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Fac/Perm/Co ID #	Date	Doc ID#
11-07	3/27/09	7102

March 25, 2009

Mr. Allen Gaither
North Carolina Department of Environmental and Natural Resources
Division of Waste Management
Solid Waste Section
2090 US Highway 70
Swannanoa, North Carolina 28778

RECEIVED
MAR 26 2009
SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE

Subject: Buncombe County Solid Waste Management Facility
Buncombe County, North Carolina
Landfill Gas to Energy Project
Request for Approval

Dear Mr. Gaither:

On behalf of Buncombe County, CDM is pleased to submit two (2) copies of the conceptual design plan for the proposed Landfill Gas-to-Energy (LFGTE) Project at the Buncombe County Solid Waste Management Facility for your review. The purpose of the project is to capture and destruct landfill gas generated by the Subtitle D landfill and to generate a renewable form of energy for use in the community.

Project Description

The proposed project is the first installation of the LFGTE facility which will be expanded periodically as increasing amounts of landfill gas are generated. This initial project consists of a vertical wellfield to be installed in Cells 1-5 and the installation of a generator set at the flare station that is capable of producing 1.4 MW of electrical power. A gas conditioning system will be used to dry and compress the gas collected from the landfill before it is delivered to the generator set. Additional pretreatment of the landfill gas for siloxane and/or sulfur removal is not currently planned but may be added in the future if deemed necessary.

Wellfield Layout and Well Depths

As shown on Sheet C-1 of the attached drawings (see Appendix A), there are 25 vertical wells proposed to be installed in Cells 1-5. Spacing between the wells was selected based on an assumed radius of influence of 100-ft for each well as shown on Sheet C-2. Further adjustments were made to avoid existing infrastructure of the bioreactor system.

CDM prepared a contour map using the as-built surveys for the Cells 1-5 base liner system as shown on Sheet G-2. This as-built composite surface represents the top of the 2-foot thick protective rock cover layer. Using AutoCAD Civil 3D, CDM developed a 50-ft on center

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depth grid by comparing the current landfill elevations and the as-built base grade composite surface (as shown on Sheet C-2). Waste depth was determined for each proposed well location as shown on Vertical Well Schedule on Sheet C-2. The well depth was determined by taking the waste depth and subtracting 15 feet. As shown on Detail C on Sheet D-1, the vertical well design maintains a minimum 15 feet from top of the 2-foot thick protective stone cover layer.

Areas of Cells 1-5 that were determined to be too shallow to effectively collect gas from a vertical well were designated as the No Drill Zone and are shown with a shading pattern on Sheet C-2. The No Drill Zone was established based on a required minimum waste depth of 45-ft for an area to be considered for well placement. This minimum depth was determined using the following design criteria:

1. The minimum distance between the top of the base liner system and the bottom of a well borehole shall be 15-ft.

2. The minimum length of slotted pipe section shall be 15-ft.

3. The minimum length of solid pipe section shall be 15-ft.

Wellfield Modeling

Analysis of the proposed wellfield was performed using the USEPA Landfill Gas Emissions Model (LandGEM) and KYPipe Pipe2006 model (see Appendices B and C for results). The LandGEM modeling results estimate a peak flow rate of 490 scfm for the Cells 1-5 area for 2009. The KYPipe modeling results indicate that 4-inch diameter gas piping will be adequate to ensure that sufficient vacuum will be provided to each well to effectively collect gas from the wellfield. Additionally, the pipe modeling indicated that existing gas piping is adequately sized in diameter.

Condensate Management

The gas piping, as shown on Sheet C-1, is sloped to allow landfill gas condensate to flow by gravity to one of the three existing condensate recovery systems (CRSs) located along the existing 24-inch perimeter gas header (see Sheet G-1). Condensate generated in the pipe segments from VW-19 to VW-23 and from VW-24 to VW-23 will drain to the existing Cell 5 east leachate cleanout.

Prevention of Base Liner System Damage

At the time of construction the Contractor's surveyor will stake out the well locations for drilling. Prior to drilling, the stake locations will be verified by the Owner's surveyor to

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ensure that the stakes have been properly located and match the coordinates provided on the plans. In addition, the elevation at each well location will checked to ensure that significant settlement has not occurred. If settlement has occurred the depth of the borehole will be adjusted accordingly to maintain the 15-ft separation between the base liner system and the bottom of the borehole. In the event that a borehole needs to be relocated due to refusal a new location and borehole depth will be established by the Engineer. The Contractor's surveyor will stake out the new location and the Owner's surveyor will confirm the location and elevation prior to drilling.

If you have any questions or need additional information, please do not hesitate to call me at (919) 787-5620.

Very truly yours,

NORTH CAROLINA PROFESSIONAL SEAL 029928 ENGINEER KENTON J. YANG
03/25/2009

Kenton Yang, P.E.
Camp Dresser & McKee

xc: E. Mussler, NCDENR SWS
J. Creighton/J. Mears/K. Smith, BCGSD
J. Wiseman/J. Boyer/C. Gabel, CDM

Appendix A
Conceptual Design Drawings

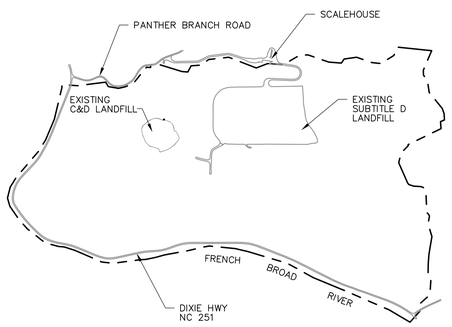
BUNCOMBE COUNTY

NORTH CAROLINA

BUNCOMBE COUNTY SOLID WASTE MANAGEMENT FACILITY LANDFILL GAS TO ENERGY PROJECT

CONTRACT NO.

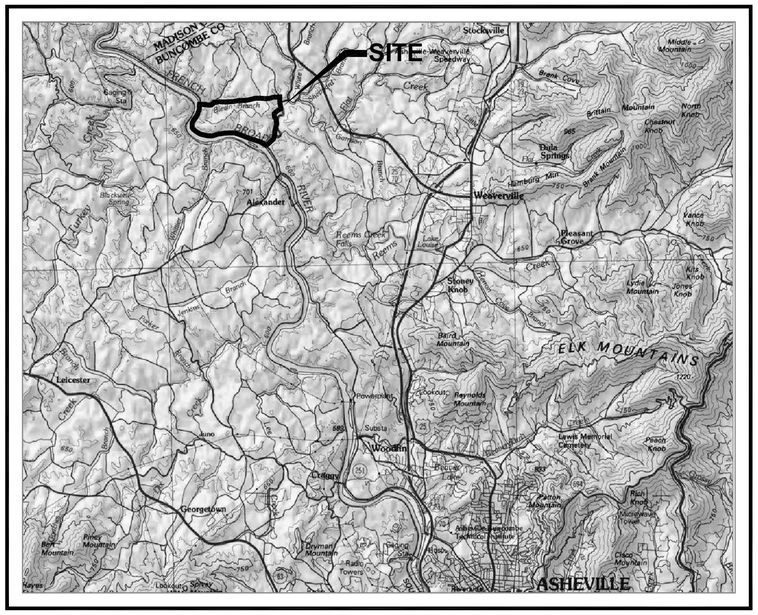
6447-64253



VICINITY MAP

VICINITY MAP

NOT TO SCALE



LOCATION MAP

INDEX OF DRAWINGS

--	COVER SHEET
G-1	EXISTING CONDITIONS
G-2	AS-BUILT BASE LINER GRADES
C-1	PROJECT LAYOUT
C-2	WELL DEPTH AND LOCATION PLAN
D-1	DETAILS

MARCH 2009

PREPARED BY

CDM Camp Dresser & McKee

consulting engineering construction operations

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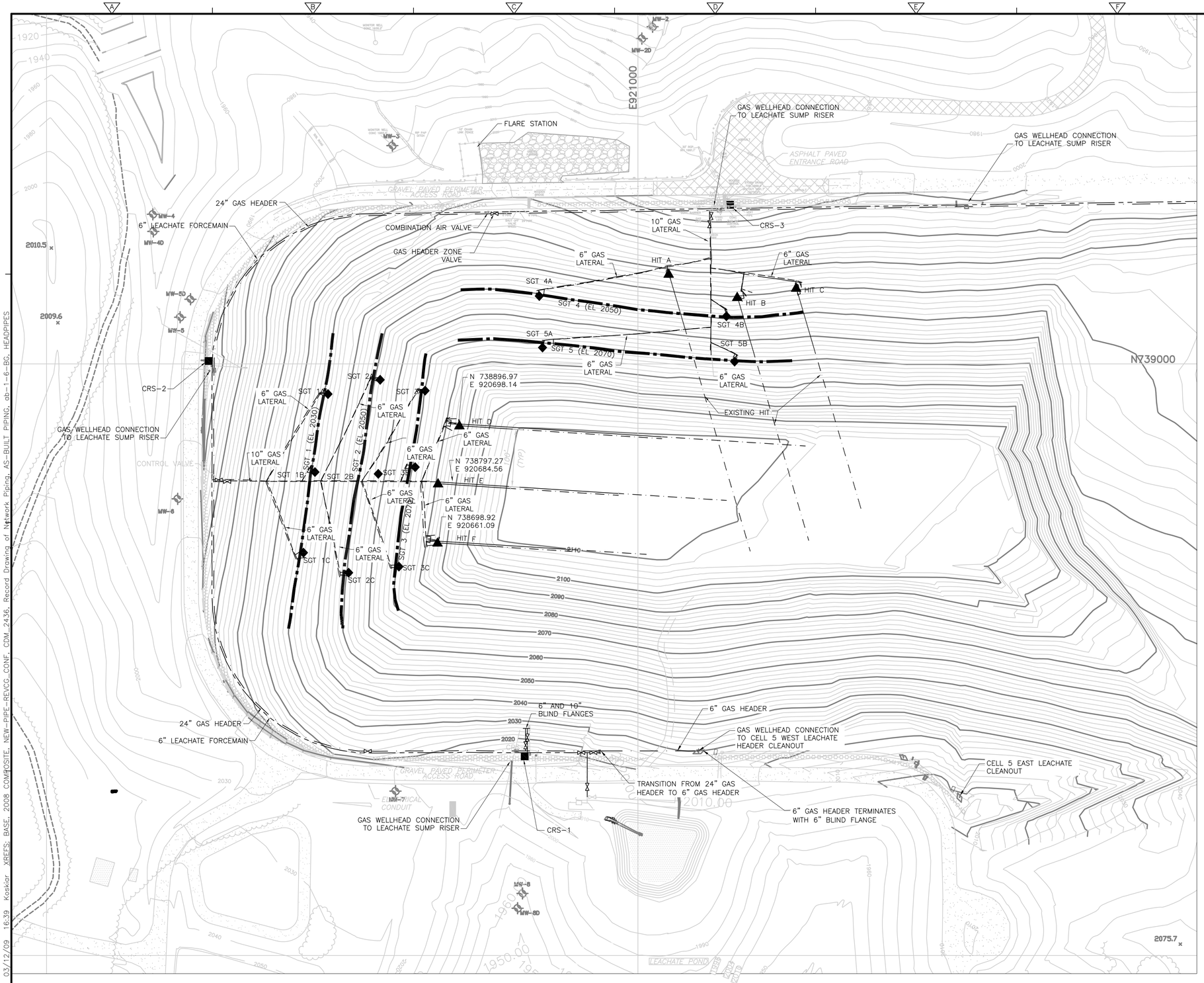

N

1" = 80'

40 0 80

LEGEND

2010	EXISTING INDEX CONTOUR
	EXISTING SURFICIAL GRAVITY TRENCH (SGT)
	EXISTING HORIZONTAL INJECTION TRENCH (HIT)
SGT 2A	EXISTING SGT INJECTION PORT/GAS WELLHEAD
HIT A	EXISTING HIT INJECTION PORT/GAS WELLHEAD
CRS-1	EXISTING CONDENSATE RECOVERY SYSTEM (CRS)
	EXISTING 24" GAS HEADER
	EXISTING 6" OR 10" GAS LATERAL
	EXISTING 6" LEACHATE INJECTION FORCEMAIN
	EXISTING 4" LEACHATE INJECTION LATERAL

C:\CAD\Buncombe\dwg\ G-1 03/12/09 16:39 Koskiar XREFS: BASE, 2008 COMPOSITE, NEW-PIPE-REVCG-CONF, CDM_2436, Record Drawing of Network Piping, AS-BUILT PIPING, ab-1-6-BG, HEADPIPES

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: K YANG
DRAWN BY: M KOSKI
SHEET CHK'D BY: K YANG
CROSS CHK'D BY: C GABEL
APPROVED BY: C GABEL
DATE: MARCH 2009

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BUNCOMBE COUNTY, NORTH CAROLINA
BUNCOMBE COUNTY SOLID WASTE MANAGEMENT FACILITY

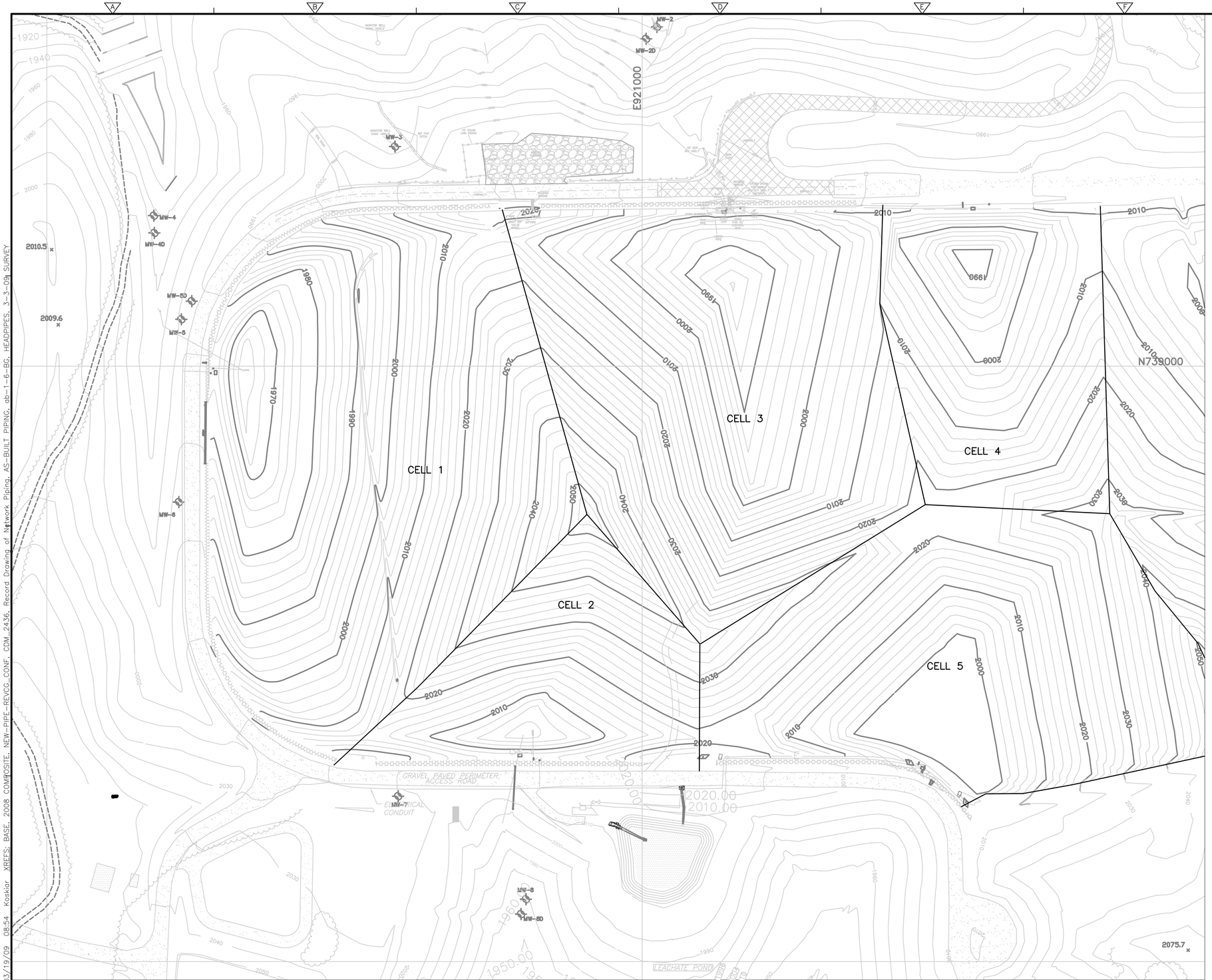
LANDFILL GAS TO ENERGY PROJECT

EXISTING CONDITIONS

PROJECT NO. 6447-64253
FILE NAME: CWFPL001.DWG

SHEET NO.
G-1

FOR REVIEW ONLY



N

1" = 80'

40 0 80

LEGEND

——2010——	EXISTING INDEX CONTOUR
————	EXISTING INTERMEDIATE CONTOUR

NOTE:

1. ELEVATIONS ARE TOP OF 2 FT ROCK DRAINAGE LAYER

C:\CAD\Buncombe\dwg\ G-2 03/19/09 08:54 Koskior XREFS: BASE, 2008 COMPOSITE, NEW-PIPE-REVCG-CONF, CDM 2436, Record Drawing of Network Piping, AS-BUILT PIPING, ab-1-6-BG, HEADPIPES, 3-3-09 SURVEY

REV. NO.	DATE	DRWN	CHKD	REMARKS

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BUNCOMBE COUNTY, NORTH CAROLINA
BUNCOMBE COUNTY SOLID WASTE MANAGEMENT FACILITY

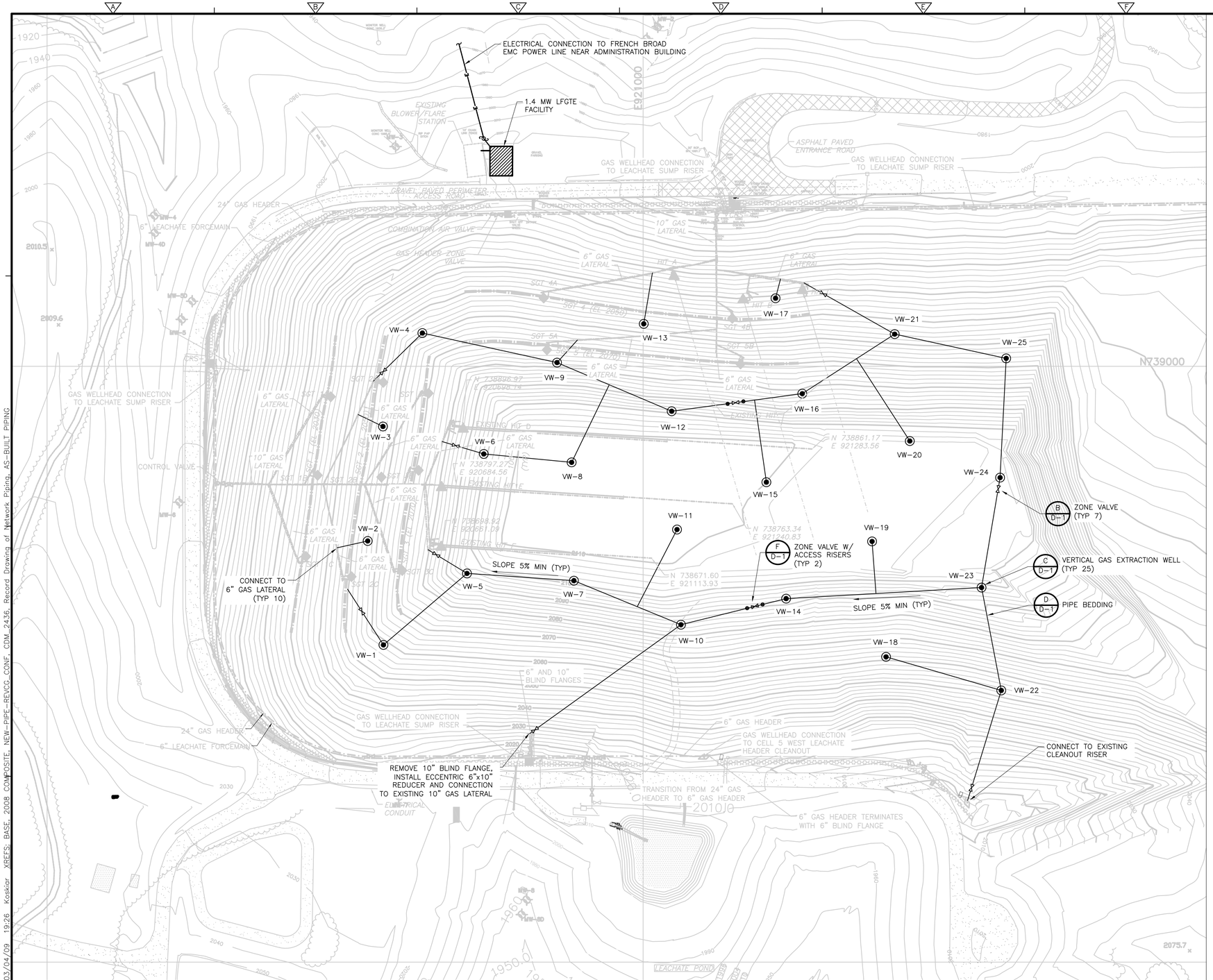
LANDFILL GAS TO ENERGY PROJECT

AS-BUILT BASE LINER GRADES

PROJECT NO. 6447-64253
FILE NAME: CSTPL002.DWG

SHEET NO.
G-2

FOR REVIEW ONLY



N

1" = 80'

40 0 80

NOTES:

1. ALL SURFICIAL GRAVITY TRENCHES (SGT) AND HORIZONTAL INJECTION TRENCHES (HIT) ARE EXISTING.

LEGEND

- 6" GAS PIPE
- VERTICAL GAS EXTRACTION WELL
- 6" ZONE VALVE
- 2010 — EXISTING INDEX CONTOUR
- EXISTING SURFICIAL GRAVITY TRENCH (SGT)
- EXISTING HORIZONTAL INJECTION TRENCH (HIT)
- SGT 2A — EXISTING SGT INJECTION PORT/GAS WELLHEAD
- HIT A — EXISTING HIT INJECTION PORT/GAS WELLHEAD
- CRS-1 — EXISTING CONDENSATE RECOVERY SYSTEM (CRS)
- EXISTING 24" GAS HEADER
- EXISTING 6" OR 10" GAS LATERAL
- EXISTING 6" LEACHATE INJECTION FORCEMAIN
- EXISTING 4" LEACHATE INJECTION LATERAL

VERTICAL WELL SCHEDULE

WELL ID	NORTHING	EASTING	WASTE DEPTH (FT)	WELL BOTTOM (EL)	WELL DEPTH (VF)
VW-1	738532.0	920564.0	47	2026	32
VW-2	738706.0	920537.0	56	2015	41
VW-3	738899.0	920563.5	56	2012	42
VW-4	739055.7	920629.6	51	2021	37
VW-5	738652.3	920704.5	67	2042	53
VW-6	738852.9	920732.7	72	2040	58
VW-7	738640.2	920883.9	60	2054	45
VW-8	738838.8	920880.1	63	2061	48
VW-9	739006.2	920855.6	47	2044	32
VW-10	738566.3	921063.5	46	2054	31
VW-11	738726.0	921056.9	83	2041	68
VW-12	738924.6	921047.9	82	2030	67
VW-13	739071.2	921001.1	49	2021	34
VW-14	738610.0	921240.0	61	2046	46
VW-15	738805.4	921206.9	113	2011	98
VW-16	738954.0	921267.1	83	2013	68
VW-17	739114.2	921222.2	50	2005	35
VW-18	738512.3	921407.7	54	2022	39
VW-19	738706.0	921384.2	80	2040	65
VW-20	738874.5	921447.5	88	2032	73
VW-21	739054.0	921422.2	45	2025	30
VW-22	738456.0	921601.0	49	2018	34
VW-23	738628.6	921567.9	86	2026	71
VW-24	738813.1	921599.0	84	2034	69
VW-25	739013.3	921609.3	64	2016	50

REV. NO.	DATE	DRWN	CHKD	REMARKS

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BUNCOMBE COUNTY, NORTH CAROLINA
BUNCOMBE COUNTY SOLID WASTE MANAGEMENT FACILITY

LANDFILL GAS TO ENERGY PROJECT

PROJECT LAYOUT

PROJECT NO. 6447-64253
FILE NAME: C-1.DWG
SHEET NO.
C-1

FOR REVIEW ONLY

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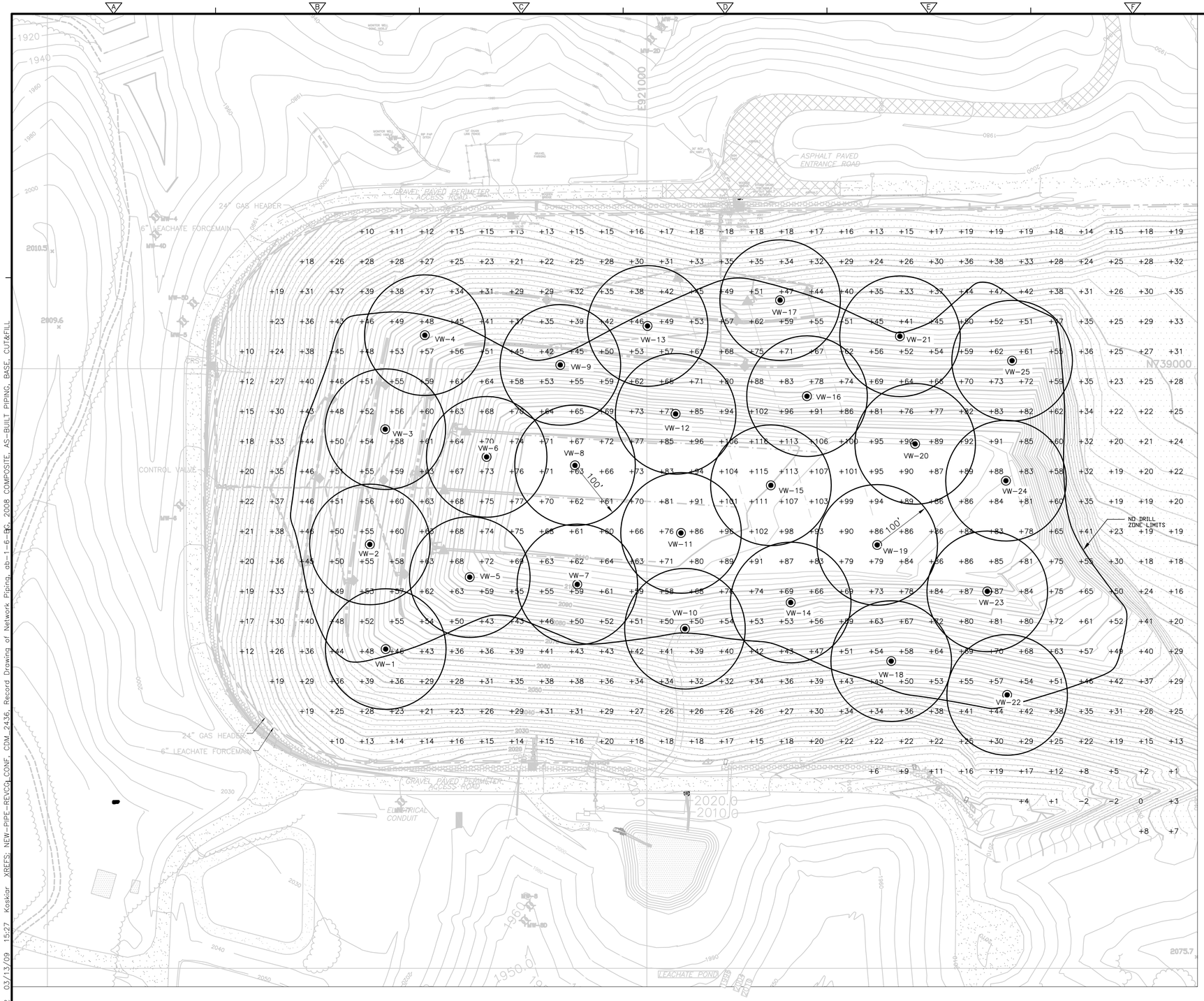

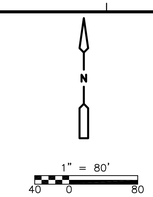

NOTES:

1. NO DRILL ZONE DELINEATED BY WASTE DEPTH LESS THAN 45'. THE 45' WAS DETERMINED BY VERTICAL WELLS CRITERIA:
   - SOLID RISER PIPE = 15'
   - MINIMUM DISTANCE FROM BASE LINER = 15'
   - MINIMUM SLOTTED PIPE SECTION = 15'
2. WELL RADIUS ASSUMED TO BE 100'.

LEGEND

	NO DRILL ZONE
+20.8	DEPTH (FEET)
2010	EXISTING INDEX CONTOUR
	EXISTING SURFICIAL GRAVITY TRENCH (SGT)
	EXISTING HORIZONTAL INJECTION TRENCH (HIT)
SGT 2A	EXISTING SGT INJECTION PORT/GAS WELLHEAD
HIT A	EXISTING HIT INJECTION PORT/GAS WELLHEAD
CRS-1	EXISTING CONDENSATE RECOVERY SYSTEM (CRS)
	EXISTING 24" GAS HEADER
	EXISTING 6" OR 10" GAS LATERAL
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	EXISTING 4" LEACHATE INJECTION LATERAL

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BUNCOMBE COUNTY SOLID WASTE MANAGEMENT FACILITY

LANDFILL GAS TO ENERGY PROJECT

WELL DEPTH AND LOCATION PLAN

PROJECT NO. 6447-64253
FILE NAME: CWFPL002.DWG

SHEET NO.
C-2

FOR REVIEW ONLY

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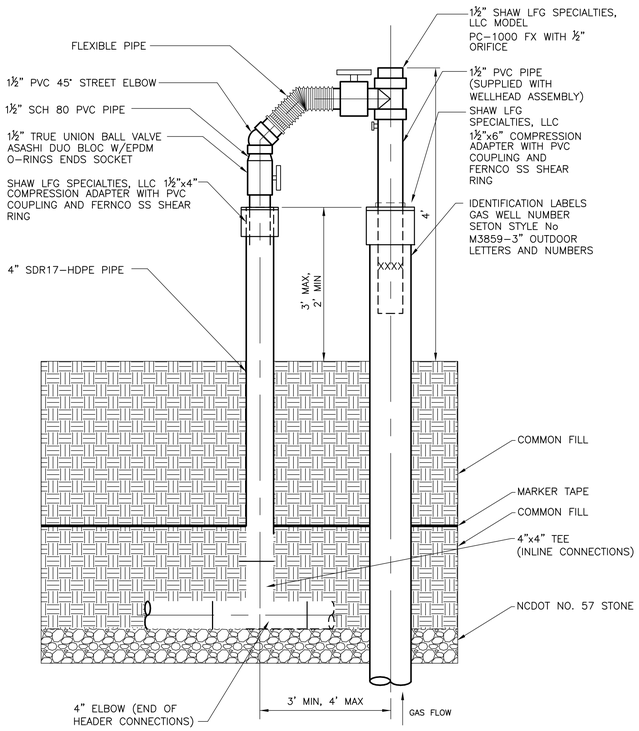
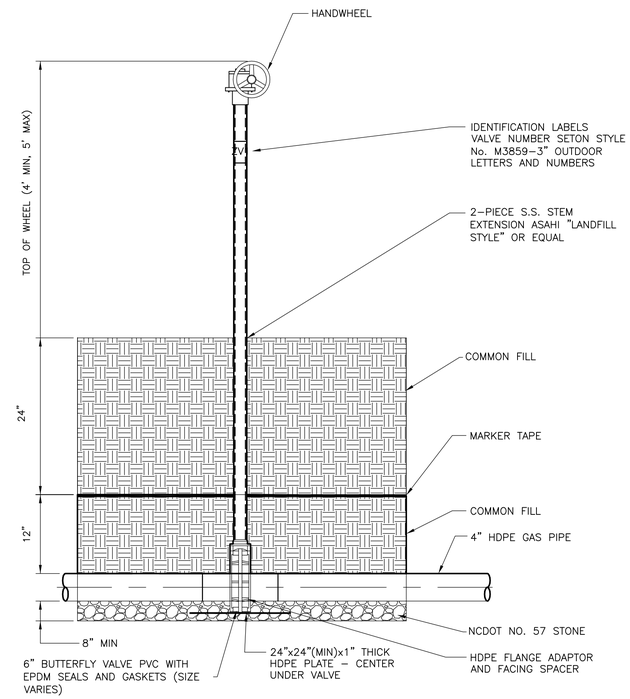


SECTION

WELLHEAD ASSEMBLY

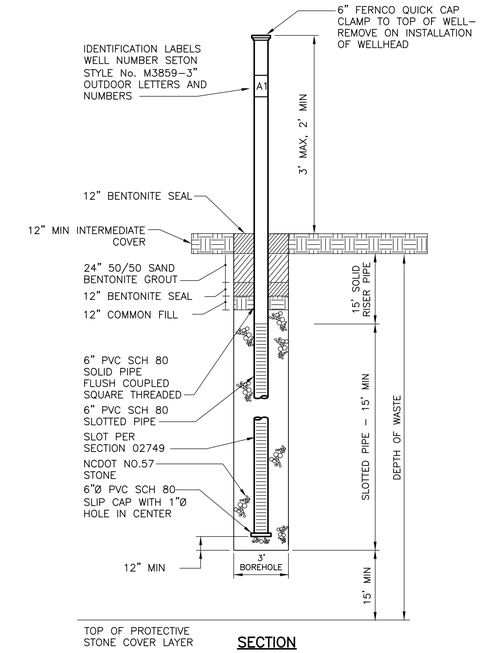
DETAIL A – NTS



SECTION

ZONE VALVE

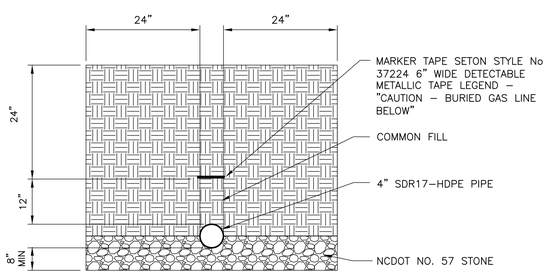
DETAIL B – NTS



SECTION

VERTICAL GAS EXTRACTION WELL

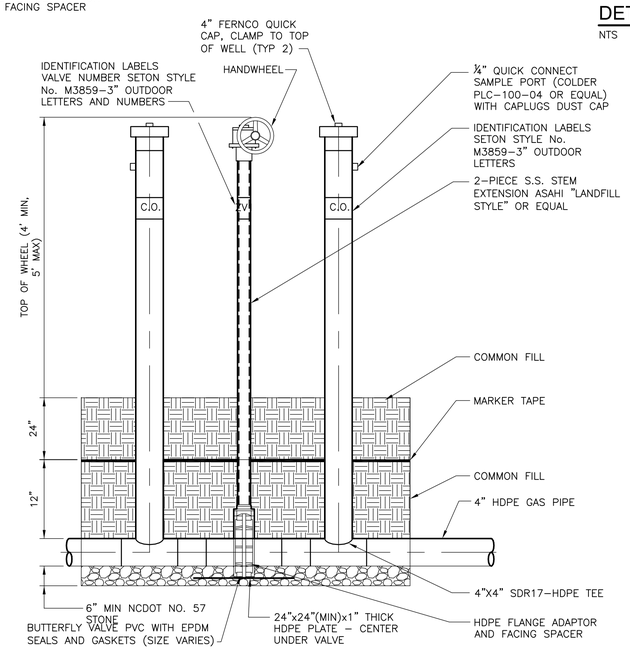
DETAIL C – NTS C-1



SECTION

PIPE BEDDING

DETAIL D – NTS C-1



ZONE VALVE W/ ACCESS RISERS

DETAIL F – NTS C-1

REV. NO.	DATE	DRWN	CHKD	REMARKS

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BUNCOMBE COUNTY, NORTH CAROLINA
BUNCOMBE COUNTY SOLID WASTE MANAGEMENT FACILITY

LANDFILL GAS TO ENERGY PROJECT

DETAILS

PROJECT NO. 6447-64253
FILE NAME: D-1.DWG
SHEET NO. **D-1**

FOR REVIEW ONLY

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Appendix B
LandGEM Results

Summary Report

Landfill Name or Identifier: Buncombe County Landfill

Date: Friday, March 27, 2009

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

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

Where,

Q_{CH_4} = annual methane generation in the year of the calculation *(m^3/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate *($year^{-1}$)*
L_o = potential methane generation capacity *(m^3/Mg)*

M_i = mass of waste accepted in the ith year *(Mg)*
t_{ij} = age of the jth section of waste mass M_i accepted in the ith year *(decimal years, e.g., 3.2 years)*

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

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

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**1997**	
Landfill Closure Year (with 80-year limit)	**2026**	
Actual Closure Year (without limit)	***2026***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**3,175,130**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year^{-1}*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**322**	*ppmv as hexane*
Methane Content	**55**	*% by volume*

GASES / POLLUTANTS SELECTED

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

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1997	16,148	17,763	0	0
1998	81,279	89,407	16,148	17,763
1999	107,707	118,478	97,427	107,170
2000	109,954	120,949	205,134	225,647
2001	112,690	123,959	315,088	346,597
2002	118,070	129,877	427,778	470,556
2003	138,749	152,624	545,848	600,433
2004	135,309	148,840	684,597	753,057
2005	115,871	127,458	819,906	901,897
2006	96,787	106,466	935,777	1,029,355
2007	98,776	108,654	1,032,564	1,135,820
2008	111,890	123,079	1,131,340	1,244,474
2009	111,890	123,079	1,243,230	1,367,553
2010	111,890	123,079	1,355,120	1,490,632
2011	111,890	123,079	1,467,010	1,613,711
2012	111,890	123,079	1,578,900	1,736,790
2013	111,890	123,079	1,690,790	1,859,869
2014	111,890	123,079	1,802,680	1,982,948
2015	111,890	123,079	1,914,570	2,106,027
2016	111,890	123,079	2,026,460	2,229,106
2017	111,890	123,079	2,138,350	2,352,185
2018	111,890	123,079	2,250,240	2,475,264
2019	111,890	123,079	2,362,130	2,598,343
2020	111,890	123,079	2,474,020	2,721,422
2021	111,890	123,079	2,585,910	2,844,501
2022	111,890	123,079	2,697,800	2,967,580
2023	111,890	123,079	2,809,690	3,090,659
2024	111,890	123,079	2,921,580	3,213,738
2025	111,890	123,079	3,033,470	3,336,817
2026	29,770	32,747	3,145,360	3,459,896
2027	0	0	3,175,130	3,492,643
2028	0	0	3,175,130	3,492,643
2029	0	0	3,175,130	3,492,643
2030	0	0	3,175,130	3,492,643
2031	0	0	3,175,130	3,492,643
2032	0	0	3,175,130	3,492,643
2033	0	0	3,175,130	3,492,643
2034	0	0	3,175,130	3,492,643
2035	0	0	3,175,130	3,492,643
2036	0	0	3,175,130	3,492,643

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2037	0	0	3,175,130	3,492,643
2038	0	0	3,175,130	3,492,643
2039	0	0	3,175,130	3,492,643
2040	0	0	3,175,130	3,492,643
2041	0	0	3,175,130	3,492,643
2042	0	0	3,175,130	3,492,643
2043	0	0	3,175,130	3,492,643
2044	0	0	3,175,130	3,492,643
2045	0	0	3,175,130	3,492,643
2046	0	0	3,175,130	3,492,643
2047	0	0	3,175,130	3,492,643
2048	0	0	3,175,130	3,492,643
2049	0	0	3,175,130	3,492,643
2050	0	0	3,175,130	3,492,643
2051	0	0	3,175,130	3,492,643
2052	0	0	3,175,130	3,492,643
2053	0	0	3,175,130	3,492,643
2054	0	0	3,175,130	3,492,643
2055	0	0	3,175,130	3,492,643
2056	0	0	3,175,130	3,492,643
2057	0	0	3,175,130	3,492,643
2058	0	0	3,175,130	3,492,643
2059	0	0	3,175,130	3,492,643
2060	0	0	3,175,130	3,492,643
2061	0	0	3,175,130	3,492,643
2062	0	0	3,175,130	3,492,643
2063	0	0	3,175,130	3,492,643
2064	0	0	3,175,130	3,492,643
2065	0	0	3,175,130	3,492,643
2066	0	0	3,175,130	3,492,643
2067	0	0	3,175,130	3,492,643
2068	0	0	3,175,130	3,492,643
2069	0	0	3,175,130	3,492,643
2070	0	0	3,175,130	3,492,643
2071	0	0	3,175,130	3,492,643
2072	0	0	3,175,130	3,492,643
2073	0	0	3,175,130	3,492,643
2074	0	0	3,175,130	3,492,643
2075	0	0	3,175,130	3,492,643
2076	0	0	3,175,130	3,492,643

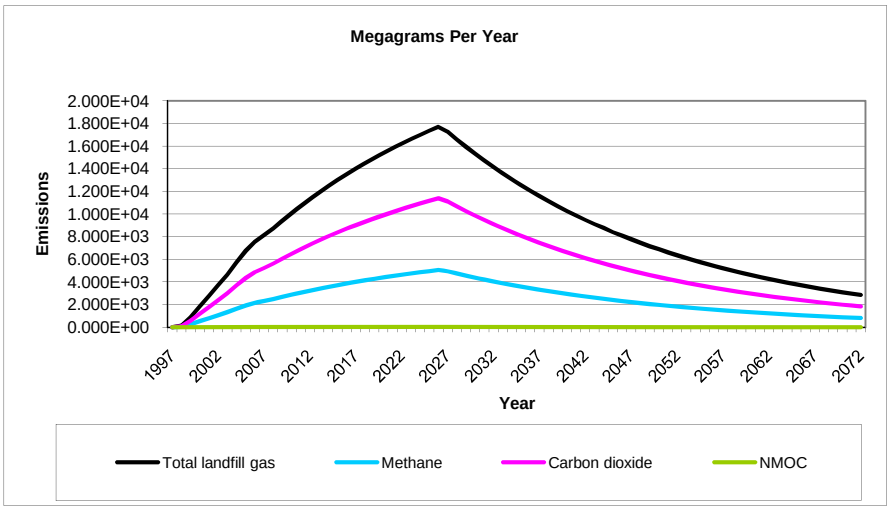
Pollutant Parameters

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

Pollutant Parameters (Continued)

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

Graphs


Megagrams Per Year
Emissions
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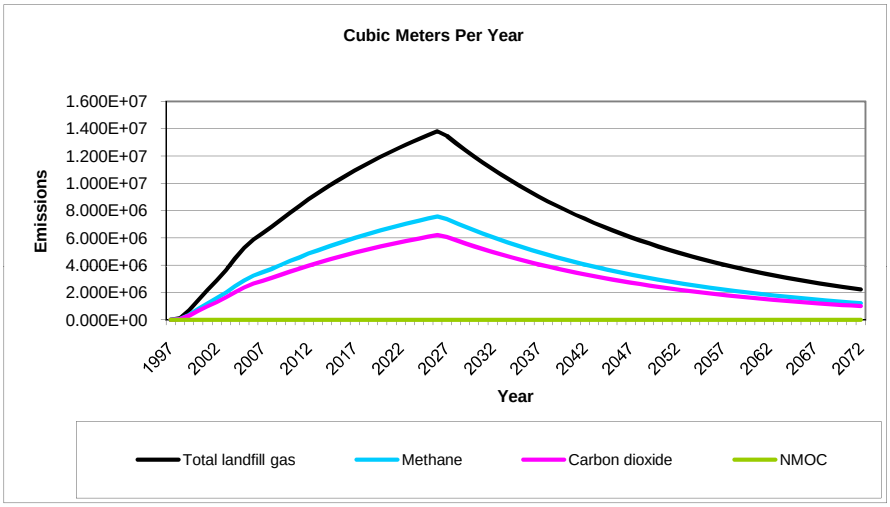
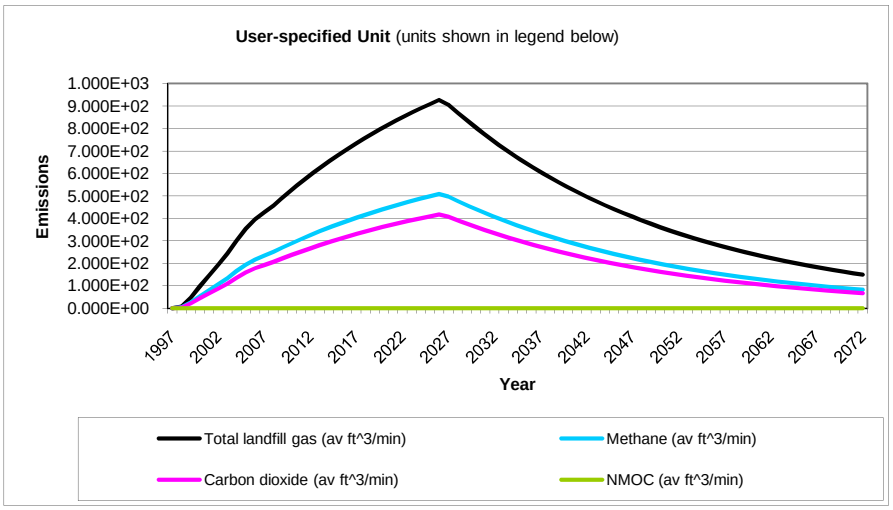
1.800E+04
1.600E+04
1.400E+04
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
1997 2002 2007 2012 2017 2022 2027 2032 2037 2042 2047 2052 2057 2062 2067 2072
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
1.600E+07
1.400E+07
1.200E+07
1.000E+07
8.000E+06
6.000E+06
4.000E+06
2.000E+06
0.000E+00
1997 2002 2007 2012 2017 2022 2027 2032 2037 2042 2047 2052 2057 2062 2067 2072
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
1.000E+03
9.000E+02
8.000E+02
7.000E+02
6.000E+02
5.000E+02
4.000E+02
3.000E+02
2.000E+02
1.000E+02
0.000E+00
1997 2002 2007 2012 2017 2022 2027 2032 2037 2042 2047 2052 2057 2062 2067 2072
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1997	0	0	0	0	0	0
1998	1.481E+02	1.156E+05	7.765E+00	4.233E+01	6.344E+04	4.263E+00
1999	8.877E+02	6.927E+05	4.654E+01	2.537E+02	3.803E+05	2.555E+01
2000	1.841E+03	1.436E+06	9.651E+01	5.261E+02	7.886E+05	5.298E+01
2001	2.777E+03	2.167E+06	1.456E+02	7.937E+02	1.190E+06	7.993E+01
2002	3.702E+03	2.888E+06	1.941E+02	1.058E+03	1.586E+06	1.065E+02
2003	4.639E+03	3.620E+06	2.432E+02	1.326E+03	1.987E+06	1.335E+02
2004	5.730E+03	4.471E+06	3.004E+02	1.638E+03	2.455E+06	1.649E+02
2005	6.746E+03	5.264E+06	3.537E+02	1.928E+03	2.890E+06	1.942E+02
2006	7.544E+03	5.887E+06	3.955E+02	2.156E+03	3.232E+06	2.172E+02
2007	8.136E+03	6.349E+06	4.266E+02	2.325E+03	3.485E+06	2.342E+02
2008	8.723E+03	6.807E+06	4.573E+02	2.493E+03	3.737E+06	2.511E+02
2009	9.407E+03	7.341E+06	4.932E+02	2.689E+03	4.030E+06	2.708E+02
2010	1.006E+04	7.853E+06	5.277E+02	2.876E+03	4.312E+06	2.897E+02
2011	1.070E+04	8.346E+06	5.608E+02	3.057E+03	4.582E+06	3.079E+02
2012	1.130E+04	8.820E+06	5.926E+02	3.230E+03	4.842E+06	3.253E+02
2013	1.189E+04	9.275E+06	6.232E+02	3.397E+03	5.092E+06	3.421E+02
2014	1.245E+04	9.712E+06	6.525E+02	3.557E+03	5.332E+06	3.582E+02
2015	1.298E+04	1.013E+07	6.807E+02	3.711E+03	5.562E+06	3.737E+02
2016	1.350E+04	1.054E+07	7.079E+02	3.859E+03	5.784E+06	3.886E+02
2017	1.400E+04	1.092E+07	7.339E+02	4.001E+03	5.997E+06	4.029E+02
2018	1.448E+04	1.130E+07	7.589E+02	4.137E+03	6.201E+06	4.167E+02
2019	1.493E+04	1.165E+07	7.830E+02	4.268E+03	6.398E+06	4.299E+02
2020	1.537E+04	1.200E+07	8.061E+02	4.394E+03	6.586E+06	4.425E+02
2021	1.580E+04	1.233E+07	8.283E+02	4.515E+03	6.768E+06	4.547E+02
2022	1.620E+04	1.264E+07	8.496E+02	4.631E+03	6.942E+06	4.664E+02
2023	1.660E+04	1.295E+07	8.701E+02	4.743E+03	7.109E+06	4.777E+02
2024	1.697E+04	1.324E+07	8.898E+02	4.850E+03	7.270E+06	4.885E+02
2025	1.733E+04	1.352E+07	9.087E+02	4.953E+03	7.425E+06	4.989E+02
2026	1.768E+04	1.379E+07	9.268E+02	5.052E+03	7.573E+06	5.088E+02
2027	1.726E+04	1.347E+07	9.048E+02	4.932E+03	7.393E+06	4.967E+02
2028	1.658E+04	1.294E+07	8.693E+02	4.739E+03	7.103E+06	4.773E+02
2029	1.593E+04	1.243E+07	8.353E+02	4.553E+03	6.825E+06	4.586E+02
2030	1.531E+04	1.194E+07	8.025E+02	4.375E+03	6.557E+06	4.406E+02
2031	1.471E+04	1.148E+07	7.710E+02	4.203E+03	6.300E+06	4.233E+02
2032	1.413E+04	1.103E+07	7.408E+02	4.038E+03	6.053E+06	4.067E+02
2033	1.358E+04	1.059E+07	7.118E+02	3.880E+03	5.816E+06	3.908E+02
2034	1.304E+04	1.018E+07	6.838E+02	3.728E+03	5.588E+06	3.754E+02
2035	1.253E+04	9.779E+06	6.570E+02	3.582E+03	5.369E+06	3.607E+02
2036	1.204E+04	9.395E+06	6.313E+02	3.441E+03	5.158E+06	3.466E+02
2037	1.157E+04	9.027E+06	6.065E+02	3.306E+03	4.956E+06	3.330E+02
2038	1.111E+04	8.673E+06	5.827E+02	3.177E+03	4.761E+06	3.199E+02
2039	1.068E+04	8.333E+06	5.599E+02	3.052E+03	4.575E+06	3.074E+02
2040	1.026E+04	8.006E+06	5.379E+02	2.932E+03	4.395E+06	2.953E+02
2041	9.858E+03	7.692E+06	5.168E+02	2.817E+03	4.223E+06	2.837E+02
2042	9.471E+03	7.391E+06	4.966E+02	2.707E+03	4.057E+06	2.726E+02
2043	9.100E+03	7.101E+06	4.771E+02	2.601E+03	3.898E+06	2.619E+02
2044	8.743E+03	6.822E+06	4.584E+02	2.499E+03	3.746E+06	2.517E+02
2045	8.400E+03	6.555E+06	4.404E+02	2.401E+03	3.599E+06	2.418E+02
2046	8.071E+03	6.298E+06	4.232E+02	2.307E+03	3.458E+06	2.323E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2047	7.754E+03	6.051E+06	4.066E+02	2.216E+03	3.322E+06	2.232E+02
2048	7.450E+03	5.814E+06	3.906E+02	2.129E+03	3.192E+06	2.145E+02
2049	7.158E+03	5.586E+06	3.753E+02	2.046E+03	3.067E+06	2.060E+02
2050	6.878E+03	5.367E+06	3.606E+02	1.966E+03	2.946E+06	1.980E+02
2051	6.608E+03	5.156E+06	3.464E+02	1.889E+03	2.831E+06	1.902E+02
2052	6.349E+03	4.954E+06	3.329E+02	1.815E+03	2.720E+06	1.827E+02
2053	6.100E+03	4.760E+06	3.198E+02	1.743E+03	2.613E+06	1.756E+02
2054	5.861E+03	4.573E+06	3.073E+02	1.675E+03	2.511E+06	1.687E+02
2055	5.631E+03	4.394E+06	2.952E+02	1.609E+03	2.412E+06	1.621E+02
2056	5.410E+03	4.222E+06	2.836E+02	1.546E+03	2.318E+06	1.557E+02
2057	5.198E+03	4.056E+06	2.725E+02	1.486E+03	2.227E+06	1.496E+02
2058	4.994E+03	3.897E+06	2.618E+02	1.427E+03	2.139E+06	1.438E+02
2059	4.798E+03	3.744E+06	2.516E+02	1.371E+03	2.056E+06	1.381E+02
2060	4.610E+03	3.597E+06	2.417E+02	1.318E+03	1.975E+06	1.327E+02
2061	4.429E+03	3.456E+06	2.322E+02	1.266E+03	1.898E+06	1.275E+02
2062	4.256E+03	3.321E+06	2.231E+02	1.216E+03	1.823E+06	1.225E+02
2063	4.089E+03	3.191E+06	2.144E+02	1.169E+03	1.752E+06	1.177E+02
2064	3.928E+03	3.066E+06	2.060E+02	1.123E+03	1.683E+06	1.131E+02
2065	3.774E+03	2.945E+06	1.979E+02	1.079E+03	1.617E+06	1.086E+02
2066	3.626E+03	2.830E+06	1.901E+02	1.036E+03	1.554E+06	1.044E+02
2067	3.484E+03	2.719E+06	1.827E+02	9.958E+02	1.493E+06	1.003E+02
2068	3.348E+03	2.612E+06	1.755E+02	9.568E+02	1.434E+06	9.636E+01
2069	3.216E+03	2.510E+06	1.686E+02	9.193E+02	1.378E+06	9.258E+01
2070	3.090E+03	2.411E+06	1.620E+02	8.832E+02	1.324E+06	8.895E+01
2071	2.969E+03	2.317E+06	1.557E+02	8.486E+02	1.272E+06	8.546E+01
2072	2.853E+03	2.226E+06	1.496E+02	8.153E+02	1.222E+06	8.211E+01
2073	2.741E+03	2.139E+06	1.437E+02	7.833E+02	1.174E+06	7.889E+01
2074	2.633E+03	2.055E+06	1.381E+02	7.526E+02	1.128E+06	7.580E+01
2075	2.530E+03	1.974E+06	1.327E+02	7.231E+02	1.084E+06	7.283E+01
2076	2.431E+03	1.897E+06	1.275E+02	6.948E+02	1.041E+06	6.997E+01
2077	2.336E+03	1.823E+06	1.225E+02	6.675E+02	1.001E+06	6.723E+01
2078	2.244E+03	1.751E+06	1.177E+02	6.413E+02	9.613E+05	6.459E+01
2079	2.156E+03	1.682E+06	1.130E+02	6.162E+02	9.236E+05	6.206E+01
2080	2.071E+03	1.616E+06	1.086E+02	5.920E+02	8.874E+05	5.963E+01
2081	1.990E+03	1.553E+06	1.043E+02	5.688E+02	8.526E+05	5.729E+01
2082	1.912E+03	1.492E+06	1.003E+02	5.465E+02	8.192E+05	5.504E+01
2083	1.837E+03	1.434E+06	9.633E+01	5.251E+02	7.871E+05	5.288E+01
2084	1.765E+03	1.377E+06	9.255E+01	5.045E+02	7.562E+05	5.081E+01
2085	1.696E+03	1.323E+06	8.892E+01	4.847E+02	7.266E+05	4.882E+01
2086	1.629E+03	1.272E+06	8.543E+01	4.657E+02	6.981E+05	4.690E+01
2087	1.566E+03	1.222E+06	8.208E+01	4.475E+02	6.707E+05	4.506E+01
2088	1.504E+03	1.174E+06	7.886E+01	4.299E+02	6.444E+05	4.330E+01
2089	1.445E+03	1.128E+06	7.577E+01	4.131E+02	6.191E+05	4.160E+01
2090	1.389E+03	1.084E+06	7.280E+01	3.969E+02	5.949E+05	3.997E+01
2091	1.334E+03	1.041E+06	6.995E+01	3.813E+02	5.715E+05	3.840E+01
2092	1.282E+03	1.000E+06	6.720E+01	3.663E+02	5.491E+05	3.690E+01
2093	1.232E+03	9.610E+05	6.457E+01	3.520E+02	5.276E+05	3.545E+01
2094	1.183E+03	9.233E+05	6.204E+01	3.382E+02	5.069E+05	3.406E+01
2095	1.137E+03	8.871E+05	5.960E+01	3.249E+02	4.870E+05	3.272E+01
2096	1.092E+03	8.523E+05	5.727E+01	3.122E+02	4.679E+05	3.144E+01
2097	1.049E+03	8.189E+05	5.502E+01	2.999E+02	4.496E+05	3.021E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2098	1.008E+03	7.868E+05	5.286E+01	2.882E+02	4.320E+05	2.902E+01
2099	9.688E+02	7.559E+05	5.079E+01	2.769E+02	4.150E+05	2.788E+01
2100	9.308E+02	7.263E+05	4.880E+01	2.660E+02	3.987E+05	2.679E+01
2101	8.943E+02	6.978E+05	4.689E+01	2.556E+02	3.831E+05	2.574E+01
2102	8.592E+02	6.705E+05	4.505E+01	2.456E+02	3.681E+05	2.473E+01
2103	8.255E+02	6.442E+05	4.328E+01	2.359E+02	3.537E+05	2.376E+01
2104	7.931E+02	6.189E+05	4.158E+01	2.267E+02	3.398E+05	2.283E+01
2105	7.620E+02	5.946E+05	3.995E+01	2.178E+02	3.265E+05	2.193E+01
2106	7.322E+02	5.713E+05	3.839E+01	2.093E+02	3.137E+05	2.107E+01
2107	7.035E+02	5.489E+05	3.688E+01	2.011E+02	3.014E+05	2.025E+01
2108	6.759E+02	5.274E+05	3.544E+01	1.932E+02	2.895E+05	1.945E+01
2109	6.494E+02	5.067E+05	3.405E+01	1.856E+02	2.782E+05	1.869E+01
2110	6.239E+02	4.869E+05	3.271E+01	1.783E+02	2.673E+05	1.796E+01
2111	5.994E+02	4.678E+05	3.143E+01	1.713E+02	2.568E+05	1.725E+01
2112	5.759E+02	4.494E+05	3.020E+01	1.646E+02	2.467E+05	1.658E+01
2113	5.534E+02	4.318E+05	2.901E+01	1.582E+02	2.371E+05	1.593E+01
2114	5.317E+02	4.149E+05	2.788E+01	1.520E+02	2.278E+05	1.530E+01
2115	5.108E+02	3.986E+05	2.678E+01	1.460E+02	2.188E+05	1.470E+01
2116	4.908E+02	3.830E+05	2.573E+01	1.403E+02	2.103E+05	1.413E+01
2117	4.715E+02	3.680E+05	2.472E+01	1.348E+02	2.020E+05	1.357E+01
2118	4.531E+02	3.535E+05	2.375E+01	1.295E+02	1.941E+05	1.304E+01
2119	4.353E+02	3.397E+05	2.282E+01	1.244E+02	1.865E+05	1.253E+01
2120	4.182E+02	3.263E+05	2.193E+01	1.195E+02	1.792E+05	1.204E+01
2121	4.018E+02	3.136E+05	2.107E+01	1.148E+02	1.721E+05	1.157E+01
2122	3.861E+02	3.013E+05	2.024E+01	1.103E+02	1.654E+05	1.111E+01
2123	3.709E+02	2.894E+05	1.945E+01	1.060E+02	1.589E+05	1.068E+01
2124	3.564E+02	2.781E+05	1.869E+01	1.019E+02	1.527E+05	1.026E+01
2125	3.424E+02	2.672E+05	1.795E+01	9.786E+01	1.467E+05	9.856E+00
2126	3.290E+02	2.567E+05	1.725E+01	9.403E+01	1.409E+05	9.470E+00
2127	3.161E+02	2.466E+05	1.657E+01	9.034E+01	1.354E+05	9.098E+00
2128	3.037E+02	2.370E+05	1.592E+01	8.680E+01	1.301E+05	8.741E+00
2129	2.918E+02	2.277E+05	1.530E+01	8.339E+01	1.250E+05	8.399E+00
2130	2.803E+02	2.188E+05	1.470E+01	8.012E+01	1.201E+05	8.069E+00
2131	2.694E+02	2.102E+05	1.412E+01	7.698E+01	1.154E+05	7.753E+00
2132	2.588E+02	2.019E+05	1.357E+01	7.396E+01	1.109E+05	7.449E+00
2133	2.486E+02	1.940E+05	1.304E+01	7.106E+01	1.065E+05	7.157E+00
2134	2.389E+02	1.864E+05	1.253E+01	6.828E+01	1.023E+05	6.876E+00
2135	2.295E+02	1.791E+05	1.203E+01	6.560E+01	9.833E+04	6.607E+00
2136	2.205E+02	1.721E+05	1.156E+01	6.303E+01	9.447E+04	6.348E+00
2137	2.119E+02	1.653E+05	1.111E+01	6.056E+01	9.077E+04	6.099E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1997	0	0	0	0	0	0
1998	9.540E+01	5.212E+04	3.502E+00	1.334E-01	3.721E+01	2.500E-03
1999	5.719E+02	3.124E+05	2.099E+01	7.995E-01	2.231E+02	1.499E-02
2000	1.186E+03	6.478E+05	4.352E+01	1.658E+00	4.625E+02	3.108E-02
2001	1.789E+03	9.773E+05	6.566E+01	2.501E+00	6.977E+02	4.688E-02
2002	2.385E+03	1.303E+06	8.753E+01	3.334E+00	9.301E+02	6.249E-02
2003	2.989E+03	1.633E+06	1.097E+02	4.178E+00	1.166E+03	7.832E-02
2004	3.691E+03	2.016E+06	1.355E+02	5.161E+00	1.440E+03	9.673E-02
2005	4.346E+03	2.374E+06	1.595E+02	6.076E+00	1.695E+03	1.139E-01
2006	4.860E+03	2.655E+06	1.784E+02	6.795E+00	1.896E+03	1.274E-01
2007	5.241E+03	2.863E+06	1.924E+02	7.328E+00	2.044E+03	1.374E-01
2008	5.619E+03	3.070E+06	2.063E+02	7.856E+00	2.192E+03	1.473E-01
2009	6.060E+03	3.311E+06	2.224E+02	8.472E+00	2.364E+03	1.588E-01
2010	6.483E+03	3.542E+06	2.380E+02	9.064E+00	2.529E+03	1.699E-01
2011	6.890E+03	3.764E+06	2.529E+02	9.633E+00	2.688E+03	1.806E-01
2012	7.281E+03	3.978E+06	2.673E+02	1.018E+01	2.840E+03	1.908E-01
2013	7.657E+03	4.183E+06	2.810E+02	1.070E+01	2.986E+03	2.007E-01
2014	8.018E+03	4.380E+06	2.943E+02	1.121E+01	3.127E+03	2.101E-01
2015	8.364E+03	4.569E+06	3.070E+02	1.169E+01	3.262E+03	2.192E-01
2016	8.697E+03	4.751E+06	3.192E+02	1.216E+01	3.392E+03	2.279E-01
2017	9.017E+03	4.926E+06	3.310E+02	1.261E+01	3.517E+03	2.363E-01
2018	9.325E+03	5.094E+06	3.423E+02	1.304E+01	3.637E+03	2.444E-01
2019	9.620E+03	5.256E+06	3.531E+02	1.345E+01	3.752E+03	2.521E-01
2020	9.904E+03	5.411E+06	3.635E+02	1.385E+01	3.863E+03	2.596E-01
2021	1.018E+04	5.560E+06	3.735E+02	1.423E+01	3.969E+03	2.667E-01
2022	1.044E+04	5.703E+06	3.832E+02	1.459E+01	4.072E+03	2.736E-01
2023	1.069E+04	5.840E+06	3.924E+02	1.495E+01	4.170E+03	2.802E-01
2024	1.093E+04	5.972E+06	4.013E+02	1.528E+01	4.264E+03	2.865E-01
2025	1.116E+04	6.099E+06	4.098E+02	1.561E+01	4.355E+03	2.926E-01
2026	1.139E+04	6.221E+06	4.180E+02	1.592E+01	4.442E+03	2.984E-01
2027	1.112E+04	6.073E+06	4.081E+02	1.554E+01	4.336E+03	2.914E-01
2028	1.068E+04	5.835E+06	3.921E+02	1.493E+01	4.166E+03	2.799E-01
2029	1.026E+04	5.607E+06	3.767E+02	1.435E+01	4.003E+03	2.690E-01
2030	9.860E+03	5.387E+06	3.619E+02	1.379E+01	3.846E+03	2.584E-01
2031	9.474E+03	5.175E+06	3.477E+02	1.325E+01	3.695E+03	2.483E-01
2032	9.102E+03	4.973E+06	3.341E+02	1.273E+01	3.550E+03	2.385E-01
2033	8.745E+03	4.778E+06	3.210E+02	1.223E+01	3.411E+03	2.292E-01
2034	8.402E+03	4.590E+06	3.084E+02	1.175E+01	3.277E+03	2.202E-01
2035	8.073E+03	4.410E+06	2.963E+02	1.129E+01	3.149E+03	2.116E-01
2036	7.756E+03	4.237E+06	2.847E+02	1.084E+01	3.025E+03	2.033E-01
2037	7.452E+03	4.071E+06	2.735E+02	1.042E+01	2.907E+03	1.953E-01
2038	7.160E+03	3.912E+06	2.628E+02	1.001E+01	2.793E+03	1.876E-01
2039	6.879E+03	3.758E+06	2.525E+02	9.618E+00	2.683E+03	1.803E-01
2040	6.610E+03	3.611E+06	2.426E+02	9.241E+00	2.578E+03	1.732E-01
2041	6.350E+03	3.469E+06	2.331E+02	8.878E+00	2.477E+03	1.664E-01
2042	6.101E+03	3.333E+06	2.240E+02	8.530E+00	2.380E+03	1.599E-01
2043	5.862E+03	3.202E+06	2.152E+02	8.196E+00	2.286E+03	1.536E-01
2044	5.632E+03	3.077E+06	2.067E+02	7.874E+00	2.197E+03	1.476E-01
2045	5.411E+03	2.956E+06	1.986E+02	7.566E+00	2.111E+03	1.418E-01
2046	5.199E+03	2.840E+06	1.908E+02	7.269E+00	2.028E+03	1.363E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2047	4.995E+03	2.729E+06	1.834E+02	6.984E+00	1.948E+03	1.309E-01
2048	4.800E+03	2.622E+06	1.762E+02	6.710E+00	1.872E+03	1.258E-01
2049	4.611E+03	2.519E+06	1.693E+02	6.447E+00	1.799E+03	1.208E-01
2050	4.431E+03	2.420E+06	1.626E+02	6.194E+00	1.728E+03	1.161E-01
2051	4.257E+03	2.325E+06	1.562E+02	5.951E+00	1.660E+03	1.116E-01
2052	4.090E+03	2.234E+06	1.501E+02	5.718E+00	1.595E+03	1.072E-01
2053	3.930E+03	2.147E+06	1.442E+02	5.494E+00	1.533E+03	1.030E-01
2054	3.775E+03	2.063E+06	1.386E+02	5.278E+00	1.473E+03	9.894E-02
2055	3.627E+03	1.982E+06	1.331E+02	5.071E+00	1.415E+03	9.506E-02
2056	3.485E+03	1.904E+06	1.279E+02	4.873E+00	1.359E+03	9.133E-02
2057	3.349E+03	1.829E+06	1.229E+02	4.682E+00	1.306E+03	8.775E-02
2058	3.217E+03	1.758E+06	1.181E+02	4.498E+00	1.255E+03	8.431E-02
2059	3.091E+03	1.689E+06	1.135E+02	4.322E+00	1.206E+03	8.101E-02
2060	2.970E+03	1.622E+06	1.090E+02	4.152E+00	1.158E+03	7.783E-02
2061	2.853E+03	1.559E+06	1.047E+02	3.989E+00	1.113E+03	7.478E-02
2062	2.742E+03	1.498E+06	1.006E+02	3.833E+00	1.069E+03	7.185E-02
2063	2.634E+03	1.439E+06	9.668E+01	3.683E+00	1.027E+03	6.903E-02
2064	2.531E+03	1.383E+06	9.289E+01	3.538E+00	9.871E+02	6.632E-02
2065	2.432E+03	1.328E+06	8.925E+01	3.399E+00	9.484E+02	6.372E-02
2066	2.336E+03	1.276E+06	8.575E+01	3.266E+00	9.112E+02	6.122E-02
2067	2.245E+03	1.226E+06	8.239E+01	3.138E+00	8.755E+02	5.882E-02
2068	2.157E+03	1.178E+06	7.916E+01	3.015E+00	8.411E+02	5.652E-02
2069	2.072E+03	1.132E+06	7.605E+01	2.897E+00	8.082E+02	5.430E-02
2070	1.991E+03	1.088E+06	7.307E+01	2.783E+00	7.765E+02	5.217E-02
2071	1.913E+03	1.045E+06	7.021E+01	2.674E+00	7.460E+02	5.013E-02
2072	1.838E+03	1.004E+06	6.745E+01	2.569E+00	7.168E+02	4.816E-02
2073	1.766E+03	9.646E+05	6.481E+01	2.469E+00	6.887E+02	4.627E-02
2074	1.696E+03	9.267E+05	6.227E+01	2.372E+00	6.617E+02	4.446E-02
2075	1.630E+03	8.904E+05	5.983E+01	2.279E+00	6.357E+02	4.271E-02
2076	1.566E+03	8.555E+05	5.748E+01	2.189E+00	6.108E+02	4.104E-02
2077	1.505E+03	8.220E+05	5.523E+01	2.104E+00	5.868E+02	3.943E-02
2078	1.446E+03	7.897E+05	5.306E+01	2.021E+00	5.638E+02	3.788E-02
2079	1.389E+03	7.588E+05	5.098E+01	1.942E+00	5.417E+02	3.640E-02
2080	1.334E+03	7.290E+05	4.898E+01	1.866E+00	5.205E+02	3.497E-02
2081	1.282E+03	7.004E+05	4.706E+01	1.793E+00	5.001E+02	3.360E-02
2082	1.232E+03	6.730E+05	4.522E+01	1.722E+00	4.805E+02	3.228E-02
2083	1.184E+03	6.466E+05	4.344E+01	1.655E+00	4.616E+02	3.102E-02
2084	1.137E+03	6.212E+05	4.174E+01	1.590E+00	4.435E+02	2.980E-02
2085	1.093E+03	5.969E+05	4.010E+01	1.527E+00	4.261E+02	2.863E-02
2086	1.050E+03	5.735E+05	3.853E+01	1.468E+00	4.094E+02	2.751E-02
2087	1.009E+03	5.510E+05	3.702E+01	1.410E+00	3.934E+02	2.643E-02
2088	9.690E+02	5.294E+05	3.557E+01	1.355E+00	3.780E+02	2.539E-02
2089	9.310E+02	5.086E+05	3.417E+01	1.302E+00	3.631E+02	2.440E-02
2090	8.945E+02	4.887E+05	3.283E+01	1.251E+00	3.489E+02	2.344E-02
2091	8.594E+02	4.695E+05	3.155E+01	1.202E+00	3.352E+02	2.252E-02
2092	8.257E+02	4.511E+05	3.031E+01	1.154E+00	3.221E+02	2.164E-02
2093	7.934E+02	4.334E+05	2.912E+01	1.109E+00	3.094E+02	2.079E-02
2094	7.622E+02	4.164E+05	2.798E+01	1.066E+00	2.973E+02	1.998E-02
2095	7.324E+02	4.001E+05	2.688E+01	1.024E+00	2.856E+02	1.919E-02
2096	7.036E+02	3.844E+05	2.583E+01	9.838E-01	2.744E+02	1.844E-02
2097	6.761E+02	3.693E+05	2.482E+01	9.452E-01	2.637E+02	1.772E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2098	6.495E+02	3.548E+05	2.384E+01	9.081E-01	2.533E+02	1.702E-02
2099	6.241E+02	3.409E+05	2.291E+01	8.725E-01	2.434E+02	1.635E-02
2100	5.996E+02	3.276E+05	2.201E+01	8.383E-01	2.339E+02	1.571E-02
2101	5.761E+02	3.147E+05	2.115E+01	8.054E-01	2.247E+02	1.510E-02
2102	5.535E+02	3.024E+05	2.032E+01	7.738E-01	2.159E+02	1.451E-02
2103	5.318E+02	2.905E+05	1.952E+01	7.435E-01	2.074E+02	1.394E-02
2104	5.109E+02	2.791E+05	1.875E+01	7.144E-01	1.993E+02	1.339E-02
2105	4.909E+02	2.682E+05	1.802E+01	6.863E-01	1.915E+02	1.287E-02
2106	4.717E+02	2.577E+05	1.731E+01	6.594E-01	1.840E+02	1.236E-02
2107	4.532E+02	2.476E+05	1.663E+01	6.336E-01	1.768E+02	1.188E-02
2108	4.354E+02	2.379E+05	1.598E+01	6.087E-01	1.698E+02	1.141E-02
2109	4.183E+02	2.285E+05	1.536E+01	5.849E-01	1.632E+02	1.096E-02
2110	4.019E+02	2.196E+05	1.475E+01	5.619E-01	1.568E+02	1.053E-02
2111	3.862E+02	2.110E+05	1.417E+01	5.399E-01	1.506E+02	1.012E-02
2112	3.710E+02	2.027E+05	1.362E+01	5.187E-01	1.447E+02	9.723E-03
2113	3.565E+02	1.947E+05	1.308E+01	4.984E-01	1.390E+02	9.342E-03
2114	3.425E+02	1.871E+05	1.257E+01	4.788E-01	1.336E+02	8.976E-03
2115	3.291E+02	1.798E+05	1.208E+01	4.601E-01	1.284E+02	8.624E-03
2116	3.162E+02	1.727E+05	1.161E+01	4.420E-01	1.233E+02	8.286E-03
2117	3.038E+02	1.659E+05	1.115E+01	4.247E-01	1.185E+02	7.961E-03
2118	2.919E+02	1.594E+05	1.071E+01	4.080E-01	1.138E+02	7.649E-03
2119	2.804E+02	1.532E+05	1.029E+01	3.920E-01	1.094E+02	7.349E-03
2120	2.694E+02	1.472E+05	9.889E+00	3.767E-01	1.051E+02	7.061E-03
2121	2.589E+02	1.414E+05	9.501E+00	3.619E-01	1.010E+02	6.784E-03
2122	2.487E+02	1.359E+05	9.129E+00	3.477E-01	9.701E+01	6.518E-03
2123	2.390E+02	1.305E+05	8.771E+00	3.341E-01	9.320E+01	6.262E-03
2124	2.296E+02	1.254E+05	8.427E+00	3.210E-01	8.955E+01	6.017E-03
2125	2.206E+02	1.205E+05	8.097E+00	3.084E-01	8.604E+01	5.781E-03
2126	2.119E+02	1.158E+05	7.779E+00	2.963E-01	8.266E+01	5.554E-03
2127	2.036E+02	1.112E+05	7.474E+00	2.847E-01	7.942E+01	5.336E-03
2128	1.956E+02	1.069E+05	7.181E+00	2.735E-01	7.631E+01	5.127E-03
2129	1.880E+02	1.027E+05	6.900E+00	2.628E-01	7.332E+01	4.926E-03
2130	1.806E+02	9.866E+04	6.629E+00	2.525E-01	7.044E+01	4.733E-03
2131	1.735E+02	9.479E+04	6.369E+00	2.426E-01	6.768E+01	4.547E-03
2132	1.667E+02	9.107E+04	6.119E+00	2.331E-01	6.502E+01	4.369E-03
2133	1.602E+02	8.750E+04	5.879E+00	2.239E-01	6.247E+01	4.198E-03
2134	1.539E+02	8.407E+04	5.649E+00	2.152E-01	6.003E+01	4.033E-03
2135	1.479E+02	8.078E+04	5.427E+00	2.067E-01	5.767E+01	3.875E-03
2136	1.421E+02	7.761E+04	5.215E+00	1.986E-01	5.541E+01	3.723E-03
2137	1.365E+02	7.457E+04	5.010E+00	1.908E-01	5.324E+01	3.577E-03

Appendix C
KY Pipe Modeling Results

CALCULATION COVER SHEET

Project Title	Buncombe County Solid Waste Management Facility LFGTE Project
Client	Buncombe County, NC
Project number	6447-64253
Calculation title	LFG wellfield modeling
Calculated by/date	K. Yang 03/23/2009
Reviewed by/date	C. Gabel 03/23/2009
Purpose of the calculation	To determine gas pipe diameter per design criteria.
Results	4-inch HDPE SDR17 gas pipe was determined to be adequate for the new gas piping. Existing pipe diameters (6-, 10-, and 24-inch) were also determined to be adequate.

CDM

TASK:

Determine pipe Ø for wellfield using KY Pipe

ASSUMPTIONS:

- Total peak flowrate = 490 scfm @ 2009
- Flare station vaccum = 40" WC
- Design criteria:
  - Con-current velocity = 40 fps max
  - Min. available vacuum @ each wellhead = 10" WC
  - Max. frictional loss = 1" WC / 100 LF

METHOD:

1. The model was developed as shown on Figure 1
2. Two model were ran:
   a. One model with all wells (25) to verify vacuum criteria (see Att 1)
   b. Second model w/o wells 2, 3, 13, & 17 since they may not be installed due to construction constraints - pipe Ø & max friction loss was determine (see Att 2)
3. Wellhead demand (Node)
   - ⇨ Model 1 = 490 scfm/25 wells = 19.6 scfm per well
   - ⇨ Model 2 = 490 scfm/21 wells = 23.3 scfm per well

CONCLUSIONS:

1. From Attmt 1 - VW18 available vacuum is 37.32" WC.
   VW18 is the farthest wellhead
   - Min. available vacuum is established

2. From Attmt 2 - max. con-current velocity = 20.87 fps in segment P-48
   - Con-current velocity criteria is met

3. From Attmt 2 - Max. friction loss in segment
   $P\text{-}48 = \left(0.22\ psi/1000\ LF\right)\left(\frac{27.68"WC}{1\ psi}\right) = \frac{0.6"WC}{100\ LF}$
   Is below Max. friction loss of 1"WC/100 LF

4. Model was developed with all new pipe = 4" Ø
   This was determined to be adequate
   - See Figure 2 for pipe Ø

Figure 1

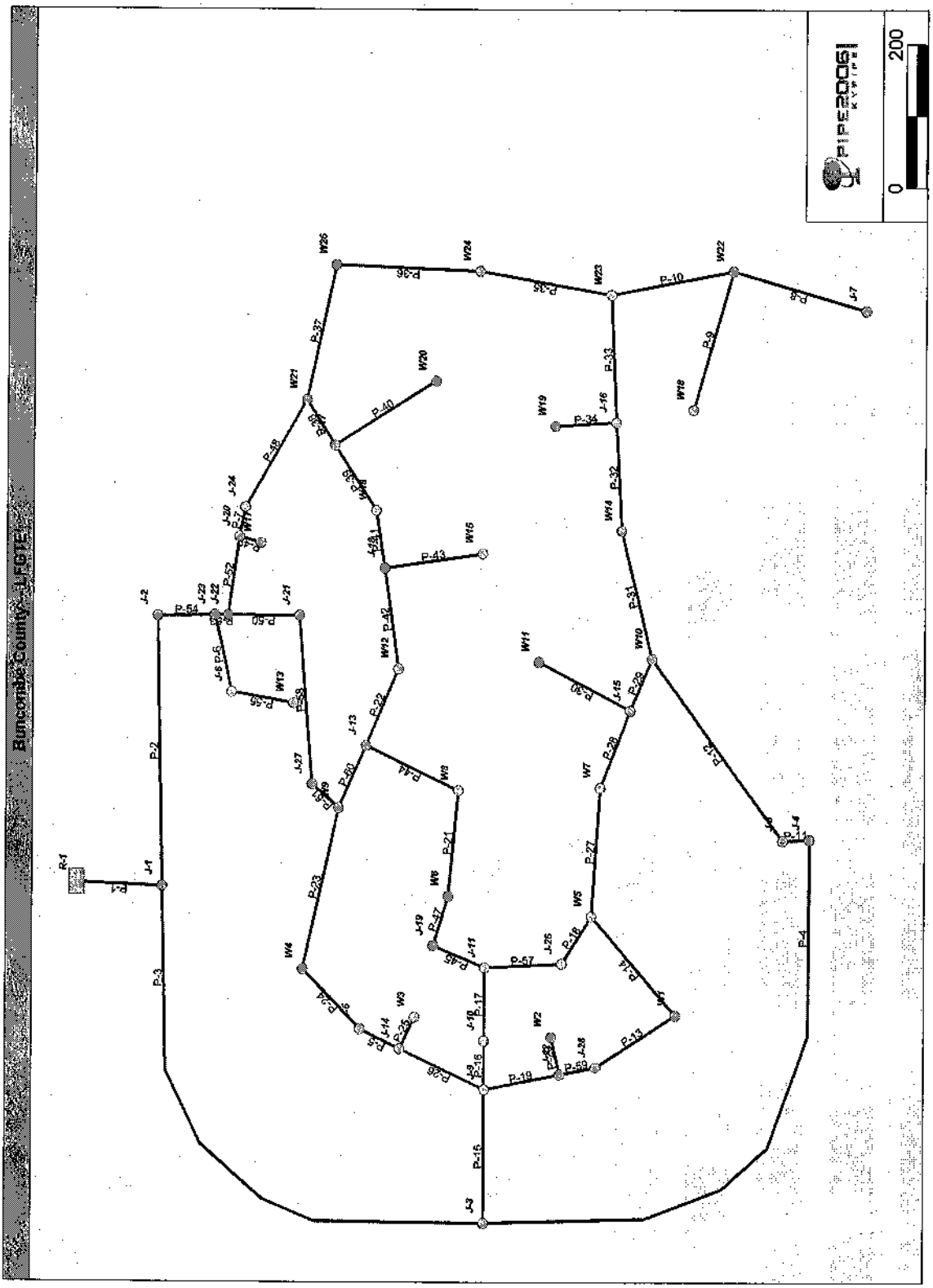
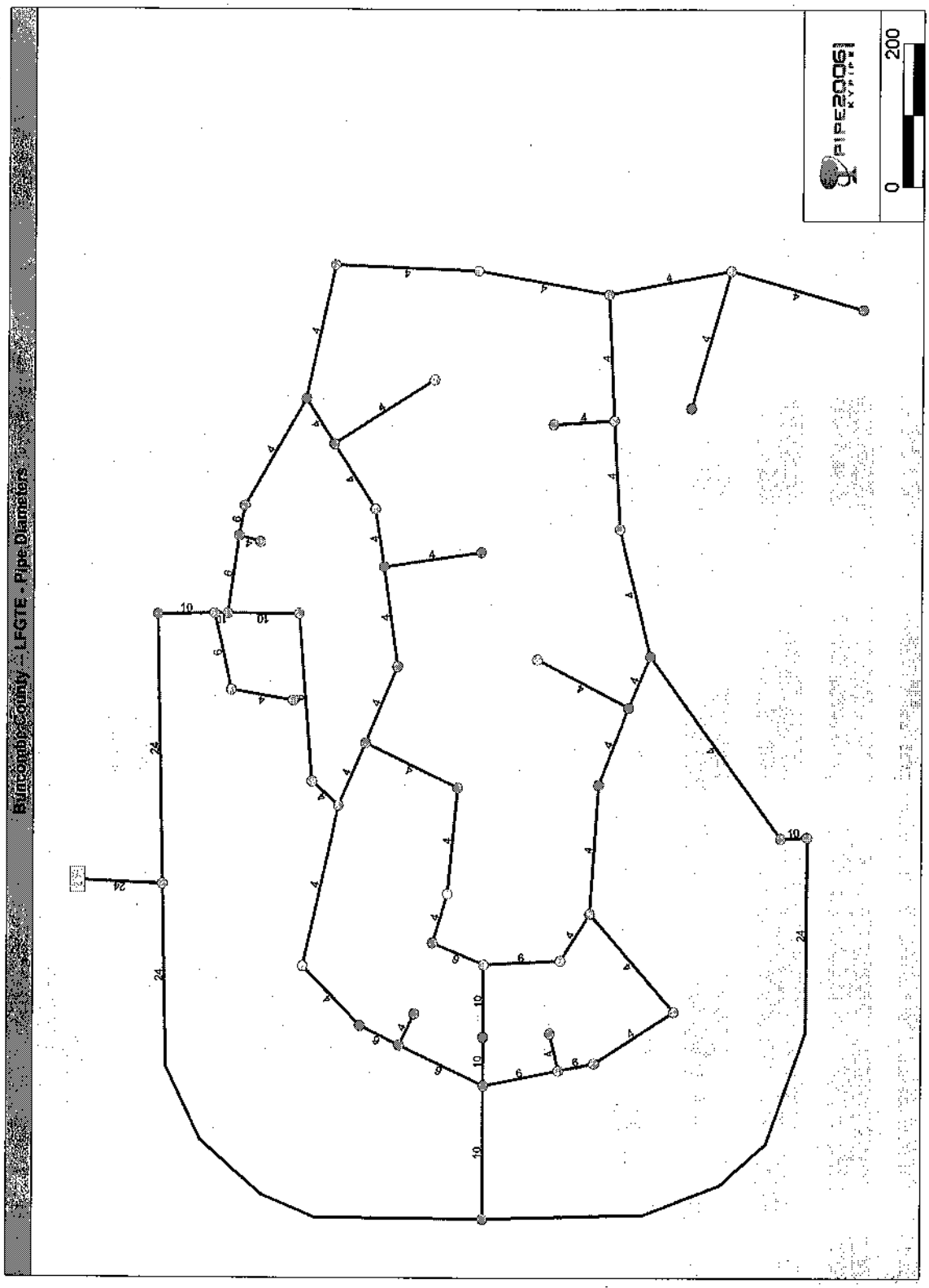


Figure 2



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LEXINGTON, KY
Updated March 2007


INPUT DATA FILE NAME FOR THIS SIMULATION  = C:\yangkj\Buncombe\LFGTE\Modeling\B
uncombe.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = C:\yangkj\Buncombe\LFGTE\Modeling\B
uncombe.OT2

DATE FOR THIS COMPUTER RUN       :  3-23-2009
START TIME FOR THIS COMPUTER RUN : 11: 2:17: 5


SUMMARY OF DISTRIBUTION SYSTEM CHARACTERISTICS:
-----------------------------------------------


NUMBER OF PIPES           =    59
NUMBER OF JUNCTION NODES  =    53

UNITS SPECIFIED           = ENGLISH


A CONSTANT DENSITY FLUID IS SPECIFIED - DENSITY =        .08POUNDS / CUBIC FOOT
  ABSOLUTE VISCOSITY                   =    .28E-06 POUND SECONDS/SQUARE FOOT


USER SPECIFIED FLOW UNITS (USFU)     = SCF / MIN.
USER SPECIFIED PRESSURE UNITS (USPU) = INCHES OF WATER (ABS.)


------- SUMMARY OF PIPE NETWORK GEOMETRIC AND OPERATING DATA  -------
```

PIPE NAME	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	ROUGHNESS (MILLIFEET)	SUM-M FACT.	PUMP ID	ELEVATION CHANGE
P- 1	J- 1	R- 1	119.0	21.0	.005	.4	0	-5.0
P- 2	J- 2	J- 1	375.0	21.0	.005	.4	0	19.0
P- 3	J- 3	J- 1	800.0	21.0	.005	.4	0	38.0
P- 4	J- 4	J- 3	865.0	21.0	.005	.4	0	-27.0
P- 5	J- 5	J-14	62.0	5.8	.005	.0	0	-4.0
P- 6	J- 6	J-23	109.0	5.8	.005	.0	0	-8.0
P- 7	J-24	J-20	42.0	5.8	.005	.0	0	-3.0
P- 8	W22	J- 7	194.0	3.9	.005	.3	0	-45.0
P- 9	W18	W22	201.0	3.9	.005	8.1	0	-8.0
P-10	W22	W23	176.0	3.9	.005	8.5	0	45.0
P-11	J- 8	J- 4	37.0	9.4	.005	.3	0	-14.0
P-12	W10	J- 8	313.0	3.9	.005	8.1	0	-58.0
P-13	W1	J-28	133.0	3.9	.005	8.4	0	-11.0
P-14	W5	W1	182.0	3.9	.005	8.5	0	-38.0
P-15	J- 9	J- 3	184.0	9.4	.005	.4	0	-48.0
P-16	J-10	J- 9	68.0	9.4	.005	.4	0	-17.0
P-17	J-11	J-10	101.0	9.4	.005	.4	0	-22.0
P-18	W5	J-26	77.0	3.9	.005	8.8	0	-16.0
P-19	J-12	J- 9	108.0	5.8	.005	.4	0	-9.0
P-20	W2	J-12	53.0	3.9	.005	8.1	0	-12.0
P-21	W8	W6	148.0	3.9	.005	.0	0	-12.0
P-22	W12	J-13	115.0	3.9	.005	.0	0	-12.0
P-23	W9	W4	229.0	3.9	.005	8.1	0	-18.0
P-24	W4	J- 5	116.0	3.9	.005	8.1	0	-11.0
P-25	W3	J-14	49.0	3.9	.005	8.1	0	-10.0
P-26	J-14	J- 9	132.0	5.8	.005	.4	0	-9.0
P-27	W7	W5	180.0	3.9	.005	8.1	0	-5.0
P-28	J-15	W7	115.0	3.9	.005	.4	0	8.0
P-29	W10	J-15	78.0	3.9	.005	8.1	0	7.0
P-30	W11	J-15	145.0	3.9	.005	8.1	0	-17.0
P-31	W14	W10	182.0	3.9	.005	8.4	0	-6.0
P-32	J-16	W14	151.0	3.9	.005	.4	0	2.0
P-33	W23	J-16	177.0	3.9	.005	8.1	0	-8.0
P-34	W19	J-16	86.0	3.9	.005	8.1	0	-19.0

P-35	W23	W24	187.0	3.9	.005	8.8	0	6.0
P-36	W24	W25	202.0	3.9	.005	8.1	0	-39.0
P-37	W25	W21	192.0	3.9	.005	8.1	0	-9.0
P-38	J-17	W21	75.0	3.9	.005	.4	0	-9.0
P-39	J-17	W16	108.0	3.9	.005	8.1	0	17.0
P-40	W20	J-17	167.0	3.9	.005	8.1	0	-41.0
P-41	W16	J-18	81.0	3.9	.005	.4	0	4.0
P-42	J-18	W12	140.0	3.9	.005	.7	0	12.0
P-43	W15	J-18	139.0	3.9	.005	8.1	0	-24.0
P-44	J-13	W8	144.0	3.9	.005	8.1	0	24.0
P-45	J-19	J-11	79.0	5.8	.005	.0	0	-4.0
P-47	W6	J-19	72.0	3.9	.005	8.4	0	-20.0
P-48	W21	J-24	172.0	3.9	.005	8.8	0	-20.0
P-49	W17	J-20	31.0	3.9	.005	8.1	0	-8.0
P-50	J-21	J-22	100.0	9.4	.005	.4	0	-26.0
P-51	W9	J-27	50.0	3.9	.005	8.5	0	-11.0
P-52	J-20	J-22	110.0	5.8	.005	.4	0	-5.0
P-53	J-22	J-23	18.0	9.4	.005	.4	0	-4.0
P-54	J-23	J- 2	80.0	9.4	.005	.4	0	-18.0
P-55	W13	J- 6	88.0	3.9	.005	8.5	0	-23.0
P-57	J-26	J-11	108.0	5.8	.005	.0	0	-6.0
P-58	J-27	J-21	234.0	5.8	.005	.0	0	-12.0
P-59	J-28	J-12	51.0	5.8	.005	.0	0	-3.0
P-60	J-13	W9	95.0	3.9	.005	8.5	0	-9.0

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	FPN PRESSURE
J- 1		.00	
J- 2		.00	
J- 3		.00	
J- 4		.00	
J- 5		.00	
J- 6		.00	
J- 7		.00	
J- 8		.00	
J- 9		.00	

J-10	.00	
J-11	.00	
J-12	.00	
J-13	.00	
J-14	.00	
J-15	.00	
J-16	.00	
J-17	.00	
J-18	.00	
J-19	.00	
J-20	.00	
J-21	.00	
J-22	.00	
J-23	.00	
J-24	.00	
J-26	.00	
J-27	.00	
J-28	.00	
R- 1	.00	-40.00
W1	-19.60	
W10	-19.60	
W11	-19.60	
W12	-19.60	
W13	-19.60	
W14	-19.60	
W15	-19.60	
W16	-19.60	
W17	-19.60	
W18	-19.60	
W19	-19.60	
W2	-19.60	
W20	-19.60	
W21	-19.60	
W22	-19.60	
W23	-19.60	
W24	-19.60	
W25	-19.60	
W3	-19.60	

W4	-19.60
W5	-19.60
W6	-19.60
W7	-19.60
W8	-19.60
W9	-19.60

==========

========== RESULTS FOR THIS SIMULATION FOLLOW ==========

Solution was obtained in 11 trials
Flow Accuracy = .0026[< .005]
RV Accuracy = .0000[< .001]

PIPE NO.	NODE #1	NODE #2	FLOW (USFU)	LOSS (USPU)	VELOCITY (FT/S)	DENSITY (#/CF)	FRICTION FACTOR	AREA RATIO
P- 1	J- 1	R- 1	490.000	.00	3.41	.076	.0207	
P- 2	J- 2	J- 1	182.794	.00	1.27	.076	.0262	
P- 3	J- 3	J- 1	307.206	.01	2.14	.076	.0231	
P- 4	J- 4	J- 3	72.759	.00	.51	.076	.0336	
P- 5	J- 5	J-14	36.908	.01	3.37	.076	.0285	
P- 6	J- 6	J-23	19.600	.01	1.79	.076	.0338	
P- 7	J-24	J-20	88.547	.03	8.09	.076	.0229	
P- 8	W22	J- 7	.000	.00	.00	.076	.0000	
P- 9	W18	W22	19.600	.09	3.88	.076	.0304	
P-10	W22	W23	39.200	.30	7.76	.076	.0254	
P-11	J- 8	J- 4	72.759	.00	2.53	.076	.0270	
P-12	W10	J- 8	72.759	1.37	14.41	.076	.0219	
P-13	W1	J-28	42.196	.29	8.36	.076	.0249	

P-14	W5	W1	22.596	.11	4.48	.076	.0293
P-15	J- 9	J- 3	234.447	.08	8.14	.076	.0205
P-16	J-10	J- 9	116.144	.01	4.03	.076	.0241
P-17	J-11	J-10	116.144	.01	4.03	.076	.0241
P-18	W5	J-26	56.305	.40	11.15	.076	.0233
P-19	J-12	J- 9	61.796	.04	5.65	.076	.0250
P-20	W2	J-12	19.600	.04	3.88	.076	.0304
P-21	W8	W6	40.239	.16	7.97	.076	.0253
P-22	W12	J-13	73.394	.37	14.54	.076	.0219
P-23	W9	W4	17.308	.08	3.43	.076	.0315
P-24	W4	J- 5	36.908	.21	7.31	.076	.0258
P-25	W3	J-14	19.600	.04	3.88	.076	.0304
P-26	J-14	J- 9	56.508	.04	5.16	.076	.0255
P-27	W7	W5	59.301	.65	11.75	.076	.0230
P-28	J-15	W7	39.701	.13	7.86	.076	.0253
P-29	W10	J-15	20.101	.05	3.98	.076	.0302
P-30	W11	J-15	19.600	.07	3.88	.076	.0304
P-31	W14	W10	73.259	.98	14.51	.076	.0219
P-32	J-16	W14	53.659	.29	10.63	.076	.0235
P-33	W23	J-16	34.059	.23	6.75	.076	.0263
P-34	W19	J-16	19.600	.05	3.88	.076	.0304
P-35	W23	W24	24.741	.14	4.90	.076	.0285
P-36	W24	W25	44.341	.41	8.78	.076	.0246
P-37	W25	W21	63.941	.78	12.66	.076	.0226
P-38	J-17	W21	5.006	.00	.99	.076	.0456
P-39	J-17	W16	14.594	.04	2.89	.076	.0330
P-40	W20	J-17	19.600	.08	3.88	.076	.0304
P-41	W16	J-18	34.194	.07	6.77	.076	.0263
P-42	J-18	W12	53.794	.28	10.65	.076	.0235
P-43	W15	J-18	19.600	.07	3.88	.076	.0304
P-44	J-13	W8	20.639	.08	4.09	.076	.0300
P-45	J-19	J-11	59.839	.03	5.47	.076	.0252
P-47	W6	J-19	59.839	.43	11.85	.076	.0229
P-48	W21	J-24	88.547	1.38	17.54	.076	.0209
P-49	W17	J-20	19.600	.04	3.88	.076	.0304
P-50	J-21	J-22	55.047	.00	1.91	.076	.0290
P-51	W9	J-27	55.047	.33	10.90	.076	.0234
P-52	J-20	J-22	108.147	.12	9.88	.076	.0218

P-53	J-22	J-23	163.194	.01	5.67	.076	.0222
P-54	J-23	J- 2	182.794	.02	6.35	.076	.0216
P-55	W13	J- 6	19.600	.06	3.88	.076	.0304
P-57	J-26	J-11	56.305	.03	5.15	.076	.0255
P-58	J-27	J-21	55.047	.07	5.03	.076	.0256
P-59	J-28	J-12	42.196	.01	3.86	.076	.0275
P-60	J-13	W9	52.755	.38	10.45	.076	.0236
R- 1	R- 1	R- 1	-490.000	.00	.00	.076********	

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	PRESSURE (USPU)	PRESSURE (PSIA)	PRESSURE (PSIG)	DENSITY #/CF
J- 1		.00	-40.07	-1.45	-16.14	.076
J- 2		.00	-39.79	-1.44	-16.13	.076
J- 3		.00	-39.50	-1.43	-16.12	.076
J- 4		.00	-39.90	-1.44	-16.14	.076
J- 5		.00	-40.26	-1.45	-16.15	.076
J- 6		.00	-40.14	-1.45	-16.15	.076
J- 7		.00	-37.29	-1.35	-16.04	.076
J- 8		.00	-40.10	-1.45	-16.14	.076
J- 9		.00	-40.12	-1.45	-16.14	.076
J-10		.00	-40.36	-1.46	-16.15	.076
J-11		.00	-40.67	-1.47	-16.16	.076
J-12		.00	-40.21	-1.45	-16.15	.076
J-13		.00	-40.15	-1.45	-16.15	.076
J-14		.00	-40.21	-1.45	-16.15	.076
J-15		.00	-39.73	-1.43	-16.13	.076
J-16		.00	-38.37	-1.39	-16.08	.076
J-17		.00	-39.09	-1.41	-16.11	.076
J-18		.00	-39.50	-1.43	-16.12	.076
J-19		.00	-40.70	-1.47	-16.17	.076
J-20		.00	-40.03	-1.45	-16.14	.076
J-21		.00	-40.46	-1.46	-16.16	.076
J-22		.00	-40.08	-1.45	-16.14	.076
J-23		.00	-40.03	-1.45	-16.14	.076

J-24	.00	-40.05	-1.45	-16.14	.076
J-26	.00	-40.73	-1.47	-16.17	.076
J-27	.00	-40.56	-1.46	-16.16	.076
J-28	.00	-40.25	-1.45	-16.15	.076
R- 1	.00	-40.00	-1.44	-16.14	.076
W1	-19.60	-40.11	-1.45	-16.14	.076
W10	-19.60	-39.58	-1.43	-16.13	.076
W11	-19.60	-39.91	-1.44	-16.14	.076
W12	-19.60	-39.95	-1.44	-16.14	.076
W13	-19.60	-40.42	-1.46	-16.16	.076
W14	-19.60	-38.68	-1.40	-16.09	.076
W15	-19.60	-39.78	-1.44	-16.13	.076
W16	-19.60	-39.37	-1.42	-16.12	.076
W17	-19.60	-40.11	-1.45	-16.14	.076
W18	-19.60	-37.32	-1.35	-16.04	.076
W19	-19.60	-38.59	-1.39	-16.09	.076
W2	-19.60	-40.34	-1.46	-16.15	.076
W20	-19.60	-39.61	-1.43	-16.13	.076
W21	-19.60	-38.96	-1.41	-16.10	.076
W22	-19.60	-37.29	-1.35	-16.04	.076
W23	-19.60	-38.25	-1.38	-16.08	.076
W24	-19.60	-38.48	-1.39	-16.09	.076
W25	-19.60	-38.31	-1.38	-16.08	.076
W3	-19.60	-40.31	-1.46	-16.15	.076
W4	-19.60	-40.21	-1.45	-16.15	.076
W5	-19.60	-40.56	-1.46	-16.16	.076
W6	-19.60	-40.57	-1.46	-16.16	.076
W7	-19.60	-39.98	-1.44	-16.14	.076
W8	-19.60	-40.58	-1.47	-16.16	.076
W9	-19.60	-40.40	-1.46	-16.15	.076

* This designates the use of default density in a low pressure region

THE NET SYSTEM DEMAND (USFU) = -490.000

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) :

NAME	FLOW (USFU)	FPN TITLE
R- 1	-490.0	R- 1

SUMMARY OF MINIMUM.AND.MAXIMUM VELOCITIES (FT/S)

	MINIMUM		MAXIMUM
R- 1	.00	P-48	17.54
P- 4	.51	P-22	14.54
P-38	.99	P-31	14.51
P- 2	1.27	P-12	14.41
P- 6	1.79	P-37	12.66

SUMMARY OF MINIMUM.AND.MAXIMUM LOSS/1000. (PSI)

	MINIMUM		MAXIMUM
P- 4	.00	P-48	.16
P- 2	.00	P-22	.12
P- 3	.00	P-31	.12
P-50	.00	P-12	.11
P-38	.00	P-37	.09

SUMMARY OF MINIMUM.AND.MAXIMUM PRESSURES (USPU)

	MINIMUM		MAXIMUM
J-26	-40.73	W22	-37.29
J-19	-40.70	W18	-37.32
J-11	-40.67	W23	-38.25

W8	-40.58	W25	-38.31
W6	-40.57	J-16	-38.37

********** END OF KYGAS SIMULATION **********

DATE FOR THIS COMPUTER RUN : 3-23-2009
START TIME FOR THIS COMPUTER RUN : 11: 2:17:10

```
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Updated March 2007


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uncombe.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = C:\yangkj\Buncombe\LFGTE\Modeling\B
uncombe.OT2

DATE FOR THIS COMPUTER RUN       :  3-23-2009
START TIME FOR THIS COMPUTER RUN : 11: 9:24:62


SUMMARY OF DISTRIBUTION SYSTEM CHARACTERISTICS:
-----------------------------------------------


NUMBER OF PIPES           =    59
NUMBER OF JUNCTION NODES  =    53

UNITS SPECIFIED           = ENGLISH


A CONSTANT DENSITY FLUID IS SPECIFIED - DENSITY =        .08POUNDS / CUBIC FOOT
  ABSOLUTE VISCOSITY                   =    .28E-06 POUND SECONDS/SQUARE FOOT


USER SPECIFIED FLOW UNITS (USFU)      = SCF / MIN.
USER SPECIFIED PRESSURE UNITS (USPU) = INCHES OF WATER (ABS.)


-------  SUMMARY OF PIPE NETWORK GEOMETRIC AND OPERATING DATA  -------
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PIPE NAME	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	ROUGHNESS (MILLIFEET)	SUM-M FACT.	PUMP ID	ELEVATION CHANGE
P- 1	J- 1	R- 1	119.0	21.0	.005	.4	0	-5.0
P- 2	J- 2	J- 1	375.0	21.0	.005	.4	0	19.0
P- 3	J- 3	J- 1	800.0	21.0	.005	.4	0	38.0
P- 4	J- 4	J- 3	865.0	21.0	.005	.4	0	-27.0
P- 5	J- 5	J-14	62.0	5.8	.005	.0	0	-4.0
P- 6	J- 6	J-23	109.0	5.8	.005	.0	0	-8.0
P- 7	J-24	J-20	42.0	5.8	.005	.0	0	-3.0
P- 8	W22	J- 7	194.0	3.9	.005	.3	0	-45.0
P- 9	W18	W22	201.0	3.9	.005	8.1	0	-8.0
P-10	W22	W23	176.0	3.9	.005	8.5	0	45.0
P-11	J- 8	J- 4	37.0	9.4	.005	.3	0	-14.0
P-12	W10	J- 8	309.0	3.9	.005	8.1	0	-58.0
P-13	W1	J-28	131.0	3.9	.005	8.4	0	-11.0
P-14	W5	W1	182.0	3.9	.005	8.5	0	-38.0
P-15	J- 9	J- 3	184.0	9.4	.005	.4	0	-48.0
P-16	J-10	J- 9	68.0	9.4	.005	.4	0	-17.0
P-17	J-11	J-10	101.0	9.4	.005	.4	0	-22.0
P-18	W5	J-26	74.0	3.9	.005	8.8	0	-16.0
P-19	J-12	J- 9	108.0	5.8	.005	.4	0	-9.0
P-20	W2	J-12	53.0	3.9	.005	8.1	0	-12.0
P-21	W8	W6	148.0	3.9	.005	.0	0	-12.0
P-22	W12	J-13	112.0	3.9	.005	.0	0	-12.0
P-23	W9	W4	233.0	3.9	.005	8.1	0	-18.0
P-24	W4	J- 5	113.0	3.9	.005	8.1	0	-11.0
P-25	W3	J-14	49.0	3.9	.005	8.1	0	-10.0
P-26	J-14	J- 9	132.0	5.8	.005	.4	0	-9.0
P-27	W7	W5	180.0	3.9	.005	8.1	0	-5.0
P-28	J-15	W7	119.0	3.9	.005	.4	0	8.0
P-29	W10	J-15	74.0	3.9	.005	8.1	0	7.0
P-30	W11	J-15	143.0	3.9	.005	8.1	0	-17.0
P-31	W14	W10	182.0	3.9	.005	8.4	0	-6.0
P-32	J-16	W14	155.0	3.9	.005	.4	0	2.0
P-33	W23	J-16	177.0	3.9	.005	8.1	0	-8.0
P-34	W19	J-16	86.0	3.9	.005	8.1	0	-19.0

P-35	W23	W24	187.0	3.9	.005	8.8	0	6.0
P-36	W24	W25	202.0	3.9	.005	8.1	0	-39.0
P-37	W25	W21	192.0	3.9	.005	8.1	0	-9.0
P-38	J-17	W21	75.0	3.9	.005	.4	0	-9.0
P-39	J-17	W16	112.0	3.9	.005	8.1	0	17.0
P-40	W20	J-17	165.0	3.9	.005	8.1	0	-41.0
P-41	W16	J-18	77.0	3.9	.005	.4	0	4.0
P-42	J-18	W12	144.0	3.9	.005	.7	0	12.0
P-43	W15	J-18	139.0	3.9	.005	8.1	0	-24.0
P-44	J-13	W8	146.0	3.9	.005	8.1	0	24.0
P-45	J-19	J-11	79.0	5.8	.005	.0	0	-4.0
P-47	W6	J-19	68.0	3.9	.005	8.4	0	-20.0
P-48	W21	J-24	172.0	3.9	.005	8.8	0	-20.0
P-49	W17	J-20	31.0	3.9	.005	8.1	0	-8.0
P-50	J-21	J-22	100.0	9.4	.005	.4	0	-26.0
P-51	W9	J-27	48.0	3.9	.005	8.5	0	-11.0
P-52	J-20	J-22	110.0	5.8	.005	.4	0	-5.0
P-53	J-22	J-23	18.0	9.4	.005	.4	0	-4.0
P-54	J-23	J- 2	80.0	9.4	.005	.4	0	-18.0
P-55	W13	J- 6	88.0	3.9	.005	8.5	0	-23.0
P-57	J-26	J-11	108.0	5.8	.005	.0	0	-6.0
P-58	J-27	J-21	238.0	5.8	.005	.0	0	-12.0
P-59	J-28	J-12	51.0	5.8	.005	.0	0	-3.0
P-60	J-13	W9	95.0	3.9	.005	8.5	0	-9.0

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	FPN PRESSURE
J- 1		.00	
J- 2		.00	
J- 3		.00	
J- 4		.00	
J- 5		.00	
J- 6		.00	
J- 7		.00	
J- 8		.00	
J- 9		.00	

J-10	.00	
J-11	.00	
J-12	.00	
J-13	.00	
J-14	.00	
J-15	.00	
J-16	.00	
J-17	.00	
J-18	.00	
J-19	.00	
J-20	.00	
J-21	.00	
J-22	.00	
J-23	.00	
J-24	.00	
J-26	.00	
J-27	.00	
J-28	.00	
R- 1	.00	-40.00
W1	-23.30	
W10	-23.30	
W11	-23.30	
W12	-23.30	
W13	.00	
W14	-23.30	
W15	-23.30	
W16	-23.30	
W17	.00	
W18	-23.30	
W19	-23.30	
W2	.00	
W20	-23.30	
W21	-23.30	
W22	-23.30	
W23	-23.30	
W24	-23.30	
W25	-23.30	
W3	.00	

W4	-23.30
W5	-23.30
W6	-23.30
W7	-23.30
W8	-23.30
W9	-23.30

==========

========== RESULTS FOR THIS SIMULATION FOLLOW ==========

Solution was obtained in 10 trials
Flow Accuracy = .0037[< .005]
RV Accuracy = .0000[< .001]

PIPE NO.	NODE #1	NODE #2	FLOW (USFU)	LOSS (USPU)	VELOCITY (FT/S)	DENSITY (#/CF)	FRICTION FACTOR	AREA RATIO
P- 1	J- 1	R- 1	489.300	.00	3.41	.076	.0207	
P- 2	J- 2	J- 1	169.373	.00	1.18	.076	.0267	
P- 3	J- 3	J- 1	319.927	.01	2.23	.076	.0229	
P- 4	J- 4	J- 3	86.153	.00	.60	.076	.0320	
P- 5	J- 5	J-14	45.185	.01	4.13	.076	.0270	
P- 6	J- 6	J-23	.000	.00	.00	.076	.0000	
P- 7	J-24	J-20	105.392	.04	9.63	.076	.0220	
P- 8	W22	J- 7	.000	.00	.00	.076	.0000	
P- 9	W18	W22	23.300	.13	4.62	.076	.0290	
P-10	W22	W23	46.600	.42	9.23	.076	.0243	
P-11	J- 8	J- 4	86.153	.00	2.99	.076	.0259	
P-12	W10	J- 8	86.153	1.85	17.06	.076	.0211	
P-13	W1	J-28	50.870	.41	10.08	.076	.0238	

P-14	W5	W1	27.570	.16	5.46	.076	.0278
P-15	J- 9	J- 3	233.774	.08	8.12	.076	.0205
P-16	J-10	J- 9	137.718	.01	4.78	.076	.0231
P-17	J-11	J-10	137.718	.02	4.78	.076	.0231
P-18	W5	J-26	66.364	.54	13.14	.076	.0224
P-19	J-12	J- 9	50.870	.03	4.65	.076	.0262
P-20	W2	J-12	.000	.00	.00	.076	.0000
P-21	W8	W6	48.054	.22	9.52	.076	.0242
P-22	W12	J-13	87.321	.49	17.30	.076	.0210
P-23	W9	W4	21.885	.12	4.33	.076	.0296
P-24	W4	J- 5	45.185	.30	8.95	.076	.0246
P-25	W3	J-14	.000	.00	.00	.076	.0000
P-26	J-14	J- 9	45.185	.03	4.13	.076	.0270
P-27	W7	W5	70.634	.90	13.99	.076	.0221
P-28	J-15	W7	47.334	.18	9.38	.076	.0242
P-29	W10	J-15	24.034	.08	4.76	.076	.0288
P-30	W11	J-15	23.300	.10	4.62	.076	.0290
P-31	W14	W10	86.887	1.35	17.21	.076	.0211
P-32	J-16	W14	63.587	.40	12.59	.076	.0226
P-33	W23	J-16	40.287	.31	7.98	.076	.0252
P-34	W19	J-16	23.300	.08	4.62	.076	.0290
P-35	W23	W24	29.613	.19	5.87	.076	.0272
P-36	W24	W25	52.913	.56	10.48	.076	.0236
P-37	W25	W21	76.213	1.07	15.10	.076	.0217
P-38	J-17	W21	5.879	.00	1.16	.076	.0432
P-39	J-17	W16	17.421	.05	3.45	.076	.0314
P-40	W20	J-17	23.300	.11	4.62	.076	.0290
P-41	W16	J-18	40.721	.09	8.07	.076	.0252
P-42	J-18	W12	64.021	.39	12.68	.076	.0226
P-43	W15	J-18	23.300	.10	4.62	.076	.0290
P-44	J-13	W8	24.754	.11	4.90	.076	.0286
P-45	J-19	J-11	71.354	.04	6.52	.076	.0241
P-47	W6	J-19	71.354	.59	14.13	.076	.0220
P-48	W21	J-24	105.392	1.92	20.87	.076	.0202
P-49	W17	J-20	.000	.00	.00	.076	.0000
P-50	J-21	J-22	63.981	.00	2.22	.076	.0279
P-51	W9	J-27	63.981	.43	12.67	.076	.0225
P-52	J-20	J-22	105.392	.11	9.63	.076	.0220

P-53	J-22	J-23	169.373	.01	5.88	.076	.0220
P-54	J-23	J- 2	169.373	.02	5.88	.076	.0220
P-55	W13	J- 6	.000	.00	.00	.076	.0000
P-57	J-26	J-11	66.364	.05	6.07	.076	.0245
P-58	J-27	J-21	63.981	.09	5.85	.076	.0247
P-59	J-28	J-12	50.870	.01	4.65	.076	.0262
P-60	J-13	W9	62.566	.53	12.39	.076	.0227
R- 1	R- 1	R- 1	-489.300	.00	.00	.076********	

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	PRESSURE (USPU)	PRESSURE (PSIA)	PRESSURE (PSIG)	DENSITY #/CF
J- 1		.00	-40.07	-1.45	-16.14	.076
J- 2		.00	-39.79	-1.44	-16.13	.076
J- 3		.00	-39.50	-1.43	-16.12	.076
J- 4		.00	-39.89	-1.44	-16.14	.076
J- 5		.00	-40.27	-1.45	-16.15	.076
J- 6		.00	-40.03	-1.45	-16.14	.076
J- 7		.00	-36.13	-1.30	-16.00	.076
J- 8		.00	-40.10	-1.45	-16.14	.076
J- 9		.00	-40.12	-1.45	-16.14	.076
J-10		.00	-40.36	-1.46	-16.15	.076
J-11		.00	-40.66	-1.47	-16.16	.076
J-12		.00	-40.23	-1.45	-16.15	.076
J-13		.00	-39.88	-1.44	-16.14	.076
J-14		.00	-40.23	-1.45	-16.15	.076
J-15		.00	-39.27	-1.42	-16.11	.076
J-16		.00	-37.40	-1.35	-16.05	.076
J-17		.00	-38.55	-1.39	-16.09	.076
J-18		.00	-39.00	-1.41	-16.10	.076
J-19		.00	-40.68	-1.47	-16.17	.076
J-20		.00	-40.04	-1.45	-16.14	.076
J-21		.00	-40.46	-1.46	-16.16	.076
J-22		.00	-40.08	-1.45	-16.14	.076
J-23		.00	-40.03	-1.45	-16.14	.076

J-24	.00	-40.05	-1.45	-16.14	.076
J-26	.00	-40.71	-1.47	-16.17	.076
J-27	.00	-40.54	-1.46	-16.16	.076
J-28	.00	-40.26	-1.45	-16.15	.076
R- 1	.00	-40.00	-1.44	-16.14	.076
W1	-23.30	-40.00	-1.44	-16.14	.076
W10	-23.30	-39.09	-1.41	-16.11	.076
W11	-23.30	-39.42	-1.42	-16.12	.076
W12	-23.30	-39.56	-1.43	-16.12	.076
W13	.00	-40.03	-1.45	-16.14	.076
W14	-23.30	-37.83	-1.37	-16.06	.076
W15	-23.30	-39.25	-1.42	-16.11	.076
W16	-23.30	-38.85	-1.40	-16.10	.076
W17	.00	-40.04	-1.45	-16.14	.076
W18	-23.30	-36.12	-1.30	-16.00	.076
W19	-23.30	-37.61	-1.36	-16.05	.076
W2	.00	-40.23	-1.45	-16.15	.076
W20	-23.30	-39.04	-1.41	-16.11	.076
W21	-23.30	-38.42	-1.39	-16.08	.076
W22	-23.30	-36.13	-1.30	-16.00	.076
W23	-23.30	-37.21	-1.34	-16.04	.076
W24	-23.30	-37.48	-1.35	-16.05	.076
W25	-23.30	-37.48	-1.35	-16.05	.076
W3	.00	-40.23	-1.45	-16.15	.076
W4	-23.30	-40.13	-1.45	-16.15	.076
W5	-23.30	-40.40	-1.46	-16.15	.076
W6	-23.30	-40.39	-1.46	-16.15	.076
W7	-23.30	-39.57	-1.43	-16.12	.076
W8	-23.30	-40.34	-1.46	-16.15	.076
W9	-23.30	-40.27	-1.45	-16.15	.076

* This designates the use of default density in a low pressure region

THE NET SYSTEM DEMAND (USFU) = -489.300

SUMMARY OF INFLOWS(+).AND.OUTFLOWS(-) :

NAME	FLOW (USFU)	FPN TITLE
R- 1	-489.3	R- 1

SUMMARY OF MINIMUM.AND.MAXIMUM VELOCITIES (FT/S)

	MINIMUM		MAXIMUM
R- 1	.00	P-48	20.87
P- 4	.60	P-22	17.30
P-38	1.16	P-31	17.21
P- 2	1.18	P-12	17.06
P-50	2.22	P-37	15.10

SUMMARY OF MINIMUM.AND.MAXIMUM LOSS/1000. (PSI)

	MINIMUM		MAXIMUM
P- 4	.00	P-48	.22
P- 2	.00	P-22	.16
P- 3	.00	P-31	.16
P- 1	.00	P-12	.15
R- 1	.00	P-37	.12

SUMMARY OF MINIMUM.AND.MAXIMUM PRESSURES (USPU)

	MINIMUM		MAXIMUM
J-26	-40.71	W18	-36.12
J-19	-40.68	W22	-36.13
J-11	-40.66	W23	-37.21

J-27	-40.54	J-16	-37.40
J-21	-40.46	W25	-37.48

********** END OF KYGAS SIMULATION **********

DATE FOR THIS COMPUTER RUN : 3-23-2009
START TIME FOR THIS COMPUTER RUN : 11: 9:24:63