ANNUAL ENVIRONMENTAL REPORT

FOR

ARTHURSTOWN LANDFILL
KILL, CO. KILDARE

FOR THE PERIOD

1ST JANUARY 2013 – 31ST DECEMBER 2013

WASTE LICENSE NO: W0004-04

Prepared by:

Facility Management,
Arthurstown Landfill,
Kill,
Co. Kildare.

31st March 2014

AER 15

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1. INTRODUCTION

1.1. Site Location

Arthurstown landfill, Kill, Co. Kildare is owned and operated by South Dublin County Council (SDCC). SDCC was granted a waste licence to operate the site by the Environmental Protection Agency. Land-filling commenced in October 1997.
The current waste licence register number is W004-004 and was issued December 2009. The facility is located approximately 25 km south-west of Dublin City and caters for the Greater Dublin Region.

The national grid coordinates for the facility are E 295691 N 220936. Figure 1.1 is a site location map.

The prevailing land use in the area is the bloodstock industry and agriculture. The site was a disused quarry when purchased by SDCC in 1992. It had been a sand and gravel quarry. Some unauthorised dumping took place in the 1970's. SDCC carried out remediation and restoration works on the unauthorised "dump" known locally as "Gavin's Dump".

Groundwater generally flows in a north-westerly direction. There are two rivers in the area, the Hartwell River and the Kill River. Surface water run-off from the site is first collected and stored in the on-site surface water storage lagoon before being discharged to the Hartwell River along with pumped groundwater. Groundwater levels beneath the landfill were artificially reduced during cell construction using a cut-off pipe system so that the water table is maintained below the landfill lining system base level.

The prevailing winds are south to south westerly. The annual rainfall for the area is approximately 1,000 mm.
The landfill is now closed and is now in the aftercare and restoration phases.

Final capping is now complete and this was achieved during the final quarter of 2013.

There are some small minor landscaping works which will be completed in 2014 as the weather improves.

Figure 1.1 Facility Location Map

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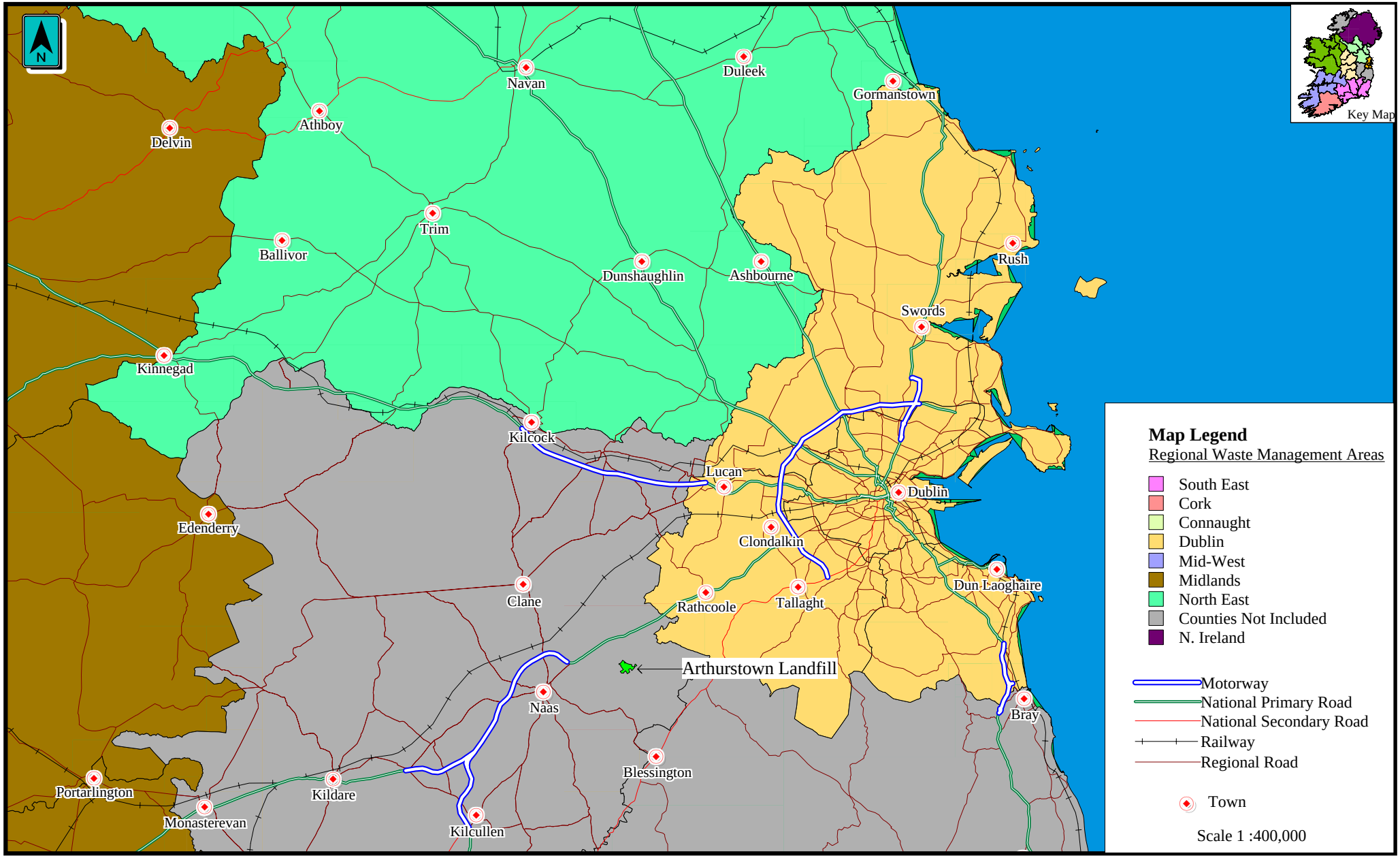
SDC-AP_Figure 2.1_ Site Location-Regional _Rev A



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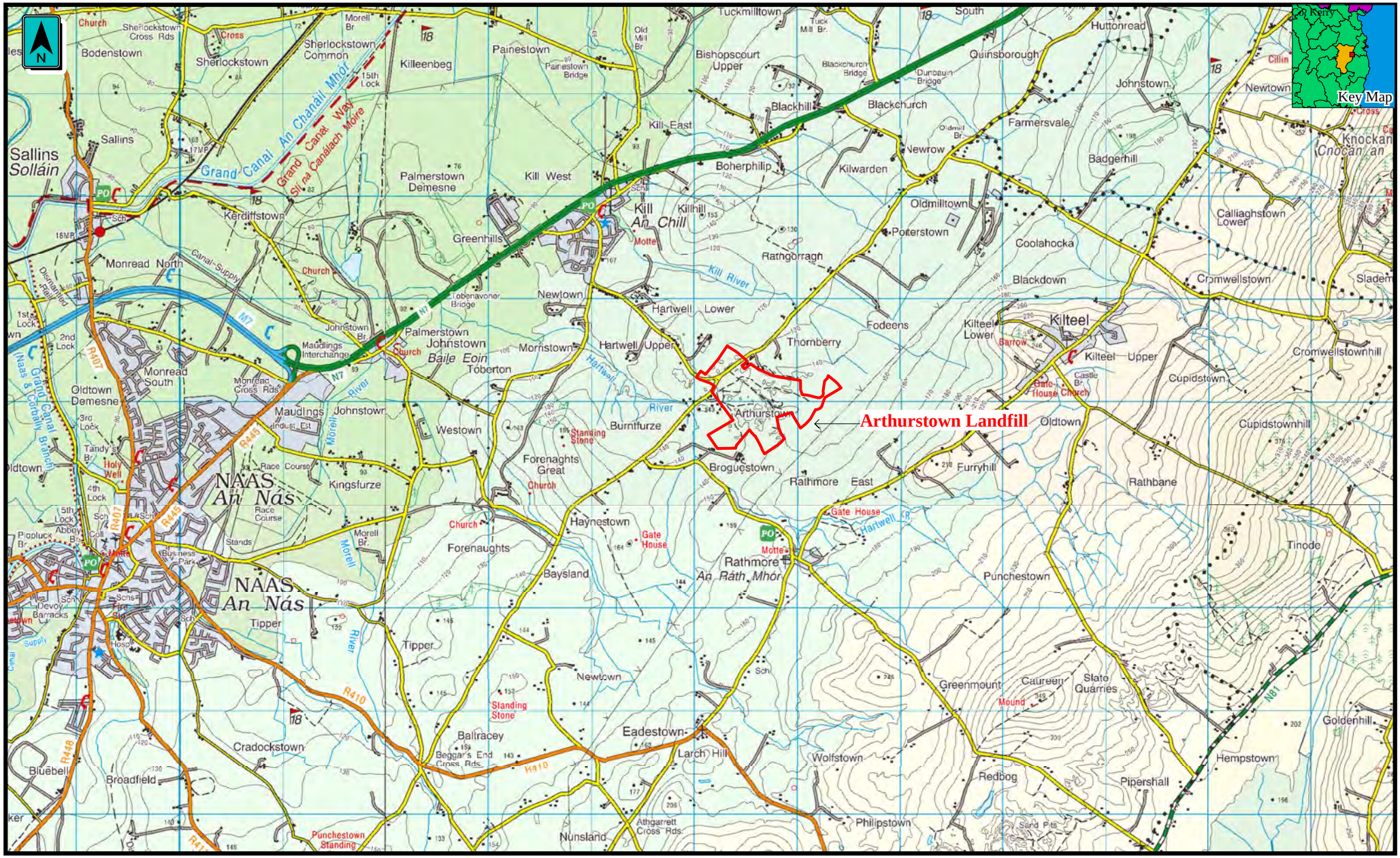
Site Location - Regional

Figure 2.1



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1: 50,000 Site Location Map

Figure 2.2

1.2. Purpose

This Annual Environmental Report (AER) has been prepared in compliance with Condition 11.5 of the waste licence. It is the 15th AER for the facility.

Condition 11.5.1 states that:

"Annual Environmental Report"

The licensee shall submit to the Agency for its agreement, by 31st March each year, an Annual Environmental Report (AER).

The AER shall include as a minimum the information specified in *Schedule F: Content of Annual Environmental Report*, of this licence and shall be reported in accordance with any relevant written guidance issued by the Agency".

The AER includes all of the items that are required by Schedule F of the current waste licence for the facility.

This AER covers the operational period of the landfill from 1st January 2013 to 31st December 2013.

This is the third AER to cover the period of closure for the facility as this facility is now closed for receiving waste since 21st December 2010.

2. SITE DESCRIPTION AND ACTIVITIES

2.1. Waste Activities

Waste activities carried out at Arthurstown Landfill are in accordance with the licence as follows:

Licensed Waste Disposal Activities,
in accordance with the Third Schedule of the Waste Management Acts 1996-2003

Class 1 **Deposit on, in or under land (including landfill):**

This activity is limited to the deposit of baled municipal waste at the facility.

Class 4 **Surface impoundment; including placement of liquid or sludge discards into pits, ponds or lagoons:**

This activity is limited to the storage of leachate in the storage and treatment tank and lagoons and the storage of surface water and groundwater at the facility.

Class 5 **Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment:**

This activity is limited to the deposit of baled municipal waste into lined cells at the facility.

Class 6 **Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1. to 10. of this Schedule:**

This activity is limited to the biological treatment of leachate arising from the waste disposed of on-site.

Class 7 **Physico-chemical treatment not referred to elsewhere in this Schedule (including evaporation, drying and calcination) which results in final compounds or mixtures which are disposed of by means of any activity referred to in Paragraphs 1. to 10. of this Schedule:**

This activity is limited to the physico-chemical treatment of leachate arising from the waste disposed of on-site.

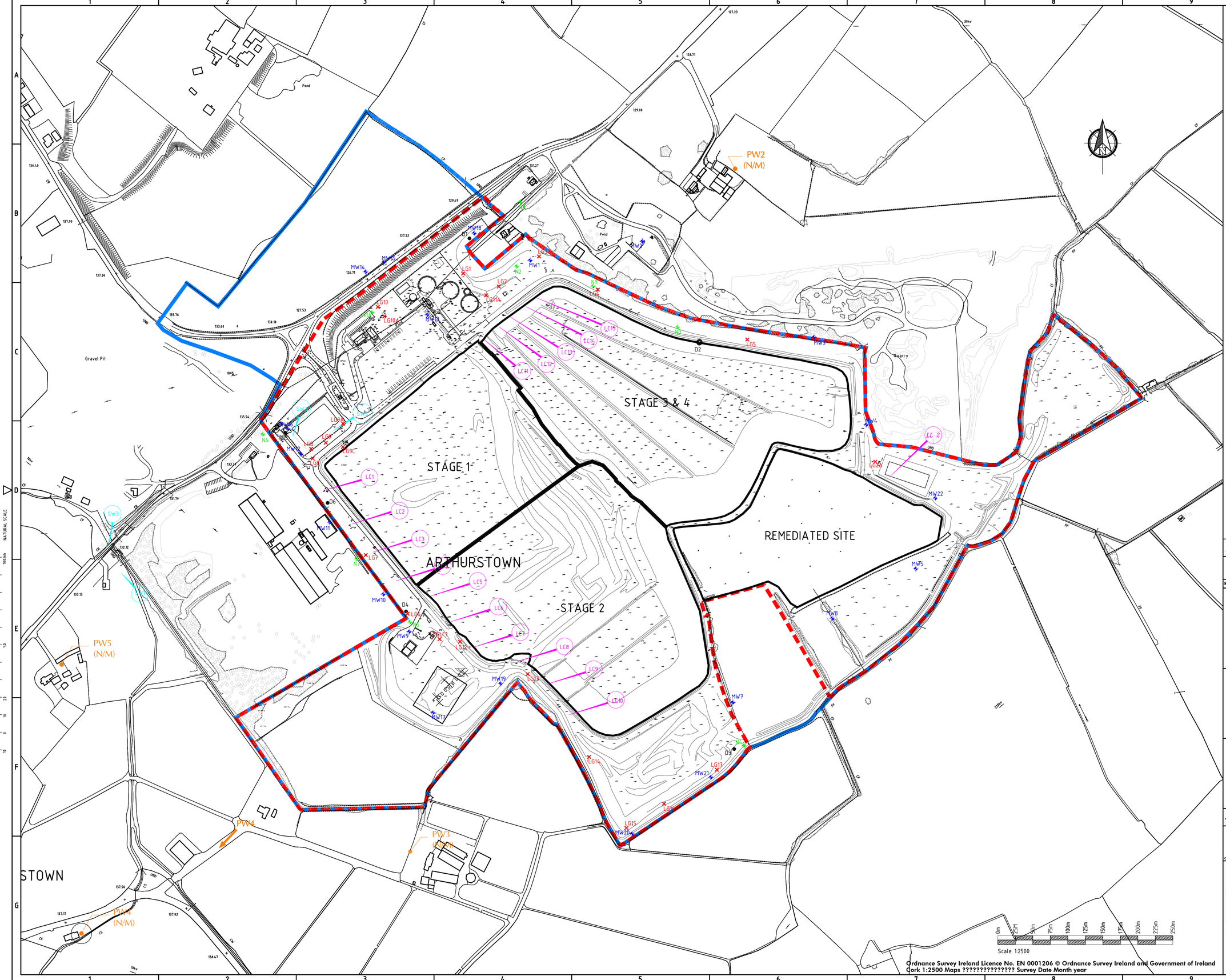
2.2. Waste quantities

Table 2.1 is a list of waste material received at the facility for land-filling since operations commenced in 1997 until 21st December 2010 when land filling ceased.

Table 2.1 Waste Intake (Tonnes)

Year	Waste Materials (Tonnes)	
	Cumulative Waste Inputs	Annual Waste Inputs
2010	4,779,021.09	191,553
2009	4,587,468	214,560
2008	4,372,908	301,828
2007	4,071,077	480,529
2006	3,590,548	591,755
2005	2,998,793	497,400
2004	2,501,393	423,626
2003	2,077,767	483,582
2002	1,594,185	463,436
2001	1,130,749	334,333
2000	796,416	274,642
1999	521,774	271,079
1998	250,695	216,284
1997	34,411	34,411

The facility closed on the 21st December 2010 and is now in its aftercare and monitoring phase.



LANDFILL GAS	LEACHATE
LG 1	LC 1
LG 2	LC 2
LG 3	LC 3
LG 4	LC 4
LG 5	LL 2
LG 6	LT 1
LG 7	LT 2
LG 8	L B
LG 9	L R
LG 10	LGW
LG 2A	LC11
LG 12	LC12
LG 13	LC13
LG 14	LC14
LG 15	LC15
LG 16	LC 5
LG 17	LC 6
LFGF1	LC 7
LG 9A	LC 8
LG 9B	LC 9
LG 9C	LC 10
LG10A	DUST
LG 11A	D 1
GROUNDWATER	D 2
MW 1	D 3
MW 2	D 4
MW 3	D 5
MW 4	D 6
MW 5	NOISE
MW 6	N1A
MW 6A	N2
MW 7	N3
MW 8	N4
MW 9	N5
MW 10	N6
MW 11	N7
MW 12	N8
MW 13	N9
MW 14	SURFACE WATER
MW 15	SW 1
MW16	SW 2
MW 17	SW 3
MW 18	SW 4
MW 19	SW 5
MW 20	PRIVATE WELLS
MW 21	PW 1
	PW 2
	PW 3
	PW 4
	PW 5

Rev.	Drawn	Chk'd	App'd		
A	KL	ME	CC	Cork 14.12.06	ISSUE FOR PLANNING
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Revision History: A

Name of Client

SOUTH DUBLIN COUNTY COUNCIL

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ARTHURSTOWN LANDFILL
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Title of Drawing

ENVIRONMENTAL MONITORING LOCATIONS

Scales Used
1:2500

Dwg. No. 2006-054-03-FIG2.4 — **Rev.** A

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2.3. Resource and Energy Consumption

The principal resources consumed at the landfill facility are diesel oil and electricity. Site vehicles are fuelled by diesel oil.

Table 2.2 Resource Use and Energy Consumption

Resource/Energy	Units	Quantity Used in 2013
Diesel Oil	(Litres)	30,000 (Approx)
Electricity (As per SCADA)	(kWh)	656,212

Note: reduction in diesel consumption due to no waste transportation taking place. (only minor works)

2.4. Leachate Generation

In 2013 leachate was collected from the waste cells and pumped to the leachate treatment plant. Treated leachate is discharged to the local sewer with the permission of Kildare County Council and the Agency. During periods of heavy rainfall there is the occasional requirement for leachate to be removed from site by road tanker for discharge to the agreed foul sewer location.
Table 2.3 lists the quantities of leachate tankered off site and treated leachate discharged to sewer in 2013. These figures should reduce over the coming years due to the landfill area now being completely capped.

The total quantity of leachate tankered off-site and discharged to sewer for 2013 is 33,776.31 tonnes or m^3.

Table 2.3 Leachate Removal Off-Site for 2013.

Month	Tonnes leachate tankered off site 2013	Tonnes Leachate Discharged to Sewer 2013	Total Discharged
January	2,349.84	1,631.35	3,981.19
February	2,235.12	1,527.51	3,762.63
March	0.00	1,636.13	1,636.13
April	1,750.54	1,515.09	3,265.63
May	1,774.80	1,530.83	3,305.63
June	0.00	1,372.33	1,372.33
July	2,179.94	1,443.05	3,622.99
August	0.00	1,145.63	1,145.63
September	1,538.80	1,074.18	2,612.98
October	1,661.56	831.24	2,492.80
November	1,516.10	1,513.43	3,029.53
December	2,328.48	1,220.36	3,548.84
Total	**17,335.18**	**16,441.13**	**33,776.31**

ENVIRONMENTAL MONITORING

This is a summary of results and interpretation of environmental monitoring carried out in the period 1st January 2013 to 31st December 2013.

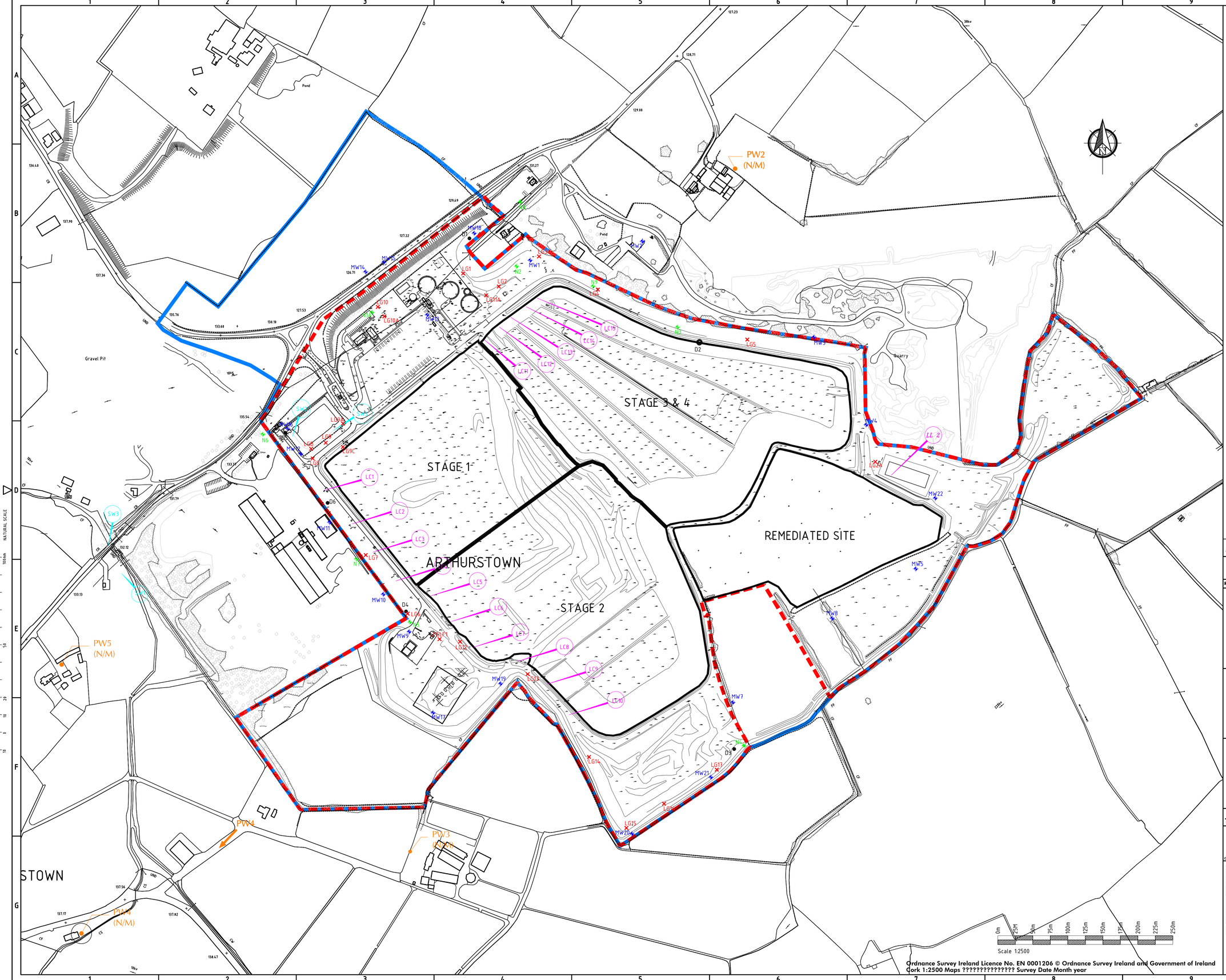
Environmental monitoring of the following is carried out in compliance with Condition 8 and Schedule D of the licence. (W0004-004)

- Landfill Gas
- Landfill Gas Utilisation Plant
- Dust Deposition
- Noise
- Surface Water including Biological Assessment
- Groundwater
- Private Wells (Groundwater)
- Leachate (including discharges to sewer)
- Nuisance
- Meteorological

Environmental monitoring is carried out on a monthly, quarterly, bi-annual and annual basis for various parameters of the various media. The AER presents the results of annual monitoring with interpretation.

2.5. Monitoring Locations

The environmental monitoring points are shown on Drawing Number AWL03 – 14. All samples were collected at the sampling points listed in Table D.1.1 of the licence unless specified otherwise in the following sections.



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MW 3	D 5
MW 4	D 6
MW 5	NOISE
MW 6	N1A
MW 6A	N2
MW 7	N3
MW 8	N4
MW 9	N5
MW 10	N6
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2.6. Landfill Gas

Perimeter Monitoring Wells

There are 23 no. perimeter gas monitoring wells at the facility. In accordance with Schedule D.2.1 of the licence, monitoring of the wells is carried out on a monthly basis. An investigation was carried out in 2005 into elevated levels of carbon dioxide and methane at a number of perimeter wells. The investigation concluded that the elevated levels of CH_4 and $C0_2$ were due to incidences of rotting vegetation, proximity to old percolation areas etc. and was not due to landfill gas migration.

Appendix 3.2 shows methane and carbon dioxide levels measured in perimeter wells in 2013. The levels are comparable to levels recorded in 2011 & 2012.

Landfill Gas Extraction Wells

The final capped areas are connected to the gas extraction system. This system is controlled and monitored by landfill gas field balancing. A gas balancing model is used by the staff at Arthurstown.

Experience to date at the facility shows that vents do not produce viable landfill gas until they are approximately 9 - 12 months old. The connection of vents is carried out if waste deposition in the area of the vent has either reached final levels or is to cease for 6 months or more. There are no longer any temporary connections to the gas extraction system. There are a total of over 450 permanent gas wells within the landfill area.
All vents on site are now permanently connected to the gas extraction system for utilisation.

Site Buildings

There are four permanent gas monitors, one in each building on site:

- Administration building
- Staff services building
- Leachate plant building
- Maintenance building

The following is the report of monitoring of these buildings for 2013.

- Quarter 1 – no exceedences
- Quarter 2 - no exceedences
- Quarter 3 - no exceedences
- Quarter 4 - no exceedences

2.6.1. Interpretation of Landfill Gas Results

Landfill gas results are typical for Arthurstown landfill.
Certain perimeter wells as indicated in the appendix tables are above the limit for CH_4 and CO^2. The Facility Management staff already engaged Odour Monitoring Ireland on 17th June 2005 to investigate these levels of methane in some of the perimeter wells.
The report concluded that due to the high sulphuric content of the gas in the perimeter wells that the gas was not migrating from the landfill and that this was occurring naturally due to decaying vegetation in certain areas and as a result of an old percolation area in another location. Before land-filling took place there was also background monitoring carried out. Levels of methane were also detected at that stage. Please refer to the consultants report reference 090905A. This report was again submitted to the Agency during 2009.

Landfill Gas Utilisation Plant Emissions

In accordance with Schedule D.7.1of the licence annual monitoring of the landfill gas utilisation plant was carried out.
The Landfill Gas Utilisation Plant commenced operations April 2004 with three no. Jensbaucher landfill gas engines extracting gas at a rate of approximately 3,000 m^3/hr. The Council requested that the enclosed flare operate in conjunction with the engines. This was carried out and the extraction rate increased to 4,900 m^3 per hour. During December 2004 a fourth engine was installed and the rate further increased to approximately 5,700 m^3 per hour. In 2005 an additional enclosed flare unit was installed.
The extraction rate capacity in the utilisation plant is currently 5,000 m^3/hour; this is generated by 5 no. engines. The 2 no. enclosed flares within the compound are mostly on standby. A further 2 no 2,500m3 per hour enclosed flares operated by SDCC to extract gas from the temporary capped areas are on stand-by as all landfill gas is now being diverted to the utilisation plant for electricity production.

Annual monitoring of the landfill gas utilisation plant emissions is a requirement of the licence. Monitoring was carried out for the period 2013 and the tables are included in the appendix.

2.6.2. Interpretation of Utilisation Emissions

All monitoring of flares and engine stacks showed all readings are in compliance with waste license W0004-004 for 2013.

European PRTR Table Arthurstown Landfill flares and gas utilisation engines only.

Table 1. Table for European-PRTR requirements for Landfill flare and Gas utilisation engines only 2013.

Location	Nitrogen Oxides (NO_x as NO_2) (kg/yr)	Carbon Monoxide (CO) (kg/yr)	Sulphur dioxide (SO_2) (kg/yr)	Total particulates (kg/yr)	TNMVOC's (kg/yr)	Methane (kg/yr)	Carbon dioxide (CO_2) (kg/yr)
Flare 1	1,386	37	454		124	42	2,062,812
Flare 2	957	162	2,155		95	55	1,468,394
AR02	8,147	16,297	4,283	67	11,125	420	4,389,320
AR05	9,208	18,160	4,666	156	17,863	214	4,856,976
AR07	7,908	15,022	4,005	107	9,908	165	4,045,221
AR08	7,823	15,145	3,907	108	9,696	112	4,057,634
AR09	7,269	14,053	3,646	84	8,930	194	3,788,428
Totals	**42,699**	**78,877**	**23,114**	**523**	**57,740**	**1,202**	**24,668,785**

Notes:

[1] denotes that the total values reported are based on 24 hr per day 365 days per year operation and for gas engines only. If the hours of operation are known through site records then the total actual amount can be calculated by calculating the yearly total to an hourly figure and then multiply by the number of hours operation (e.g. Emissions (kg/yr) / 8760 hrs = kg/hr × hours operation = Total emission in kg/yr).

2.7. Dust Deposition

Dust monitoring was carried out in accordance with the licence at 6 monitoring locations, three times in the year.

Dust monitoring was carried out over a 30 day period +/- 2 days. The periods were as follows:

- ___15th April 2013
- ___20th May 2013
- ___15th July 2013

2.7.1. Dust Deposition

Dust deposition results for 2013 are shown appendix 3.3.

2.7.2. Interpretation of Dust Deposition Results

The license limit for dust at the facility is 350 mg/m2/day. This was not exceeded during 2013. The maximum recorded during 2013 was only 94 mg/m2/day.

2.8. Noise

In compliance with Schedule D (D.4) of the waste licence, noise monitoring was carried during 2013.

The noise monitoring event took place as follows:

Day time monitoring – 25th and 26th November 2013
Night time monitoring – 26th and 27th November 2013
As the landfill is now closed the Noise monitoring will be reduced to one round per year.

Noise Results

The results of noise monitoring events are shown in Appendix 3.4.
Noise levels are consistent with previous years monitoring. Three readings were taken at each of the seven locations. 11 out of the 21 readings exceeded the daytime limit of 55 dB $L_{Aeq.}$
Similarly for night time readings, out of a total of 14 readings 4 exceeded the night time limit of 45 dBA L_{Aeq} .
These are mainly due to the close proximity of the meter to the adjacent facility (at N5 and N6) and to traffic movements. As the landfill is now closed the elevated noise readings cannot be attributed to land-filling activities. The Noise monitoring locations will be relocated in future closer to any possible receptors.

2.9. Surface Water

The following is a summary of annual surface water quality findings in 2013. More detailed information has been submitted in each of the quarterly reports from ANUA. (formerly Bord Na Mona)

There are 5 no. surface water monitoring points. Chemical analyses are carried out at all 5 of the monitoring locations and a biological assessment was carried out at SW1, SW3 (Hartwell River) and at SW4 (Kill River). The 5 no. surface water monitoring points are located as follows:

- SW1 upstream of the outfall from the storm water lagoon in the Hartwell River
- SW2 outlet for the on site storm water pond(storm and ground waters)
- SW3 downstream of the outfall from the storm water lagoon in the Hartwell River
- SW4 downstream of Arthurstown Road in the Kill River
- SW5 inlet to the storm water pond (storm and ground waters)

2.9.1. Surface Water Results

Chemical Analysis

The results of surface water analysis are shown in tables and charts in Appendix 3.5.

2.9.2. Interpretation of Surface Water Results

During 2013 the biological quality rating for surface water has remained consistent with previous years as can be seen with the Q rating in table 3.1 overleaf.
Quarterly monitoring is carried out by ANUA at all monitoring points for surface water.
Monitoring points SW2 and SW5 are within the on-site surface water retention pond. During 2013 there were slightly elevated levels of NH_4 Ammonia, nitrite and sulphates at location SW2 and SW5. These locations are within the surface water retention pond. On examining the results of the monitoring points in the Hartwell River (SW1 & SW3) there was no effect as a result of these levels and therefore no pollution caused throughout 2013. This proves that the surface water retention pond is working effectively.
During 2013 all SW reports were sent to the Agency, Kildare County Council and the Department of Inland Fisheries.

Biological Sampling

During 2013 biological sampling was carried out in the Hartwell and Kill Rivers. The Hartwell received a Q rating of 4 and the Kill River a Q rating of 4. This is consistent with 2012 & 2011 figures and an improvement of the Q rating figures compared to 2007.

Biological sampling is carried out annually in accordance with the licence. It was carried out during the third quarter of 2013. (23rd July 2013) The Q rating system was used. This rating system recognises five macro-invertebrate communities/faunal groups ranging from A to E (i.e. most sensitive to most tolerant of pollution) and relates

to their relative abundance, from a standard 2 minute kick sample, to a quality rating – the Q Index. The area surveyed is then assigned a Q rating from 5 to 1, 5 being pristine unpolluted waters to 1 gross polluted. Results of biological sampling are shown below in Table 3.12.

Q Rating of Surface Waters for 2013.

Biological Q Rating for Surface Waters (within rivers)			
Location	SW-1	SW-3	SW-4
Q-Rating	4	4	4

Table 3.12

Quality at point SW1 is consistent with last year's results. This point is upstream of the Arthurstown surface water discharge point. (note: discharge from ALCRETE Ltd is within 5m upstream of the discharge from Arthurstown Landfill)
Quality at point SW3 is consistent with previous years which indicate that discharges from the surface water retention pond from the landfill are having no impact on the surface water quality at point SW3 or the Hartwell River in general.
Quality at point SW4 is also consistent with last year's results. This point is on the Kill River which is approximately 500m northeast of the site. No discharges are taking place to the Kill River from Arthurstown landfill.

The overall bio-diversity noted for the Hartwell River was very good. The results of the biological survey indicate that the quality of water in the Hartwell River is good (using the Q-value system) / excellent (using the LQI interpretation of water quality) upstream and downstream of the landfill.

Groundwater

There are 22 no. groundwater monitoring wells and 5. no. private wells. Table 3.13 shows the locations of the wells in relation to the facility and in relation to groundwater flow in the area. Table 3.14 shows the depths of groundwater wells. Private Wells are discussed in Section 3.7.

Table 3.13 Location of groundwater monitoring boreholes relevant to the facility and the groundwater flow in the area

Well	**Direction with respect to the facility**	**Location with respect to groundwater flow***
MW3	260 M NE	**US**
MW4	400 m E	US
MW5	400 m E	US
MW6	100 m ESE	US
MW7	80 m SE	US
MW8	**240 m ESE**	**US**
MW20	**150 m S**	**US**
MW21	140 m SSE	US
MW22	**400 m E**	US
MW2	**260 m NE**	**CG**
MW17	100 m WSW	CG
MW19	20 m WSW	CG
MW1	140 m NE	DS
MW9	**50 m W**	**DS**
MW10	50 m W	DS
MW11	50 m W	DS
MW12	50 m NW	DS
MW13	100 m N	DS
MW14	**200 m NNE**	**DS**
MW15	200 m NNE	DS
MW16	**90 m NNW**	**DS**
MW18	170 m N	DS

*Note: US upstream
DS downstream
CS cross gradient
Wells highlighted in bold font are those that are required to be monitored by the waste licence.

The waste licence (W004-004), Schedule D.1 Table D.1.states that groundwater levels should be recorded for all wells on a monthly basis and that sampling for chemical parameters should be carried out in 7 no. wells. These 7 wells (as selected by the Agency) are highlighted in bold in Table 3.13.

Table 0.1 Depths of Groundwater Monitoring Wells

Wells	Base of wells m O.D (2006)*	Well height at ground level m O.D	Depth of Borehole (m)
MW1	130.04	138.67	8.63
MW2	130.22	137.00	6.78
MW3	131.67	140.20	8.53
MW4	141.72	143.40	1.68
MW5	146.12	148.00	1.88
MW6A	144.7	150.50	5.80
MW7	147	153.60	6.60
MW8	115.19	149.20	34.01
MW9	110.01	139.50	29.49
MW10	132.19	135.10	2.91
MW11	129.28	133.75	4.47
MW12	130.83	134.74	3.91
MW13	127.28	135.60	8.32
MW14	125.13	129.40	4.27
MW15	126.61	129.42	2.81
MW16	112.84	135.54	22.70
MW17	129.05	139.40	10.35
MW18	102.16	136.68	34.52
MW19	118.72	145.30	26.58
MW20	147.51	156.50	8.99
MW21	146.83	155.00	8.17
MW22	140.64	145.00	4.36

*Note: The total depths of wells are as per measurements in 2006. Wells can silt up gradually over time, diminishing their total depth.

2.9.3. Groundwater Results

Tables and charts showing groundwater results and trends are included in Appendix 3.6.

2.9.4. Interpretation of Groundwater Results

Annual Results

A total of twenty two groundwater monitoring boreholes are located at Arthurstown Landfill. During the annual sampling event for 2013 a total number of 7 boreholes were sampled.
Chemical analysis, Metals analysis, Organic analysis and Microbial Analysis were carried out as part of the annual analysis of the groundwater.

Appendix 3.6 Groundwater Annual outlines all elevated readings for the annual monitoring event and can be summarised as follows:

MW2 – Ammonia, Chloride, Nitrite, Sodium, Magnesium, Manganese and Calcium.
MW8 – Magnesium and Manganese
MW9 – Magnesium
MW14 – Ammonia, Magnesium and Manganese
MW16 – Magnesium and Manganese
MW20 – Sulphate, Magnesium and Calcium
MW22 – Magnesium and Manganese

High levels of faecal coli-forms were detected in locations MW2 and MW14.

Locations MW2, MW3 and MW14 are not within the boundary of the landfill and are in an agricultural location (i.e. a farm adjacent with poor standards).

MW2 and MW3 are adjacent to the landfill and located on a cross-gradient flow in relation to the groundwater contour flow below the landfill. The elevated readings at MW2 and MW3 cannot be attributed to the landfill due to its location.
External agricultural factors are contributing at these locations.

Facility Management are currently relocating some ground water boreholes in the early part of 2014.

The majority of monitoring at all other locations is consistent with previous years monitoring results.

2.10. Private Wells (Groundwater)

There are 5 no. private groundwater monitoring wells, referred to as Private Wells. Monitoring of the wells is carried out on a quarterly and annual basis.
PW1 is sampled on a quarterly basis and wells PW2 – PW5 are sampled on an annual basis.

The location of the wells is shown on Drawing Number AWL03 – 14 inserted as Figure 3.1.

2.10.1. Private Wells Results

Copies of the analysis for private wells for 2013 are included in the appendix.

2.10.2. Interpretation of Results

Annual
All private wells (PW1 – PW5) are sampled on an annual basis.
All chemical analysis for all private well locations (PW1 – PW5) was within the guidelines for drinking water.
During the microbiological analysis there were elevated coli-form readings at locations PW1, PW2 and PW4.
All well owners were notified.

The location of all wells are rural agricultural.

All other results for 2013 were below MAC limits.

Quarterly

PW 1 is the only private well that is sampled every quarter. See appendix for quarterly results for PW1 2013. All quarterly PW1 analysis was below the prescribed limits for drinking water for 2013.

2.11. Leachate

The waste licence (W004-004), Schedule D.1 Table D.1.states that leachate levels should be recorded for all sumps and collection points on a continuous basis. This continued during 2013.

SDCC carries out quarterly and annual monitoring at 5 locations, LC1, LC3, LC11, LL (leachate lagoon) and LB (leachate balance tank).

2.11.1. Leachate Results

Tables and charts showing leachate results and trends are included as follows in Appendix 3.8:

2.11.2. Interpretation of Leachate Results

Leachate results for 2013 are typical for leachate analysis for Arthurstown Landfill depending on age of the waste in the cell being tested.
At the end of 2007 all 15 cells contained leachate.
During 2013 treated leachate was discharged to the twin rising main connection to the local sewer in Kill.
The annual leachate results are enclosed in Appendix 3.8.

2.12. Meteorological Monitoring

Condition 8.10.1 and schedule D.6.1. of the current Waste Licence W0004-04 requires the daily monitoring of rainfall, temperature (min/max), wind speed and direction, evaporation, humidity and atmospheric pressure at the landfill site.
All weather data has been recorded by the on site "VIASALA" Weather Station which was installed during March 2003.
The data indicates prevailing wind directions from a south to south-westerly direction.

Total annual rainfall during 2013 was approximately 633 mm, which is below the annual average of 1000mm and 163 mm less than the previous year. There was 95.8 mm recorded in the month of October 2013 alone.

The data indicates prevailing wind directions from a south to south-westerly direction. (200 degrees approximately for the entire year 2013 – Actual average for 2013 is 198 degrees)

Monthly summaries of meteorological conditions are included in Appendix 3.9 for 2013.

A new weather station (Precision Weather Station Vantage Vue by DAVIS) was installed at Arthurstown Landfill facility during December 2013. This will address the data loss issues encountered during 2013 and 2012.

2.13. Odour and Odour Control at Arthurstown

The facility management staff endeavour at all times to reduce odours and complaints at the facility.

The Facility is now closed since December 21st 2010. Odour control works are now greatly reduced due to the completion of the final capping works. The final phase 8 of the capping was completed during November 2013.
The integrity of the cap will continue to be checked every quarter by the surface VOC emissions monitoring carried out by Odour Monitoring Ireland.

Quarterly Odour Assessments:

Waste license W0004-004 states in condition 8.14.5 that an independent odour assessment is carried out once every quarter. The quarterly odour audits are carried out by Odour Monitoring Ireland.

Quarterly surface emissions monitoring audits are carried out on site by Odour Monitoring Ireland Ltd. They took place on:

- Q1 – 12th March 2013 – 3 locations over limit.
- Q2 – 6th June 2013 - 5 locations over limit.
- Q3 – 29th August 2013 - 8 locations over limit.
- Q4 – 26th November 2013 – No locations detected. (Final cap complete)

The methodologies employed include:

- Capping source monitoring using a continuous ppb PID and Jerome 631X analyser to detect areas of potential landfill gas release.
- Sniff odour assessments at pre-selected resident locations in the vicinity of the landfill
- Geo-referencing of detected leakage locations for remediation.

The new methodology used in the odour audit is very useful in identifying areas of potential leakage. It is concluded that this technique is very successful in the reduction of landfill odours in order to prevent odour impact downwind of the landfill operations.
Once the quarterly odour audit is carried out, the findings are brought to the attention of the Facility Manager, who carries out the remediation.

2.13.1. Odour Results

The colour odour charts for the landfill that are produced for each quarter are contained in the following four pages. (Note the map for Q4 2013 showing no leaks detected)
The colour maps of the site highlight where the most problems arise due to the concentrations measured on the temporary capped areas.
At the end of each odour audit the consultant meets with the Facility Manager to highlight the areas for remediation. These works are carried out as soon as possible

2.14. Complaints for 2013.

The total number of complaints for 2013 was 10. This is the lowest amount of complaints in one year at Arthurstown.
The number of complaints due to odour was mainly during the early part of the year where there was a temporary cap still in operation and also due to the drilling works associated with the final phase of the capping works.
Since the completion of the capping works in November 2013 there have been no odour complaints to date.
The balance of complaints has been due to traffic related issues.
See complaint summary chart overleaf for 2013.

Q1 – 2012	Total Complaints	11
Q2 – 2012	Total Complaints	4
Q3 – 2012	Total Complaints	6
Q4 – 2012	Total Complaints	9

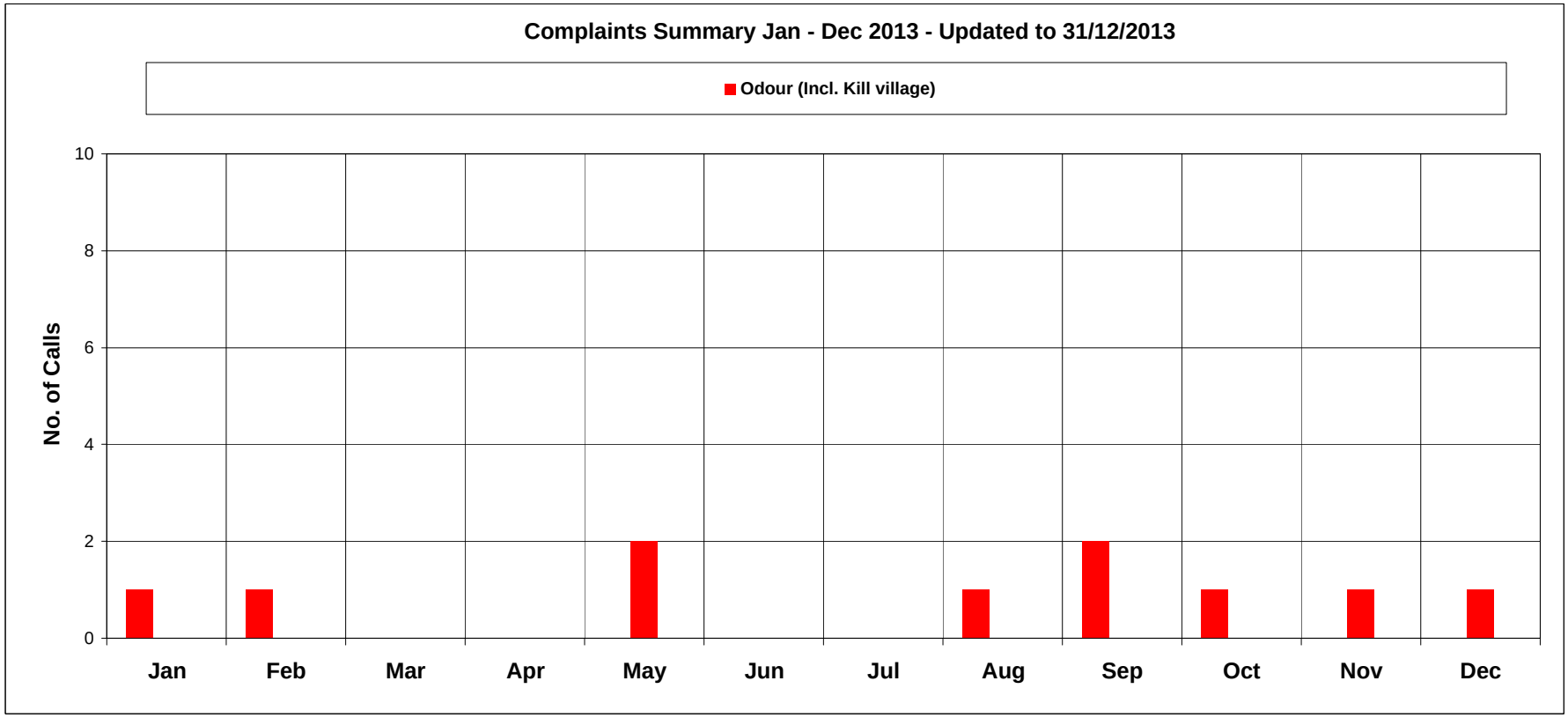
Total Complaints for 2012 was 30.

Q1 – 2013	Total Complaints	2
Q2 – 2013	Total Complaints	2
Q3 – 2013	Total Complaints	3
Q4 – 2013	Total Complaints	3

Total Complaints for 2013 was 10.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Odour (Incl. Kill village)	1	1	0	0	0	0	0	1	2	1	0	0	6
Odour (Kill Village only)	0	0	0	0	0	0	0	1	0	0	0	0	1
Noise (Anywhere)	0	0	0	0	0	0	0	0	0	0	0	0	0
Traffic (Anywhere)	0	0	0	0	2	0	0	0	0	0	1	1	4
Callers	1	1	0	0	2	0	0	1	2	1	1	1	10
Max Calls from 1 Caller	1	1	0	0	1	0	0	1	1	1	1	1	8
Callers on Max	1	1	0	0	2	0	0	1	2	1	1	1	10
Monthly Total Calls	**1**	**1**	**0**	**0**	**2**	**0**	**0**	**1**	**2**	**1**	**1**	**1**	**10**
Most Frequent Callers													

Updated by M.Heffernan on 31/12/2013



2.15. Landfill Gas Emissions

Approximately 43,800,000 m^3 of landfill gas was utilised by the gas extraction system in 2013. **(based on an average of 5,000 m^3 per hour)*
From July 2009 onwards all gas captured was sent to the utilisation plant.
During 2013 all gas is now being utilised. Flaring is only on standby mode should any of the engines fail.

Estimates vary as to the efficiency with which gas collection systems in landfills gather the methane formed in waste. Modern gas wells installed throughout a landfill site may collect between 70% – 90%. The efficiency for Arthurstown landfill is estimated here as 90% because the wells are relatively new and in good condition, capping is now complete. **Based on this efficiency it is estimated that the total landfill gas generated at Arthurstown Landfill in 2013 was 48,666,666 m^3.**

Gas extracted from the landfill is managed in 3 different ways:

- Electricity production from landfill gas in 6 no. engines at the Bioverda compound (Approx. 6 MW)
- Flaring in 2 no. enclosed flares at the Bioverda compound.
- Flaring in 2 no. 2,500m3 /hour enclosed flares on the temporary capped areas.

All of the gas collected is directed to the Bioverda compound for electricity generation. The available generation capacity is 4,800 m^3 per hour and the capacity to flare gas is 10,000m^3. The maximum available extraction rate is approximately 14,800 m^3/hour.
Note: The current average extraction rate is 5,000 m3 per hour.
All gas is now being extracted by the utilisation plant. The 4 no enclosed flares are currently on stand by.

The table overleaf contains the results for the European PRTR in relation to the Utilisation plant and the enclosed flare units at Arthurstown Landfill.

European PRTR Table Arthurstown Landfill flares and gas utilisation engines only.

Table 1. Table for European-PRTR requirements for Landfill flare and Gas utilisation engines only 2013.

Location	Nitrogen Oxides (NO_x as NO_2) (kg/yr)	Carbon Monoxide (CO) (kg/yr)	Sulphur dioxide (SO_2) (kg/yr)	Total particulates (kg/yr)	TNMVOC's (kg/yr)	Methane (kg/yr)	Carbon dioxide (CO_2) (kg/yr)
Flare 1	1,386	37	454		124	42	2,062,812
Flare 2	957	162	2,155		95	55	1,468,394
AR02	8,147	16,297	4,283	67	11,125	420	4,389,320
AR05	9,208	18,160	4,666	156	17,863	214	4,856,976
AR07	7,908	15,022	4,005	107	9,908	165	4,045,221
AR08	7,823	15,145	3,907	108	9,696	112	4,057,634
AR09	7,269	14,053	3,646	84	8,930	194	3,788,428
Totals	**42,699**	**78,877**	**23,114**	**523**	**57,740**	**1,202**	**24,668,785**

Notes:

[1] denotes that the total values reported are based on 24 hr per day 365 days per year operation and for gas engines only. If the hours of operation are known through site records then the total actual amount can be calculated by calculating the yearly total to an hourly figure and then multiply by the number of hours operation (e.g. Emissions (kg/yr) / 8760 hrs = kg/hr × hours operation = Total emission in kg/yr).

2.16. Estimated Emissions from the Landfill Gas Generation Plant.

In summary, 1,202 kg / year of methane and 78,877 kg / year of CO were produced at Arthurstown Landfill during 2013. (as per PRTR Table produced by Odour Monitoring Ireland Ltd. (as per Table 1.)

A GASSIM model for landfill gas production at Arthurstown was produced during 2008. The findings of the model did not reflect the actual gas production on site. This report on the capacity of the utilisation plant at Arthurstown and possible future capacity issues was submitted to the Agency on 03rd December 2008.

Table 4.2 Estimated Electricity Production at Arthurstown Landfill from Landfill Gas.

During 2013 the amount of electricity produced at Arthurstown Landfill by converting the landfill gas via the 5 gas engines is outlined as follows:

Month 2013	MW per month
January	5,146
February	4,690
March	4,900
April	4,600
May	4,500
June	4,500
July	4,589
August	4,452
September	4,385
October	4,400
November	4,146
December	3,917
Total 2013 MW produced	**54,215 MW h**

2.17. Indirect Emissions to Groundwater

Estimated Annual and Cumulative Quantity of Indirect Emissions to Groundwater.

Monitoring results to date do not indicate the presence of indirect emissions to ground waters. Considering that groundwater flow is in a generally north-westerly (NW to NNW) direction, monitoring wells can be deemed to be upstream, downstream, or cross-gradient of the landfill area. Table 4.3 below presents a summary assessment of monitoring well locations relative to the existing waste body. Parameters selected for this assessment, because they are known to exhibit high concentrations in landfill leachate at Arthurstown, are Ammonia-N, Chloride and Electrical Conductivity.

Condition 6.4.1 states that there shall be no direct emissions to groundwater.

Table 0.2 Calculation of Direct and Indirect Emissions to Groundwater

Location	Direction	Relative Position	Summary of Results since March 1999 - Dec 2013				
			Ammonia (mg/l)		Chloride (mg/l)	Conductivity (uS/cm)	
			Max	Avg	Avg	Max	Avg
MW3	260 M NE	US	2.45 (April'04)	0.13	19.27	913 (May'07)	669
MW4 **	400 m E	US	1.2	<0.31	7.5	952 (Apr '02)	761
MW5 **	400 m E	US	<0.2	<0.2	10.6	686 (Oct '99)	481
MW6A	100 m ESE	US	5.8 (May'08)	0.18	14.6	838 (Nov'08)	694
MW7	80 m SE	US	5.7 (May'08)	1.20	16.4	987 (Nov'08)	881
MW8	240 m ESE	US	1.04 (April '05)	0.06	16.2	716 (Nov '10)	667
MW20	150 m S	US	1.7 (Feb '03)	0.04	25.4	2815 (Nov '09)	1725
MW21	140 m SSE	US	1.5 (May '01)	0.07	15.6	1568 (Apr '05)	1071
MW22	400 m E	US	0.33 (Feb ' 03)	0.07	12	805 (Apr '05)	517
MW2	260 m NE	CG	**7.6 (July '13)**	4.3	219 (July '13)	2363 (Nov'10)	1460
MW17	100 m WSW	CG	0.6 (May '01)	0.14	23.5	2097 (May'07)	1234
MW19	20 m WSW	CG	3.08 (July '07)	0.11	18.6	1204 (Jul'06)	911
MW1	140 m NE	DS	Dry	Dry	Dry	Dry	Dry
MW9	50 m W	DS	1.2 (July '01)	0.05	12.2	738 (Nov'08)	617
MW10 **	50 m W	DS	Dry	Dry	Dry	Dry	Dry
MW11	50 m W	DS	0.36 (April'04)	0.08	10.4	690 (Apr'04)	617
MW12 **	50 m NW	DS	Dry	Dry	Dry	Dry	Dry
MW13 **	100 m N	DS	0.2 (Nov '02)	<0.2	27.9	944 (Nov'02)	944
MW14	200 m NNE	DS	24 (Aug '11)	0.15	13.8	1042 (Feb'09)	629
MW15 *	200 m NNE	DS	1.0 (May'01	<0.28	33	900 (Feb'03)	802
MW16	90 m NNW	DS	0.7 (July '01)	0.04	13.8	992 (Nov'08)	689
MW18	170 m N	DS	1.2 (May'01)	0.23	12.8	719 (Nov '10)	650

DS – downstream
US – upstream
CG – cross gradient

Locations upstream from the landfill are located in an agricultural area and are therefore sprayed several times a year with “slurry”.
Only location MW2 showed an increase in ammonia levels during 2013. This can be attributed to agricultural activity on the lands adjacent.
Facility management are already re-locating some wells to avoid contamination from surface water ingress into groundwater sampling. It was deemed that some of the ground water sampling boreholes are too shallow and are scheduled to be re-drilled in 2014.

Due to the upstream and cross gradient locations of the boreholes and proximity to agricultural activities, it can be assumed that emissions to groundwater are satisfactory for the period 2013.

2.18. Water Balance

A number of assumptions were made in the calculation of the water balance.

Evaporation

Due to the nature of baled waste, rainfall tends to flow through the edges of each bale quickly and makes its way deep into the waste body or onto the cell floor quickly. Hence a nominal value of 10% of the recorded evaporation in the calculation.

Capped Areas

Uncapped Area approx:	50,000 m2
Final Capped Area approx.	240,000 m2
Total Final Capped Area	290,000 m2

Absorptive Capacity of Waste

Due to the nature of baled waste, cells with new waste will have a lower absorptive capacity. This increases with the age of the waste and as the waste is in contact with moisture for longer periods. An absorptive capacity of 15% of the traditional value of 0.07 m^3/t has been assumed.

The volume of leachate tankered off-site and discharged to sewer in 2013 was 33,776 m3.
Results of the water balance calculation estimate that a theoretical figure of approximately 22,960 m3 of leachate was produced during 2013.
Therefore for the first time at Arthurstown the leachate leaving the site by tanker and sewer has exceeded the theoretical figure of leachate produced. This is due to the progression of the final capping works. This figure should improve even further next year as the entire landfill footprint is now capped.

The pumping of the leachate from each cell will continue during 2014. The leachate levels are seasonal at Arthurstown with levels normalising during the drier months of April, May, June & July.
Facility management staff is endeavouring at all times to maintain the levels to the 1m limit by constant pumping of leachate.

A summary of the calculation is shown overleaf in Table 5.1.

Table 5.1 Water Balance Calculation Summary 2013.

Month	Rainfall	Evaporation	Effective Rainfall	Waste Input	Active Area	Intermediate Area (temporarily capped)	Fully Capped Area	Total Predicted Leachate	Cumulative Predicted Leachate	Actual leachate tankered off site	Actual SW/GW discharged to river
		(mm)	(mm)	(tonnes)	(m2)	(m2)	(m2)	(m3)	(m3)	(m3)	(m3)
Jan-11	65.6	18.2	47.4	0	50,000	50,000	240,000	3,280.00	3,280.00	2,349.84	1,631.35
Feb-11	69	24.1	44.9	0	50,000	50,000	240,000	3,450.00	6,730.00	2,235.12	1,527.51
Mar-11	51.2	27.8	23.4	0	50,000	50,000	240,000	2,560.00	9,290.00	0.00	1,636.13
Apr-11	65.4	53.8	11.6	0	50,000	50,000	240,000	3,270.00	12,560.00	1,750.54	1,515.09
May-11	54.8	55.6		0	50,000	50,000	240,000	2,740.00	15,300.00	1,774.80	1,530.83
Jun-11	21.2	42.2		0	50,000	50,000	240,000	1,060.00	16,360.00	0.00	1,372.33
Jul-11	35.4	52.5		0	50,000	50,000	240,000	1,770.00	18,130.00	2,179.94	1,443.05
Aug-11	66.6	59	7.6	0	50,000	50,000	240,000	3,330.00	21,460.00	0.00	1,145.63
Sep-11	30	25.4	4.6	0	50,000	50,000	240,000	1,500.00	22,960.00	1,538.80	1,074.18
Oct-11	95.8	26.9	68.9	0	0	0	290,000	0.00	22,960.00	1,661.56	831.24
Nov-11	23.2	19.1	4.1	0	0	0	290,000	0.00	22,960.00	1,516.10	1,513.43
Dec-11	54.6	9.8	44.8	0	0	0	290,000	0.00	22,960.00	2,328.48	1,220.36
Total	**632.8**	**414.4**	**257.3**	0	0	0		**22,960**	**22,960**	**17,335.18**	**16,441.13**

3. FACILITY DEVELOPMENT

3.1. Site Survey

A topographical survey of the landfill facility was carried out by the facility management team during March 2013.
The survey is attached as Appendix 5.1.

3.2. Developments Undertaken in 2013.

3.2.1. Capping Works

The final phase (phase 8) of the capping works commenced during the summer of 2013.

30,000 m^2 of final cap was installed during November 2013.
All final capping works are now complete at Arthurstown Landfill Facility.

3.2.2. Bioverda Power Systems Utilisation Plant

The plant is now extracting on average 5,000 m3 of gas per hour.
No further works were carried out during 2013 as the plant is now on a downward operating trend due to fall off in the gas production from the landfill.
There may be a requirement to relocate the 2 no SDCC enclosed flare units to the compound. This is still under consideration.

3.2.3. Staff reductions during 2013

There was a reduction in the number of staff at Arthurstown during 2013.
The staff number reduced further down to 4 during Q1 2013 as our site foreman Mr. Sean Finnegan retired after 16 years at the facility.

3.3. Developments Proposed for 2014.

3.3.1. Leachate Treatment Trials.

Approval has been received from the Agency for commencement of leachate treatment trials with Biocore Ireland. These trials are continuing and it is hoped that the facility management will be able to further progress the possibilities of other uses for Arthurstown during its period of closure.

Restoration Report

3.3.2. Completed Cells

Cells 1-15 are now fully capped and restored.

All cells are now closed. The Landfill no longer accepts waste since 21st December 2010 due to the expiration of the planning permission.

The landfill is now in the restoration and aftercare phase.

3.3.3. Restoration

The final phase (phase 8) of the capping works was completed during 2013.

Landscaping and fencing will continue during 2014 as due to the wettest winter on record, these works had to be postponed.
Works to be completed during 2014 include top soiling of areas required then seeding these areas, fencing, planting and further landscaping of areas which were used previously as yards or stockpile areas.
Also during 2014 a full condition survey of all infrastructures at the facility will be undertaken. This will improve the quality of records for maintenance into the future years of the aftercare period.

4. ENVIRONMENTAL OBJECTIVES AND TARGETS

4.1. Objectives and Targets

The list of objectives and targets for 2013 will be submitted as part of the EMP revision which will be submitted in the coming weeks.

5. FACILITY MANAGEMENT

5.1. Summary of New Written Procedures

The revision of the EMP in the coming weeks will include an updated EMS taking into account the recent closure and the need for a final EMP submission and a review of other annual monitoring requirements.

5.2. Tank, Pipeline and Bund Testing

Routine inspections of tank, pipeline and bund inspections are carried out once every three years.
The completed reports are kept on site for the Agency's Inspection.
The report currently held on site was carried out in November 2012.
A review will take place during 2015 of all tanks, pipelines and bunds.

5.3. Reported Incidents and Complaints

5.3.1. Reported Incidents

A summary of reported incidents during 2013 is shown as per table below.
Incidents are defined by Condition 1.6 of the current waste licence (W004-04).

There were 19 incidences reported to the EPA in 2013.

	Incident Date	Cause	Mitigation Measure
Ground Water (MW2)	070613	Elevated biological Readings at MW2	Re-sampled and relocated and re-drilled wells
Gas borehole trigger levels	310113	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 310113 (submitted to Agency)
	280213	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 280213 (submitted to Agency)
	260313	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 260313 (submitted to Agency)
	260413	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 260413 (submitted to Agency)
	270513	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 270513 (submitted to Agency)
	280613	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 280613 (submitted to Agency)
	310713	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 310713 (submitted to Agency)
	290813	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 290813 (submitted to Agency)
	240913	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 240913 (submitted to Agency)
	301013	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 301013 (submitted to Agency)
	291113	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 291113 (submitted to Agency)
	301213	Elevated trigger levels in Perimeter Gas Boreholes	See Report dated 301213 (submitted to Agency)
Leachate Sump Levels	130213	Breach of the 1m limit in the Leachate cells.	See Report dated 301213 (submitted to Agency)
	250313	Breach of the 1m limit in the Leachate cells.	See Report dated 301213 (submitted to Agency)
	260413	Breach of the 1m limit in the Leachate cells.	See Report dated 301213 (submitted to Agency)
Surface VOC Emissions	240613	Quarterly Surface VOC Emissions Monitoring: Breach in emission levels.	See Report dated 301213 (submitted to Agency)
	021013	Quarterly Surface VOC Emissions Monitoring: Breach in emission levels.	See Report dated 301213 (submitted to Agency)

5.3.2. Complaints

There were 10 no. complaints to the facility in 2013.
Overleaf is a graphical summary of complaints for the year.

This represents a massive decrease on the number of complaints made in during the previous years. There were 382 complaints in 2007 and 174 during 2008.
Although the 38 complaints received during 2010 is an increase on the 26 complaints received during 2009.

The 2013 figure represents the lowest amount of complaints to date.

5.4. Review of Nuisance Controls

Litter

Litter is not a nuisance at the Arthurstown landfill. This was mainly due to the baling of the waste. A number of portable litter fences surround the top edge of the landfill in the off chance that litter should escape from the bale face. Litter patrols no longer take place at the facility as the site is now closed to waste intake. **Final capping works were completed during 2013 and as a result has eliminated all sources of litter.**

Birds & Vermin

Due to the excellent vector control programme, there were no nuisances caused by Birds and Vermin at this Facility. As a result of the excellent housekeeping in the marshalling yard and again at the bale face, vermin did not cause nuisance at this facility. There were also several different types of Birds of Prey on-site throughout the day, seven days a week. A Peregrine falcon, a Saker falcon, Harris hawks, American red-tailed Eagle and other cross breeds of falcon. All proved effective means of deterrent for birds which otherwise could cause nuisance at the site.
The bird contractor is no longer on site due to the closure of Arthurstown Landfill.

Odour

Due to the final capping completion during 2013 there have been no odour complaints. Currently all gas is now being utilised and two of the enclosed flare units are on stand-by or are activated when deemed necessary by the Facility manager.
As indicated in the earlier section, complaints for 2013 are the lowest recorded to date.

5.5. Report on Staff Training

The following training courses/seminars were attended by the staff at Arthurstown Landfill during 2013.

Table 5.1 Staff Training Log 2013.

Training Course /Seminar	Staff Attendees
None / Due to budgetary constraints	None

5.6. Non-Compliances at Arthurstown Landfill during 2013.

During 2013 Arthurstown landfill received a total of 1 non-compliance from the Environmental Protection Agency. They were for the following reasons:

Reason for NC	Number	EPA Site Visit
Not reporting Incident Notification	1	No

Table 5.3 Non-Compliance Log for 2013.

All non compliances were responded to in writing by the facility management team and returned to the EPA.

The non compliances during 2013 were as a result of failure to notify Agency of an incident involving the de-silting of the surface water retention pond.

Total number of non compliances for 2013 is 1.

1.1. Reports of Financial Provision

Report on Financial Provisions under Waste Licence

South Dublin County Council has taken out a bond in favour of Kildare County Council (the local authority in whose functional area the facility is located) in order to ensure satisfactory completion of Arthurstown Landfill. Significant contributions are made annually towards leachate treatment, environmental monitoring and landfill closure/aftercare.
Budgetary estimates for activities at Arthurstown during 2013 were in the region of € 1.1 m.
Under the Closure Restoration and Aftercare Management Plan (CRAMP) as part of the Environmental Liabilities and Risk Assessment (ELRA) conditions of the waste license South Dublin County Council have contributed approximately €4.3 million Euro to the aftercare and restoration fund.

Report on Programme for Public Information

In accordance with Waste Licence W0004-04, information is made available on site and submitted to the EPA on a regular basis. During 2013 there were numerous visits conducted at the facility for interested parties including schools and university groups, local and other international visitors.
Information about the facility is available on the website which can be accessed at *www.arthurstown.ie*. Site contact numbers are posted at the facility entrance.
A site DVD is now complete since March 2003. This 11 minute short film describes the site from the landfill construction and operational perspectives. It is used during site visits to present visitors with a clear understanding of the nature of the site activities. The site has also featured in televised waste management documentaries as being the most state of the art and well managed landfill to date in Ireland.

Report on Management and Operation Structure

The site is owned and managed by South Dublin County Council, who also holds the Waste Licence and Planning Permission (now expired), for the facility. Waste placement at the site is supervised by the Facility Manager (J. Smith) and Deputy Facility Manager (M.Heffernan).
At the end of 2013 South Dublin County Council had 4 direct employees engaged in full time management and administrative functions at the site, namely the Facility Manager (J. Smith), Deputy Facility Manager (M.Heffernan), Assistant Site Foreman (S. Fitzgerald) and E. Comerford (GO).
The Senior Engineer for South Dublin County Council Environmental Services is Mr. Leo Magee and the Director of Services for Environmental Services is now Ms. Teresa Walsh.

5.8. Local Environmental Project Funding

Contributions to the Locality.

South Dublin County Council was conditioned by An Bord Pleanala to contribute the sum of € 100,000 annually to Kildare County Council.

The required committee was formed and funds were distributed.

There was a total of €300,000 to be distributed locally for the community.

During 2010 the committee awarded approximately €200,000 Euro to local community groups and projects in the environs of Kill, Kilteel and Rathmore.

The final meeting of the committee took place during 2011 to allocate the remainder of the funds.
The committee has now fulfilled its duty and is no longer required to meet.

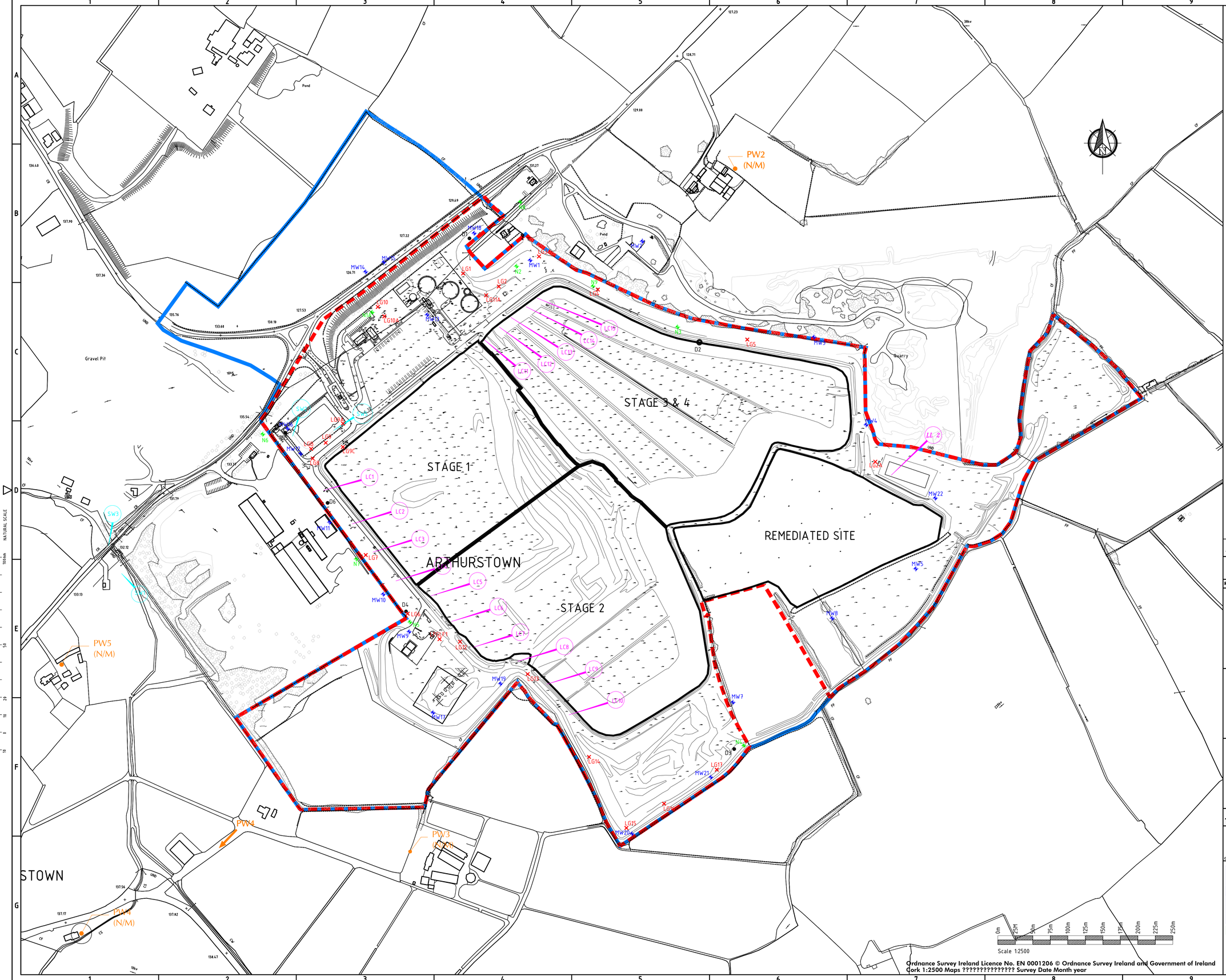
Some of the beneficiaries were:

Kill GAA
Rathmore Primary School
Kill Tidy Towns
Saplings School

This has now concluded and will no longer be reported on.

APPENDIX 3.1

Monitoring Locations Drawing



LANDFILL GAS	LEACHATE
LG 1	LC 1
LG 2	LC 2
LG 3	LC 3
LG 4	LC 4
LG 5	LL 2
LG 6	LT 1
LG 7	LT 2
LG 8	L B
LG 9	L R
LG 10	LGW
LG 2A	LC11
LG 12	LC12
LG 13	LC13
LG 14	LC14
LG 15	LC15
LG 16	LC 5
LG 17	LC 6
LFGF1	LC 7
LG 9A	LC 8
LG 9B	LC 9
LG 9C	LC 10
LG10A	DUST
LG 11A	D 1
GROUNDWATER	D 2
MW 1	D 3
MW 2	D 4
MW 3	D 5
MW 4	D 6
MW 5	NOISE
MW 6	N1A
MW 6A	N2
MW 7	N3
MW 8	N4
MW 9	N5
MW 10	N6
MW 11	N7
MW 12	N8
MW 13	N9
MW 14	SURFACE WATER
MW 15	SW 1
MW16	SW 2
MW 17	SW 3
MW 18	SW 4
MW 19	SW 5
MW 20	PRIVATE WELLS
MW 21	PW 1
	PW 2
	PW 3
	PW 4
	PW 5

Rev.	Drawn	Chk'd	App'd		
A	KL	ME	CC	Cork 14.12.06	ISSUE FOR PLANNING
				Rev Origin Date	Description

Revision History: A

Name of Client

SOUTH DUBLIN COUNTY COUNCIL

Name of Job

ARTHURSTOWN LANDFILL
PLANNING AND EIS

Title of Drawing

ENVIRONMENTAL MONITORING LOCATIONS

Scales Used
1:2500

Dwg. No. 2006-054-03-FIG2.4 — **Rev.** A

O:\ACAD\2006\054\03\adc-ps_Fig24

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APPENDIX 3.2

Landfill Gas Charts and Tables (Perimeter monitoring wells and Audit Sheet for Landfill Gas Wells)

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Jan-13**
Address :	**Kill, Co. Kildare.**	Date :	**31st Jan 2013**
Licensee :	**South Dublin County Council**	Time :	**15:00hrs - 16:20hrs**
Licence Reg.:	**W0004-004**	Personnel :	**M.Heffernan**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**991 mb**	Next Calibration :	**Jun-13**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	0.7	21.0	
LG2	BH	7.90	0.0	0	**1.7**	15.2	
LG2A	BH	4.40	0.0	0	1.2	15.0	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	21.0	
LG5	BH	5.70	0.0	0	0.0	21.0	
LG6	BH	7.00	0.0	0	**5.5**	8.0	
LG7	BH	6.00	0.0	0	**1.8**	19.2	
LG8	BH	7.00	0.0	0	**3.8**	14.3	
LG9	BH	7.00	0.0	0	0.2	22.3	
LG9A	BH	7.40	0.3	6	0.5	20.5	
LG9B	BH	5.80	0.0	0	**9.8**	3.4	
LG9C	BH	7.00	0.0	0	0.0	21.9	
LG10	BH	5.60	**15.3**	**306**	**3.7**	8.1	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	**1.6**	19.5	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	21.0	
LG13	BH	13.05	0.0	0	**4.2**	12.5	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	21.0	
LG16	BH	9.32	0.0	0	0.8	19.2	
LG17	BH	8.15	0.0	0	0.0	21.0	
LG18	BH	4.42	0.0	0	1.2	19.0	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 15.3/ 5 x 100 = 306

Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Feb-13**
Address :	**Kill, Co. Kildare.**	Date :	**28th Feb 2013**
Licensee :	**South Dublin County Council**	Time :	**15:00hrs - 16:20hrs**
Licence Reg.:	**W0004-004**	Personnel :	**M.Heffernan**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**1017 mb**	Next Calibration :	**Jun-13**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	0.5	20.9	
LG2	BH	7.90	0.0	0	**1.5**	14.0	
LG2A	BH	4.40	0.0	0	1.0	17.0	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.9	
LG5	BH	5.70	0.0	0	0.0	20.9	
LG6	BH	7.00	0.0	0	**4.0**	11.0	
LG7	BH	6.00	0.0	0	**1.6**	19.0	
LG8	BH	7.00	0.0	0	**4.0**	12.5	
LG9	BH	7.00	0.0	0	0.0	21.0	
LG9A	BH	7.40	0.0	0	0.0	20.9	
LG9B	BH	5.80	0.0	0	**8.0**	4.5	
LG9C	BH	7.00	0.0	0	0.0	20.9	
LG10	BH	5.60	**13.5**	**270**	**3.0**	7.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	**1.8**	18.5	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.9	
LG13	BH	13.05	0.0	0	**4.0**	10.5	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	20.9	
LG16	BH	9.32	0.0	0	0.0	20.9	
LG17	BH	8.15	0.0	0	0.0	20.9	
LG18	BH	4.42	0.0	0	**1.5**	18.0	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 13.5/ 5 x 100 = 270 Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Mar-13**
Address :	**Kill, Co. Kildare.**	Date :	**26th March 2013**
Licensee :	**South Dublin County Council**	Time :	**15:00hrs - 16:20hrs**
Licence Reg.:	**W0004-004**	Personnel :	**M.Heffernan**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**1002 mb**	Next Calibration :	**Jun-13**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	0.0	20.8	
LG2	BH	7.90	0.0	0	**1.8**	13.5	
LG2A	BH	4.40	0.0	0	0.8	18.0	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.8	
LG5	BH	5.70	0.0	0	0.0	20.8	
LG6	BH	7.00	0.0	0	**2.8**	14.0	
LG7	BH	6.00	0.0	0	**1.8**	18.0	
LG8	BH	7.00	0.0	0	**3.2**	14.0	
LG9	BH	7.00	**2.1**	**42**	**1.5**	14.0	
LG9A	BH	7.40	0.0	0	0.0	20.8	
LG9B	BH	5.80	0.0	0	**5.5**	6.0	
LG9C	BH	7.00	0.0	0	0.0	20.8	
LG10	BH	5.60	**14.8**	**296**	**5.5**	3.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	**2.2**	15.5	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.8	
LG13	BH	13.05	0.0	0	**3.2**	11.5	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	20.8	
LG16	BH	9.32	0.0	0	0.0	20.8	
LG17	BH	8.15	0.0	0	0.0	20.8	
LG18	BH	4.42	0.0	0	**1.8**	16.0	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 14.8/ 5 x 100 = 296 Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Apr-13**
Address :	**Kill, Co. Kildare.**	Date :	**26th April 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**M.Heffernan**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**1004 mb**	Next Calibration :	**Jun-13**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	0.0	20.9	
LG2	BH	7.90	0.0	0	1.1	14.5	
LG2A	BH	4.40	0.0	0	0.8	19.2	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.9	
LG5	BH	5.70	0.0	0	0.0	20.9	
LG6	BH	7.00	0.0	0	**2.2**	15.0	
LG7	BH	6.00	0.0	0	**1.5**	18.5	
LG8	BH	7.00	0.0	0	**2.5**	15.5	
LG9	BH	7.00	**1.8**	**36**	1.2	12.0	
LG9A	BH	7.40	0.0	0	0.0	20.9	
LG9B	BH	5.80	0.8	16	**0.0**	12.5	
LG9C	BH	7.00	0.0	0	0.0	20.9	
LG10	BH	5.60	**11.5**	**230**	**3.8**	4.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	**2.5**	14.0	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.9	
LG13	BH	13.05	0.0	0	**2.4**	12.5	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	20.9	
LG16	BH	9.32	0.0	0	0.0	20.9	
LG17	BH	8.15	0.0	0	0.0	20.9	
LG18	BH	4.42	0.0	0	**2.2**	15.0	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 11.5/ 5 x 100 = 230 Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**May-13**
Address :	**Kill, Co. Kildare.**	Date :	**27th May 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**M.Heffernan**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**982 mb**	Next Calibration :	**Jun-13**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	0.0	20.8	
LG2	BH	7.90	0.0	0	0.8	15.5	
LG2A	BH	4.40	0.0	0	0.0	20.1	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.8	
LG5	BH	5.70	0.0	0	0.0	20.8	
LG6	BH	7.00	0.0	0	**1.8**	16.0	
LG7	BH	6.00	0.0	0	1.2	19.0	
LG8	BH	7.00	0.0	0	**2.2**	16.0	
LG9	BH	7.00	0.0	0	**7.0**	8.1	
LG9A	BH	7.40	**2.5**	**50**	**2.3**	5.4	
LG9B	BH	5.80	0.1	2	**8.5**	6.2	
LG9C	BH	7.00	0.0	0	0.0	18.1	
LG10	BH	5.60	**27.1**	**542**	**1.6**	0.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	0.0	20.6	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.8	
LG13	BH	13.05	0.0	0	**1.8**	11.0	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	20.8	
LG16	BH	9.32	0.0	0	0.0	20.8	
LG17	BH	8.15	0.0	0	0.0	20.8	
LG18	BH	4.42	0.0	0	0.8	20.6	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Example of Calc of LEL at LG10 27.1/ 5 x 100 = 542

Signed :- _____

Facility Manager

Date :- _____

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Jun-13**
Address :	**Kill, Co. Kildare.**	Date :	**28th June 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**J.Smith**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**1005 mb**	Next Calibration :	**Jun-13**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	0.0	20.9	
LG2	BH	7.90	0.0	0	0.0	19.0	
LG2A	BH	4.40	0.0	0	0.0	20.9	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.8	
LG5	BH	5.70	0.0	0	0.0	20.9	
LG6	BH	7.00	0.0	0	**2.2**	15.5	
LG7	BH	6.00	0.0	0	1.0	17.5	
LG8	BH	7.00	0.0	0	**2.8**	12.5	
LG9	BH	7.00	0.0	0	**5.5**	9.0	
LG9A	BH	7.40	**2.0**	**40**	**1.8**	6.8	
LG9B	BH	5.80	0.0	0	**4.0**	8.0	
LG9C	BH	7.00	0.0	0	0.0	20.2	
LG10	BH	5.60	**20.2**	**404**	**2.1**	0.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	0.0	20.5	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.9	
LG13	BH	13.05	0.0	0	**2.0**	12.0	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	20.9	
LG16	BH	9.32	0.0	0	0.0	20.9	
LG17	BH	8.15	0.0	0	0.0	20.8	
LG18	BH	4.42	0.0	0	0.8	20.4	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 20.2/ 5 x 100 = 404

Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Jul-13**
Address :	**Kill, Co. Kildare.**	Date :	**31st July 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**E.Comerfod**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**994 mb**	Next Calibration :	**Dec-13**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	0.0	20.8	
LG2	BH	7.90	0.0	0	0.0	20.0	
LG2A	BH	4.40	0.0	0	0.0	20.8	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.8	
LG5	BH	5.70	0.0	0	0.0	20.8	
LG6	BH	7.00	0.0	0	**3.2**	12.5	
LG7	BH	6.00	0.0	0	1.2	15.0	
LG8	BH	7.00	0.0	0	**2.2**	14.5	
LG9	BH	7.00	0.0	0	**2.0**	11.0	
LG9A	BH	7.40	**1.5**	**30**	**1.2**	8.0	
LG9B	BH	5.80	0.0	0	**0.0**	18.5	
LG9C	BH	7.00	0.0	0	0.0	20.4	
LG10	BH	5.60	**16.5**	**330**	**3.0**	0.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	0.0	20.8	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.8	
LG13	BH	13.05	0.0	0	**2.2**	11.0	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	20.8	
LG16	BH	9.32	0.0	0	0.0	20.8	
LG17	BH	8.15	0.0	0	0.0	20.7	
LG18	BH	4.42	0.0	0	1.0	19.0	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 16.5/ 5 x 100 = 330

Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Aug-13**
Address :	**Kill, Co. Kildare.**	Date :	**29th August 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**E.Comerfod**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**1003 mb**	Next Calibration :	**Dec-13**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	0.0	20.9	
LG2	BH	7.90	0.0	0	0.8	16.0	
LG2A	BH	4.40	0.0	0	1.1	15.5	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.8	
LG5	BH	5.70	0.0	0	0.0	20.8	
LG6	BH	7.00	0.0	0	**1.8**	18.0	
LG7	BH	6.00	0.0	0	**2.0**	15.0	
LG8	BH	7.00	0.0	0	**2.3**	14.0	
LG9	BH	7.00	**2.2**	**44**	**1.5**	9.0	
LG9A	BH	7.40	0.0	0	0.0	20.8	
LG9B	BH	5.80	**1.2**	**24**	0.2	8.0	
LG9C	BH	7.00	0.0	0	0.0	20.9	
LG10	BH	5.60	**14.5**	**290**	**6.0**	2.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	**2.5**	12.0	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.8	
LG13	BH	13.05	0.0	0	**1.8**	14.0	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	20.8	
LG16	BH	9.32	0.0	0	0.0	20.8	
LG17	BH	8.15	0.0	0	0.0	20.8	
LG18	BH	4.42	0.0	0	**1.8**	17.0	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 14.5/ 5 x 100 = 330 Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Sep-13**
Address :	**Kill, Co. Kildare.**	Date :	**24th September 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**E.Comerfod**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 5000**
Atmospheric Pressure :	**1000 mb**	Next Calibration :	**Mar-14**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	**2.5**	14.5	
LG2	BH	7.90	0.0	0	0.0	20.3	
LG2A	BH	4.40	0.0	0	0.7	18.0	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.8	
LG5	BH	5.70	0.0	0	0.0	20.8	
LG6	BH	7.00	0.0	0	**6.0**	8.8	
LG7	BH	6.00	0.0	0	0.0	20.4	
LG8	BH	7.00	0.0	0	1.2	18.9	
LG9	BH	7.00	0.0	0	0.2	20.1	
LG9A	BH	7.40	0.0	0	**3.1**	8.0	
LG9B	BH	5.80	0.0	0	0.0	20.4	
LG9C	BH	7.00	0.0	0	0.0	14.6	
LG10	BH	5.60	**16.4**	**328**	1.2	0.5	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	0.2	20.0	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.8	
LG13	BH	13.05	0.0	0	**2.0**	14.0	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	0.0	20.8	
LG16	BH	9.32	0.0	0	0.0	20.8	
LG17	BH	8.15	0.0	0	0.0	20.8	
LG18	BH	4.42	0.0	0	1.2	18.0	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 16.4/ 5 x 100 = 328

Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Oct-13**
Address :	**Kill, Co. Kildare.**	Date :	**30th October 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**E.Comerfod**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 2000**
Atmospheric Pressure :	**995 mb**	Next Calibration :	**Mar-14**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	**2.2**	14.0	
LG2	BH	7.90	0.0	0	0.0	20.9	
LG2A	BH	4.40	0.0	0	1.2	16.0	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.3	
LG5	BH	5.70	0.0	0	0.0	20.9	
LG6	BH	7.00	0.0	0	**5.5**	10.0	
LG7	BH	6.00	0.0	0	0.0	20.8	
LG8	BH	7.00	0.0	0	1.0	18.0	
LG9	BH	7.00	0.0	0	0.0	20.5	
LG9A	BH	7.40	0.0	0	**2.8**	9.0	
LG9B	BH	5.80	0.0	0	0.0	20.8	
LG9C	BH	7.00	0.0	0	0.0	15.5	
LG10	BH	5.60	**14.8**	**296**	**2.2**	2.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	1.2	18.0	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.8	
LG13	BH	13.05	0.0	0	**3.2**	12.0	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	**1.8**	18.0	
LG16	BH	9.32	0.0	0	**2.2**	18.0	
LG17	BH	8.15	0.0	0	1.0	19.0	
LG18	BH	4.42	0.0	0	**2.2**	16.0	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 14.8/ 5 x 100 = 296

Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Nov-13**
Address :	**Kill, Co. Kildare.**	Date :	**29th November 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**E.Comerfod**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 2000**
Atmospheric Pressure :	**1017 mb**	Next Calibration :	**Mar-14**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	**1.8**	16.0	
LG2	BH	7.90	0.0	0	0.0	20.8	
LG2A	BH	4.40	0.0	0	1.4	14.2	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	1.0	20.8	
LG5	BH	5.70	0.0	0	1.2	20.8	
LG6	BH	7.00	0.0	0	**3.5**	14.0	
LG7	BH	6.00	0.0	0	0.0	20.8	
LG8	BH	7.00	0.0	0	**2.4**	16.0	
LG9	BH	7.00	0.8	16	1.2	18.0	
LG9A	BH	7.40	0.0	0	**2.2**	11.0	
LG9B	BH	5.80	0.0	0	0.0	20.8	
LG9C	BH	7.00	0.0	0	0.0	19.0	
LG10	BH	5.60	**16.2**	**324**	**2.8**	2.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	1.2	19.0	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.8	
LG13	BH	13.05	0.0	0	**2.2**	16.8	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	**2.8**	16.0	
LG16	BH	9.32	0.0	0	1.2	18.0	
LG17	BH	8.15	0.0	0	0.0	20.8	
LG18	BH	4.42	0.0	0	0.0	20.8	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 16.2/ 5 x 100 = 324

Facility Manager

Date :-

MONTHLY MONITORING OF PERMIETER GAS BOREHOLES

Site Name :	**Arthurstown Landfill**	Period :	**Dec-13**
Address :	**Kill, Co. Kildare.**	Date :	**30th December 2013**
Licensee :	**South Dublin County Council**	Time :	**11:00hrs - 12:30hrs**
Licence Reg.:	**W0004-004**	Personnel :	**M.Heffernan**
Site Status :	**Closed: Aftercare Phase**	Instrument :	**GA 2000**
Atmospheric Pressure :	**983 mb**	Next Calibration :	**Mar-14**

Ref. No.	*BH VT SP*	*Survey Depth (m)*	*CH_4 % v/v*	*CH_4 % LEL*	*CO_2 % v/v*	*O_2 % v/v*	*Comments*
LG1	BH	9.90	0.0	0	**2.2**	15.0	
LG2	BH	7.90	0.0	0	0.0	20.9	
LG2A	BH	4.40	0.0	0	1.2	16.0	
LG3	BH	9.30					UTM (Obstructed)
LG4	BH	6.50	0.0	0	0.0	20.9	
LG5	BH	5.70	0.0	0	0.0	20.8	
LG6	BH	7.00	0.0	0	**2.8**	15.0	
LG7	BH	6.00	0.0	0	0.0	20.9	
LG8	BH	7.00	0.0	0	**2.2**	16.0	
LG9	BH	7.00	**1.2**	**24**	0.8	15.5	
LG9A	BH	7.40	0.0	0	**2.0**	13.0	
LG9B	BH	5.80	0.0	0	0.0	20.9	
LG9C	BH	7.00	0.0	0	0.0	20.0	
LG10	BH	5.60	**18.0**	**360**	**3.2**	1.0	Located in Old Percolation Area.
LG10A	BH	0.00	0.0	0	1.0	20.0	
LG11A	BH	7.10					UTM (Obstructed)
LG11B	BH	4.63					UTM (Obstructed)
LG12	BH	11.12	0.0	0	0.0	20.9	
LG13	BH	13.05	0.0	0	**1.8**	17.0	
LG14	BH	8.55					UTM (Flooded)
LG15	BH	9.34	0.0	0	**2.2**	16.0	
LG16	BH	9.32	0.0	0	0.0	20.0	
LG17	BH	8.15	0.0	0	0.0	20.9	
LG18	BH	4.42	0.0	0	0.0	19.8	

Note : Bold type denotes attainment or excedence of Trigger Level
(1.0 % v/v (20% LEL) CH_4 & 1.5% v/v CO_2) - Ref. Waste Licence 4-4 Condition 6.3.1.

Signed :-

Example of Calc of LEL at LG10 18/ 5 x 100 = 360

Facility Manager

Date :-

APPENDIX 3.3

Dust Charts and Tables

Table A.3.3.x: All Stations, All Parameters for Dust - AER Sample (Page: 1/1)

Sample Type: Dust, Year: 2013

Sample Point --- Parameter --- MAC			15-Apr	20-May	15-Jul
			1st event	2nd event	3rd event
D1	Dust Deposition (mg/m2/day)	350	84	63	41
D2	Dust Deposition (mg/m2/day)	350	65	87	25
D3	Dust Deposition (mg/m2/day)	350	35	64	32
D4	Dust Deposition (mg/m2/day)	350	94	30	46
D5	Dust Deposition (mg/m2/day)	350	81	45	63
D6	Dust Deposition (mg/m2/day)	350	80	88	38

MAC: Maximum Allowed Concentration - (values exceeded are shaded in yellow)

The MAC for dust is set by the waste licence.

Occasions where the sampler was unable to record a measurement are indicated in a separate comments table.

Results marked with '<' indicate that it is below the level of detection of the measuring instrument. The levels of detection used may have varied over time depending on the lab or the method of detection used.

APPENDIX 3.4

Noise Charts and Tables

3. SURVEY RESULTS

3.1 Measurement Units

The unit of sound pressure level is the decibel (dB). This is calculated as a logarithm of sound. A change of 10 dB corresponds approximately to halving or doubling the loudness of sound. The use of decibels (A-weighted), dB(A), as the basic unit for general environmental and traffic noise, is widely accepted. Decibels measured on a sound level meter incorporating this frequency weighting differentiates between sounds of different frequencies in a manner similar to the human ear. That is, measurements in dB(A) broadly agree with human beings assessment of loudness. It has been demonstrated that noise levels in dB(A) from a wide range of sources adequately represent loudness.

In order to understand the terms used below, some definitions of the terms used are outlined as follows:

L_{A10} Refers to those noise levels in the top 10th percentile of the sampling period; it is the level which is exceeded for 10% of the measurement period. It is used to determine the intermittent high noise level features of locally generated noise and usually gives an indicator of the level of traffic.

L_{A90} Refers to those noise levels in the lower 90th percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level.

L_{Aeq} The average level recorded over the sampling period. The closer the L_{Aeq} value is to either the L_{A10} or L_{A90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.

Impulsive noise: a noise of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.

Tonal noise: A noise source that is concentrated in a narrow band of the frequency spectrum.

3.2 Survey Findings

Results of the noise monitoring conducted are summarised in Tables 3.1 and 3.2. A detailed outline of noise sources audible during each monitoring period is provided in Appendix 2.

There were no tonal or impulsive characteristics audible or determined from the survey data therefore there is no requirement to tabulate rated noise levels. Measured L_{Aeq} values which exceed the emission limits values are shown in bold.

Table 3.1: Daytime Noise Survey Results

Location	Daytime Round 1			Daytime Period 2			Daytime Period 3		
	L_{Aeq} dB	L_{A10} dB	L_{A90} dB	L_{Aeq} dB	L_{A10} dB	L_{A90} dB	L_{Aeq} dB	L_{A10} dB	L_{A90} dB
N1A	52	54	47	49	53	42	48	51	45
N2	46	49	38	**61**	59	50	42	43	36
N3	45	48	36	**65**	61	48	**62**	61	42
N4	54	58	39	55	58	46	**60**	63	51
N5	**57**	57	55	**59**	61	55	**56**	57	54
N6	**57**	58	52	53	56	49	**56**	58	53
N9	53	46	35	**63**	60	48	**56**	58	46
Emission Limit Value	**55**						**55**		

Table 3.2: Night-time Noise Survey Results

Location	Start Time	Night Time Round 1			Start Time	Night Time Round 2		
		L_{Aeq} dB(A)	L_{A10} dB(A)	L_{A90} dB(A)		L_{Aeq} dB(A)	L_{A10} dB(A)	L_{A90} dB(A)
N1A	00.59	39	41	38	23.07	43	45	40
N2	01.39	36	37	33	02.30	42	37	32
N3	02.44	36	39	32	03.15	36	38	32
N4	23.04	39	40	37	01.52	40	41	37
N5	23.39	**53**	54	52	00.17	**55**	55	53
N6	00.14	**51**	52	50	23.42	**51**	52	49
N9	02.13	35	37	32	03.04	36	39	32
Emission Limit Value		**45**				**45**		

3.3 Discussion of Noise Results

The noise levels at N1A represent the noise in the area of the site entrance and site offices. N1A and N4 are the two furthest from the active restoration/capping area of the landfill. During this monitoring period, the area surrounding N4 was being used as a temporary storage area for soil to be used in the final capping phase. Truck traffic and heavy machinery were constant sources of noise at N4. The locations N2, N3 and N9 are on-site located near the onsite access road and adjacent to the current restoration area of the site and are thus not considered representative of the overall noise emissions from the site. There are also no noise-sensitive locations along this part of the site boundary. Rather they represent a concentration of the loudest emissions from vehicle movements to the restoration area. Locations N5 and N6 are located adjacent to the offsite industrial facility on the western boundary of the landfill site and thus are also subject to noise emissions from that facility.

3.3.1. Daytime Noise Monitoring

Compliant Values

During the Daytime Period 1 monitoring, the L_{Aeq} values at N1A, N2, N3, N4 and N9 were compliant with the daytime emission limit value of 55 dB (A).

During the Daytime Period 2 monitoring, the L_{Aeq} values at N1A, N2, N3 and N6 were compliant with the daytime emission limit value of 55 dB (A).

During the Daytime Period 3 monitoring, the L_{Aeq} values at N1A and N2 were compliant with the day time emission limit value of 55 dB (A).

Non-Compliance at N2

A non-compliance was recorded at N2 during Daytime Period 2. All the daytime measurements for N2 are presented in Table 3.3 and it is evident that untypical noise events occurred during the second monitoring period as each of the reported parameters exceeds the other two monitoring periods by 10 to 20 dB(A).

Table 3.3: Daytime Measurements at N2

Sampling Period	Date	Start Time	L_{Aeq} dB	L_{A10} dB	L_{A90} dB
Daytime Round 1	25/11/2013	10.21	46	49	38
Daytime Period 2	26/11/2013	08.12	**61**	59	50
Daytime Period 3	26/11/2013	13.29	42	43	36

The non-compliant L_{Aeq} value during Daytime Period 2 is greater than the respective L_{A10} value showing that the L_{Aeq} value was influenced by short, loud events occurring for less than 3 minutes of the 30 minute monitoring periods.

The non compliance at location N2 during Daytime Period 2 was caused by the noise from a front end loader moving constantly around the monitoring location and using its reversing siren.

Non-Compliances at N3

Non-compliances were recorded at N3 during Daytime Periods 2 and 3.

Table 3.4: Daytime Measurements at N3

Sampling Period	Date	Start Time	L_{Aeq} dB	L_{A10} dB	L_{A90} dB
Daytime Round 1	25/11/2013	11.28	45	48	36
Daytime Period 2	26/11/2013	09.17	**65**	61	48
Daytime Period 3	26/11/2013	12.55	**62**	61	42

At this location, the non-compliant L_{Aeq} values are greater than the respective L_{A10} values showing that the L_{Aeq} values were influenced by short, loud events occurring for less than 3 minutes of the 30 minute monitoring periods.

The non compliance at location N3 during Daytime Periods 2 and 3 was caused by the noise from vehicles passing directly beside the location. These vehicles took 1 minute to pass the location with the noise level building until the vehicle passed and then falling again, thus influencing the L_{A10} values.

Non-Compliance at N4

A non-compliance was noted at N4 during Daytime Period 3.

Table 3.5: Daytime Measurements at N4

Sampling Period	Date	Start Time	L_{Aeq} dB	L_{A10} dB	L_{A90} dB
Daytime Round 1	25/11/2013	12.19	54	58	39
Daytime Period 2	25/11/2013	14.59	55	58	46
Daytime Period 3	26/11/2013	11.49	**60**	63	51

The non compliance at location N4 during Daytime Period 3 was caused by the noise from trucks passing very close to the location as compared to Periods 1 and 2 when they passed a greater distance from the location. These short, loud events occurring for less than 3 minutes of the 30 minute monitoring period has influenced the elevated L_{Aeq} and L_{A10} values.

The excavator was working nearer to the location for the duration of the monitoring event, resulting in a higher L_{A90} value.

Non-Compliances at N5 and N6

At N5 and N6 the most significant offsite noise source is the continuous background noise from the nearby industrial timber processing plant. Noise sources from the industrial plant included continuous ventilation, fan and equipment operation, intermittent vehicle movement and reversing sirens. Onsite sources audible at N5 and N6 included onsite vehicle movement. Continuous noise from the landfill gas facility (flares/engines) was also audible at N5.

The non-compliances at locations N5 and N6 for the three monitoring periods are caused by the noise emissions from the nearby industrial facility on the western boundary of the landfill site. The LAeq values are not representative of on-site noise sources therefore the non-compliances cannot be attributed to the operations at Arthurstown Landfill.

Non-Compliances at N9

Non-compliances were noted at N9 during Daytime Periods 2 and 3.

Table 3.6: Daytime Measurements at N9

Sampling Period	Date	Start Time	L_{Aeq} dB	L_{A10} dB	L_{A90} dB
Daytime Round 1	25/11/2013	10.54	53	46	35
Daytime Period 2	26/11/2013	08.44	**63**	60	48
Daytime Period 3	26/11/2013	14.06	**56**	58	46

The non compliance at location N9 during Daytime Periods 2 and 3 was caused by the noise from vehicles passing directly beside the location. These vehicles took 1 minute to pass the location with the noise level building until the vehicle passed and then falling again, thus influencing the L_{A10} values.

3.3.2. Night–time Noise Monitoring

Compliant Values

For both night-time monitoring periods, the L_{Aeq} values at N1A, N2, N3, N4 and N9 were compliant with the night-time emission limit value of 45 dB (A).

Non-compliant Values

The noise levels recorded at locations N5 and N6 exceeded the 45 dB L_{Aeq} night time emission limit value. The recorded levels ranged from 51 to 55 dB. At N5, an audible onsite source was the landfill gas facility (flares/engines). There were no audible on-site noise sources at N6 except for an on-site drain.

At both locations, the most significant noise source is the nearby industrial timber processing plant. Noise levels from the industrial plant were caused by a continuous ventilation system, fan and equipment operation, intermittent vehicle movement and reversing sirens. The L_{Aeq} values measured at N5 and N6 are not representative of on-site noise levels during night-time hours therefore the night-time non-compliances at these locations are not attributable to Arthurstown Landfill.

3.4 Tonal Compliance

In accordance with Annex D of ISO 1996-2:2007 Acoustics - Description and measurement of environmental noise – Part 2, a tone is deemed to be present if the level in one 1/3 octave band is:

- 15 dB, higher than the level in the two adjacent bands in the low frequency one third octave bands (25 Hz to 125 Hz)
- 8 dB higher than the level in the two adjacent bands in middle frequency bands (160Hz-400Hz)
- 5 dB higher than the level in the two adjacent bands in high frequency bands (500 Hz to 10, 000 Hz)

All measurements were subject to a one-third octave band analysis to identify if tonal components were present. The plotted spectra and tabulated frequency data is presented in Appendix 3.

Dominant frequencies of 40 and 50 Hz were noted at several locations however, tonal characteristics in accordance with ISO 1996-2:2007 were not identified from the daytime or night-time measurements.

4. CONCLUSION

Onsite noise levels are variable during daytime due to vehicles entering and leaving the site, vehicle movement within the site and landfill capping activities.

Off-site noise sources are also variable with nearby road traffic and the adjacent industrial timber processing plant being the main contributor to offsite noise levels in the area.

The day-time levels at N1A show compliance with the 55 dB L_{Aeq} emission limit value.

The day-time levels at N2, N3, N4 and N9 were not in compliance with the 55 dB L_{Aeq} emission limit value. These locations were influenced by activities associated with the current restoration activities at the site and are thus not considered representative of the overall noise emissions from the site. There are also no noise-sensitive locations along this part of the site boundary

The day-time levels at N5 and N6 were above the 55 dB L_{Aeq} emission limit value. These locations were influenced by activities associated with the nearby industrial timber processing plant; therefore the values measured are not representative of on-site noise levels during night-time hours. These day-time non-compliances are not attributable to Arthurstown Landfill and the site is considered to be compliant with the night-time noise emission limit.

The night-time levels at N1A, N2, N3, N4 and N9 show compliance with the 45 dB L_{Aeq} emission limit value where a dominant off-site noise source was not audible. At N5 and N6, the nearby industrial timber processing plant was the dominant night-time source therefore the values measured are not representative of on-site noise levels during night-time hours. These night-time non-compliances are not attributable to Arthurstown Landfill and the site is considered to be compliant with the night-time noise emission limit.

Tonal components were not identified in the one-third octave band data for each noise monitoring location during both the day-time and night-time monitoring events.

APPENDIX 3.5

Surface Water Charts and Tables

TABLE 5.3: RESULTS OF CHEMICAL ANALYSIS OF SURFACE WATER SAMPLES						
Parameter	**Surface Water Quality Standard**	**SW-1**	**SW-3**	**SW-5**	**SW-2**	**SW-4**
		Up-stream	**Down-stream**	**Pond Inlet**	**Pond Outlet**	**Kill River**
pH (pH units)	***6.0 – 9.0*** *Note 1*	8.1	8.0	8.1	7.5	8.1
Conductivity (µS/cm @ 25^0C)	***1000*** *Note 2*	539	597	712	883	586
BOD (TCMP) (mg/l)	***High Status: ≤ 2.2 Good Status: ≤2.6*** *Note 1*	<2	<2	<2	<2	<2
COD (mg/l)	***40*** *Note 2*	<10	<10	<10	<10	13
Ammonia as N (mg/l) (Konelab)	***High Status: ≤ 0.04 Good Status ≤0.065*** *Note 1*	<0.02	<0.02	<0.02	0.04	<0.02
Suspended Solids (mg/)l	***25*** *Note3*	<5	<5	<5	6	<5
Total Alkalinity ($CaC0_3$) (mg/l)	-	252	275	232	348	291
Chloride (mg/l)	***250*** *Note 2*	13	16	36	36	13
Sulphate (mg/l)	***200*** *Note 2*	15	26	99	98	14
Total Phosphorous (mg/l)	-	0.05	<0.05	<0.05	<0.05	0.1
Ortho-phosphate as P (mg/l)	***High Status:≤0.025 Good Status:≤0.035*** *Note 1*	<0.01	<0.01	<0.01	<0.01	0.02
Nitrate as N (mg/l)	***11.29**** *Note 2*	1.8	1.8	1.3	1.8	0.59
Nitrite (mg/l)	**0.015** *Note 3*	<0.02	<0.02	<0.02	0.03	<0.02
TON as N (mg/l)	-	1.8	1.8	1.3	1.8	0.59
Cyanide (free) (mg/l)	-	<0.01	<0.01	<0.01	<0.01	<0.01
VOC's		<1	NA	NA	NA	<1

Notes:

Note 1: *Water Quality Standard = Water Quality Standards set in the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989. Limit values for A1 waters are shown.*

Note 2*: European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009).*

Note 3: *Water Quality Standard = 1988 Statutory Instrument No. 293, European Communities (Quality of Salmonid Waters) Regulations 1988.*

Results highlighted in red bold text represent exceedences of respective surface water limits.

* Converted GTV for Ammonia as N mg/l, Nitrate as N mg/l and Nitrite as N mg/l.

TABLE 5.4: RESULTS OF METAL ANALYSIS OF SURFACE WATER SAMPLES						
Parameter	**Surface Water Quality Standard**	**SW-1**	**SW-3**	**SW-5**	**SW-2**	**SW-4**
		Up-stream	**Down-stream**	**Pond Inlet**	**Pond Outlet**	**Kill River**
Boron (total) (µg/l)	***2,000***	9	16	59	61	13
Calcium (total) (mg/l)	***200***[Note 2]	87	94	97	136	114
Chromium (total) (µg/l)	***50***	<2	<2	<2	<2	<2
Cadmium (total) (µg/l)	***5***	<2	<2	<2	<2	<2
Copper (total) (µg/l)	***50***	<2	<2	<2	2	<2
Iron (total) (mg/l)	***0.20***	<0.1	<0.1	<0.1	<0.1	<0.1
Potassium (total) (mg/l)	***5***	1.9	2.0	1.7	2.5	3.5
Magnesium (total) (mg/l)	***50***[Note 2]	8.1	8.6	14	14	8.2
Manganese (total) (µg/l)	***50***	<2	4	2	31	6
Sodium (total) (mg/l)	***200***[Note 2]	8.2	8.6	27	27	10
Nickel (total) (µg/l)	***20***	<2	<2	3	3	<2
Lead (total) (µg/l)	***50***	<2	<2	<2	<2	<2
Zinc (total) (µg/l)	***3,000***	<2	<2	4	9	<2
Mercury (total) (µg/l)	***1***	<1	<1	<1	<1	<1

Note 1: *S.I. 294 of 1989: Water Quality Standard = Water Quality Standards set in the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989. Limit values for A1 waters are shown.*

***Note 2**: European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988)*

< Indicates less than the laboratory detection limit

Results highlighted in bold represent an exceedence of water quality standard.

TABLE 5.5: CALCULATED BIOLOGICAL QUALITY RATING (Q RATING) FOR SURFACE WATERS [Note 1]			
Location	**SW-1**	**SW-3**	**SW-4**
Q-Rating	4	4	4

Note 1: All sampling stations classified as Eroding Substrata

TABLE 5.6: COUNTS OF MACROINVERTEBRATES SPECIES PER SAMPLE STATION WITH REVISED BMWP AND ASPT SCORES			
Species	**SW-1**	**SW-3**	**SW-4**
Gammarus spp	38	32	25
Baetidae	>100	>100	>100
Lymnaeidae	1	-	-
Limnius spp.	1	-	-
Nemoura spp.	2	2	1
Ecdyonuridae	7	5	5
Rhyacophilidae	3	-	-
Simulidae	8	4	5
Chironomidae	2	3	5
Odontoceridae	2	1	3
Assellus spp.	5	6	-
Hydropsychida	-	1	3
Tipula spp	-	-	1
Chloroperlidae	2	-	-
Hydrobidae	3	-	-
Valvatidae	-	-	-
Number Of Taxa	**13**	**9**	**9**
Revised BMWP Score	92.5	64.6	67.9
ASPT Score	7.11	7.17	7.54

Not included in calculations of BMWP score

TABLE 5.7: REVISED BMWP SCORES, ASPT SCORES AND LQI INTERPRETATION; RESULTS SUMMARY							
Sampling Station	**BMWP Score**	**ASPT Score**	**X Rating**	**Y Rating**	**OQR**	**LQI**	**LQI Interpretation**
SW-1	92.5	7.11	5	7	6.0	A+	Excellent Quality
SW-3	64.6	7.17	4	7	5.5	A+	Excellent Quality
SW-4	67.9	7.54	4	7	5.5	A+	Excellent Quality

APPENDIX 3.6

Groundwater Charts and Tables

Table A.3.6.x: All Stations, All Parameters for Groundwater Annual - AER Sample (Page: 1/2)

Sample Type: Groundwater Annual, Year: 2013

Parameter --- MAC		MW14	MW16	MW2	MW20	MW22	MW8	MW9
		23-Jul	23-Jul	23-Jul	23-Jul	23-Jul	23-Jul	23-Jul
Ammoniacal Nitrogen (mg/l)	0.12	0.18		7.6				0.03
Chloride (mg/l)	30	11	12	219	24	12	16	12
Conductivity (µS/cm)	1000	542	637	1764	1564	498	668	599
Dissolved Oxygen (mg/l)		6.36	1.8	2.44	4.23	3.1	2.77	1.13
pH (pH units)	9.5	7.8	7.7	7.3	7.3	7.9	7.7	7.8
Temperature (C)	25	12.2	11.7	12	11	12.3	12.5	12.3
Boron (µg/l)	1000	34	12	26	27	11	10	18
Cadmium (µg/l)	5	<2	<2	<2	<2	<2	<2	<2
Calcium (mg/l)	200	75	95	214	338	77	121	98
Chromium (µg/l)	30	<2	<2	<2	<2	<2	<2	<2
Copper (µg/l)	30	<2	<2	<2	<2	<2	<2	<2
Iron (mg/l)	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lead (µg/l)	10	<2	<2	<2	<2	<2	<2	<2
Magnesium (mg/l)	50	14	18	15	17	14	13	18
Manganese (µg/l)	50	1519	1291	155		174	152	47
Mercury (µg/l)	1	<1	<1	<1	<1	<1	<1	<1
Nickel (µg/l)	20		4	3				
Potassium (mg/l)	5	1.9	1.1	13	1.3	0.95	0.87	1.3
Sodium (mg/l)	150	25	13	151	21	13	9.4	12
Sulphate (mg/l)	200	20	16	118	488	23	14	21
Total Alkalinity CaCO3 (mg/l)		248	320	472	440	243	342	276
Total Phosphorus (mg/l)				0.6	0.05			0.06
Zinc (µg/l)	100		4	3			9	

Table A.3.6.x: All Stations, All Parameters for Groundwater Annual - AER Sample (Page: 2/2)

Parameter --- MAC		MW14	MW16	MW2	MW20	MW22	MW8	MW9
		23-Jul	23-Jul	23-Jul	23-Jul	23-Jul	23-Jul	23-Jul
Nitrate (mg/l)	25	0.27		4.8	2.9			
Nitrite (mg/l)	0.1	0.03		0.03				
Groundwater Level (m O.D)		126.5	129.12	132.8	149.89	141.6	141.51	131.61
Total Organic Carbon (mg/l)		<5	<5	<5	<5	<5	<5	<5
Fluoride (mg/l)	1			<0.1	<0.1	<0.1	<0.1	
Total dissolved solids (mg/l)	1000	514	346	1044	446	304	408	354
Orthophosphate (mg/l)	0.03		0.01	0.52		0.01		0.02
Total Oxidised Nitrogen (mg/l)		0.3		4.8	2.9			
Faecal Coliforms (MPN/100ml)		34000	11	259000	66		62	11
Total Coliforms (MPN/100ml)		>2419.6		>2419.6			>2419.6	>2419.6
Cyanide (total)(mg/l)	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

MAC: Maximum Allowed Concentration - (values exceeded are shaded in yellow)

The MACs are the IGVs taken from "Interim Guideline Value-Towards Setting Guideline Values for the Protection of Groundwater in Ireland Interim Report (EPA 2003). The limit is set for Ammonium at 0.15 mg/l. The lab reports this as Ammoniacal Nitrogen so the IGV standard has been converted for that.

Results marked with < indicate that it is below the level of detection of the measuring instrument. The levels of detection used may have varied over time depending on the lab or the method of detection used.

Occasions where the sampler was unable to record a measurement are indicated in a separate comments table.

APPENDIX 3.7

Private Wells (Groundwater) Charts and Tables

Table A.3.6.x: All Stations, All Parameters for Private Groundwater Wells Annual - AER Sample (Page: 1/2)

Sample Type: Private Groundwater Wells Annual, Year: 2013

Parameter --- MAC		PW1	PW2	PW3	PW4
		23-Jul	23-Jul	23-Jul	23-Jul
Ammoniacal Nitrogen (mg/l)	0.23	<0.02	<0.02	<0.02	<0.02
Chloride (mg/l)	250	37	13	11	21
Conductivity (µS/cm)	2500	907	578	739	697
pH (pH units)	9.5	7	7.4	7.2	7.2
Boron (µg/l)	1000	37	11	13	12
Cadmium (µg/l)	5	<2	<2	<2	<2
Calcium (mg/l)	200	159	91	155	116
Chromium (µg/l)	50	<2	<2	<2	<2
Copper (µg/l)	2000	5	3	2	46
Iron (mg/l)	0.2	<0.1	<0.1	<0.1	<0.1
Lead (µg/l)	10	<2	<2	<2	<2
Magnesium (mg/l)	50	15	15	8.1	16
Manganese (µg/l)	50	<2		<2	<2
Mercury (µg/l)	1	<1	<1	<1	<1
Nickel (µg/l)	20	<2	<2	<2	<2
Potassium (mg/l)	5	7.2	0.89	0.49	0.82
Sodium (mg/l)	200	30	13	7.9	8.8
Sulphate (mg/l)	250	70	14	16	26
Zinc (µg/l)	100	12	24		
Total Organic Carbon (mg/l)		<5	<5	<5	<5
Fluoride (mg/l)	0.8	<0.1		<0.1	<0.1
Residue on Evaporation (mg/l)		310	322	436	382
Faecal Coliforms (cfu/100ml)		2419.6	2419.6	1	

Table A.3.6.x: All Stations, All Parameters for Private Groundwater Wells Annual - AER Sample (Page: 2/2)

Parameter --- MAC		PW1	PW2	PW3	PW4
		23-Jul	23-Jul	23-Jul	23-Jul
Orthophosphate (mg/l)	0.03	<0.01		<0.01	<0.01
Total Oxidised Nitrogen (mg/l)		2.5		0.69	4.6
Faecal Coliforms (MPN/100ml)	0	19cfu/100 ml	81cfu/100 ml	<1cfu/100 ml	133 cfu/100ml
Total Coliforms (MPN/100ml)	0	2419.6	2419.6	1	
Cyanide (total)(mg/l)		<0.01	<0.01	<0.01	<0.01

MAC: Maximum Allowed Concentration - (values exceeded are shaded in yellow)

The MACs are taken primarily from the European Communities Drinking Water (No. 2) Regulations, 2007 and where not available from the Interim Guideline Value-Towards Setting Guideline Values for the Protection of Groundwater in Ireland Interim Report (EPA 2003) (pH, T, Ca, Mg, K, Zn, TDS, PO4, Faecal Coli.).

Occasions where the sampler was unable to record a measurement are indicated in a separate comments table.

Results marked with '<' indicate that it is below the level of detection of the measuring instrument. The levels of detection used may have varied over time depending on the lab or the method of detection used.

Table A.3.7.x: All Stations, All Parameters for Private Groundwater Wells Quarterly - AER Sample (Page: 1/1)

Sample Type: Private Groundwater Wells Quarterly, Year: 2013

Sample Point --- Sample Period --- Date			Ammoniacal Nitrogen (mg/l)	Chloride (mg/l)	Conductivity (µS/cm)	Dissolved Oxygen (mg/l)	pH (pH units)	Temperature (C)	Total Organic Carbon (mg/l)
			0.23	250	2500		9.5	25	
PW1	Qtr 1	15-Jan	<0.02	26	852		7	3.3	<5
	Qtr 2	22-Apr	0.04	39	919		7.1	10.4	<5
	Qtr 4	22-Oct	<0.02	32	881	7.8	7.4	10.2	<5

MAC: Maximum Allowed Concentration - (values exceeded are shaded in yellow)

The MACs are taken primarily from the European Communities Drinking Water (No. 2) Regulations, 2007 and where not available from the Interim Guideline Value-Towards Setting Guideline Values for the Protection of Groundwater in Ireland Interim Report (EPA 2003) (i.e. pH & T).

Occasions where the sampler was unable to record a measurement are indicated in a separate comments table.

Results marked with '<' indicate that it is below the level of detection of the measuring instrument. The levels of detection used may have varied over time depending on the lab or the method of detection used.

APPENDIX 3.8

Leachate Charts and Tables

4.3 Leachate Results

TABLE 4.9 (A): RESULTS OF LABORATORY ANALYSIS OF LEACHATE SAMPLES					
Parameter	**LC-1**	**LC-8**	**LC-11**	**LL**	**LBT**
pH (pH units)	7.5	6.8	7.8	8.0	6.0
Conductivity (uS/cm)	21310	2189	34100***	26820	25110
Temperature (ºC)	22.1	20.3	26.3	24.8	26.9
Odour	Foul Odour	No	Strong Odour	Strong Odour	No Odour
Visual Inspection	Brown/black	Pale Yellow	Brown	Black/brown	Black
BOD – TCMP (mg/l)	70	66	725	362	488
COD (mg/l)	2968	82	7115	4785	3280
Ammonia-N (mg/l)	1952	10	3366	2504	2.4
Chloride (mg/l)	1990	36	3306	2499	2532
Fluoride (mg/l)	<0.5	<0.5	2.1	1.6	<0.5
Total P (mg/l)	24	0.76	50	33	31
Nitrate-N (mg/l)	0.26	2.3	1.6	0.36	2448***
Nitrite-N (mg/l)	<0.02	0.07	4.6	<0.02	0.17
Sulphate (mg/l)	15	868	121	66	180
TON (mg/l)	0.26	2.3	6.2	0.36	2448***
Calcium (mg/l)	118	465	82	97	115
Iron (mg/l)	4.6	14	6.4	5	5.2
Potassium (mg/l)	1073	13	1843	1295	1374
Sodium (mg/l)	1812	40	3061	2184	4952
Magnesium (mg/l)	57	54	77	64	70
Total Chromium	476	<20	937	657	699
Manganese (µg/l)	381	1600	483	392	592
Nickel (µg/l)	479	25	932	563	566
Copper (µg/l)	<20	44	8122	22	<20
Zinc (µg/l)	84	212	3110	198	288
Cadmium (µg/l)	<20	<20	<20	<20	<20
Lead (µg/l)	<20	<20	134	<20	<20
Boron (µg/l)	3175	405	6263	4218	4596
Mercury (µg/l)	<10	<10	<10	<10	<10

Note: < = Less Than Laboratory Limit of Detection. *** = Outside accredited range

APPENDIX 3.9

Meteorological Monitoring

2013	evap	rain	Temp(oC)			RH			Atm PR			NR			Indoor Temp(oC)_			Wind Dir			WindSpeed (m/s)		
	(mm)	(mm)																					
jan	18.2	65.6	5.8	12.7	-1.5	82	94	63	952	1019	966	-19	107	-132	18.3	20.8	16.8	197	360	0	4.2	23.9	0
feb	24.1	69	4.2	11.6	-3.2	82	96	48	1002	1022	974	-11	244	-200	23.2	39	18.3	184	360	1	2.9	24.7	0
mar	27.8	51.2	3.2	13.2	-3.2	79	95	36	992	1017	970	1	353	-200	22.6	24.6	19.2	134	360	1	3.5	24	0
apr	53.8	65.4	7	17.8	-3.8	74	94	35	997	1016	973	20	533	-183	20.9	29.5	16.9	195	360	1	3.9	24.8	0
may	55.6	54.8	10	21.4	1.9	74	93	39	995	1010	973	32	515	-187	20.6	25.9	17.5	221	360	1	3.4	21.8	0
jun	42.2	21.2	14	23.9	4.5	74	94	39	1002	1017	980	40	521	-131	22.4	26.8	19.5	195	360	1	2.5	16.7	0
jul	52.5	35.4	17.4	30.2	9.7	73	93	26	1003	1020	983	41	495	-200	24.3	34.7	19.9	190	360	1	2.3	15.6	0
aug	59	66.6	15.8	23.3	8.7	78	94	40	1000	1010	983	24	437	-183	21.9	25.8	18.8	225	360	1	2.6	15.2	0
sep	25.4	30	13.2	24.1	5.8	82	95	39	997	1012	979	6	333	-200	20.9	26.7	17.1	197	360	1	2.1	18.3	0
oct	26.9	95.8	11.1	16.9	4.1	83	94	54	988	1012	967	-18	255	-118	20.1	23.5	16.6	188	360	1	3.6	20.6	0
nov	19.1	23.2	6.3	13.2	-3.3	85	94	58	1003	1026	966	-16	116	-122	20.7	23.4	18.2	221	360	1	2.4	21.5	0
dec	9.8	54.6	4.6	10.3	0.9	81	94	59	971	996	945	-36	71	-105	21.7	24.2	19.8	223	360	1	5.8	27.8	0.5
	Sum	**Sum**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**
Totals	414.4	632.8	9.4	30.2	-3.8	79	96	26	992	1026	945	5	533	-200	21.5	39	16.6	198	360	0	3.3	27.8	0

Summary

Evap	**414.4**
Rain	**632.8**
Max Temp	**30.2**
Min Temp	**-3.8**
Max Wind Speed	**27.8**
Max Pressure	**1026**

APPENDIX 4.1

Landfill Gas Emissions (gas extraction system)

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TITLE: AIR EMISSION TESTING OF TWO LANDFILL FLARES AND FIVE GAS UTILISATION ENGINES LOCATED IN ARTHURSTOWN LANDFILL, KILL, CO. KILDARE

PREFORMED BY ODOUR MONITORING IRELAND ON BEHALF OF SOUTH DUBLIN COUNTY COUNCIL

PREPARED BY:	Dr. John Casey
ATTENTION:	Mr. John Smith
LICENCE NUMBER:	WL0004-4
LICENCE HOLDER:	South Dublin County Council
FACILITY NAME:	Arthurstown Landfill Facility
DATE OF MONITORING VISIT:	18, 19th Dec. 2013
NAME AND ADDRESS OF CLIENT ORGANISATION:	South Dublin County Council, Arthurstown Landfill, Kill, Co. Kildare
NAME AND ADDRESS OF MONITORING ORGANISATION:	Odour Monitoring Ireland, Unit 32 DeGranville Court, Dublin Road, Trim, Co. Meath
DATE OF REPORTING:	15th Jan. 2014
NAME AND THE FUNCTION OF THE PERSON APPROVING THE REPORT:	Dr. Brian Sheridan, Managing Partner, Odour Monitoring Ireland
REPORT NUMBER:	20131012(1)
REVIEWERS:	

TABLE OF CONTENTS

Document Amendment Record

Client: ***South Dublin County Council***

Project: Air emission testing of two Landfill flares and five gas utilisation engines located in Arthurstown Landfill, Kill, Co. Kildare.

Project Number: 20131012(1)			**Document Reference:**		
20131012(1)	Document for review	B.A.S.	JMC	B.A.S	15/01/2014
Revision	**Purpose/Description**	**Originated**	**Checked**	**Authorised**	**Date**

Signing sheet

_____

Brian Sheridan Ph.D Eng

For and on behalf of Odour Monitoring Ireland

1. Executive Summary

The results of the monitoring exercise are contained in Section 2 of this report.

- NO_x as NO_2, CO, Particulates, TVOC, TNMVOC, HCL and HF emissions from AR02, AR05, AR07, AR08 and AR09 were within the emission limit values specified in Waste licence W0004-4;
- NO_x as NO_2, CO, TOC, HCL and HF emissions from Flare 1 and Flare 2 were within the emission limit values specified in Waste licence W0004-4;

1.1 Monitoring Objectives

This report has been prepared by Odour Monitoring Ireland and contains the results of emission testing carried out on 2 No. Enclosed ground flares and 5 No. Gas utilisation engines at Arthurstown Landfill, Kill, Co. Kildare. The monitoring was carried out at this facility as part of compliance monitoring with the requirements of Waste licence W0004-04. The emission testing was carried out by Odour Monitoring Ireland on behalf of South Dublin County Council.

1.2 Special Monitoring Requirements

There were no special monitoring requirements for this campaign.

1.3 The substances to be monitored at each emission point

The parameters listed in *Table 1.1* were monitored using the appropriate instrumentation as illustrated in *Table 1.1*. All monitoring was carried out in accordance with Environmental Protection Agency Office of Environmental Enforcement (OEE) Air Emission Monitoring Guidance Note 2 (AG2).

Table 1.1. Monitored parameters and techniques for Arthurstown Landfill

Sample location	Parameter	Analytical equipment and methods
2 Landfill Flares and 5 Gas utilisation engines AR02, AR05, AR07, AR08 and AR09 outlets	Volumetric airflow rate & Temperature (^{0}C)	Pitot in accordance with EN13284-1 where possible. MGO coated K type thermocouple and PT100 Volumetric airflow rate theoretical calculated for Landfill flare.
2 Landfill Flares and 5 Gas utilisation engines AR02, AR05, AR07, AR08 and AR09 outlets	Oxides of nitrogen (NO_X as NO_2), Carbon monoxide (CO), Carbon dioxide (CO_2), Sulphur dioxide (SO_2), and Oxygen (O_2)	Horiba PG250 gas analyser, NOx EN14672-2006, CO EN15058-2006
5 Gas utilisation engines AR02, AR05, AR07, AR08 and AR09 outlets	Total non methane VOC's (TNMVOC)	Portable Signal 3030PM FID calibrated with Propane in accordance with EN13526:2002 non- methane hydrocarbon cutter. Charcoal tube/GCMS
5 Gas utilisation engines AR02, AR05, AR07, AR08 and AR09 outlets	Total Volatile Organic Carbon (TVOC)	Portable Signal 3030PM FID calibrated with Propane in accordance with EN13526:2002.
5 Gas utilisation engines AR02, AR05, AR07, AR08 and AR09 outlets	Total Particulates	TCR Tecora isokinetic Particulate sampler with QMA (Quartz) high temperature filters in accordance with ISO9096:2003.
2 Landfill Flares and 5 Gas utilisation engines AR02, AR05, AR07, AR08 and AR09 outlets	Hydrogen chloride (HCL)	Impinger train containing deionised water solution in accordance with EN1911-2010
2 Landfill Flares and 5 Gas utilisation engines AR02, AR05, AR07, AR08 and AR09 outlets	Hydrogen fluoride (HF)	Impinger train containing 0.10 molar sodium hydroxide in accordance with EN15713-2006
2 Landfill Flares outlets	Total Organic Carbon (TOC)	Portable Signal 3030PM FID calibrated with Propane in accordance with EN13526:2002.

This report presents details of this monitoring programme. This environmental monitoring was carried out Dr. John Casey, Managing Partner, Odour Monitoring Ireland on the 18th and 19th Dec. 2013. Methodology, Results, Discussion and Conclusions are presented herein.

2. Monitoring Results

This section will present the results of the monitoring exercise.

2.1 Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load
AR02	18/12/2013	Gas Utilisation Engine	Continuous	Landfill Gas	N/A	None	Landfill Gas
AR05	18/12/2013	Gas Utilisation Engine	Continuous	Landfill Gas	N/A	None	Landfill Gas
AR07	18/12/2013	Gas Utilisation Engine	Continuous	Landfill Gas	N/A	None	Landfill Gas
AR08	18/12/2013	Gas Utilisation Engine	Continuous	Landfill Gas	N/A	None	Landfill Gas
AR09	19/12/2013	Gas Utilisation Engine	Continuous	Landfill Gas	N/A	None	Landfill Gas
Flare 1	19/12/2013	Landfill flare	Continuous	Landfill Gas	N/A	None	Landfill Gas
Flare 2	19/12/2013	Landfill flare	Continuous	Landfill Gas	N/A	None	Landfill Gas

2.2 Monitoring Result Reference Conditions

Emission Point Reference	Temperature (K)	Pressure	Moisture Correction	Oxygen Correction (%)
AR02	K	101.3	Yes	5
AR05	K	101.3	Yes	5
AR07	K	101.3	Yes	5
AR08	K	101.3	Yes	5
AR09	K	101.3	Yes	5
Flare 1	K	101.3	Yes	3
Flare 2	K	101.3	Yes	3

2.3. Sampling Location Summary

Comment	Yes/No
Recommended 5 hydraulic diameters straight length before sampling plane	Yes
Recommended 2 hydraulic diameters straight length after sampling plane	Yes
Ports number <1.5m - 2 ports >1.5m - 4 ports	1 port
Appropriate port size	Yes
Suitable working platform	Yes

Note: Temperature and airflow rate traverse measurements were performed across the stack in one plane only. Only one plane was possible due to access port issues.

2.4. Sampling time runs on the for monitoring of 2 landfill flares and 5 gas utilisation engines.

Parameter	Approx. Sampling period for 2 landfill flares	Approx. Sampling period for 5 gas utilisation engines
Inlet CH_4	30 minutes	30 minutes
Inlet O_2	30 minutes	30 minutes
Volumetric air flow rate	Theoretically calculated	Manually calculated
SO_2	40 minutes	40 minutes
NO_x	40 minutes	40 minutes
CO	40 minutes	40 minutes
O_2	40 minutes	40 minutes
CO_2	45 minutes	40 minutes
Stack gas temp	40 minutes	40 minutes
TVOC	40 minutes	40 minutes
Particulates	-	30 minutes
TNMVOC	-	30 minutes
TOC	30 minutes	-
HCL	30 minutes	30 minutes
HF	30 minutes	30 minutes

2.5. Characteristics of raw inlet gas to 4 enclosed Landfill flares gas burner and 6 No. Gas utilisation engines.

Parameter	Main header 1[1]	Main header 2[2]	Main header 3[3]	Units
CH_4	45	45	45	%
CO_2	36	36	36	%
O_2	3.2	3.2	3.2	%
Volumetric flow rate	1205	2,804	750	m^3/hr
Total chloride	8	7	12	mg/Nm^3
Total fluoride	<1.12	<1.05	<1.14	mg/Nm^3
Total sulphur	12	15	12	mg/Nm^3

Denotes: [1] denotes header carrying landfill gas to Flare 1 and gas utilisation engine AR2
[2] denotes header carrying landfill gas to Flare 2 and gas utilisation engines AR5 to AR8
[3] denotes header carrying landfill gas to gas utilisation engine AR9

2.6. Theoretically calculated landfill gas exhaust volume and physical characteristics from the Landfill flares.

Parameter	Enclosed flare 1	Enclosed flare 2
Total Volumetric methane loading (m^3/hr)	542	405
Total Volumetric Oxygen loading (m^3/hr)	38	29
Ratio to complete combustion of methane assuming no excess Oxygen	9.57	9.57
Oxygen concentration level in flue gas (%)	11.64	12.1
Flue gas temperature (Kelvin)[2]	1,280	1,281
Theoretical calculated Volumetric exhaust airflow rate (m^3/h)	14,355	11,318
Normalised average exhaust airflow rate ($Nm^3\ h^{-1}$)[3]	3,061	2,411

Notes: [1] denotes data from 18th Dec 2013.
[2] denoted converted from degrees Celsius to Kelvin (^0C + 273.15);
[3] denotes normalised to 273.15 Kelvin and 101.3 kPa.

Table 2.7. Emission value results for landfill gas flare 1.

Flare 1	Conc.	Normalised (mgN/m^3)	Oxygen corrected emission concentration to flare (mgN/m^3) 3% ref.	Mass Kg/hr	Expanded uncertainty as percentage of limit value (%)[1]	Emission limit Values	Operating Status
Total NOx [as NO_2] (ppm)	24.67	50.57	97.82	0.15	12.5	<150 mg/Nm^3	As Normal
CO (ppm)	6.70	8.38	16.20	0.026	10.2	<50 mg/Nm^3	As Normal
Total Organic Carbon (mg/m^3)	2.94	4.70	9.09	0.01	9.5	<10 mg/Nm^3	As Normal
Average Hydrogen Chloride (mg/m^3)	0.30	0.30	0.58	0.0009	-	<50 mg/Nm^3 (at mass flow > 0.30 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m^3)	1.07	1.07	2.07	0.0033	-	<5 mg/Nm^3 (at mass flow > 0.050 kg/hr)	As Normal
SO_2 (ppm)	39.93	113.81	220.15	0.35	-	-	As Normal
O_2 (%)	11.65	-	-	-	-	-	As Normal
Temperature (degrees)	1007	1280.15K	-	-	-	>1,273K	As Normal
CO_2 (%)	7.76	-	8	-	-	-	As Normal
Volumetric Airflow (m^3/hr)	-	-	1583[2]		-	<3,000[2]	As Normal
Efficiency (%)	>99	-	-	-	-	-	As Normal

Notes: [1] denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources.
[2] denotes units m^3N/hr

Table 2.8. Emission value results for landfill gas flare 2.

Flare 2	Conc.	Normalised (mgN/m^3)	Oxygen corrected emission concentration to flare (mgN/m^3) 3% ref.	Mass Kg/hr	Expanded uncertainty as percentage of limit value (%)[1]	Emission limit Values	Operating Status
Total NOx [as NO_2] (ppm)	22.10	45.30	92.52	0.11	12.5	<150 mg/Nm^3	As Normal
CO (ppm)	6.13	7.66	15.65	0.02	9.5	<50 mg/Nm^3	As Normal
Total Organic Carbon (mg/m^3)	1.61	2.58	5.27	0.0062	10.2	<10 mg/Nm^3	As Normal
Average Hydrogen Chloride (mg/m^3)	0.44	0.44	0.90	0.0011	-	<50 mg/Nm^3 (at mass flow > 0.30 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m^3)	1.00	1.00	2.04	0.0024	-	<5 mg/Nm^3 (at mass flow > 0.050 kg/hr)	As Normal
SO_2 (ppm)	35.78	101.98	208.31	0.25	-	-	As Normal
O_2 (%)	12.14	-	-	-	-	-	As Normal
Temperature (degrees)	1008	1281.15K	-	-	-	>1,273K	As Normal
CO_2 (%)	7.23	-	-	-	-	-	As Normal
Volumetric Airflow (m^3/hr)	-	-	1181[2]	-	-	<3,000[2]	As Normal
Efficiency (%)	>99	-	-	-	-	-	As Normal

Notes:[1] denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources.
[2] denotes units m^3N/hr

Table 2.9. Emission value results for landfill gas utilisation AR02.

AR02	Conc.	Normalised (mgN/m^3)	Oxygen corrected emission concentration to flare (mgN/m^3) 3% ref.	Mass Kg/hr	Expanded uncertainty as percentage of limit value (%)[1]	Emission limit Values	Operating Status
Total NOx [as NO_2] (ppm)	189.27	388.00	451.71	0.93	1.5	<500 mg/Nm^3	As Normal
CO (ppm)	620.93	776.16	903.61	1.86	1.8	<1,400 mg/Nm^3	As Normal
Average Hydrogen Chloride (mg/m^3)	0.62	0.62	0.72	0.0015	-	50 mg/Nm^3 (at mass flows >0.3 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m^3)	1.18	1.18	1.37	0.0028	-	5 mg/Nm^3 (at mass flows >0.05 kg/hr)	As Normal
SO_2 (ppm)	71.57	203.96	237.45	0.4889	-	-	As Normal
Particulates (mg/m^3)	3.20	3.20	3.73	0.01	3.2	<130 mg/Nm^3	As Normal
Average TVOC (ppm)	331.14	529.82	616.81	1.27	2.1	<1,000 mg/Nm^3	As Normal
TNMVOC (ppm)	12.50	20.00	23.28	0.05	1.8	<75 mg/Nm^3	As Normal
O_2 (%)	7.24	-	-	-	-	-	As Normal
Temperature (degrees)	453.00	726.15K	-	-	-	-	As Normal
CO_2 (%)	12.39	-	-		-	-	As Normal
Volumetric Airflow (m^3/hr)	6967.70	-	2059	-	-	<3,000	As Normal

Notes:[1] denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources

Table 2.10. Emission value results for landfill gas utilisation AR05.

AR05	Conc.	Normalised (mgN/m^3)	Oxygen corrected emission concentration to flare (mgN/m^3) 3% ref.	Mass Kg/hr	Expanded uncertainty as percentage of limit value (%)[1]	Emission limit Values	Operating Status
Total NOx [as NO_2] (ppm)	187.89	385.18	448.40	1.05	1.25	<500 mg/Nm^3	As Normal
CO (ppm)	607.71	759.64	884.30	2.07	5.5	<1,400 mg/Nm^3	As Normal
Average Hydrogen Chloride (mg/m^3)	0.68	0.68	0.79	0.0019	-	50 mg/Nm^3 (at mass flows >0.3 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m^3)	1.34	1.34	1.56	0.0037	-	5 mg/Nm^3 (at mass flows >0.05 kg/hr)	As Normal
SO_2 (ppm)	68.49	195.20	227.23	0.5327	-	-	As Normal
Particulates (mg/m^3)	6.54	6.54	7.61	0.02	3.2	<130 mg/Nm^3	As Normal
Average TVOC (ppm)	567.57	747.20	869.83	2.48	10.5	<1,000 mg/Nm^3	As Normal
TNMVOC (ppm)	5.60	8.96	10.43	0.02	9.5	<75 mg/Nm^3	As Normal
O_2 (%)	7.24	-	-		-	-	As Normal
Temperature (degrees)	465.00	738.15K			-	-	As Normal
CO_2 (%)	12.0404	-	-		-	-	As Normal
Volumetric Airflow (m^3/hr)	7375	-	2344		-	<3,000	As Normal

Notes:[1] denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources

Table 2.11. Emission value results for landfill gas utilisation AR07.

AR07	Conc.	Normalised (mgN/m^3)	Oxygen corrected emission concentration to flare (mgN/m^3) 3% ref.	Mass Kg/hr	Expanded uncertainty as percentage of limit value (%)[1]	Emission limit Values	Operating Status
Total NOx [as NO_2] (ppm)	194.34	398.40	461.81	0.90	1.65	<500 mg/Nm^3	As Normal
CO (ppm)	605.44	756.80	877.25	1.71	9.54	<1,400 mg/Nm^3	As Normal
Average Hydrogen Chloride (mg/m^3)	1.03	1.03	1.19	0.002	-	50 mg/Nm^3 (at mass flows >0.3 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m^3)	1.35	1.35	1.56	0.003	-	5 mg/Nm^3 (at mass flows >0.05 kg/hr)	As Normal
SO_2 (ppm)	70.79	201.74	233.85	0.457	-	-	As Normal
Particulates (mg/m^3)	5.41	5.41	6.27	0.01	3.21	<130 mg/Nm^3	As Normal
Average TVOC (ppm)	311.95	499.12	578.56	1.13	10.5	<1,000 mg/Nm^3	As Normal
TNMVOC (ppm)	5.20	8.32	9.64	0.02	11.4	<75 mg/Nm^3	As Normal
O_2 (%)	7.18	-	-	-	-	-	As Normal
Temperature (degrees)	468	741.15K	-	-	-	-	As Normal
CO_2 (%)	12.02	-	-	-	-	-	As Normal
Volumetric Airflow (m^3/hr)	6425	2368	1955	-	-	<3,000	As Normal

Notes:[1] denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources

Table 2.12. Emission value results for landfill gas utilisation AR08.

AR08	Conc.	Normalised (mgN/m^3)	Oxygen corrected emission concentration to flare (mgN/m^3) 3% ref.	Mass Kg/hr	Expanded uncertainty as percentage of limit value (%)[1]	Emission limit Values	Operating Status
Total NOx [as NO_2] (ppm)	190.12	389.75	452.41	0.89	3.2	<500 mg/Nm^3	As Normal
CO (ppm)	603.62	754.53	875.82	1.73	7.5	<1,400 mg/Nm^3	As Normal
Average Hydrogen Chloride (mg/m^3)	0.59	0.59	0.68	0.001	-	50 mg/Nm^3 (at mass flows >0.3 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m^3)	1.00	1.00	1.16	0.002	-	5 mg/Nm^3 (at mass flows >0.05 kg/hr)	As Normal
SO_2 (ppm)	68.29	194.63	225.92	0.45	-	-	As Normal
Particulates (mg/m^3)	5.40	5.40	6.27	0.01	9.5	<130 mg/Nm^3	As Normal
Average TVOC (ppm)	301.90	483.04	560.70	1.11	10.5	<1000 mg/Nm^3	As Normal
TNMVOC (ppm)	3.50	5.60	6.50	0.01	4.2	<75 mg/Nm^3	As Normal
O_2 (%)	7.20	-	-	-	-	-	As Normal
Temperature (degrees)	455.00	728.15K	-	-	-	-	As Normal
CO_2 (%)	11.95	-	-	-	-	-	As Normal
Volumetric Airflow (m^3/hr)	6108.05	2291.30	1973.98	-	-	<3,000	As Normal

Notes:[1] denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources

Table 2.13. Emission value results for landfill gas utilisation AR09.

AR09	Conc.	Normalised (mgN/m^3)	Oxygen corrected emission concentration to flare (mgN/m^3) 3% ref.	Mass Kg/hr	Expanded uncertainty as percentage of limit value (%)[1]	Emission limit Values	Operating Status
Total NOx [as NO_2] (ppm)	189.95	389.39	450.24	0.83	3.52	<500 mg/Nm^3	As Normal
CO (ppm)	602.27	752.83	870.48	1.60	4.7	<1,400 mg/Nm^3	As Normal
Average Hydrogen Chloride (mg/m^3)	0.57	0.57	0.66	0.001	-	50 mg/Nm^3 (at mass flows >0.3 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m^3)	0.84	0.84	0.97	0.002	-	5 mg/Nm^3 (at mass flows >0.05 kg/hr)	As Normal
SO_2 (ppm)	68.53	195.30	225.82	0.42	-	-	As Normal
Particulates (mg/m^3)	4.50	4.50	5.20	0.01	10.5	<130 mg/Nm^3	As Normal
Average TVOC (ppm)	299.00	478.40	553.16	1.02	3.2	<1,000 mg/Nm^3	As Normal
TNMVOC (ppm)	6.50	10.40	12.03	0.02	2.5	<75 mg/Nm^3	As Normal
O_2 (%)	7.15	-	-	-	-	-	As Normal
Temperature (degrees)	455.00	728.15K	-	-	-	-	As Normal
CO_2 (%)	11.95	-	-	-	-	-	As Normal
Volumetric Airflow (m^3/hr)	5680.48	2130.91	1842.91	-	-	<3,000	As Normal

Notes:[1] denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources

3. Discussion of results

Tables 2.1 to *2.13* present the results of the emission monitoring carried out on the 2 landfill flares and 5 utilisation engines located in Arthurstown Landfill, Kill, Co. Kildare.

There was very little variation at one traverse in oxygen and flue gas temperature profiles across the stack during the monitoring exercise (i.e. less than 15% as recommended by the Environment Agency, UK (Environment Agency, 2002)).

A high temperature Inconel 625 and ceramic probe (Testo, Germany) was used to prevent variations in CO emissions data. Normal stainless steel probes when subjected to temperatures above 600^0C can release CO from within the structure of the material and cause the recording of erroneous results (Environment Agency, 2002).

Correction of data to 3% & 5% oxygen was performed. Due to possible inaccuracies in airflow rate measurement, it was not possible to determine the oxygen intake of the flare through the louver system using measurement. Since the volume of intake air required for complete combustion was known and the oxygen concentration in the exhaust flue gas was known, the volume of intake excess fuel air could be theoretically calculated through numerous iterations using the Solver program (i.e. Microsoft Excel). This allows for the calculation of the volume of intake excess air through the louver landfill flare intake system (Environment Agency, 2002).

4. Conclusion

The following conclusions can be drawn from this study:

1. A theoretically exhaust flue gas volume was calculated for the landfill flares. Actual measurements were performed on the eleven gas utilisation engines AR02, AR05, AR07, AR08 and AR09.
2. NO_x as NO_2, SO_2, CO, O_2, Particulates, TVOC, TNMVOC, TOC, HCL and HF monitoring and analysis was carried out in accordance with specified requirements;
3. All data was standardised to 273.15 Kelvin, 101.3 kPa;
4. All data is presented as Oxygen corrected to 3% and 5% (v/v) using the appropriate equations;
5. NO_x as NO_2, CO, Particulates, TVOC, TNMVOC, HCL and HF emissions from AR02, AR06, AR07, AR08 and AR09 were within the emission limit values specified in Waste licence W0004-4;
6. NO_x as NO_2, CO, TOC, HCL and HF emissions from Flare 1 and Flare 2 were within the emission limit values specified in Waste licence W0004-4;

5. References

1. Environment Agency. (2002). Guidance for Monitoring Enclosed Landfill Gas Flares. www.environment-agency.co.uk
2. McVay, M., (2003). Personal communication. Environment Agency, Wales, UK.
3. Environmental Protection Agency. (2009). Air Emissions Monitoring Guidance Note 2 (AG2).
4. ISO 10780, (1984). Stationary source emissions-Measurement of velocity and volume flow rate of gas streams in ducts.

- IS EN13526:2002-Stationary source emissions-Determination of the mass concentration of total gaseous organic carbon in flue gases from solvent using processes-Continuous flame ionisation detector method.
- IS EN12619:1999-Stationary source emissions-Determination of the mass concentration of total gaseous organic carbon at low concentrations in flue gases-Continuous flame ionisation detector method.
- I.S. EN13649:2002-Stationary source emissions-Determination of the mass concentration of individual gaseous organic compounds-Activated carbon and solvent desorption method.

6. *Appendix I*-Sampling, analysis

6.1.1 Location of Sampling

Arthurstown Landfill, Kill, Co. Kildare.

6.1.2 Date & Time of Sampling

18th and 19th Dec. 2013

6.1.3 Personnel Present During Sampling

Dr. John Casey, Odour Monitoring Ireland, Trim, Co. Meath.

6.1.4 Instrumentation check list

Horiba PG 250;
Federal Method 2 S type pitot and MGO coated thermocouple;
L type pitot tube
Testo 400 handheld and appropriate probes.
Ceramic and Inconel 625 sampling probes.
TCR Tecora Iso-kinetic Particulate and gas sampling train
Portable Signal 3030PM FID calibrated with Propane with non-methane hydrocarbon cutter.
SKC sample pumps and Bios Primary calibrator

APPENDIX 5.1

Discharge to Sewer Results
(as per PRTR reporting)

TelLab

ANALYSIS OF AQUEOUS SAMPLE.

Date Sampled:13.06.2013
Date Received:13.06.2013
Date Analysis Commenced:13.06.2013
Our Ref.:WS-34443, 13-32449/1 & 13-83171
Your Ref : Arthurstown
Certificate No. L/13/1128

	Sample ID	**Balance Tank**
DETERMINAND	**Lab ID**	**109461**
Alkalinity	n/a	520
Ammonia as NH_3	n/a	0.36
Ammoniacal Nitrogen	n/a	0.30
Arsenic (ug/l)#	++	280
BOD	n/a	39
Cadmium by GFAAS (ug/l)#	**	<0.1
Chloride	**	2246
Chromium by GFAAS (ug/l)#	**	399
COD	n/a	3240
Copper#	**	<0.05
Cyanide	n/a	0.05
Fluoride	**	<1(note 1)
Kjeldhal Nitrogen	n/a	84
Lead by GFAAS (ug/l)#	**	<2
Magnesium	**	76
Manganese#	**	0.39
Mercury (ug/l)#	++	<0.010
Nickel#	**	0.58
Nitrate as N	n/a	2332
Nitrite as N	**	<0.61(note1)
Orthophosphate as P	**	27
pH	**	6.4
Selenium (ug/l)#	++	4.7
Sulphate	**	169
Suspended Solids	n/a	210
TOC	n/a	1064
Zinc#	**	0.25
Faecal Coliforms (cfu/10mls)	n/a	42
Total Coliforms (cfu/10mls)	n/a	>100

Concentrations are expressed as mg/l (ppm)
unless otherwise specified.
Analysis of metals are performed on the filtered sample.
** = INAB Accredited Tests ++ = Subcontracted Tests n/a = Non-INAB Accredited Tests
Note 1: LOD raised due to matrix interference.
The above results relate only to the sample tested

TelLab

ANALYSIS OF AQUEOUS SAMPLES.

Date Sampled:13.06.2013
Date Received:13.06.2013
Date Analysis Commenced:13.06.2013
Our Ref.:WS-34443, 13-32449/1 & 13-83171
Your Ref : Arthurstown
Certificate No. L/13/1128

Volatile Organic Compounds ug/l ++

	Sample ID	Balance Tank
Determinand	**Lab ID**	**109461**
Dichlorofluoromethane	ug/l	<1
Chloromethane	ug/l	<1
Vinyl Chloride	ug/l	<1
Bromomethane	ug/l	<1
Chloroethane	ug/l	<1
Trichlorofluoromethane	ug/l	<1
1,1-dichloroethylene	ug/l	<1
Trans-1,2-dichloroethylene	ug/l	<1
1,1-dichloroethane	ug/l	<1
Cis-1,2-dichloroethylene	ug/l	<1
2,2-dichlororopane	ug/l	<2
Chloroform	ug/l	<1
Bromochloromethane	ug/l	<4
1,1,1-trichloroethane	ug/l	<1
1,1-dichloropropene	ug/l	<1
Carbon tetrachloride	ug/l	<1
1,2-dichloroethane	ug/l	<1
Benzene	ug/l	<1
Trichloroethylene	ug/l	<1
1,2-dichloropropane	ug/l	<1
Dibromomethane	ug/l	<1
Bromodichloromethane	ug/l	<4
cis-1,3-dichloropropene	ug/l	<1
Toluene	ug/l	<1
trans-1,3-dichloropropene	ug/l	<1
1,1,2-trichloroethane	ug/l	<1
Tetrachloroethylene	ug/l	<1
1,3-dichloropropane	ug/l	<1
Dibromochloromethane	ug/l	<1
1,2-dibromoethane	ug/l	<1
Chlorobenzene	ug/l	<1
1,1,1,2-tetrachloroethane	ug/l	<1
Ethylbenzene	ug/l	<1
m+p-Xylene	ug/l	<2
o-Xylene	ug/l	<1
Styrene	ug/l	<1
Bromoform	ug/l	<1
Isopropylbenzene	ug/l	<1
1,1,2,2-tetrachloroethane	ug/l	<1
Bromobenzene	ug/l	<1
1,2,3-trichloropropane	ug/l	<1
n-propylbenzene	ug/l	<1
2-chlorotoluene	ug/l	<1
1,3,5-trimethylbenzene	ug/l	<1
4-chlorotoluene	ug/l	<1
Tert-butylbenzene	ug/l	<1
1,2,4-trimethylbenzene	ug/l	<1
sec-butylbenzene	ug/l	<1
p-isopropyltoluene	ug/l	<1
1,3-dichlorobenzene	ug/l	<2
1,4-dichlorobenzene	ug/l	<1
n-butylbenzene	ug/l	<1
1,2-dichlorobenzene	ug/l	<1
1,2-dibromo-3-chloropropane	ug/l	<1
1,2,4-trichlorobenzene	ug/l	<1
Hexachlorobutadiene	ug/l	<1
Naphthalene	ug/l	6
1,2,3-trichlorobenzene	ug/l	<1

Concentrations expressed as ug/l (ppb)
unless otherwise stated

** = INAB Accredited Tests ++ = Subcontracted Tests n/a = Non-INAB Accredited Tests

The above results relate only to the sample tested

TelLab

ANALYSIS OF AQUEOUS SAMPLES.

Date Sampled:13.06.2013
Date Received:13.06.2013
Date Analysis Commenced:13.06.2013
Our Ref.:WS-34443, 13-32449/1 & 13-83171
Your Ref : Arthurstown
Certificate No. L/13/1128

Semi Volatile Organic Compounds ug/l ++

	Sample ID	Balance Tank
Determinand	**Lab ID**	**109461**
Phenol	ug/l	<1.0
Aniline	ug/l	<1.0
2-Chlorophenol	ug/l	<1.0
Benzyl Alcohol	ug/l	<1.0
2-Methylphenol	ug/l	<1.0
Bis(2-chloroisopropyl)ether	ug/l	<1.0
3&4-Methylphenol	ug/l	<1.0
Bis(2-chloroethoxy)methane	ug/l	<1.0
2,4-Dimethylphenol	ug/l	<1.0
2,4-Dichlorophenol	ug/l	<1.0
1,2,4-Trichlorobenzene	ug/l	<1.0
4-Chloro-3-methylphenol	ug/l	<1.0
2-Methylnaphthalene	ug/l	<1.0
1,2-Dinitrotoluene	ug/l	<1.0
Hexachlorocyclopentadiene	ug/l	<1.0
2,4,6-Trichlorophenol	ug/l	<1.0
2,4,5-Trichlorophenol	ug/l	<1.0
2-Chloronaphthalene	ug/l	<1.0
2-Nitroaniline	ug/l	<1.0
2,4-Dinitrotoluene	ug/l	<1.0
Acenaphthylene	ug/l	<1.0
3-Nitroaniline	ug/l	<1.0
Acenaphthene	ug/l	<1.0
4-Nitrophenol	ug/l	<1.0
Dibenzofuran	ug/l	<1.0
2,6-Dinitrotoluene	ug/l	<1.0
2,3,4,6-Tetrachlorophenol	ug/l	<1.0
Diethylphthalate	ug/l	<1.0
4-Chlorophenylphenylether	ug/l	<1.0
Fluorene	ug/l	<1.0
4-Nitroaniline	ug/l	<1.0
Diphenylamine	ug/l	<1.0
4-Bromophenylphenylether	ug/l	<1.0
Hexachlorobenzene	ug/l	<1.0
Bis(2-ethylhexyl)esther	ug/l	19
Pentachlorophenol	ug/l	<1.0
Phenanthrene	ug/l	<1.0
Anthracene	ug/l	<1.0
Di-n-butylphthalate	ug/l	<1.0
Fluoranthene	ug/l	<1.0
Pyrene	ug/l	<1.0
Butylbenzylphthalate	ug/l	<1.0
Benzo(a)anthracene	ug/l	<1.0
Chrysene	ug/l	<1.0
Bis(2-ethylhexyl)phthalate	ug/l	<1.0
Di-n-octylphthalate	ug/l	<1.0
Benzo(b)fluoranthene	ug/l	<1.0
Benzo(k)fluoranthene	ug/l	<1.0
Benzo(a)pyrene	ug/l	<1.0
Indeno(123cd)pyrene	ug/l	<1.0
Dibenzo(ah)anthracene	ug/l	<1.0
Benzo(ghi)perylene	ug/l	<1.0
1,4-Dinitrobenzene	ug/l	<1.0
Dimethylphthalate	ug/l	<1.0
1,3-Dinitrobenzene	ug/l	<1.0
2,3,5,6-Tetrachlorophenol	ug/l	<1.0
Azobenzene	ug/l	<1.0
Carbazole	ug/l	<1.0

Concentrations expressed as ug/l (ppb)
unless stated otherwise

** = INAB Accredited Tests ++ = Subcontracted Tests n/a = Non-INAB Accredited Tests
The above results relate only to the sample tested
This report should not be regenerated except in full and with the consent of T.E. Laboratories Ltd.

TelLab

ANALYSIS OF AQUEOUS SAMPLES.

Date Sampled:13.06.2013
Date Received:13.06.2013
Date Analysis Commenced:13.06.2013
Our Ref.:WS-34443, 13-32449/1 & 13-83171
Your Ref : Arthurstown
Certificate No. L/13/1128

Organochlorine Pesticides

Determinand	Sample ID Lab ID	Balance Tank 109461
Aldrin	++	<0.02
Alpha-HCH	++	<0.02
Beta-HCH	++	0.05
Cis-Chlordane	++	<0.02
Delta-HCH	++	<0.02
Dieldrin	++	<0.02
Endosulfan A	++	<0.02
Endosulfan B	++	<0.02
Endrin	++	<0.02
Gamma-HCH (lindane)	++	<0.02
Heptachlor	++	<0.02
Heptachlor Epoxide	++	<0.02
Hexachlorobenzene (HCB)	++	<0.02
Isodrin	++	<0.02
Methoxychlor	++	<0.02
o,p'-DDD	++	<0.02
o,p'DDE	++	<0.02
o,p'-DDT	++	<0.02
p,p'-DDD	++	<0.02
p,p'-DDE	++	<0.02
p,p'-DDT	++	<0.02
Trans-chlordane	++	<0.02
Trifluralin	++	<0.02

Concentrations expressed as ug/l
unless stated otherwise

** = INAB Accredited Tests ++ = Subcontracted Tests n/a = Non-INAB Accredited Tests
The above results relate only to the sample tested
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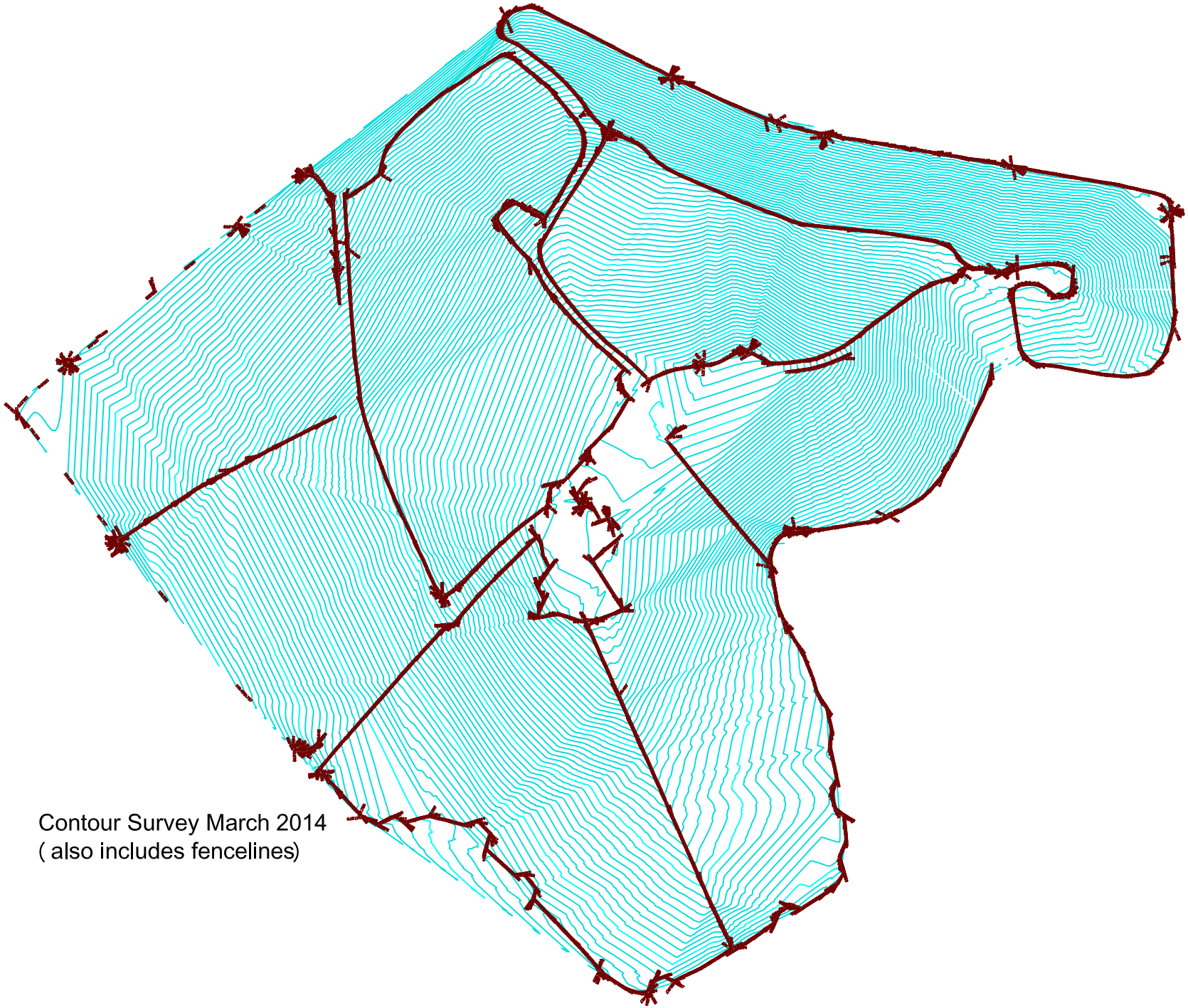
APPENDIX 6.1

Topographical Survey



Contour Survey March 2014
(also includes fencelines)

APPENDIX 7.1

PRTR Returns

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.18

REFERENCE YEAR	2013

1. FACILITY IDENTIFICATION

Parent Company Name	South Dublin County Council
Facility Name	Arthurstown Landfill
PRTR Identification Number	W0004
Licence Number	W0004-04

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).
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
3.6	Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1. to 10. of this Schedule.
3.7	##

Address 1	Arthurstown
Address 2	Kill
Address 3	Co. Kildare
Address 4	
	Kildare
Country	Ireland
Coordinates of Location	-8.10013 54.5569
River Basin District	IEEA
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Mark Heffernan
AER Returns Contact Email Address	arthurstownlandfill@eircom.net
AER Returns Contact Position	Assistant Landfill Manager
AER Returns Contact Telephone Number	045877674
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	045877849
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	5
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

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. WASTE IMPORTED/ACCEPTED ONTO SITE Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	

This question is only applicable if you are an IPPC or Quarry site

4.1 RELEASES TO AIR

Link to previous years emissions data

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs										
POLLUTANT		METHOD										QUANTITY		
			Method Used		FL1	FL2	AR02	AR05	AR07	AR08	AR09			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	Emission Point 4	Emission Point 5	Emission Point 6	Emission Point 7	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
08	**Nitrogen oxides (NOx/NO2)**	M	ALT	Horiba PG250 gas analyser EN14672:2006	37.97	26.22	7745.0	8956.0	7691.0	7630.0	6054.0	38140.19	0.0	0.0
02	Carbon monoxide (CO)	M	EN 15058:2004	Horiba PG250 gas analyser EN15058:2006	1.01	4.44	15493.0	17662.0	14610.0	14772.0	11704.0	74246.45	0.0	0.0
11	Sulphur oxides (SOx/SO2)	M	OTH	Horiba PG250 gas analyser	12.44	59.04	4072.0	4538.0	3895.0	3811.0	3037.0	19424.48	0.0	0.0
07	Non-methane volatile organic compounds (NMVOC)	M	OTH	Portable signal 3030PMFID and charcoal tube/GCMS	3.37	2.6	10576.0	17374.0	9637.0	9457.0	7438.0	54487.97	0.0	0.0
03	Carbon dioxide (CO2)	M	OTH	Horiba PG250 gas analyser	56460.6	40229.97	4173484.0	4723908.0	3934393.0	3957583.0	3155293.0	20041351.57	0.0	0.0
01	Methane (CH4)	M	OTH		1.15	1.51	399.0	208.0	104.0	105.0	162.0	1888046.66	0.0	1887066.0

* 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		FL1	FL2	AR02	AR05	AR07	AR08	AR09			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	Emission Point 4	Emission Point 5	Emission Point 6	Emission Point 7	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0	0.0	0.0	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		FL1	FL2	AR02	AR05	AR07	AR08	AR09			
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	Emission Point 4	Emission Point 5	Emission Point 6	Emission Point 7	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
244	Total Particulates	M	ALT	TCR Tecora isokentic particulate sampler with QMA in accordance with ISO9096:203	0.0	0.0	64.0	152.0	104.0	105.0	70.0	495.0	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) KGlyr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Arthurstown Landfill

Please enter summary data on the quantities of methane flared and / or utilised			Method Used			
	T (Total) kg/Year	**M/C/E**	**Method Code**	**Designation or Description**	**Facility Total Capacity m3 per hour**	
Total estimated methane generation (as pe site model)	12946227.0	E	MAB	Calibrated landgem model	N/A	
Methane flared	315313.0	M	ESTIMATE	flaring volume measured at	1000.0	(Total Flaring Capacity)
Methane utilised in engine/s	10743848.0	M	ESTIMATE	utilisation volume measured	5200.0	(Total Utilising Capacity)
Net methane emission (as reported in Sectio A above)	1887066.0	C	ESTIMATE	Calculated nett predicted vs	N/A	

4.2 RELEASES TO WATERS

Link to previous years emissions data

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should NOT be submitted under AER / PRTR Reporting as this only concerns Releases from your facility

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT						QUANTITY		
			Method Used		SW2			
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
79	**Chlorides (as Cl)**	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	111.71	111.71	0.0	0.0
24	Zinc and compounds (as Zn)	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	0.03	0.0	0.0	0.0
20	Copper and compounds (as Cu)	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	0.01	0.0	0.0	0.0

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

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT						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 WATERS					Please enter all quantities in this section in KGs			
POLLUTANT						QUANTITY		
			Method Used		SW2			
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
374	Boron	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	0.19	0.19	0.0	0.0
305	Calcium	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	422.01	0.0	0.0	0.0
320	Magnesium	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	43.44	0.0	0.0	0.0
321	Manganese (as Mn)	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	0.02	0.0	0.0	0.0
338	Potassium	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	7.76	0.0	0.0	0.0
343	Sulphate	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	304.09	0.0	0.0	0.0
341	Sodium	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	83.78	0.0	0.0	0.0
379	Total Oxidised Nitrogen (TON)	C	OTH	annual lab result for SW2 combined with total water released at SW2 in 2013	5.59	0.0	0.0	0.0

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

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KG			
POLLUTANT		METHOD			QUANTITY			
			Method Used		Balance Tank			
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
20	Copper and compounds (as Cu)	M	OTH	1 Lab analysis and calculated for annual discharge to sewer	0.82205	0.82205	0.0	0.0

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

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KG			
POLLUTANT		METHOD			QUANTITY			
			Method Used		Balance Tank			
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
303	**BOD**	M	OTH	1 Lab analysis and calculated for annual discharge to sewer	328.82	328.82	0.0	0.0

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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

Please enter all quantities on this sheet in Tonnes

0

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	19 07 03	No	33776.31	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	Osberstown Wastewater Treatment Plan,.	Osberstown Wastewater Treatment Plan,Naas,Kildare,.,ireland		
Within the Country	19 07 03	No	17335.18	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	Ringsend Waste Water Treatmetment Plant,D0034-01	Pigeon House Road,NA,NA,Dub 4,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
Link to Waste Guidance