Memorandum

November 16, 2016

To:	Tej Gidda, Brian Dermody, Blair Shoniker	Ref. No.:	031913-97
	BPS		
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Subject: Predicted Methane Generation – Brooks Road Landfill

The following presents a summary of the methane generation modeling analysis for the Brooks Road Landfill located in Cayuga, Ontario. The modeling methodology was taken from Title 40 of the United States Code of Federal Regulations (CFR), Part 98, Subpart HH [Mandatory Greenhouse Gas Reporting (GHG) for Municipal Solid Waste (MSW) Landfills].

Please note that this modeling analysis only details anthropogenic emissions from the landfill and does not include biogenic emissions.

Modeling Methane Generation – No Gas Collection System

The methane generation within a landfill for a given year can be calculated based on historical waste records. Equation 1 presents the Scholl-Cannon equation which is used to calculate the methane generation from a landfill for a given year:

$$G_{CH4} = \sum \{W_x * L_{o,x} * (e^{-k\,(T - x - 1)} - e^{-k\,(T - x)})\} \quad [\text{for } x = S \text{ through } T\text{-}1] \qquad (1)$$

where,

G_{CH4} = modeled methane generation rate in year T in metric tonnes per year

x = year in which waste was disposed

S = start year of calculation

T = reporting year for which emissions are calculated

W_x = quantity of waste disposed in year x (metric tonnes, wet weight)

L_o = CH_4 generation potential (metric tonnes CH_4 / metric tonnes waste)

k = rate constant from Table 1 (yr^{-1})

The methane generation potential L_o is calculated using Equation 2:

$$L_o = \frac{MCF * DOC * DOC_F * F * 16}{12} \qquad (2)$$

where,

L_o = CH_4 generation potential (metric tonnes CH_4 / metric tonnes waste)

MCF = methane correction factor (default value is 1)

DOC = degradable organic carbon from Table 1 (metric tonnes C/metric tonne waste)

DOC_F = Fraction of DOC dissimilated (default value is 0.5)

F = Fraction by volume of CH_4 in landfill gas from measurement data, if available (default value is 0.5)

Actual waste disposal numbers were provided by the Site in the form of a Material Activity Report (refer to Attachment 1 for this report) for the period of October 8, 2009 through October 9, 2016. In order to get an average annual quantity for the period of 2009 through 2016, the values in Attachment 2 were divided by 7 (2009 value was prorated based on 84 calendar days). Table 2 presents the breakdown of waste into the categories shown in Table 1 (i.e., bulk waste, C&D waste, food waste, garden waste, paper, wood & straw, textiles, diapers, sewage sludge, or inerts) along with the approximate composition (percent of total).

A waste acceptance rate (WAR) of 75,500 tonnes per year (half of the maximum waste acceptance rate) was assumed for future years (starting in 2017) until the landfill design capacity was reached for both the Existing Landfill (approximately 624,065 tonnes assuming a density of 1 tonne per cubic meter) and the proposed Expansion (approximately 421,000 tonnes assuming a density of 1 tonne per cubic meter). Waste composition for future years was assumed to be the same as shown in Table 2. Table 3 presents the annual breakdown of waste quantities for the Brooks Road Landfill from the open year (2009) to closure (approximately 2023 when assuming the half of the maximum WAR).

Table 4 presents a summary of the input values used for the model. A review of climate data for the Site shows that the average precipitation at the Site is between 20-40 inches per year. It is assumed that mean annual precipitation exceeds the potential evapotranspiration rate at the Site. The default methane concentration of 50 percent by volume was also assumed.

The estimated methane generation in the peak year (2024) for each waste category is shown in the following tables:

- Table 5 presents the estimated peak methane generation for the bulk waste portion
- Table 6 presents the estimated peak methane generation for the C&D waste portion
- Table 7 presents the estimated peak methane generation for the sewage sludge portion
- Table 8 presents the estimated peak methane generation for the garden waste portion
- Table 9 presents the estimated peak methane generation for the food waste portion
- Table 10 presents the estimated peak methane generation for all waste types (please note that inert waste does not generate methane emissions)

Methane generation values (in tons per year) were converted to carbon dioxide equivalents (as tonnes CO_2e per year) by applying a 100-year warming factor of 25 (for methane).

For landfills without landfill gas collection and control systems, methane emissions are calculated using an oxidation factor shown in equation 3:

$$MG = G_{CH4} * (1 - OX) \qquad (3)$$

where,

MG = methane generation, after adjustment for oxidation (metric tonnes CH_4)

G_{CH4} = modeled methane generation rate in reporting year, calculated from equation (1) (metric tonnes CH_4)

OX = Oxidation fraction

This equation accounts for methane that is oxidized upon diffusion through the soil cover. Table 11 presents the estimated peak methane emissions from the Brooks Road Landfill when accounting for soil cover oxidation. Therefore, without a LFG collection and control system, peak methane emissions from the Brooks Road Landfill (in 2024) are estimated to be approximately 809 tonnes of methane (approximately 20,224 tonnes CO_2e). Converting to units of standard cubic feet per minute (scfm), the maximum methane generation rate is approximately 80.5 scfm (in 2024).

Figure 1 presents the projected methane generation for the Brooks Road Landfill (this figure provides total generation quantities prior to cover oxidation). This figure was produced by utilizing the USEPA LandGEM model which is the same first-order Scholl-Canyon model used in Ontario for estimating landfill gas volumes.

Modeling Methane Generation – With Gas Collection and Control System

This section presents a discussion of the impacts associated with the operation of a gas collection and control system. The environmental, economical and energy impacts were evaluated for the installation of a gas collection and control system at the Brooks Road Landfill.

In order to determine the effectiveness of the system, the estimated methane emission reduction was calculated. A gas collection recovery factor of 60 percent was assumed as most of the Site currently has daily cover (see Table HH-3 of 40 CFR 98, Subpart HH). The methane that is generated in the landfill and not recovered by the collection system is given an oxidation factor. A destruction efficiency is applied to the methane that is recovered by the collection system (the lesser of 99 percent and the manufacturer's specified destruction efficiency). Equation 4 is used to calculate total annual methane emissions:

$$E_{CH4} = [(G_{CH4} - R) * (1 - OX)] + [R * (1 - (DE * f_{dest}))] \qquad (4)$$

where,

E_{CH4} = Methane emissions from landfill (metric tonnes CH_4)

R = Quantity of recovered CH_4 in collection system [R= Collection Efficiency (%) * G_{CH4}]

OX = Oxidation fraction

DE = Destruction Efficiency

f_{dest} = fraction of hours the control device was operating (annual operating hours/8,760 hours per year). If the gas is destroyed in a back-up flare (or similar device) or if the gas is transported off-site for destruction, use f_{dest} = 1

Figure 2 presents the projected methane collection (in scfm) for the Brooks Road Landfill. Table 12 presents a summary of the methane emissions for each option (Option 1: No Collection System, Option 2: With Gas Collection System), as well as the estimated methane reduction by going forward with Option 2. It is assumed that the only feasible control option is an open/ utility flare, since the Site does not generate enough gas to support an enclosed flare.

Gas Collection and Control System – Environmental Impacts

In an open/utility flare, LFG is burned in the elevated flare tip located at the top of the gas flare stack. Commonly the flame is open at the top of the gas flare stack and hence the name. Due to the open flame, this type of flare system can be a source of noise. Also the radiant heat from open flame renders some area around the stack unsuitable for installation of some equipment.

Gas Collection and Control System – Energy Impacts

An active gas collection system would require the operation of a blower system. In addition, the open flare would require a fuel source for startup. An active collection and control system would also require much more monitoring and maintenance, which would result in more vehicle traffic to and from the Site. All of the aforementioned items would be a source of GHG emissions which would partially offset any methane reduction that is achieved by a gas collection and control system.

Gas Collection and Control System – Economic Impacts

The average annual costs (capital and operating) associated with the operation of a utility flare and a gas collection system over a 30-year period is presented in Tables 13 and 14, respectively. The total annual cost for the operation of a gas collection and control system is estimated to be $333,712 per year. The average annual methane emission reduction for the period of 2019 – 2048 is estimated to be 7,060 tonnes CO_2e per year. Therefore, the cost effectiveness with this option is estimated to be $47 per tonne CO_2e reduced. Typically, the threshold for determining if a project is cost effective is in the range of $3 - $15 per tonne CO_2e reduced (for GHG). Based on current pricing under Western Climate Initiative eligible entries, the price point for carbon exchange under Ontario's regulatory Cap-and-Trade system is envisioned to be in the $12-$15/tonne CO_2e range. Therefore, the operation of a gas collection and control system at the Brooks Road Landfill is not considered cost-effective.

Discussion/Conclusion

The estimated maximum landfill gas generation and methane generation quantities for the Brooks Road Landfill are shown in the table below (adjusted for cover oxidation):

	Maximum Generation	
	cfm	m^3/hr
LFG	160.9	273.4
Methane	72.4	123.0

Based on an evaluation of the waste quantities shown in Table 2, the landfill accepts mostly construction/demolition waste (~53 percent) and inert material (~30 percent). These waste categories contain a very low amount of degradable organic content (DOC) when compared with higher organic materials such as bulk waste and food waste. Therefore, the landfill is not expected to generate a large amount of methane emissions as a typical MSW landfill would.

It should be noted that the Brooks Road Landfill did accept waste prior to 2009; however, the Site does not have detailed waste records for years prior to 2009. Therefore, it is more conservative to start the modeling analysis in 2009 using a fixed design capacity of 624,065 metric tons for the Existing Landfill. By employing a fixed design capacity of 624,065 metric tons, the waste is assumed to be deposited in the landfill sooner than it actually was which is a conservative assumption since newer waste is expected to produce more gas than older waste. Therefore, the numbers in this modeling analysis are expected to be slightly inflated.

Based on the low level of methane generation at the Brooks Road Landfill and the negative environmental, energy and economical factors associated with a gas collection and control system, it has been demonstrated that the operation of such a system is not considered feasible.

Figure 1
Brooks Road Landfill
LandGEM - Modeled Methane Generation

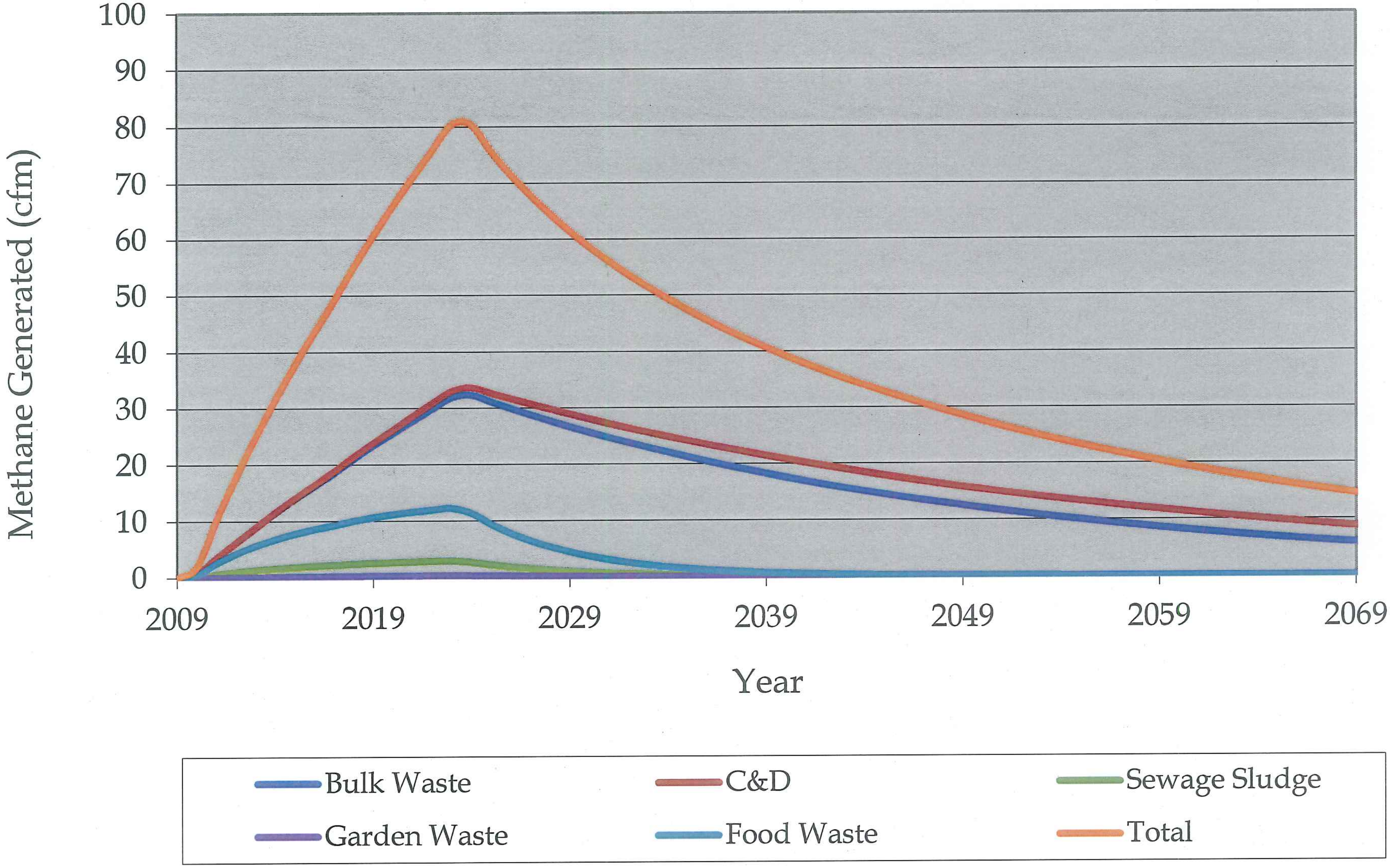

Figure 2
Brooks Road Landfill
LandGEM - Modeled Methane Collection

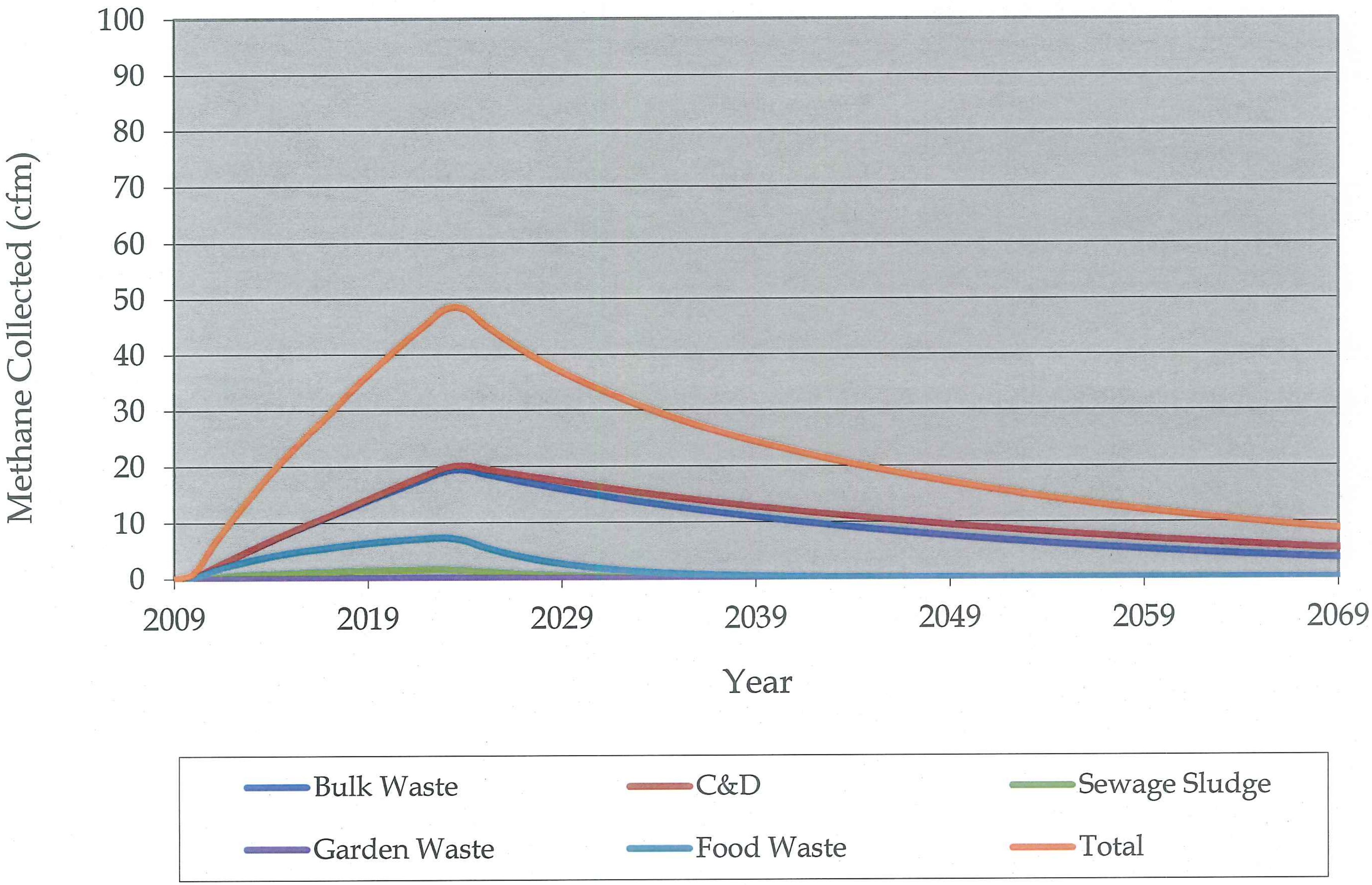

Table 1

Modeling Parameters
Brooks Road Landfill

Factor	Default value	Units
DOC and k values—Bulk waste option		
DOC (bulk waste)	0.2	Weight fraction, wet basis.
k (precipitation plus recirculated leachate[a] <20 inches/year)	0.02	yr^{-1}
k (precipitation plus recirculated leachate[a] 20-40 inches/year)	0.038	yr^{-1}
k (precipitation plus recirculated leachate[a] >40 inches/year)	0.057	yr^{-1}
DOC and k values—Modified bulk MSW option		
DOC (bulk MSW, excluding inerts and C&D waste)	0.31	Weight fraction, wet basis.
DOC (inerts, e.g., glass, plastics, metal, concrete)	0	Weight fraction, wet basis.
DOC (C&D waste)	0.08	Weight fraction, wet basis.
k (bulk MSW, excluding inerts and C&D waste)	0.02 to 0.057[b]	yr^{-1}
k (inerts, e.g., glass, plastics, metal, concrete)	0	yr^{-1}
k (C&D waste)	0.02 to 0.04[b]	yr^{-1}
DOC and k values—Waste composition option		
DOC (food waste)	0.15	Weight fraction, wet basis.
DOC (garden)	0.2	Weight fraction, wet basis.
DOC (paper)	0.4	Weight fraction, wet basis.
DOC (wood and straw)	0.43	Weight fraction, wet basis.
DOC (textiles)	0.24	Weight fraction, wet basis.
DOC (diapers)	0.24	Weight fraction, wet basis.
DOC (sewage sludge)	0.05	Weight fraction, wet basis.
DOC (inerts, e.g., glass, plastics, metal, cement)	0	Weight fraction, wet basis.
k (food waste)	0.06 to 0.185[c]	yr^{-1}
k (garden)	0.05 to 0.10[c]	yr^{-1}
k (paper)	0.04 to 0.06[c]	yr^{-1}
k (wood and straw)	0.02 to 0.03[c]	yr^{-1}
k (textiles)	0.04 to 0.06[c]	yr^{-1}
k (diapers)	0.05 to 0.10[c]	yr^{-1}
k (sewage sludge)	0.06 to 0.185[c]	yr^{-1}
k (inerts e.g., glass, plastics, metal, concrete)	0	yr^{-1}
Other parameters—All MSW landfills		
MCF	1	
DOC_F	0.5	
F	0.5	
OX	See Table HH-4 of this	
DE	0.99	

[a]Recirculated leachate (in inches/year) is the total volume of leachate recirculated from company records or engineering estimates divided by the area of the portion of the landfill containing waste with appropriate unit conversions. Alternatively, landfills that use leachate recirculation can elect to use the k value of 0.057 rather than calculating the recirculated leachate rate.

[b]Use the lesser value when precipitation plus recirculated leachate is less than 20 inches/year. Use the greater value when precipitation plus recirculated leachate is greater than 40 inches/year. Use the average of the range of values when precipitation plus recirculated leachate is 20 to 40 inches/year (inclusive). Alternatively, landfills that use leachate recirculation can elect to use the greater value rather than calculating the recirculated leachate rate.

[c]Use the lesser value when the potential evapotranspiration rate exceeds the mean annual precipitation rate plus recirculated leachate. Use the greater value when the potential evapotranspiration rate does not exceed the mean annual precipitation rate plus recirculated leachate. Alternatively, landfills that use leachate recirculation can elect to use the greater value rather than assessing the potential evapotranspiration rate or recirculated leachate rate.

Table 2

Historical Waste Receipts (2009 - 2016)
Brooks Road Landfill

	Putrescible?	Total Waste (MT)	Putrescible Waste (MT)	Waste Category (MT)
Waste [1]		350,951.53		
70% C&D - Transfer Stations	X	245,666.07	245,666.07	C&D
5% Food Waste	X	17,547.58	17,547.58	FOOD
10% Inerts (Glass, Roxul)		35,095.15		INERT
15% Residential Rolloffs	X	52,642.73	52,642.73	BULK
C&D	X	5,514.35	5,514.35	C&D
Shingles		15,876.78		INERT
Contaminated Soil		87,691.42		INERT
Sludge	X	12,644.03	12,644.03	SEWAGE SLUDGE
Yard Waste	X	461.11	461.11	GARDEN
Asbestos		5,398.30		INERT
Demolition	X	105.44	105.44	C&D
Demo/brick/block	X	2,112.12	2,112.12	C&D
Clay		0.00		INERT
Tire Fluff		770.67		INERT
Salt Cake		233.14		INERT
Ash		2,289.55		INERT
C&D/Roofing/Shingles	X	2,056.40	2,056.40	C&D
Total Material (2009 - 2016)		**486,105**	**338,750**	
Total Material (per year)		**69,444**	**48,393**	

Total Bulk Waste (per year)	**7,520**	**MT/yr**
Total Bulk Waste (% of Total)	**10.8**	
Total C&D Waste (per year)	**36,493**	**MT/yr**
Total C&D Waste (% of Total)	**52.6**	
Total Sewage Sludge (per year)	**1,806**	**MT/yr**
Total Sewage Sludge (% of Total)	**2.6**	
Total Garden Waste (per year)	**66**	**MT/yr**
Total Garden Waste (% of Total)	**0.1**	
Total Food Waste (per year)	**2,507**	**MT/yr**
Total Food Waste (% of Total)	**3.6**	
Total Inert Waste (per year)	**21,051**	**MT/yr**
Total Inert Waste (% of Total)	**30.3**	

1 Breakdown of 'Waste' provided by Brooks Road Environmental

Table 3

Average Annual Waste Quantities
Brooks Road Landfill

Year	Existing Permitted Landfill							Expansion							
	Total Waste	**Bulk**	**C&D**	**Sludge**	**Garden**	**Food**	**Inert**	**Total Waste**	**Bulk**	**C&D**	**Sludge**	**Garden**	**Food**	**Inert**	Total Waste
	(MT/yr)	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	***(MT/yr)***	*(MT/yr)*
2009	15,982	1,731	8,399	416	15	577	4,845								15,982
2010	69,444	7,520	36,493	1,806	66	2,507	21,051								69,444
2011	69,444	7,520	36,493	1,806	66	2,507	21,051								69,444
2012	69,444	7,520	36,493	1,806	66	2,507	21,051								69,444
2013 [1]	119,444	7,520	36,493	1,806	66	2,507	71,051								119,444
2014	69,444	7,520	36,493	1,806	66	2,507	21,051								69,444
2015	69,444	7,520	36,493	1,806	66	2,507	21,051								69,444
2016	69,444	7,520	36,493	1,806	66	2,507	21,051								69,444
2017	71,979	7,795	37,826	1,872	68	2,598	21,819	3,521	381	1,850	92	3	127	1,067	75,500
2018								75,500	8,176	39,676	1,964	72	2,725	22,887	75,500
2019								75,500	8,176	39,676	1,964	72	2,725	22,887	75,500
2020								75,500	8,176	39,676	1,964	72	2,725	22,887	75,500
2021								75,500	8,176	39,676	1,964	72	2,725	22,887	75,500
2022								75,500	8,176	39,676	1,964	72	2,725	22,887	75,500
2023								39,979	4,330	21,009	1,040	38	1,443	12,119	39,979
Total	624,065	62,168	301,679	14,932	545	20,723	224,019	421,000	45,592	221,241	10,951	399	15,197	127,620	1,045,065
	Capacity							**Capacity**							**Total Capacity**
	624,065							**421,000**							**1,045,065**

Notes

1 Includes 50,000 cubic meters of relocated waste from decommissioned Original Landfill Area; due to the composition and age of this waste, it is assumed to be inert material with respect to current waste stream

Table 4

Methane Generation Model
Input Values
Brooks Road Landfill

Enter the Landfill Open Year: 2009
Enter the Peak Year: 2024

Step 1 - Selection of rate constant (k) for bulk waste

		Bulk Waste k (yr^{-1})	C&D k (yr^{-1})
Option 1:	Mean annual precipitation less than 20 inches/year and landfill does not practice leachate recirculation	0.02	0.02
Option 2:	Mean annual precipitation between 20 - 40 inches/year and landfill does not practice leachate recirculation	0.038	0.03
Option 3:	Mean annual precipitation greater than 40 inches/year or landfill does practice leachate recirculation	0.057	0.04

Select option using criteria above (Enter 1, 2, or 3): **2**

Step 2 - Selection of rate constants (k) for categorized wastes

Waste Type	Option 1: Potential evapotranspiration rate exceeds mean annual precipitation and no leachate recirculation at landfill k (yr^{-1})	Option 2: Mean annual precipitation exceeds potential evapotranspiration rate or landfill practices leachate recirculation k (yr^{-1})
Food Waste	0.06	0.185
Garden Waste	0.05	0.1
Paper Waste	0.04	0.06
Wood & Straw	0.02	0.03
Textiles	0.04	0.06
Diapers	0.05	0.1
Sewage Sludge	0.06	0.185

Select option using criteria above (Enter 1 or 2): **2**

Step 3 - Selection of methane concentration (F) for landfill gas

If measured methane concentration is available, enter value as a percent by volume; if measured methane concentration is not available, use default value of 50%

Select methane concentration (F) using criteria above: **50** %

Table 5

Methane Generation Model
Bulk Waste
Brooks Road Landfill

Landfill Year Open:	2009	
Peak Year:	2024	
MCF:	1.0	(default value)
DOC:	0.31	(bulk waste)
DOC_F:	0.5	(default value)
F:	0.5	
k:	0.038	yr^{-1}
Calculated L_o	0.1033	megagrams CH_4 / megagram waste

Year	Bulk Waste Disposed (metric tons of waste disposed)	Contribution to 2024 Generation (metric tons of CH_4 Generated)
2009	1,731	4
2010	7,520	18
2011	7,520	18
2012	7,520	19
2013	7,520	20
2014	7,520	21
2015	7,520	21
2016	7,520	22
2017	8,176	25
2018	8,176	26
2019	8,176	27
2020	8,176	28
2021	8,176	29
2022	8,176	30
2023	4,330	17

Total 2024 CH_4 Generated (metric tons):	**326**
Total 2024 CO_2 Equivalents Generated (metric tons):	**8,138**

Table 6

Methane Generation Model
Construction and Demolition Waste
Brooks Road Landfill

Landfill Year Open:	2009	
Peak Year:	2024	
MCF:	1.0	(default value)
DOC:	0.08	(C&D)
DOC_F:	0.5	(default value)
F:	0.5	
k:	0.03	yr^{-1}
Calculated L_o	0.0267	megagrams CH_4 / megagram waste

Year	C&D Waste Disposed (metric tons of waste disposed)	Contribution to 2024 Generation (metric tons of CH_4 Generated)
2009	8,399	4
2010	36,493	19
2011	36,493	20
2012	36,493	21
2013	36,493	21
2014	36,493	22
2015	36,493	23
2016	36,493	23
2017	39,676	26
2018	39,676	27
2019	39,676	28
2020	39,676	29
2021	39,676	29
2022	39,676	30
2023	21,009	17

Total 2024 CH_4 Generated (metric tons): **339**

Total 2024 CO_2 Equivalents Generated (metric tons): **8,487**

Table 7

Methane Generation Model
Sewage Sludge Waste
Brooks Road Landfill

Landfill Year Open:	2009	
Peak Year:	2024	
MCF:	1.0	(default value)
DOC:	0.05	(sewage sludge waste)
DOC_F:	0.5	(default value)
F:	0.5	
k:	0.185	yr^{-1}
Calculated L_o	0.0167	megagrams CH_4 / megagram waste

Year	Sewage Sludge Waste Disposed (metric tons of waste disposed)	Contribution to 2024 Generation (metric tons of CH_4 Generated)
2009	416	0
2010	1,806	0
2011	1,806	1
2012	1,806	1
2013	1,806	1
2014	1,806	1
2015	1,806	1
2016	1,806	1
2017	1,964	2
2018	1,964	2
2019	1,964	3
2020	1,964	3
2021	1,964	4
2022	1,964	5
2023	1,040	3

Total 2024 CH_4 Generated (metric tons):	**27**
Total 2024 CO_2 Equivalents Generated (metric tons):	**681**

Table 8

Methane Generation Model
Garden Waste
Brooks Road Landfill

Landfill Year Open:	2009	
Peak Year:	2024	
MCF:	1.0	(default value)
DOC:	0.2	(garden waste)
DOC_F:	0.5	(default value)
F:	0.5	
k:	0.1	yr^{-1}
Calculated L_o	0.0667	megagrams CH_4 / megagram waste

Year	Garden Waste Disposed (metric tons of waste disposed)	Contribution to 2024 Generation (metric tons of CH_4 Generated)
2009	15	0
2010	66	0
2011	66	0
2012	66	0
2013	66	0
2014	66	0
2015	66	0
2016	66	0
2017	72	0
2018	72	0
2019	72	0
2020	72	0
2021	72	0
2022	72	0
2023	38	0

Total 2024 CH_4 Generated (metric tons): **3**

Total 2024 CO_2 Equivalents Generated (metric tons): **83**

Table 9

Methane Generation Model
Food Waste
Brooks Road Landfill

Landfill Year Open:	2009	
Peak Year:	2024	
MCF:	1.0	(default value)
DOC:	0.15	(food waste)
DOC_F:	0.5	(default value)
F:	0.5	
k:	0.185	yr^{-1}
Calculated L_o	0.0500	megagrams CH_4 / megagram waste

Year	Food Waste Disposed (metric tons of waste disposed)	Contribution to 2024 Generation (metric tons of CH_4 Generated)
2009	577	0
2010	2,507	2
2011	2,507	2
2012	2,507	3
2013	2,507	3
2014	2,507	4
2015	2,507	5
2016	2,507	6
2017	2,725	8
2018	2,725	9
2019	2,725	11
2020	2,725	13
2021	2,725	16
2022	2,725	19
2023	1,443	12

Total 2024 CH_4 Generated (metric tons): **113**
Total 2024 CO_2 Equivalents Generated (metric tons): **2,835**

Table 10

Methane Generation Model
Totals
Brooks Road Landfill

Landfill Year Open:	2009
Reporting Year:	2024

Waste Type	2024 CH_4 Generation (metric tons)
Bulk Waste	326
C&D	339
Sewage Sludge	27
Garden	3
Food	113
Inerts	0

Total 2024 CH_4 Generated (metric tons):	**809**
Total 2024 CO_2 Equivalents Generated (metric tons):	**20,224**
Threshold (metric tons):	**100,000**

Table 11

Calculation of Methane Generation and Emissions
Brooks Landfill Site

Calculation of methane generation, adjusted for oxidation, from the modeled CH_4, using Equation HH-5

$$MG = G_{CH4} * (1 - OX)$$

G_{CH4} =	Modeled methane generation rate =	809.0	metric tons CH_4 in 2024
SArea =	Surface Area of the landfill =	60,703	square meters
MF =	Methane Flux rate from the landfill =	37	g/m^2/day
OX =	Oxidation fraction =	0.1	(Landfill has 1 foot of interim cover; 6" of daily cover, option C4)

MG = 728.1 metric tons CH_4

MG = 18,201.6 metric tons CO_2 equivalents

Table HH-4 to Subpart HH of Part 98—Landfill Methane Oxidation Fractions

Under these conditions:	Use this landfill methane oxidation fraction:
I. For all reporting years prior to the 2013 reporting year	
C1: For all landfills regardless of cover type or methane flux	0.10
II. For the 2013 reporting year and all subsequent years	
C2: For landfills that have a geomembrane (synthetic) cover with less than 12 inches of cover soil for the majority of the landfill area containing waste	0.0
C3: For landfills that do not meet the conditions in C2 above, and for which you elect not to determine methane flux	0.10
C4: For landfills that do not meet the conditions in C2 above and that do not have a soil cover of at least 24 inches for a majority of the landfill area containing waste	0.10
C5: For landfills that have a soil cover of at least 24 inches for a majority of the landfill area containing waste and for which the methane flux rate is less than 10 grams per square meter per day ($g/m^2/d$)	0.35
C6: For landfills that have a soil cover of at least 24 inches for a majority of the landfill area containing waste and for which the methane flux rate is 10 to 70 $g/m^2/d$	0.25
C7: For landfills that have a soil cover of at least 24 inches for a majority of the landfill area containing waste and for which the methane flux rate is greater than 70 $g/m^2/d$	0.10

Table 12

Methane Modeling Summary
Brooks Road Landfill

Year	Methane Generated					
	Bulk Waste (cfm)	C&D (cfm)	Sewage Sludge (cfm)	Garden Waste (cfm)	Food Waste (cfm)	Total (cfm)
2009	0	0	0	0	0	0
2010	1	1	0	0	0	2
2011	4	3	1	0	3	10
2012	6	6	1	0	4	18
2013	9	9	1	0	6	25
2014	11	12	2	0	7	32
2015	14	14	2	0	8	38
2016	16	16	2	0	9	44
2017	19	19	2	0	9	49
2018	21	21	2	0	10	55
2019	23	24	3	0	11	61
2020	26	26	3	0	11	66
2021	28	29	3	0	12	71
2022	30	31	3	0	12	76
2023	32	33	3	0	12	80
2024	32	34	3	0	11	80
2025	31	33	2	0	9	76
2026	30	32	2	0	8	72
2027	29	31	2	0	7	68
2028	28	30	1	0	5	65
2029	27	29	1	0	5	62
2030	26	28	1	0	4	59
2031	25	27	1	0	3	56
2032	24	27	1	0	3	54
2033	23	26	1	0	2	52
2034	22	25	0	0	2	49
2035	21	24	0	0	1	47
2036	20	24	0	0	1	46
2037	20	23	0	0	1	44
2038	19	22	0	0	1	42
2039	18	21	0	0	1	41
2040	18	21	0	0	1	39
2041	17	20	0	0	0	38
2042	16	20	0	0	0	37
2043	16	19	0	0	0	35
2044	15	19	0	0	0	34
2045	15	18	0	0	0	33
2046	14	17	0	0	0	32
2047	13	17	0	0	0	31
2048	13	16	0	0	0	30
2049	13	16	0	0	0	29
2050	12	15	0	0	0	28
2051	12	15	0	0	0	27
2052	11	15	0	0	0	26
2053	11	14	0	0	0	25
2054	10	14	0	0	0	24
2055	10	13	0	0	0	23
2056	10	13	0	0	0	23
2057	9	13	0	0	0	22
2058	9	12	0	0	0	21
2059	9	12	0	0	0	20
2060	8	11	0	0	0	20
2061	8	11	0	0	0	19
2062	8	11	0	0	0	18
2063	7	10	0	0	0	18
2064	7	10	0	0	0	17
2065	7	10	0	0	0	17
2066	7	10	0	0	0	16
2067	6	9	0	0	0	16
2068	6	9	0	0	0	15
2069	6	9	0	0	0	15
2070	6	8	0	0	0	14
2071	5	8	0	0	0	14

Table 12

Methane Modeling Summary
Brooks Road Landfill

	Methane Generated					
Year	Bulk Waste (cfm)	C&D (cfm)	Sewage Sludge (cfm)	Garden Waste (cfm)	Food Waste (cfm)	Total (cfm)
2072	5	8	0	0	0	13
2073	5	8	0	0	0	13
2074	5	8	0	0	0	12
2075	5	7	0	0	0	12
2076	4	7	0	0	0	12
2077	4	7	0	0	0	11
2078	4	7	0	0	0	11
2079	4	6	0	0	0	10
2080	4	6	0	0	0	10
2081	4	6	0	0	0	10
2082	4	6	0	0	0	9
2083	3	6	0	0	0	9
2084	3	6	0	0	0	9
2085	3	5	0	0	0	9
2086	3	5	0	0	0	8
2087	3	5	0	0	0	8
2088	3	5	0	0	0	8
2089	3	5	0	0	0	8
2090	3	5	0	0	0	7
2091	3	5	0	0	0	7
2092	2	4	0	0	0	7
2093	2	4	0	0	0	7
2094	2	4	0	0	0	6
2095	2	4	0	0	0	6
2096	2	4	0	0	0	6
2097	2	4	0	0	0	6
2098	2	4	0	0	0	6
2099	2	4	0	0	0	5
2100	2	3	0	0	0	5
2101	2	3	0	0	0	5
2102	2	3	0	0	0	5
2103	2	3	0	0	0	5
2104	2	3	0	0	0	5
2105	1	3	0	0	0	4
2106	1	3	0	0	0	4
2107	1	3	0	0	0	4
2108	1	3	0	0	0	4
2109	1	3	0	0	0	4
2110	1	3	0	0	0	4
2111	1	2	0	0	0	4
2112	1	2	0	0	0	4
2113	1	2	0	0	0	3
2114	1	2	0	0	0	3
2115	1	2	0	0	0	3
2116	1	2	0	0	0	3
2117	1	2	0	0	0	3
2118	1	2	0	0	0	3
2119	1	2	0	0	0	3
2120	1	2	0	0	0	3
2121	1	2	0	0	0	3
2122	1	2	0	0	0	3
2123	1	2	0	0	0	2
2124	1	2	0	0	0	2
2125	1	2	0	0	0	2
2126	1	2	0	0	0	2
2127	1	2	0	0	0	2
2128	1	1	0	0	0	2
2129	1	1	0	0	0	2

Table 12

Methane Modeling Summary
Brooks Road Landfill

Year	Methane Collected						Option 1: No Collection System	Option 2: With Collection System	Option 2: With Collection System
	Bulk Waste (cfm)	C&D (cfm)	Sewage Sludge (cfm)	Garden Waste (cfm)	Food Waste (cfm)	Total (cfm)	Methane Emissions (MT CO2e/yr)	Methane Emissions (MT CO2e/yr)	Methane Reduction (MT CO2e/yr)
2009	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	1	439	178	260
2011	2	2	0	0	2	6	2,312	940	1,372
2012	4	4	1	0	3	11	4,045	1,645	2,400
2013	5	5	1	0	3	15	5,655	2,300	3,355
2014	7	7	1	0	4	19	7,157	2,910	4,246
2015	8	8	1	0	5	23	8,564	3,483	5,081
2016	10	10	1	0	5	26	9,886	4,020	5,866
2017	11	11	1	0	6	29	11,133	4,528	6,606
2018	13	13	1	0	6	33	12,479	5,075	7,404
2019	14	14	2	0	6	36	13,752	5,592	8,159
2020	15	16	2	0	7	40	14,958	6,083	8,875
2021	17	17	2	0	7	43	16,104	6,549	9,555
2022	18	19	2	0	7	45	17,196	6,993	10,203
2023	19	20	2	0	7	48	18,237	7,416	10,821
2024	19	20	2	0	7	48	18,257	7,424	10,832
2025	19	20	1	0	6	46	17,211	6,999	10,212
2026	18	19	1	0	5	43	16,273	6,618	9,655
2027	17	18	1	0	4	41	15,428	6,274	9,154
2028	17	18	1	0	3	39	14,662	5,963	8,700
2029	16	17	1	0	3	37	13,965	5,679	8,286
2030	15	17	1	0	2	35	13,325	5,419	7,906
2031	15	16	0	0	2	34	12,737	5,180	7,557
2032	14	16	0	0	2	32	12,193	4,958	7,234
2033	14	15	0	0	1	31	11,687	4,753	6,934
2034	13	15	0	0	1	30	11,215	4,561	6,654
2035	13	15	0	0	1	28	10,773	4,381	6,392
2036	12	14	0	0	1	27	10,358	4,212	6,145
2037	12	14	0	0	1	26	9,966	4,053	5,913
2038	11	13	0	0	1	25	9,595	3,902	5,693
2039	11	13	0	0	0	24	9,243	3,759	5,484
2040	11	13	0	0	0	24	8,909	3,623	5,286
2041	10	12	0	0	0	23	8,591	3,494	5,097
2042	10	12	0	0	0	22	8,287	3,370	4,917
2043	9	11	0	0	0	21	7,997	3,252	4,745
2044	9	11	0	0	0	20	7,719	3,139	4,580
2045	9	11	0	0	0	20	7,453	3,031	4,422
2046	8	10	0	0	0	19	7,197	2,927	4,270
2047	8	10	0	0	0	18	6,952	2,827	4,125
2048	8	10	0	0	0	18	6,716	2,731	3,985
2049	8	10	0	0	0	17	6,489	2,639	3,850
2050	7	9	0	0	0	17	6,270	2,550	3,720
2051	7	9	0	0	0	16	6,060	2,464	3,596
2052	7	9	0	0	0	15	5,857	2,382	3,475
2053	6	8	0	0	0	15	5,662	2,302	3,359
2054	6	8	0	0	0	14	5,473	2,226	3,247
2055	6	8	0	0	0	14	5,291	2,152	3,140
2056	6	8	0	0	0	14	5,116	2,080	3,035
2057	6	8	0	0	0	13	4,946	2,012	2,935
2058	5	7	0	0	0	13	4,783	1,945	2,838
2059	5	7	0	0	0	12	4,625	1,881	2,744
2060	5	7	0	0	0	12	4,472	1,819	2,654
2061	5	7	0	0	0	11	4,325	1,759	2,566
2062	5	6	0	0	0	11	4,183	1,701	2,482
2063	4	6	0	0	0	11	4,045	1,645	2,400
2064	4	6	0	0	0	10	3,912	1,591	2,321
2065	4	6	0	0	0	10	3,784	1,539	2,245
2066	4	6	0	0	0	10	3,660	1,488	2,172
2067	4	6	0	0	0	9	3,540	1,440	2,100
2068	4	5	0	0	0	9	3,424	1,392	2,032
2069	4	5	0	0	0	9	3,312	1,347	1,965
2070	3	5	0	0	0	8	3,204	1,303	1,901
2071	3	5	0	0	0	8	3,099	1,260	1,839

Table 12

Methane Modeling Summary
Brooks Road Landfill

Year	Methane Collected						Option 1: No Collection System	Option 2: With Collection System	Option 2: With Collection System
	Bulk Waste (cfm)	C&D (cfm)	Sewage Sludge (cfm)	Garden Waste (cfm)	Food Waste (cfm)	Total (cfm)	Methane Emissions (MT CO2e/yr)	Methane Emissions (MT CO2e/yr)	Methane Reduction (MT CO2e/yr)
2072	3	5	0	0	0	8	2,998	1,219	1,779
2073	3	5	0	0	0	8	2,900	1,179	1,721
2074	3	5	0	0	0	7	2,805	1,141	1,664
2075	3	4	0	0	0	7	2,714	1,104	1,610
2076	3	4	0	0	0	7	2,625	1,068	1,558
2077	3	4	0	0	0	7	2,540	1,033	1,507
2078	2	4	0	0	0	6	2,457	999	1,458
2079	2	4	0	0	0	6	2,377	967	1,410
2080	2	4	0	0	0	6	2,300	935	1,365
2081	2	4	0	0	0	6	2,225	905	1,320
2082	2	4	0	0	0	6	2,153	875	1,277
2083	2	3	0	0	0	6	2,083	847	1,236
2084	2	3	0	0	0	5	2,015	820	1,196
2085	2	3	0	0	0	5	1,950	793	1,157
2086	2	3	0	0	0	5	1,887	767	1,119
2087	2	3	0	0	0	5	1,826	742	1,083
2088	2	3	0	0	0	5	1,766	718	1,048
2089	2	3	0	0	0	5	1,709	695	1,014
2090	2	3	0	0	0	4	1,654	673	981
2091	2	3	0	0	0	4	1,600	651	950
2092	1	3	0	0	0	4	1,549	630	919
2093	1	3	0	0	0	4	1,499	609	889
2094	1	2	0	0	0	4	1,450	590	860
2095	1	2	0	0	0	4	1,403	571	833
2096	1	2	0	0	0	4	1,358	552	806
2097	1	2	0	0	0	3	1,314	534	780
2098	1	2	0	0	0	3	1,272	517	755
2099	1	2	0	0	0	3	1,231	501	730
2100	1	2	0	0	0	3	1,191	484	707
2101	1	2	0	0	0	3	1,153	469	684
2102	1	2	0	0	0	3	1,116	454	662
2103	1	2	0	0	0	3	1,080	439	641
2104	1	2	0	0	0	3	1,045	425	620
2105	1	2	0	0	0	3	1,011	411	600
2106	1	2	0	0	0	3	979	398	581
2107	1	2	0	0	0	3	947	385	562
2108	1	2	0	0	0	2	917	373	544
2109	1	2	0	0	0	2	888	361	527
2110	1	2	0	0	0	2	859	349	510
2111	1	1	0	0	0	2	832	338	493
2112	1	1	0	0	0	2	805	327	478
2113	1	1	0	0	0	2	779	317	462
2114	1	1	0	0	0	2	754	307	447
2115	1	1	0	0	0	2	730	297	433
2116	1	1	0	0	0	2	707	287	419
2117	1	1	0	0	0	2	684	278	406
2118	1	1	0	0	0	2	662	269	393
2119	1	1	0	0	0	2	641	261	380
2120	1	1	0	0	0	2	621	252	368
2121	0	1	0	0	0	2	601	244	356
2122	0	1	0	0	0	2	582	236	345
2123	0	1	0	0	0	1	563	229	334
2124	0	1	0	0	0	1	545	222	323
2125	0	1	0	0	0	1	528	215	313
2126	0	1	0	0	0	1	511	208	303
2127	0	1	0	0	0	1	495	201	293
2128	0	1	0	0	0	1	479	195	284
2129	0	1	0	0	0	1	464	189	275

Table 13

Cost Analysis: Utility Flare
Brooks Road Landfill

Capital Costs

<u>Direct Costs</u>		
Utility Flare	$100,000	(estimated)
(includes enclosed stack, control panel/ instrumentation, and blower skid/ mechanical components)		
Auxiliary Equipment	$6,000	(6% of Flare System Costs)
Equipment Cost ($) ……………………………………	$106,000	
Sales Tax	$3,180	(3% of Equipment Cost)
Freight	$5,300	(5%of Equiment Cost)
Purchased Equipment Cost ($) …………………..	$114,480	
<u>Direct Installation Costs</u>		
Foundations & Supports	$13,738	12% of PEC
Handling & Erection	$45,792	40% of PEC
Electrical	$1,145	1% of PEC
Piping	$2,290	2% of PEC
Insulation	$1,145	1% of PEC
Painting	$1,145	1% of PEC
Direct Installation Cost ($)	$65,254	
Site Preparation	$0	
Facilities & Buildings	$0	
Total Direct Costs, DC ($) ……………………………	$179,734	
<u>Indirect Costs, IC</u>		
Engineering	$11,448	10% of PEC
Construction and Field Expenses	$11,448	10% of PEC
Contractor Fees	$11,448	10% of PEC
Start-up	$1,145	1% of PEC
Performance Test	$1,145	1% of PEC
Contingencies	$3,434	3% of PEC
Total Indirect Costs, IC	$40,068	
Total Capital Investment ($) …………………………	$219,802	

Table 13

Cost Analysis: Utility Flare
Brooks Road Landfill

Annual Cost Inputs

Operating factor (hr/yr):		8,760	100% operation capacity
Annual interest rate (fraction):		0.05	
Project life (years):		30	
Capital recovery factor:		0.06505	
Flare Operator Labor Rate	$	30.00	/ hour
Maintenance Labor Rate	$	33.00	/ hour
<u>Direct Annual Costs</u>			
Operator labor costs		$18,900	630 hours/year
Supervisor		$2,835	(15% of Operator labor)
Maintenance Labor		$18,068	(0.5 hr per shift)
Maintenance Materials		$18,068	(100% of Maintenance Labor)
Utilities			
Electricity		$33,328	(30 HP blower; $0.17/kw-hr)
Propane		$1,000	(estimated)
Total Direct Costs, DC ($) ………………………….		$92,198	
<u>Indirect Annual Costs, IC</u>			
Overhead		$34,722	(60% of labor % material costs)
Administrative Charges		$4,396	2% of TCI
Property Tax		$2,198	1% of TCI
Insurance		$2,198	1% of TCI
Capital Recovery		$14,298	
Total Indirect Costs, IC ($) ………………………….		$57,812	
Total Annual Costs ($) ……………………………….		$150,011	

Note: Cost assumptions and recommendations were referenced from the *EPA Air Pollution Cost Control Manual, Sixth Edition* (January 2002)

Table 14

Cost Analysis: Installation of Gas Collection System
Brooks Road Landfill

Capital Costs

<u>Direct Costs</u>		
Installation of Gas Collection System	$450,000	($30,000 per acre)
Equipment Cost ($) ……………………………………	$450,000	
Sales Tax	$13,500	(3% of Equipment Cost)
Freight	$22,500	(5% of Equiment Cost)
Purchased Equipment Cost ($) …………………..	$486,000	
<u>Direct Installation Costs</u>		
Foundations & Supports	$58,320	12% of PEC
Handling & Erection	$194,400	40% of PEC
Electrical	$4,860	1% of PEC
Piping	$9,720	2% of PEC
Insulation	$4,860	1% of PEC
Painting	$4,860	1% of PEC
Direct Installation Cost ($)	$277,020	
Site Preparation	$0	
Facilities & Buildings	$0	
Total Direct Costs, DC ($) ……………………………	$763,020	
<u>Indirect Costs, IC</u>		
Engineering	$48,600	10% of PEC
Construction and Field Expenses	$48,600	10% of PEC
Contractor Fees	$48,600	10% of PEC
Start-up	$4,860	1% of PEC
Performance Test	$4,860	1% of PEC
Contingencies	$14,580	3% of PEC
Total Indirect Costs, IC	$170,100	
Total Capital Investment ($) …………………………	$933,120	

Table 14

Cost Analysis: Installation of Gas Collection System
Brooks Road Landfill

Annual Cost Inputs

Operating factor (hr/yr):	8,760	100% operation capacity
Annual interest rate (fraction):	0.05	
Project life (years):	30	
Capital recovery factor:	0.06505	
Direct Annual Costs		
Operating Costs	$61,500	($4,100 per acre)
Total Direct Costs, DC ($)	$61,500	
Indirect Annual Costs, IC		
Capital Recovery	$60,701	
Operating Costs	$61,500	
Total Indirect Costs, IC ($)	$122,201	
Total Annual Costs ($)	$183,701	

Note: Cost assumptions and recommendations were referenced from the *EPA Air Pollution Cost Control Manual, Sixth Edition* (January 2002)

Attachment 1
Material Activity Report

Summary Material Activity Report

All Ticket Types | October 08, 2009 to October 09, 2016 | All Facilities
History and Waiting | All Materials
* - Confirmed Qty Applied to Billing

Material	Weight Inbound	Weight Outbound	Volume Inbound	Volume Outbound	Count Inbound	Count Outbound	Billing Qty	Material Total	Tax Total	Total	Item Count	Ticket Count
Waste	350,951.53	0.00 MT	0.00	0.00 YD	21,440.00	0.00	350,951.53 MT	$13,407,183.54	$1,632,115.30	15,039,298.84	17867	
C&D	5,514.35	0.00 MT	0.00	0.00 YD	0.00	0.00	5,514.35 MT	$165,093.44	$19,760.71	$184,854.15	238	
Shingles	15,876.78	0.00 MT	0.00	0.00 YD	0.00	0.00	15,876.78 MT	$453,567.55	$39,846.11	$493,413.66	427	
Contaminated Soil	87,691.42	19.24 MT	0.00	0.00 YD	68,450.00	0.00	87,710.66 MT	$1,960,418.49	$227,003.64	$2,187,422.13	2903	
Sludge	12,644.03	0.00 MT	0.00	0.00 YD	0.00	0.00	12,644.03 MT	$288,658.61	$22,780.75	$311,439.36	310	
Yard Waste	461.11	1,308.44 MT	0.00	0.00 YD	0.00	0.00	1,769.55 MT	$8,299.98	$1,079.02	$9,379.00	47	
Asbestos	5,398.30	0.00 MT	0.00	0.00 YD	0.00	0.00	5,398.30 MT	$938,551.27	$121,539.09	$1,060,090.36	1219	
Demolition	105.44	0.00 MT	0.00	0.00 YD	0.00	0.00	105.44 MT	$3,780.65	$189.03	$3,969.68	4	
Demo/brick/block	2,112.12	0.00 MT	0.00	0.00 YD	0.00	0.00	2,112.12 MT	$67,203.57	$7,973.54	$75,177.11	125	
Clay	0.00	40,000.00 MT	0.00	0.00 YD	0.00	0.00	40,000.00 MT	$180,000.00	$23,400.00	$203,400.00	2	
Leachate	(123.20)	18,781.94 MT	0.00	0.00 YD	0.00	0.00	18,658.74 MT	$0.00	$0.00	$0.00	500	
Tire Fluff	770.67	0.00 MT	0.00	0.00 YD	0.00	0.00	770.67 MT	$20,181.42	$2,623.59	$22,805.01	63	
Salt Cake	233.14	0.00 MT	0.00	0.00 YD	0.00	0.00	233.14 MT	$8,159.90	$1,060.79	$9,220.69	6	
Ash	2,289.55	0.00 MT	0.00	0.00 YD	0.00	0.00	2,289.55 MT	$59,528.30	$7,738.67	$67,266.97	68	
C&D/Roofing/Shingles	2,056.40	0.00 MT	0.00	0.00 YD	0.00	0.00	2,056.40 MT	$52,586.06	$3,459.97	$56,046.03	88	
	485,981.64	60,109.62 MT	0.00	0.00 YD	9,890.00	0.00	546,091.26 MT	$17,613,212.78	$2,110,570.21	$19,723,782.99	23867	23867

Material Summary	Weight Inbound	Weight Outbound	Volume Inbound	Volume Outbound	Count Inbound	Count Outbound	Billing Quantity	Material Total	Tax Total	Total
Waste	350,951.53	0.00 MT	0.00	0.00 YD	21,440.00	0.00	350,951.53 MT	407,183.54	2,115.30	39,298.84
C&D	5,514.35	0.00 MT	0.00	0.00 YD	0.00	0.00	5,514.35 MT	165,093.44	9,760.71	84,854.15
Shingles	15,876.78	0.00 MT	0.00	0.00 YD	0.00	0.00	15,876.78 MT	453,567.55	9,846.11	93,413.66
Contaminated Soil	87,691.42	19.24 MT	0.00	0.00 YD	68,450.00	0.00	87,710.66 MT	960,418.49	7,003.64	87,422.13
Sludge	12,644.03	0.00 MT	0.00	0.00 YD	0.00	0.00	12,644.03 MT	288,658.61	2,780.75	11,439.36
Yard Waste	461.11	1,308.44 MT	0.00	0.00 YD	0.00	0.00	1,769.55 MT	$8,299.98	1,079.02	$9,379.00
Asbestos	5,398.30	0.00 MT	0.00	0.00 YD	0.00	0.00	5,398.30 MT	938,551.27	1,539.09	60,090.36
Demolition	105.44	0.00 MT	0.00	0.00 YD	0.00	0.00	105.44 MT	$3,780.65	$189.03	$3,969.68
Demo/brick/block	2,112.12	0.00 MT	0.00	0.00 YD	0.00	0.00	2,112.12 MT	67,203.57	7,973.54	75,177.11
Clay	0.00	40,000.00 MT	0.00	0.00 YD	0.00	0.00	40,000.00 MT	180,000.00	3,400.00	03,400.00
Leachate	(123.20)	18,781.94 MT	0.00	0.00 YD	0.00	0.00	18,658.74 MT	$0.00	$0.00	$0.00
Tire Fluff	770.67	0.00 MT	0.00	0.00 YD	0.00	0.00	770.67 MT	20,181.42	2,623.59	22,805.01
Salt Cake	233.14	0.00 MT	0.00	0.00 YD	0.00	0.00	233.14 MT	$8,159.90	1,060.79	$9,220.69
Ash	2,289.55	0.00 MT	0.00	0.00 YD	0.00	0.00	2,289.55 MT	59,528.30	7,738.67	67,266.97
C&D/Roofing/Shingles	2,056.40	0.00 MT	0.00	0.00 YD	0.00	0.00	2,056.40 MT	52,586.06	3,459.97	56,046.03