ANNUAL ENVIRONMENTAL REPORT (2010)

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME (2011)

FOR

BALYDONAGH LANDFILL

2010

WASTE LICENCE NO. W0028-03

Prepared By: -

Environment Section,
Westmeath County Council,
County Buildings,
Mullingar,
Co. Westmeath.

ANNUAL ENVIRONMENTAL REPORT

FOR

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(1st January 2010 to December 31st 2010)

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April 2011

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1. INTRODUCTION

This is the twelfth Annual Environmental Report (AER) for Ballydonagh Landfill, Athlone, County Westmeath, and the second AER under the revised Waste Licence Number W0028-03. The AER was prepared in response to Schedule E of the Waste Licence (Waste Licence Register Number W0028-03).

The contents of the report are based on Schedule G of the Waste Licence. The report format follows guidelines set in the "Draft Guidance on Environmental Management Systems and Reporting to the Agency" issued by the Environmental Protection Agency (EPA) and recommendations made by the EPA on the previous AER's.

This AER details the Site Activities for the period from 1st January to 31st December 2010.

The addressees of the facility and the operator are as follows: -

Landfill

Ballydonagh Landfill,
Ballydonagh,
Dublin Road,
Athlone,
County Westmeath.

Operator

Westmeath County Council,
County Buildings,
Mullingar,
County Westmeath.

2. SITE DESCRIPTION

2.1 Waste Management Activities

Both Waste Disposal and Waste Recovery Activities are carried out at the site, in accordance with the Third and Fourth Schedules of the Waste Management Act, 1996. The site is licensed to accept the following categories of non-hazardous waste; household waste, commercial waste, construction & demolition waste, and industrial waste for disposal in lined engineered landfill cells. The site also has recycling Bring Banks for the recovery of Glass bottles & aluminium cans, and clothes.
Land filling of waste ceased on the 31st July 2010. The civic waste facility is now operated by Oxigen Environmental as a household waste depot. Waste is transferred off site to one of the designated facilities as approved by the EPA.

2.2 Total Quantity of Wastes Accepted

A summary of the total quantity of each type of waste accepted at the facility for the reporting period 1st January 2010 to 31st December 2010 is presented in two separate tables below. Table 2.1 below shows the quantities of waste landfilled at the facility between 1st January and 31st July 2010. Table 2.2 show the quantities of waste accepted at the facility between 1st August and 31st December 2010. Figure 2.1 shows the trend in waste acceptance for the last five years.
The gate charge was €140 / tonne inc Landfill Tax for both domestic and commercial waste with a sliding scale charge for larger volume for the landfilling of waste.

Table 2.1 Total Quantity of Each Waste Type Landfilled between January – July

WASTE TYPE	TONNES PER REPORTING PERIOD
Household	3,310.49
Commercial	18,989.73
Sewage Sludge	0
Construction & Demolition	0
Industrial Non-Hazardous Sludges	0
Industrial Non-Hazardous Solids	283.94 *Note 1*
Total	22584.16

Notes
Note 1: Tonnage for Industrial Non-Hazardous Solids includes Street Sweeping Tonnage of 283.94 tonnes.

In addition to the total quantity of waste accepted at the facility during the reporting period 1409.72 tonnes of cover and bunding materials were brought onto the site. Only virgin road making materials were brought onto site. This brings the total quantity of materials placed in the landfill to 23,993.88 tonnes

Table 2.2 Total Quantity of Each Waste Type Accepted Between August - December

WASTE TYPE	TONNES PER REPORTING PERIOD
Domestic	1183.88
Cover	311.04
Wood	20.04
Glass & Aluminium Cans	14.50
Textiles	2.26
Steel	8.62
Total	1,540.34

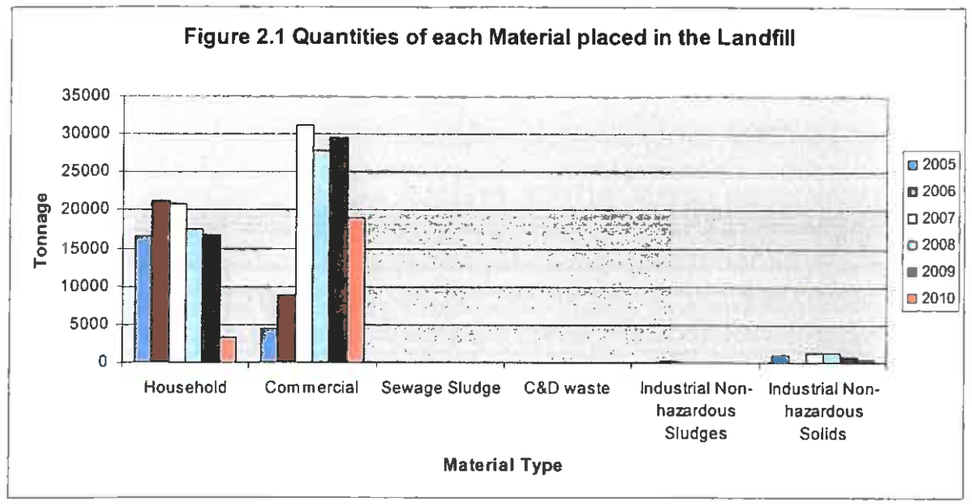
.
Cover material brought in during August was used by Westmeath County Council as cover material for the active area.

Table 2.3 below shows a breakdown of waste accepted into Ballydonagh for January to July 2010.

Table 2.2 Quantity Waste Accepted & landfilled (1st January 2010 to July 2010).

	Household	Commercial	Sewage Sludge	C&D Waste	Industrial Non-Hazardous Sludges	Industrial Non-Hazardous Solids
Tonnes 2010	3,310.49	18,989.73	0	0	0	283.94

Figure 2.1 below shows the trend in the quantities of each material placed in the landfill over the last six years.



Note* 2010 quantities are waste brought in up to end of July 2010.

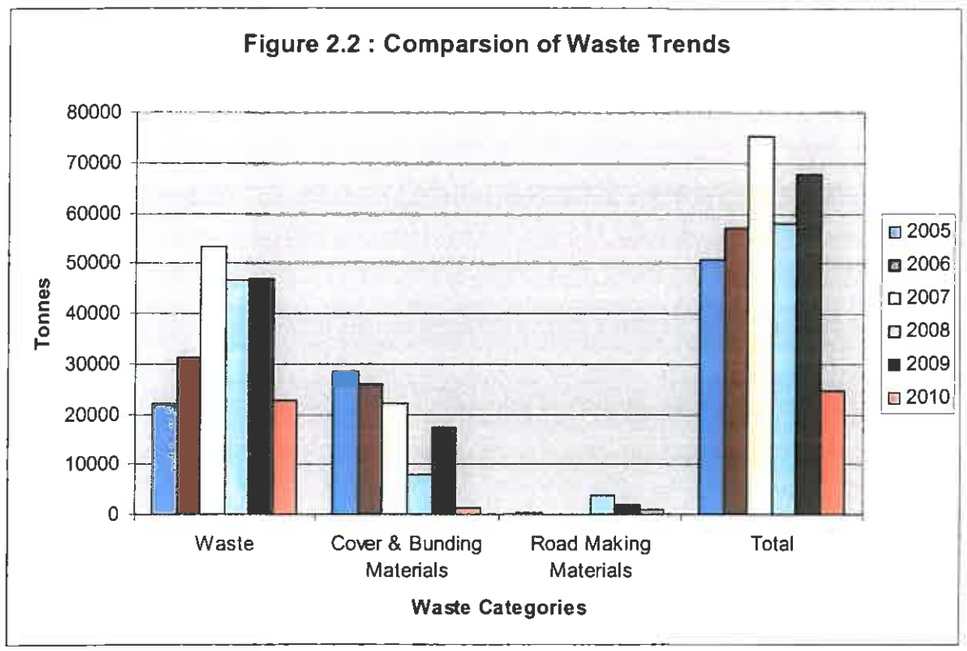
Table 2.3 Waste Breakdown for January 2010 to July 2010.

The following table shows the breakdown of the waste landfilled into Ballydonagh Landfill for 2010.

	Waste	Cover & Bunding Materials	Road Making Materials inc trenching materials	Total
Tonnes 2010	22,584.16	1409.72*	902	24,095.48

*includes cover brought in during August of 311.04 tonnes, to cover active area.

Figure 2.2 below, graphs the trends of the waste types accepted into the landfill over the last six monitoring years.



2.3 Calculated Remaining Capacity of the Site

The site was originally designed with a capacity for 400,000 tonnes of waste. Based on the waste acceptance records, approximately 420,603.25 tonnes of waste has been landfilled in Phase 1 and Phase 2. This is greater than the designed capacity of 400,000 tonnes for Phase 1 and Phase 2. Prior approval was given for a further 10% increase in height from the EPA for phase II. The volume of waste is also greater than the designed capacity because of using greater compaction on the waste.

The extension to the landfill was granted on 12th November 2004 and this allowed for a further 300,000 tonnes of waste, at a maximum filling rate of 60,000 tonnes per year. However, planning permission was only received for the construction of three new cells with a capacity of 180,000 tonnes of waste. 22,584.16 tonnes of waste was placed in phase 3 during 2010, therefore 169,370.35 tonnes of waste was placed in Cells 9, 8 & 7 of Phase 3 between 2007 and 2010.
In total, 589,973.60 tonnes of waste has been placed in Ballydonagh landfill from 1991 to 2010 inclusive.

2.3.1 Area Occupied By Waste

Approximately 64,000 m^2 of the landfill has been filled with waste. This consists of Cells 1 & 2 (14,000 m^2), Cells 3 & 4 (10,000 m^2), Cells 5 & 6 (10,000 m^2) and cells 7, 8 & 9 (30,000 m^2).

2.3.2 Waste Deposition

Waste was brought to the active tipping face by refuse transport vehicles. The vehicles reversed to the tipping face and tipped the loads out. The waste was spread out and compacted into the active tip face by a Bomag Compactor. This usually takes 3 to 4 passes to fully compact the waste into the active fill face.

Only one working face was operated at any time. The working face was maintained at less than 25 metres wide and 2.5 metres in height after compaction with a slope of no greater than 1.3. Cover material was placed over the working face at the end of each working day.

2.4 Local Environmental Conditions

2.4.1 Meteorological Report

A meteorological report for the period 1st January 2010 to 31st December 2010 from the meteorological station at Mullingar is included in Appendix 1. The report includes daily rainfall, air temperature, wind (speed and direction), relative humidity, barometric pressure, monthly evaporation and potential evapotranspiration totals.

3. EMISSION MONITORING

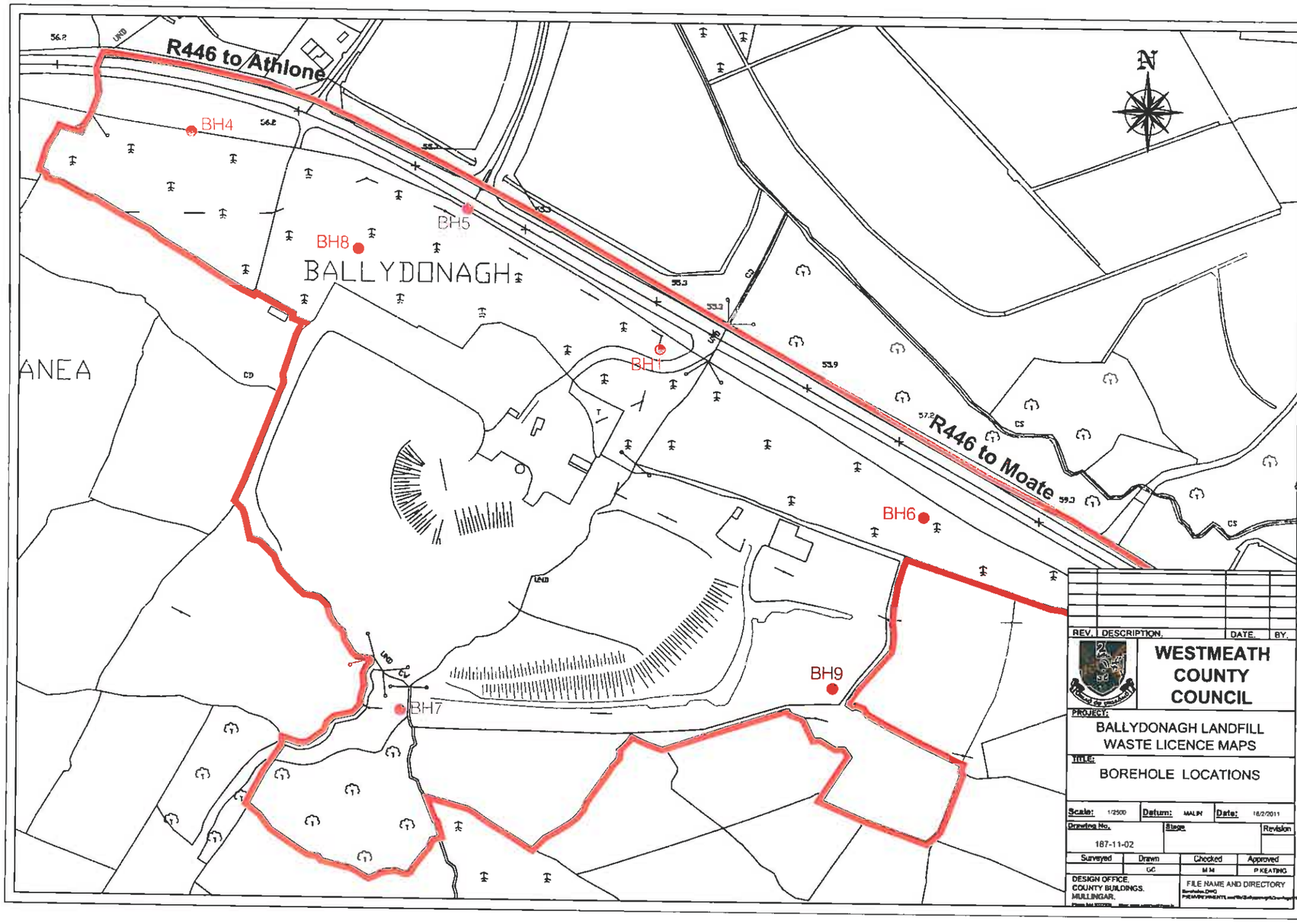
The Council carries out a comprehensive environmental monitoring programme in compliance with licence conditions to assess the significance of emissions. The monitoring programme includes odour, surface water, groundwater, landfill gas, leachate level and quality, noise and dust.

Each element of the monitoring programme requires a range of different techniques and sampling and testing frequencies. The results of all monitoring carried out in the reporting period have already been submitted to the EPA. This report discusses the findings of all the monitoring events completed during the year 2010.

An overview of the monitoring results for the reporting period, and comparisons with previous monitoring results, are presented in this Section. The results are discussed in the context of the impact of the emissions on the environment and compared with available data on background and or ambient conditions.

3.1 Groundwater Monitoring

The Council monitor groundwater quality in 7 monitoring boreholes (BH1, BH3, BH4, BH5, BH6, BH7, BH8 and BH9) located around the landfill.
Boreholes BH1, BH3, BH4, BH5 and BH6 were installed before 1998. Boreholes BH7 and BH8 were installed in June 1999. BH3 was removed during construction works in 2006 for the extension of the landfill. BH9 was installed in November 2007.
Borehole locations are shown in attached drawing No. 187-11-02 namely Borehole locations. Grid references for borehole locations are contained in Table 3.1.


R446 to Athlone
R446 to Moate
BH4
BH5
BH6
BH7
BH8
BH9
BH1
BALLYDONAGH
ANEA
N
REV. | DESCRIPTION. | DATE. | BY.
WESTMEATH COUNTY COUNCIL
PROJECT:
BALLYDONAGH LANDFILL WASTE LICENCE MAPS
TITLE:
BOREHOLE LOCATIONS
Scale: 1/2500
Datum: MALIN
Date: 16/2/2011
Drawing No.
187-11-02
Stage
Revision
Surveyed
Drawn
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Approved
P KEATING
DESIGN OFFICE.
COUNTY BUILDINGS.
MULLINGAR.
FILE NAME AND DIRECTORY

Table 3.1 Ground water Monitoring Locations

Station	Easting	Northing
BH1	209525	238745
BH4	209116	238891
BH5	209373	238825
BH6	209864	238607
BH7	209288	238435
BH8	209122	238893
BH9	209641	238472

The boreholes are positioned up and down hydraulic gradient of the landfill cells. Monitoring boreholes BH3, BH7 and BH9 are upgradient of the landfill cells and monitor background groundwater quality. Boreholes BH1, BH5 and BH8 are down gradient of the landfill cells. Boreholes BH4 and BH-6 are located downgradient, to the west and east of the landfill cells respectively.

3.1.1 Groundwater Quality

Groundwater quality is monitored in the 7 on-site boreholes and the 8 off-site domestic wells on a monthly and quarterly basis in accordance with Waste Licence conditions and includes in-situ and laboratory testing. The range of analysis is as specified in Schedule D5 of the Waste Licence and includes pH, electrical conductivity, and organic, inorganic and microbiological parameters. The sampling and analysis is carried out in accordance with recognised quality assurance and control procedure.

Full details of all the monitoring results are included in the quarterly monitoring reports, prepared by RPS Ltd. along with Westmeath County Council, Environment Section. The discussion on water quality presented in this AER is based on the monitoring reports. Tables 3.3 and 3.4 summarise the results of the more significant quality indicator parameters.

Total coliforms were detected throughout the year in borehole 1 (BH-1) with the exception of June & October when none were detected. The highest number of total coliforms detected was 15 cfu/100ml in November. Faecal coliforms were present in two months throughout the year in July and August. Ammonia concentration increased during July 2011 to 0.65mg/l N.

Borehole 3 (BH-3) was removed during the construction of phase III, the extension of the landfill in 2006.

For Borehole 4 (BH-4), total coliforms exceeded 100cfu/ml during April and values of between 1cfu/100ml and 23cfu/100ml were recorded for the remainder of the year excluding January, February, October and November when results were 0. Ammonia levels were below detectable levels of <0.04mg/l N throughout the year except in January when 0.1mg/l N was recorded.

Ammonia levels in Borehole 5 (BH-5) were high throughout the entire year, with ranges of between 1.34mg/l and 4.99mg/l. Total coliforms were present at >100cfu/100ml in July and September and were present from June onwards with a range of 1cfu/100ml to 4cfu/100ml. Levels of chloride during 2010 were well below the drinking water limit of 250 mg/L Cl as per SI No. 278 of 2007.

For Borehole 6 (BH-6) total coliforms were present throughout the whole year excluding July, November and December. Faecal Coliforms were only present in January, March, June and August. Ammonia levels were below the drinking water limit throughout the year.

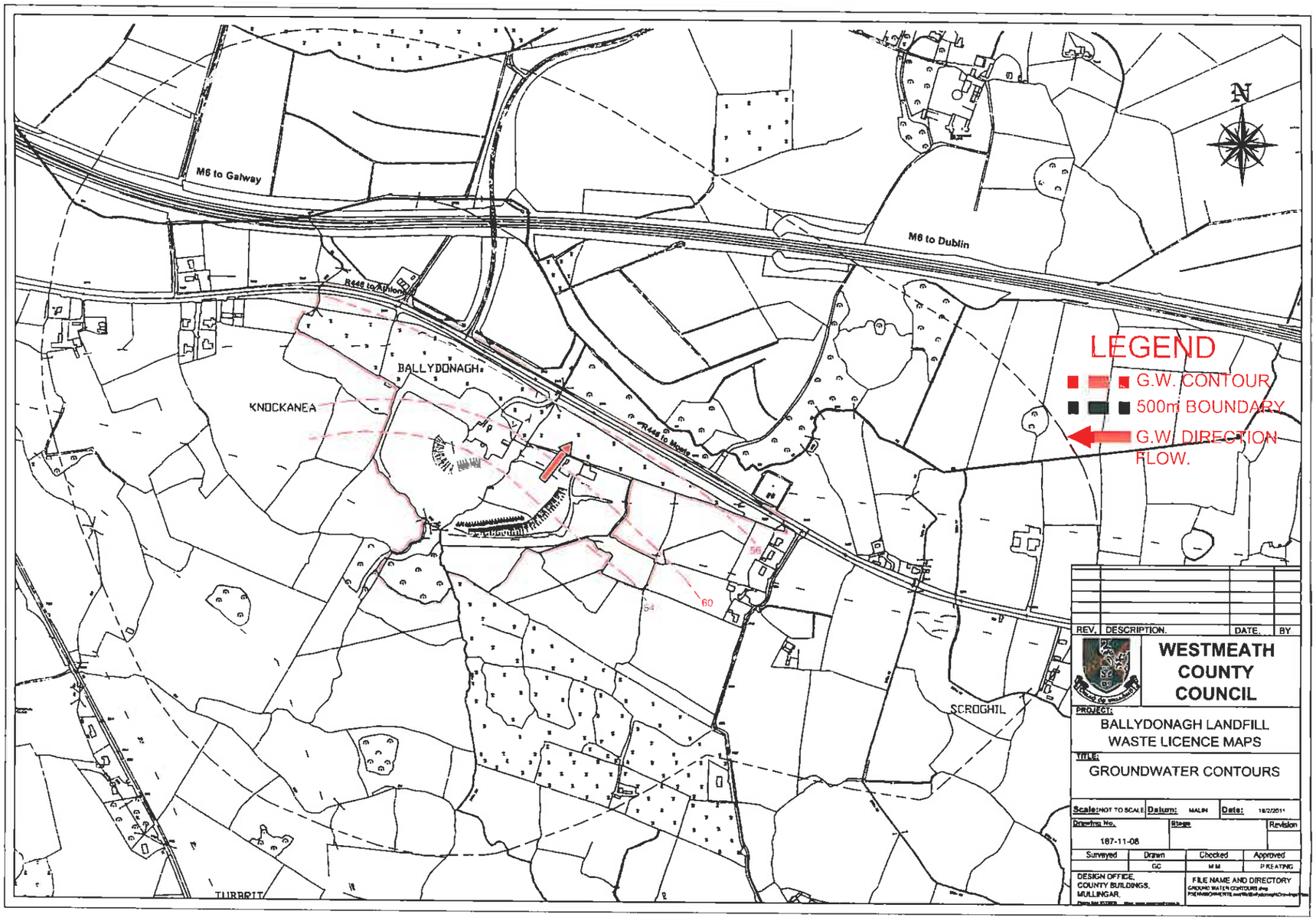
Borehole 7 (BH-7) is located up-gradient of the landfill active cells. It is located in the field at the back of the landfill in agricultural land. This well showed Total Coliforms during each monitoring event in 2010 except March, when none was detected. Faecal Coliforms were present in July and August. Ammonia levels remained below 0.09mg/ l and Chloride remained stable at 18 – 27mg/l through out the year.

Borehole 8 (BH-8) exceeds the recommended drinking water limit value of 0.30 mg/l Ammonium (set out in SI No. 278 of 2007) during January & February, both samples measuring 0.33mg/l. Total coliforms are present in between the values 1 - 48 cfu/100ml throughout 2010 except during the first three months of the year and June, November and December. Chloride levels were between 18mg/l and 27mg/l throughout the year.

Borehole 9 (BH-9) was installed to the east of the landfill at the perimeter fence, east of Phase III in November 2007. Total coliforms were present at >100cfu/100ml during July and were below 2cfu/100ml during April, September, October and November. Chloride and Ammonia were well below the drinking water standard for all monitoring occasions.

The monitoring confirmed that background quality upgradient of the landfill cells (BH-7 & BH9) remained generally good throughout the monitoring period. No elevated levels as compared with SI No. 278 of 2007 for ammonia, chloride and conductivity. However the presence of Faecal and total coliforms were detected in BH7 and in BH9.

Boreholes BH-1, BH-4, BH-5, BH-6 and BH-8, which are located down gradient of the landfill cells, all parameters remain relatively as previous. Ammonia levels BH1 & BH8 increased slightly on 2009 concentrations, but were marginally over the drinking water standard on three occasions in BH1 and on two occasions in BH8. We are continuing to closely monitor all analysis results to ensure that the landfill site and associated activities have no impact on the surrounding groundwater.


M6 to Galway
M6 to Dublin
R446 to Athlone
R446 to Mosta
BALLYDONAGH
KNOCKANEA
SCROGHIL
TURRPIT
N
LEGEND
G.W. CONTOUR
500m BOUNDARY
G.W. DIRECTION FLOW.
REV. DESCRIPTION. DATE. BY
WESTMEATH COUNTY COUNCIL
PROJECT:
BALLYDONAGH LANDFILL WASTE LICENCE MAPS
TITLE:
GROUNDWATER CONTOURS
Scale: NOT TO SCALE
Datum: MALIN
Date: 18/2/2011
Drawing No.
187-11-08
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Revision
Surveyed
Drawn
GC
Checked
MM
Approved
P KEATING
DESIGN OFFICE, COUNTY BUILDINGS, MULLINGAR.
FILE NAME AND DIRECTORY
GROUND WATER CONTOURS.dwg

Table 3.3 Summary of Groundwater Monitoring Results 2010

Sampling Location	Monitoring Period	Parameter					
		Conductivity mScm-1	TOC mg/L C	Ammonical Nitrogen as N (mg/L)	Chloride (mg/l)	Faecal Coliform (cfu/100mls)	Total Coliforms (cfu/100ml)
BH1	January	627	1.94	0.32		0	3
	February	72	2.27	0.23	37	0	7
	March	669	2.82	0.28		0	1
	April	524	2.66	0.27		0	3.1
	May	507	0.68	0.14	26	0	6
	June	581	0.9	0.22		0	0
	July	701	3.4	0.65		1	9
	August	593	1.1	0.25		4	14
	September	612	<0.7	0.33	40.1	0	3
	October	576	<0.7	0.21		0	0
	November	610	<0.7	0.25		0	15
	December	550	<0.7	0.25	27.6	0	2
BH4	January	503	1.32	0.1		0	0
	February	584	2.13	<0.05	22	0	0
	March	569	2.53	<0.04		0	8
	April	486	2.59	<0.04		0	579.4
	May	435	1.22	<0.04	19	0	5
	June	566	1.6	<0.04		2	23
	July	544	1.7	<0.04		1	1
	August	559	1.5	<0.04		20	20
	September	569	<0.7	<0.04	29.1	0	2
	October	575	<0.7	<0.04		0	0
	November	579	<0.7	<0.04		0	0
	December	550	<0.7	<0.04	20.9	0	3
BH5	January	738	3.1	2.48		0	0
	February	301	3.89	2.66	35	0	0
	March	801	4.34	2.3		0	0
	April	684	5	1.34		0	<1
	May	683	4.3	2.68	41	0	0
	June	931	3.3	3.15		1	1
	July	833	4	3.57		0	>100
	August	955	7.6	3.79		0	1
	September	827	1.72	2.88	39.9	0	>100
	October	931	3.42	4.99		0	4
	November	753	1.43	1.58		0	1
	December	794	1.95	3.29	36.5	0	4

Table 3.3 Summary of Groundwater Monitoring Results 2010

Sampling Location	Monitoring Period	Parameter					
		Conductivity mScm-1	TOC mg/L C	Ammonical Nitrogen as N (mg/L)	Chloride (mg/l)	Faecal Coliform (cfu/100mls)	Total Coliforms (cfu/100ml)
BH6	January	645	2.26	0.3		6	10
	February	738	1.81	<0.05	19	0	3
	March	639	2.24	<0.04		1	1
	April	565	2.67	<0.04		0	12
	May	507	0.84	<0.04	16	0	5
	June	631	1.3	<0.04		7	11
	July	616	2.4	<0.04		0	0
	August	648	4.1	<0.04		80	80
	September	660	<0.7	<0.04	25.6	0	3
	October	676	1.11	<0.04		0	2
	November	694	<0.7	<0.04		0	0
	December	634	<0.7	<0.04	18.7	0	0
BH7	January	572	1.5	<0.05		0	>50
	February	490	1.53	<0.05	21	0	18
	March	528	2.1	<0.04		0	0
	April	488	2.68	<0.04		0	47.1
	May	466	0.79	<0.04	18	0	0
	June	539	1.3	0.09		0	55
	July	528	1.8	<0.04		54	54
	August	549	1.2	<0.04		3	>100
	September	537	<0.7	<0.04	26.7	0	75
	October	526	<0.7	0.07		0	>80
	November	536	<0.7	<0.04		0	15
	December	506	<0.7	<0.04	20.3	0	10
BH8	January	546	1.77	0.33		0	0
	February	469	1.86	0.33	20	0	0
	March	503	1.26	0.28		0	0
	April	485	1.94	0.25		0	<1
	May	473	0.96	<0.04	18	0	1
	June	506	0.9	0.25		0	0
	July	510	2	0.28		0	9
	August	515	1	0.29		5	48
	September	531	<0.7	0.25	27.7	11	24
	October	500	<0.7	0.26		8	21
	November	559	<0.7	0.16		0	0
	December	493	<0.7	0.23	20	0	0

Table 3.3 Summary of Groundwater Monitoring Results 2010

Sampling	Monitoring	Parameter					
Location	Period	Conductivity mScm-1	TOC mg/L C	Ammonical Nitrogen as N (mg/L)	Chloride (mg/l)	Faecal Coliform (cfu/100mls)	Total Coliforms (cfu/100ml)
BH9	January	626	2.99	<0.05		0	0
	February	971	4044	<0.05	13	0	0
	March	852	3.92	<0.04		0	0
	April	703	4.85	<0.04		0	1
	May	591	2.65	<0.04	11	0	0
	June	910	3.5	<0.04		0	0
	July	807	3.3	<0.04		0	>100
	August	922	2.6	<0.04		0	0
	September	893	0.86	<0.04	19.6	0	2
	October	876	1.11	<0.04		0	1
	November	955	0.91	<0.04		0	1
	December	873	1.07	<0.04	18.8	0	0

Table 3.4: Private Well Monitoring Results 2010

Sampling Location	Monitoring Period	Parameter					
		Conductivity mScm-1	TOC mg/L C	Ammonical Nitrogen as N (mg/L)	Chloride (mg/l)	Faecal Coliform (cfu/100mls)	Total Coliforms (cfu/100ml)
PW1	January	587	2.15	<0.05		0	2
	February	166	1.74	<0.05	22	0	55
	March	555	2.39	<0.04		0	6
	April	500	2.45	<0.04		0	12.2
	May	458	1.41	<0.04	20	0	20
	June	585	1.3	<0.04		2	16
	July	573	2.4	<0.04		11	27
	August	594	1.2	<0.04		0	23
	September	573	<0.7	<0.04	27.3	0	0
	October	536	<0.7	<0.04		0	0
	November	557	<0.7	<0.04		0	2
	December	518	<0.7	<0.04	20.9	1	12
PW3	January	ns	ns	ns	ns	ns	ns
	February	71	4.77	<0.05	20	1	27
	March	745	3.36	<0.04		1	2
	April	666	4.75	<0.04		0	435
	May	604	2.91	<0.04	26	0	6
	June	813	2.8	<0.04		0	1
	July	738	6.5	<0.04		>100	>100
	August	859	3	<0.04		1	86
	September	731	0.96	<0.04	30.6	50	76
	October	709	2.12	<0.04		60	60
	November	720	1.49	<0.04		0	8
	December	677	1.99	<0.04	19.3	5	39
PW5	January	871	5.12	<0.05		0	3
	February	93	5.65	<0.05	28	0	0
	March	873	6.45	<0.04		0	1
	April	758	6.45	<0.04		0	12
	May	651	5.31	<0.04	26	0	0
	June	932	4.9	<0.04		0	0
	July	ns	ns	ns	ns	ns	ns
	August	936	9.8	<0.04		0	0
	September	924	2.76	<0.04	30.9	0	8
	October	860	2.85	<0.04		0	22
	November	890	3.04	<0.04		0	32
	December	ns	ns	ns	ns	ns	ns

Table 3.4: Private Well Monitoring Results 2010

Sampling Location	Monitoring Period	Parameter					
		Conductivity mScm-1	TOC mg/L C	Ammonical Nitrogen as N (mg/L)	Chloride (mg/l)	Faecal Coliform (cfu/100mls)	Total Coliforms (cfu/100ml)
PW6	January	573	2.08	<0.05		0	0
	February	69	2.13	<0.05	13	0	0
	March	549	3.26	<0.04		0	0
	April	503	3.05	<0.04		0	8
	May	447	1.96	<0.04	16	0	3
	June	613	1.5	<0.04		0	26
	July	574	3.7	<0.04		0	4
	August	579	1.8	<0.04		0	3
	September	585	<0.7	<0.04	14.2	1	16
	October	529	1.05	<0.04		0	68
	November	559	0.93	<0.04		0	13
	December	520	0.71	<0.04	11.9	0	0
PW7	January	609	3.08	<0.05		0	0
	February	130	2.84	<0.05	15	0	0
	March	611	3.03	<0.04		0	1
	April	519	3.87	<0.04		0	20
	May	483	2.27	<0.04	15	0	1
	June	601	2.1	<0.04		0	12
	July	583	3.2	<0.04		2	13
	August	617	1.9	<0.04		0	0
	September	588	<0.7	<0.04	16.6	0	1
	October	497	1.41	<0.04		1	7
	November	560	<0.7	<0.04		0	2
	December	551	0.92	<0.04	12.9	0	0
PW8	January	852	6.23	0.1		1	>100
	February	ns	ns	ns	ns	ns	ns
	March	778	5.17	<0.04		0	0
	April	ns	ns	ns	ns	ns	ns
	May	ns	ns	ns	ns	ns	ns
	June	ns	ns	ns	ns	ns	ns
	July	ns	ns	ns	ns	ns	ns
	August	ns	ns	ns	ns	ns	ns
	September	ns	ns	ns	ns	ns	ns
	October	ns	ns	ns	ns	ns	ns
	November	ns	ns	ns	ns	ns	ns
	December	ns	ns	ns	ns	ns	ns

Table 3.4: Private Well Monitoring Results 2010

Sampling	Monitoring	Parameter					
Location	Period	Conductivity mScm-1	TOC mg/L C	Ammonical Nitrogen as N (mg/L)	Chloride (mg/l)	Faecal Coliform (cfu/100mls)	2
PW9	January	675	6.58	<0.05		1	7
	February	312	6.86	<0.05	39	0	1
	March	771	5.85	<0.04		0	70
	April	648	9.06	<0.04		1	238
	May	624	4.09	<0.04	46	9	15
	June	772	5.7	0.05		1	1
	July	681	8.3	0.13		0	30
	August	805	5.4	0.07		0	>100
	September	715	5.25	<0.04	36.1	6	>100
	October	729	4.22	<0.04		2	34
	November	694	5.24	<0.04		0	23
	December	683	4.1	<0.04	33	0	8
PW11	January	684	2.76	0.1		0	0
	February	ns	ns	ns	ns	ns	ns
	March	655	3.16	0.05		0	0
	April	556	6.83	0.07		0	<1
	May	538	1.53	<0.04	28	0	0
	June	720	1.6	<0.04		0	0
	July	679	3.3	<0.04		0	4
	August	735	1.9	<0.04		0	0
	September	686	<0.7	<0.04	23.1	>100	>100
	October	673	0.96	<0.04		0	0
	November	629	<0.7	0.08		0	0
	December	616	0.8	0.06	13.4	0	0

The Council monitor groundwater quality in 8 wells (1, 3, 5, 6, 7, 8, 9 and 11) used for domestic water supply in residences located within 500 m of the landfill. PW4 is no longer monitored as the occupant of the house died during 2004. Well 1 is located down hydraulic gradient of the landfill cells. The remaining wells are to the north east of the landfill and not directly down gradient of the fill area.

The monitoring of the private wells established that only PW11 complied with the EU drinking water directive standards on all sampling events during the reporting period except for Total Coliforms detected during July and September 2010.

Total Coliforms were detected in all other wells during 2010, and faecal coliforms were detected in every well except PW5.
Ammonia concentrations in all private wells were below the EU drinking water limit of 0.30mg/l for ammonia over the year.
No elevated levels above the parametric limits for conductivity, TOC or Chloride were detected during any monitoring event in 2010 in any of the domestic wells.

Prior notice was given for each monitoring occasion by letter to the occupants of the house.

It is considered that the landfill is not the source of the elevated levels of contaminants measured in the domestic wells because: -

- The location of the wells with respect to both the general groundwater flow and the location of the landfill,

- An assessment of the chemical results obtained for both the potentiometrically upgradient and downgradient monitoring boreholes at the landfill.

3.1.2 Estimated Annual and Cumulative Quantity of Emissions to Groundwater

With the exception of the septic tank percolation area there are no direct emissions to groundwater at the facility. Indirect emissions to groundwater may potentially occur as a result of leaks from the landfill liner, leachate collection system or from contaminated surface water.

The landfill cell design comprises a double HDPE liner incorporating a leakage detection system. The council have installed an upgraded monitoring system on the leachate detection system to monitor for leaks. The top liner is overlain by a leachate drainage blanket and pipe work that collects and drains the leachate to the leachate storage tank from where it is removed off-site. There is an automated alarm leachate detection system installed in the site office so collection and storage of leachate levels are available at all times. All 4 manholes in phase 2 have been lined with HDPE liner applied to the shaft of the manholes to eliminate any possible leak from the manholes should they surcharge in times of heavy rainfall alarm sensors will notify the caretaker if such a surcharge happens and steps can be taken to lower the leachate levels by tankering away leachate from the site.

The groundwater monitoring boreholes installed around the site monitor groundwater quality to determine if the lining system is operating satisfactorily.

Surface water is a potential source of groundwater recharge and as such provides a possible pathway for indirect discharge to groundwater. All rainfall on the active fill areas is contained within the landfill cells. This prevents contaminated surface water runoff from entering the surface water drains and eliminates this indirect discharge pathway.

3.2 Surface Water Quality Monitoring

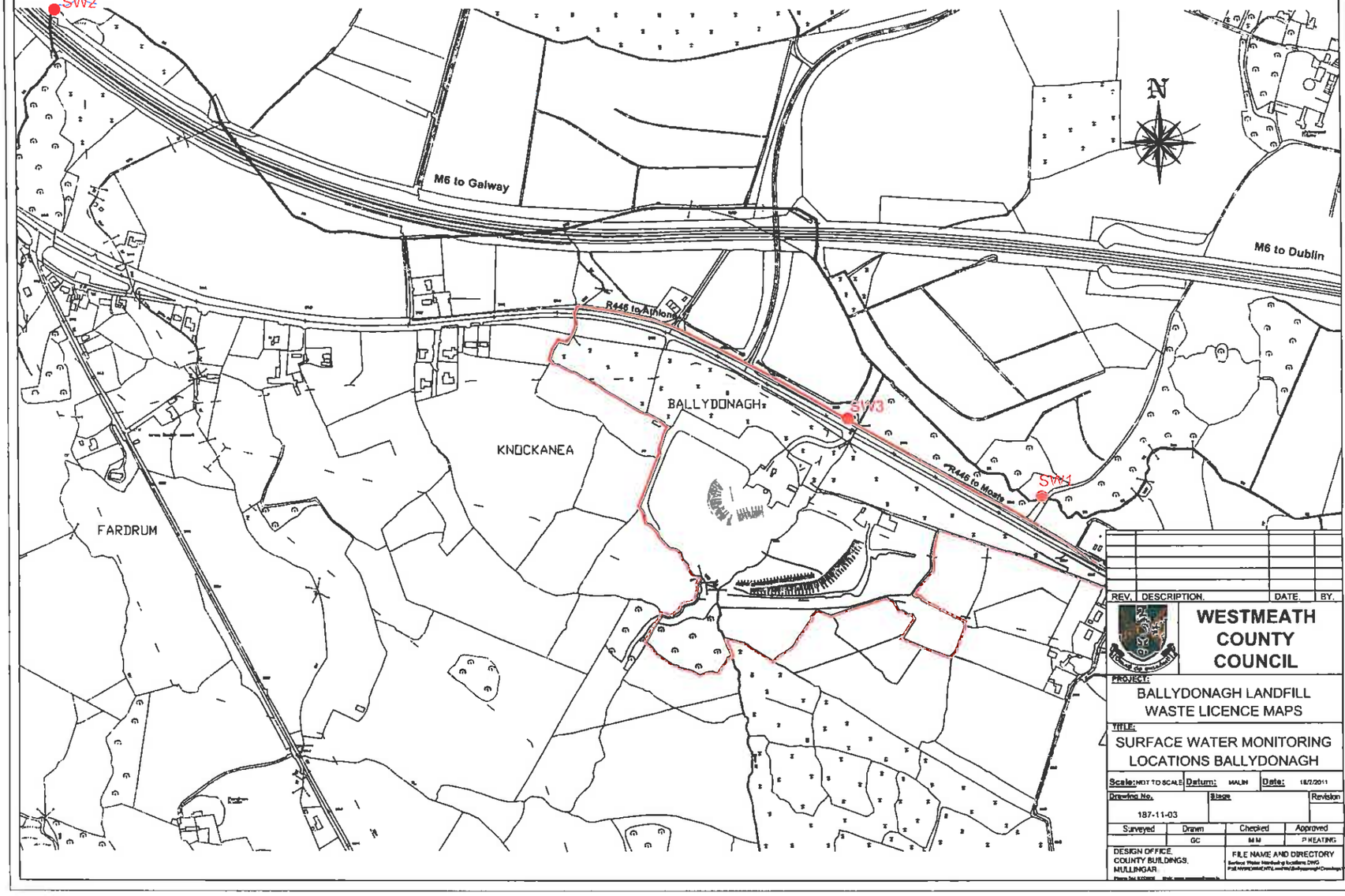
The Council monitors surface water quality in 3 locations (SW1, SW2 and SW3) shown on drawing No. 187-11-03 - Surface Water Monitoring Locations Ballydonagh and described in Table 3.5. SW1 is upstream of the site, SW2 is downstream of the site, the stream to the north of the (N6) Dublin to Galway road, and SW3 is located on a drainage channel close to the entrance of the landfill. This drainage channel enters the stream downstream of SW1. Due to major road works in the vicinity of Ballydonagh landfill site, sampling location SW2 is monitored further downstream from approx. mid 2007. This sample is taken after the confluence of a new diverted channel and the original stream bed for SW2.

Table 3.5 Surface Water Monitoring Locations

Station	Easting	Northing
SW1	209860	238373
SW2	208151	239501
SW3	209551	238765

Weekly visual surface water inspections are carried out by Westmeath County Council. Quarterly and annual monitoring is carried out by our consultants in accordance with Licence conditions and includes in-situ and laboratory testing. The range of analysis is as specified in Schedule D5 of the Waste Licence and includes dissolved oxygen, pH, electrical conductivity, and organic and inorganic parameters.

The sampling and analysis is carried out in accordance with recognised quality assurance and control procedures. The detailed monitoring results are presented in the quarterly monitoring reports submitted to the Agency in the reporting period.



REV.	DESCRIPTION.	DATE.	BY.

WESTMEATH COUNTY COUNCIL

PROJECT:
BALLYDONAGH LANDFILL
WASTE LICENCE MAPS

TITLE:
SURFACE WATER MONITORING
LOCATIONS BALLYDONAGH

Scale: NOT TO SCALE	Datum: MALIN	Date: 18/2/2011	
Drawing No. 187-11-03	Stage		Revision
Surveyed	Drawn GC	Checked MM	Approved PHEATING

DESIGN OFFICE.
COUNTY BUILDINGS.
MULLINGAR

FILE NAME AND DIRECTORY

The monitoring reports prepared by RPS Ltd., contain an evaluation of the results, which is summarised below. Table 3.6 summarises some of the significant quality indicator parameters recorded during the reporting period.

Results for SW1, located upstream of the landfill and SW2, located downstream of the landfill, during the monitoring period, remained broadly the same since the previous monitoring results.

SW1, located upstream meets the Surface Water Regulations for category A1 water quality. It is the highest category of raw water for all parameters tested throughout 2010. It also complies with the limits for high status based on SI 272 of 2009.

SW-2 located downstream of the landfill also meets the Surface Water Regulations for category A1 water quality which is the highest category of raw water for all parameters tested throughout 2010.

SW-3 was sampled three times during 2010. The stream was dry in the second quarter 2010. The volume of water in the drain, SW-3, is weather dependent and at times the drain is not discharging water. Results for conductivity, suspended solids and chloride spiked during the last quarter sampled on 16th December 2010.
The extreme cold weather spell began 28th November 2010 and salting of the N6 and Ballydonagh yard was ongoing for the latter period of November and December 2010. The run off from both the N6 and Ballydonagh yard flows into SW3. Extra salting was required during this time, because of the extreme weather conditions. The run off from the roads at this time, would have contributed to the high concentrations in SW3.

Consistent with previous monitoring events, the general quality of the surface water both upstream and downstream is considered good. SW2, located downstream of SW1 and of the landfill, showed very similar conditions to those upstream.

Table 3.6: Summary of Surface Water Monitoring Results 2010

Sampling Location	Monitoring Period	Parameter					
		Conductivity (μScm^{-1})	Suspended Solids mg/L	Chloride (mg/l)	Ammoniacal Nitrogen as N (mg/L)	BOD (mg/l)	COD (mg/l)
SW-1	1st Quarter 2010	683	12	27	<0.05	<1	<20
	2nd Quarter 2010	656	36	26.8	<0.04	1	<11
	3rd Quarter 2010	696	29	29.4	<0.04	<1	<11
	4th Quarter 2010	659	11	25.2	<0.04	<1	<11
SW-2	1st Quarter 2010	671	10	30	0.11	<1	35
	2nd Quarter 2010	660	35	31.3	0.04	<1	47
	3rd Quarter 2010	ns	ns	ns	ns	ns	ns
	4th Quarter 2010	628	6	29.5	0.07	<1	32
SW-3	1st Quarter 2010	1360	53	254	0.23	>24	43
	2nd Quarter 2010	ns*	ns*	ns*	ns*	ns*	ns*
	3rd Quarter 2010	908	8	144	<0.04	<1	36
	4th Quarter 2010	4300	722	1520	0.24	<1	181
SW-4	1st Quarter 2010	1040	40	98	8.54	130	342

3.3 Leachate

Leachate is generated by incident rainfall in the active and completed landfill cells. Other potential sources of leachate such as groundwater and surface water run-off are prevented from entering the waste fill areas through a combination of the landfill lining system and site engineering works.

Leachate from phase 1 and 11 is collected in the leachate collection system installed in each landfill cell and directed to the leachate-holding tank located in the northern area of the landfill. The location of the storage tank is shown in drawing No. 187-11-04 "Leachate Monitoring Locations Ballydonagh".
A new storage tank for leachate has been built for Phase 3, tank No 2 on drawing No. 187-11-04.

Leachate is removed from the tanks on a routine basis and transported to either Athlone or Mullingar wastewater treatment plants for treatment in accordance with Licence Condition 5.12 and 6.6. Table 3.8 below shows the grid references of the leachate monitoring locations.

Table 3.8 Location of Leachate Monitoring Locations

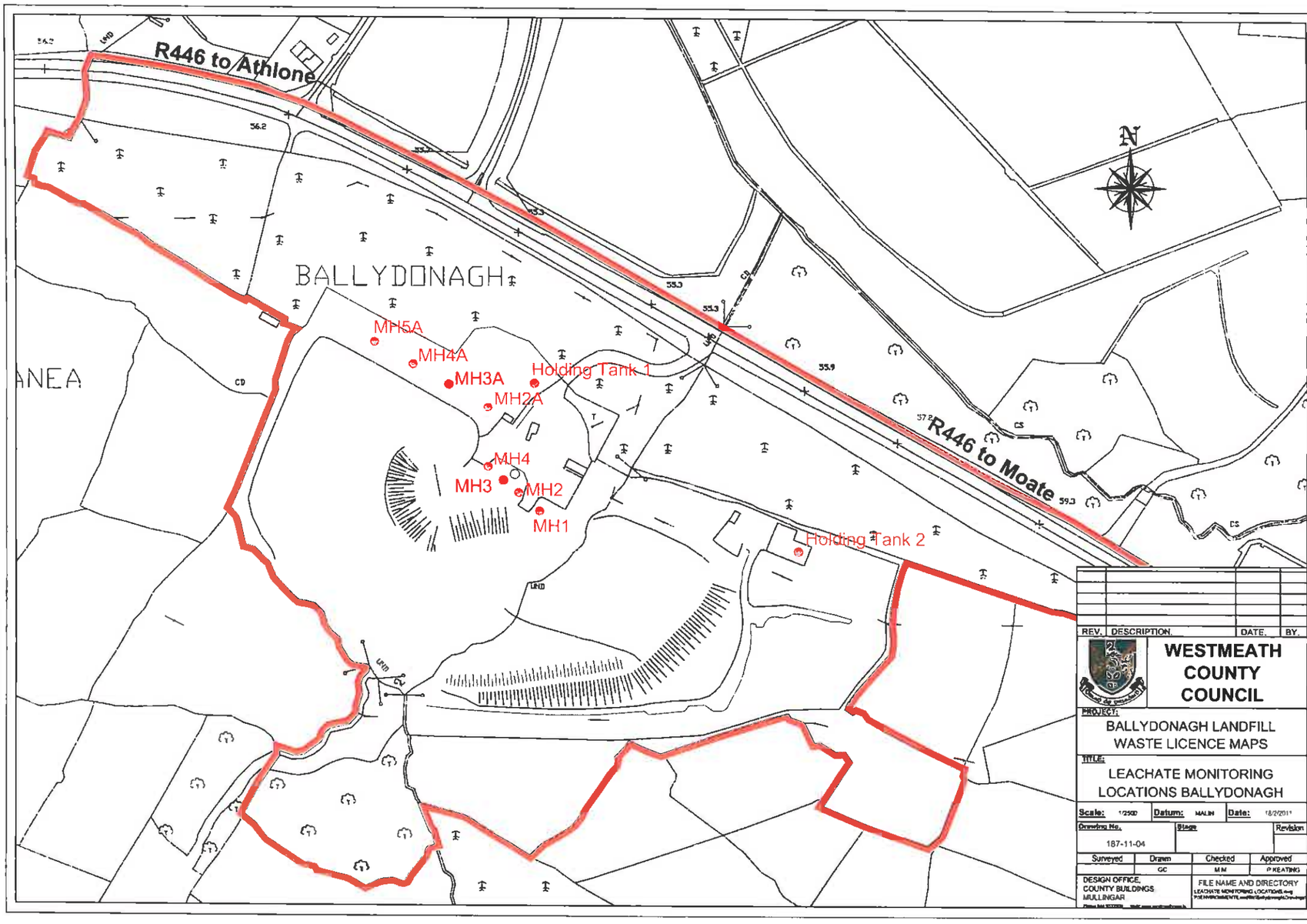
Leachate Inspection Manhole	Easting	Northing
MH3	209403	238625
MH4	209391	238623
MH2A	209381	238682
MH3A	209348	238691
Leachate holding Tank 1	209408	238715
Leachate holding Tank 2	209614	238583

The Council monitors leachate levels at weekly intervals and leachate quality at quarterly and annual intervals.

3.3.1 Leachate Levels

Leachate levels are measured in four inspection chambers (MH2A, MH3A, MH3 and MH4) located on the leachate collection pipe-work running from Phases 1 and 2.

The leachate level is monitored in Phase 3 of the landfill at three leachate monitoring points, cell 9, cell 8 & cell 7 through the telemetry system. The three new cells of Phase 3 each contain one leachate sump and one leachate monitoring well. The leachate level varies in the inspection chambers and in the landfill depending on the rate of removal from the holding tanks.


R446 to Athlone
R446 to Moate
BALLYDONAGH
MH5A
MH4A
MH3A
MH2A
Holding Tank 1
MH4
MH3
MH2
MH1
Holding Tank 2
N
REV.
DESCRIPTION
DATE.
BY.
WESTMEATH COUNTY COUNCIL
PROJECT:
BALLYDONAGH LANDFILL WASTE LICENCE MAPS
TITLE:
LEACHATE MONITORING LOCATIONS BALLYDONAGH
Scale: 1:2500
Datum: MALIN
Date: 18/2/2011
Drawing No.
187-11-04
Stage
Revision
Surveyed
Drawn
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Checked
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Approved
P KEATING
DESIGN OFFICE
COUNTY BUILDINGS
MULLINGAR
FILE NAME AND DIRECTORY
LEACHATE MONITORING LOCATIONS.dwg

3.3.2 Leachate Volumes

Water balance calculations have been prepared for 2010. The calculations include a cumulative total for the twelve-month period.

The water balance addressed the volume of leachate generated at the site on a monthly basis including the estimated annual infiltration of rainfall through the capping layer. The water balance methodology is described below and the calculations shown on Table 3.10.

The water balance calculations are based on the methodology specified in the EPA's Landfill Site Design Manual. The calculation used is as follows: -

$Lo = [ER(A) + LW + IRCA + ER(l)] - [aw]$

Lo = leachate produced (m^3)
ER = effective rainfall (m) (Use actual rainfall (R) for active cells)
A = area of cell (m^2)
LW = liquid waste (also includes excess water from sludges) (m^3)
IRCA = infiltration through restored and capped areas (m)
l = surface area of lagoon (m^2)
a = absorptive capacity of waste (m^3/t)
W = weight of waste deposited (t/a)

The data used was from the meteorological station at Mullingar. The landfill areas included in the calculations were the active fill areas of Cells 8 and 7, the temporary capped area of cell 8 and the final capped area's of cell 9 in phase 3 and Phase 1 and Phase 2.
Meteorological data is presented in Appendix 1.

Actual (Total) rainfall rates were used for the active fill area, in cells 8 and 7. Conservative estimates of 25% of the annual rainfall figure was used to calculate the infiltration through the temporary capped area's of cells 7 & 8. This is in accordance with the EPA Landfill Site Design Manual.

An absorptive capacity of 0.06 m^3 per tonne was assumed based on a compacted waste density of 0.85 tonnes/m^3.

Liquid wastes and sludges with less than 20% solids are not accepted in the landfill.

The landfill accepts any industrial sludge with solids content of 55% or greater.

Table 3.10: Annual Leachate Volume Calculations 2010

Month	[1]Active Fill Area	Total Area of Active Fill (m^2)	Actual Rainfall (m) ER	[3]Infiltration through Active Areas (m^3) A	Restored Area	Restored Area (m^2) A	[2]Infiltration Through Restored Area (m^3) IRCA	Weight of Waste Deposited (Tonnes) W	Absorbtive Capacity of the Waste (m^3/t) a	Volume of Water Absorbed (m^3)	[3]Liquid Waste (m^3) LW	Leachate Produced (m^3) Lo
January	Cell 7	13,000	0.045	585	Cell 8	6,000	67.50	1860	0.06	111.62	0	540.88
February	Cell 7	13,000	0.0419	544.7	Cell 8	6,000	62.85	1902	0.06	114.11	0	493.45
March	Cell 7	13,000	0.0820	1066	none	0	0.00	2820	0.06	169.19	0	896.81
April	Cell 7	13,000	0.0538	699.4	none	0	0.00	3556	0.06	213.37	0	486.03
May	Cell 7	13,000	0.0395	513.5	none	0	0.00	3802	0.06	228.12	0	285.38
June	Cell 7	13,000	0.0505	656.5	none	0	0.00	4783	0.06	286.98	0	369.52
July	Cell 7	7,000	0.1500	1050	Cell 7	6,000	225.00	3861	0.06	231.66	0	1043.34
August	Cell 7	7,000	0.0474	331.8	Cell 7	6,000	71.10	0	0.06	0.00	0	402.90
September	Cell 7	7,000	0.1645	1151.5	Cell 7	6,000	246.75	0	0.06	0.00	0	1398.25
October	none	0	0.0594	0	Cell 7	13,000	193.05	0	0.06	0.00	0	193.05
November	none	0	0.1252	0	Cell 7	13,000	406.90	0	0.06	0.00	0	406.90
December	none	0	0.0372	0	Cell 7	13,000	120.90	0	0.06	0.00	0	120.90
											Total	6637.40

Notes:

(1) The actual rainfall figures were used to calculate the infiltration through the active fill areas, a 25% infiltration rate was used for restored areas.
(2) Liquid waste is not accepted on-site.
(3) An absorbtive capacity of 0.06m3/t was used based on a waste density of 0.85t/m3.
(4) Cells 1, 2, 3, 4, 5, 6 & 9 were final capped during 2009. Cell 8 final cap was completed in February 1010.

The estimated volume of leachate generated for the period 1st January to 31st December 2010 is 6,637.40m^3. During the same period the Council removed 9,562.87m^3 of leachate from the site for treatment in the wastewater treatment plants. A monthly breakdown of the volumes removed is presented in Table 3.11.

Table 3.11 Leachate Volumes Removed from Site 2010

Month	Volume of Leachate Removed (m^3)
January	1,305.74
February	954.41
March	854.68
April	989.41
May	862.17
June	260.24
July	677.88
August	844.4
September	778.16
October	774.14
November	963.58
December	298.06
Total	**9,562.87**

There is a difference between the estimated volumes generated and the volumes removed. The leachate removed includes the rainwater run-off from Phase 1 and 2 which flows into the wheel wash and goes directly into the leachate holding tank.

Estimates of the cumulative volumes generated at the site since the start of landfilling in 1991 were prepared based on information provided in the Waste Licence application and the water balance calculations. These are presented in Table 3.12 below.

The weighbridge was not installed at the site until January 1999 and the waste figures used in the calculations for the previous years are estimates. Annual average actual rainfall figures are used. Before the issue of the Waste Licence the facility accepted industrial and municipal sewage sludges.

3.3.3 Leachate Quality

Leachate analysis is carried out quarterly from the eight inspection chambers (MH1, MH2, MH3, MH4, MH2A, MH3A, MH4A and MH5A) during the reporting period. Quarterly monitoring includes a visual inspection / odour and temperature check. Annual monitoring is carried out on two samples one from each of the two leachate holding chambers. Annual monitoring includes a range of monitoring parameters as indicated in Schedule D5 of Waste Licence.

The results of the leachate quality analysis for indicator parameters only, are presented in Table 3.13. The results in general are indicative of a landfill at various stages within its waste degradation lifecycle.

Table 3.12 - Cumulative Leachate Volume Calculations 2010

Year	Active Cell	Active Area (m^2)	Active area infiltration (m^3)	Waste inputs tonnes	Restored area (m^2)	Rest. area infiltration (m^3)	Total Water (m^3)	Cumulative water (m^3)	Absorptive Capacity input (m^3)	Cumulative Absorptive Capacity (m^3)	Cumulative Leachate (m^3)	Annual Leachate (m^3)
1991	1	7250	4771		0	0	4771	4771	0	0	4771	4771
1992	1	7250	4771	12000	0	0	4771	9541	720	720	8821	4051
1993	1	7250	4771	15000	0	0	4771	14312	900	1620	12692	3871
1994	1+2	14500	9541	15000	0	0	9541	23853	900	2520	21333	8641
1995	1+2	14500	9541	15500	0	0	9541	33394	930	3450	29944	8611
1996	1+2	14500	9541	17250	0	0	9541	42935	1035	4485	38450	8506
1997	1+2	14500	9541	19000	0	0	9541	52476	1140	5625	46851	8401
1998	3+5	10000	6580	15000	14500	66	6646	59121	900	6525	52596	5746
1999	3+5+(4+6)	20000	13160	15000	14500	270	13430	72551	900	7425	65126	12530
2000	3+5+(4+6)	20000	18820	18438	14500	3411	22231	94782	1106	8531	86251	21125
2001	3+5+(4+6)	20000	19828	25165	14500	3594	23422	118204	1510	10041	108163	21912
2002	4+6 +(3+5)	20000	17016	20465	14500	3084	20100	138304	1228	11269	127035	18872
2003	4+6 +(3+5)	20000	17016	31894	14500	3084	20100	158405	1914	13183	145222	18187
2004	4+6 +(3+5)	20000	17016	31040.09	14500	3594	20610	179014	1862	15045	163969	18747
2005 (Jan to Aug)	4+6 +(3+5)	20000	12906	14610.59	14500	2339.2125	15245	194260	877	15922	178338	14369
2005(Sept to Dec)	4+6 +(3+5)	200	62	7305.3	34300	2641.1	2703	196962	438	16360	180602	2264
2006	4+6 +(3+5)	5000	5023	31054.06	29500	7408.1875	12431	209393	1863	18223	191170	10567
07 Jan to March	4+6 +(3+5)	3000	762	8037	31500	2001.04	2763	212156	482.22	18706	193450	2281
07 April to July	3+9	5800	1998	23328	33700	2902.42	4901	217057	1400	20105	196951	3501
07 Aug to Dec	8+9	9500	3606	21911	34500	3274.06	6880	223937	1315	21420	202517	5566
2008	8+9	9500	10233	46506.03	34500	9290.85	19524	243461	2790	24210	219251	16734
Jan-09	8+7	20000	23650	47003.92	40,000	11825	35475	278936	2820	27030	251906	32655
Feb-09	8 +7	17500	20694	47003.92	32,500	9607.8125	30302	309238	2820	29851	279387	27481
Mar-09	8 +7	15000	17738	47003.92	25,000	7390.625	25128	334366	2820	32671	301695	22308
Apr-09	8 +7	12500	14781	47003.92	17,500	5173.4375	19955	354320	2820	35491	318829	17134
May - Dec 09	7	10000	11825	47003.92	10,000	2956.25	14781	369102	2820	38311	330790	11961
Jan - Feb 2010	7	13000	1130	3762.11	6,000	130.35	1260	370362	226	38537	331825	1034
Mar-June 2010	7	13000	2935	14961.1	0	0	2935	373297	898	39435	333862	2038
Jul-10	7	7000	1050	3860.95	6,000	225	1275	374572	232	39666	334906	1043
Aug - Sept 2010	7	7000	1483	0	6,000	317.85	1801	372163	0	38537	333626	1801
Oct - Dec 2010	none	0	0	0	13,000	720.85	721	372884	0	38537	334347	721

(1)Actual rainfall used to calcutate infiltration through active areas.
(2)25% infiltration rate was used for restored areas.

Table 3.13: Summary of Annual Leachate Monitoring Results 2010

Monitoring Well	Sampling Date	Parameters								
		Conductivity μScm^{-1}	Ammoniacal Nitrogen (mg/l)	Sulphate (mg/l)	Chloride (mg/l)	TON (mg/l)	BOD (mg/l)	COD (mg/l)	Potassium (mg/l)	Sodium (mg/l)
Holding Tank 1 Phase 1 & 2	16th December 2010	3930	247	47.3	488	0.45	21	383	203	423
Holding tank 2 Phase 3	16th December 2010	13900	1360	421	1670	<0.29	126	2150	757	1610

3.4 Landfill Gas

Landfill gas is produced during the breakdown of waste within the landfill. It is a by-product of the digestion, by anaerobic bacteria, of the organic component of the waste. Landfill gas comprises a mixture of different gases. Methane and carbon dioxide (in the ratio of 3:2) are the main components, with small concentrations of a wide variety of compounds. The number and ratio of gases at any one time depends on the breakdown process which occurs in stages and which is subject to controlling factors. These factors include: -

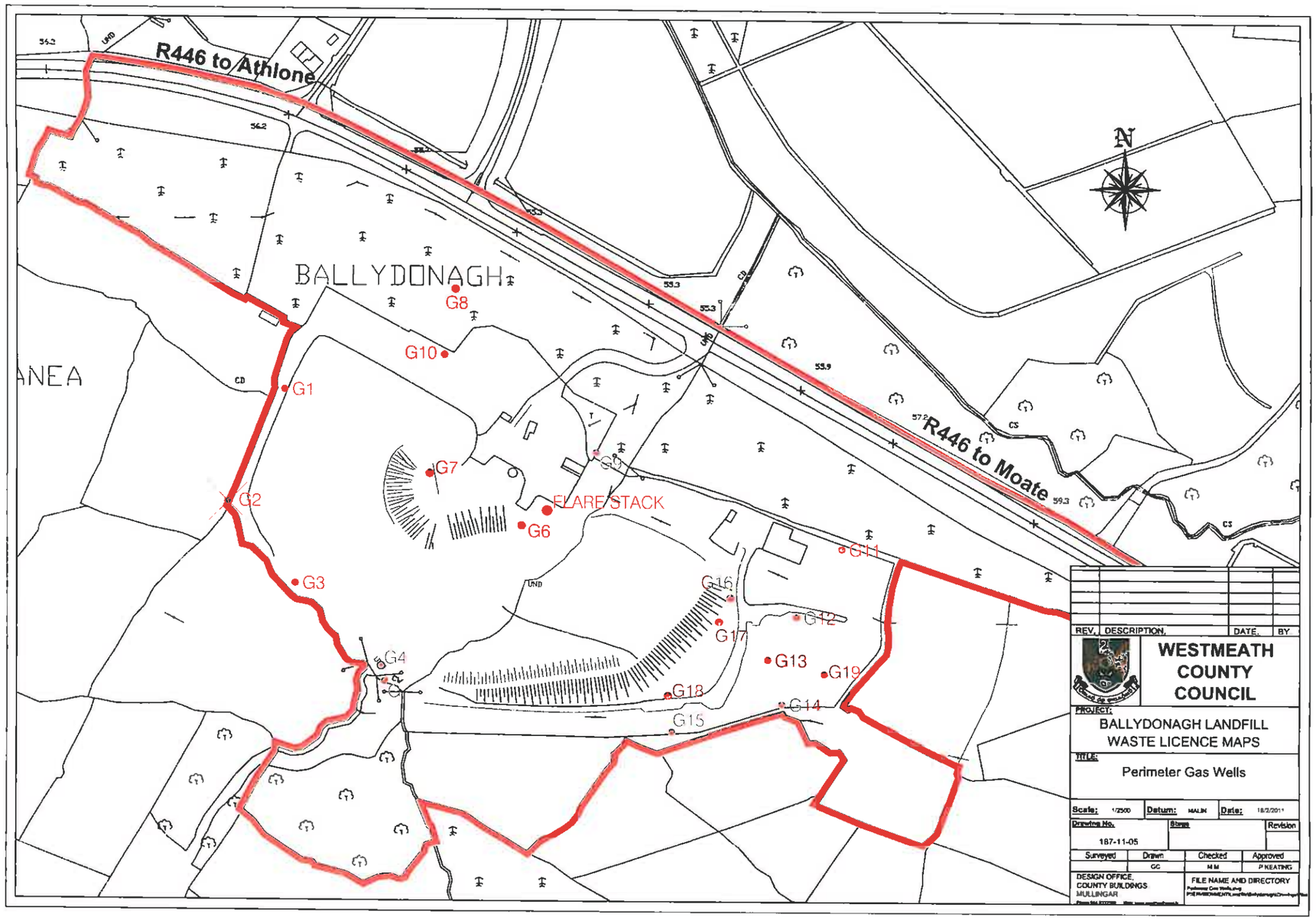
- Physical dimension of the site,
- Type and input rate of waste deposited,
- Waste age,
- Moisture content, pH, temperature and density of wastes,
- Application of cover, compaction and capping.

3.4.1 Landfill Gas Monitoring

The Council monitors landfill gas at 18 monitoring locations (G1 to G19) around the landfill, at the landfill flare stack and in the site offices. G5 was removed during construction of phase 3. The monitoring locations are positioned outside the landfill cell to establish if the migration of landfill gas away from the fill area is occurring. The locations are shown on detailed site survey drawing no. 187-11-05 "Perimeter Gas Wells". OS co-ordinates are presented in Table 3.15.

Table 3.15 Perimeter Monitoring Locations

[illegible]	[illegible]	Northing
G1	238675	209192
G2	238620	209170
G3	238553	209226
G4	238490	209290
G6	238602	209400
G7	238643	209328
G8	238789	209348
G9	238628	209427
G10	238742	209280
G11	209652	238585
G12	209617	238531
G13	209592	238497
G14	209605	238462
G15	209518	238440
G16	209564	238545
G17	209555	238526
G18	209515	238467
G19	209636	238486
Flare Stack	238612	209469


R446 to Athlone
R446 to Moate
BALLYDONAGH
N
G1
G2
G3
G4
G5
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G7
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G10
G11
G12
G13
G14
G15
G16
G17
G18
G19
FLARE STACK
REV. DESCRIPTION. DATE. BY
WESTMEATH COUNTY COUNCIL
PROJECT:
BALLYDONAGH LANDFILL
WASTE LICENCE MAPS
TITLE:
Perimeter Gas Wells
Scale: 1/2500
Datum: MALIN
Date: 18/2/2011
Drawing No.
187-11-05
Status
Revision
Surveyed
Drawn
GC
Checked
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DESIGN OFFICE,
COUNTY BUILDINGS
MULLINGAR
FILE NAME AND DIRECTORY

Monitoring is carried out at the monitoring locations on the perimeter of the landfill at monthly intervals, and perimeter monitoring wells G11 to G19 is monitored on a weekly basis.

Monitoring locations G1-G8 are located around Phase I and Phase II. Monitoring locations G11-G19 are located around Phase III. G16-G18 were installed at the toe of the landfill as part of the investigation into the gas migration problem. G19 was installed at the top of the landfill on the Dublin side i.e. the east side of the landfill also as part of the investigation onto the gas migration problem identified at G12 and G13.

Graphs 1 to 19 in Appendix 2 show the monthly methane and carbon dioxide monitoring results from G1 to G19 from January 2010 to December 2010. The monthly monitoring has identified the presence of elevated carbon dioxide concentrations (greater than 1.5% by volume) at monitoring locations G2,G3, G4, G6, G11, G12, G13, G14, G15, G17 & G19 during different monitoring events.
Monitoring did identify the presence of Methane above the 1.0% by volume at G6, G7 and G13 perimeter gas wells during 2010.

An investigation was carried out by our consultants TMS Environment. A report was issued to the agency, and our consultants concluded that the elevated methane and carbon dioxide levels recorded were due to naturally occurring gas and was not from migrating gas from the landfill.

Weekly gas balancing is carried out on the gas extraction system at each well head within the landfill, manifolds, flare and site office. The monitoring includes methane, carbon dioxide, oxygen, atmospheric pressure, flow rate and temperature.

The nearest building to Phase I and Phase II is the site office and the public tipping area. The public tipping area is an above ground fully vented structure. Monitoring in the site office, which is north of the public tipping area has not identified the presence of methane or elevated concentrations of carbon dioxide.

3.4.2 Landfill Gas Volumes

Estimates of potential gas volumes generated are based on predictions of potential recoverable gas yields. Estimates of gas yields were included in the application for a waste licence. The predictions were based on assumptions on waste type and volume. The estimates were based on calculations developed by landfill gas flaring and utilisation equipment and were based on practical experience of a wide range of landfills.

Further estimates of annual and cumulative gas yields have been prepared for this Annual Environmental Report. The estimates are based on calculations used in previous AERs, taking into consideration up-dated data on waste types and volumes.

The site accepted non-hazardous domestic, commercial and industrial wastes. Commercial waste has the same characteristics as domestic waste. Hazardous waste and liquid waste were not accepted at the facility. The biodegradable content of the waste stream, including the organic and paper fraction is estimated at approximately 62%.

The landfill has been in operation since 1991 to July 2010. The volume of waste placed in the landfill is 589,750.84 tonnes. This consists of 420,603.25 tonnes of waste placed in Phase 1 and Phase 2 and 169,129.59 tonnes of waste placed in Phase 3.

Gas predictions were based on the following assumptions of waste inputs and landfill gas characteristics: -

Time to reach steady stage production	0.75 years
Potential future gas production per annum	8.76 m^3/tonne of waste;years 1-10
Potential future gas production per annum	1.33m^3/tonne of waste;years10-40

For predictive purposes Year 1 is taken as 1991. It is assumed that waste is generating gas at 8.76m^3 / tonne for the first ten years it is placed in the landfill, and after ten years, it produces gas at 1.33m^3 / tonne.

The annual and cumulative years are presented in Table 3.16. It is assumed that the annual waste inputs will reach steady state conditions within 9 months. Therefore, only waste deposited prior to March 2010 is used in the calculation. The estimated annual volume of LFG generated for 2010 is 3,028 x 10^3 m^3. The cumulative volume for the period from start of the landfill to the start of this reporting period is 27,442 x 10^3 m^3.

There is an active gas abstraction and flaring system operational on site. This includes a 1000m^3/hr enclosed gas flare system that extracts gas from all three phases of the landfill.

There are currently fifty six active gas wells between phases 1, 2 and 3.

3.4.3 Landfill Gas Control

Westmeath County Council has installed a comprehensive LFG management system at the landfill to: -

- Minimise the risk of migration of LFG beyond the perimeter of the site,
- Minimise the risk of migration of LFG into services and buildings on site,
- Minimise the impact on air quality and the effect of greenhouse gases on the global climate.

Table 3.16: Landfill Gas Volumes

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Cumulative Total ($m^3 \times 10^3$)
Annual Waste Input 1×10^3 tonne/year	16 25	15	15	15	15 5	17 25	19	19	15	18 44	22 07	14 2	31 9	31 04	21 92	31 05	53 58	46 5	47 03	22 584	
Cumulative Waste Input 1×10^3 tonne/year	16 25	31 25	46 25	61.25	76 75	94	113	132	147	165 44	187 51	201 71	233 61	264 65	286 57	317 62	371 2	417 7	464 73	487 314	
Waste producing **Gas** at 8.76 m^3 / tonne (NOTE 1)	3	20 0	35 0	50 0	65 1	81 1	98 8	117 8	135 8	151 6	171 0	184 5	178 4	195 1	208 9	202 1	237 0	269 8	297 5	323 4	
Waste producing **Gas** at 1.33 m^3 / tonne (NOTE 2)	0	0	0	0	0	0	0	0	0	0	0	3	31 25	46 3	61.3	76 8	94 0	113 0	132 0	147 0	
Gas Yield m^3/yr x 10^3 (NOTE 3)	26	175	307	438	570	710	865	1031	1189	1328	1498	1620	1605	1771	1911	1872	2201	2514	2781	3028	27442

NOTE 1: Total quantity of waste placed in the landfill (up until 9 months prior to end of the Reporting Period) that is generating LFG at the rate of 8.76m^3/tonne/year.
NOTE 2: Total quantity of waste placed in the landfill that is generating LFG at the rate of 1.33m3/tonne/year.
NOTE 3: Total volume of LFG produced during each year.

3.5 Noise Survey

The location of the noise monitoring locations is shown on Figure 10.2 and further described in Table 3.17 below.

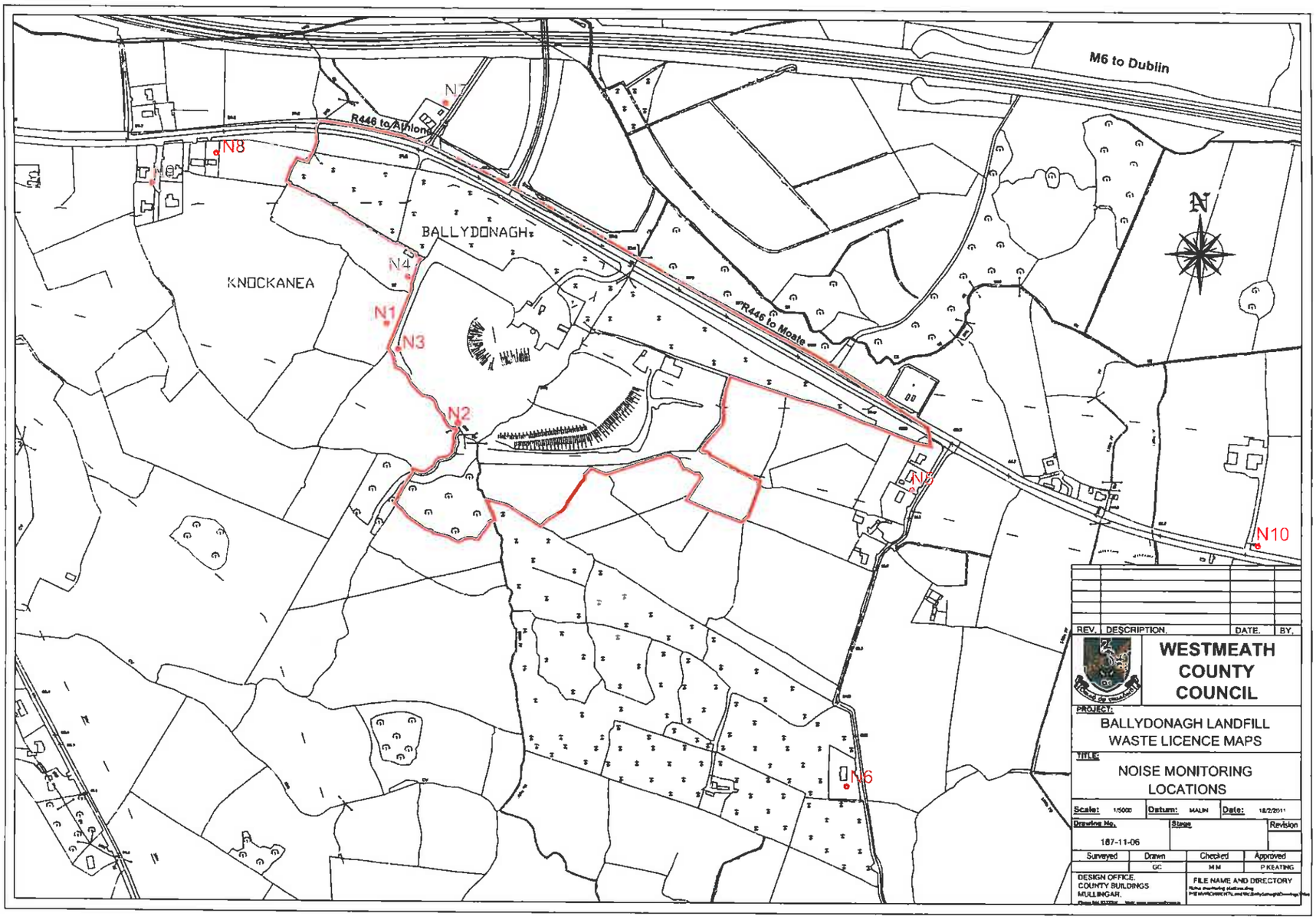
Table 3.17 Noise Monitoring Locations

Station	Easting	Northing
N1	209167	238655
N2	209277	238500
N3	209185	238615
N4	209200	238728
N5	209980	238400
N6	209879	237935
N7	209260	239000
N8	208905	238920
N9	208805	238873
N10	210517	238315

The noise survey was carried out in the last quarter of the reporting period, during November 2010. The limits set out by the licence are 55 Db(A) L_{Aeq}(15 minutes) for the daytime and 45 Db(A) L_{Aeq}(15 minutes) for the night-time.

Noise in the general area of the landfill is dominated by the N6 road, which was noted to carry heavy volumes of traffic throughout the day. Measured noise levels that were well below the licence limit of 55Db(A) at all monitoring locations.

The results of the noise monitoring survey suggest that Ballydonagh Landfill site is in compliance with condition 6.1 of the Waste Licence.


M6 to Dublin
R446 to Athlone
R446 to Moate
BALLYDONAGH
KNOCKANEA
N
N1
N2
N3
N4
N5
N6
N7
N8
N10
REV.
DESCRIPTION.
DATE.
BY.
WESTMEATH COUNTY COUNCIL
PROJECT:
BALLYDONAGH LANDFILL WASTE LICENCE MAPS
TITLE:
NOISE MONITORING LOCATIONS
Scale: 1/5000
Datum: MALIN
Date: 18/2/2011
Drawing No.
187-11-06
Stage
Revision
Surveyed
Drawn
GC
Checked
MM
Approved
P.KEATING
DESIGN OFFICE,
COUNTY BUILDINGS
MULLINGAR.
FILE NAME AND DIRECTORY

3.6 Dust Monitoring

The locations of the Dust monitoring locations are shown on Figure 10.1 and further described in Table 3.18 below.

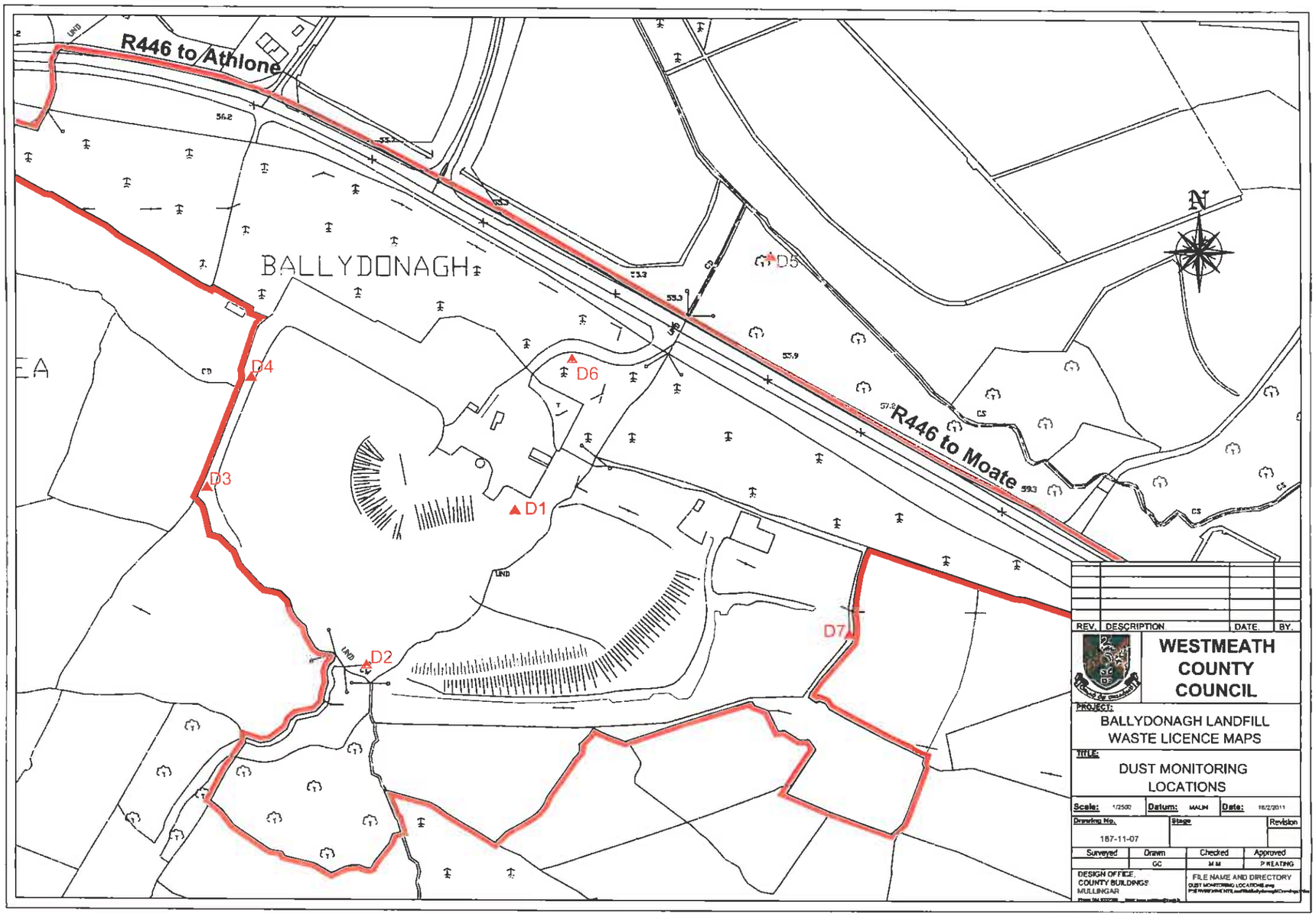
Table 3.18 Dust Monitoring Locations

Station	Easting	Northing
D1	209420	238605
D2	209304	238483
D3	209177	238622
D4	209210	238710
D5	209620	238806
D6	209465	238725
D7	209683	238507

The waste licence specifies that dust deposition limits to be no more than 350 mg/m^2-day at the site boundaries.

The results showed that the Licence Limit Value was exceeded at one monitoring location, D2 during the July monitoring period.
D2 is located at the south side of phase 1, south west of phase 3. The high reading of 416.8 mg/m^2 - day may be attributed to the proximity to the active area, where extra soil was being used as temporary cover, during the final month of landfilling in Ballydonagh.

All other dust measurements during 2010 are well below the licence limit of 350mg/m^2/day.


R446 to Athlone
BALLYDONAGH
R446 to Moate
N
D1
D2
D3
D4
D5
D6
D7
REV. DESCRIPTION DATE. BY.
WESTMEATH COUNTY COUNCIL
PROJECT:
BALLYDONAGH LANDFILL WASTE LICENCE MAPS
TITLE:
DUST MONITORING LOCATIONS
Scale: 1/2500
Datum: MALIN
Date: 16/2/2011
Drawing No. 187-11-07
Stage
Revision
Surveyed
Drawn GC
Checked M M
Approved P KEATING
DESIGN OFFICE: COUNTY BUILDINGS MULLINGAR
FILE NAME AND DIRECTORY
DUST MONITORING LOCATIONS.dwg

4. SITE DEVELOPMENT WORKS

4.1 Engineering Works Undertaken During the Reporting Period

The following engineering works were carried out during the reporting period: -

- Completed the final capping of phases 1 & 2, Cell 9 and part of cell 8 of phase 3.
- Instillation of three layers of horizontal gas extraction wells in cell 8 and cell 7 in Phase 3.
- Connect three gas horizontal extraction wells with spokes onto 315mm pipe from phase 3.
- Continued balancing the gas field to optimise the complete gas network
- Site was transferred to Oxigen Environmental as Waste Civic Amenity site.

4.2 Site Restoration

The permanent restoration has been completed by our consultants Priority Construction. It consists of a seeded cap with HDPE liner and a drainage blanket, a gas collection blanket and a further metre of soil. Further details of site restoration are described in the Report on Phasing and Restoration submitted to the EPA.

4.3 Site Survey

The filled area and levels are shown on the site survey Drawing No. Survey completed in accordance with Schedule G of the Licence.
Drawing No. Survey is contained in Appendix 3.

4.4 Future Developments

Future developments on-site will include the following: -

- Complete final capping of the remaining 13,000m^2 temporary capped area.
- Determine the feasibility of using the landfill gas as a source of energy.
- Servicing the site with mains water during 2011.
- Investigate the suitability of treatment of leachate prior to removal off site.

A more detailed description of future developments is included in the Schedule of Objectives and Targets in the revised Environmental Management Programme (EMP) for 2010. A copy of the schedule of objectives and targets for the forthcoming year is included in Section 7.2.

4.5 Resource Consumption

The following resources were used on-site during the reporting period: -

- Electricity (151.463 MWhr)
- Water (2,812 litres of drinking water),
- Bird scaring cartridges (950).

5. WASTE RECEIVED AND CONSIGNED FROM THE FACILITY

Table 5.1 below shows the total waste quantities accepted and landfilled at Ballydonagh landfill site from 1st January 2010 to 31st December 2010.

Table 5.1 Non-Hazardous Waste Received by the Landfill Facility

Waste Description	EWC Code	Non-Hazardous Waste Received			
		On-Site Disposal		On-Site Recovery	
		Method	Tonnes	Method	Tonnes
Household	20 03 01	Landfill	3,310.49		0
Commercial	20 03 01	Landfill	18,989.73		0
Industrial Non-Hazardous Solids	20 03 01	Landfill	283.94		0
Total			**22,584.16**	**Total**	**0**

The quantity for Industrial non-hazardous solids includes street sweeping of 283.94 tonnes. In addition to the total quantity of waste accepted at the facility during the reporting period 1,409.72 tonnes of cover and bunding materials were was brought onto site. This brings the total quantity of materials placed in the landfill to 23,993.88 tonnes.

Table 5.2 shows the total waste quantities accepted at the Ballydonagh Civic Amenity Site for disposal / recovery from 1st January to 31st December 2010.

Table 5.2 Non-Hazardous Waste received & Consigned at Ballydonagh Civic Amenity Site for Disposal and Recovery 2010

Waste Description	EWC Code	Tonnes	Details of Haulage Contractor	Recovery/ Disposal	Name & Address of Recovery/ Disposal Site
Mixed Municipal Waste	20 03 01	89.08	Oxigen Environmental Ltd.	Disposal	Oxigen Environmental Ltd., Merrywell Ind Estate, Ballymount Road Lower, Dublin 22.
Mixed Municipal Waste	30 03 01	184.06	Oxigen Environmental Ltd.	Disposal	Derryclure Landfill, Tullamore, Co. Offaly
Mixed Municipal Waste	20 03 01	865.32	Oxigen Environmental Ltd.	Disposal	Oxigen Environmental Ltd., Robinhood Road, Clondalkin, Dublin 22.
Steel	20 01 40	2.24	Oxigen Environmental Ltd.	Recovery	Oxigen Environmental Ltd., Merrywell Ind Estate, Ballymount Road Lower, Dublin 22.
Steel	20 01 40	6.38	Oxigen Environmental Ltd.	Recovery	The Hammond Lane Metal Company Ltd., Pigeon House Road, Dublin 4
Wood	17 02 01	7.76	Oxigen Environmental Ltd.	Recovery	Conroy Recycling Company Ltd., Slanebeg, Mullingar, Co. Westmeath
Wood	17 02 01	12.28	Oxigen Environmental Ltd.	Recovery	Concrete Recycling Specialists Ltd., Barnan, Daingean, Co. Offaly
Textiles	20 01 10	2.26	Textile Recycling Ltd.	Recovery	Textile Recycling Ltd., Glen Abbey Complex, Belgard Road, Tallaght, Dublin 24
Glass Bottles & Aluminium Cans	20 01 02 20 01 05	14.50	Mr. Binman	Recovery	Luddenmore, Grange, Kilmallock. Co. Limerick
Total		1183.88			

6. ENVIRONMENTAL INCIDENTS AND COMPLAINTS

6.1 Incidents

There were sixty three notifiable incidents as defined under condition 3.1 of the Waste Licence at the facility during the reporting period.

There were thirty three incidents for an odour nuisance outside the perimeter of the landfill. Odour monitoring is carried on a daily basis at specified locations agreed with the Agency. During early 2010, our contractors were completing the final cap on phases 1 and 11 and Cells 9 & 8 of Phase 111.
The main flare was down from 1st January till 12th January due to a fault in the blower, and the blower was sent off to be repaired. The back up flare was running at its capacity during this time. Horizontal trenching of spokes to existing gas wells in the active area were installed throughout the first half of 2010.

One incident was relating to a leachate overspill from tank 1, where the valve from phase 1 to drain the leachate from the chambers to the leachate holding tank was left open overnight and the leachate tank overflowed by approx ¾ M into the concrete surround above the tank. Extra monitoring along with the scheduled monitoring was carried out on groundwater, including private wells and surface water. Results did not show any contamination in any of the samples taken.

The remaining twenty nine incidents related to problems with the flare, including flare shutdown for servicing of the flare, cleaning of the flame arresters, frozen pipe to the emissions analyser during the extreme cold weather, and the flare going out due to ESB power cut.

Table 6.1 Summary of incidents

No. of incidents	Nature of incident	Cause	Corrective action
33	Odour outside perimeter	Problems with blower of main flare from 1st Jan – 12th Jan. Main flare down. Trenching of additional spokes to existing gas extraction wells in active area.	Back up flare running when main flare down. Filling in of trenching as soon as possible, no waste exposed overnight.
1	Leachate overspill	Valve from chambers from phase 1 left open overnight & holding tank overflowed into concrete surround above holding tank.	Leachate tankered away following morning. Monitoring carried out on groundwater, surface water & private wells & all results being closely monitored.
29	Flare shutdown	Servicing of flare, cleaning of flame arresters, ESB power cuts & frozen pipe to the analyser during extreme cold weather.	Main flare restarted as soon as possible due to text alert to three mobile phones. Back up flare operated when main flare down.

6.2 Register of Complaints

The Council maintains a register of complaints received in accordance with Condition 3.14 of the waste licence. Eight complaints were received in relation to the operation of the facility for the reporting period.

All eight of the complaints were relating to odour emanating from Ballydonagh Landfill. Six of these complaints were on the 4th January and one was for the 7th January. The main flare was down between the 25th December 2009 and 13th January 2010 due to a mechanical fault with the motor and while it was sent off for repair. The back up flare was operational during this time.
A complaint was also received on 10th November 2010 for odour. During the night of 9th November, an extraction pipe from a gas well became loose and disconnected. This caused an odour downwind of the site. The gas pipe was reconnected the following morning.

All complaints were made directly to the EPA, and directed onto Westmeath County Council.

7. ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

7.1 Report on Progress Towards Achieving Objectives & Targets in the EMP for 2010

The Environmental Management Programme (EMP) 2010 contained a schedule of objectives and targets and the means for their implementation. The EMP report was submitted to the Agency in accordance with Waste Licence Condition 2.3.1.

The means of achieving the objectives and targets was by establishing a number of projects to be completed within a specified timeframe. A total of 7 projects were established, the status of each of these is outlined in Sections 7.1.1 to 7.1.6 below.

7.1.1 Project 1 & 2– Recovery & Recycling of Waste and Reduction of Green Waste sent to Landfill

Task 1: Continue the public information campaign e.g. newspaper advertisements, postal drops, site notices and radio advertisements aimed at encouraging the public to recycle materials. This task is ongoing over the entire lifetime of the landfill.

Task 2: The task is ongoing to increase the awareness of the Recycling Centre in Athlone as a facility for the collection of green waste for composting. This task is ongoing.

7.1.2 Project 3-Packaging Waste Reduction

Task 1: Continue to communicate with the producers of packaging waste, small as well as large producers including small retailers within the county, with a view to ensuring compliance with the Packaging Regulations. This task is ongoing over the lifetime of the landfill.

Task 2: Implement the Packaging Regulations 2001 to 2004. This task is ongoing over the lifetime of the landfill.

Task 3: Promote the awareness of Mullingar and Athlone Recycling Centres.
This task is ongoing.

Task 4: Continue the pilot scheme for the introduction of the brown bin collection of organic waste.
This task is continuing.

7.1.3 Project 4 – Construction of Temporary Plastic Liner on Cells 8 and 7 of Phase 3

Task 1: Temporary Capping of Phase 3 by 30/09/10.
This task was completed by the stated deadline.

7.1.5 Project 5 – Carry out a detailed assessment fordesigning a system for using landfill gas as a source of energy

Task 1: Design a specification for a small on site CHP generating plant by 30/09/10 if deemed feasible.
Discussions with a number of energy supply companies have taken place with a view to the provision of a gas turbine engine, run on landfill gas, which would feed electricity to the national grid via a new network connection. This task is continuing.

7.1.6 Project 6 – Advance the design of the permanent landfill cap for cells 7 and 8 of Phase 3

Task 1: To prepare the design for the permanent capping of the remainder of Phase 3 by 31/03/2011.
This task has not been completed. As the performance of the temporary liner has been satisfactory, there is not an urgency to place a permanent cap on this area. However, the licencee is aware that the permanent cap needs to be in place by July 2012. This task will be carried forward and included in the list of objectives for 2011.

7.1.7 Project 7 – Resources use and Energy Efficiency.

Task 1: Carry out an Audit of processes that use energy on the site by 20 /11/2010.
The energy consumption for the facility has been quantified. This task is continuing.

Task 2: Identify reductions in water usage on the site by 20/11/2010.
This task has not been completed.

Task 3: Carry out an assessment of use of raw materials used in various processes and obtain a reduction in waste generated from the various processes and identify any improvements made.
This task has not been completed.

7.2 Objectives and Targets for 2011

Ballydonagh Landfill

EMP - Future Targets & Objectives for 2011

Date: Mar. 2011

Objective		Projects	Target	Responsibility
1	Advance the design of the permanent landfill cap for cells 7 and 8 of Phase 3	Project 1A: Preparation of the design.	November 2011.	Landfill Manager
2	Examine and procure the utilisation of landfill gas as a source of energy	Project 2A: Identification of an energy service company to generate electricity from landfill gas.	December 2011.	Landfill Manager
3	Reduce leachate transport costs	Project 3A: Consider options for the on site pre-treatment of leachate to facilitate increased daily tankering rates to waste water treatment plants.	December 2011.	Landfill Manager
4	Provide a mains water supply for the site	Project 4A: Make a connection to the water main adjacent to the site, and provide a number of separate supplies for various uses.	December 2011.	Landfill Manager
5	To improve the energy efficiency of site operations and activities	Project 5A: Identification of primary energy consuming appliances and systems	June 2011.	Landfill Manager
		Project 5B: Implementation of energy saving measures	December 2011.	Landfill Manager

7.3 Staffing Structure

The day-to-day management of the landfill and associated facilities is the responsibility of the Landfill Manager and the staff listed below:

During the first half of the year, during landfilling activities, the names of the persons who provided management and supervision and their positions are set out below

Landfill Manager:	Mr. Michael Rooney, Executive Engineer.
Deputy Manager:	Ms Geraldine Glennon, Env. Technician Grade 1.
Operations Manager:	Mr. Patrick Tighe, Senior Ex. Technician
Deputy Manager / Caretaker.	Mr. Peter Buckley
Assistant Caretaker:	Mr. Ollie Galvin
General Operative:	Mr. Michael Mc Cann
General Operative:	Mr. Jim Allen

From 15th September 2010 onwards, the following is the management structure;

Landfill Manager:	Mr. Michael Rooney, Executive Engineer.
Deputy Manager:	Ms Geraldine Glennon, Env. Technician Grade 1.
Caretaker:	Mr. Ollie Galvin
Deputy Caretaker:	Mr. Pat Conlon

Since 26th July 2010, the management and operation of waste activities in the civic waste facility (CWF) has been carried out by Oxigen Environmental Ltd., and overseen by the Landfill Manager. The staffing structure is listed below:

Landfill Manager:	Mr. Michael Rooney, Executive Engineer (WCC)
CWF Manager:	Mr. Ger Cullivan (Oxigen Environmental Ltd.)
Weighbridge / Reception Operator:	Ms. Catherine McCaffery (Oxigen Environmental Ltd.)
Yard Operative:	Mr. Leo Walshe (Oxigen Environmental Ltd.)

7.4 Approach to Environmental Management

7.4.1 Training

In the past year Michael Rooney completed the following courses:

- FAS Waste Management Course
- Managing Safely for Construction Managers
- Certified First Aid Refresher Course
- Manual Handling

In the past year Catherine McCaffery has completed the following courses:

- FAS Waste Management Course
- Manual Handling

In the past year Leo Walshe has completed the following courses:

- Manual Handling

7.4.2 Corrective Action Implemented

No corrective actions were taken in the past year.

7.4.3 Standard Operating Procedures

No new operating procedures were implemented in the past year.

7.5 Financial Provision

Westmeath County Council will draw from reserved internal capital resources in 2011 and 2012 to fund the design of the Phase 3 permanent capping works and the ongoing aftercare of the landfill.

8 OTHER REPORTS

8.1 Assessment of Waste Density and Settlement

A topographic survey is used to assess the rate of settlement and to calculate the waste density. Drawing No. 187-11-01 showing the most recent survey carried out by Westmeath County Council in March 2011 and is included in Appendix 3.

APPENDIX 1

Meteorological Report

January

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	0.0	2.8	315	94	1011.5	1.0	-3.7	0.0	0.0
2	0.1	2.6	240	95	1018.5	2.4	-6.5	0.0	0.1
3	0.0	4.9	45	81	1024.5	2.7	-1.1	0.2	0.3
4	0.0	2.7	260	91	1021.4	1.0	-4.9	0.1	0.1
5	0.5	4.3	320	92	1008.9	1.3	-2.4	0.0	0.0
6	0.0	5.0	350	82	1012.8	1.3	-5.3	0.1	0.2
7	0.0	2.2	270	97	1017.5	-1.8	-7.4	0.1	0.1
8	0.0	0.9	350	97	1028.0	1.0	-9.0	0.0	0.0
9	0.0	1.8	330	97	1031.4	-0.2	-9.6	0.1	0.2
10	0.9	5.3	20	90	1025.3	1.8	-5.4	0.3	0.4
11	1.9	5.4	100	96	1016.8	1.6	0.4	0.3	0.4
12	5.8	12.8	100	90	999.4	2.9	0.5	0.5	0.7
13	4.8	5.3	100	99	996.2	3.3	0.4	0.2	0.2
14	0.5	3.7	155	97	1001.5	6.5	0.7	0.0	0.1
15	5.3	12.3	160	93	1000.0	10.5	5.4	0.5	0.6
16	5.5	7.8	205	92	996.2	9.0	2.6	0.1	0.1
17	0.0	6.4	210	90	1012.5	8.9	2.0	0.2	0.3
18	0.0	5.3	215	92	1020.5	10.2	2.5	0.1	0.2
19	2.2	9.5	125	89	1013.1	6.6	3.7	0.4	0.5
20	3.9	3.3	175	95	1008.7	7.7	1.0	0.0	0.1
21	7.7	10.4	145	97	1006.6	10.0	1.0	0.2	0.4
22	0.2	2.5	220	95	1015.0	8.4	-1.6	0.0	0.1
23	0.0	1.0	270	99	1024.2	1.1	-3.9	0.0	0.0
24	0.0	1.6	235	100	1026.2	0.9	-2.3	0.1	0.2
25	0.0	1.6	345	99	1034.0	5.3	-2.1	0.1	0.1
26	0.0	0.9	185	95	1041.4	6.1	-3.8	0.0	0.2
27	0.6	5.1	255	95	1033.1	9.2	1.8	0.2	0.3
28	1.9	6.7	285	94	1016.8	7.8	4.1	0.2	0.3
29	3.1	7.4	315	87	1001.6	7.6	0.4	0.1	0.2
30	0.0	3.2	290	93	1005.7	3.7	-2.7	0.1	0.2
31	0.1	4.2	290	94	1009.4	4.2	-2.1	0.2	0.3
Total	45.0							4.3	

February

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	0.0	4.6	215	94	1014.4	6.4	-0.4	0.2	0.4
2	5.6	5.9	250	94	1005.8	8.5	4.3	0.2	0.4
3	6.7	5.0	110	94	1004.4	8.7	0.7	0.4	0.5
4	10.0	7.7	120	97	994.7	8.8	0.2	0.3	0.4
5	3.5	5.3	120	91	994.3	9.0	2.5	0.3	0.5
6	0.2	2.3	295	99	1016.7	6.6	1.2	0.3	0.4
7	0.0	4.9	95	100	1022.2	5.3	1.2	0.3	0.4
8	0.1	4.5	65	90	1017.8	3.6	0.7	0.3	0.5
9	0.0	4.1	25	75	1019.6	4.7	-1.7	0.5	0.7
10	0.0	2.5	340	79	1023.7	5.4	-2.4	0.5	0.7
11	0.0	2.5	335	84	1028.4	5.5	-4.5	0.4	0.6
12	0.0	2.8	330	89	1029.4	6.6	0.0	0.4	0.6
13	0.0	1.9	330	87	1028.1	5.5	-1.2	0.4	0.6
14	0.0	3.2	285	95	1020.4	6.4	-2.8	0.3	0.5
15	2.0	5.0	265	93	1004.2	7.6	1.2	0.5	0.7
16	0.4	3.5	195	98	990.3	5.1	-2.1	0.4	0.6
17	0.0	2.8	50	91	990.5	6.1	-1.4	0.4	0.7
18	0.0	2.9	325	95	993.9	4.7	-2.5	0.4	0.6
19	0.1	4.1	290	97	996.2	4.7	-1.8	0.4	0.6
20	0.1	2.3	190	100	996.0	2.1	-5.2	0.3	0.4
21	0.0	1.9	250	94	991.1	1.4	-4.0	0.3	0.4
22	0.0	3.3	60	90	990.4	4.0	-5.5	0.4	0.6
23	4.2	6.5	70	88	990.0	2.6	-1.7	0.4	0.6
24	2.3	4.1	340	97	987.0	3.1	1.1	0.4	0.5
25	0.1	2.0	300	89	986.6	3.6	0.3	0.5	0.7
26	6.4	2.8	255	96	988.7	5.6	-0.2	0.6	0.8
27	0.2	2.5	85	88	991.1	7.0	-2.3	0.6	0.9
28	0.0	2.1	325	95	996.2	5.3	-2.9	0.5	0.7
Total	41.9							10.8	

March

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	0.0	1.4	225	84	1010.9	8.5	-3.9	0.6	1.0
2	0.0	4.0	90	86	1021.4	7.4	-4.9	0.7	1.1
3	0.0	3.8	120	81	1018.8	6.1	-1.9	0.6	0.9
4	0.0	3.1	25	84	1027.3	7.7	-3.4	0.8	1.1
5	0.0	2.0	315	83	1033.2	10.1	-4.5	0.9	1.3
6	0.0	2.6	340	83	1030.1	8.4	0.1	0.8	1.1
7	0.0	4.5	90	78	1032.0	6.8	-2.7	0.9	1.4
8	0.0	3.8	70	72	1031.6	7.2	-5.9	1.1	1.6
9	0.0	1.8	70	71	1033.5	8.8	-5.7	0.9	1.4
10	0.0	1.8	355	80	1033.0	7.5	-4.9	0.7	1.0
11	0.0	2.7	325	79	1029.1	8.3	-4.5	0.9	1.3
12	0.0	4.9	340	81	1028.0	9.2	4.1	1.0	1.4
13	0.0	3.7	300	79	1033.7	9.1	2.6	0.8	1.1
14	0.0	3.8	285	84	1033.2	10.9	-1.3	1.0	1.5
15	0.0	2.8	240	78	1028.5	10.6	-1.7	1.0	1.5
16	0.0	6.5	150	84	1020.4	9.1	-2.0	0.7	1.0
17	0.2	7.7	195	85	1013.3	13.4	5.6	1.2	1.6
18	1.5	12.5	165	86	1002.8	12.7	8.8	1.2	1.6
19	5.2	5.0	220	79	1005.9	10.2	5.0	1.1	1.5
20	4.1	3.8	335	80	1005.5	11.2	1.6	1.2	1.8
21	0.0	6.0	185	77	1011.3	13.1	1.3	1.3	1.9
22	5.6	9.5	215	83	1008.6	10.3	1.6	1.0	1.7
23	1.0	8.1	160	86	1008.0	9.4	2.8	1.1	1.6
24	4.9	6.2	100	82	998.0	11.9	5.4	1.3	1.9
25	8.7	6.7	80	89	994.0	12.2	5.9	1.1	1.6
26	3.4	3.7	185	87	993.5	12.7	4.7	1.3	1.8
27	0.0	5.4	275	78	1005.7	11.2	4.6	1.5	2.1
28	0.0	3.5	280	77	1006.7	10.4	2.8	1.5	2.1
29	14.4	6.5	70	94	993.6	5.0	1.7	0.4	0.7
30	24.8	9.8	300	99	984.7	2.4	0.2	0.4	0.7
31	8.2	9.9	300	84	999.2	5.3	0.5	1.3	2.2
Total	82.0							30.6	

April

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	0.7	4.9	240	84	1004.0	9.2	0.1	1.4	2.0
2	4.8	5.8	85	90	994.3	9.4	1.8	1.0	1.4
3	1.3	3.9	335	89	1000.5	7.6	1.1	1.1	1.5
4	2.7	6.9	265	82	1011.8	8.6	0.2	1.2	1.9
5	7.7	14.7	180	88	1006.2	12.3	6.8	1.1	1.8
6	20.8	6.9	270	91	1005.3	10.6	4.7	1.0	1.5
7	0.1	4.0	280	84	1022.2	11.6	1.9	1.8	2.6
8	0.0	4.1	240	84	1030.4	12.4	3.7	1.4	2.0
9	0.0	4.4	160	78	1031.8	13.6	3.3	1.7	2.4
10	0.0	5.3	150	71	1032.3	17.7	4.4	2.5	3.5
11	0.0	2.6	70	72	1031.2	17.9	1.0	2.3	3.1
12	0.0	3.8	55	69	1030.5	16.2	4.7	2.3	3.2
13	0.0	4.3	60	75	1028.8	14.1	4.8	2.0	2.8
14	0.0	4.5	55	78	1026.4	11.3	3.5	1.7	2.4
15	0.0	3.8	25	84	1027.7	11.6	2.4	1.5	2.1
16	0.0	2.7	185	74	1029.1	15.1	0.8	2.4	3.4
17	0.0	2.8	280	81	1021.6	13.6	1.2	2.1	3.0
18	1.2	2.6	320	80	1017.4	12.9	4.2	1.5	2.1
19	0.2	3.7	340	67	1019.6	11.7	3.5	2.2	3.1
20	0.0	3.5	330	70	1022.2	10.6	1.9	1.8	2.4
21	0.0	1.7	50	68	1023.9	10.7	-3.0	1.9	2.6
22	0.0	2.5	160	66	1018.6	13.8	0.7	2.4	3.3
23	0.0	5.2	170	62	1013.7	15.9	5.4	2.8	3.8
24	0.6	7.7	150	83	1012.6	14.9	5.9	1.7	2.4
25	3.5	6.3	225	87	1014.9	16.2	8.7	2.1	2.9
26	0.1	4.5	215	81	1023.3	18.0	8.1	2.3	3.1
27	0.3	9.4	160	86	1021.4	14.9	8.6	1.9	2.7
28	5.4	9.0	180	86	1012.1	16.8	9.9	1.8	2.5
29	0.1	5.0	235	80	1009.2	12.6	7.1	1.9	2.6
30	4.3	4.4	225	86	1006.3	13.8	5.9	2.0	2.8
Total	53.8							54.6	

May

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	4.8	2.0	275	87	1010.0	12.5	5.0	1.5	2.1
2	0.4	4.4	345	78	1019.8	11.2	6.1	1.9	2.5
3	0.0	4.8	340	71	1029.3	12.2	2.1	2.4	3.4
4	0.0	4.7	315	76	1031.4	12.4	4.1	1.8	2.4
5	1.8	4.9	300	90	1023.6	16.4	8.1	1.7	2.2
6	2.2	4.8	5	91	1016.4	13.4	7.8	1.3	1.7
7	0.0	6.5	60	72	1017.5	11.4	5.8	2.1	3.0
8	0.0	6.5	45	57	1019.2	14.0	3.7	3.3	4.6
9	0.0	3.0	345	73	1016.6	12.5	3.1	1.9	2.6
10	0.0	5.5	345	72	1016.8	9.9	4.0	1.9	2.6
11	2.4	3.5	325	80	1017.2	9.8	-0.1	1.8	2.5
12	0.7	3.6	340	76	1017.7	10.3	0.5	2.0	2.8
13	1.1	5.5	205	85	1010.4	11.0	4.1	1.4	2.0
14	0.1	4.8	290	78	1010.3	14.6	4.0	2.6	3.7
15	0.4	5.4	240	74	1016.2	14.1	3.0	2.3	3.3
16	0.9	4.8	280	79	1017.5	14.9	3.3	2.4	3.5
17	0.3	2.9	215	76	1024.4	15.5	5.1	2.8	3.8
18	2.7	7.2	170	93	1025.5	14.8	7.4	1.4	2.1
19	0.5	3.5	185	90	1026.1	19.5	10.6	1.9	2.5
20	0.1	2.5	195	83	1030.8	23.4	13.5	2.9	3.8
21	4.8	4.4	135	81	1030.4	22.1	12.5	3.2	4.3
22	0.0	3.2	165	73	1028.4	24.8	7.5	3.7	4.9
23	0.0	2.4	260	69	1023.4	23.8	8.2	4.3	5.7
24	0.0	4.2	15	73	1017.9	18.6	10.0	3.2	4.4
25	0.0	4.7	20	66	1015.5	15.8	5.1	3.2	4.5
26	0.0	4.8	350	65	1013.5	15.0	4.9	3.3	4.5
27	0.2	5.4	280	74	1011.6	14.2	4.2	2.8	4.0
28	0.0	3.6	225	72	1012.8	15.1	3.0	2.5	3.5
29	2.0	4.3	65	94	1006.2	13.2	8.7	1.1	1.5
30	0.1	3.7	300	73	1015.6	16.5	5.1	3.1	4.2
31	14.0	6.7	145	75	1018.6	17.5	8.1	2.6	3.6
Total	39.5							74.2	

June

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	5.1	3.8	300	83	1015.7	16.8	9.4	2.3	3.1
2	0.0	2.9	220	78	1021.6	20.6	8.3	3.8	5.1
3	0.0	6.9	135	73	1020.0	20.3	9.5	3.5	5.0
4	0.0	4.7	155	69	1016.9	21.4	12.0	3.6	4.7
5	0.6	3.3	280	75	1018.0	20.6	10.9	4.0	5.3
6	10.8	2.5	315	84	1014.8	18.1	11.8	2.2	2.8
7	5.1	5.9	80	90	1006.7	16.6	10.3	1.9	2.7
8	3.5	5.1	55	97	1001.0	15.9	12.0	1.3	1.7
9	8.7	6.0	45	95	1007.5	14.4	11.7	1.0	1.4
10	0.0	4.3	35	80	1014.9	18.1	7.8	2.3	3.1
11	0.0	5.1	315	83	1014.4	18.8	8.3	2.7	3.7
12	0.0	3.8	310	69	1019.5	16.9	10.5	2.8	3.8
13	1.6	5.5	305	86	1015.8	15.2	9.2	2.3	3.3
14	0.0	3.5	320	80	1023.4	18.5	8.2	2.4	3.2
15	0.0	2.5	40	68	1030.1	20.6	8.5	3.9	5.2
16	0.0	3.3	260	73	1027.7	21.3	10.1	3.7	4.9
17	0.0	2.5	330	76	1025.3	21.7	13.4	3.0	3.9
18	0.0	3.8	330	77	1023.6	20.1	11.6	2.8	3.7
19	0.0	5.3	340	67	1022.3	18.5	8.4	3.8	5.2
20	0.0	3.4	315	65	1023.4	21.7	5.7	4.3	5.9
21	0.0	3.4	225	67	1022.0	24.5	9.3	4.7	6.2
22	0.0	4.3	215	72	1021.4	21.7	9.7	3.5	4.8
23	2.3	4.7	190	82	1019.2	19.8	13.3	2.2	2.9
24	0.4	2.7	245	80	1019.4	19.4	10.8	2.6	3.5
25	0.0	3.7	170	80	1016.8	19.6	11.0	2.1	2.8
26	1.5	6.0	160	79	1013.4	22.1	13.8	3.2	4.2
27	0.0	6.7	205	72	1014.9	20.6	11.8	4.0	5.6
28	8.0	4.7	175	97	1016.3	18.8	11.1	1.4	1.9
29	0.2	2.0	305	79	1019.3	19.8	10.0	3.4	4.4
30	2.7	7.3	170	81	1014.6	22.2	13.5	3.5	4.7
Total	50.5							88.2	

July

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	10.8	9.2	210	78	1002.8	20.8	14.1	3.1	4.4
2	0.5	7.8	210	76	1006.0	19.0	11.3	3.2	4.5
3	0.1	6.3	215	77	1015.8	17.9	10.5	2.7	3.7
4	3.0	9.8	250	78	1012.5	18.6	12.3	2.7	4.1
5	0.4	4.5	280	76	1022.7	18.2	9.2	3.1	4.2
6	0.3	7.5	185	88	1019.8	17.3	8.8	1.3	2.0
7	1.1	7.7	220	75	1013.0	18.0	12.2	3.0	4.2
8	3.5	6.6	205	86	1014.4	17.3	10.7	2.2	3.1
9	19.5	4.7	220	91	1012.0	17.5	12.4	1.8	2.4
10	16.0	5.8	50	96	1009.4	18.4	12.0	1.1	1.6
11	2.0	5.1	265	79	1012.4	17.2	10.0	2.7	3.7
12	0.0	2.3	75	77	1013.3	19.1	9.1	2.7	3.5
13	3.2	6.0	85	88	1005.8	18.4	10.4	1.9	2.6
14	7.7	6.5	115	88	994.3	19.2	13.0	2.4	3.3
15	22.9	4.2	220	94	994.3	16.9	11.8	1.7	2.3
16	16.3	6.2	275	82	1002.8	15.9	11.0	2.6	3.7
17	0.4	6.1	235	78	1015.5	18.6	10.9	2.9	3.9
18	14.5	5.5	205	96	1015.6	18.6	13.2	1.3	1.8
19	2.2	6.0	185	83	1013.0	21.0	13.3	2.8	3.8
20	3.2	3.0	210	84	1008.1	18.8	12.1	2.6	3.4
21	10.3	3.2	15	94	1004.1	17.6	12.5	1.7	2.2
22	1.2	4.4	345	85	1014.6	17.6	11.5	2.0	2.6
23	0.1	2.4	245	78	1021.4	17.8	7.5	2.6	3.4
24	0.2	4.8	205	88	1019.1	21.2	12.7	2.4	3.2
25	0.4	4.3	265	92	1019.1	20.3	13.8	1.9	2.5
26	0.2	5.3	255	91	1018.5	22.0	15.5	2.4	3.3
27	0.6	4.7	255	83	1017.6	18.8	13.2	2.6	3.6
28	0.3	4.7	265	85	1018.7	17.7	12.1	2.4	3.3
29	0.1	2.9	280	86	1018.8	17.0	12.2	1.6	2.1
30	6.3	4.1	245	94	1011.6	17.9	13.4	1.4	1.8
31	2.7	4.5	275	89	1010.7	16.2	12.3	1.9	2.6
Total	150.0							70.5	

August

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	0.3	3.2	265	85	1014.5	18.3	12.2	2.1	2.8
2	0.1	2.7	245	86	1019.5	15.5	10.1	1.3	1.6
3	2.2	4.7	275	87	1014.7	16.0	10.6	1.6	2.3
4	7.0	5.5	305	86	1011.0	17.3	10.8	2.6	3.6
5	0.2	4.8	265	82	1012.9	18.6	12.0	2.6	3.5
6	5.4	6.2	225	93	1007.6	16.7	12.5	1.7	2.4
7	0.2	4.4	305	85	1016.7	17.5	12.3	1.9	2.5
8	0.0	3.5	215	84	1019.9	19.0	8.7	2.5	3.3
9	3.6	5.3	235	83	1010.9	18.0	10.4	2.6	3.6
10	0.3	5.9	300	79	1008.9	18.0	10.0	3.0	4.2
11	0.0	4.6	295	85	1015.5	17.3	9.4	2.2	3.1
12	0.4	5.6	315	83	1021.6	16.1	11.8	1.9	2.5
13	0.0	4.5	320	79	1024.4	15.5	10.9	1.7	2.2
14	0.0	3.0	325	81	1023.4	17.3	8.8	1.8	2.4
15	0.0	2.0	325	77	1024.9	23.0	7.4	2.8	3.8
16	6.1	3.6	215	96	1018.9	15.8	8.2	0.9	1.3
17	1.1	4.5	305	83	1011.7	16.9	11.3	1.8	2.4
18	2.1	5.5	230	86	1005.9	16.8	10.6	2.3	3.2
19	1.8	6.0	200	91	1004.2	17.9	11.2	1.5	2.2
20	2.2	8.0	240	82	1004.9	19.2	11.2	2.1	3.2
21	0.7	6.2	215	85	1013.3	19.1	11.5	2.1	2.8
22	5.8	3.6	215	89	1010.6	18.7	10.8	1.9	2.5
23	5.7	5.0	250	88	1000.7	15.3	9.6	1.8	2.6
24	1.4	6.6	295	87	1007.0	16.6	9.2	1.6	2.3
25	0.0	3.1	65	84	1012.0	16.5	4.5	1.9	2.6
26	0.0	3.2	360	80	1009.9	18.4	7.4	2.0	2.6
27	0.0	3.6	310	80	1016.0	17.7	8.4	2.2	3.0
28	0.3	5.8	285	83	1022.4	17.1	8.9	2.0	2.8
29	0.5	5.7	335	75	1022.2	15.5	8.2	1.9	2.7
30	0.0	3.0	95	75	1027.4	17.3	4.3	2.4	3.3
31	0.0	4.0	155	78	1024.3	19.1	4.5	2.4	3.2
Total	47.4							62.9	

September

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	0.0	4.3	150	78	1020.3	19.7	7.7	2.3	3.0
2	0.0	4.9	130	70	1019.6	21.6	8.4	2.9	3.9
3	0.0	6.5	135	76	1018.6	21.1	9.7	2.7	3.7
4	6.5	6.3	140	94	1015.9	17.6	12.6	0.9	1.2
5	7.6	8.8	130	91	1010.5	18.4	13.7	1.5	2.2
6	61.0	7.3	125	98	998.8	16.1	13.6	0.6	0.8
7	19.4	4.6	205	95	994.8	14.9	10.9	1.0	1.4
8	1.9	5.0	170	91	1001.0	18.1	10.9	1.6	2.3
9	10.1	4.8	225	92	1012.2	17.6	10.9	1.6	2.2
10	9.2	4.8	205	92	1008.6	18.6	14.1	1.4	1.9
11	5.9	4.4	280	91	1011.8	17.3	10.6	1.6	2.2
12	0.7	4.9	275	87	1023.9	15.9	9.1	1.4	2.0
13	11.0	9.8	225	96	1017.7	18.6	12.9	0.9	1.2
14	5.6	8.0	265	82	1013.0	15.9	9.6	1.4	2.2
15	0.4	7.5	285	86	1012.2	15.2	9.1	1.5	2.2
16	0.4	4.7	295	84	1015.7	16.0	8.6	1.8	2.4
17	0.3	2.8	295	87	1020.9	14.3	4.5	1.3	1.9
18	4.7	5.9	210	97	1017.4	13.3	4.1	0.5	0.8
19	1.5	6.5	220	93	1008.5	16.7	12.8	1.1	1.5
20	0.3	5.7	225	87	1009.7	19.3	12.8	1.7	2.3
21	0.1	7.4	160	88	1013.3	18.1	12.1	1.4	1.9
22	5.6	5.7	200	92	1008.2	19.8	11.0	1.5	2.0
23	2.1	5.1	315	93	1005.5	15.2	11.0	1.1	1.5
24	0.0	5.0	350	76	1016.2	12.7	7.8	1.3	1.8
25	0.0	2.9	350	73	1022.4	10.7	7.0	1.0	1.4
26	0.0	2.5	65	77	1019.1	12.1	3.5	1.1	1.5
27	0.0	4.5	140	81	1015.1	15.2	3.3	1.5	2.2
28	9.9	5.0	155	96	1012.1	14.5	7.2	0.6	0.9
29	0.2	2.3	260	89	1012.6	16.2	5.8	1.2	1.7
30	0.1	5.7	155	91	1007.5	14.8	5.2	1.1	1.5
Total	164.5							41.4	

October

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	2.2	8.0	210	84	993.2	14.2	7.8	1.1	1.6
2	5.1	7.0	175	90	995.2	14.6	7.7	1.1	1.5
3	0.4	4.2	210	91	992.0	16.0	7.2	1.1	1.5
4	2.2	7.6	195	92	992.4	14.6	5.9	0.8	1.2
5	0.1	7.8	190	79	991.7	14.5	9.0	1.5	2.0
6	0.1	5.8	205	85	999.7	15.0	4.4	1.2	1.6
7	0.2	8.6	150	83	1010.2	16.9	8.7	1.4	1.9
8	0.0	9.1	105	87	1010.0	19.4	13.7	1.4	1.8
9	0.0	10.1	80	90	1013.6	15.0	12.3	0.9	1.2
10	0.0	7.0	70	89	1015.6	13.2	10.7	0.7	0.9
11	0.3	5.5	70	87	1021.5	16.8	8.3	1.1	1.5
12	0.3	2.3	65	95	1023.1	14.5	3.3	0.7	1.0
13	0.2	1.2	45	98	1023.9	9.5	4.8	0.5	0.6
14	0.0	1.5	340	88	1024.6	10.9	8.5	0.6	0.8
15	0.1	3.8	315	87	1023.5	14.2	7.8	0.7	0.9
16	0.1	1.9	320	86	1025.6	13.2	1.1	0.6	1.0
17	0.8	3.4	215	91	1025.1	13.2	0.1	0.6	0.8
18	0.8	5.3	265	88	1019.6	12.6	9.0	0.7	0.9
19	1.0	4.8	280	88	1016.7	10.8	3.1	0.6	0.9
20	0.0	3.5	285	83	1023.7	9.7	0.0	0.6	1.0
21	0.0	4.3	225	88	1021.3	11.7	1.6	0.7	0.9
22	6.4	6.0	205	95	1011.3	10.7	5.0	0.3	0.5
23	1.3	3.2	315	92	1006.5	11.5	2.6	0.5	0.8
24	0.0	2.3	320	89	1020.9	10.3	-1.4	0.5	0.8
25	1.3	5.6	160	84	1024.4	9.8	-3.7	0.5	0.8
26	11.1	9.5	205	95	1010.8	16.3	9.5	0.6	0.8
27	2.9	7.5	210	90	1009.0	12.2	7.5	0.6	0.8
28	2.6	9.5	175	93	1003.1	14.2	6.4	0.4	0.7
29	18.6	6.4	205	94	987.5	13.6	5.8	0.6	0.7
30	0.2	3.7	180	93	991.0	12.8	2.5	0.4	0.7
31	1.1	3.0	15	93	1003.5	11.2	5.0	0.4	0.5
Total	59.4							23.2	

November

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	6.3	6.5	200	93	1008.9	13.0	0.9	0.4	0.5
2	11.8	9.8	225	91	1001.2	12.5	9.3	0.5	0.7
3	8.0	5.0	220	96	1006.9	14.3	7.5	0.4	0.5
4	19.2	10.1	235	97	1009.4	14.8	11.7	0.3	0.5
5	2.4	5.6	230	93	1017.4	10.6	7.8	0.4	0.5
6	2.9	3.3	285	93	1017.4	7.5	2.6	0.2	0.4
7	11.5	8.0	225	93	1004.1	6.9	0.7	0.2	0.3
8	4.6	5.3	190	97	966.4	8.0	2.6	0.0	0.1
9	8.6	7.3	25	87	987.4	8.4	1.9	0.4	0.6
10	1.0	4.7	180	87	999.2	7.5	-2.3	0.2	0.3
11	11.3	14.0	245	83	977.6	10.2	7.0	0.4	0.6
12	0.3	7.6	240	84	988.4	9.1	4.6	0.5	0.6
13	1.8	5.1	215	95	988.9	6.4	2.7	0.3	0.4
14	0.0	1.3	215	96	995.9	3.5	-1.6	0.2	0.2
15	0.5	2.5	220	90	1011.2	8.2	-2.0	0.2	0.3
16	4.1	9.0	135	89	1010.6	8.9	1.8	0.3	0.5
17	7.4	12.3	140	88	991.5	9.9	6.5	0.4	0.4
18	4.0	8.7	200	92	995.1	9.9	4.3	0.2	0.3
19	0.2	3.0	135	93	1007.8	9.7	0.6	0.1	0.2
20	0.0	4.8	55	92	1015.2	8.6	4.3	0.3	0.4
21	0.0	3.7	15	89	1018.1	6.0	1.4	0.1	0.1
22	0.1	3.2	330	95	1015.6	7.3	0.3	0.1	0.2
23	0.0	2.7	330	95	1016.9	7.5	2.1	0.1	0.2
24	0.0	3.2	335	94	1015.2	5.4	-0.6	0.0	0.1
25	1.8	4.6	320	89	1016.7	5.0	-1.3	0.0	0.0
26	0.0	4.6	300	93	1011.5	3.5	-1.9	0.0	0.1
27	0.0	4.2	360	87	1010.0	2.3	-2.2	0.2	0.3
28	0.0	2.4	335	94	1008.1	0.0	-5.1	0.0	0.0
29	0.0	2.7	10	95	1015.7	2.2	-4.6	0.0	0.1
30	17.4	5.3	45	90	1019.7	1.4	-2.9	0.2	0.3
Total	125.2							6.5	

December

Day	Rainfall (mm)	Wind Speed (Knots)	Wind Direction (Degrees from North)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)	Potential Evapotranspiration (Penman)	Evaporation (mm)
1	0.5	4.4	5	83	1018.1	-0.7	-5.0	0.1	0.2
2	0.2	3.8	345	90	1017.6	0.3	-9.9	0.0	0.1
3	1.6	3.6	205	91	1007.8	0.4	-8.9	0.1	0.2
4	0.0	1.6	300	94	1003.9	1.1	-6.3	0.0	0.0
5	0.0	1.4	220	93	1007.7	-0.3	-8.8	0.0	0.0
6	3.6	2.4	195	95	1002.5	-0.2	-3.1	0.0	0.0
7	0.0	2.4	335	96	1007.9	-0.2	-6.0	0.2	0.2
8	0.0	1.9	315	98	1021.4	-1.0	-9.3	0.0	0.0
9	0.0	1.9	220	98	1033.4	3.9	-8.6	0.1	0.1
10	0.4	3.3	265	98	1033.9	5.3	2.8	0.0	0.1
11	0.7	2.0	270	96	1029.5	5.3	-1.9	0.1	0.2
12	0.0	3.5	90	90	1025.8	5.6	-0.7	0.0	0.0
13	0.0	2.3	85	91	1029.1	3.9	-1.5	0.2	0.3
14	0.0	2.1	325	90	1038.1	4.4	0.2	0.0	0.1
15	0.1	3.1	295	95	1040.7	5.4	1.7	0.2	0.3
16	2.4	7.3	275	90	1017.3	7.6	-2.4	0.2	0.3
17	1.2	5.3	275	98	1001.9	-0.2	-2.7	0.0	0.0
18	0.0	2.6	290	97	992.9	-2.3	-9.8	0.0	0.0
19	0.0	1.8	45	95	996.5	0.0	-10.0	0.0	0.0
20	0.0	1.6	335	96	1002.6	-5.0	-10.9	0.0	0.0
21	0.0	1.2	330	96	1006.1	-5.7	-13.3	0.0	0.0
22	0.0	1.7	340	97	1012.5	-2.6	-8.3	0.0	0.0
23	0.0	2.1	325	96	1020.1	-1.8	-7.1	0.0	0.0
24	0.0	1.8	305	95	1026.4	-3.5	-11.0	0.0	0.0
25	0.0	0.8	130	92	1029.5	-0.4	-13.7	0.0	0.0
26	10.3	8.2	155	94	1018.3	5.1	-6.4	0.2	0.3
27	12.9	10.5	165	97	1003.0	7.7	5.4	0.3	0.5
28	0.6	5.2	165	98	1005.8	10.6	6.4	0.1	0.2
29	2.6	4.8	165	98	1014.6	8.9	6.6	0.2	0.3
30	0.1	3.8	70	96	1023.7	8.3	5.6	0.2	0.3
31	0.0	1.0	55	95	1027.1	7.2	5.1	0.3	0.4
Total	37.2							2.7	

Effective Rainfall Calculation 2010 (Actual Rainfall minus Potential Evaporation)

Month	Rainfall (m)	Potential Evapotranspiration (m)	Effective Rainfall (m)
Jan	0.0450	0.0043	0.0407
Feb	0.0419	0.0108	0.0311
Mar	0.0820	0.0306	0.0514
Apr	0.0538	0.0546	-0.0008
May	0.0395	0.0742	-0.0347
Jun	0.0505	0.0882	-0.0377
Jul	0.1500	0.0705	0.0795
Aug	0.0474	0.0629	-0.0155
Sep	0.1645	0.0414	0.1231
Oct	0.0594	0.0232	0.0362
Nov	0.1252	0.0065	0.1187
Dec	0.0372	0.0027	0.0345
Total	0.8964	0.4699	0.4265

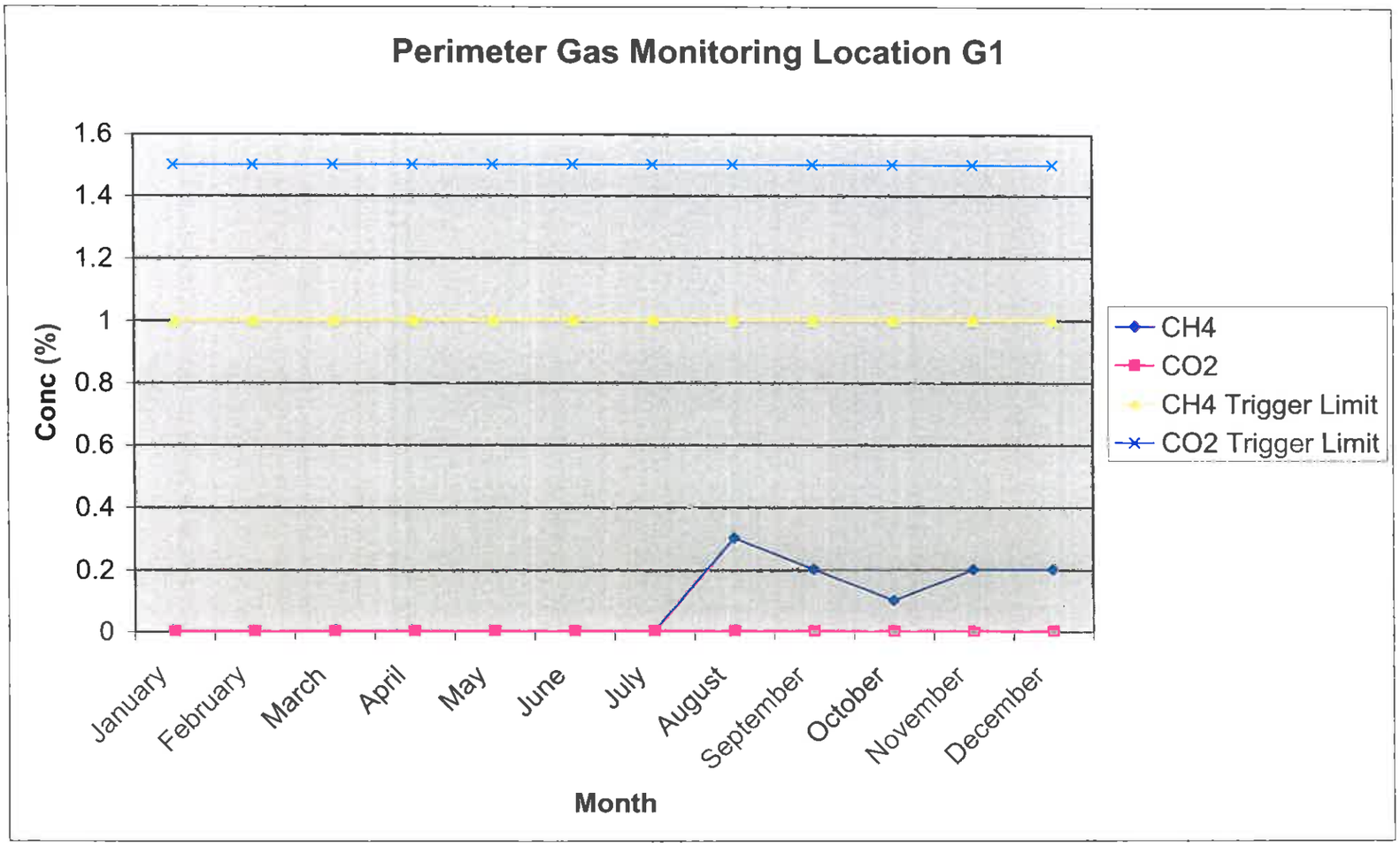
Effective Rainfall Calculation 2010 (Actual Rainfall minus Potential Evaporation)

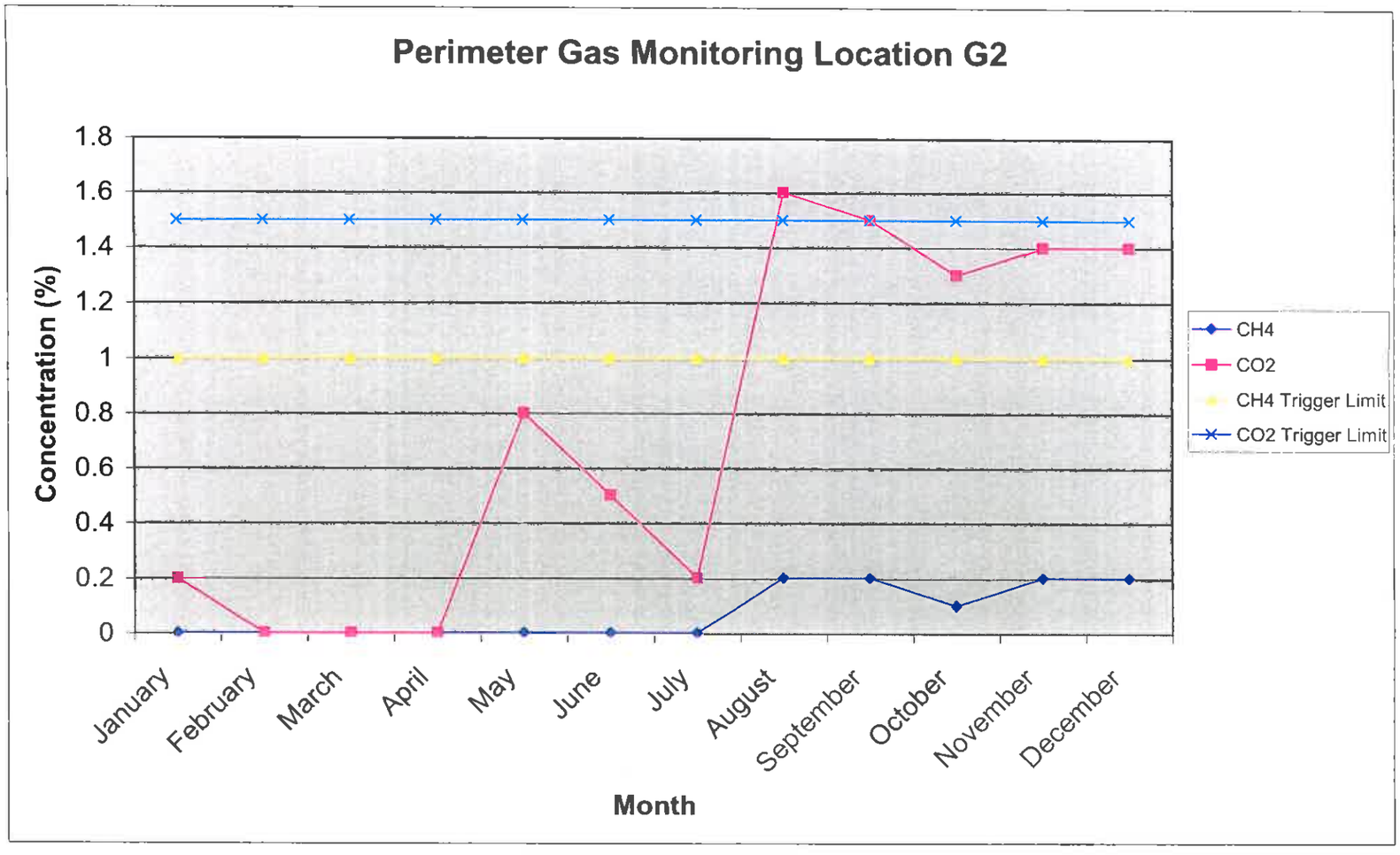
Month	Rainfall (mm)	Potential Evapotranspiration (mm)	Effective Rainfall (mm)
Jan	45.0	4.3	40.7
Feb	41.9	10.8	31.1
Mar	82.0	30.6	51.4
Apr	53.8	54.6	-0.8
May	39.5	74.2	-34.7
Jun	50.5	88.2	-37.7
Jul	150.0	70.5	79.5
Aug	47.4	62.9	-15.5
Sep	164.5	41.4	123.1
Oct	59.4	23.2	36.2
Nov	125.2	6.5	118.7
Dec	37.2	2.7	34.5
Total	896.4	469.9	426.5

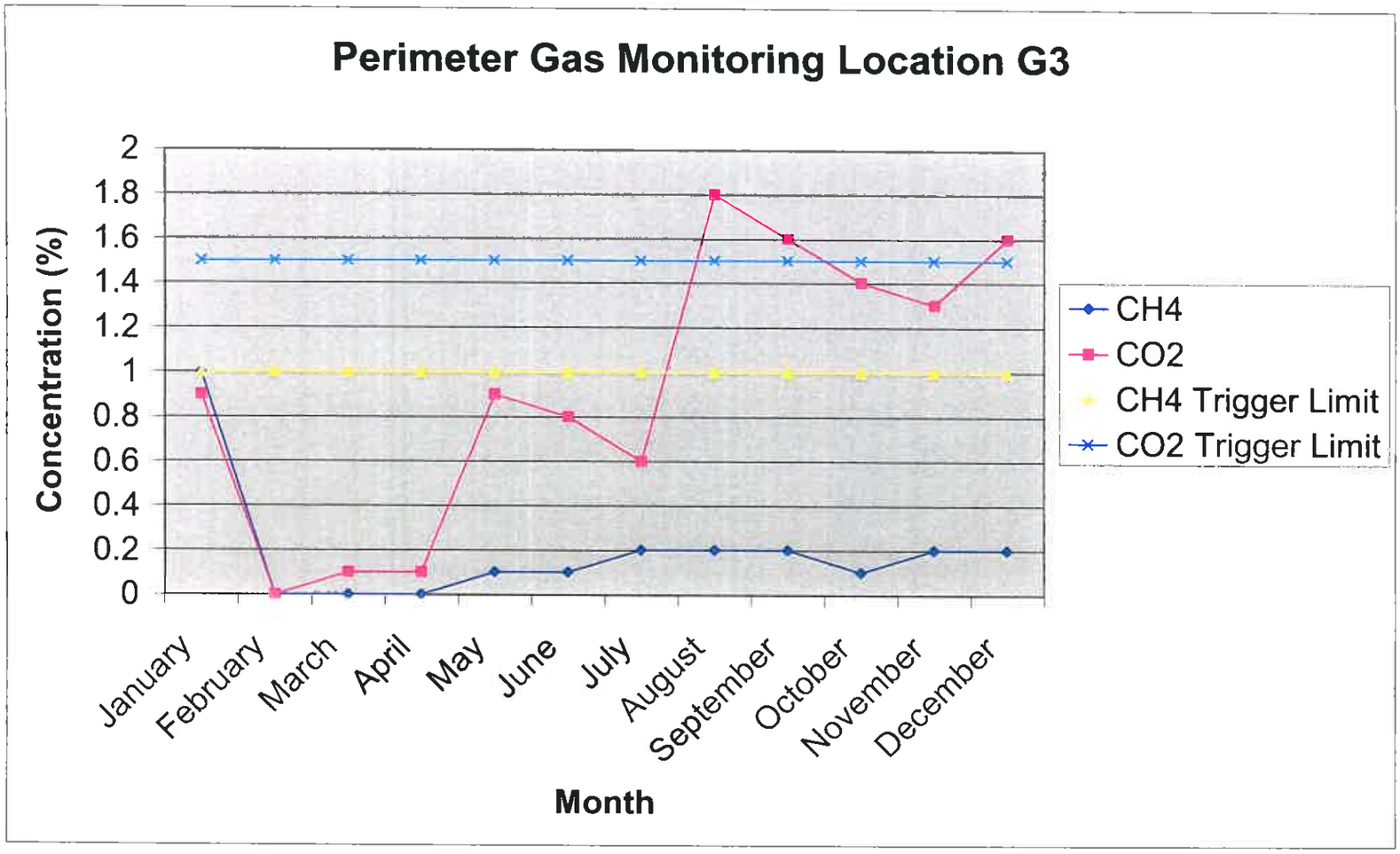
Note: The effective rainfall values for April, May, June and August are negative values, assumed to be 0

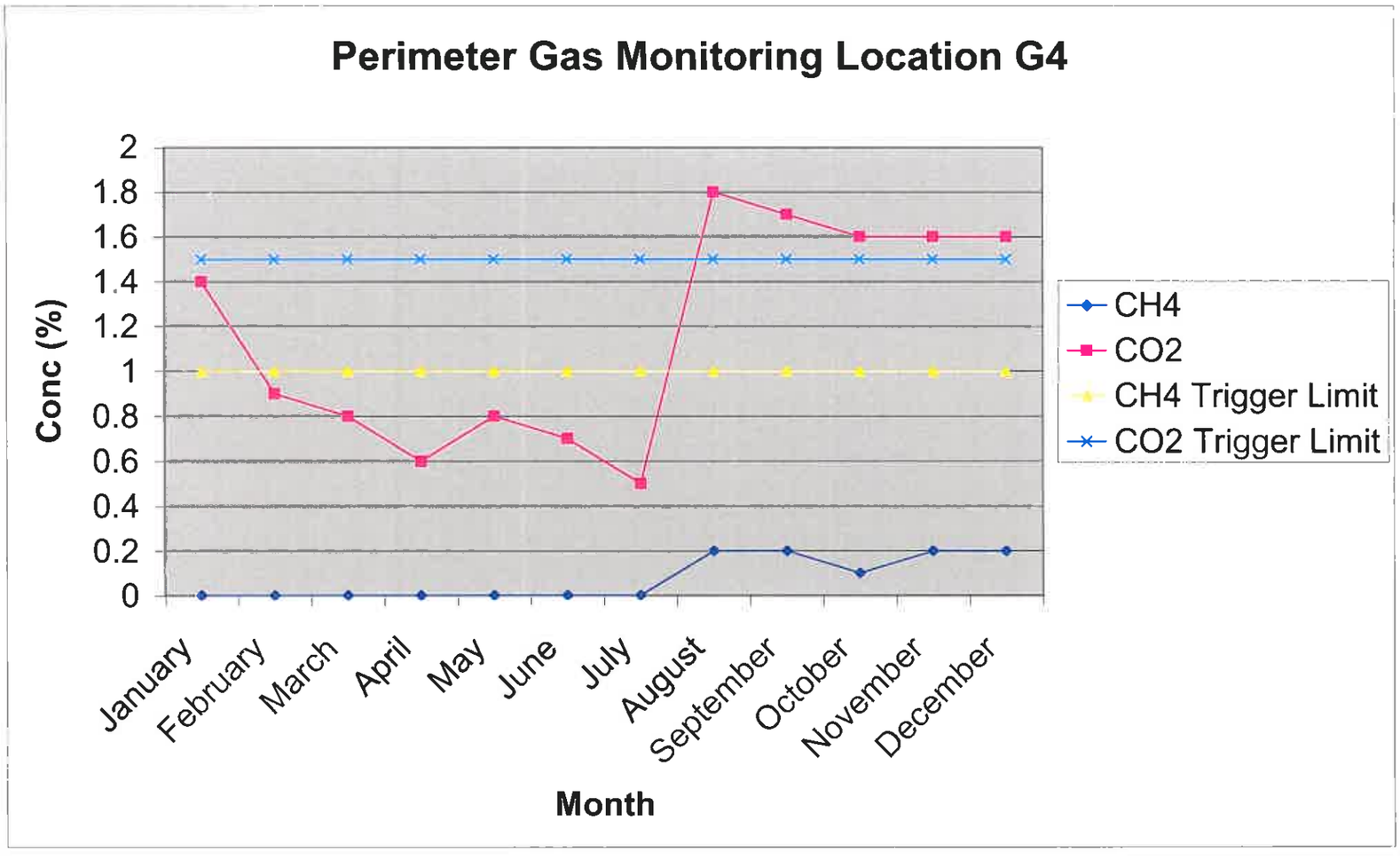
APPENDIX 2

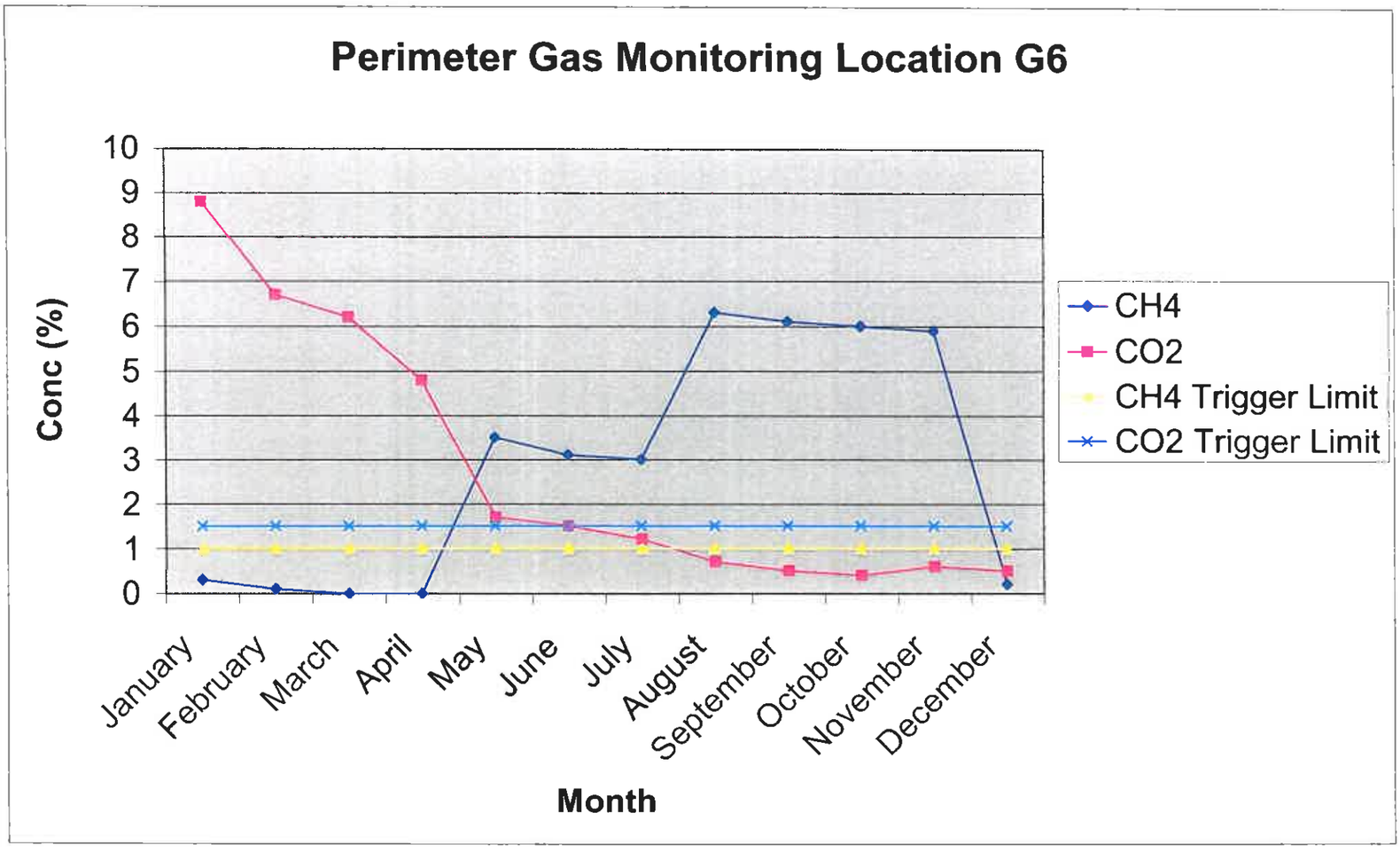
Perimeter Gas Well Graphs

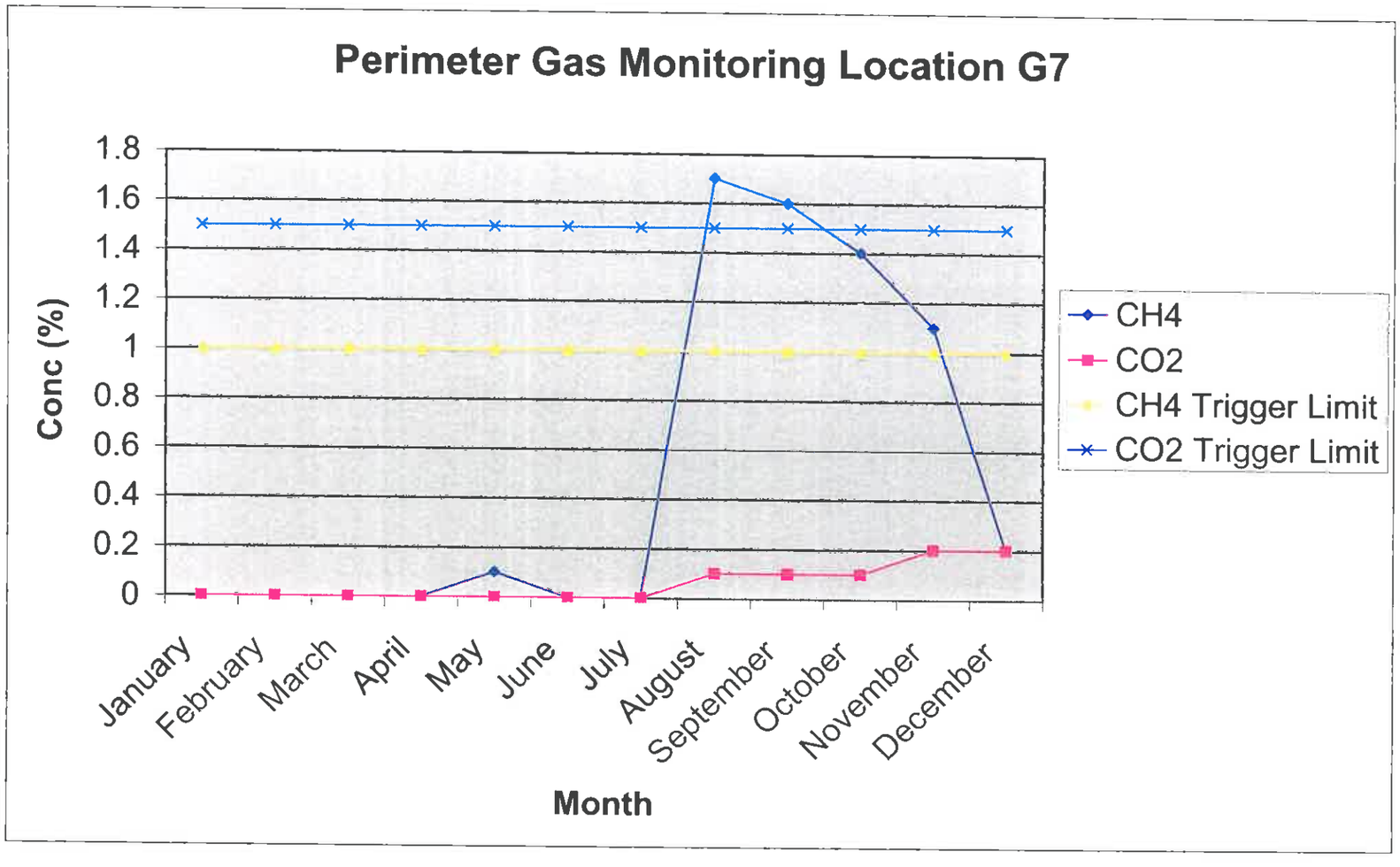

Perimeter Gas Monitoring Location G1
Conc (%)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

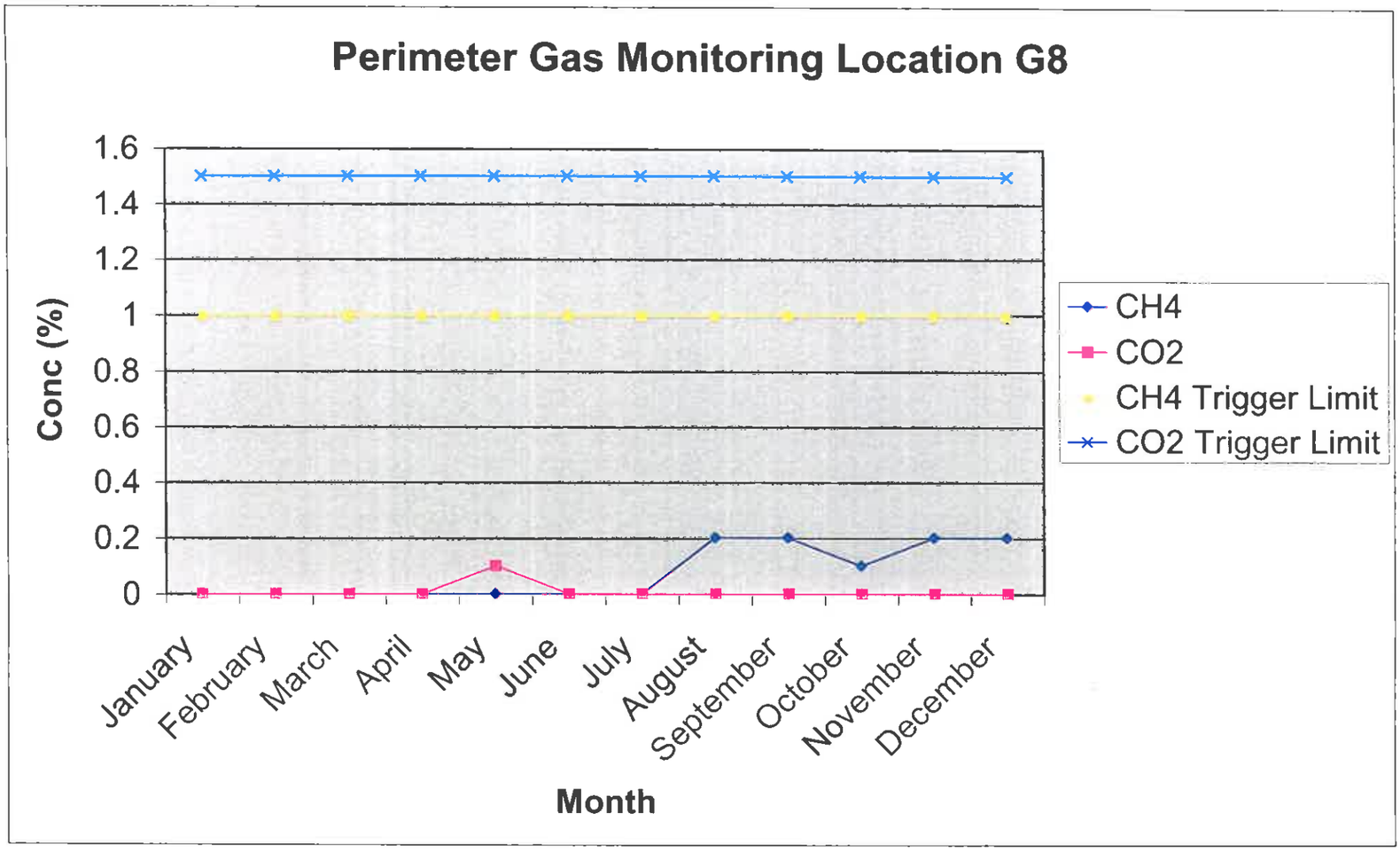

Perimeter Gas Monitoring Location G2
Concentration (%)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

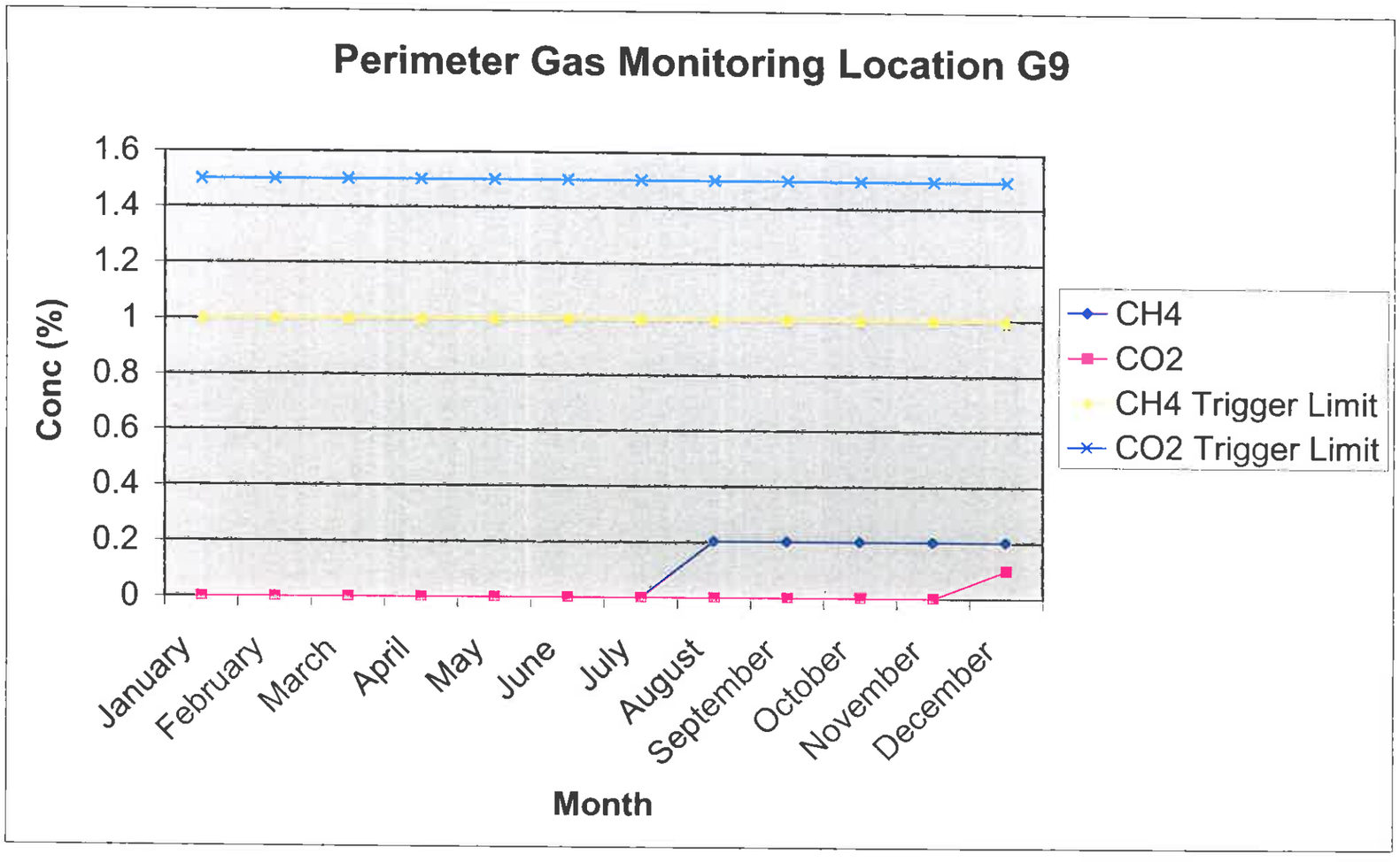

Perimeter Gas Monitoring Location G3
Concentration (%)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

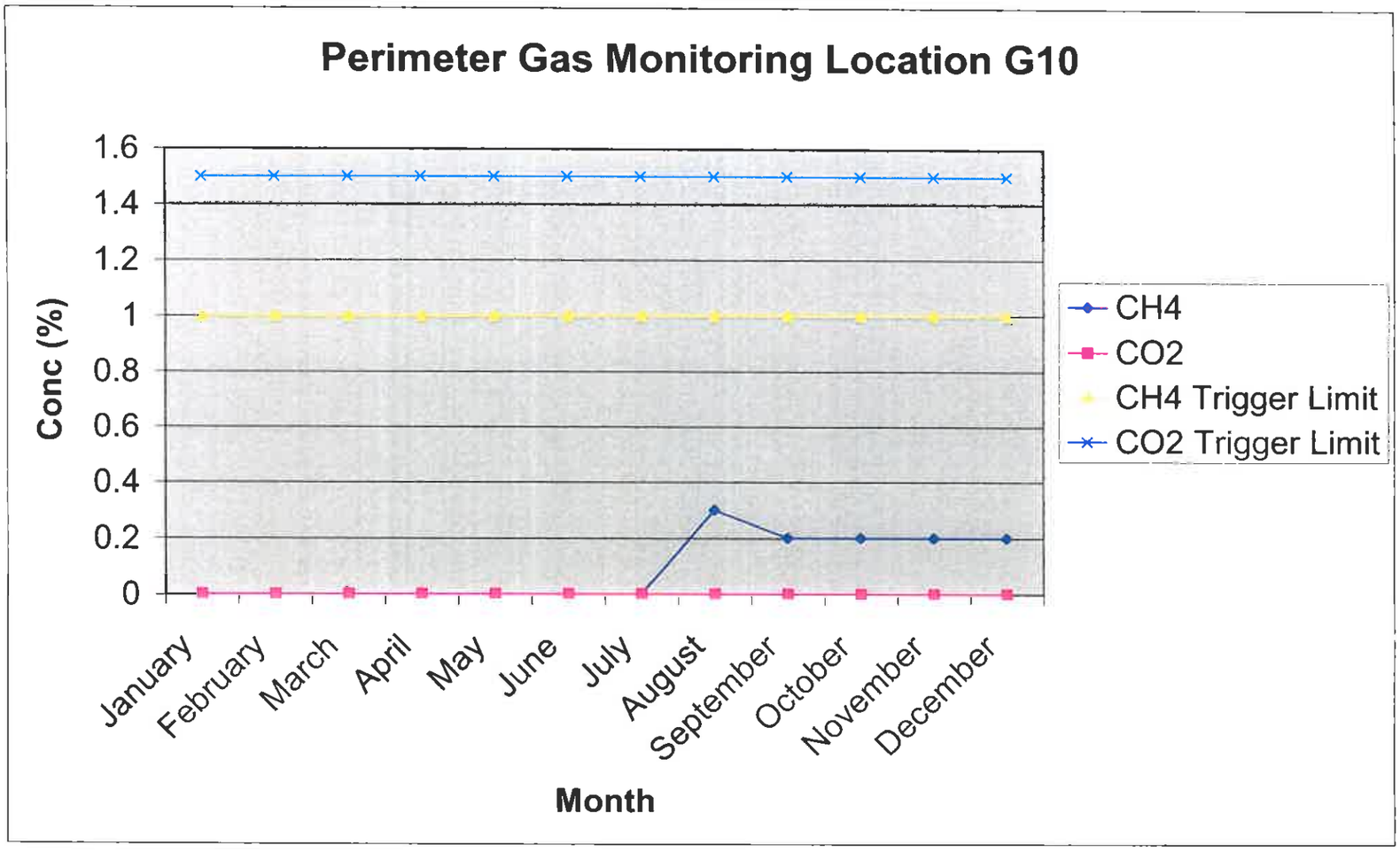

Perimeter Gas Monitoring Location G4
Conc (%)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

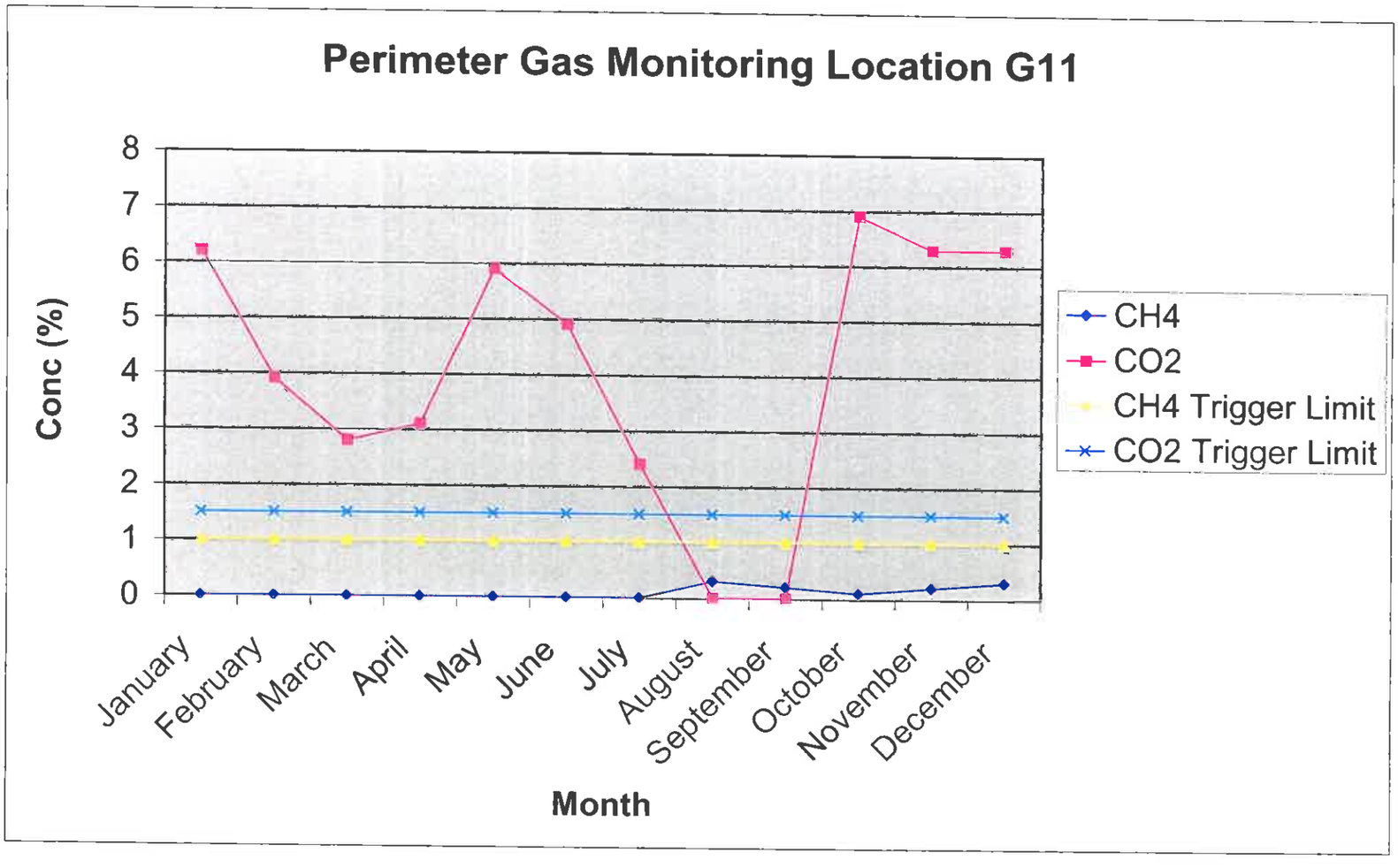

Perimeter Gas Monitoring Location G6
Conc (%)
10
9
8
7
6
5
4
3
2
1
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

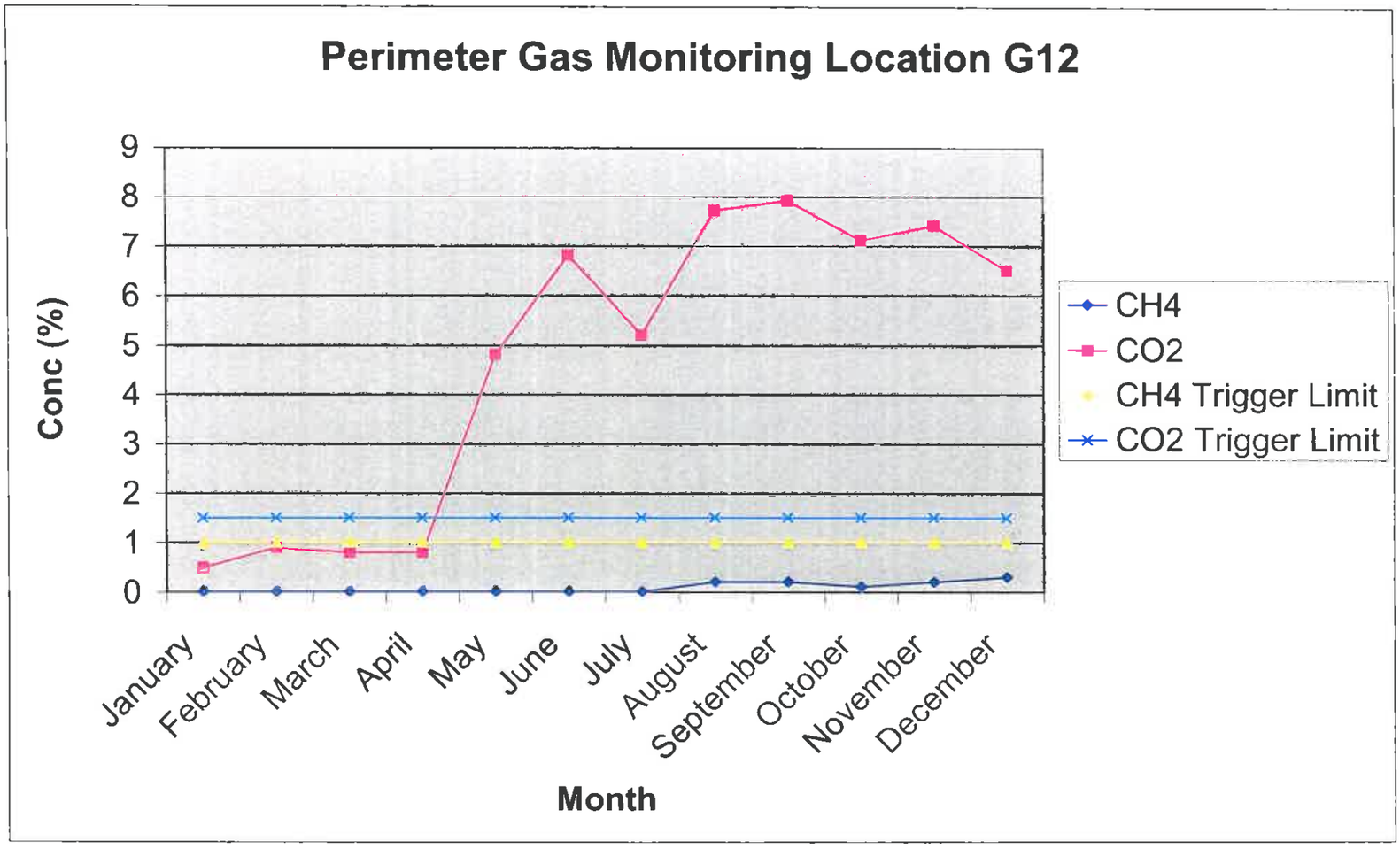

Perimeter Gas Monitoring Location G7
Conc (%)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

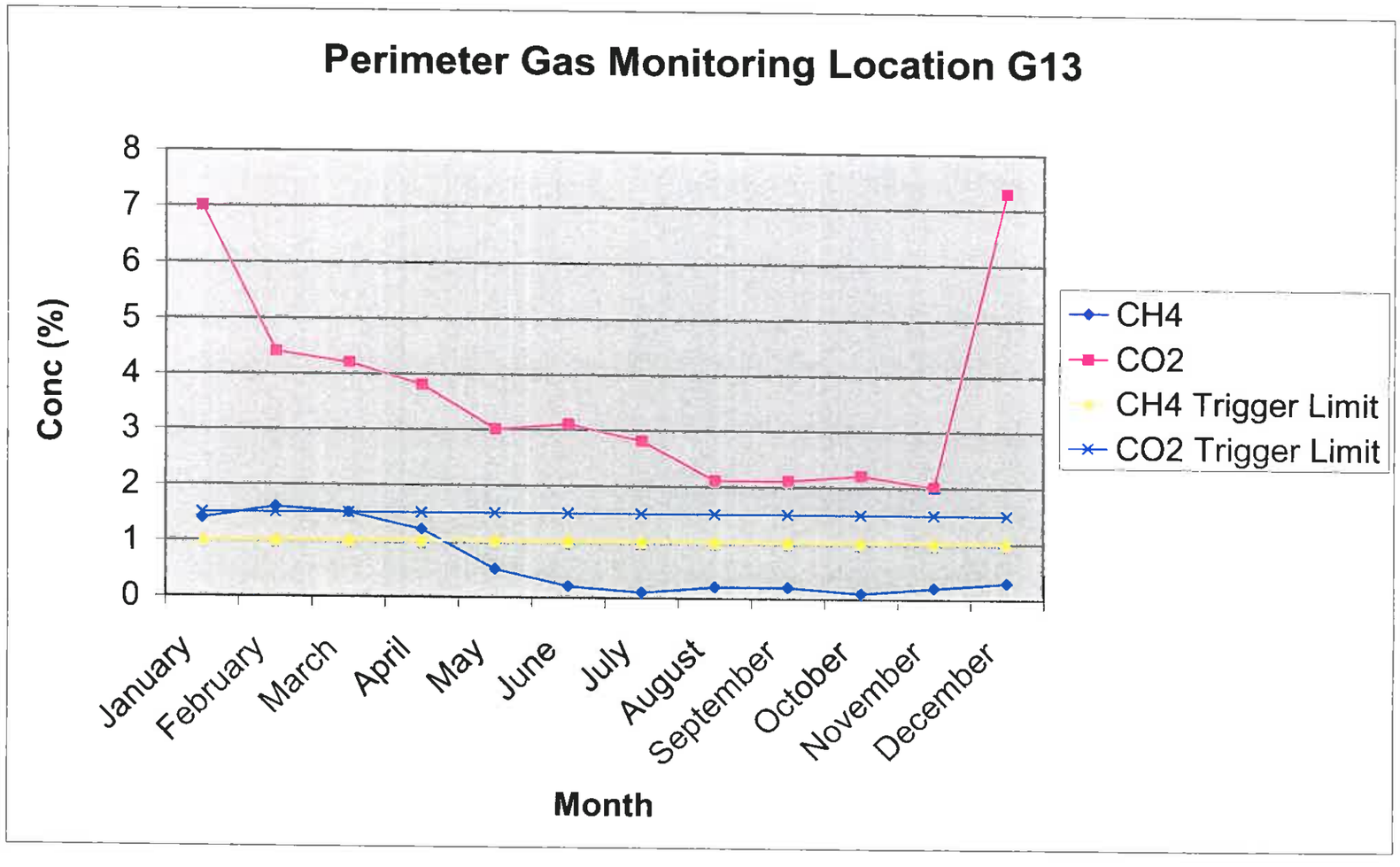

Perimeter Gas Monitoring Location G8
Conc (%)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

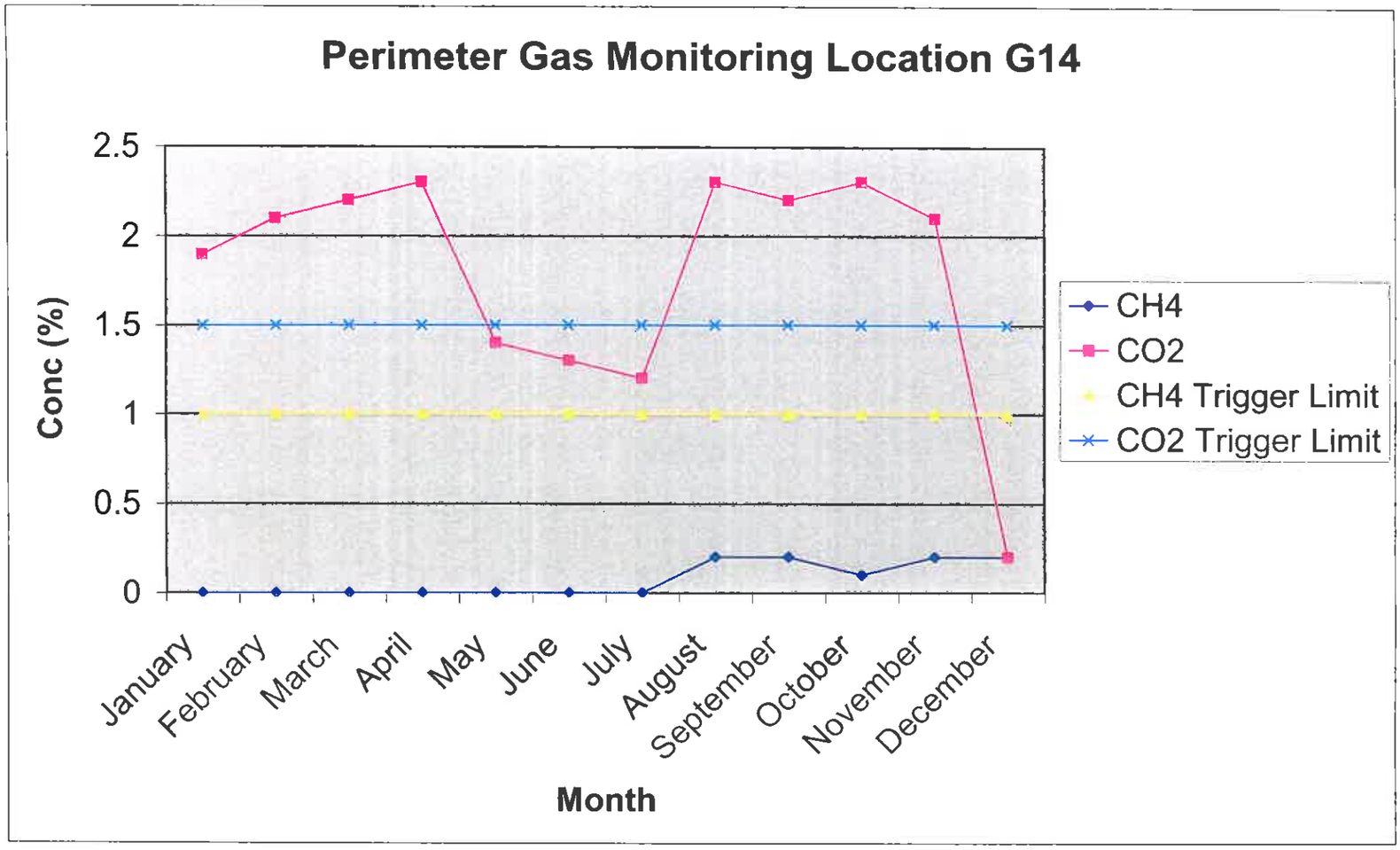

Perimeter Gas Monitoring Location G9
Conc (%)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

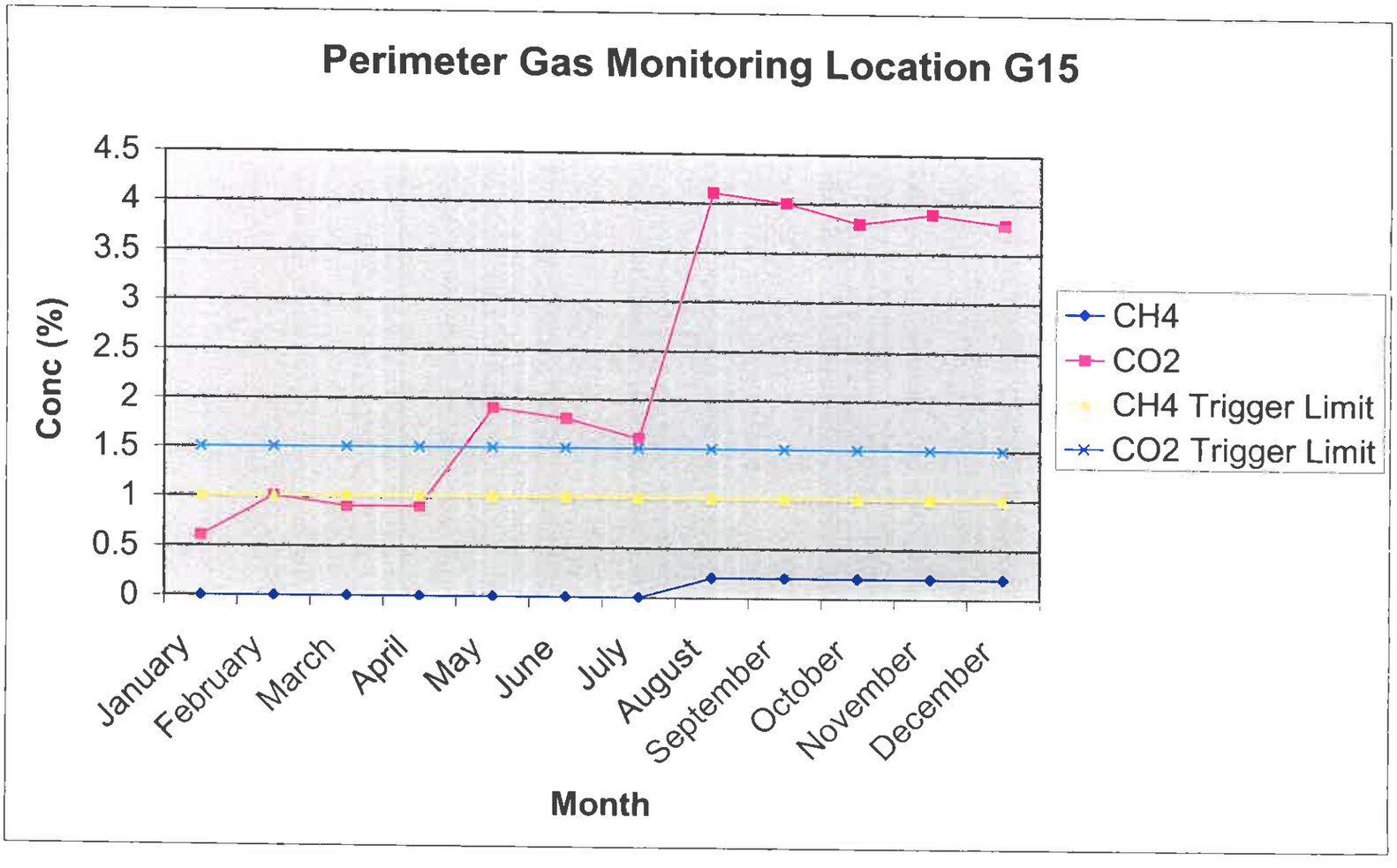

Perimeter Gas Monitoring Location G10
Conc (%)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

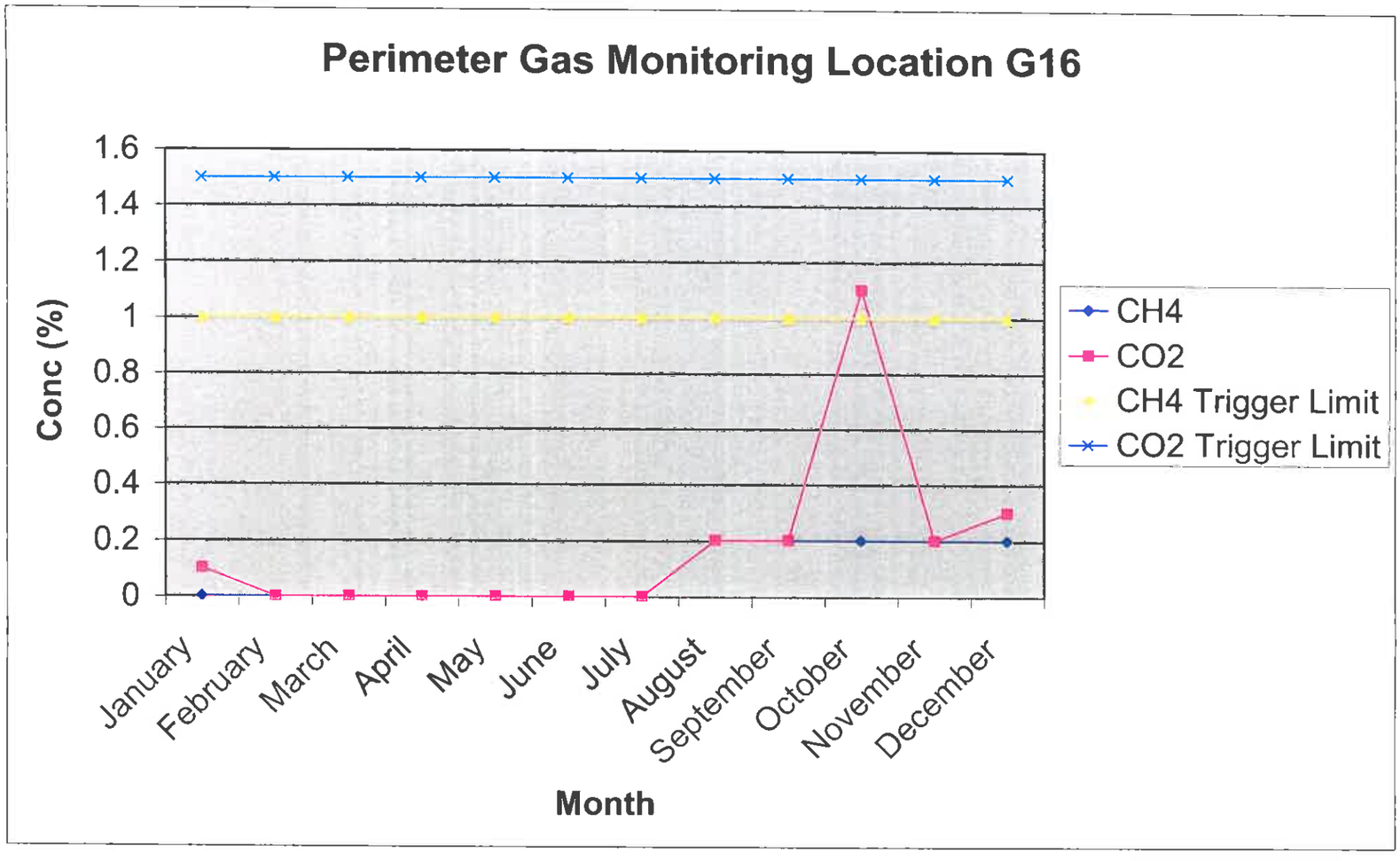

Perimeter Gas Monitoring Location G11
Conc (%)
8
7
6
5
4
3
2
1
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

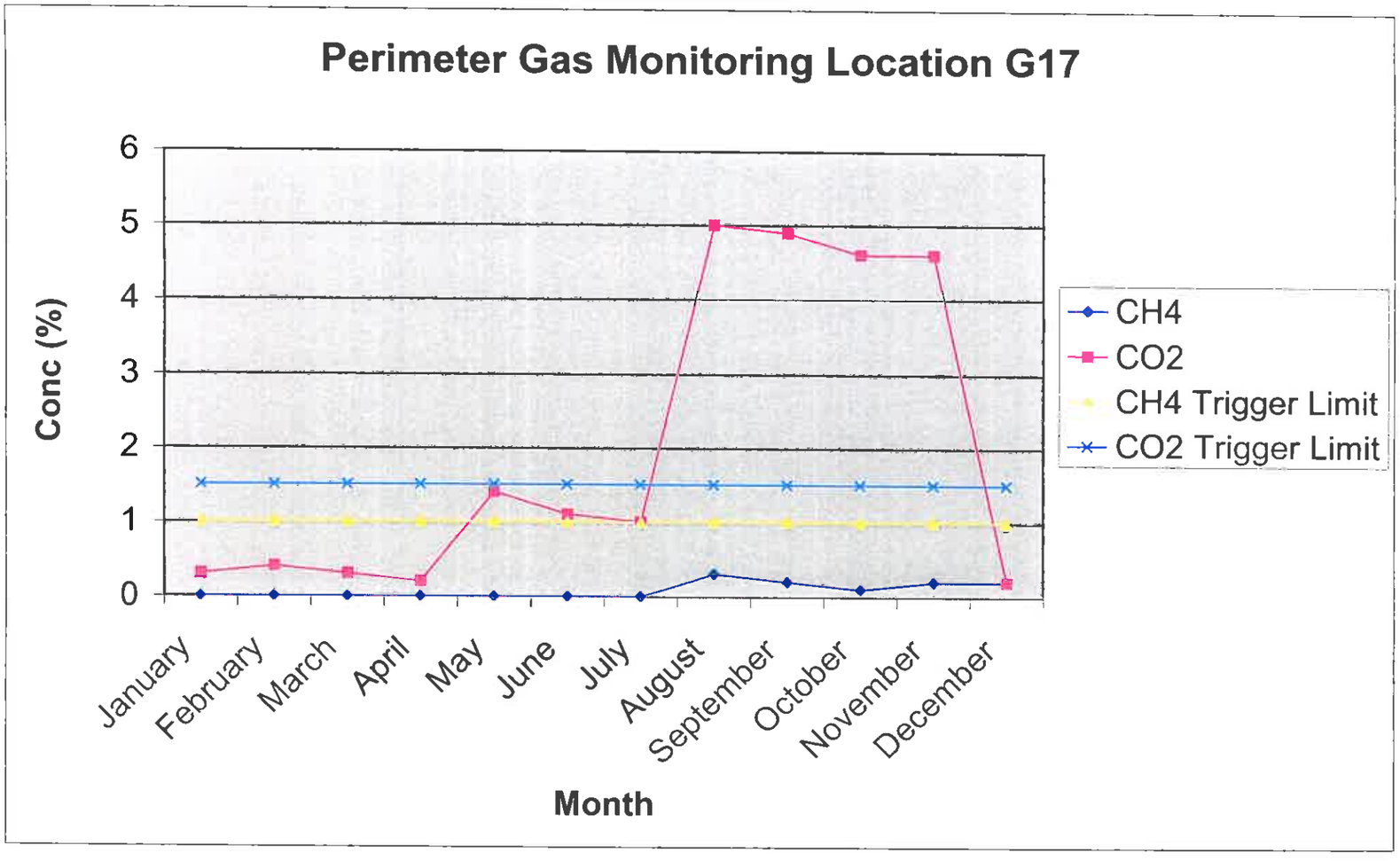

Perimeter Gas Monitoring Location G12
Conc (%)
9
8
7
6
5
4
3
2
1
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

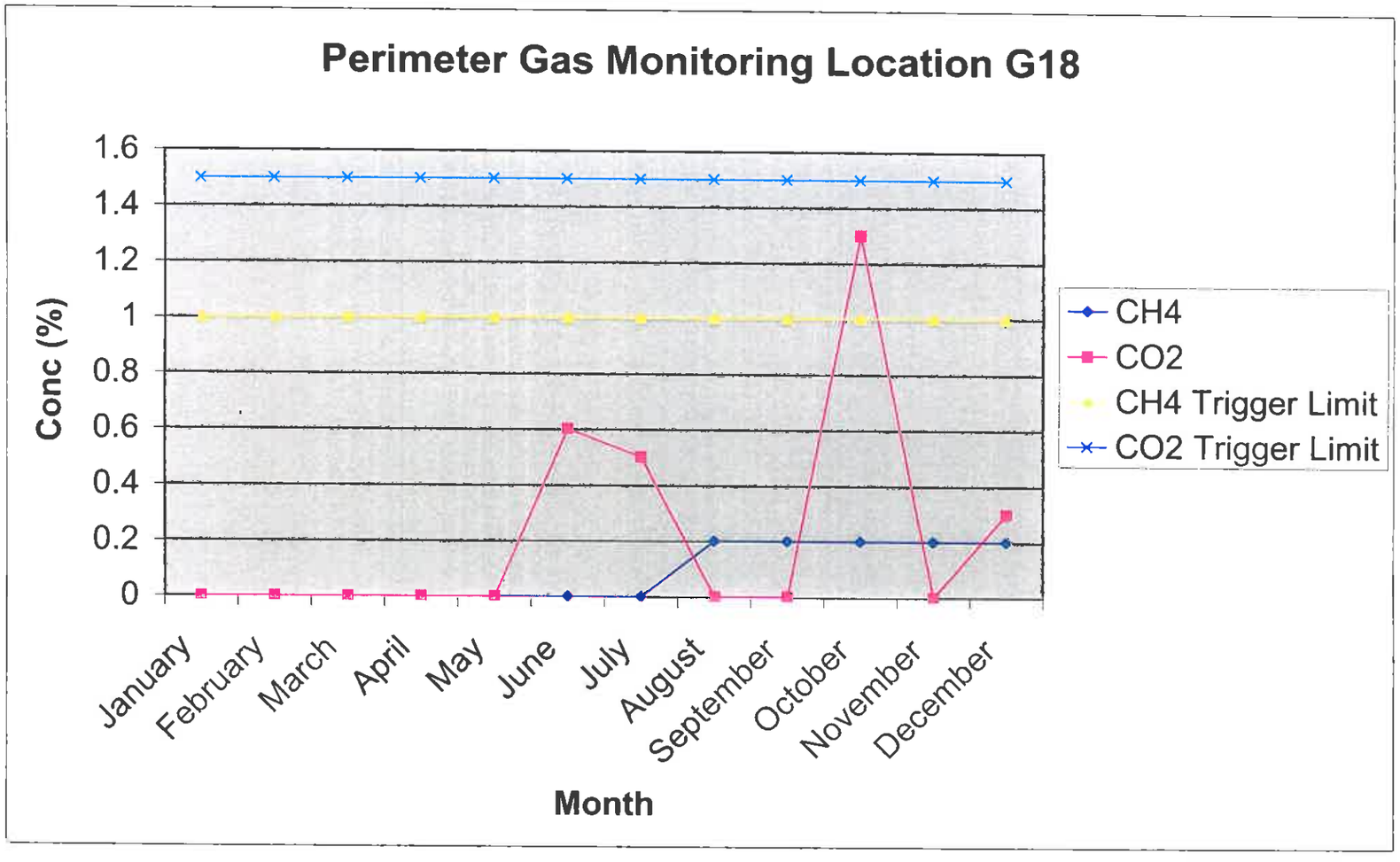

Perimeter Gas Monitoring Location G13
Conc (%)
0
1
2
3
4
5
6
7
8
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

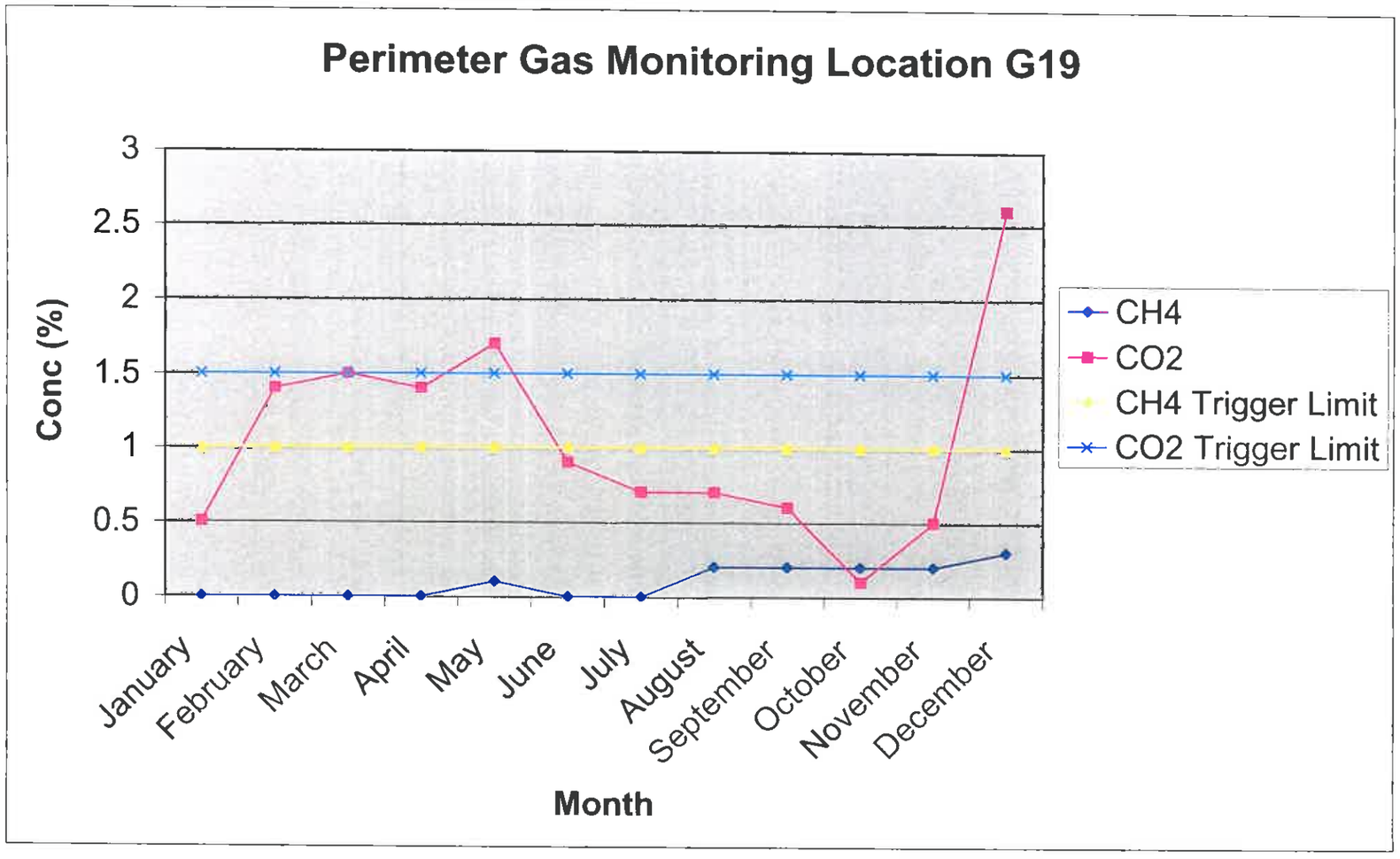

Perimeter Gas Monitoring Location G14
Conc (%)
2.5
2
1.5
1
0.5
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit


Perimeter Gas Monitoring Location G15
Conc (%)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit


Perimeter Gas Monitoring Location G16
Conc (%)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

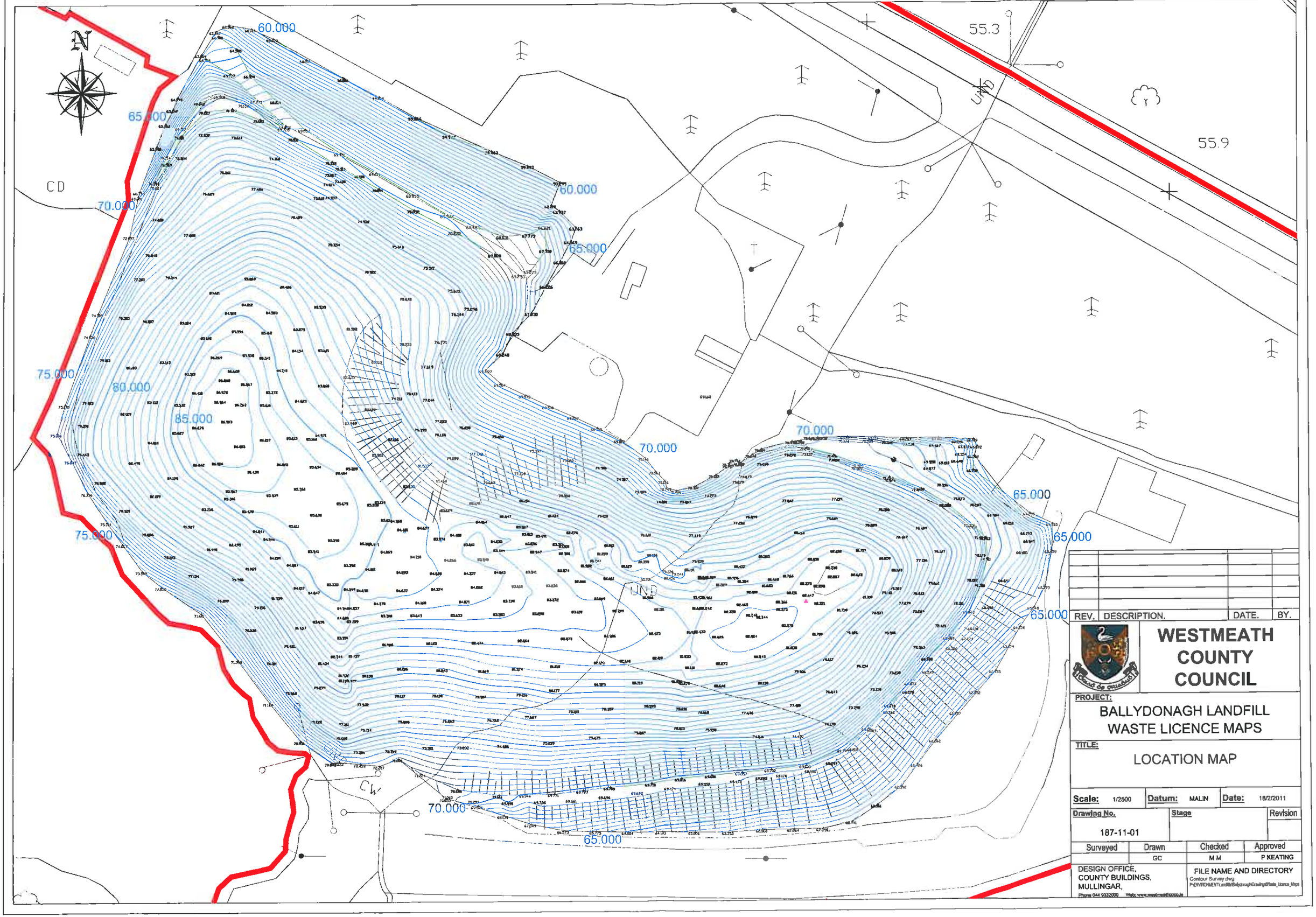

Perimeter Gas Monitoring Location G17
Conc (%)
0
1
2
3
4
5
6
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit


Perimeter Gas Monitoring Location G18
Conc (%)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit


Perimeter Gas Monitoring Location G19
Conc (%)
3
2.5
2
1.5
1
0.5
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
CH4
CO2
CH4 Trigger Limit
CO2 Trigger Limit

APPENDIX 3

Detailed Site Survey



REV.	DESCRIPTION.	DATE.	BY.

WESTMEATH COUNTY COUNCIL

PROJECT:
BALLYDONAGH LANDFILL
WASTE LICENCE MAPS

TITLE:
LOCATION MAP

Scale: 1/2500	Datum: MALIN	Date: 18/2/2011	
Drawing No. 187-11-01	Stage		Revision

Surveyed	Drawn	Checked	Approved
	GC	M M	P KEATING

DESIGN OFFICE,
COUNTY BUILDINGS,
MULLINGAR,
Phone 044 9332000 Web: www.westmeathcoco.ie

FILE NAME AND DIRECTORY
Contour Survey.dwg
P:\ENVIRONMENT\Landfill\Ballydonagh\Drawings\Waste_Licence_Maps

| PRTR# : W0028 | Facility Name : Ballydonagh Landfill | Filename : W0028_2010(1).xls | Return Year : 2010 | 19/04/2011 15:50

Environmental Protection Agency

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.11

REFERENCE YEAR	2010

1. FACILITY IDENTIFICATION

Parent Company Name	Westmeath County Council
Facility Name	Ballydonagh Landfill
PRTR Identification Number	W0028
Licence Number	W0028-03

Waste or IPPC Classes of Activity

No.	class_name
3.5	Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
3.1	Deposit on, in or under land (including landfill).
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.3	Recycling or reclamation of metals and metal compounds.
4.4	Recycling or reclamation of other inorganic materials.

Address 1	Ballydonagh
Address 2	Dublin Road
Address 3	Athlone
Address 4	Co. Westmeath
Country	Ireland
Coordinates of Location	-6.22878 53.3496
River Basin District	IEEA
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Geraldine Glennon
AER Returns Contact Email Address	gglennon@westmeathcoco.ie
AER Returns Contact Position	Environment Technician - Environment Section
AER Returns Contact Telephone Number	044 9332110
AER Returns Contact Mobile Phone Number	087 2918748
AER Returns Contact Fax Number	044 9342330
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	0
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(d)	Landfills
5(c)	Installations for the disposal of non-hazardous waste
5(d)	Landfills
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	
Have you been granted an exemption ?	
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4.1 RELEASES TO AIR Link to previous years emissions data | PRTR# : W0028 | Facility Name : Ballydonagh Landfill | Filename : W0028_2010(1).xls | Return Year : 2010 | 19/04/2011 15:50

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01	**Methane (CH4)**	C	PER	Calculated using gas sim	0.0	13112.0	0.0	13112.0
03	Carbon dioxide (CO2)	C	PER	Calculated using gas sim	0.0	225350.0	0.0	225350.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Ballydonagh Landfill

Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used: Method Code	Method Used: Designation or Description	Facility Total Capacity m3 per hour	
Total estimated methane generation (as per site model)	1920000.0	C	PER	Calculated using gas sim	N/A	
Methane flared	1906888.0	C	PER	Calculated using average flo	1000.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	13112.0	C	OTH	Methane generated minus m	N/A	

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

Please enter all quantities on this sheet in Tonnes

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	20 03 07	No	89.08	bulky waste	D13	M	Weighed	Onsite in Ireland	Oxigen Environmental Ltd. ,W0208-01	Merrywell Industrial Estate,Ballymount Road Lower,Dublin 22,Dublin 22,Ireland		
Within the Country	20 03 01	No	184.06	mixed municipal waste	D1	M	Weighed	Onsite in Ireland	Derryclure Landfill,W0029-02	Derryclure,Tullamore,Offaly, Co. Offaly,Ireland		
Within the Country	20 03 01	No	865.32	mixed municipal waste	D1	M	Weighed	Onsite in Ireland	Oxigen Environmental Ltd.,W0152-03	Robinhood road,Clondalkin,Dublin 22,Dublin 22,Ireland		
Within the Country	20 01 40	No	2.24	metals	R4	M	Weighed	Onsite in Ireland	Oxigen Environmental Ltd. ,W0208-01	Merrywell Industrial Estate,Ballymount Road Lower,Dublin 22,Dublin 22,Ireland		
Within the Country	20 01 40	No	6.38	metals	R4	M	Weighed	Onsite in Ireland	The Hammond Lane Metal Company Ltd. ,WP98107	Pigeon House Road,Dublin,Dublin 4,Dublin 4,Ireland		
Within the Country	17 02 01	No	7.76	wood	R3	M	Weighed	Onsite in Ireland	Conroy Recycling Company Ltd. ,WP-152-2006	Slanebeg,Mullingar,Westmeath,Co. Westmeath,Ireland		
Within the Country	**17 02 01**	**No**	12.28	wood	R3	M	Weighed	Onsite in Ireland	Concrete Recycling Specialists Ltd. ,WP 138-06	Barnan,Daingean,Offaly,Co. Offlay,Ireland		
Within the Country	20 01 10	No	2.26	clothes	R3	M	Weighed	Onsite in Ireland	Textile Recycling Lyd. ,WPR 014	Glen Abbey Complex,Belgard Road,Tallaght,Dublin 24,Ireland		
Within the Country	20 01 02	No	14.5	glass	R5	M	Weighed	Onsite in Ireland	Mr. Binman,W0061-02	Luddenmore,Grange,Kilmallock,Co. Linerick,Ireland		
Within the Country	19 07 03	No	9562.87	landfill leachate other than those mentioned in 19 07 02	D8	M	Weighed	Onsite in Ireland	Athlone Waste Water Treatment Plant,D0007-01	Golden Island,Athlone ,Westmeath,Co. Westmeath,Ireland		

* Select a row by double-clicking the Description of Waste then click the delete button

Link to previous years waste data
Link to previous years waste summary data & percentage change