.172E+07	3.123E+04	4.681E+07
2021	1.204E+07	3.155E+04	4.729E+07
2022	1.237E+07	3.185E+04	4.775E+07
2023	1.269E+07	3.214E+04	4.818E+07
2024	1.302E+07	3.242E+04	4.859E+07
2025	1.334E+07	3.268E+04	4.898E+07
2026	1.367E+07	3.293E+04	4.936E+07
2027	1.399E+07	3.316E+04	4.971E+07
2028	1.432E+07	3.339E+04	5.005E+07
2029	1.464E+07	3.360E+04	5.037E+07
2030	1.497E+07	3.381E+04	5.067E+07
2031	1.529E+07	3.400E+04	5.096E+07
2032	1.562E+07	3.419E+04	5.124E+07
2033	1.594E+07	3.436E+04	5.150E+07
2034	1.607E+07	3.340E+04	5.007E+07
2035	1.607E+07	3.177E+04	4.763E+07
2036	1.607E+07	3.023E+04	4.530E+07
2037	1.607E+07	2.875E+04	4.310E+07
2038	1.607E+07	2.735E+04	4.099E+07
2039	1.607E+07	2.601E+04	3.899E+07
2040	1.607E+07	2.475E+04	3.709E+07
2041	1.607E+07	2.354E+04	3.528E+07
2042	1.607E+07	2.239E+04	3.356E+07
2043	1.607E+07	2.130E+04	3.193E+07
2044	1.607E+07	2.026E+04	3.037E+07
2045	1.607E+07	1.927E+04	2.889E+07
2046	1.607E+07	1.833E+04	2.748E+07
2047	1.607E+07	1.744E+04	2.614E+07
2048	1.607E+07	1.659E+04	2.486E+07
2049	1.607E+07	1.578E+04	2.365E+07
2050	1.607E+07	1.501E+04	2.250E+07
2051	1.607E+07	1.428E+04	2.140E+07
2052	1.607E+07	1.358E+04	2.036E+07
2053	1.607E+07	1.292E+04	1.936E+07
2054	1.607E+07	1.229E+04	1.842E+07
2055	1.607E+07	1.169E+04	1.752E+07
2056	1.607E+07	1.112E+04	1.667E+07
2057	1.607E+07	1.058E+04	1.585E+07
2058	1.607E+07	1.006E+04	1.508E+07
2059	1.607E+07	9.570E+03	1.435E+07
2060	1.607E+07	9.104E+03	1.365E+07
2061	1.607E+07	8.660E+03	1.298E+07
2062	1.607E+07	8.237E+03	1.235E+07
2063	1.607E+07	7.836E+03	1.174E+07
2064	1.607E+07	7.453E+03	1.117E+07
2065	1.607E+07	7.090E+03	1.063E+07
2066	1.607E+07	6.744E+03	1.011E+07
2067	1.607E+07	6.415E+03	9.616E+06
2068	1.607E+07	6.102E+03	9.147E+06
2069	1.607E+07	5.805E+03	8.701E+06
2070	1.607E+07	5.522E+03	8.276E+06
2071	1.607E+07	5.252E+03	7.873E+06
2072	1.607E+07	4.996E+03	7.489E+06
2073	1.607E+07	4.753E+03	7.124E+06
2074	1.607E+07	4.521E+03	6.776E+06
2075	1.607E+07	4.300E+03	6.446E+06

2076	1.607E+07	4.091E+03	6.131E+06
2077	1.607E+07	3.891E+03	5.832E+06
2078	1.607E+07	3.701E+03	5.548E+06
2079	1.607E+07	3.521E+03	5.277E+06
2080	1.607E+07	3.349E+03	5.020E+06
2081	1.607E+07	3.186E+03	4.775E+06
2082	1.607E+07	3.030E+03	4.542E+06
2083	1.607E+07	2.883E+03	4.321E+06
2084	1.607E+07	2.742E+03	4.110E+06
2085	1.607E+07	2.608E+03	3.910E+06
2086	1.607E+07	2.481E+03	3.719E+06
2087	1.607E+07	2.360E+03	3.537E+06
2088	1.607E+07	2.245E+03	3.365E+06
2089	1.607E+07	2.135E+03	3.201E+06
2090	1.607E+07	2.031E+03	3.045E+06
2091	1.607E+07	1.932E+03	2.896E+06
2092	1.607E+07	1.838E+03	2.755E+06
2093	1.607E+07	1.748E+03	2.621E+06
2094	1.607E+07	1.663E+03	2.493E+06
2095	1.607E+07	1.582E+03	2.371E+06
2096	1.607E+07	1.505E+03	2.256E+06
2097	1.607E+07	1.431E+03	2.146E+06
2098	1.607E+07	1.362E+03	2.041E+06
2099	1.607E+07	1.295E+03	1.941E+06
2100	1.607E+07	1.232E+03	1.847E+06
2101	1.607E+07	1.172E+03	1.757E+06
2102	1.607E+07	1.115E+03	1.671E+06
2103	1.607E+07	1.060E+03	1.589E+06
2104	1.607E+07	1.009E+03	1.512E+06
2105	1.607E+07	9.595E+02	1.438E+06
2106	1.607E+07	9.127E+02	1.368E+06
2107	1.607E+07	8.682E+02	1.301E+06
2108	1.607E+07	8.259E+02	1.238E+06
2109	1.607E+07	7.856E+02	1.178E+06
2110	1.607E+07	7.473E+02	1.120E+06
2111	1.607E+07	7.108E+02	1.065E+06
2112	1.607E+07	6.762E+02	1.014E+06
2113	1.607E+07	6.432E+02	9.641E+05
2114	1.607E+07	6.118E+02	9.171E+05
2115	1.607E+07	5.820E+02	8.723E+05
2116	1.607E+07	5.536E+02	8.298E+05
2117	1.607E+07	5.266E+02	7.893E+05
2118	1.607E+07	5.009E+02	7.508E+05
2119	1.607E+07	4.765E+02	7.142E+05
2120	1.607E+07	4.532E+02	6.794E+05
2121	1.607E+07	4.311E+02	6.462E+05
2122	1.607E+07	4.101E+02	6.147E+05
2123	1.607E+07	3.901E+02	5.847E+05
2124	1.607E+07	3.711E+02	5.562E+05
2125	1.607E+07	3.530E+02	5.291E+05
2126	1.607E+07	3.358E+02	5.033E+05
2127	1.607E+07	3.194E+02	4.787E+05
2128	1.607E+07	3.038E+02	4.554E+05
2129	1.607E+07	2.890E+02	4.332E+05
2130	1.607E+07	2.749E+02	4.121E+05
2131	1.607E+07	2.615E+02	3.920E+05
2132	1.607E+07	2.487E+02	3.728E+05
2133	1.607E+07	2.366E+02	3.547E+05
2134	1.607E+07	2.251E+02	3.374E+05
2135	1.607E+07	2.141E+02	3.209E+05
2136	1.607E+07	2.037E+02	3.053E+05
2137	1.607E+07	1.937E+02	2.904E+05
2138	1.607E+07	1.843E+02	2.762E+05

2139	1.607E+07	1.753E+02	2.627E+05
2140	1.607E+07	1.667E+02	2.499E+05
2141	1.607E+07	1.586E+02	2.377E+05
2142	1.607E+07	1.509E+02	2.261E+05
2143	1.607E+07	1.435E+02	2.151E+05
2144	1.607E+07	1.365E+02	2.046E+05
2145	1.607E+07	1.299E+02	1.946E+05
2146	1.607E+07	1.235E+02	1.852E+05
2147	1.607E+07	1.175E+02	1.761E+05
2148	1.607E+07	1.118E+02	1.675E+05
2149	1.607E+07	1.063E+02	1.594E+05
2150	1.607E+07	1.011E+02	1.516E+05
2151	1.607E+07	9.620E+01	1.442E+05
2152	1.607E+07	9.151E+01	1.372E+05
2153	1.607E+07	8.705E+01	1.305E+05
2154	1.607E+07	8.280E+01	1.241E+05
2155	1.607E+07	7.876E+01	1.181E+05
2156	1.607E+07	7.492E+01	1.123E+05
2157	1.607E+07	7.127E+01	1.068E+05
2158	1.607E+07	6.779E+01	1.016E+05
2159	1.607E+07	6.448E+01	9.666E+04
2160	1.607E+07	6.134E+01	9.194E+04
2161	1.607E+07	5.835E+01	8.746E+04
2162	1.607E+07	5.550E+01	8.319E+04
2163	1.607E+07	5.280E+01	7.914E+04
2164	1.607E+07	5.022E+01	7.528E+04
2165	1.607E+07	4.777E+01	7.161E+04
2166	1.607E+07	4.544E+01	6.811E+04
2167	1.607E+07	4.323E+01	6.479E+04
2168	1.607E+07	4.112E+01	6.163E+04
2169	1.607E+07	3.911E+01	5.863E+04
2170	1.607E+07	3.720E+01	5.577E+04
2171	1.607E+07	3.539E+01	5.305E+04
2172	1.607E+07	3.366E+01	5.046E+04
2173	1.607E+07	3.202E+01	4.800E+04
2174	1.607E+07	3.046E+01	4.566E+04
2175	1.607E+07	2.897E+01	4.343E+04
2176	1.607E+07	2.756E+01	4.131E+04
2177	1.607E+07	2.622E+01	3.930E+04
2178	1.607E+07	2.494E+01	3.738E+04
2179	1.607E+07	2.372E+01	3.556E+04
2180	1.607E+07	2.257E+01	3.382E+04
2181	1.607E+07	2.147E+01	3.217E+04
2182	1.607E+07	2.042E+01	3.061E+04
2183	1.607E+07	1.942E+01	2.911E+04
2184	1.607E+07	1.848E+01	2.769E+04
2185	1.607E+07	1.757E+01	2.634E+04
2186	1.607E+07	1.672E+01	2.506E+04
2187	1.607E+07	1.590E+01	2.384E+04
2188	1.607E+07	1.513E+01	2.267E+04
2189	1.607E+07	1.439E+01	2.157E+04
2190	1.607E+07	1.369E+01	2.052E+04
2191	1.607E+07	1.302E+01	1.951E+04
2192	1.607E+07	1.238E+01	1.856E+04
2193	1.607E+07	1.178E+01	1.766E+04
2194	1.607E+07	1.121E+01	1.680E+04
2195	1.607E+07	1.066E+01	1.598E+04
2196	1.607E+07	1.014E+01	1.520E+04
2197	1.607E+07	9.645E+00	1.446E+04
2198	1.607E+07	9.174E+00	1.375E+04
2199	1.607E+07	8.727E+00	1.308E+04
2200	1.607E+07	8.301E+00	1.244E+04
2201	1.607E+07	7.897E+00	1.184E+04

2202	1.607E+07	7.511E+00	1.126E+04
2203	1.607E+07	7.145E+00	1.071E+04
2204	1.607E+07	6.797E+00	1.019E+04
2205	1.607E+07	6.465E+00	9.691E+03
2206	1.607E+07	6.150E+00	9.218E+03
2207	1.607E+07	5.850E+00	8.769E+03
2208	1.607E+07	5.565E+00	8.341E+03
2209	1.607E+07	5.293E+00	7.934E+03
2210	1.607E+07	5.035E+00	7.547E+03
2211	1.607E+07	4.790E+00	7.179E+03
2212	1.607E+07	4.556E+00	6.829E+03
2213	1.607E+07	4.334E+00	6.496E+03
2214	1.607E+07	4.122E+00	6.179E+03
2215	1.607E+07	3.921E+00	5.878E+03
2216	1.607E+07	3.730E+00	5.591E+03
2217	1.607E+07	3.548E+00	5.318E+03
2218	1.607E+07	3.375E+00	5.059E+03
2219	1.607E+07	3.211E+00	4.812E+03
2220	1.607E+07	3.054E+00	4.578E+03
2221	1.607E+07	2.905E+00	4.354E+03
2222	1.607E+07	2.763E+00	4.142E+03
2223	1.607E+07	2.629E+00	3.940E+03
2224	1.607E+07	2.500E+00	3.748E+03
2225	1.607E+07	2.378E+00	3.565E+03
2226	1.607E+07	2.262E+00	3.391E+03
2227	1.607E+07	2.152E+00	3.226E+03
2228	1.607E+07	2.047E+00	3.068E+03
2229	1.607E+07	1.947E+00	2.919E+03
2230	1.607E+07	1.852E+00	2.776E+03
2231	1.607E+07	1.762E+00	2.641E+03
2232	1.607E+07	1.676E+00	2.512E+03
2233	1.607E+07	1.594E+00	2.390E+03

SECTION
3

Dept. of Environment Protection
FEB 07 2008
Southwest District

LENA ROAD LANDFILL

CONTRACT FOR
STAGE III LANDFILL GAS COLLECTION SYSTEM

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

SECTION 01005

GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE AND INTENT

A. Description

The work to be done consists of the furnishing of all labor, materials, and equipment and the performance of all work included in this Contract.

B. Work Included

The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, shop drawings, working drawings and other means of construction necessary or proper for performing and completing the work. He shall obtain and pay for all required permits necessary for the work other than the Florida Department of Environmental Protection Landfill Closure Permit. He shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer and Owner, and in strict accordance with the Contract Documents. The Contractor shall clean up the work and maintain it during and after construction, until accepted, and shall do all work and pay all costs incidental thereto. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

The cost of incidental work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.

The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials, and equipment, prior approval of the Engineer notwithstanding.

1.02 PLANS AND SPECIFICATIONS

A. Plans

When obtaining data and information from the Plans, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small scale drawings.

B. Copies Furnished to Contractor

The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

C. Supplementary Drawings

When, in the opinion of the Engineer, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the Engineer and five paper prints thereof will be given to the Contractor.

D. Contractor to Check Plans and Data

The Contractor shall verify all dimensions, quantities, and details shown on the Plans, Supplementary Drawings, Schedules, Specifications, or other data received from the Engineer, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction, or improper operation resulting there from nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

E. Specifications

The Technical Specifications consist of three parts: General, Products, and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

F. Intent

All work called for in the Specifications applicable to this Contract, but not shown on the Plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Plans or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

The inclusion of the Related Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

The names of proposed manufacturers, material men, suppliers and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer for approval. Such approval must be obtained before shop drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Contract unless he shall be of good reputation and have a plant of ample capacity. He shall, upon the request of the Engineer, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

B. Delivery

The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories

The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled, and equipped with good grade cylinder locks and duplicate keys.

D. Installation of Equipment.

The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character.

Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the Engineer during installation. All equipment shall be correctly aligned, leveled, and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

E. Service of Manufacturer's Engineer

The Contract prices for equipment shall include the cost of furnishing (as required by equipment specifications sections) a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation the equipment in conformity with the Contract Documents. After the equipment is placed in permanent operation by the Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General

Inspection and testing of materials will be performed by the Owner unless otherwise specified.

For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Three (3) copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the Owner.

The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

B. Costs

All inspection and testing of materials furnished under this Contract will be performed by the Owner or duly authorized inspection engineers or inspections bureaus without cost to the Contractor, unless otherwise expressly specified.

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.

Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Owner for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests on materials and equipment which are rejected for non-compliance.

C. Certificate of Manufacture

When inspection is waived or when the Engineer so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the work have been manufactured and tested in conformity

with the Contract Documents. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences

If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the Engineer, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The Engineer shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

1.06 TEMPORARY SERVICES

A. First Aid

The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the work.

1.07 LINES AND GRADES

A. Grade

All work under this Contract shall be constructed in accordance with the lines and grades shown on the Plans, or as given by the Owner/Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor. The grades shown on the drawings for piping and ditches are minimum grades. The soil component thicknesses shown on the drawings are minimum thicknesses. The soil thicknesses for cover over pipes shown on the drawings are minimum thicknesses. The pipe dimensions shown on the drawings are nominal dimensions per ASTM Standards.

B. Safeguarding Marks

The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes and marks.

The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

C. Datum Plane

All elevations indicated or specified refer to the Mean Sea Level Datum of the NGVD 1929 Datum and/or NAVD 1988.

1.08 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights

During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" signs at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public.

B. Smoke Prevention

A strict compliance with ordinances regulating the production and emission of smoke will be required. No open fires will be permitted.

C. Noise

The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers. In the vicinity of hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

Except in the event of an emergency, no work shall be done between the hours of 7:00 P.M. and 7:00 A.M. If the proper and efficient prosecution of the work requires operations during the night, the written permission of the Owner shall be obtained before starting such items of the work.

D. Dust prevention

The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all times.

1.09 CUTTING AND PATCHING

The Contractor shall do all cutting, fitting or patching of his portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the Engineer and in accordance with the Plans and Specifications. The work must be done by competent workmen skilled in the trade required by the restoration.

1.10 CLEANING

A. During Construction

During construction of the work, the Contractor shall, at all times, keep the site of the work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the Engineer, such material, debris, or rubbish constitutes a nuisance or is objectionable.

The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.

B. Final Cleaning

At the conclusion of the work, all equipment, tools, temporary structures, and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished, and new operating condition.

1.11 MISCELLANEOUS

A. Protection Against Siltation and Bank Erosion

1. The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches.
2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as directed by the Engineer which results from his construction operations.

B. Existing Facilities

The work shall be so conducted to maintain existing facilities in operation insofar as is possible. The flare shall be kept in operation at all times.

C. Use of Chemicals

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

D. Spill Prevention, Control and Reporting

The contractor shall take care to prevent fuel spills, and shall have a training program and plan for the prevention and control of spills. Fuel spills shall be reported, and cleaned up per F.A.C. Chapter 62-770 Petroleum Contamination Site Cleanup Criteria. Temporary storage tanks for the project shall meet F.A.C. Chapter 62-762 Above Ground Storage Tank System as applicable.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDED

A. The work included in this contract consists of the construction of the Lena Road Landfill Stage IIII Landfill Gas Collection System which involves expanding the existing landfill gas collection system. The landfill gas collection system expansion consists of installing the landfill gas extraction wells in the landfill, the well heads, collection pipes including the laterals and headers and connecting the header to the existing header pipe connection at the existing flare. The Contractor shall phase his work such that the landfill gas flare is kept in operation. Work includes start-up and testing of each well, balancing the new gas extraction wells with the existing system so the final system is in complete operation at the end of the project. The Contractor shall operate the landfill gas collection system for a minimum of thirty days such that there is negative vacuum to each well. The Contractor shall be responsible for sodding all disturbed areas, and watering the sod until the sod is established. The Owner will provide the Contractor with reuse water from the adjacent wastewater plant for watering the sod.

B. The Contractor shall furnish all shop drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all work required by these Specifications and as shown on the Contract Drawings.

C. The Contractor shall perform the work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by the Owner.

D. The Contractor shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the Contract Documents or not.

1.02 WORK SEQUENCE

A. All work for this project will be done under this Contract, and shall be done with a minimum of inconvenience to the users of the landfill.

B. The Contractor shall, if necessary and feasible, construct the work in stages to accommodate the Owner's use of the premises during the construction period; coordinate the construction schedule and operations with the Owner's Representative.

1.03 CONSTRUCTION AREAS

A. The Contractor shall: Limit his use of the construction areas for work and for storage, to allow for:

1. Works by other Contractors.
2. Owner's Use.
3. Public Use.

B. Coordinate use of work site under direction of Engineer or Owner's Representative.

C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

D. Move any stored products under the Contractor's control, which interfere with operations of the Owner or separate contractor.

1.04 OWNER OCCUPANCY

A. It is assumed that portions of the Work will be completed prior to completion of the entire Work. Upon completion of construction of each individual section, including testing, the section may be connected to the landfill gas collection system and landfill gas sent to the flare. The Owner will accept the entire work as a whole when it is completed, tested and approved by the Engineer and Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01015

CONTROL OF WORK

PART 1 GENERAL

1.01 WORK PROGRESS

The Contractor shall furnish personnel and equipment which will be efficient, appropriate and adequately sized to secure a satisfactory quality of work and a rate of progress which will ensure the completion of the work within the time stipulated in the Contract. If at any time such personnel appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 WORK LOCATIONS

Work shall be located substantially as indicated on the drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.03 PROCEDURES FOR IDENTIFYING, PROTECTING AND REPAIRING THE SLURRY WALL

A. The approximate location of the slurry wall is shown on the drawings. The contractor shall locate and identify the slurry wall, and flag or mark on the ground the location of the slurry wall when working in the area. The Contractor shall take care to protect the slurry wall by bracing the excavation when excavating near the slurry wall. If the slurry wall is damaged, the Contractor shall repair the slurry wall.

B. The slurry wall shall be repaired by mixing powered sodium bentonite with Protective Cover Soil (Silty Sand) at a ratio of 10% bentonite to 90% Protective Cover Soil by volume. This mixture shall be used for backfill in the area where the slurry wall must be repaired. The backfill shall be compacted to 98% Modified Proctor at plus or minus 2% of the optimum moisture content, and the repaired section shall be a minimum of 5-feet wide. The QA monitor shall observe and photograph the mixing, backfilling and compacting. A detailed report shall be submitted with the construction certification documentation for each slurry wall section damaged and repair.

C. One compaction test shall be taken at each repair location, or every 10 cubic yards. One sample of slurry wall repair material shall be taken at random from the in-place, compacted slurry wall repair using a Shelby tube, or other approved sampling

method. The sample shall be tested in the laboratory for permeability per ASTM D5084-03 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter – Method A. The sample shall have a minimum permeability of $1x10^{-7}$ cm/sec. Test results shall be submitted to FDEP with the certification of construction completion. The sample hole shall be backfilled will bentonite, or bentonite/slurry wall repair material.

1.04 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of open trench, prohibiting stacking excavated material and requiring that the trench shall not remain open overnight.

B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be barricaded and well lighted at all times when construction is not in progress.

1.05 TEST PITS

Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after location and the surface shall be restored in a manner equal or better than the original condition. No separate payment will be made.

1.06 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition equal or better to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the Engineer.

C. Along the location of this work, all physical features shall be protected and restored in a thoroughly workmanlike manner unless otherwise shown on the drawings. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and sodded to equal or exceed original conditions.

1.07 MAINTENANCE OF TRAFFIC

A. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, Contractor shall, at his own expense, provide normal traffic flow during extended construction stoppage. Extended stoppage will be defined by the Engineer.

B. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other safety measures which are satisfactory to the Engineer and Owner.

C. Detours around construction areas will be subject to the approval of the Owner and the Engineer. Where detours are permitted, the contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the Contractor shall expedite construction operations and periods when traffic is being detoured, will be strictly controlled by the Owner.

1.08 WATER FOR CONSTRUCTION PURPOSES

A. Reuse water is available for the Contractor from the adjacent wastewater treatment plant by way of an effluent waster water pipeline.

1.09 CLEANUP

During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residues resulting from the construction work and at the conclusion of the work; he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.

1.10 COOPERATION WITHIN THIS CONTRACT

A. All firms or person authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

1.11 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.

B. All newly constructed work or existing work such as landfill gas wells, well heads, pipes, storm water inlets, energy dissipaters, groundwater monitoring wells, landfill gas monitoring probes, etc. shall be protected in a manner approved by the Engineer. Should any newly constructed work be damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the warranty period described in the Contract.

1.12 PROCEDURE IF WASTE IS ENCOUNTERED DURING EXCAVATIONS

A. If waste is encountered during excavations such as for pipelines, test pits, borings for gas wells, etc., the waste shall be loaded into a truck and hauled to the working face of the active landfill for disposal. No waste shall be returned to any excavation or boring. No waste shall be left exposed over night. Before the end of each work day, all waste excavated that day shall be hauled to the working face for disposal prior to Manatee County placing the initial cover over the solid waste received for that day.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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Revised 4/17/08

SECTION 01030

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SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS

Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the Owner to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the Engineer. The costs for obtaining all permits shall be borne by the Contractor.

1.02 CONNECTIONS TO EXISTING SYSTEM

The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Owner/Engineer. The cost for this work and for the actual connection to the existing systems shall be included in the price bid for the project and shall not result in any additional cost to the Owner. The termination point for each contract shall be as shown on the Contract Drawings.

1.03 RELOCATIONS

The Contractor shall be responsible for the coordination of the relocation of structures, including but not limited to light poles, power poles, signs, sign poles, fences, piping, conduits and drains that interfere with the positioning of the work as set out on the Drawings. No relocation of the items under this Contract shall be done without approval from the Engineer.

1.04 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various water, sewer, gas, telephone, electrical, or other utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the existing lines. Cost for relocation of all existing lines shall be included in the price bid for the project. Should damage occur to an existing line, the Contractor shall bear the cost of all repairs.

B. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the close proximity of excavation, are temporarily stayed in position while work proceeds in the vicinity of the pole and that

the utility or other companies concerned be given reasonable advance notice of any such excavation by the Contractor.

C. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered. The Contractor shall be responsible for notifying the various utility companies to locate their respective utilities in advance of construction in conformance with all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

D. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown on the Drawings are disturbed, the Contractor shall notify the Engineer of the location of the pipeline or utility and shall reroute or relocate the pipeline or utility as directed. Cost for relocation of existing pipelines or utilities shall be included in the price bid for the project.

E. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the Engineer and/or the owner of the utility.

F. It is intended that wherever existing utilities such as water, sewer, gas, telephone, electrical, or other service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated in the Drawings. However, when in the opinion of the Engineer this procedure is not feasible, he may direct the use of fittings for a utilities crossing as detailed on the Drawings. No deflections will be allowed in gravity sanitary sewer lines or in existing storm sewer lines.

1.05 SUSPENSION OF WORK DUE TO WEATHER

The contractor shall suspend work due to inclement weather such as rainstorms, thunderstorms, threat of lightening, hurricanes, etc., or when the weather impairs the quality of the work. (Revised 4/17/08)

1.06 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the Engineer and Owner a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the Owner in case of a hurricane warning.

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B. In the event of inclement weather, or whenever Engineer shall direct, Contractor shall insure that he and his Subcontractors shall carefully protect work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any portion of work or materials is damaged due to the failure on the part of the Contractor or Subcontractors to protect the work, such work and materials shall be removed and replaced at the expense of the Contractor.

1.07 POWER SUPPLY

Electricity as may be required for construction and permanent power supply shall be secured and purchased by the Contractor.

1.08 SALVAGE

Any existing equipment or material, including, but not limited to, valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the Engineer or Owner and if so shall be protected for a reasonable time until picked up by the Owner. Any equipment or material not worthy of salvaging, as directed by the Engineer, shall be disposed of by the Contractor at no additional cost.

1.09 DEWATERING

A. The Contractor shall do all groundwater pumping necessary to prevent flotation of any part of the work during construction operations with his own equipment.

B. The Contractor shall pump out water and wastewater which may seep or leak into the excavations for the duration of the Contract and with his own equipment. He shall dispose of this water by pumping it to the nearest leachate manhole for disposal with the landfill leachate. (Revised 4/17/08)

1.10 ADDITIONAL PROVISIONS

A. Before commencing work on any of the existing pipelines, structures or equipment, the Contractor shall notify the Engineer, in writing, at least 10 calendar days in advance of the date he proposes to commence such work.

B. The Contractor shall provide, at his own expense, all necessary temporary facilities for access to and for protection of, all existing facilities. The Owner's personnel must have ready access at all times to the existing facilities. The Contractor is responsible for all damage to existing structures, equipment and facilities caused by his construction operations and must repair all such damage when and as ordered by the Engineer.

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1.11 CONSTRUCTION CONDITIONS

The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) and/or agency (ies) having jurisdiction over the work. Wherever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must meet Manatee County Ordinance #87-34, (which amends Ordinance 81-3, The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or County for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to, contract time and contract price.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.13 WARRANTIES

A. All material supplied under these Specifications shall be warranted by the Contractor and the manufacturers for a period of three (3) years. Warranty period shall commence on the date of Owner acceptance.

B. The material shall be warranted to be free from defects in workmanship, design and materials. If any part of the system should fail during the warranty period, it shall be replaced at no expense to the Owner.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining warranties from each of the respective suppliers or manufacturers for all the material specified under these contract specifications,

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Owner or Engineer shall schedule the pre-construction meeting, periodic progress meetings and special meetings, if required, throughout progress of work.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 PRE-CONSTRUCTION MEETING

A. Attendance:

1. Owner's Engineer.
2. Owner's Project Manager
3. Contractor.
4. Resident Project Representative.
5. Related Labor Contractor's Superintendent.
6. Major Subcontractors.
7. Major Suppliers.
8. Others as appropriate.

B. Suggested Agenda:

1. Distribution and discussion of:

    a. List of major subcontractors.
    b. Projected Construction Schedules.
    c. Coordination of Utilities

2. Critical work sequencing.

3. Project Coordination.

    a. Designation of responsible personnel.
    b. Emergency contact persons with phone numbers.

4. Procedures and processing of:
   a. Field decisions.
   b. Submittals.
   c. Change Orders.
   d. Applications for Payment.

5. Procedures for maintaining Record Documents.

6. Use of premises:
   a. Office, work and storage areas.
   b. Owner's REQUIREMENTS.

7. Temporary utilities.
8. Housekeeping procedures.
9. Liquidated damages.
10. Equal Opportunity Requirements.
11. Laboratory testing.
12. Job meetings.

1.03 PROGRESS MEETINGS

A. Schedule regular meetings. The progress meetings will be held weekly or less with the first meeting 30 days after the pre-construction meeting, or seven days after the notice to proceed, which ever is sooner. The Contractor, Resident Project Representative, Design Engineer and Owner must be represented at the weekly progress meetings. Subcontractors as needed shall also be represented.

B. Hold special meetings as required.

C. The Resident Project Representative shall meet daily with the Contractor's Superintendent to review the progress of the project.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 02221

TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, surveying and incidentals necessary to perform all excavation, backfill, compaction, grading, trench protection or other related work required to complete the piping work shown on the Drawings and specified herein.

B. Prior to commencing work, the Contractor shall examine the site and undertake his own subsurface investigations if needed, and take into consideration all conditions that may affect his work.

1.02 PROTECTION

A. Sheeting and Bracing in Excavations:

1. If needed, the Contractor shall properly construct sheeting and bracing as required to support the sides of excavations to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures from undermining or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

B. Drainage

1. The Contractor shall construct and place all pipelines, bedding and cover in-the-dry.

2. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until pipes have been completed. Any water that collects in the excavation shall be pumped to the nearest leachate collection manhole.

3. The Contractor shall furnish all materials and equipment to perform all work required for handling water that may be encountered during construction of pipelines.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials for use as backfill shall be described below. For each material, the Contractor shall notify the Engineer of the source of the material and shall furnish the Engineer, for approval, a representative sample weighing approximately 50 pounds.

2. Additional materials shall be furnished as required from off-site sources and hauled to the site.

B Common Fill

1. Common fill material used in trenches for backfill shall be free from organic matter, muck or marl and rock exceeding 1/2" in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials.

2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer, is not suitable for reuse or is contaminated with solid waste shall be hauled to the working face of the on-site Stage III landfill by the Contractor for disposal.

C. Pipe Bedding

1. Coarse aggregate shall be used for pipe bedding at locations indicated on the Drawings.

2. Coarse aggregate for pipe bedding shall be size No. 57 or No.7 with gradation as noted in Table 1 of Section 901 of Florida Department of Transportation, Construction of Roads and Bridges.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION, BACKFILLING AND COMPACTION

A. Excavation for all trenches required for the installation of pipes shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for placing the pipe bedding and laying the pipe within the trenches.

B. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with compacted pipe bedding material to the mid-diameter of the pipe.

C. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with common fill and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe.

D. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.

E. The remainder of the trench above the compacted backfill, as just described above shall be filled and thoroughly compacted.

F. Trench backfill shall be placed in layers not to exceed nine inches in depth as measured before compaction. Each layer shall be compacted to at least 95 percent of the maximum density as determined by AASHTO T-180.

3.02 PIPELINE GRADE

A. Pipelines shall follow the grades as shown on the drawings. If invert elevations or slopes are not given, then the pipeline shall follow the grade of the landfill. The minimum slope for all landfill gas collection pipes is 2%, and for storm water pipes it is 4%. Minute adjustments in lines or grades may be made if found necessary as the work progresses due to discrepancies in the landfill topography or in order to obtain satisfactory construction, but in no case shall the slopes be less than the minimum specified.

B. The record drawings shall include a final survey of all pipes installed with record elevations taken at a minimum of 100 ft apart along the pipe or at any change in slope.

END OF SECTION

SECTION 02276

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of the provision, maintenance and removal of temporary erosion and sedimentation controls as necessary.

B. Temporary erosion controls include, but are not limited to mulching, netting, watering, and sodding on-site surfaces and ditches to ensure that erosion during construction will be controlled to keep eroded soils within the limits of construction.

C. Temporary sedimentation controls include, but are not limited to silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces and in ditches to ensure that sedimentation during construction will be controlled to keep eroded soils within the limits of construction.

D. The Contractor is responsible for providing effective temporary erosion and sediment control measures as needed during construction or until final controls become effective.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Netting - fabricated.

B. Sod.

C. Mulch

2.02 SEDIMENTATION CONTROL

A. Bales - clean, seed-free cereal hay type.

B. Netting - fabricated of material acceptable to the Owner.

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Minimum procedures in problem areas shall be:

1. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.
2. Apply netting over mulched areas on sloped surfaces if needed.
3. Place sod in problem areas, stake on slopes if necessary to keep the sod in place and water.

3.02 SEDIMENTATION CONTROL

A. The Contractor shall install and maintain silt dams, traps, barriers, and appurtenances as needed during construction to keep eroded soils within the limits of construction.

3.03 PERFORMANCE

A. The Contractor, at his own expense, shall immediately take whatever steps are necessary to correct any deficiencies of the temporary erosion and sediment control measures employed if they fail to keep eroded soils within the limits of construction.

END OF SECTION

SECTION 02485

SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials and equipment necessary to place sod in the areas designated on the drawings, and satisfactorily return all disturbed areas to their original conditions.

B. Work shall include furnishing and placing sod, fertilizing, planting, watering and maintenance until the sod is established and accepted by Engineer/Owner.

1.02 QUALITY ASSURANCE

A. Requirements

It is the intent of this Specification that the Contractor is obliged to deliver a satisfactory stand of grass. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering and sodding at no additional cost to the Owner until a satisfactory stand is obtained. A satisfactory stand of grass is herein defined as full cover over sodded areas free of weeds, alive and growing with no bare spots.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fertilizer

The fertilizer shall be of the slow-release type meeting the following minimum requirements: 12 percent nitrogen, 8 percent phosphorus, 8 percent potassium; 40 percent other available materials derived from organic sources. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source, which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Sodding

Sod shall be provided as required on the construction drawings or at locations as directed by the Engineer in accordance with Florida Department of Transportation,

Specifications Section 575 and 981. The Contractor shall furnish Bahia grass sod. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575, except that no additional payment will be made for placement and/or watering. This cost shall be included in the Contract price bid for sodding.

E. Water

Reuse water is available on-site from an effluent pipeline coming from the adjacent Manatee County Wastewater Treatment plant, and is suitable for use in watering the sod. The Contractor shall furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of sod as may be required to establish the sod.

PART 3 EXECUTION

3.01 INSTALLATION

A. When the surfaces are ready, the Contractor shall commence work placing sod including fine grading as necessary and as directed by the Engineer.

B. Finish Grading

Areas to be sodded shall be finish graded and debris removed. Soft spots and uneven grades shall be eliminated. The Engineer shall approve the finish grade of all areas to be sodded prior to sod placement.

C. Protection

Sodded areas shall be protected against traffic or other use by placing warning signs or erecting barricades as necessary. The Contractor as directed by the Engineer shall repair any areas damaged prior to acceptance by the Owner.

3.02 CLEANUP

Soil or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of sodding operations, all excess soil, stones and debris remaining shall be removed from the construction areas.

3.03 SOD MAINTENANCE

Maintain landscape work for a period of 90 days immediately following complete installation of work or until Owner accepts project. Watering, weeding, cultivating, restoration of grade, mowing and trimming, protection from insects and diseases,

fertilizing and similar operations as needed to ensure normal growth and good health for sod shall be included at no additional cost to the Owner.

3.04 REPAIRS TO SODDED AREAS DISTURBED BY CONTRACTOR'S OPERATORS

Sodded areas planted under this Contract and all existing sodded areas damaged by the Contractor's operation shall be repaired at once by proper soil preparation, fertilizing and sodding, in accordance with these Specifications.

END OF SECTION

SECTION 02610

LANDFILL GAS WELL AND WELLHEAD

PART 1 GENERAL

1.01 SCOPE OF APPLICATION

A. Supply all equipment, materials, and labor needed to install landfill gas (LFG) extraction wells and wellheads as specified herein and as indicated on the Drawings.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

2. ASTM C702 - Standard Practice for Reducing Field Samples of Aggregate to Testing Size.

3. ASTM D1557 - Standard Test Method of Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.54 kg) Rammer and 18-inch (457 mm) Drop.

4. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes.

5. ASTM D2488 - Standard Practice for Description of Soils (Visual-Manual Procedure).

6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

7. ASTM 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.03 SUBMITTALS

A. Submit to the Engineer Certificates of Compliance on materials furnished, and manufacturer's brochures containing complete information and instructions

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pertaining to the storage, handling, installation, and inspection of pipe and appurtenances furnished.

B. The Contractor shall submit to the Engineer samples of all well backfill materials furnished.

C. The Contractor shall keep detailed well logs and construction diagrams for all wells drilled, including the elevation at top of ground, total depth of the well, the static water level, the temperature of spoils, depth, thickness, and description of soil or waste strata and the occurrence of any water-bearing zones. Well logs shall be submitted to the Engineer.

1.04 SITE CONDITIONS

A. Obstructions and saturated conditions such as asbestos, sludge, concrete, steel and other solid wastes are sometimes encountered when drilling in a landfill, many of which can be drilled through. Contractor is expected to make reasonable effort to drill through obstructions and saturated conditions and will be paid for offset re-drilling and boring abandonment only with prior approval in writing by Owner. Contractor will be paid for abandonment of abandoned hole and for well installation at new location.

PART 2 PRODUCTS

2.01 AGGREGATE

A. The aggregate shall be non-calcareous washed well graded granite that is a natural stone with a gradation as given in FDOT Standard Specifications for Road and Bridge Construction (Latest Edition) Section 901 Table 1 Size Number 2 or 3 as summarized below:

Amounts Finer than Each Laboratory Sieve, weight percent

Size #	3-in.	2 ½-in	2-in	1 ½-in	1-in.	¾-in	½-in
2	100	90 to 100	35 to 70	0 to 15	-	0 to 5	-
3	-	100	90-100	35-70	0-15	-	0-5

Revised June 18, 2008

B. The granite shall be that as specified in FDOT Standard Specifications for Road and Bridge Construction (Latest Edition) Section 901-2.2. The granite shall be a coarse aggregate produced from the crushing of granites that are sound and durable. The Los Angeles Abrasion requirement of FDOT 901-1.3 is modified to permit a maximum loss up to 50 (FM 1-T 096). Maximum amount of mica schist permitted is five percent (AASHTO T 189).

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2.02 BENTONITE WELL SEAL

A. The landfill gas extraction well shall be sealed using 3/8" bentonite chips. The bentonite chips shall be placed dry in the well at the depths indicated on the drawings, and water added to the well to hydrate the bentonite chips in place.

2.03 SOLID WALL PIPE

A. All pipe and fittings shall be high-density polyethylene pipe (HDPE), SDR 11. Refer to Section 15051 for HDPE pipe.

2.04 PERFORATED PIPE

A. Perforations in HDPE extraction well piping shall be 5/8-inch diameter hole spaced 90 degrees around the circumference of the pipe, and 3 inches on center along the pipe, and approximately 16 holes per foot.

2.05 WELL HEADS

A. The well head is a CES Landtec Accu-Flo Model 200 standard wellhead with flex hose and couplings.

PART 3 EXECUTION

3.01 DRILLING

A. Extraction wells are to be 36-inch diameter, drilled to the depth shown on the Drawings. All borings shall be made with bucket type augers. Auger lengths shall be clearly marked on the equipment so as to permit checking the depth of the boring. The invert of the solid waste is at El. +29 NGVD. The depths of the borings as given on the Drawings are designed to penetrate the solid waste to approximately 80% of the depth of the solid waste as measured at the location of the well. The Contractor shall verify the ground elevation at each well prior to starting the drilling, and verify the design depth as given on the drawings using the ground elevation and the solid waste invert El. +29 NGVD. If there is a discrepancy, the Contractor shall notify the Engineer prior to boring the well. (Revised 4/17/08)

B. The boring depths shown on the Drawings may be adjusted in the field by the Engineer if obstructions or water is encountered. If water is encountered in a boring, the Contractor may be directed to drill beyond the point at which it was encountered. If wet conditions remain, the boring may be terminated and the length of perforated pipe adjusted by the Engineer, or the well may be relocated.

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If wet conditions cease (e.g., due to trapped water layer), then drilling will continue to the design depth. If an obstruction is encountered, the Engineer may terminate the boring or relocate it.

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. The bore for the well shall be straight and the well pipe shall be installed in the center of the borehole. The Contractor will take all tension off of the pipe by mechanical means and center the pipe in the middle of the borehole before starting to backfill.

3.02 BACKFILLING

A. Backfilling of the well shall commence immediately after well drilling is completed and the well piping has been installed in the borehole. Backfill materials shall be installed as indicated on the Drawings and as approved by the Engineer.

B. The aggregate shall be poured or scooped through the screen at a rate that will not endanger the integrity of the well casing.

C. The well seal will be formed by evenly distributing the bentonite chips around the annulus of the well and then adding at least 10 gallons of fresh water in a manner that will allow for a thorough saturation of the bentonite material. This process will be continued until a minimum plug thickness of 2 feet has been achieved (approximately 15 sacks).

D. The bentonite well seal shall be backfilled as per the material specifications. The Contractor shall soak each lift prior to filling the next one.

E. Soil backfill shall be rodded in the boring to provide even distribution and compaction.

F. Wellhead shall be installed on the extraction well as shown on the drawings.

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3.03 DISPOSAL

A. Refuse from well drilling operations shall be disposed of in accordance with landfill operations at the landfill working face. The Contractor shall haul the refuse to the working face of the landfill.

3.04 ABANDONMENT OF GAS WELLS

A. Casing Backfilling:

1. The casing shall be backfilled with uniform-sized gravel to the top of the perforated section of the pipe, followed by a non-shrink cement-bentonite grout to within four feet of the ground surface. The grout shall be installed using tremie methods. The tremie pipe shall be placed within two feet of the bottom of the casing. The grout level shall be maintained at least five feet above the discharge end of the tremie pipe during pumping.

2. The grout mix shall consist of one sack of cement, 10 to 12 gallons of water, and one pound of powdered bentonite. One teaspoon of aluminum powder or other approved "non-shrink" additive shall be added per sack of cement to reduce shrinkage of the grout mix during set up and to improve the seal of the casing.

3. The grout shall be allowed to set-up and harden for at least 24 hours before removing the upper portion of the casing. A second or third grouting effort may be required to raise the level of the grout in the casing. The surface of the grout is expected to settle as grout seeps into slots at the bottom of the casing.

B. Casing Removal:

1. The casing shall be removed to a depth of at least four feet below ground surface. This can be accomplished by (1) over drilling the casing with an auger of similar drilling tool or (2) locally excavating with a backhoe and breaking or cutting the casing at the required depth.

2. When the casing is over drilled, the diameter of the drilling tools shall bore a hole at least equal to the original borehole.

3. When the casing is removed by localized excavation, the excavation shall encompass the entire area of the original borehole.

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C. Final Cover Backfill:

1. After the casing has been removed to at least four feet below ground surface, the resulting borehole or excavation shall be backfilled to the existing ground surface.

END OF SECTION

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SECTION 15051

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF APPLICATION

A. Supply and installation of High Density Polyethylene (HDPE) pipe and fittings in nominal pipe sizes of 4-inch through 18 inches for the landfill gas collection system header and lateral pipes, landfill gas extraction wells and storm water pipes. All pipes are smooth wall exterior and interior. All pipes are solid wall pipe except for that portion of the landfill gas extraction well pipe that must be perforated as indicated on the drawings.

1.02 REFERENCES

A. ASTM D-1248: Specification for Polyethylene Plastics Molding and Extrusion Materials.

B. ASTM D-2513: Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.

C. ASTM D-3261: Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

D. ASTM D-3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

1.03 SUBMITTALS

A. Pipe Certifications.

1.04 MANUFACTURER'S QUALITY ASSURANCE

A. The pipe and fittings manufacturer shall have an established quality assurance program responsible for inspecting incoming and outgoing materials. At a minimum, incoming polyethylene materials shall be inspected for density per ASTM D-1505, melt flow rate per ASTM D-1238, and contamination. The supplier shall certify all incoming polyethylene materials. Quality Assurance shall verify certification. Incoming materials shall be approved by Quality Assurance before processing into finished goods.

B. The pipe and fittings manufacturer shall have an established quality assurance program responsible for assuring the long-term performance of materials and products. Representative samples of polyethylene materials shall be tested against the physical property requirements of this specification. Each extrusion line and molding machine shall be qualified to produce pressure-rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D-1598.

C. Quality assurance test for representative pipe and fitting samples shall include:

Test	Standard	Pipe	Fittings
Ring ESCR	ASTM F-1248	Yes	Not Applicable
Sustained pressure at 176°F/725 psi hoop stress	ASTM D-1598	Yes (f_0>100 h)	Yes (f_0>100 h)
Sustained pressure at 73°F/1600 psi hoop stress	ASTM D-1598	Yes (f_0>1000 h)	Yes (f_0>1000 h)

D. All outgoing materials shall be inspected for diameter, wall thickness, length, straightness, out-of-roundness, concentricity, toe-in, inside and outside surface finish, markings, and end cut. Quality Control shall perform tests of density, melt flow rate, carbon content, and carbon dispersion. In addition, samples of the pipe provided shall be tested for hoop tensile strength and ductility by either quick burst per ASTM D-1599 or ring tensile per ASTM D-2290. Molded fittings shall be subject to x-ray inspection for voids, and tests for knot-line strength. All fabricated fittings shall be inspected for fusion quality and alignment.

E. The pipe and fitting manufacturer shall maintain permanent QC and QA records.

1.05 PACKAGING DELIVERY AND HANDLING

A. The pipe and fitting manufacturer shall package products for shipment in a manner suitable for safe transport by commercial carrier. When delivered, a receiving inspection shall be performed, and any shipping damage reported to the pipe and fittings manufacturer. Pipe and fittings shall be handled, installed, and tested in accordance with manufacturer's recommendations, and the requirements of this specification.

PART 2 PRODUCTS

2.01 PHYSICAL PROPERTIES

A. Materials used for the manufacture of polyethylene pipe and fittings shall meet the following physical property requirements:

Property	Unit	Test Procedure	Value
Material Designation	-	PPI/ASTM	-
PPI Material Listing	-	PPI TR-4	PE 3408
Material Classification	-	ASTM D-1248	III C 5 P34
Cell Classification	-	ASTM D-3350	345434C or 355434C
Density	g/cm^3	ASTM D-1505	>0.941
Melt Index [E]	g/10 min	ASTM D-1238	<0.15
Flexural Modulus	psi	ASTM D-790	>110,000 and <160,000
Tensile Strength	psi	ASTM D-638	3000 to 3500
ESCR [C]	hours	ASTM D-1693	f_0>5000
HDB	psi	ASTM D-2837	1600 23°C
UV Stabilizer [C]	% Carbon Black	ASTM D-1603	2 to 3
Elastic Modulus	psi	ASTM D-638	110,000
Brittleness Temperature	°F	ASTM D-746	<-180
Vicat Softening Temperature	°F	ASTM D-1525	255
Thermal Expansion	in/in/°F	ASTM D-696	8 x 10E-5
Hardness	Shore D	ASTM D-2240	64
Molecular Weight Category	-	-	Extra High

B. There shall be no evidence of splitting, cracking or breaking when the pipe is tested in accordance with Section 2.03F.

C. Ring Stiffness Constant (RSC) values for the pipe can be directly related to the pipe's class designation. (Nominal RSC of Class 40 pipe = 40, etc.). The minimum RSC is 90% of the nominal.

D. The pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.

E. Clean rework or recycled material generated by the manufacturer's own production may be used so long as the pipe or fittings produced meet all the requirements of this specification.

2.02 PIPE AND FITTINGS:

A. Dimensions:

1. Pipe Dimensions: The nominal inside diameter of the pipe shall be true to the specified pipe size in accordance with ASTM D-2513. Standard laying lengths shall be 40 feet ±2". The pipe SDR shall be as indicated on the drawings.

2. Fitting Dimensions: Fittings such as coupling, wyes, tees, adaptors, etc., for use in laying pipe shall have standard dimensions that conform to ASTM D-3261.

B. Where possible, pipe and fittings should be produced by the same manufacturer from identical materials meeting the requirements of this specification. Special or custom fittings may be exempted from this requirement.

C. Pipe and fittings shall be pressure rated to meet the service pressure requirements specified by the Engineer. Whether molded or fabricated, fittings shall be fully pressure rated to at least the same service pressure rating as the pipe to which joining is intended.

D. Molded fittings shall meet the requirements of ASTM D-3261 and this specification. At the point of fusion, the outside diameter and minimum wall thickness of fitting butt fusion outlets shall meet the diameter and wall thickness specifications of the mating system pipe. Fitting markings shall include a production code from which the location and date of manufacture can be determined. Upon request, the manufacturer shall provide an explanation of his production code.

E. Marking:

1. Each standard and random length of pipe and fitting in compliance with this standard shall be clearly marked with the following information:

a) ASTM Standard Designation
b) Pipe Size
c) Class and Profile Number
d) Production Code
e) Standard Dimension Ratio

2.03 SOURCE QUALITY CONTROL

A. The pipe and fitting manufacturer shall certify that samples of his production pipe have undergone stress regression testing, evaluation, and validation in accordance with ASTM D-2837 and PPI TR-3. Under these procedures, the minimum hydrostatic design basis shall be certified by the pipe and fitting manufacturer to be 1600 psi at 73.4°F and 800 psi at 140°F.

B. Material shall be listed in the name of the pipe and fitting manufacturer by the Plastics Pipe Institute (PPI) in PPI TR-4 with the following Standard Grade ratings:

		73.4°F	140°F
1.	Hydrostatic Design Basis	(HDB) 1600 psi	800 psi
2.	Hydrostatic Design Stress	(HDS) 800 psi	400 psi

C. PPI material listing in the name of the resin supplier is not acceptable in meeting this requirement.

D. Inspection Requirements:

1. Notification: If inspection is specified by the purchaser, the manufacturer shall notify the purchaser in advance of the date, time and place of testing of the pipe in order that the purchaser may be represented at the test.

2. Access: The Owner's representative shall have free access to the inspection area of the manufacturer's plant. The manufacturer shall make available to the Owner's representative, without charge, all reasonable facilities for determining whether the pipe meets the requirements of this specification.

3. Certification: As the basis of the acceptance of the material, the manufacturer will furnish a certificate of conformance of these specifications upon request. When prior agreement is being made in writing between the purchaser and the manufacturer, the manufacturer will furnish other conformance certification in the form of affidavit of conformance, test results, or copies of test reports.

E. Test Methods

1. Flattening: Three specimens of pipe, a minimum of 12 inches long, shall be flattened between parallel plates in a suitable press until the distance between the plates is 40 percent of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is

completed within 2 to 5 minutes. Remove the load, and examine the specimens for splitting cracking or breaking.

2. Pipe Ring Stiffness Constant: The pipe ring stiffness constant shall be determined utilizing procedures similar to those outlined in ASTM D-2412. The stiffness of HDPE pipe is defined in terms of the load, applied between parallel plates, which causes 1% reduction of pipe diameter. Test specimens shall be a minimum of two-pipe diameter or 4 feet in length, whichever is less.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to Specifications or following:

1. Fractures or cracks passing through pipe wall, except single crack not exceeding 2 inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment shall 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 prevents making satisfactory joint.

B. Acceptance of fittings, stubs or other specifically fabricated pipe sections shall be based on visual inspection at job site and documentation of conformance to these Specifications.

C. Notify surveyor prior to backfilling trench to allow surveyor to obtain as-built top of pipe coordinates and elevations at 100-foot intervals along the pipe and at changes in slope.

3.02 INSTALLATION

A. Trench, backfill, and compact in accordance with Section 02221.

B. Heat Fusion of Pipe:

1. Weld in accordance with manufacturer's recommendation for butt fusion methods. Provide fusion operators certified by the pipe manufacturer.
2. Butt fusion equipment for joining procedures shall be capable of meeting conditions recommended by pipe manufacturer including, but not limited to, temperature requirements, alignment, and fusion pressures.

3. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with manufacturer's recommendations.
4. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade.
5. Do not subject pipe to strains that will overstress or buckle piping or impose excessive stress on joints.
6. Branch saddle fusions shall be joined in accordance with manufacturer's recommendations and procedures. Branch saddle fusion equipment shall be of size to facilitate saddle fusion within trench.
7. Before butt fusing pipe, inspect each length for presence of dirt, sand, mud, shavings, and other debris or animals. Remove debris from pipe.
8. Cover at end of each working day open ends of fused pipe. Cap to prevent entry by animals or debris.
9. Use compatible fusion techniques when polyethylenes of different melt indexes are fused together. Refer to manufacturer's specifications for compatible fusion.

C. Flange Jointing:

1. Use on flanged pipe connection sections.
2. Connect slip-on carbon steel backup flanges with stainless steel nuts and bolts.
3. Butt fuse fabricated flange adapters to pipe.
4. Observe following precautions in connection of flange joints.
   a) Align flanges or flange/valve connections to provide tight seal. Require nitrile-butadiene gaskets if needed to achieve seal. Gaskets are required for flange/valve connections.
   b) Place U.S. Standard round washers as may be required on some flanges in accordance with manufacturer's recommendations. Bolts shall be lubricated in accordance with manufacturer's recommendations.
   c) Tighten flange bolts in sequence and accordance with manufacturer's recommendations. CAUTION: Do not over-torque bolts.
5. Pull bolt down by degrees to uniform torque in accordance with manufacturer's recommendation.
6. Protect below grade bolts and flanges by covering with a 5 mil polyethylene wrap. Duct tape wrap to HDPE pipe.
7. Electrofusion couplers, where used, shall be installed per the manufacturer's specifications.

D. Pipe Placement:

1. Grade control equipment shall be of type to accurately maintain design grades and slopes during installation of pipe.
2. Remove standing water in trench before pipe installation.
3. Unless otherwise specifically stated, install pipe in accordance with manufacturer's recommendations.
4. Maximum lengths of fused pipe to be handled as one section shall be placed according to manufacturer's recommendations as to pipe size, pipe SDR, and topography so as not to cause excessive gouging or surface abrasion; but not to exceed 400 ft.
5. Cap pipe sections longer than single joining (usually 40 ft.) on both ends during placement except during fusing operations.
6. Notify ENGINEER prior to installing pipe into trench and allow time for Engineer's inspection to correct irregularities found during inspection.
7. Complete tie-ins or backfilling activity.
8. Allow pipe sufficient time to adjust to trench temperature prior to testing, segment tie-ins or backfilling activity.
9. Install reducers adjacent to laterals and tees.
10. To reduce branch saddle stress, install saddles at slope equal to, and continuous with, lateral piping.
11. Place in trench by allowing minimum 12-in./100 ft. for thermal contraction and expansion.
12. Coordinate construction of pipes near access roads with OWNER to limit impediment of landfill operations or operations of other Contractors.

3.03 PIPE TESTING

A. Air Test all pipe sections of the landfill gas collection system (Storm water pipes and landfill gas extraction well pipe do not have to be pressure tested.) and fittings after placement in trench, in accordance with manufacturer's recommendations. Follow the piping manufacturer's recommendations for testing. Pipe should be tested in section not to exceed 2,000 feet. At a minimum, test pipe sections for one hour at 10 psig. Pressure drop over one hour shall not exceed one percent after correcting pressure drop for temperature. Wells and other system openings should be blocked off for testing. Pressure test below ground systems only. Special precautions are required for this type of testing. Alternatively, a vacuum test can be conducted. Submit vacuum test procedure to Engineer for approval.

3.04 PIPE CLEANING

A. All pipes shall be flushed with water, or cleaned by other means approved by the Engineer so as to remove all pipe cuttings and other debris from the pipe.

END OF SECTION

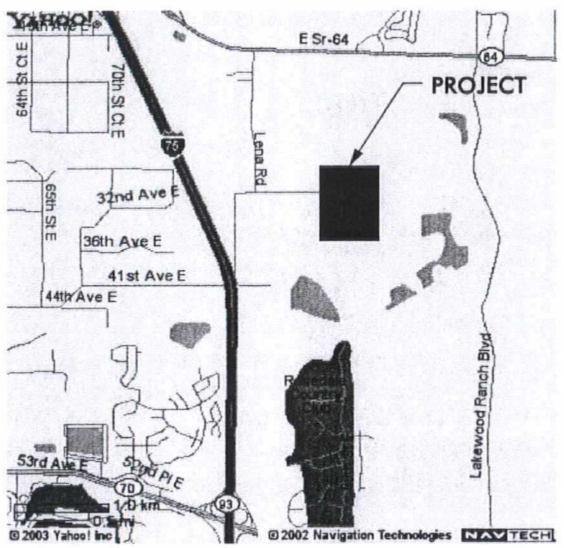
SECTION
4

PERMIT DRAWINGS FOR

MANATEE COUNTY
LENA ROAD LANDFILL
STAGE III LANDFILL
GAS COLLECTION SYSTEM

IFB 08-1655-OV

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
JUN 25 2008
SOUTHWEST DISTRICT TAMPA



LENA ROAD LANDFILL
3333 LENA ROAD
BRADENTON, FLORIDA 34202

MANATEE COUNTY
UTILITY OPERATIONS
DEPARTMENT

4410 66th STREET WEST
BRADENTON, FLORIDA 34210

JANUARY 2008

REVISED: APRIL 2008

LIST OF DRAWINGS		CONSTRUCTION START DATE
C-1	COVER	
C-2	GENERAL SITE PLAN	
C-3	GAS COLLECTION SYSTEM PLAN – PHASE I	MAY 2008
C-3A	GAS COLLECTION SYSTEM PLAN – PHASE II	SEPT. 2011
C-3B	GAS COLLECTION SYSTEM PLAN – PHASE III	NOV. 2013
C-4	GAS COLLECTION SYSTEM – DETAILS (1 of 2)	
C-5	GAS COLLECTION SYSTEM – DETAILS (2 of 2)	
C-6	VERTICAL GAS EXTRACTION WELL SCHEDULE	

PBSJ
An Employee – Owned Company
Consulting Engineers and Planners
482 South Keller Road
Orlando, Florida 32810

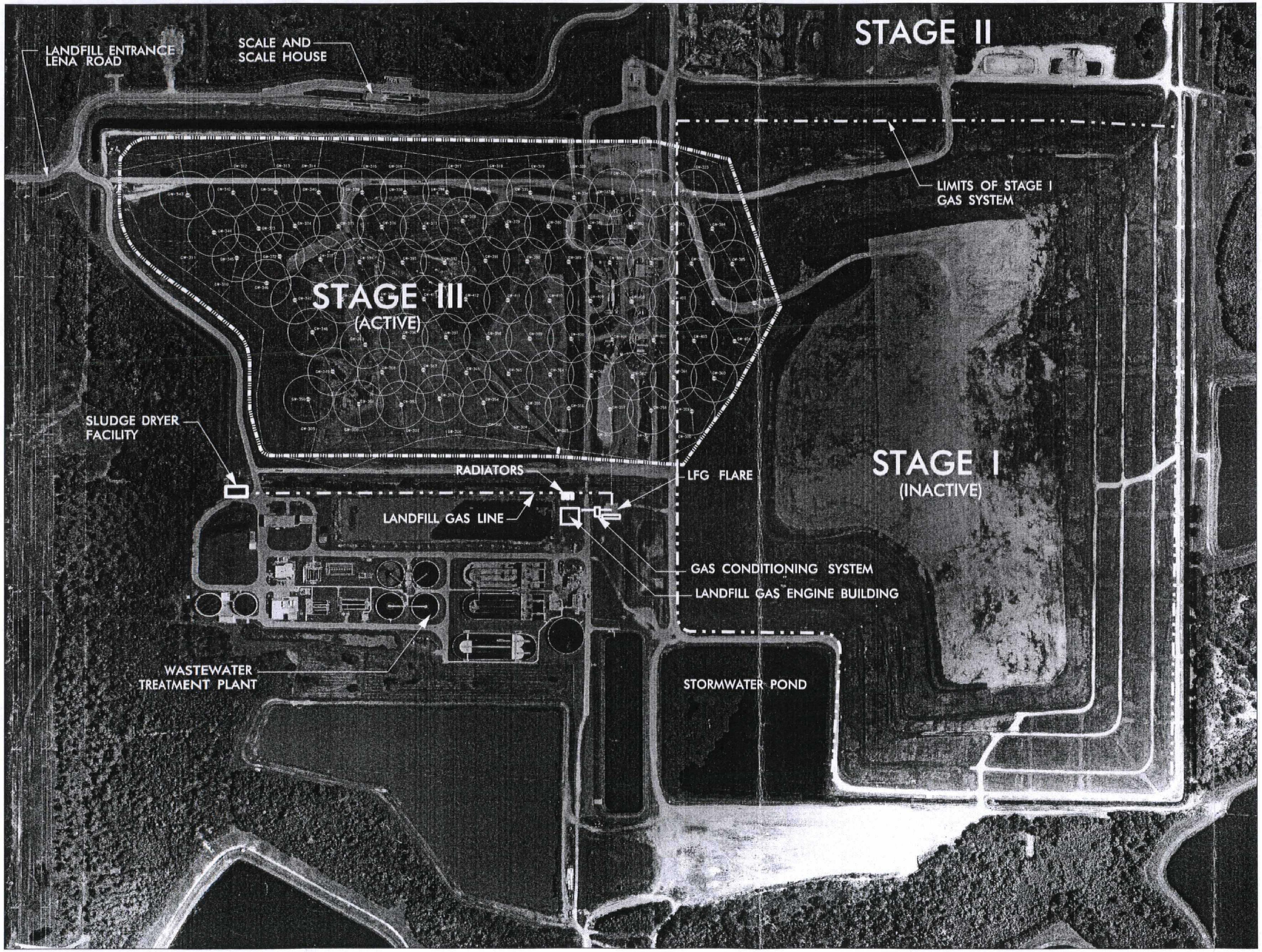
JOSEPH LAWRENCE MILLER
LICENSE No. 39177
STATE OF FLORIDA

6/18/08

ENGINEER'S PROJECT NO. 100931.91

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
JUN 25 2008
SOUTHWEST DISTRICT TAMPA

MANATEE COUNTY – LENA ROAD LANDFILL- STAGE III LANDFILL GAS COLLECTION SYSTEM (JAN. 2008)



NORTH

0 200 400

GRAPHIC SCALE
SCALE: 1" = 200'

LEGEND:

- LIMITS OF STAGE I LANDFILL GAS SYSTEM
- LIMITS OF STAGE III LANDFILL GAS SYSTEM
- VERTICAL GAS WELL AND RADIUS OF INFLUENCE
- LANDFILL TERRACE
- STAGE III LANDFILL GAS PIPE LINE

FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION
JUN 25 2008
SOUTHWEST DISTRICT
TAMPA

AERIAL PHOTOGRAPH PROVIDED BY:

I.F. ROOKS & ASSOCIATES, INC.
106 N.W. DRANE ST.
PLANT CITY, FL 33566
(813) 752-2113

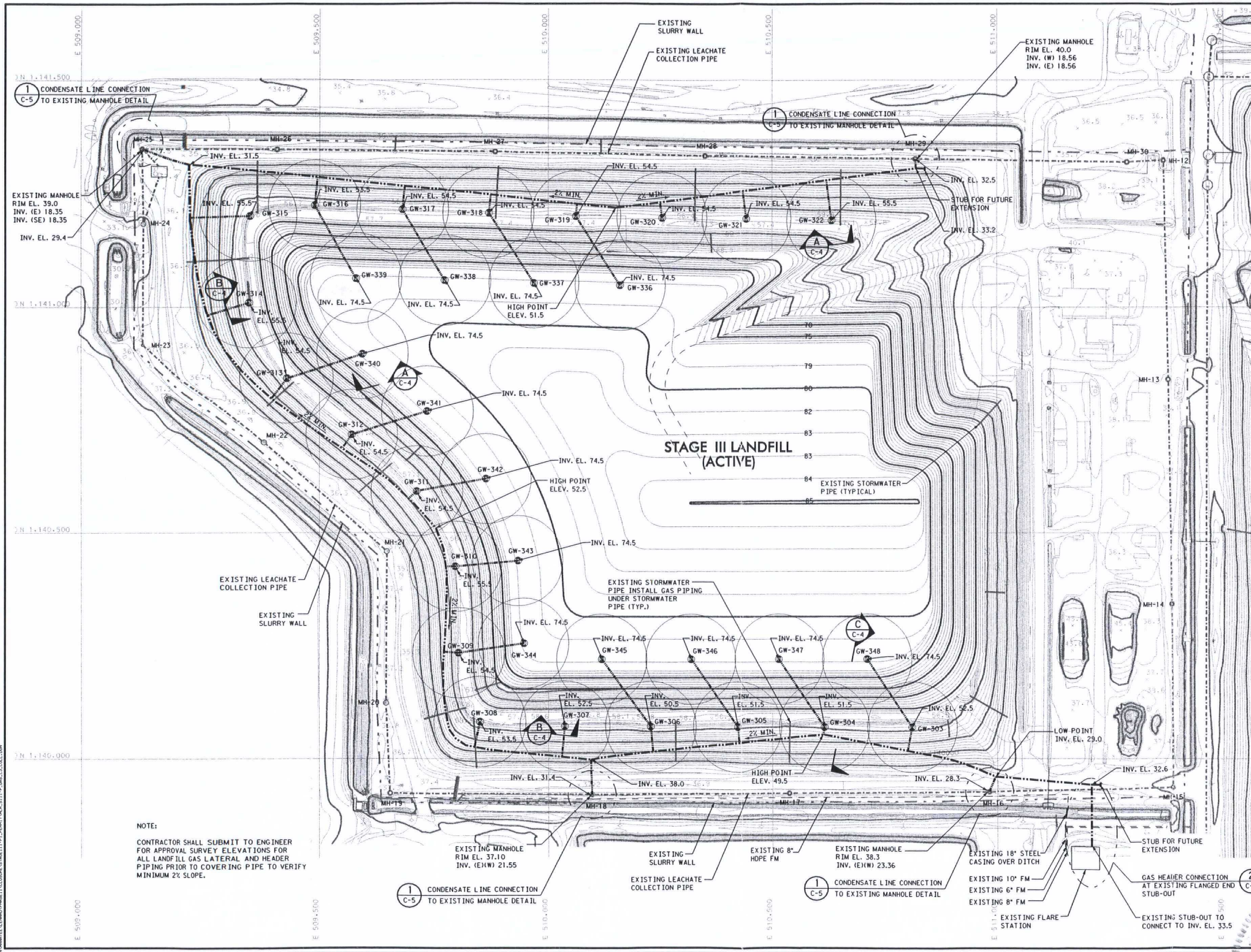
DATE: 02/24/07

JOSEPH LAWRENCE MILLER
LICENSE
No. 59177
STATE OF
PROFESSIONAL ENGINEER

C-2

PBS&J 482 South Keller Road Orlando, FL 32810-6101 Tel. (407) 647-7275 Fax. (407) 647-0624 www.pbsj.com POST BUCKLEY, SCHUH & JERNIGAN, Inc. d/b/a PBS&J 2001 N.W. 107th Ave., Miami, FL 33172-2507 FBPR Certificate of Authorization No.: 24	CLIENT MANATEE COUNTY BOARD OF COUNTY COMMISSIONERS	PROJECT LENA ROAD STAGE III LANDFILL GAS COLLECTION SYSTEM	TASK GENERAL SITE PLAN	ORIGINAL JAN. 2008 REVISIONS: 1. APR. 2008 2. 3. 4. 5.	Name: JOSEPH L. MILLER Florida P.E. No.: 59177 Address: PBS&J 482 S. Keller Road Orlando, FL 32810-6101 Signature Date 6/18/08	JOB NO. 100931.91 DRAWN RGC DESIGN JLM/RGC CHECKED JLM Q.C. DED SHEET 2/8

18-JUN-2008 15:03 --- EMP. NO: 9327



NOTE:

CONTRACTOR SHALL SUBMIT TO ENGINEER FOR APPROVAL SURVEY ELEVATIONS FOR ALL LANDFILL GAS LATERAL AND HEADER PIPING PRIOR TO COVERING PIPE TO VERIFY MINIMUM 2% SLOPE.

LEGEND:

- PROPOSED WELL HEAD AND RADIUS OF INFLUENCE
- MH-14 EXISTING LEACHATE MANHOLE
- PROPOSED 8" LATERAL
- PROPOSED 18" HEADER
- EXISTING SLURRY WALL
- EXISTING LEACHATE COLLECTION PIPE
- PROJECTED LANDFILL CONTOURS (MAY 2008)

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
JUN 25 2008
SOUTHWEST DISTRICT TAMPA

AERIAL SURVEY PROVIDED BY:

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DATE: FEBRUARY 24, 2007

C-3

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FBPR Certificate of Authorization No.: 24

CLIENT	PROJECT	TASK
MANATEE COUNTY BOARD OF COUNTY COMMISSIONERS	LENA ROAD STAGE III LANDFILL GAS COLLECTION SYSTEM	GAS COLLECTION SYSTEM PLAN PHASE I

ORIGINAL JAN. 2008
REVISIONS:
1. APR. 2008
2.
3.
4.
5.

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Florida P.E. No.: 39177
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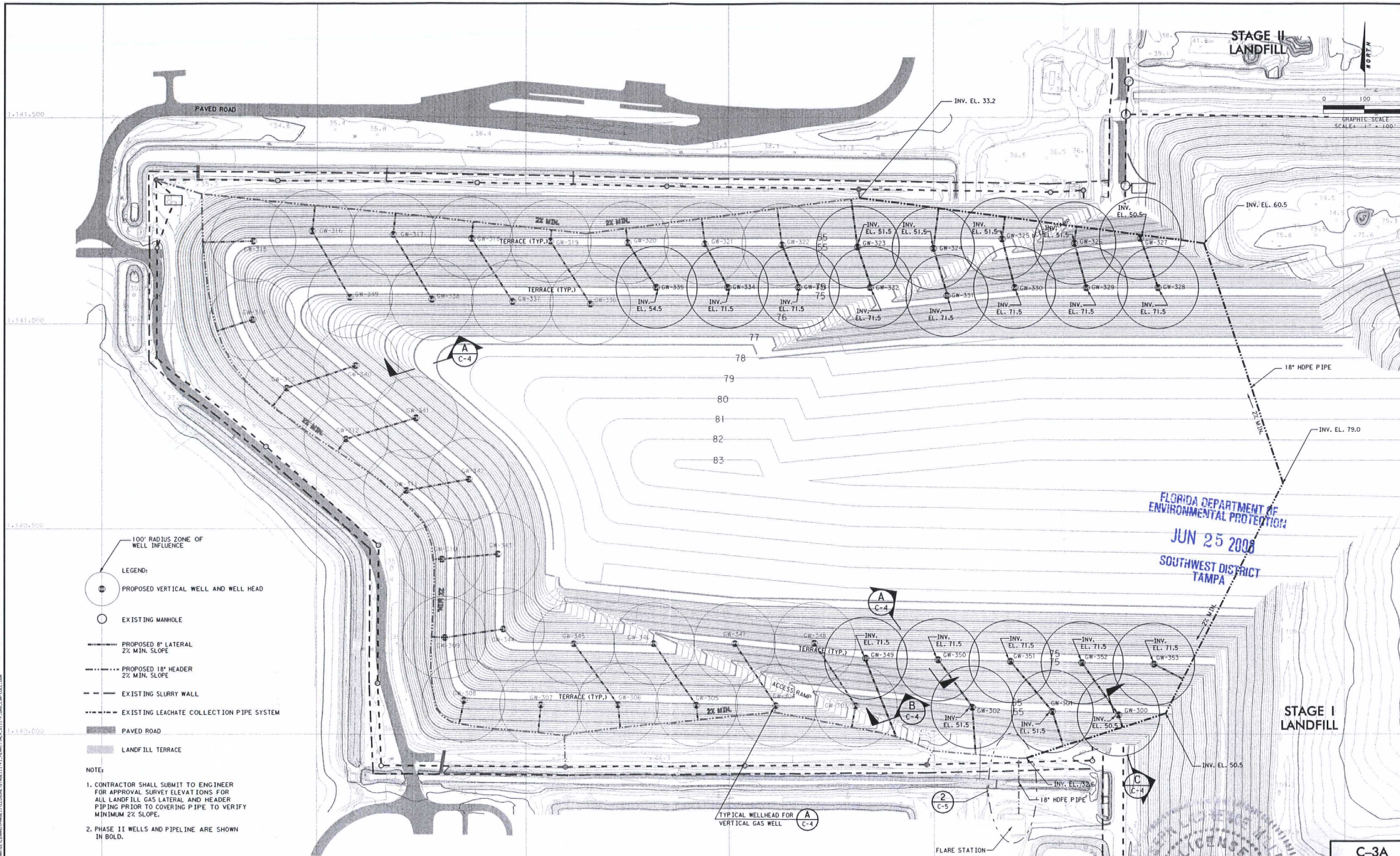
6/18/08

JOB NO.	100931.91
DRAWN	RGC
DESIGN	JLM/RGC
CHECKED	JLM
Q.C.	DED

SHEET 3/8



C-3A

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CLIENT	PROJECT	TASK
MANATEE COUNTY BOARD OF COUNTY COMMISSIONERS	LENA ROAD STAGE III LANDFILL GAS COLLECTION SYSTEM	GAS COLLECTION SYSTEM PLAN PHASE II

ORIGINAL JAN. 2008
REVISIONS:
1. APR. 2008
2.
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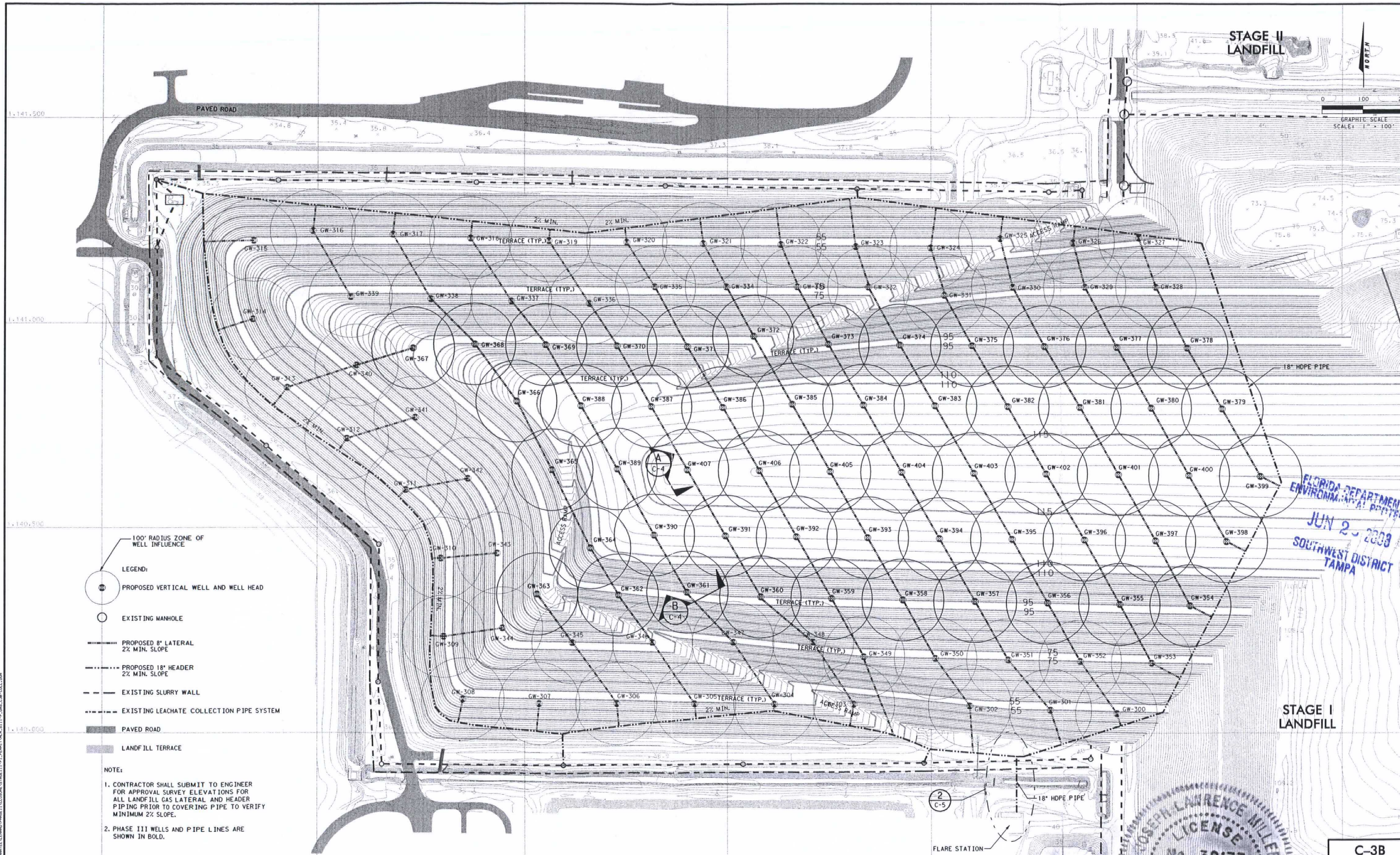
4.
5.

Name: JOSEPH L. MILLER
Florida P.E. No: 59177
Address: PBS&J 482 S Keller Road Orlando, FL 32810-6101
Signature / Date
6/18/08

JOB NO.	100931.91
DRAWN	RGC
DESIGN	JLM/RGC
CHECKED	JLM
Q.C.	DED

SHEET 4/8



LEGEND:

- PROPOSED VERTICAL WELL AND WELL HEAD
- EXISTING MANHOLE
- PROPOSED 8" LATERAL 2% MIN. SLOPE
- PROPOSED 18" HEADER 2% MIN. SLOPE
- EXISTING SLURRY WALL
- EXISTING LEACHATE COLLECTION PIPE SYSTEM
- PAVED ROAD
- LANDFILL TERRACE

NOTE:

1. CONTRACTOR SHALL SUBMIT TO ENGINEER FOR APPROVAL SURVEY ELEVATIONS FOR ALL LANDFILL GAS LATERAL AND HEADER PIPING PRIOR TO COVERING PIPE TO VERIFY MINIMUM 2% SLOPE.
2. PHASE III WELLS AND PIPE LINES ARE SHOWN IN BOLD.

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
JUN 23 2008
SOUTHWEST DISTRICT TAMPA

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FBPR Certificate of Authorization No.: 24

CLIENT	PROJECT	TASK
MANATEE COUNTY BOARD OF COUNTY COMMISSIONERS	LENA ROAD STAGE III LANDFILL GAS COLLECTION SYSTEM	GAS COLLECTION SYSTEM PLAN PHASE III

ORIGINAL JAN. 2008
REVISIONS:
1. APR. 2008
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4.
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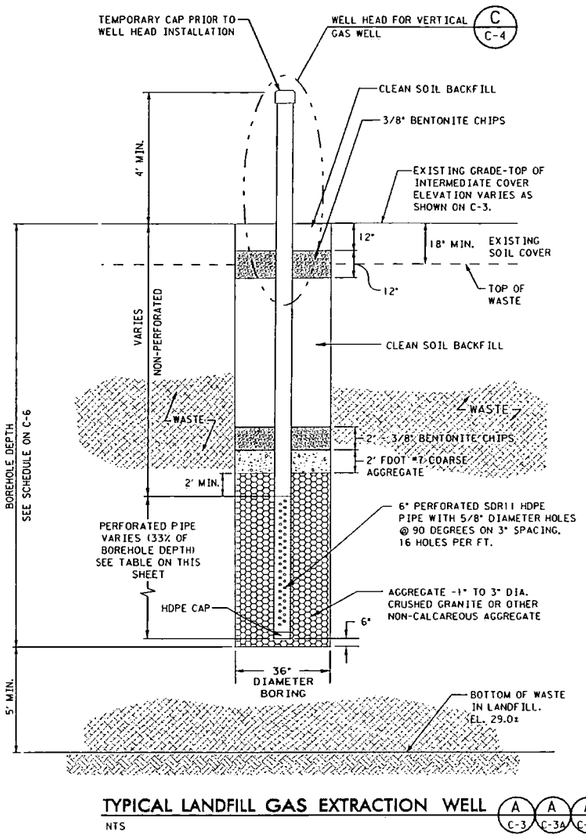
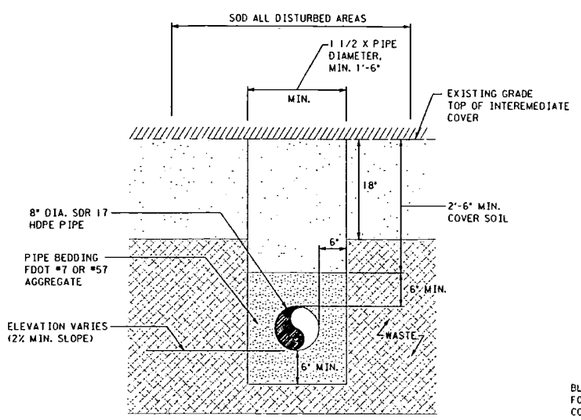
JOSEPH LAWRENCE MILLER LICENSE No. 39177 STATE OF FLORIDA PROFESSIONAL ENGINEER
6/18/08

JOB NO. 100931.91
DRAWN RGC
DESIGN JLM/RGC
CHECKED JLM
Q.C. DED
SHEET 5/8



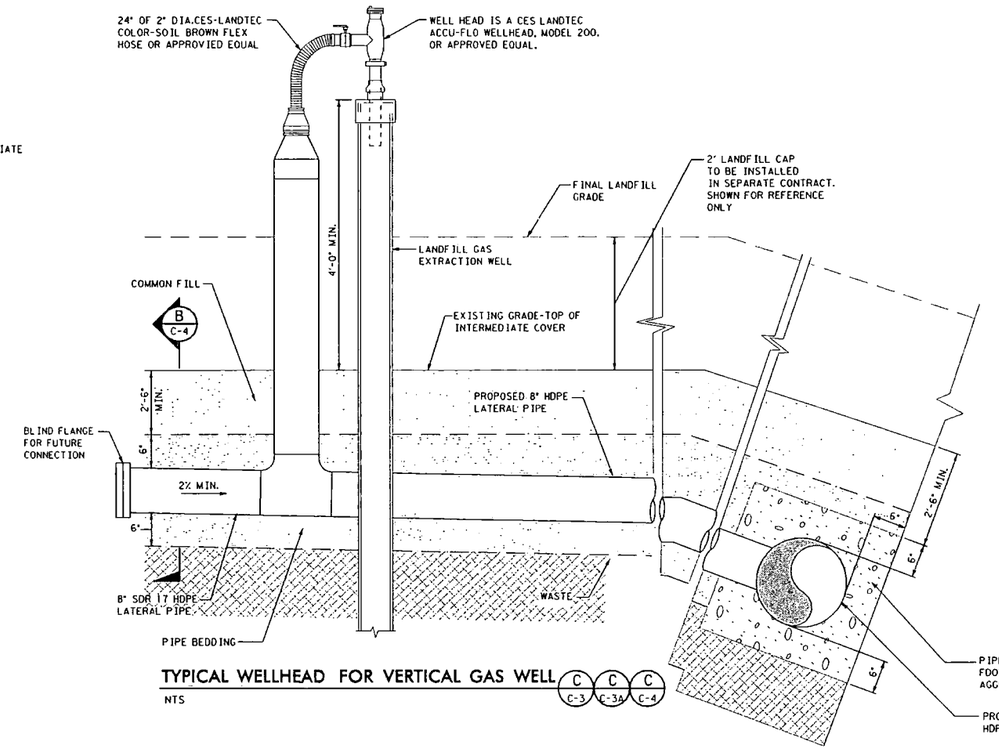
TYPICAL LANDFILL GAS EXTRACTION WELL (A C-3)(A C-3A)(A C-3B)
NTS



TYPICAL PIPE SECTION (B C-3)(B C-3A)(B C-3B)(B C-4)
NTS

NOTE:

1. THE CONTRACTOR SHALL HAUL WASTE FROM THE EXCAVATION OF TRENCHES TO THE STAGE III LANDFILL WORKING FACE FOR DISPOSAL.
2. THE PHASE III GAS SYSTEM WASTE SHALL BE HAULD TO THE WORKING FACE OF THE STAGE III LANDFILL



TYPICAL WELLHEAD FOR VERTICAL GAS WELL (C C-3)(C C-3A)(C C-4)
NTS

NOTES:

1. PROPOSED WELLS SHALL BE LABELED AS SHOWN IN THE TABLE WITH A WATER-PROOF MATERIAL.
2. THE CONTRACTOR SHALL HAUL THE WASTE FROM THE DRILLING OF THE LANDILL GAS EXTRACTION WELLS TO THE STAGE III LANDFILL WORKING FACE FOR DISPOSAL
3. THE PHASE III GAS SYSTEM WASTE SHALL BE HAULD TO THE WORKING FACE OF THE STAGE III LANDFILL.

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
JUN 25 2008
SOUTHWEST DISTRICT TAMPA

JOSEPH LAWRENCE MILLER LICENSE No. 39177 STATE OF FLORIDA 6/18/08

C-4

PBS&J
182 South Keller Road
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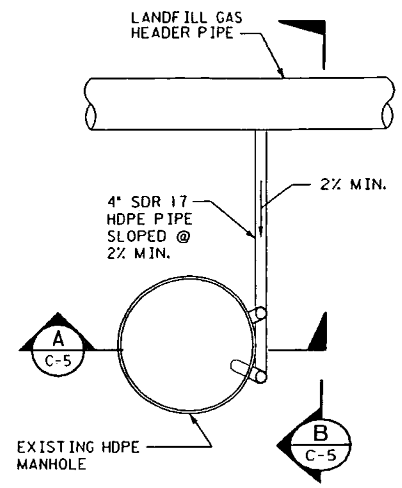
POST BUCKLEY, SCHUH & JERNIGAN, Inc. d/b/a PBS&J
3001 N.W. 107th Ave., Miami, FL 33172 3507
FBPR Certificate of Authorization No: 24

CLIENT	PROJECT	TASK
MANATEE COUNTY	LENA ROAD	GAS COLLECTION SYSTEM
BOARD OF COUNTY COMMISSIONERS	STAGE III LANDFILL	DETAILS
	GAS COLLECTION SYSTEM	(1 OF 2)

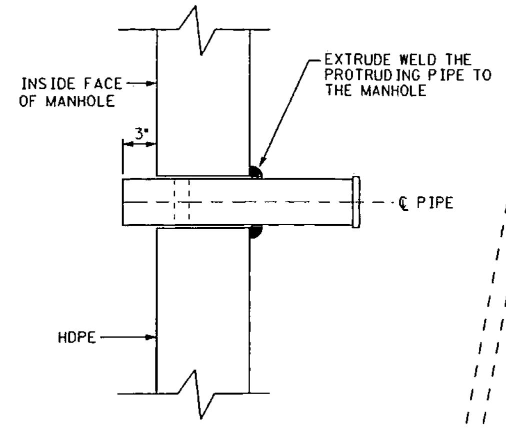
ORIGINAL JAN. 2008
REVISIONS:
1. APR. 2008
2.
3.
4.
5.

JOB NO. 100931.91
DRAWN RGC
DESIGN JLM/RGC
CHECKED JLM
Q.C. DED
SHEET 6/8

V:\OLFIELD\LENA\DWG\SYSTEM\MANATEE_ENVIRO\PHASE III\CLOSURE\STAGE III-P1_FROM TANK 5211 P_GAS_04-DETAILS.DGN
18-JAN-2008 14:13 ··· EMP. NO: 5227

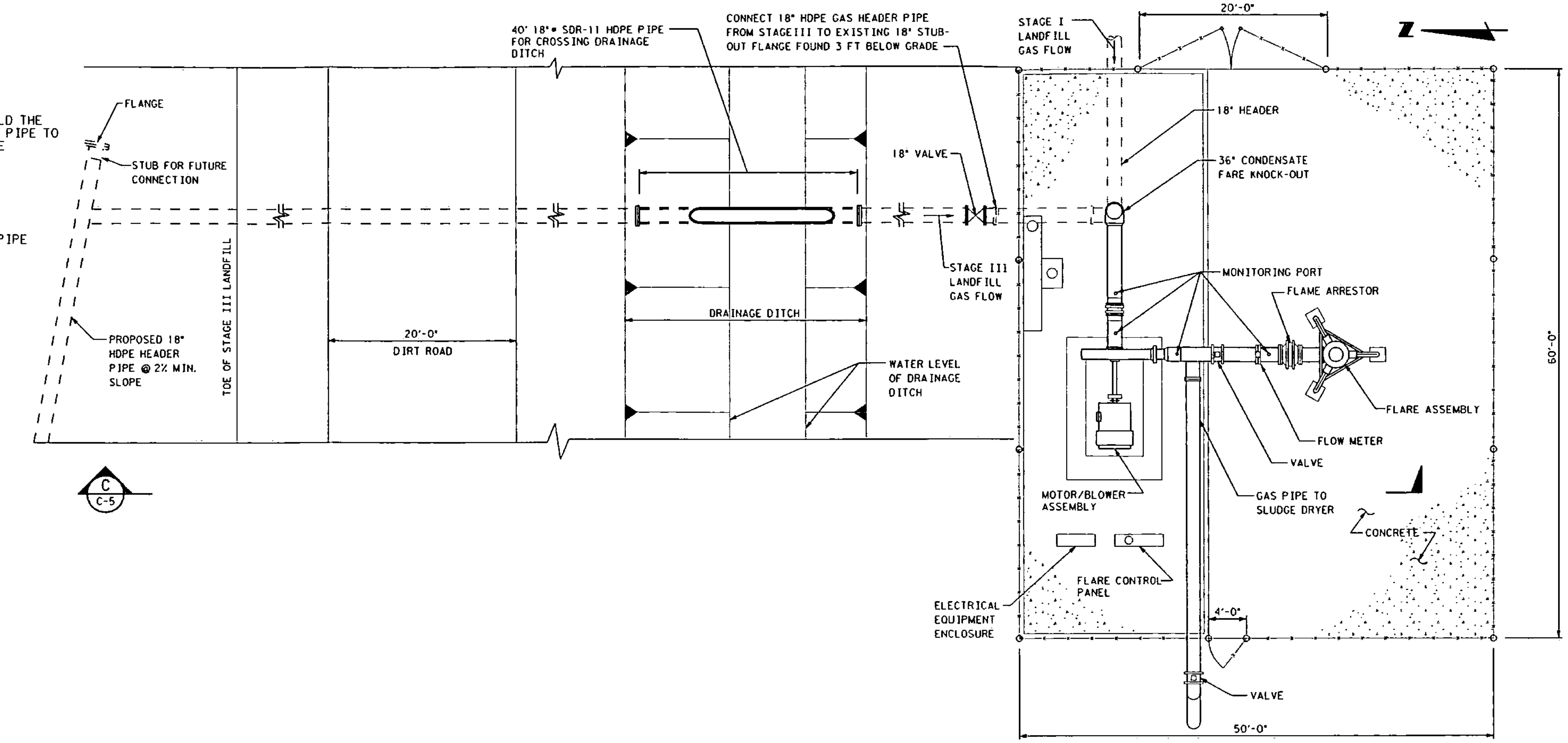


PLAN



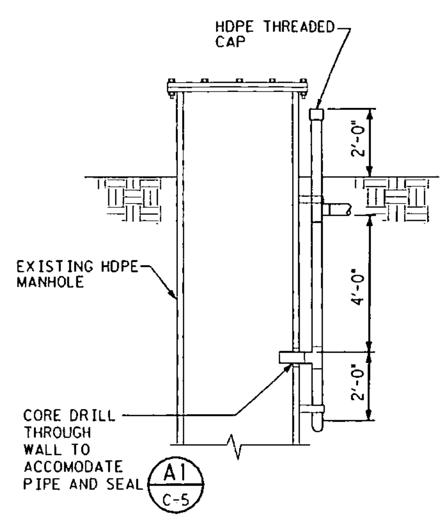
DETAIL (A1 / C-5)
NTS

CONDENSATE LINE CONNECTION TO EXISTING MANHOLES DETAIL (1 / C-3)
NTS

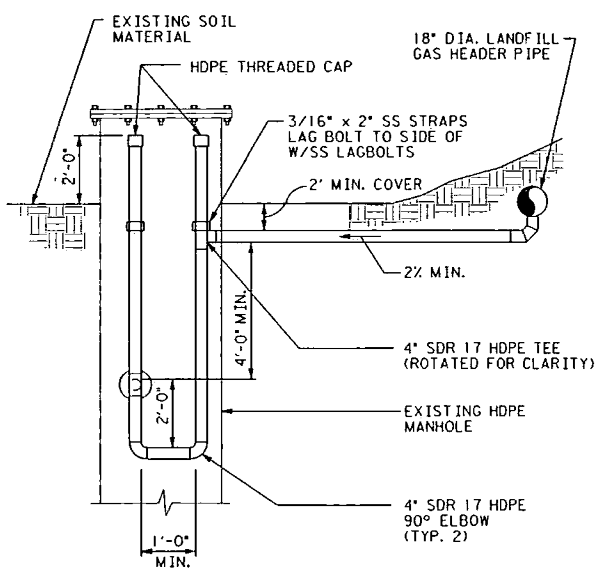


GAS HEADER CONNECTION AT EXISTING FLANGED END STUB-OUT DETAIL (2 / C-3)
NTS

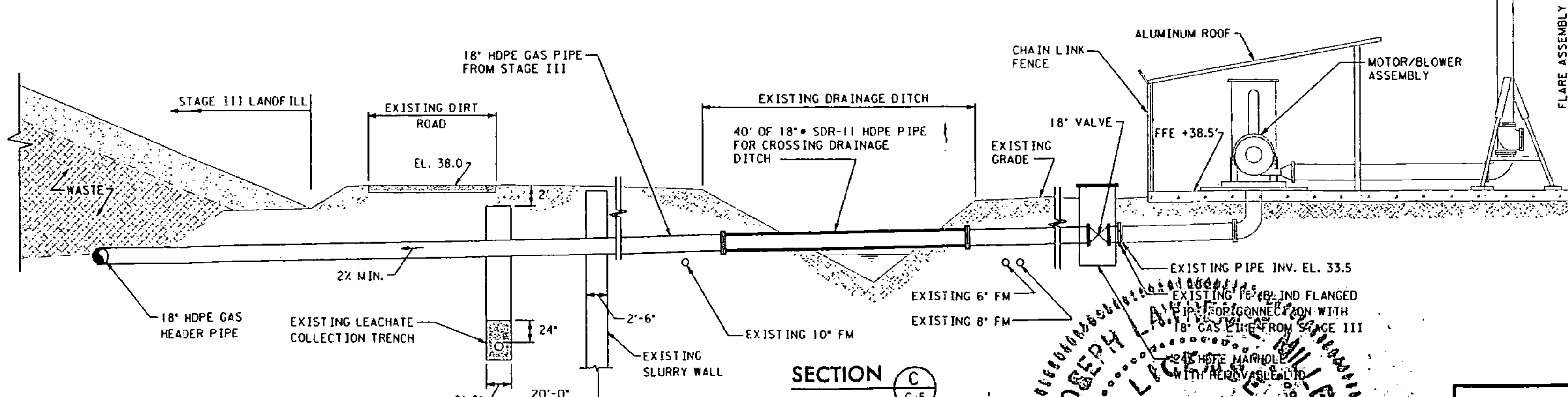
FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
JUN 2_ 2008
SOUTHWEST DISTRICT TAMPA



SECTION (A / C-5)



SECTION (B / C-5)



SECTION (C / C-5)
NTS

C-5

PBS&J — 482 South Keller Road, Orlando, FL 32810-6101; Tel. (407) 647-7275; Fax (407) 647-0624; www.pbsj.com; POST, BUCKLEY, SCHUH & JERNIGAN, Inc. dba PBS&J, 2001 N.W. 107th Ave., Miami, FL 33172-2507, FBPR Certificate of Authorization No. 24	CLIENT: MANATEE COUNTY BOARD OF COUNTY COMMISSIONERS	PROJECT: LENA ROAD STAGE III LANDFILL GAS COLLECTION SYSTEM	TASK: GAS COLLECTION SYSTEM DETAILS (2 OF 2)	ORIGINAL JAN. 2008; REVISIONS: 1. APR. 2008; 2. ; 3. ; 4. ; 5.

JOSEPH L. MILLER, LICENSE No. 39177, STATE OF FLORIDA, PROFESSIONAL ENGINEER
6/18/08

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DESIGN JLM/RGC
CHECKED JLM
Q.C. DED
SHEET 7/8

LENA ROAD LANDFILL VERTICAL GAS EXTRACTION WELL SCHEDULE

PHASE	WELL	NORTHING	EASTING	BORING TOP ELEV. (FT)	BORING DEPTH (FT)	BORING BOTTOM EL.	PERFORATED LENGTH (FT)
II	GW-300	N 1,140,047.6	E 511,448.8	54	20	34	7
	GW-301	N 1,140,055.6	E 511,287.5	55	20	35	7
	GW-302	N 1,140,066.2	E 511,093.4	55	20	35	7
I	GW-303	N 1,140,069.9	E 510,811.2	56	21	35	7
	GW-304	N 1,140,070.2	E 510,615.5	55	20	35	7
	GW-305	N 1,140,070.6	E 510,420.5	55	20	35	7
	GW-306	N 1,140,070.9	E 510,226.7	57	22	35	7
	GW-307	N 1,140,071.2	E 510,036.7	56	21	35	7
	GW-308	N 1,140,081.7	E 509,849.3	57	22	35	7
	GW-309	N 1,140,233.9	E 509,803.3	58	23	35	8
	GW-310	N 1,140,425.0	E 509,796.4	59	24	35	8
	GW-311	N 1,140,592.3	E 509,712.6	58	23	35	8
	GW-312	N 1,140,718.0	E 509,570.7	59	24	35	8
	GW-313	N 1,140,842.6	E 509,429.8	58	23	35	8
	GW-314	N 1,141,009.4	E 509,348.9	59	24	35	8
	GW-315	N 1,141,200.6	E 509,350.7	59	24	35	8
	GW-316	N 1,141,224.4	E 509,489.3	58	23	35	8
	GW-317	N 1,141,215.4	E 509,680.6	58	23	35	8
	GW-318	N 1,141,206.7	E 509,868.1	58	23	35	8
	GW-319	N 1,141,199.8	E 510,061.2	57	22	35	8
	GW-320	N 1,141,197.0	E 510,252.7	58	23	35	8
	GW-321	N 1,141,194.2	E 510,442.4	58	23	35	8
	GW-322	N 1,141,191.3	E 510,632.7	59	24	35	8
II	GW-323	N 1,141,186.4	E 510,816.9	54	20	34	7
	GW-324	N 1,141,183.1	E 511,000.1	55	20	35	7
	GW-325	N 1,141,205.6	E 511,166.9	55	20	35	7
	GW-326	N 1,141,195.7	E 511,343.8	53	18	35	6
	GW-327	N 1,141,207.1	E 511,503.9	54	20	34	7
	GW-328	N 1,141,087.3	E 511,547.1	75	35	40	12
	GW-329	N 1,141,087.5	E 511,372.3	75	35	40	12
	GW-330	N 1,141,087.7	E 511,197.5	74	35	39	12
	GW-331	N 1,141,068.1	E 511,033.1	74	35	39	12
	GW-332	N 1,141,088.1	E 510,847.9	75	35	40	12
	GW-333	N 1,141,088.3	E 510,673.1	75	35	40	12
	GW-334	N 1,141,088.5	E 510,498.4	75	35	40	12
	GW-335	N 1,141,088.7	E 510,323.6	75	35	40	12
I	GW-336	N 1,141,047.8	E 510,159.8	78	38	40	13
	GW-337	N 1,141,053.1	E 509,968.1	78	38	40	13
	GW-338	N 1,141,058.5	E 509,772.5	78	38	40	13
	GW-339	N 1,141,063.8	E 509,579.3	78	38	40	13
	GW-340	N 1,140,896.7	E 509,593.6	78	38	40	13
	GW-341	N 1,140,769.1	E 509,735.2	78	38	40	13
	GW-342	N 1,140,619.7	E 509,862.1	78	38	40	13
	GW-343	N 1,140,437.6	E 509,933.0	78	38	40	13
	GW-344	N 1,140,254.9	E 509,945.5	78	38	40	13
	GW-345	N 1,140,219.0	E 510,118.5	78	38	40	13
	GW-346	N 1,140,219.6	E 510,316.1	78	38	40	13
	GW-347	N 1,140,220.1	E 510,514.2	78	38	40	13
	GW-348	N 1,140,220.7	E 510,710.7	78	38	40	13
II	GW-349	N 1,140,185.0	E 510,835.7	75	35	40	12
	GW-350	N 1,140,181.2	E 511,010.4	75	35	40	12
	GW-351	N 1,140,177.5	E 511,185.5	75	35	40	12
	GW-352	N 1,140,173.7	E 511,360.5	75	35	40	12
	GW-353	N 1,140,169.9	E 511,535.5	75	35	40	12
III	GW-354	N 1,140,309.1	E 511,631.4	95	52	43	18
				SUB-TOTAL	1,611 (FT)		552 (FT)

LENA ROAD LANDFILL VERTICAL GAS EXTRACTION WELL SCHEDULE

PHASE	WELL	NORTHING	EASTING	BORING TOP ELEV. (FT)	BORING DEPTH (FT)	BORING BOTTOM EL.	PERFORATED LENGTH (FT)
III	GW-355	N 1,140,312.8	E 511,456.4	95	52	43	18
	GW-356	N 1,140,316.4	E 511,281.4	95	52	43	18
	GW-357	N 1,140,320.0	E 511,106.5	95	52	43	18
	GW-358	N 1,140,323.6	E 510,931.5	95	52	43	18
	GW-359	N 1,140,327.3	E 510,756.5	95	52	43	18
	GW-360	N 1,140,330.9	E 510,581.6	95	52	43	18
	GW-361	N 1,140,342.4	E 510,402.0	95	52	43	18
	GW-362	N 1,140,334.8	E 510,231.6	94	52	42	18
	GW-363	N 1,140,337.5	E 510,031.8	91	49	42	16
	GW-364	N 1,140,450.0	E 510,162.2	109	64	45	21
	GW-365	N 1,140,641.1	E 510,069.0	104	60	44	20
	GW-366	N 1,140,808.7	E 509,981.5	109	64	45	21
	GW-367	N 1,140,938.3	E 509,729.7	95	52	43	18
	GW-368	N 1,140,948.4	E 509,878.8	95	52	43	18
	GW-369	N 1,140,946.5	E 510,053.8	95	52	43	18
	GW-370	N 1,140,944.5	E 510,229.0	96	52	44	18
	GW-371	N 1,140,942.5	E 510,403.8	96	52	44	18
	GW-372	N 1,140,967.9	E 510,564.6	95	52	43	18
	GW-373	N 1,140,948.8	E 510,749.7	95	52	43	18
	GW-374	N 1,140,946.8	E 510,924.7	95	52	43	18
	GW-375	N 1,140,944.9	E 511,099.7	96	52	44	18
	GW-376	N 1,140,942.9	E 511,274.6	96	52	44	18
	GW-377	N 1,140,940.9	E 511,449.6	96	52	44	18
	GW-378	N 1,140,939.0	E 511,624.6	96	52	44	18
	GW-379	N 1,140,790.2	E 511,710.5	112	66	46	22
	GW-380	N 1,140,792.2	E 511,535.5	112	66	46	22
	GW-381	N 1,140,794.1	E 511,360.5	112	66	46	22
	GW-382	N 1,140,796.1	E 511,185.5	112	66	46	22
	GW-383	N 1,140,798.1	E 511,010.5	112	66	46	22
	GW-384	N 1,140,800.1	E 510,835.5	112	66	46	22
	GW-385	N 1,140,802.0	E 510,660.5	112	66	46	22
	GW-386	N 1,140,793.8	E 510,489.6	112	66	46	22
	GW-387	N 1,140,795.7	E 510,314.6	111	66	45	22
	GW-388	N 1,140,797.7	E 510,139.6	112	66	46	22
	GW-389	N 1,140,643.2	E 510,228.7	112	66	46	22
	GW-390	N 1,140,481.6	E 510,320.8	112	66	46	22
	GW-391	N 1,140,479.6	E 510,495.7	112	66	46	22
	GW-392	N 1,140,477.7	E 510,670.7	112	66	46	22
	GW-393	N 1,140,475.7	E 510,845.7	112	66	46	22
	GW-394	N 1,140,473.7	E 511,020.7	112	66	46	22
	GW-395	N 1,140,471.8	E 511,195.7	112	66	46	22
	GW-396	N 1,140,469.8	E 511,370.7	112	66	46	22
	GW-397	N 1,140,467.8	E 511,545.7	112	66	46	22
	GW-398	N 1,140,465.9	E 511,720.7	112	66	46	22
	GW-399	N 1,140,625.5	E 511,803.6	119	72	47	24
	GW-400	N 1,140,627.5	E 511,628.6	119	72	47	24
	GW-401	N 1,140,629.4	E 511,453.6	119	72	47	24
	GW-402	N 1,140,631.4	E 511,278.6	119	72	47	24
	GW-403	N 1,140,633.4	E 511,103.6	119	72	47	24
	GW-404	N 1,140,635.3	E 510,928.6	119	72	47	24
	GW-405	N 1,140,637.3	E 510,753.6	119	72	47	24
	GW-406	N 1,140,639.3	E 510,578.7	119	72	47	24
	GW-407	N 1,140,641.2	E 510,403.7	119	72	47	24
				SUB-TOTAL	3,245 (FT)		1,094 (FT)
				TOTAL	4,856 (FT)		1,646 (FT)

* BOREHOLE DEPTH AS MEASURED FROM TOP OF EXISTING INTERMEDIATE COVER. CONTRACTOR SHALL VERIFY DEPTH AND ELEVATIONS PRIOR TO DRILLING

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
JUN 25 2008
SOUTHWEST DISTRICT TAMPA

JOSEPH LAWRENCE MILLER
LICENSE
No. 39177
STATE OF

2/18/08

C-6

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POST BUCKLEY, SCHUH & JERNIGAN, Inc.
dba PBS&J
2001 N.W. 107th Ave., Miami, FL 33172-2507
FBPR Certificate of Authorization No.: 24

CLIENT	PROJECT	TASK
MANATEE COUNTY	LENA ROAD	VERTICAL GAS EXTRACTION
BOARD OF COUNTY COMMISSIONERS	STAGE III LANDFILL	WELL SCHEDULE
	GAS COLLECTION SYSTEM	

ORIGINAL JAN. 2008
REVISIONS:
1. APR. 2008
2.
3.
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JOB NO. 100931.91
DRAWN RGC
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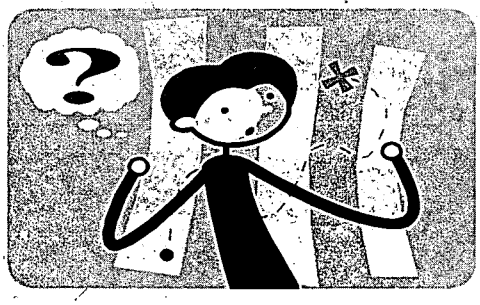
ATTENTION



OVERSIZED MAPS HAVE BEEN SCANNED SEPARATELY PLEASE SEE:

- Stage III Gas Construction-Initial Submittal: Drawing C-1
- Stage III Gas Construction-Initial Submittal: Drawing C-2
- Stage III Gas Construction-Initial Submittal: Drawing C-3
- Stage III Gas Construction-Initial Submittal: Drawing C-3A
- Stage III Gas Construction-Initial Submittal: Drawing C-3B
- Stage III Gas Construction-Initial Submittal: Drawing C-4
- Stage III Gas Construction-Initial Submittal: Drawing C-5
- Stage III Gas Construction-Initial Submittal: Drawing C-6