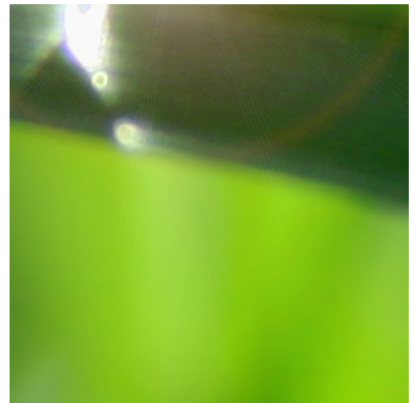
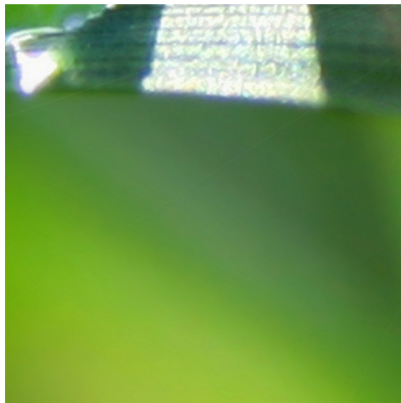
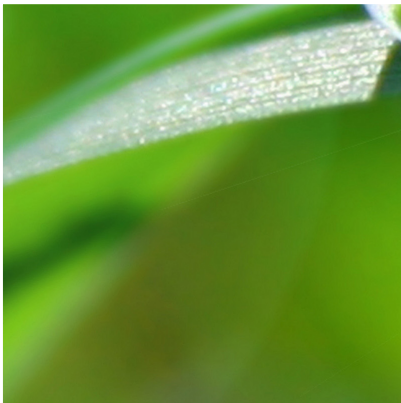
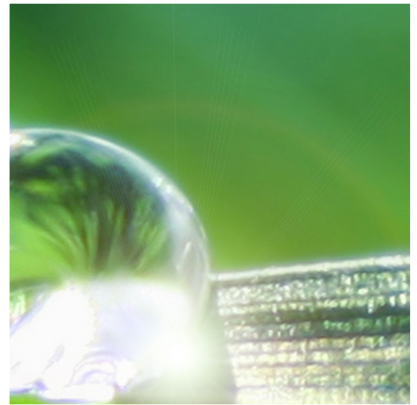
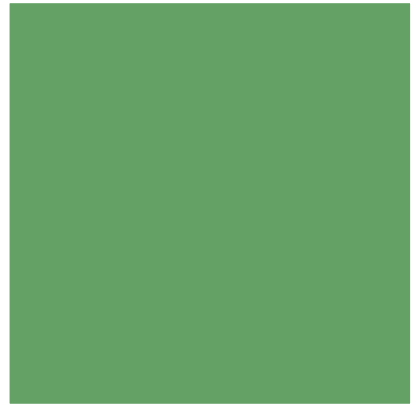
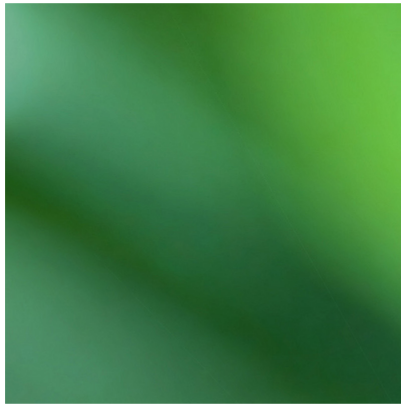
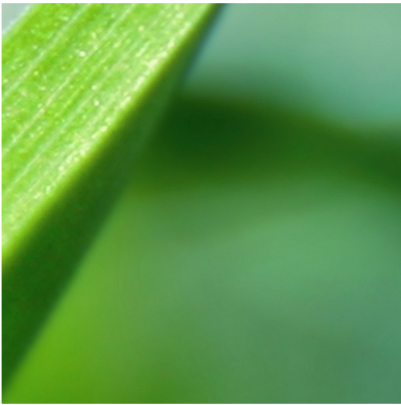


Roscommon County Council
Roscommon Landfill Environmental Monitoring
Annual Environmental Report 2010

MGE0016CR001/March 2011





Roscommon Landfill Waste Licence Compliance

Annual Environmental Report 2010

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1. INTRODUCTION

Roscommon Landfill is operated by Roscommon County Council in accordance with Waste Licence Register No. W0073-01 issued by the EPA. In accordance with Condition 5.2 of the Licence, acceptance of waste for disposal at the landfill ceased on December 31st 2001. The reporting period for the purposes of this Annual Environmental Report (AER) is January 1st 2010 to December 31st 2010.

This Annual Environmental Report (AER) has been prepared in accordance with the conditions of the Waste Licence and the EPA “Draft Guidance on Environmental Management Systems and Reporting to the Agency, 1999”.

2. SITE DESCRIPTION

Roscommon Landfill is located in the townland of Killarney, approximately 3km north east of Roscommon town on the N63 Longford Road. The total area of waste covers an area of approximately 5 hectares. Landfilling commenced at this location in the early 1970’s. The landfill has always operated on a “dilute and disperse” principle. Initially filling of the landfill took place in the area between the road and the present culvert. In 1981, filling commenced to the south and the west of this culverted stream. A halting site was built at the facility in 1980. Landfilling at the facility ceased on December 31st 2001. When the landfill was active the principal activity was the deposit of domestic, commercial and industrial non-hazardous waste.

It is estimated that up to 170,000 tonnes of waste were deposited at the site over its lifetime. A Recycling Centre is in operation at the site which accepts recyclables such as paper, glass and cardboard (see **Table 3.1**). Domestic waste is also accepted for disposal which is transferred to Ballydonagh Landfill, Athlone, Co. Westmeath.

3. QUANTITY AND COMPOSITION OF WASTE

Table 3.1 and **Figure 3.1** outline the quantities of waste accepted for recovery during the reporting period at the Recycling Centre. A total of 571.4 tonnes of material was recovered in 2010. The total amount of material accepted for recycling in 2009 at the

Recycling Centre amounted to 1627.7 tonnes. Therefore in 2010 there was a 64.9% decrease in the amount of waste recycled at the Recycling Centre in comparison with 2009. The waste is collected for recycling by Enva, KMK Metals Recycling Ltd. (WO 113-02), Indaver (WO 36-02), Textiles Recycling Ltd, Glassdon Recycling and Barna Waste. Glassdon collect glass, KMK Metals collect WEEE waste, Textile Recycling Ltd. collect textiles and Indaver collect household hazardous waste. Barna Waste collects all other waste.

Table 3.1 Quantity and Composition of Waste Received for Recovery at the Recycling Centre in 2010

Waste Type	EW Code	Waste Collector	Waste Quantities (Tonnes)
Cardboard, Newsprint, Glossy Magazines, Milk Cartons	200101 / 200199	Barna Waste	238
PET 1, PET 2, Metal Cans, Aluminium Cans	150102 / 150104	Barna Waste	96.06
Wood	200138	Barna Waste	26.78
Batteries	200133*; 200134	Enva/Barna Waste, KMK for small batteries	2.5
Textile	200111	Textile Recycling Ltd./ Barna Waste	12.04
Aeroboard	150102	Barna Waste	0.93
Clear Glass	200102	Glassdon Recycling	72.14
WEEE	200135*; 200307	KMK Metals Recycling Ltd.	100.6
Metals	200139	Barna Waste	18.08
Hazardous Waste	200127*	Indaver/ Barna Waste	4.29
Total Tonnage			571.4

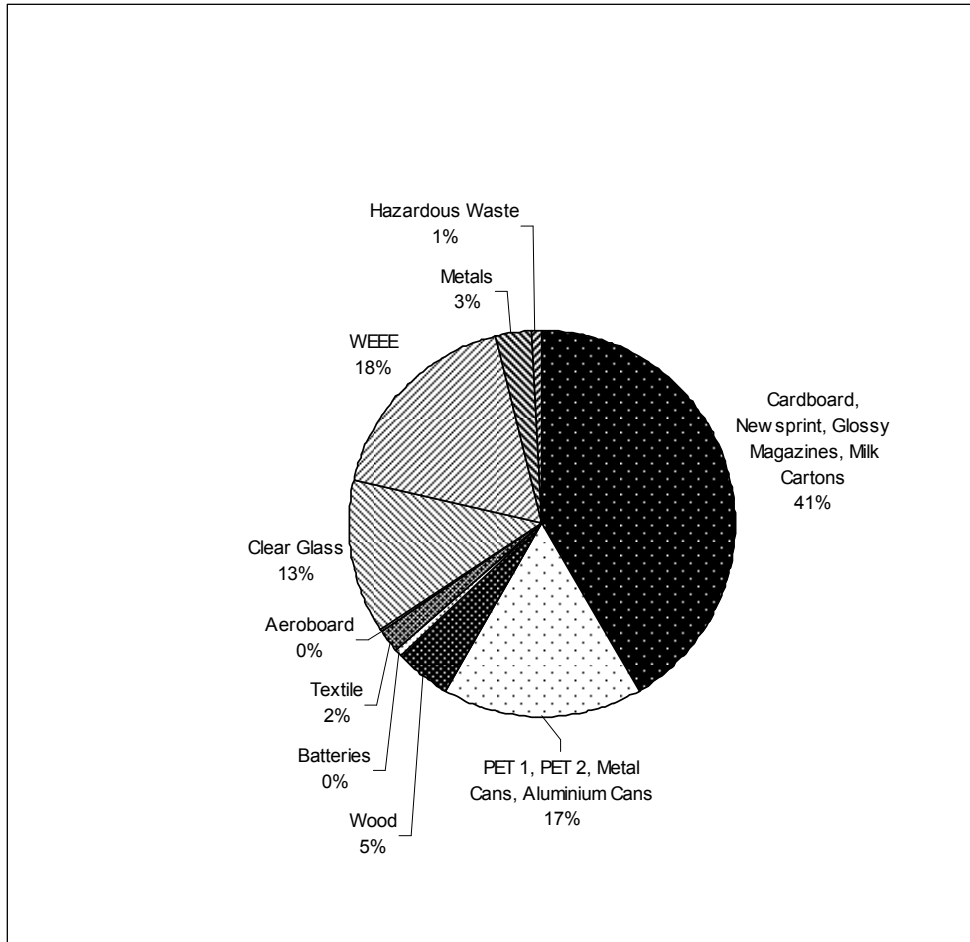
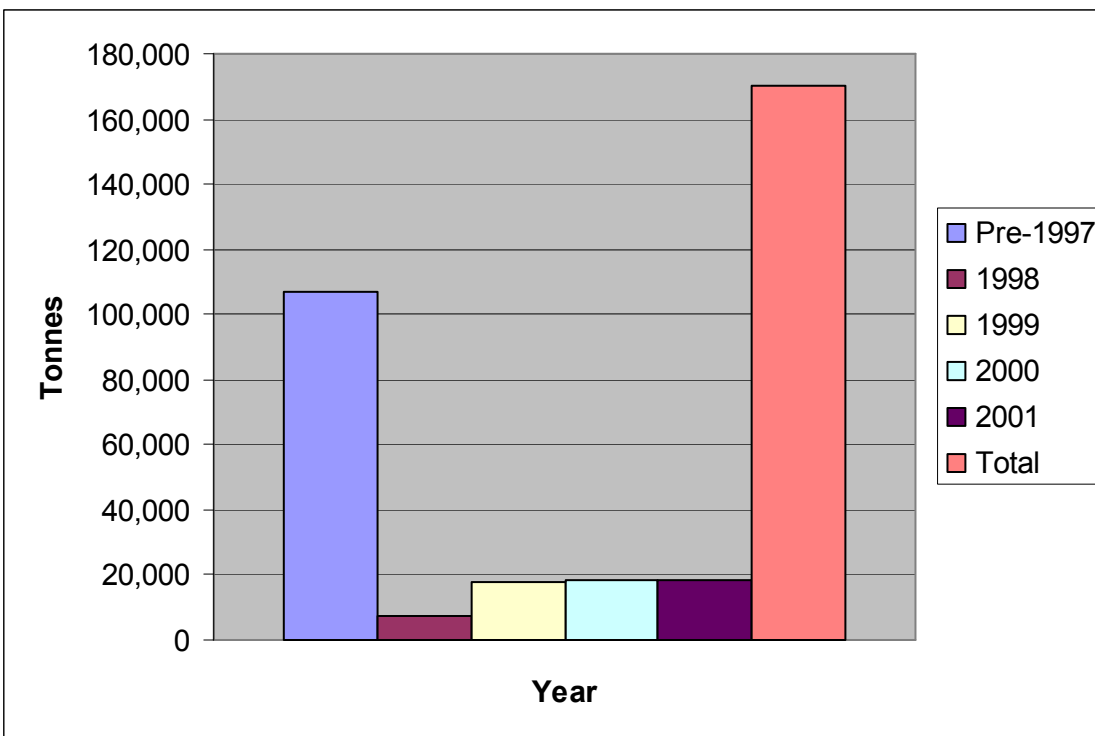


Figure 3.1 Waste Intake for 2010

Table 3.2 and **Figure 3.2** provide figures for the total tonnage of waste accepted for disposal in previous years. These figures regarding waste intake at the facility are highly approximate as there was no weighbridge on site until shortly before closure in 2001. Data on the composition of the waste for these years is unavailable.

Table 3.2 Total Estimated Waste Intake at Roscommon Landfill up to Close of Facility in 2001

Year	Approximate Waste intake (tonnes)
To end 1997	107,000 (estimate)
1998	7,535
1999	18,000
2000	18,360
2001	18,727
Total	170,000 (approx)

**Figure 3.2 Waste Intake for Years Up to Close of Facility in 2001**

4. ENVIRONMENTAL MONITORING

During the reporting period of 2004, it was agreed with the EPA that, as the landfill was closed and fully capped, the scale and scope of the Environmental Monitoring Programme could be reduced to reflect the level of current operations at the facility. A site plan showing the revised monitoring locations is included in **Appendix A**.

The following sections summarise the environmental monitoring undertaken at Roscommon Landfill during the reporting period (2010). The Waste Licence for Roscommon Landfill requires that biannual monitoring be carried out in respect of surface water, ground water, leachate and gas. A letter dated the 8th January 2008 was sent to the EPA North Western Regional Office of Environmental Enforcement on behalf of Roscommon County Council. The letter requested a review of the licence. Roscommon County Council suggested that the extent and frequency of monitoring could be decreased in 2008. In this regard it was proposed that quarterly reporting should be reduced to biannual reporting. The EPA agreed the review of the licence in this respect. For the first half of 2010 (January – June 2010), Roscommon County Council undertook sampling in July due to other responsibilities. The second round of sampling was undertaken between July – December 2010.

The AER/PRTR Emissions Data 2010 is included in **Appendix B**.

4.1 SURFACE WATER

For each half of 2010, samples of surface water were taken by Roscommon County Council from 3 no. monitoring locations. In July 2010 and December 2010 samples were taken from SW1, SW3, & SW7 (see DG0001F08 in Appendix A). All results are tabulated within **Appendix C**. Those parameters which are required to be analysed on an annual basis were monitored in December 2010. The results were compared with the European Community (Quality of Surface Water intended for Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294 of 1989) and the Fresh Water Fish Directive 78/659/EEC. The following interpretation summarises the overall surface water quality. More detailed interpretations can be found within the biannual monitoring reports which were submitted to the EPA.

4.1.1 Interpretation and Non-compliance

Throughout the sampling period (Jan-Dec 2010) the main exceedances of standards were caused by elevated concentrations of ammonia, chemical oxygen demand (COD), biological oxygen demand (BOD), suspended solids, iron and manganese. This is consistent with results from 2009.

Ammonia concentrations fluctuated through the year with a maximum concentration of 0.770 mg/l at SW7 during the first half of 2010 (H1 '10). SW1 sampling results were below the limit of 0.2 mg/l on both sampling occasions. Concentrations were elevated above the 1989 Regulations limit of 0.2 mg/l at SW7 in H1 '10 and in both SW3 and SW7 in second half of 2010 (H2 '10). The mean level of ammonia recorded for H1 '10 was 0.28 mg/l and this increased to 0.44 mg/l for H2 '10. Overall levels of ammonia have increased from a mean concentration 0.275 mg/l in 2009 to a mean concentration of 0.36 mg/l in 2010.

In H1 '10 the **COD** levels at SW1 and SW7 were compliant with the limit of 40 mg/l set for water classified as A3. The COD level at SW3 (75mg/l) exceeded the limit value in H1 '10. In H2 '10 the COD level at all three sampling points was below the level of detection of the laboratory. The maximum concentration was recorded at SW3 during the H1 '10 with a level of 75 mg/l. The mean COD level recorded in H2 '09 was 39.07 mg/l. This figure is similar to the mean COD concentration recorded in the first half of 2009 (42.43 mg/l) and has decreased substantially since the second half of 2008 (69.3 mg/l).

Dissolved oxygen concentrations were compliant with the standard of 5mg/l set by the Freshwater Fish Directive 78/659/EEC (Cyprinid waters) at all sampling points for H1 and H2 of 2010. The level of dissolved oxygen reported at SW3 tends to be lower than the level of dissolved oxygen at SW1 and SW7 however it is still greater than the standard limit (5mg/l).

The level of **Suspended Solids** at SW1, SW2 and SW7 were compliant with the required limit of 25mg/l as set by the FW Fish Directive 78/659/EEC on both sampling occasions. The level of suspended solids in SW3 exceeded the limit in H1 '10 at 39mg/l,

but was below the level of detection in H2 '10. All monitoring points were within the required limit in 2009 with the exception of SW7 in the second half of 2009.

In H1 '10, the **BOD** level at SW1 and SW7 was below the upper limit of 5 mg/l respectively for this sampling period. The BOD level at SW3 was above the recommended upper limit of 5mg/l. For the previous period in 2009, the BOD level at all surface water sampling points was below the limit set by the standards. In H2 '10 the BOD level at all sampling points was within the recommended upper limit of 5mg/l.

All of the sampling points were below the limit for **pH, Chloride, Temperature and Electrical Conductivity**.

An visual inspection of the water quality monitoring points was completed. Weed growth was consistent for SW3 throughout the year. No discolouration of water was noted at any monitoring point on either occasion. Weed growth and water discolouration at SW3 and SW7 has been noted on previous inspections. No odours were detected at any of the monitoring points.

The concentrations of cadmium, chromium, copper, lead, magnesium, mercury, phenols, potassium, sodium, sulphate, total phosphorus and zinc were under the 1989 Regulations limits. The majority of results were concurrent with those recorded for the previous annual sampling suite taken in the second half of 2009. There has been a notable decrease in levels of zinc decreasing from a mean of 37.93µg/l in 2009 to 13.77µg/l for this monitoring period. The level of sulphate has increased from a mean of 10.68mg/l in H2 2009 to 27.65mg/l for this monitoring period. The only exceeding parameters were manganese at SW3 and SW7 and iron at SW3 and SW7 which were above the relevant standards.

The standard limit for manganese is 50 µg/l. Levels recorded for this parameter were 61.8µg/l at SW3 and 63µg/l at SW7. The concentration of manganese has decreased at SW3 from 64.1µg/l in H2 2009 to 61.8µg/l. The concentration of manganese at SW7 has increased from 39.4µg/l in H2 2009 to 63µg/l for this monitoring period. The mean manganese level has increased from 42.93µg/l in the second half of 2009 to 55.63µg/l for this monitoring period.

The standard limit for iron is 200 µg/l. Levels recorded for this parameter were 211µg/l at SW3 and 264µg/l at SW7. The concentration of iron has increased at SW3 from 187.8µg/l in H2 2009 to 211µg/l for this monitoring period and at SW7 from 237µg/l in H2 2009 to 264µg/l for this monitoring period. The mean iron level has increased from 179.6µg/l in H2 2009 to 207.33µg/l for this monitoring period.

A summary of the mean concentrations of the key parameters for surface water for the reporting period can be seen in **Figure 4.1**.

4.1.2 Proposals

As the landfill is now capped and the leachate interceptor drain and abstraction system is preventing lateral migration of leachate into the stream, it is likely that contamination in the watercourses is as a result of accumulated contaminants in the banks of the streams. This contamination should decrease over time.

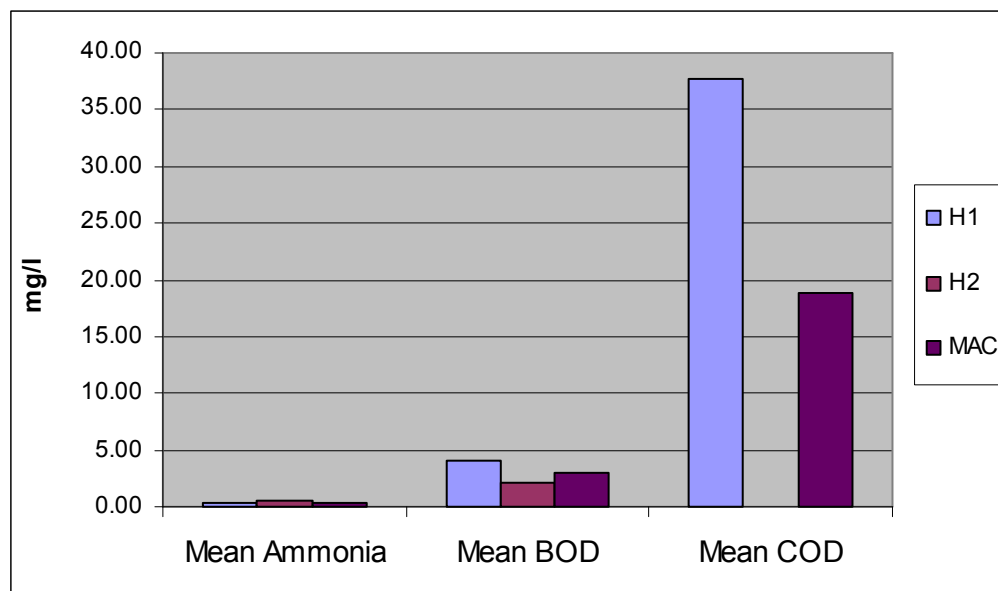


Figure 4.1 Mean Concentrations of Key Parameters for Surface Water for the Reporting Period

4.2 GROUNDWATER

Groundwater monitoring points are situated both upgradient and downgradient of the landfill. The locations of these points are shown on drawing **DG0001-01F08** in **Appendix A**. The groundwater sampling points GW2, GW4 and GW6 were analysed for the suite of parameters agreed with the Agency. The following interpretations summarise the overall water quality for 2010, the results of which are contained within **Appendix C**. Those parameters which require to be analysed on an annual basis were monitored in December 2010. Detailed interpretations can be found within the biannual monitoring reports which were submitted to the EPA.

4.2.1 Interpretation and Non-Compliance

The interim guideline value for **Ammonia** is 0.15 mg/l. The ammonia level at GW4 and GW6 exceeded the guideline value in H1 '10 and H2 '10. However, the ammonia level at GW6 has decreased from 3.59mg/l in H1 '10 to 0.7mg/l in H2 '10. GW6 was also non compliant in 2008 and 2009. Sampling point GW2 was compliant with the guideline values throughout 2010. A summary of the results obtained in H2 '10 compared against results obtained in H2 '09 and H2 '08 can be seen in **Figure 4.2**.

The interim guideline for **Dissolved Oxygen** concentration is that there should be no abnormal change. The minimum, maximum and mean concentrations for DO for the 2010 monitoring period were 4.4, 7.4 and 6.2mg/l, while the minimum, maximum and mean concentrations for H2 '09 were 21.4, 25.5 and 22.80 mg/l (please note no groundwater analysis was carried out in H1 '09). There has been a significant change in dissolved oxygen concentration at all three sampling points. The level of dissolved oxygen has decreased at all sampling points from levels recorded in H2 '09.

Values for **Electrical Conductivity, Temperature and pH** were within the guideline limits at all sampling points on all sampling occasions.

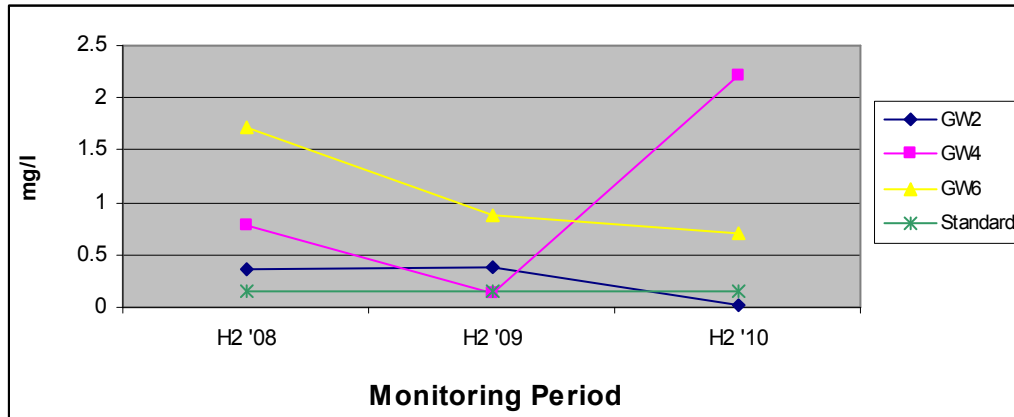


Figure 4.2 Ammonia Levels in Groundwater for the Reporting Period

Additional parameters were tested in the second half of 2010. The concentrations of cadmium, chromium, copper, magnesium, mercury, phenols, sodium and sulphate were all below the standard guideline values set.

The mean concentration of iron increased slightly from the levels recorded in 2009. The iron level at all three locations exceeded the standard of 200µg/l in this monitoring period, with a concentration of 1558µg/l at GW2, 2483µg/l at GW4 and 1224µg/l at GW6. The concentration of lead at GW4 and GW6 is within the guideline limit value of 10µg/l however the concentration of lead at GW2 (25.4µg/l) is greater than the limit of 10µg/l specified by the guidelines. The level of lead at GW2 has increased from 0.3µg/l in H2 2009 to 25.4µg/l for this monitoring period.

Concentrations of manganese were above the limit of 50 µg/l at all three locations. The levels of manganese have increased at GW2 from 113µg/l in H2 2009 to 224µg/l for this monitoring period and have decreased at GW4 and GW6 from 97.8µg/l and 149.6µg/l in H2 2009 to 90.8µg/l and 124µg/l for this monitoring period. The level of potassium at GW2 is greater than the limit of 5mg/l specified by the guidelines increasing from 2.21mg/l in H2 2009 to 15.6mg/l for this monitoring period.

The mean level of total phosphorus is 0.06 mg/l which is above the standard limit of 0.03 mg/l. The level of total phosphorus at GW2 and GW6 exceeded the standard limit with a concentration of 0.097mg/l and 0.042mg/l respectively. The concentration of total

phosphorus at GW2 (0.032mg/l) is slightly above the standard limit of 0.03 mg/l which has decreased from 0.043 mg/l in H2 2009 to 0.032 mg/l for this monitoring period.

The mean concentration of zinc at GW2 has increased from 7.7µg/l in H2 2009 to 157µg/l for the monitoring period. This is greater than the guideline limit of 100µg/l set by the regulations.

Groundwater levels are tabulated in **Appendix C**. On comparing groundwater levels recorded in H2 '10 period with those recorded in H1 '10, levels have decreased at sampling point GW2 and GW4, with levels decreasing by 0.6 and 0.1 meters for GW2 and GW4 respectively. The groundwater level at GW1 has increased by 0.2 meter from the level recorded in H1 '10.

4.2.2 Proposals

Leachate abstraction is ongoing from the leachate interceptor drain and from leachate boreholes in the waste body reducing infiltration of leachate to groundwater. As the landfill is capped, there is a minimum amount of leachate being generated. The combined effect of these measures should demonstrate a continual improvement in the quality of the groundwater over time.

4.3 LEACHATE

Samples of leachate were taken by Roscommon County Council from the 3 no. chambers situated on the leachate interceptor drain and at the leachate lagoon (see **DG0001F08** in **Appendix A**). The results of this analysis are contained within **Appendix C**. The following interpretation summarises the overall leachate quality. More detailed interpretations can be found within the biannual monitoring reports which were submitted to the EPA.

4.3.1 Interpretation and Non-compliance

The leachate level in LMH1 has decreased since H1 2010 decreasing from 3.4m to 5.2m for this monitoring period. The leachate level in LMH2 has increased from 2.6m in H1 2010 to 1.9m for this monitoring period. The leachate level in LMH3 (2.3m) remains

consistent with the level recorded in H1 2010 (2.2m). The operation of a leachate pumping system installed by Roscommon County Council during the summer of 2004 is set to automatically maintain leachate levels in the landfill and in the interceptor drain.

Levels of ammonia, chloride and electrical conductivity recorded at LMH1 and LMH2 in H2 '10 decreased significantly from levels recorded in H1 '10. In H1 '10, ammonia, chloride and electrical conductivity levels had increased substantially at LMH1 and LMH2 when compared against the previous monitoring period in 2009. The level of ammonia and electrical conductivity at LMH3 increased slightly from H1 '10 to H2 '10. The levels of chloride monitored at LMH3 decreased from H1 '10 to H2 '10.

The mean COD level of the three leachate chambers has decreased 115mg/l in H1 '10 to 27mg/l in H2 '10. The highest COD value for the sampling period was recorded at LMH1 (81mg/l) which is a decrease on the result recorded for LMH1 in H1 '10 (87mg/l). The COD level has decreased at LMH2 from 258mg/l in H1 '10 to below the level of detection for this monitoring period. The COD level at LMH3 was below the level of detection throughout 2010. The mean level of COD has decreased from the level recorded in 2009.

The mean level of BOD has decreased from 7.33mg/l in H1 2010 to 0.93mg/l for H2 '10. For LMH2, the BOD result was deemed "result not valid" in H2 '10. The BOD level at LMH1 has decreased from 5mg/l in H1 2010 to 1.98mg/l for this monitoring period. Overall the mean level of BOD has decreased from the level recorded in 2009.

All parameters measured were at the lower end of the expected range of values for leachate (**Table 4.1**). There was an overall decrease in the strength of the leachate over the reporting period (**Figure 4.3**).

Figure 4.4 shows the change in BOD/COD ratio over the reporting period. A maximum value of 0.063 was recorded in the first half of 2010 which is a decrease on the value recorded in 2009 (0.21). The BOD/COD ratio is typically assumed to drop from 0.8 to 0.1 over a 30 year period. A BOD/COD ratio of less than 0.25 is typical of the methanogenic phase leachate. The maximum value of 0.063 for BOD/COD is typical of the

methanogenic phase leachate. Other contaminants analysed are within the scale in terms of leachate strength as defined in the EPA Landfill Site Design Manual.

Table 4.1 Comparison of Typical Leachate Composition Values and Values at Roscommon Landfill

Determinant	Unit	High values (young landfill)	Low values (old landfill)	Values at Roscommon Landfill for H2 2010
pH	-	6-8	6-8	7.21
Conductivity	µS/cm	5,000-20,000	2,500-10,000	795.67
COD	mg/l	8,000-12,000	4,000-6,000	27
BOD ₅	mg/l	7,000-10,000	2,000-3,000	0.93
Tot – P	mg/l	10-25	1-5	0.09
Chloride	mg/l	1,000-5,000	100-1,000	29.93
Magnesium	mg/l	50-1,500	10-50	0.665
Potassium	mg/l	500-1,500	50-200	20.03
Chromium	mg/l	<1	<0.1	0.0007
Manganese	mg/l	<5	<0.5	0.665
Iron	mg/l	10-150	1-5	1.069
Copper	mg/l	<1	<1	-
Zinc	mg/l	10	1-5	12.1
Cadmium	mg/l	<0.1	<0.01	0.000007
Mercury	mg/l	<0.01	<0.001	0.00001
Lead	mg/l	1-2	<1	0.00047

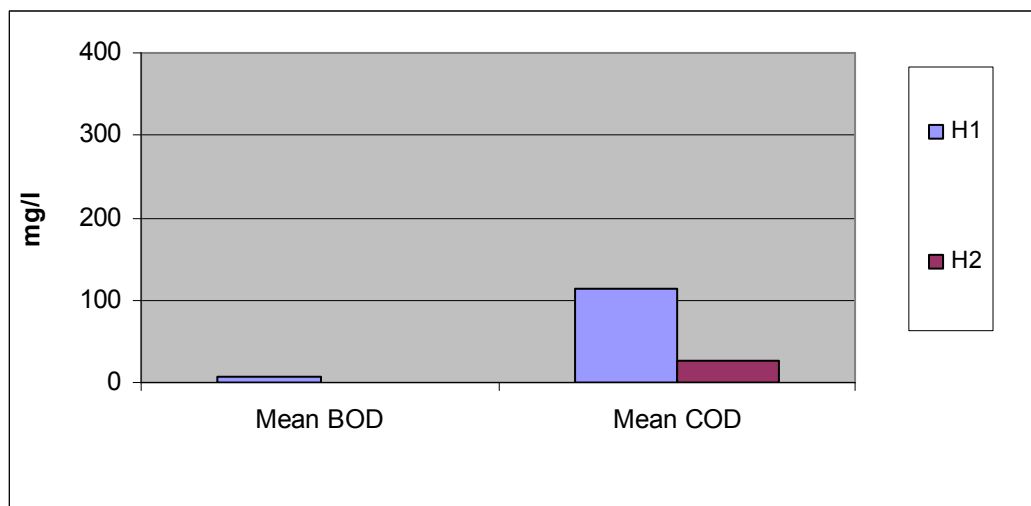


Figure 4.3 Mean Concentrations of Key Leachate Parameters Over the Reporting Period

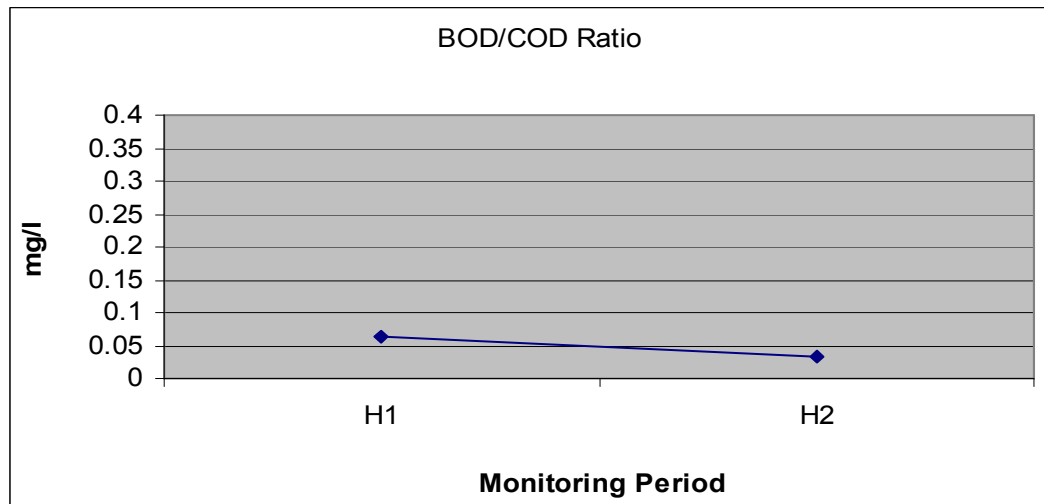


Figure 4.4 BOD/COD Ratio in Leachate over the Reporting Period

4.3.2 Proposals

Monitoring of leachate will continue in 3 no. leachate chambers on the interceptor drain as agreed with the EPA.

4.4 DUST

As the facility is a closed and capped landfill and since no construction work is ongoing at the site, it was agreed with the EPA in 2004 that dust monitoring could cease at the facility.

4.5 LANDFILL GAS

Roscommon County Council undertakes landfill gas monitoring on a quarterly basis at 10 no. gas extraction boreholes as shown on DG0001F08 (**Appendix A**). Analysis was performed on each sample for methane (CH₄), carbon dioxide (CO₂), oxygen (O₂), temperature and pressure, the results of which are contained in **Appendix C**. The quality of landfill gas varies somewhat throughout the year with methane concentrations varying between 20.4% and 83.3% v/v and carbon dioxide concentrations between 13.3% v/v and 39.9% v/v. Mean oxygen levels remain fairly constant throughout the

monitoring period. **Figure 4.5** provides a summary of the mean concentrations of the main components of the landfill gas over the monitoring period.

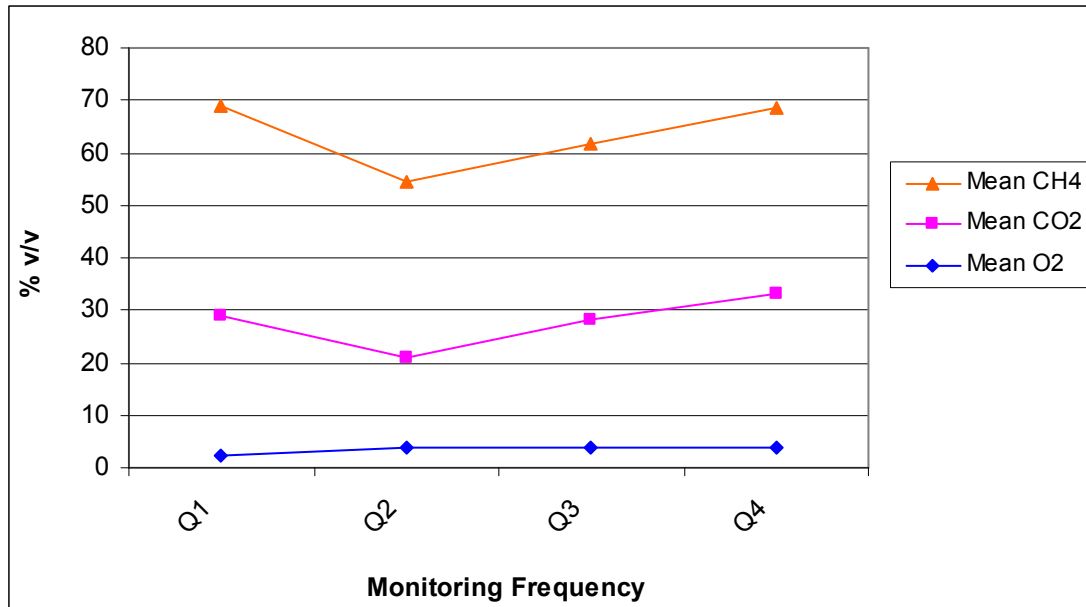


Figure 4.5 Summary of Mean Concentrations of Main Components of Landfill Gas

4.6 METEOROLOGICAL DATA

The daily meteorological data for 2010 from Claremorris weather station can be seen in **Appendix D**. This includes rainfall, wind speed, min and max temperature, relative humidity and pressure data.

Figure 4.6 illustrates monthly rainfall data for 2010. A total of 1057.7mm of rain fell at Claremorris in 2010.

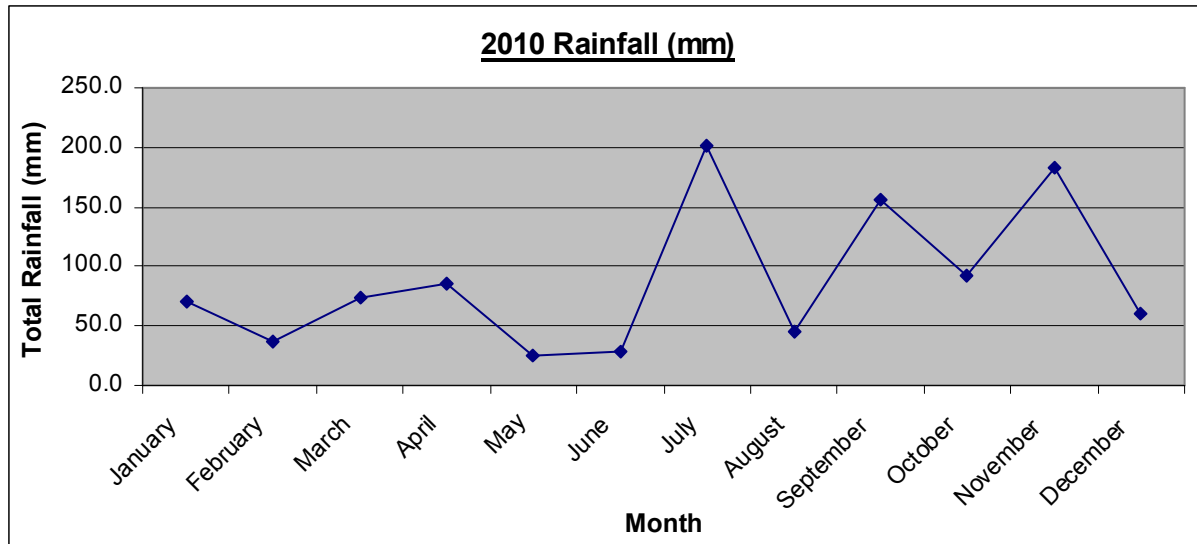


Figure 4.6 Monthly Rainfall Data for 2010 from Claremorris Weather Station

5. MASS BALANCE OF SPECIFIED SUBSTANCES

5.1 RESOURCE AND ENERGY CONSUMPTION SUMMARY

7,007 units of electricity were used during the reporting period.

5.2 EMISSIONS TO GROUNDWATER

The landfill operated on a “dilute and disperse” basis with no leachate containment measures put in place whereby the leachate generated was allowed to drain into surface and groundwater, becoming diluted and attenuated. The layers of peat and marl below the waste appear to have been effectively acting as a natural liner. The quality of the groundwater should improve as the landfill is capped and leachate abstraction continues in the leachate interceptor drain being provided around the landfill perimeter.

5.3 MONTHLY WATER BALANCE CALCULATION AND INTERPRETATION

Monthly rainfall data obtained from the nearest Met Eireann weather station at Claremorris, Co. Mayo estimated that the site received approximately 1057.7 mm of rainfall for the year 2010.

Prior to capping, it is estimated that, on average, approximately 22,700 m³ of leachate was generated on an annual basis at Roscommon Landfill. Records for 2010 indicate that 2,309 tonnes of leachate were tankered to Roscommon WWTP in the period.

5.4 LANDFILL GAS VOLUMES

Under optimum conditions one tonne of degradable waste can theoretically produce 400-500m³ of landfill gas (including moisture content). In practical terms the rate at which landfill gas which may be collected for utilisation purposes may be much lower.

It is estimated that the waste disposed of in Roscommon Landfill contains on average 50% biodegradable waste. It is therefore assumed that the gas production is approximately 200 Nm³ of gas per tonne of waste over a 30 year period.

Landfill gas generation volumes at Roscommon Landfill have been estimated using GASSIM, a gas modelling programme developed by the UK Environment Agency. Total bulk landfill gas generated in 2010 is estimated by GASSIM to be approximately 80m³/hr as shown in **Figure 5.1**.

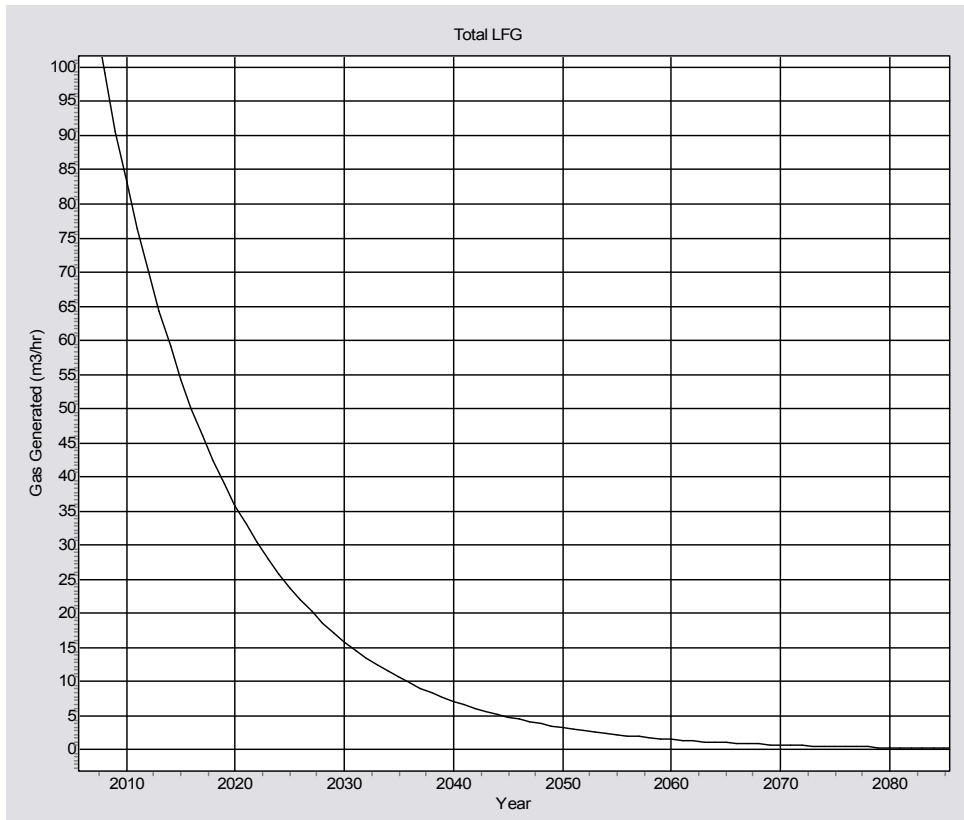


Figure 5.1 Estimated Total Gas Generation from Roscommon Landfill

A 100 m³/hr enclosed gas flare and 10 no. landfill gas extraction wells and connecting pipework were installed at the landfill in 2003. The gas management system was commissioned during the summer of 2004.

Based on flare run-time records and the quality of gas on site, it is considered that the GASSIM estimate above is too high. Landfill gas generation and quality at Roscommon Landfill has reduced significantly in the last 2-3 years. Bulk landfill gas generation for 2010 is estimated to be **30m³/hr**, which equates to 262,800m³/yr.

The landfill gas flare currently runs for a number of hours each day until it automatically shuts-off due to depleted gas volumes.

6. SITE DEVELOPMENT WORKS

6.1 DEVELOPMENT WORKS DURING THE REPORTING PERIOD

As part of the new servicing contract with Barna Waste a new slab was constructed to facilitate compactor skips.

During 2008 external contractors serviced the flare. Details of the report pertaining to this have not yet been circulated. Irish Biotech Systems (IBS) were commissioned in mid 2008 to maintain the flare under a new contract. They also contributed to balancing the gas field to prolong the flare operation hours.

6.2 PROPOSED DEVELOPMENT WORKS

There were no proposals for works at the facility for 2010.

7. PROCEDURES

A revised Environmental Management Plan (EMP) for the facility was issued in December 2004.

8. STAFFING AT ROSCOMMON LANDFILL

Table 8.1 shows the site management structure at Roscommon Landfill.

Table 8.1 Site Management Structure at Roscommon Landfill

Position		Employee Contact details
Director of Services Mr Tommy Ryan		Environmental Section, Roscommon County Council, Courthouse, Roscommon. Telephone No: 090 6637100 Fax No: 090 6637108
Senior Executive Officer Mr. Pat Murtagh		Environmental Section, Roscommon County Council, Courthouse, Roscommon.
Senior Staff Officer Sarah Scott	Senior Executive Engineer Mr. John Mockler	Environmental Section, Roscommon County Council, Courthouse,

Position		Employee Contact details
		Roscommon.
Facility Manager Mr. Noel Martin		Environmental Section, Roscommon County Council, Courthouse, Roscommon.
Deputy Facility Manager/Landfill Caretaker Mr. Joe Casey		Environmental Section, Roscommon County Council, Courthouse, Roscommon.
Site Operatives Mr. Martin Kiernan		Environmental Section, Roscommon County Council, Courthouse, Roscommon.

9. REVIEW OF NUISANCE CONTROLS

9.1 LITTER ABATEMENT

As waste is no longer being accepted at the site and all landfilled waste is covered, there is no litter problem at the facility. The Recycling Centre is continuously maintained and monitored by Council operatives and all recyclables are deposited into covered, lockable containers. Any loose litter around the facility and its environs is collected.

9.2 NOISE AND DUST

With the closure of the landfill, there is no heavy machinery and little heavy vehicular traffic to the site. Noise and dust do not pose any problems and monitoring ceased in 2004 with the agreement of the Agency.

9.3 VERMIN CONTROL

Capping of the landfill has included the installation of a geosynthetic clay liner tying into the leachate interceptor drain around the waste, thus forming a continuous barrier around the main waste body. This barrier is augmented by a clay cover which is 1m thick resulting in little or no access to the waste for nuisances such as vermin or birds. In addition, Roscommon County Council employs ECOLAB to operate a vermin control

programme. During the summer months, AOK pest control are engaged in the control of flies for Roscommon County Council.

9.4 ODOUR

As waste is no longer being accepted at the site and any landfilled waste is covered, there is no odour problem at the facility. The gas flare treats landfill gas at the facility.

10. REPORTS ON FINANCIAL PROVISIONS

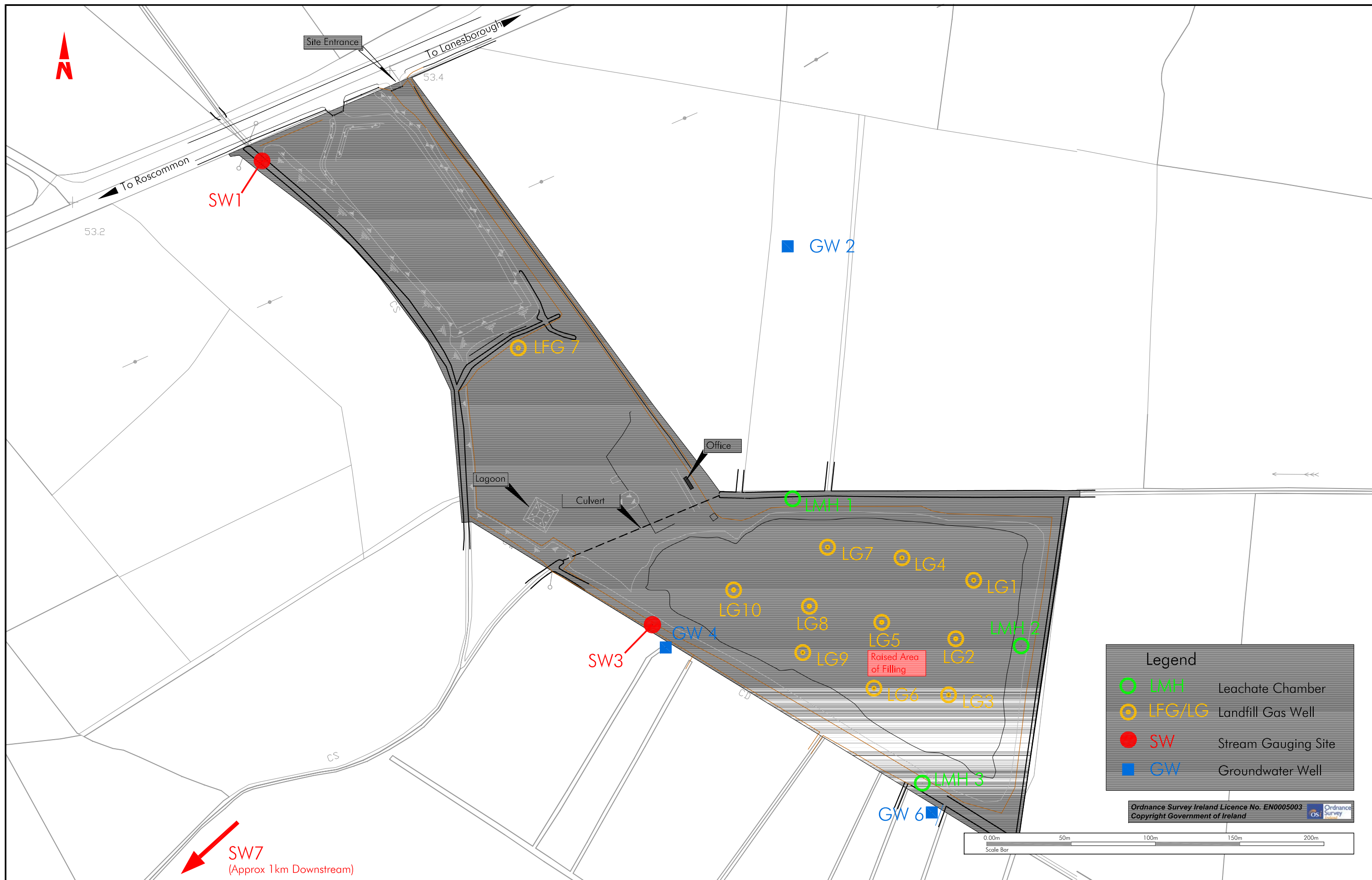
Roscommon County Council allocates funding on an annual basis from general resources. The funding will be maintained in an amount always sufficient to underwrite the current Restoration and Aftercare Plan in accordance with Condition 11 of the Waste Licence.

11. ENVIRONMENTAL INCIDENTS AND COMPLAINTS

No incidents or complaints were reported for the year 2010.

APPENDIX A

**SITE LAYOUT LOCATIONS OF MONITORING POINTS
(DG0001-01F08)**



NOTES

1. This drawing is the property of RPS-Consulting Engineers, it is a confidential document and must not be copied, used, or its content divulged without prior written consent.
2. All Levels refer to Ordnance Survey Datum, Malin Head.
3. DO NOT SCALE, use figured dimensions only, if in doubt ask.

No.	Date	By	Amendment / Issue	App.
F08	06.09.07	C/S	Final Issue	W.M.

Roscommon County Council
Roscommon Landfill Environmental Monitoring

Site Layout Locations of Monitoring Points

Drawn by:	C.N.	Job No:	MGE0016
Checked by:	S.A.	File No:	MGE0016DG0001
Approved by:	A.F.	Dir. No:	Rev:
Scale:	1:2000@A3	DG0001-01 F08	
Date:	May '03		

Roscommon County Council
 Comhairle Chontae Roscomáin
 Mr. T.Ryan
 Roscommon County Council,
 Court House,
 Roscommon.
 Tel: (090) 6637100 Fax: (090) 6637108



RPS Consulting Engineers
 RPS Consulting Engineers, Lyrr Building, IDA Business & Technology Park, Mervue, Galway, Ireland.
 T: +353 91 534100 - F: +353 91 534199
 E: ireland@rpsgroup.ie W: www.rpsgroup.com/ireland

APPENDIX B

AER/PRTR Emissions 2010



Environmental Protection Agency

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2010.xls | Return Year : 2010 |

[Guidance to completing the PRTR workbook](#)

AER Returns Workbook

Version 1.1.11

REFERENCE YEAR	2010
-----------------------	------

1. FACILITY IDENTIFICATION

Parent Company Name	Roscommon County Council
Facility Name	Roscommon Landfill Facility
PRTR Identification Number	W0073
Licence Number	W0073-01

Waste or IPPC Classes of Activity

No.	class_name
3.1	Deposit on, in or under land (including landfill).
3.11	Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule.
3.12	Repackaging prior to submission to any activity referred to in a preceding paragraph of this Schedule.
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
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	##### Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.13	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.2	Recycling or reclamation of metals and metal compounds.
4.3	Recycling or reclamation of other inorganic materials.
4.4	
Address 1	Killarney Townland
Address 2	Roscommon
Address 3	
Address 4	
Country	Ireland
Coordinates of Location	-8.15598 53.6378
River Basin District	IEGBNISH
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	John Mockler (W0073)
AER Returns Contact Email Address	jmockler@roscommoncoco.ie
AER Returns Contact Position	
AER Returns Contact Telephone Number	090 663748/087 6977600
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	

Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	0
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

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

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

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

4.1 RELEASES TO AIR

[Link to previous years emissions data](#)

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2010.xls | Return Year : 2010 |

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SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

POLLUTANT		METHOD			Please enter all quantities in this section in KGs			
No. Annex II	Name	M/C/E	Method Used		Emission Point 1	QUANTITY		
			Method Code	Designation or Description		T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
03	Carbon dioxide (CO2)	E	ESTIMATE	GASSIM	0.0	0.0	0.0	0.0
02	Carbon monoxide (CO)	E	ESTIMATE	GASSIM	75177.32	75177.32	0.0	0.0
01	Methane (CH4)	E	ESTIMATE	GASSIM	11.263	11.263	0.0	0.0
07	Non-methane volatile organic compounds (NMVOC)	E	ESTIMATE	GASSIM	73682.0	73682.0	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 B : REMAINING PRTR POLLUTANTS

POLLUTANT		METHOD			Please enter all quantities in this section in KGs			
No. Annex II	Name	M/C/E	Method Used		Emission Point 1	QUANTITY		
			Method Code	Designation or Description		T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
56	1,1,2,2-tetrachloroethane	E	ESTIMATE	GASSIM	0.014657	0.014657	0.0	0.0
62	Benzene	E	ESTIMATE	GASSIM	0.020314	0.020314	0.0	0.0
15	Chlorofluorocarbons (CFCs)	E	ESTIMATE	GASSIM	0.110571	0.110571	0.0	0.0
35	Dichloromethane (DCM)	E	ESTIMATE	GASSIM	0.09	0.09	0.0	0.0
14	Hydrochlorofluorocarbons (HCFCs)	E	ESTIMATE	GASSIM	0.006531	0.006531	0.0	0.0
72	Polycyclic aromatic hydrocarbons (PAHs)	E	ESTIMATE	GASSIM	0.042686	0.042686	0.0	0.0
52	Tetrachloroethylene (PER)	E	ESTIMATE	GASSIM	0.067629	0.067629	0.0	0.0
73	Toluene	E	ESTIMATE	GASSIM	0.000056	0.000056	0.0	0.0
54	Trichlorobenzenes (TCBs)(all isomers)	E	ESTIMATE	GASSIM	0.0	0.0	0.0	0.0
57	Trichloroethylene	E	ESTIMATE	GASSIM	0.0	0.0	0.0	0.0
58	Trichloromethane	E	ESTIMATE	GASSIM	0.0	0.0	0.0	0.0
60	Vinyl chloride	E	ESTIMATE	GASSIM	0.0288	0.0288	0.0	0.0
78	Xylenes	E	ESTIMATE	GASSIM	0.027	0.027	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)

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

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

Additional Data Requested from Landfill operators

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

Please enter summary data on the quantities of methane flared and / or utilised		Method Used			Facility Total Capacity m3 per hour
T (Total) kg/Year	M/C/E	Method Code	Designation or Description		
Total estimated methane generation (as per site model)	89352.0	E	ESTIMATE	GASSIM	N/A
Methane flared	15670.0	E	ESTIMATE	B. HYDE CALCULATION	100.0 (Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0 (Total Utilising Capacity)
Net methane emission (as reported in Section A above)	73682.0	E	ESTIMATE	GEN-FLARED = EMISSION	N/A

4.2 RELEASES TO WATERS

[Link to previous years emissions data](#)

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2010.xls | Return Year : 2010 |

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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 tr

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT		M/C/E	Method Used		QUANTITY			
No. Annex II	Name		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 B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT		M/C/E	Method Used		QUANTITY			
No. Annex II	Name		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		M/C/E	Method Used		QUANTITY			
Pollutant No.	Name		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

4.3 RELEASES TO WASTEWATER OR SEWER

[Link to previous years emissions data](#)

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2010.xls | Retu

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SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
No. Annex II	Name	M/C/E	Method Used		Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description				
					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 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 KGs			
POLLUTANT		METHOD			QUANTITY			
Pollutant No.	Name	M/C/E	Method Used		Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description				
					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

4.4 RELEASES TO LAND

[Link to previous years emissions data](#)

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2010.xls | Return Year : 2010 |

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SECTION A : PRTR POLLUTANTS

POLLUTANT		RELEASURES TO LAND			Please enter all quantities in this section in KGs		
POLLUTANT		METHOD			QUANTITY		
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year
					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 POLLUTANT EMISSIONS (as required in your Licence)

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

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2010.xls | Return Year : 2010 |

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Please enter all quantities on this sheet in Tonnes

9

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	Haz Waste : Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility	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		Non	Non Haz Waste: Address of Recover/Disposer			
Within the Country	20 01 01	No	238.0	paper and cardboard	R3	M	Weighed	Onsite in Ireland	Barna Waste W0106-02,W0106-02		Carrowbrowne,Headford Road,Galway,..,Ireland		
Within the Country	20 01 33	Yes	2.5	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these	R4	M	Weighed	Onsite in Ireland	Barna Waste/KMK Metal Recycling Ltd/Emva,W01060-02/W0113-03/W0041-01		Carrowbrowne/Cappincur Industrial Estate/Smithstown Rd/Daingean Road,Shannon,..,Tullamore/., Galway/Offaly/Clare,Ireland	Barna Waste,W0106-02,Carrowbrowne,Headford Road,Galway,..,Ireland	Carrowbrowne,Headford Road,Galway,..,Ireland
Within the Country	20 01 27	Yes	4.29	paint, inks, adhesives and resins containing dangerous substances	R5	M	Weighed	Onsite in Ireland	Barna Waste ,W0036-02		Dublin Port/Carrowbrowne, Dublin 1/ Headford Road,Dublin/Galway,..,Ireland	Indaver,W0036-02,Dublin Port,Dublin 1,Dublin,..,Ireland	Dublin Port,Dublin 1,Dublin,..,Ireland
Within the Country	15 01 02	No	96.06	PET 1, PET 2, Metal Cans, Aluminium Cans	R5	M	Weighed	Onsite in Ireland	Barna Waste W0106-02,W0106-02		Carrowbrowne,Headford Road,Galway,..,Ireland		
Within the Country	20 01 02	No	72.14	glass	R5	M	Weighed	Onsite in Ireland	Glassdon Recycling,.		Antrim,BT41 3SE,United Kingdom		
Within the Country	20 01 40	No	18.08	metals	R4	M	Weighed	Onsite in Ireland	Barna Waste W0106-02,W0106-02		Carrowbrowne,Headford Road,Galway,..,Ireland		
Within the Country	20 01 38	No	26.78	wood other than that mentioned in 20 01 37	R3	M	Weighed	Onsite in Ireland	Barna Waste W0106-02,W0106-02		Carrowbrowne,Headford Road,Galway,..,Ireland		
Within the Country	20 01 11	No	12.04	textiles	R3	M	Weighed	Onsite in Ireland	Textiles Recycling Ltd./ Barna Waste ,W0106-02		Tallaght / Headford Road,Dublin 24 / Galway,..,Ireland		
Within the Country	15 01 02	No	0.93	Aeroboard	R3	M	Weighed	Onsite in Ireland	Barna Waste W0106-02,W0106-02		Carrowbrowne,Headford Road,Galway,..,Ireland		
Within the Country	20 01 35	Yes	100.6	discarded electrical and electronic equipment other than those mentioned in 20 01 21 and and 20 01 23 containing hazardous components	R4	M	Weighed	Onsite in Ireland	KMK Metal Recycling Ltd.,W01130-03		Cappincur Industrial Estate ,Daingean Road ,Tullamore ,Co. Offaly,Ireland	KMK metal Recycling Ltd.,W0113-03,Cappincur Industrial Estate, Daingean Road,Tullamore,..,Ireland	Cappincur Industrial Estate, Daingean Road,Tullamore,..,Ireland
Within the Country	19 07 03	No	2309.0	landfill leachate other than those mentioned in 19 07 02	D8	M	Weighed	Onsite in Ireland	Roscommon Wastewater Treatment Plant,.		"", "",Roscommon,..,Ireland		

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

APPENDIX C

Monitoring Results

Surface Water Results

Roscommon County Council,
Roscommon Landfill

Date of Monitoring : 7th December 2010

Sampling point	Ammonia mg/l N	BOD mg/l	COD mg/l	Chloride mg/l CL	Conductivity @ 20°C	DO mg/l	pH	Suspended Solids mg/l	Temperature °C	Cadmium ug/l	Chromium ug/l	Copper ug/l	Iron ug/l	Lead ug/l	Magnesium mg/l	Manganese ug/l	Mercury ug/l	Potassium mg/l	Sulphate mg/l	Sodium mg/l	Total Phosphorus mg/l	Phenols mg/l	Zinc ug/l
SW2	0.066	1.40	BLD	14.7	595	10.10	7.73	BLD	2.3	BLD	BLD	NT	147	BLD	12	42.1	BLD	2.4	15.44	11	0.029	BLD	9.4
SW3	0.618	3.70	BLD	23.6	688	5.74	7.40	BLD	0.8	BLD	BLD	NT	211	BLD	10.2	61.8	BLD	4.8	39.96	13	0.104	BLD	12
SW7	0.646	1.40	BLD	17.0	625	9.08	7.58	BLD	1.7	BLD	BLD	NT	264	BLD	10.1	63	BLD	3.8	27.56	11.4	0.041	BLD	19.9
Standard	0.20	5.00	40.00	250.00	1000.00	>5 ^{2c}	5.5-8.5 ¹	25.00	25.00	5	50	50	200	50	-	50	1	-	200	-	0.5	5E-04	3000
Mean	0.44	2.17	0.00	18.45	629.33	8.31	7.57	0.00	1.60	0.00	0.00	0.00	207.33	0.00	10.77	55.63	0.00	3.67	27.65	11.8	0.06	0.00	13.77
Min	0.066	1.40	0.00	14.73	595.00	5.74	7.40	0.00	0.80	0.00	0.00	0	147	0.00	10.1	42.1	0.00	2.4	15.44	11	0.03	0.00	9.4
Max	0.646	3.70	0.00	23.60	668.00	10.10	7.73	0.00	2.30	0.00	0.00	0	264	0.00	12	63	0.00	4.80	39.96	13	0.10	0.00	19.90

¹Surface Water Regulations 1989 A1 unless otherwise specified

²Freshwater Fish Directive 78/659/EEC as amended

^{2S}Freshwater Fish Directive 78/659/EEC as amended (Salmon)

^{2c}Freshwater Fish Directive 78/659/EEC as amended (Cyprinid)

Ground Water Results

Roscommon County Council,
Roscommon Landfill

Date of Monitoring : 7th December 2010

Sampling point	Ammonia mg/l N	Conductivity @ 20°C	Levels mbgl	DO mg/l	pH	Temperature °C	Cadmium µg/l	Chromium µg/l	Copper µg/l	Iron µg/l	Lead µg/l	Magnesium mg/l	Manganese µg/l	Mercury µg/l	Phenols µg/l	Potassium mg/l	Sodium mg/l	Sulphate mg/l SO ₄	Total Phosphorus mg/l P	Zinc µg/l
GW2	0.02	447	2.1	6.60	8.13	7.6	0.20	BLD	NT	1558	25.4	12.3	224	BLD	BLD	15.6	14	59.87	0.097	157
GW4	2.21	850	0.8	5.20	7.04	7.4	BLD	BLD	NT	2483	0.40	17.7	90.8	0.02	BLD	2.5	17.4	20.34	0.032	7.8
GW6	0.70	828	0.6	7.41	7.33	8.3	0.20	1.00	NT	1224	3.0	13.7	124.0	BLD	BLD	2.0	15	2.24	0.042	21.1
Standard	0.15	1000.00	-	No abnormal change	6.5-9.5	25.00	5.00	30	30	200	10	50000	50	1.00	0.50	5.00	150	200	0.03	100
Mean	0.98	708.33	1.17	6.40	7.50	7.77	0.13	0.33	0.00	1755.00	9.60	14.57	146.27	0.01	0.00	6.70	15.47	27.48	0.06	61.97
Min	0.02	447.00	0.60	5.20	7.04	7.40	0.20	1.00	0.00	1224.00	0.40	12.30	90.80	0.02	0.00	2.00	14.00	2.24	0.03	7.80
Max	2.21	850.00	2.10	7.41	8.13	8.30	0.20	1.00	0.00	2483.00	25.40	17.70	224.00	0.02	0.00	15.60	17.40	59.87	0.10	157.00
Mean	0.98	708.33	1.17	6.40	7.50	7.77	0.18	0.20	#DIV/0!	1755.00	9.60	14.57	146.27	0.02	#DIV/0!	6.70	15.47	27.48	0.06	61.97

Leachate Results

Roscommon County Council,

Roscommon Landfill

Date of Monitoring : 7th December 2010

Sampling point	Ammonia mg/l N	BOD mg/l	COD mg/l	Chloride mg/l CL	Conductivity @ 20°C	Depth mbgl	pH	Temperature °C	Cadmium ug/l	Chromium ug/l	Copper ug/l	Iron ug/l	Lead ug/l	Magnesium mg/l	Manganese ug/l	Mercury ug/l	Potassium mg/l	Sulphate mg/l	Sodium mg/l	Total Phosphorus mg/l	Zinc ug/l
LMH1	23.36	1.98	81.0	44.29	915	5.2	7.19	8.0	BLD	1.1	NT	2478	BLD	19.3	1538	BLD	42.5	17.82	34.6	0.061	9.9
LMH2	3.55	RNV	BLD	28.38	709	1.9	7.47	7.6	0.1	BLD	NT	282	0.3	10.7	108	BLD	11.8	7.91	23.1	0.029	20.1
LMH3	1.66	0.80	BLD	17.11	763	2.3	6.97	8.2	0.1	1	NT	448	1.1	11.3	349	0.02	5.8	15.06	18.1	0.178	6.3
Mean	9.52	0.93	27.00	29.93	795.67	3.13	7.21	7.93	0.07	0.70	0.00	1069.33	0.47	13.77	665.00	0.01	20.03	13.60	25.27	0.09	12.10
Min	1.66	0.80	81.00	17.11	709.00	1.90	6.97	7.60	0.10	1.00	0.00	282.00	0.30	10.70	108.00	0.02	5.80	7.91	18.10	0.03	6.30
Max	23.36	1.98	81.00	44.29	915.00	5.20	7.47	8.20	0.10	1.10	0.00	2478.00	1.10	19.30	1538.00	0.02	42.50	17.82	34.60	0.18	20.10
Mean	9.52	1.39	81.00	29.93	795.67	3.13	7.21	7.93	0.10	1.05	#DIV/0!	1069.33	0.70	13.77	665.00	0.02	20.03	13.60	25.27	0.09	12.10

Roscommon Landfill Gas Monitoring**Quarterly Analysis : Date : 29th September 2010**

Sampling Pt	Time	Temp	CH ₄	CO ₂	O ₂	Atm Pressure
		(°C)	(% v/v)	(% v/v)	(% v/v)	(m/bars)
LFG 1	12.15	10.9	66.4	36.4	0	1002
LFG 2	12.2	11.5	64.9	35.2	0	1002
LFG 3	12.22	11.4	61.5	31.5	0	1002
LFG 4	12.24	11.6	60	31.2	0	1002
LFG 5	12.3	10.8	30.9	18.3	9.9	1002
LFG 6	12.32	11	66.9	22.7	2	1002
LFG 7	12.34	10.7	83.3	20.2	0	1002
LFG 8	12.36	10.3	68.3	37.3	0	1002
LFG 9	12.38	11.2	39.9	25.2	0	1002
LFG 10	12.4	9.9	74	31.4	0	1002
Site Office	12.5		0.1	21.2	30	1002
		Mean	61.61	28.2364	3.81	

Quarterly Analysis : Date : 7th December 2010

Sampling Pt	Time	Temp	CH ₄	CO ₂	O ₂	Atm Pressure
		(°C)	(% v/v)	(% v/v)	(% v/v)	(m/bars)
LFG 1	11.25	9.8	74	37.8	0.3	1005
LFG 2	11.27	10	72.6	35.1	3.5	1005
LFG 3	11.29	8.9	68.8	39.9	1.5	1005
LFG 4	11.3	9.2	70	38	2.1	1005
LFG 5	11.32	9.5	73.5	33.6	4	1005
LFG 6	11.34	10.1	77.4	28.9	1.6	1005
LFG 7	11.35	9.5	69.5	38.9	0	1005
LFG 8	11.37	8.8	80.1	26.8	0.6	1005
LFG 9	11.39	10.5	77.8	30	0	1005
LFG 10	11.41	9.6	72.3	35.5	0	1005
Site Office	11.5		20.1	21	30	1005
		Mean	68.7364	33.2273	3.96	

Overall results	CH ₄	CO ₂	O ₂
	(%v/v)	(%v/v)	(%v/v)
Mean	68.61	29.77	3.89
Min	20.10	18.30	0.00
Max	83.30	39.90	30.00

Surface Water Visual Inspection/Odour Results**Roscommon County Council,****Roscommon Landfill****Licence No. 73-01**

Date of Monitoring : 21st July 2010

Weather Conditions : Showers and Windy

Surface water Monitoring Point	Time	Results / Findings
SW1	11.25	Clear, No Odour
SW3	12.10	Weed Growth, No Odour
SW7	12.15	Clear, No Odour

Surface Water Results

**Roscommon County Council,
Roscommon Landfill**
Date of Monitoring : 21st July 2010

Sampling point	Ammonia mg/l N	BOD mg/l	COD mg/l	Chloride mg/l CL	Conductivity @ 20°C	DO mg/l	pH	Suspended Solids mg/l	Temperature °C
SW1	0.011	2.00	13.0	16.7	559	7.14	7.56	10.00	14.2
SW3	0.060	7.00	75.0	66.6	938	6.71	7.50	39.00	17.8
SW7	0.770	3.00	25.0	32.2	758	7.47	7.46	8.00	16.9
Standard	0.20	5.00	40.00	250.00	1000.00	100% >7 ^{2S} 100% >5 ^{2C}	5.5-8.5 ¹	25.00	25.00
Mean	0.28	4.00	37.67	38.50	751.67	7.11	7.51	19.00	16.30
Min	0.011	2.00	13.00	16.70	559.00	6.71	7.46	8.00	14.20
Max	0.770	7.00	75.00	66.60	938.00	7.47	7.56	39.00	17.80

¹Surface Water Regulations 1989 A1 unless otherwise specified

²Freshwater Fish Directive 78/659/EEC as amended

^{2S}Freshwater Fish Directive 78/659/EEC as amended (Salmon)

^{2C}Freshwater Fish Directive 78/659/EEC as amended (Cyprinid)

Ground Water Results

**Roscommon County Council,
Roscommon Landfill**
Date of Monitoring : 21st July 2010

Sampling point	Ammonia mg/l N	Conductivity @ 20°C	Levels mbgl	DO mg/l	pH	Temperature °C
GW2	0.05	871	1.5	6.28	7.27	13.2
GW4	2.32	968	0.7	4.42	7.08	15.8
GW6	3.59	947	0.8	7.43	7.12	14.8

Standard	0.15	1000.00	-	No abnormal change	6.5-9.5	25.00
Mean	1.99	928.67	1.00	6.04	7.16	14.60
Min	0.05	871.00	0.70	4.42	7.08	13.20
Max	3.59	968.00	1.50	7.43	7.27	15.80

Mean	1.99	928.67	1.00	6.04	7.16	14.60
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Leachate Results

**Roscommon County Council,
Roscommon Landfill**
Date of Monitoring : 21st July 2010

Sampling point	Ammonia mg/l N	BOD mg/l	COD mg/l	Chloride mg/l CL	Conductivity @ 20°C	Depth mbgl	pH	Temperature °C
LMH1	112.5	5.0	87.0	217.60	3120	3.4	7.32	15.2
LMH2	217.2	17.0	258.0	476.30	4490	2.6	7.08	16.1
LMH3	0.02	BLD	BLD	22.20	755	2.2	7.45	15.4
Mean	109.91	7.33	115.00	238.70	2788.33	2.73	7.28	15.57
Min	0.02	5.00	87.00	22.20	755.00	2.20	7.08	15.20
Max	217.20	17.00	258.00	476.30	4490.00	3.40	7.45	16.10
Mean	109.91	11.00	172.50	238.70	2788.33	2.73	7.28	15.57

Roscommon Landfill Gas Monitoring. January-June 2011

Quarterly Analysis : Date : 11th January 2011

Sampling Pt	Time	Temp	CH ₄	CO ₂	O ₂	Atm Pressure
		(°C)	(% v/v)	(% v/v)	(% v/v)	(m/bars)
LFG 1	10.32	7.2	73.9	31.2	0.3	995
LFG 2	10.34	6.2	81.8	32.7	0.5	995
LFG 3	10.36	6.1	50.2	36.3	0	995
LFG 4	10.38	6.4	65.1	29.4	0.2	995
LFG 5	10.40	7.3	69.7	30.8	0.7	995
LFG 6	10.42	7.1	71	29.1	0.6	995
LFG 7	10.44	6.3	77.4	34.6	1.1	995
LFG 8	10.46	6.5	61.3	32.4	0.7	995
LFG 9	10.50	6.4	63.6	28.9	0.6	995
LFG 10	11.00	7.1	75.8	30.7	0.8	995
Site Office	11.10		0	1	21.5	
		Mean	68.98	28.8273	2.45	

Quarterly Analysis : Date : 27th July 2011

Sampling Pt	Time	Temp	CH ₄	CO ₂	O ₂	Atm Pressure
		(°C)	(% v/v)	(% v/v)	(% v/v)	(m/bars)
LFG 1	11.45	9.5	28.4	25.4	0.0	1008
LFG 2	11.50	8.2	62.8	25.9	1.6	1008
LFG 3	11.52	7.6	55.6	19.3	2.0	1008
LFG 4	11.54	9.0	59.3	23.2	0.9	1008
LFG 5	11.58	8.8	55.9	26.5	3.7	1008
LFG 6	12.00	9.8	32.8	13.3	7.8	1008
LFG 7	12.02	10.3	78.0	20.1	0.0	1008
LFG 8	12.04	10.6	58.5	30.5	1.7	1008
LFG 9	12.06	9.5	58.8	23.6	0.0	1008
LFG 10	12.08	8.9	53.4	23.7	1.5	1008
Site Office	12.20		0	0.1	20.7	
		Mean	54.35	21.0545	3.63	

Overall results	CH ₄	CO ₂	O ₂
	(%v/v)	(%v/v)	(%v/v)
Mean	61.67	24.89	3.04
Min	28.40	13.30	0.00
Max	81.80	36.30	7.80

Surface Water Visual Inspection/Odour Results**Roscommon County Council,****Roscommon Landfill****Licence No. 73-01**

Date of Monitoring : 7th December 201

Weather Conditions : Dry and Frosty

Surface water Monitoring Point	Time	Results / Findings
SW2	10.50	Clear, No Odour
SW3	11.20	Weed Growth, No Odour
SW7	12.00	Clear, No Odour

APPENDIX D

Meteorological Data

Claremorris								
Year	Month	Day	Rainfall (mm)	Wind Speed (Knots)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)
2010	1	1	0.0	3.7	95	1012.5	1.8	-5.7
2010	1	2	0.1	6.5	93	1019.0	4.6	-3.5
2010	1	3	0.0	10.3	88	1024.9	2.0	-4.8
2010	1	4	0.0	4.1	95	1022.2	1.8	-5.9
2010	1	5	3.5	6.0	95	1010.9	2.1	-1.8
2010	1	6	0.0	7.3	84	1014.9	2.6	-6.5
2010	1	7	0.5	3.9	96	1017.4	2.7	-6.2
2010	1	8	0.0	2.9	97	1028.2	-0.8	-9.6
2010	1	9	0.1	2.1	97	1032.1	0.1	-11.6
2010	1	10	0.7	7.7	93	1026.4	1.6	-6.0
2010	1	11	2.1	8.3	94	1016.0	1.9	0.5
2010	1	12	7.6	18.7	89	995.8	3.5	0.6
2010	1	13	2.2	6.9	96	995.0	3.2	0.9
2010	1	14	0.2	5.1	95	1000.0	5.6	-0.7
2010	1	15	10.9	13.8	93	996.3	10.8	5.5
2010	1	16	3.5	10.8	86	994.4	10.8	3.0
2010	1	17	1.8	10.0	89	1011.3	9.6	3.5
2010	1	18	0.1	7.5	94	1019.7	10.9	3.7
2010	1	19	7.1	10.6	90	1010.6	6.9	2.4
2010	1	20	1.4	4.3	94	1008.1	9.5	0.5
2010	1	21	11.1	11.0	94	1003.3	10.5	1.8
2010	1	22	0.6	4.2	92	1014.7	9.5	-1.1
2010	1	23	0.0	1.4	96	1024.7	7.7	-3.7
2010	1	24	0.6	2.4	98	1026.3	2.2	-4.3
2010	1	25	0.3	3.7	95	1033.8	5.4	-0.3
2010	1	26	0.0	3.2	95	1041.1	7.4	-2.1
2010	1	27	0.5	7.8	92	1034.5	9.8	1.0
2010	1	28	0.9	8.7	91	1018.3	8.5	5.0
2010	1	29	8.1	9.6	88	1004.0	7.8	1.8
2010	1	30	0.8	4.0	93	1006.6	5.0	-1.7
2010	1	31	5.5	5.3	94	1010.8	5.5	-1.7
2010	2	1	0.0	6.0	93	1014.3	6.7	-1.2
2010	2	2	4.6	7.9	92	1006.3	9.3	5.3
2010	2	3	7.1	7.5	92	1003.4	9.8	2.1
2010	2	4	6.5	8.1	94	992.4	9.2	1.8
2010	2	5	0.1	7.4	91	993.2	8.7	2.4
2010	2	6	0.1	4.2	95	1016.9	10.3	-0.3
2010	2	7	0.0	9.5	90	1020.8	6.6	2.2
2010	2	8	0.0	7.8	85	1017.9	5.1	-0.8
2010	2	9	0.0	6.0	74	1020.5	4.6	-2.6
2010	2	10	0.0	4.4	78	1024.3	5.6	-3.8
2010	2	11	0.0	3.0	83	1029.1	6.9	-5.6
2010	2	12	0.0	5.8	84	1030.5	7.8	-2.4
2010	2	13	0.0	4.1	89	1028.8	6.7	-2.0
2010	2	14	0.1	4.0	95	1021.3	7.2	-3.3

2010	2	15	3.3	7.2	90	1004.9	8.4	0.5
2010	2	16	2.4	5.6	92	989.7	6.8	-0.9
2010	2	17	0.0	5.9	92	990.7	6.5	-2.1
2010	2	18	0.4	5.0	92	994.9	6.1	-3.4
2010	2	19	1.6	5.2	94	997.2	5.7	-3.1
2010	2	20	0.9	2.5	98	995.5	2.3	-6.1
2010	2	21	0.2	3.8	98	991.0	0.1	-2.9
2010	2	22	0.0	5.0	93	990.7	5.0	-4.6
2010	2	23	0.8	10.3	89	990.0	3.4	-2.1
2010	2	24	2.2	9.5	89	988.4	4.6	-0.6
2010	2	25	0.3	5.7	90	987.2	7.0	-1.7
2010	2	26	1.0	6.8	91	988.5	7.7	1.3
2010	2	27	2.8	6.3	89	989.8	8.0	-0.6
2010	2	28	2.7	5.6	87	996.3	8.3	-1.9
2010	3	1	0.0	3.2	83	1010.8	10.1	-3.8
2010	3	2	0.0	6.9	84	1020.0	7.9	-1.8
2010	3	3	8.1	6.0	91	1017.9	5.4	2.1
2010	3	4	0.0	4.7	85	1027.8	7.5	-2.1
2010	3	5	0.0	3.4	84	1033.8	10.7	-3.2
2010	3	6	0.0	3.7	82	1030.4	8.7	-1.0
2010	3	7	0.0	6.9	77	1030.8	8.1	-3.1
2010	3	8	0.0	6.2	73	1031.1	7.9	-6.2
2010	3	9	0.0	4.1	73	1033.4	10.3	-5.9
2010	3	10	0.0	3.9	77	1033.2	9.8	-4.9
2010	3	11	0.0	4.5	80	1030.0	10.2	-4.0
2010	3	12	0.4	7.6	82	1029.4	10.6	3.8
2010	3	13	0.2	4.8	84	1034.6	10.1	1.4
2010	3	14	0.0	5.6	83	1033.9	11.9	-0.6
2010	3	15	0.0	5.4	78	1028.4	11.9	3.6
2010	3	16	1.4	9.6	76	1018.0	10.8	2.5
2010	3	17	1.1	12.0	84	1011.4	13.5	7.7
2010	3	18	2.0	17.4	85	999.8	12.9	7.6
2010	3	19	0.1	6.6	75	1005.3	11.7	4.5
2010	3	20	0.0	6.5	74	1006.5	12.2	3.8
2010	3	21	1.7	8.8	79	1009.6	13.0	4.4
2010	3	22	6.5	12.1	82	1007.0	10.5	4.1
2010	3	23	0.4	11.8	84	1005.5	10.4	4.4
2010	3	24	7.6	6.5	82	997.4	12.3	1.8
2010	3	25	5.3	9.0	85	993.2	13.6	2.2
2010	3	26	6.3	4.9	87	993.6	13.6	6.2
2010	3	27	0.0	8.5	80	1006.4	12.1	5.4
2010	3	28	0.0	4.8	79	1007.2	11.2	2.6
2010	3	29	17.0	12.1	91	994.8	4.5	2.2
2010	3	30	12.9	13.8	90	989.8	4.3	2.5
2010	3	31	2.9	11.2	76	1002.2	7.5	0.5
2010	4	1	3.5	5.5	78	1003.4	9.9	0.1
2010	4	2	5.1	8.3	89	993.3	8.9	2.7
2010	4	3	4.5	8.1	85	1002.0	9.4	1.1
2010	4	4	9.3	9.5	85	1010.9	8.6	-0.9
2010	4	5	25.5	17.5	90	1002.8	12.1	6.9

2010	4	6	15.2	6.9	91	1005.0	11.6	3.2
2010	4	7	0.0	6.8	79	1022.3	12.8	2.5
2010	4	8	0.0	6.6	81	1030.1	13.5	4.7
2010	4	9	0.0	8.0	71	1030.5	16.0	5.7
2010	4	10	0.0	7.3	63	1031.1	19.0	3.8
2010	4	11	0.0	4.1	72	1031.2	19.6	2.4
2010	4	12	0.0	6.0	72	1030.9	18.6	4.0
2010	4	13	0.0	5.1	77	1029.1	17.2	3.8
2010	4	14	0.0	6.7	74	1025.6	13.9	6.4
2010	4	15	0.0	7.8	72	1028.1	15.9	2.3
2010	4	16	0.0	5.0	72	1029.3	16.4	1.1
2010	4	17	0.0	4.5	79	1022.1	14.6	0.0
2010	4	18	0.6	4.1	82	1017.9	13.7	3.7
2010	4	19	0.0	5.7	63	1020.3	13.0	1.7
2010	4	20	0.1	6.2	69	1023.0	11.4	0.6
2010	4	21	0.0	4.3	64	1023.8	13.0	-2.4
2010	4	22	0.0	4.4	65	1018.3	13.6	4.0
2010	4	23	0.0	6.1	70	1012.9	15.5	6.2
2010	4	24	1.5	6.5	81	1011.1	14.7	5.1
2010	4	25	5.9	7.1	87	1014.6	16.6	9.0
2010	4	26	0.1	8.2	82	1022.8	17.3	9.2
2010	4	27	4.7	12.3	89	1019.0	14.6	10.4
2010	4	28	4.9	12.4	91	1010.7	15.2	9.1
2010	4	29	1.8	7.0	83	1009.0	14.4	7.0
2010	4	30	2.4	5.5	82	1006.6	14.8	5.9
2010	5	1	2.5	5.1	84	1010.4	14.0	6.1
2010	5	2	0.5	10.9	74	1021.5	11.7	5.8
2010	5	3	0.2	8.6	67	1030.8	12.6	4.0
2010	5	4	0.0	5.9	74	1032.6	12.9	2.9
2010	5	5	0.2	7.6	90	1025.2	14.7	8.8
2010	5	6	0.4	10.8	83	1018.2	14.3	6.0
2010	5	7	0.0	8.4	71	1018.3	13.1	2.5
2010	5	8	0.0	9.7	59	1020.2	15.7	2.2
2010	5	9	0.0	7.3	70	1017.7	13.6	1.7
2010	5	10	0.0	10.7	63	1018.4	11.7	1.9
2010	5	11	1.3	5.3	80	1018.2	11.4	0.3
2010	5	12	0.1	5.4	68	1018.3	12.9	1.0
2010	5	13	0.8	8.0	84	1009.9	13.9	5.5
2010	5	14	1.9	6.9	77	1011.5	14.0	3.3
2010	5	15	3.5	9.0	76	1016.4	14.9	4.3
2010	5	16	0.0	7.3	79	1018.2	14.5	2.7
2010	5	17	0.1	6.0	77	1024.3	15.9	6.4
2010	5	18	3.8	8.8	93	1023.8	14.0	8.3
2010	5	19	0.2	7.4	91	1025.6	17.9	11.8
2010	5	20	0.1	7.1	83	1030.6	21.8	12.5
2010	5	21	0.1	2.8	83	1030.1	20.8	10.9
2010	5	22	0.0	4.6	75	1027.9	25.1	9.7
2010	5	23	0.0	5.1	72	1023.7	24.5	8.7
2010	5	24	0.0	8.6	71	1018.6	19.5	8.5
2010	5	25	0.0	9.2	69	1016.4	17.2	4.3

2010	5	26	0.0	8.6	66	1015.0	15.3	5.0
2010	5	27	0.0	7.8	73	1012.5	14.8	3.1
2010	5	28	0.1	4.3	72	1012.6	16.1	1.3
2010	5	29	1.6	7.0	85	1006.7	14.9	8.2
2010	5	30	0.0	4.1	73	1016.2	16.8	4.4
2010	5	31	7.0	7.9	80	1017.1	17.5	10.8
2010	6	1	0.1	7.4	80	1016.0	18.6	8.5
2010	6	2	0.0	4.7	74	1021.1	20.7	4.6
2010	6	3	0.0	7.0	71	1018.5	19.3	9.8
2010	6	4	2.1	7.9	73	1016.4	20.5	10.2
2010	6	5	0.0	5.0	83	1018.6	19.1	7.1
2010	6	6	0.0	5.4	74	1015.6	20.5	10.6
2010	6	7	1.1	7.9	83	1006.2	17.4	10.0
2010	6	8	1.8	11.5	84	1002.3	17.0	11.4
2010	6	9	1.5	9.8	88	1008.8	14.7	10.4
2010	6	10	0.0	8.4	74	1016.0	20.6	7.3
2010	6	11	0.2	7.8	79	1015.9	16.8	9.3
2010	6	12	0.0	5.7	72	1020.5	17.6	9.9
2010	6	13	4.3	9.8	83	1016.9	15.4	10.8
2010	6	14	1.3	8.0	78	1024.6	19.1	8.5
2010	6	15	0.0	4.3	78	1030.7	22.7	7.8
2010	6	16	0.0	4.6	83	1028.5	19.3	10.7
2010	6	17	0.0	3.5	81	1026.1	21.7	9.1
2010	6	18	0.0	7.3	79	1025.2	18.1	9.6
2010	6	19	0.0	10.0	68	1023.8	18.5	7.4
2010	6	20	0.0	5.2	73	1024.2	21.8	4.1
2010	6	21	0.0	6.0	72	1022.3	22.5	5.4
2010	6	22	0.0	8.4	79	1020.8	19.2	11.1
2010	6	23	0.5	8.0	86	1018.6	18.8	12.9
2010	6	24	0.1	5.7	76	1019.4	21.2	9.6
2010	6	25	0.0	5.1	76	1015.9	21.6	8.0
2010	6	26	1.5	8.4	75	1012.5	21.4	13.2
2010	6	27	2.3	12.0	80	1013.8	19.3	12.5
2010	6	28	3.8	5.6	91	1016.0	19.4	11.0
2010	6	29	0.0	3.6	77	1019.6	20.8	7.9
2010	6	30	8.6	9.5	82	1012.9	21.1	13.1
2010	7	1	11.4	13.7	79	1001.0	18.9	12.7
2010	7	2	4.9	12.8	82	1004.5	18.5	12.2
2010	7	3	2.7	9.5	85	1014.7	16.6	11.2
2010	7	4	10.7	15.2	81	1011.5	18.3	11.6
2010	7	5	0.6	9.0	74	1023.2	18.5	10.1
2010	7	6	4.6	10.4	92	1018.2	17.2	10.6
2010	7	7	0.3	12.4	78	1011.8	17.2	11.3
2010	7	8	1.6	7.7	82	1013.2	16.9	10.6
2010	7	9	14.2	4.8	87	1012.0	18.9	11.5
2010	7	10	56.0	8.0	94	1009.3	17.2	10.6
2010	7	11	1.6	7.7	78	1012.6	17.8	9.5
2010	7	12	0.5	3.4	80	1013.3	18.7	10.6
2010	7	13	6.3	7.4	88	1004.8	18.0	12.5
2010	7	14	19.2	7.3	91	993.7	19.6	13.4

2010	7	15	15.4	5.1	93	994.1	19.3	12.7
2010	7	16	2.4	10.1	82	1004.2	16.6	10.3
2010	7	17	3.5	10.0	81	1015.0	18.6	10.7
2010	7	18	0.4	8.0	82	1014.8	20.0	13.7
2010	7	19	8.6	9.0	86	1012.2	19.0	12.9
2010	7	20	1.0	5.3	85	1007.8	19.0	11.5
2010	7	21	23.2	9.0	94	1006.0	17.0	11.7
2010	7	22	0.1	11.4	75	1016.5	18.9	9.0
2010	7	23	0.1	5.0	82	1021.3	18.0	6.3
2010	7	24	0.3	7.4	88	1018.8	22.2	13.5
2010	7	25	0.0	7.7	92	1019.7	19.0	14.0
2010	7	26	2.3	7.1	92	1018.9	22.6	14.3
2010	7	27	0.4	8.0	85	1017.9	19.0	12.5
2010	7	28	0.7	7.8	87	1019.3	18.7	11.8
2010	7	29	0.0	4.1	86	1019.0	17.3	12.7
2010	7	30	6.1	8.9	91	1011.7	18.9	12.6
2010	7	31	2.2	8.5	88	1011.0	18.5	12.2
2010	8	1	0.2	5.0	85	1015.2	18.8	12.2
2010	8	2	1.9	4.5	90	1019.4	15.6	12.3
2010	8	3	6.9	7.3	89	1015.1	16.0	11.2
2010	8	4	2.5	8.0	86	1012.1	18.3	11.0
2010	8	5	0.9	7.8	84	1012.8	17.6	11.1
2010	8	6	5.4	7.3	93	1006.9	16.3	13.2
2010	8	7	0.9	6.9	82	1018.0	19.3	11.1
2010	8	8	3.7	7.3	87	1019.5	18.0	6.1
2010	8	9	0.9	7.8	84	1010.9	17.9	11.9
2010	8	10	0.8	8.0	79	1009.3	19.4	10.7
2010	8	11	0.8	5.8	87	1016.8	17.5	8.9
2010	8	12	0.8	7.9	87	1023.4	16.7	11.7
2010	8	13	1.6	8.1	84	1026.0	17.4	11.4
2010	8	14	3.4	2.8	91	1024.2	16.7	11.5
2010	8	15	0.0	3.6	82	1025.2	23.0	8.4
2010	8	16	0.8	5.3	96	1018.4	16.3	7.6
2010	8	17	0.1	7.2	83	1012.7	19.0	9.2
2010	8	18	0.1	7.8	83	1005.4	18.7	10.2
2010	8	19	0.5	6.9	87	1003.0	18.9	10.6
2010	8	20	1.4	13.3	81	1003.5	18.9	14.2
2010	8	21	0.2	9.6	82	1012.4	19.3	9.3
2010	8	22	1.2	6.6	87	1010.0	18.9	7.5
2010	8	23	10.2	10.0	85	1001.2	16.4	10.7
2010	8	24	0.0	9.6	84	1007.9	16.5	6.8
2010	8	25	0.0	4.3	80	1012.1	18.4	3.1
2010	8	26	0.0	6.3	76	1010.8	19.5	5.9
2010	8	27	0.0	6.7	81	1017.1	17.9	7.1
2010	8	28	0.0	9.6	84	1023.4	18.1	7.9
2010	8	29	0.0	8.5	78	1023.6	16.1	4.7
2010	8	30	0.1	3.4	74	1027.5	18.2	3.0
2010	8	31	0.0	5.1	75	1023.4	20.0	6.9
2010	9	1	0.0	5.7	77	1019.2	20.9	9.4
2010	9	2	0.0	6.7	73	1018.3	22.2	9.4

2010	9	3	0.0	8.0	76	1016.9	22.6	10.6
2010	9	4	2.1	6.7	83	1014.4	22.0	10.3
2010	9	5	4.2	8.5	87	1008.2	19.6	11.0
2010	9	6	46.7	5.3	96	997.6	17.2	13.0
2010	9	7	31.2	7.3	92	993.6	15.9	11.9
2010	9	8	5.4	7.8	91	999.8	18.2	12.5
2010	9	9	5.9	6.8	90	1011.2	18.2	10.7
2010	9	10	5.4	7.8	88	1008.1	19.8	13.5
2010	9	11	2.7	8.1	89	1012.1	17.7	10.1
2010	9	12	1.4	6.8	89	1023.8	16.0	7.6
2010	9	13	15.6	12.1	96	1016.7	18.1	14.2
2010	9	14	2.2	13.0	82	1013.6	15.8	9.4
2010	9	15	1.2	11.0	86	1013.7	15.9	9.4
2010	9	16	2.0	5.7	85	1017.0	17.2	8.8
2010	9	17	0.1	4.5	84	1021.6	15.6	6.1
2010	9	18	6.1	8.0	95	1016.4	14.9	7.6
2010	9	19	4.8	7.8	94	1007.7	17.1	12.9
2010	9	20	3.6	6.8	88	1009.0	19.6	12.1
2010	9	21	3.5	9.0	89	1011.1	18.4	12.6
2010	9	22	2.4	6.8	92	1007.4	18.2	12.6
2010	9	23	3.9	9.4	91	1007.8	14.3	10.7
2010	9	24	0.0	7.9	76	1018.0	13.3	8.0
2010	9	25	0.0	2.7	77	1023.0	12.0	8.2
2010	9	26	0.0	4.7	74	1018.3	11.4	7.7
2010	9	27	0.0	7.2	80	1013.5	15.3	7.9
2010	9	28	3.3	5.8	88	1010.9	16.6	4.8
2010	9	29	2.7	4.1	87	1012.5	18.6	4.0
2010	9	30	0.2	7.7	88	1005.5	15.6	7.9
2010	10	1	4.1	10.9	83	991.2	14.2	9.4
2010	10	2	3.2	9.6	86	992.8	14.8	8.7
2010	10	3	0.4	6.8	87	991.4	17.6	7.0
2010	10	4	3.0	11.0	88	989.8	14.5	7.3
2010	10	5	8.0	10.3	83	989.4	13.5	7.5
2010	10	6	1.3	8.5	86	998.0	16.0	7.0
2010	10	7	0.9	11.6	80	1007.5	17.0	10.1
2010	10	8	0.5	12.9	87	1007.7	19.0	13.1
2010	10	9	0.0	14.0	84	1012.2	16.1	12.5
2010	10	10	0.0	8.1	86	1015.9	13.3	9.8
2010	10	11	0.2	4.7	88	1021.6	17.1	4.6
2010	10	12	0.1	2.5	90	1023.4	16.3	1.5
2010	10	13	0.0	2.9	96	1024.3	9.2	2.8
2010	10	14	0.0	3.0	89	1025.4	11.8	8.0
2010	10	15	1.7	5.4	94	1024.7	14.8	5.8
2010	10	16	0.3	2.9	86	1026.1	13.9	2.6
2010	10	17	0.7	6.7	91	1024.8	15.3	1.7
2010	10	18	2.2	8.2	87	1020.4	13.3	7.4
2010	10	19	2.5	7.3	88	1018.3	12.6	5.2
2010	10	20	0.6	4.8	83	1024.1	11.1	0.2
2010	10	21	0.8	5.7	89	1021.5	13.2	3.0
2010	10	22	13.2	6.5	96	1010.7	11.1	4.5

2010	10	23	3.5	5.4	90	1007.4	12.0	2.4
2010	10	24	0.1	3.7	85	1021.4	11.7	-0.7
2010	10	25	4.1	8.1	87	1022.4	10.8	-1.0
2010	10	26	9.6	13.3	96	1009.0	15.1	10.2
2010	10	27	8.6	9.3	88	1007.7	13.4	6.2
2010	10	28	10.3	11.6	91	1000.5	14.0	6.7
2010	10	29	11.1	8.8	91	986.8	12.2	5.4
2010	10	30	0.7	4.8	93	990.2	11.9	3.1
2010	10	31	0.1	5.5	91	1004.4	11.7	1.4
2010	11	1	8.3	9.5	94	1007.2	13.8	0.3
2010	11	2	18.2	12.8	87	1000.5	12.6	9.1
2010	11	3	5.0	7.3	91	1006.2	14.4	8.1
2010	11	4	22.1	10.5	96	1009.0	14.6	9.1
2010	11	5	9.3	6.5	88	1017.2	11.3	6.5
2010	11	6	7.4	5.8	94	1018.3	8.4	2.2
2010	11	7	24.5	9.3	93	1003.0	8.5	1.9
2010	11	8	8.9	7.0	94	966.1	9.2	4.8
2010	11	9	0.2	10.5	80	989.4	9.8	0.9
2010	11	10	2.8	6.3	93	997.9	8.9	-1.3
2010	11	11	6.9	22.3	79	976.7	11.4	6.5
2010	11	12	3.5	11.3	81	988.4	10.4	3.9
2010	11	13	3.0	5.2	93	988.3	6.6	-0.8
2010	11	14	0.1	3.1	93	995.4	8.0	-3.2
2010	11	15	1.6	4.9	88	1010.5	9.2	1.2
2010	11	16	10.5	11.5	88	1006.9	9.0	3.8
2010	11	17	12.7	13.0	88	987.0	10.0	5.9
2010	11	18	9.8	9.3	90	992.7	10.3	4.5
2010	11	19	0.1	5.6	91	1006.7	9.8	3.6
2010	11	20	0.0	7.3	91	1015.6	8.3	2.2
2010	11	21	0.0	5.6	87	1019.3	6.8	0.2
2010	11	22	0.0	3.8	93	1016.7	6.5	-1.1
2010	11	23	0.0	3.4	93	1018.0	7.6	-1.1
2010	11	24	3.9	4.5	92	1016.2	6.3	0.2
2010	11	25	8.3	5.9	93	1018.6	6.1	-0.5
2010	11	26	8.8	6.7	93	1013.5	4.5	0.1
2010	11	27	5.3	5.5	96	1011.4	1.6	-1.6
2010	11	28	1.4	2.9	95	1008.8	0.4	-6.3
2010	11	29	0.0	5.0	97	1016.2	-0.1	-6.4
2010	11	30	0.0	9.4	91	1020.9	1.7	-4.2
2010	12	1	0.0	7.0	87	1019.6	-0.8	-5.7
2010	12	2	0.0	5.7	91	1018.8	0.3	-6.2
2010	12	3	2.2	5.9	95	1006.8	2.5	-5.6
2010	12	4	1.0	3.5	95	1004.3	3.6	-1.6
2010	12	5	2.1	3.4	95	1008.1	3.3	-7.5
2010	12	6	0.9	4.9	98	1002.4	1.4	-9.0
2010	12	7	0.0	5.6	92	1009.2	1.9	-4.8
2010	12	8	0.1	4.3	97	1022.3	1.9	-5.8
2010	12	9	0.1	4.0	95	1033.8	5.6	-1.8
2010	12	10	0.4	4.3	97	1034.4	6.9	3.4
2010	12	11	0.5	2.5	97	1029.9	7.2	-1.7

2010	12	12	0.1	5.3	96	1025.3	4.4	-2.0
2010	12	13	0.1	6.6	92	1028.0	4.5	-1.4
2010	12	14	0.0	3.0	88	1038.7	4.5	-0.6
2010	12	15	0.9	4.3	96	1041.8	6.3	1.8
2010	12	16	3.8	10.1	88	1019.5	8.3	-1.6
2010	12	17	6.4	6.5	98	1003.5	0.5	-2.6
2010	12	18	1.2	3.3	97	992.9	-1.6	-6.5
2010	12	19	0.0	5.5	97	996.1	-2.7	-8.4
2010	12	20	1.0	2.4	95	1003.0	-4.3	-13.2
2010	12	21	0.2	2.2	97	1006.2	-4.1	-12.0
2010	12	22	0.4	0.6	96	1013.3	-3.0	-13.5
2010	12	23	0.1	2.8	97	1021.0	-1.2	-10.7
2010	12	24	0.0	1.4	94	1027.0	-3.8	-14.7
2010	12	25	0.0	0.9	94	1028.4	-2.0	-15.0
2010	12	26	17.4	10.3	93	1014.9	5.5	-2.1
2010	12	27	13.1	7.5	97	1000.4	8.9	4.7
2010	12	28	4.3	9.8	94	1003.2	11.1	8.0
2010	12	29	3.8	8.0	98	1012.8	9.5	7.0
2010	12	30	0.1	6.3	97	1023.3	8.7	6.6
2010	12	31	0.0	2.5	93	1027.2	7.5	5.5

Month	Rainfall (mm)
January	70.2
February	37.1
March	73.9
April	85.1
May	24.4
June	29.2
July	201.3
August	45.3
September	156.6
October	91.8
November	182.6
December	60.2
Total	1057.7

