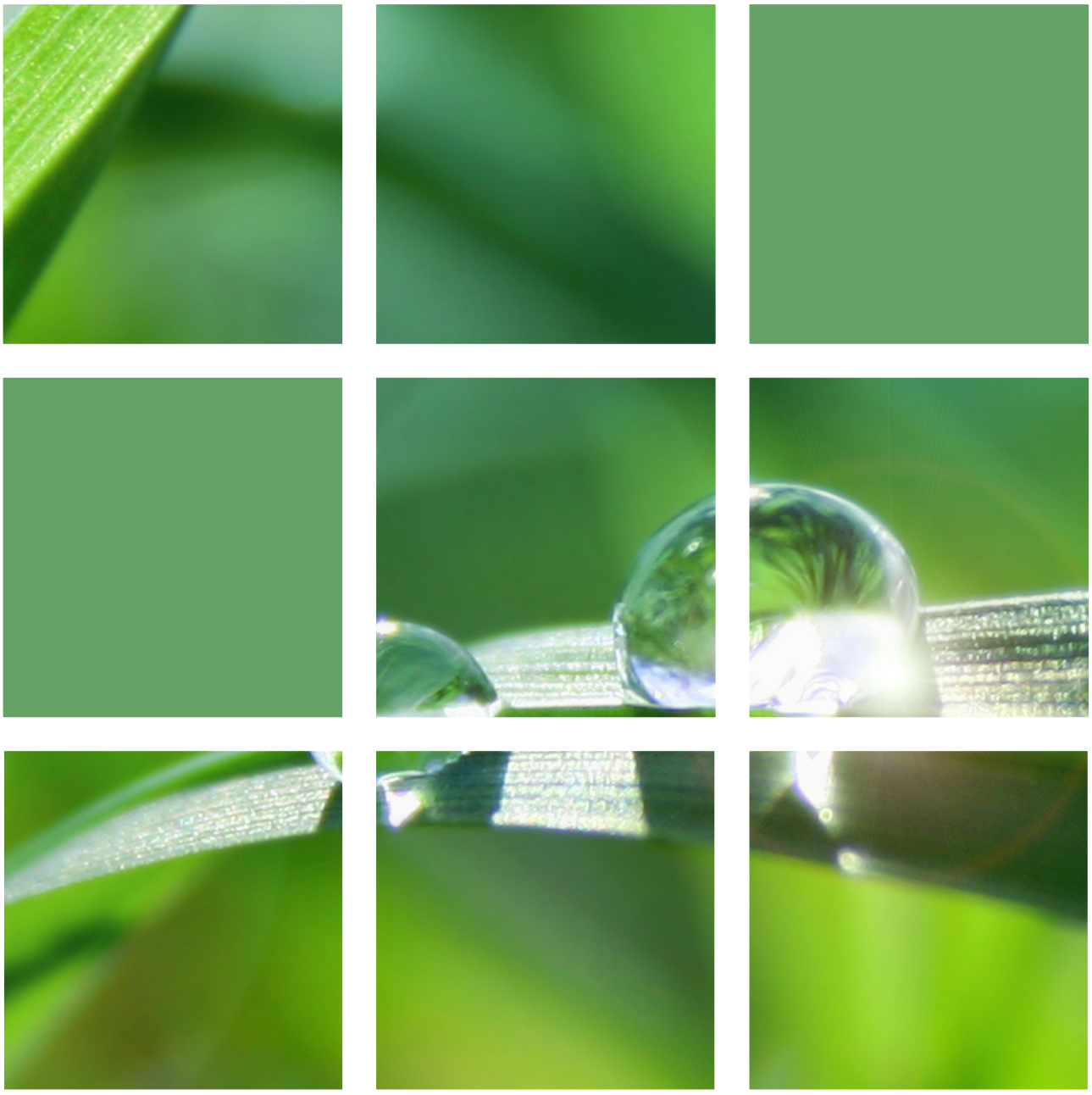
Roscommon County Council
Roscommon Landfill Environmental Monitoring
Annual Environmental Report 2011

MGE0016CR002/April 2012



Roscommon Landfill
Waste Licence Compliance

Annual Environmental Report
2011

DOCUMENT CONTROL SHEET

Client	Roscommon County Council					
Project Title	Roscommon Landfill Waste Licence Compliance					
Document Title	Annual Environmental Report for 2011					
Document No.	MGE0016RP0041F01					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	1	23	1	1	3

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
F01	Final	F.C.	M.W.	W.M.	Galway	April '12

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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 2011 to December 31st 2011.

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Annual Environmental Report (AER) has been prepared in accordance with the conditions of the Waste Licence and the EPA "Draft Guidance on Environmental Management Systems and Reporting to the Agency, 1999".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 592.14 tonnes of material was recovered in 2011. The total amount of material accepted for recycling in 2009 at the

Recycling Centre amounted to 571.4 tonnes. Therefore in 2011 there was a 3.6% increase 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 2011

Waste Type	EWC Code	Waste Collector	Waste Quantities (Tonnes)
Cardboard, Newsprint, Glossy Magazines, Milk Cartons	200101 / 200199	Barna Waste	242.8
PET 1, PET 2, Metal Cans, Aluminium Cans	150102 / 150104	Barna Waste	118.02
Wood	200138	Barna Waste	19.86
Batteries	200133*; 200134	Enva/WEEE Ireland	3.08
Textile	200111	Textile Recycling Ltd./ Barna Waste	11.99
Aeroboard	150102	Barna Waste	0.739
Clear Glass	200102	Glassdon Recycling	69.93
WEEE	200135*; 200307	KMK Metals Recycling Ltd.	90.54
Metals	200139	Barna Waste	18.42
Hazardous Waste	200127*	Indaver/ Barna Waste	16.74
Total Tonnage			**592.14**

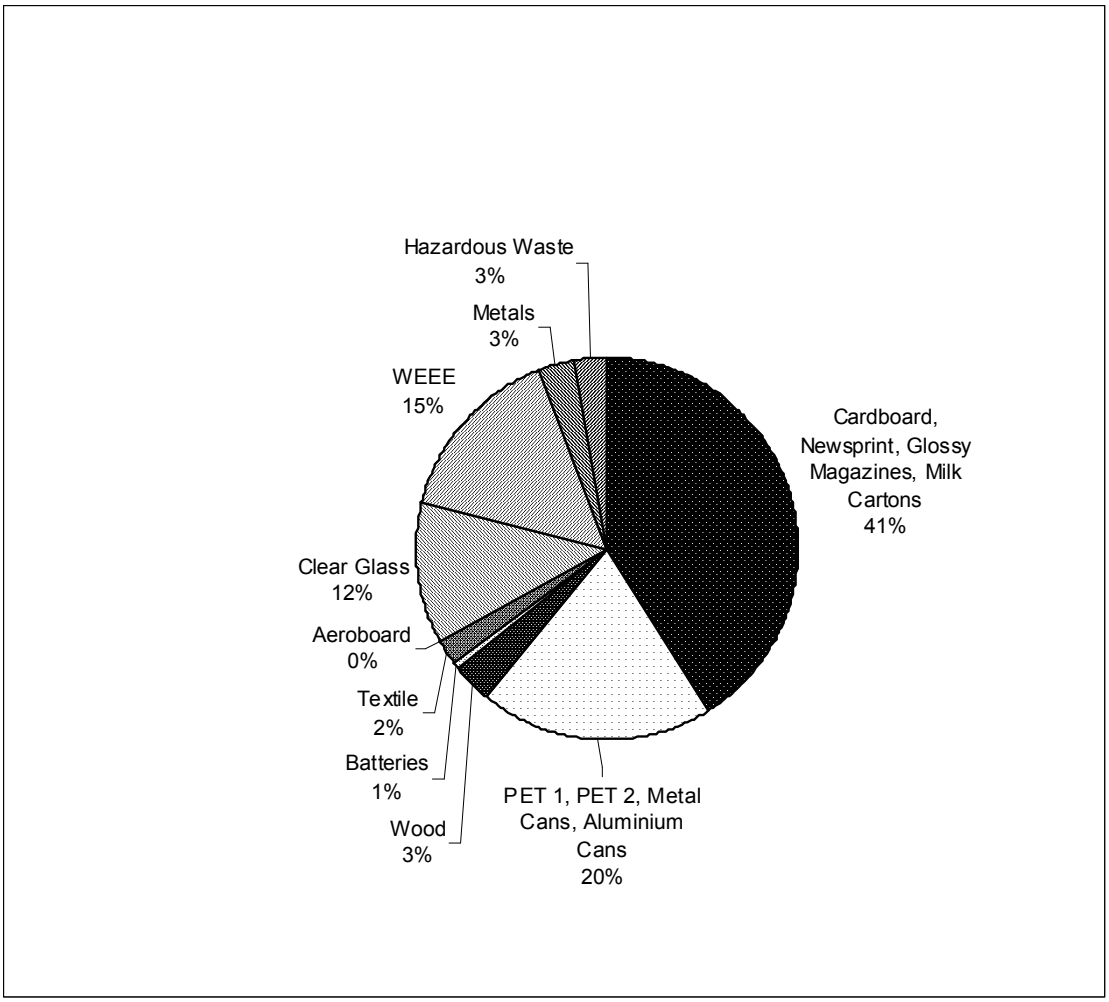


Figure 3.1 Waste Intake for 2011

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)**

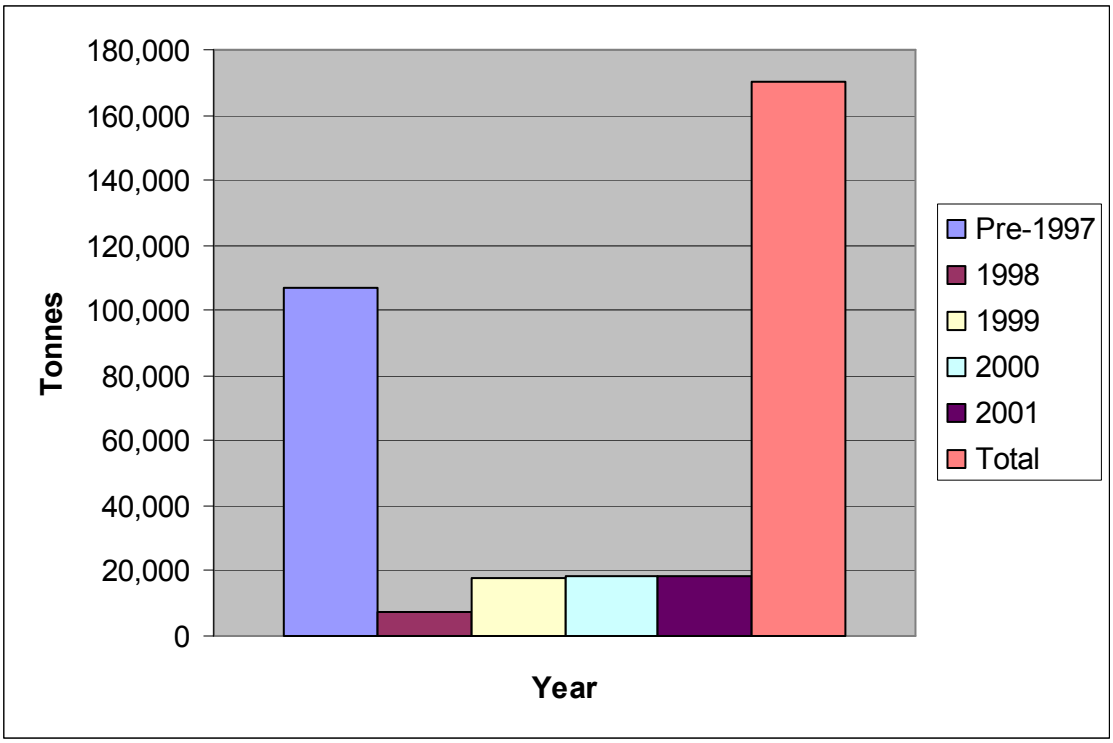


Figure 3.2 Waste Intake for Years Up to Close of Facility in 2001

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 (2011). 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 2011, Roscommon County Council undertook sampling between January and June. The second round of sampling was undertaken between July – December 2011.

The AER/PRTR Emissions Data 2011 is included in **Appendix B**.

4.1 SURFACE WATER

For each half of 2011, samples of surface water were taken by Roscommon County Council from 3 no. monitoring locations. In June 2011 and October 2011 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 October 2011. 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 2011) the main exceedances of standards were caused by elevated concentrations of ammonia, chemical oxygen demand (COD), suspended solids, iron and phenols. Overall this is consistent with results from 2010 with the exception of the exceedance of phenols.

Ammonia concentrations fluctuated through the year with a maximum concentration of 0.59 mg/l at SW7 during the first half of 2011 (H1 '11). 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 both SW7 and SW3 in H1 '11. The mean level of ammonia recorded for H1 '11 was 0.45mg/l and this decreased to 0.11mg/l for H2 '11. Overall levels of ammonia have decreased from a mean concentration 0.36mg/l in 2010 to a mean concentration of 0.28mg/l in 2011.

In H1 '11 the **COD** levels at SW1 and SW7 were compliant with the limit of 40mg/l set for water classified as A3. The COD level at SW3 (61mg/l) exceeded the limit value in H1 '11. In H2 '11 the COD level at SW3 (97mg/l) and SW7 (57mg/l) exceeded the limit value. In H2 '11 the COD level at SW1 was compliant with the limit value. The maximum concentration was recorded at SW3 during the H2 '11 with a level of 97mg/l. The mean COD level recorded in H1 '11 was 30.5mg/l and this increased to 59.33mg/l in H2 '11. Overall levels of COD have increased from a mean concentration 18.84mg/l in 2010 to a mean concentration of 44.92mg/l in 2011. This figure is similar to the mean COD concentration recorded in the first half of 2009 (42.43mg/l).

Dissolved oxygen concentrations were compliant with the standard of 5mg/l set by the Freshwater Fish Directive 78/659/EEC (Cyprinid waters) at SW3 in H2 of '11. The level of dissolved oxygen at SW3 (14.6mg/l) and SW7 (6.41mg/l) was above the standard of 5mg/l in H1 '11. The level of dissolved oxygen was above the limit value at SW1 (7.4mg/l) and SW7 (5.4mg/l) in H2 '11. The level of dissolved oxygen detected at SW3 in H1 '11 appears to have been significantly higher than levels detected in previous monitoring periods.

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 in H2 '11 however the level detected at SW3 (50mg/l) in H1 '11 was in exceedance of the required limit of 25mg/l. This is consistent with results obtained in 2010 where all monitoring points were within the required limit in 2010 with the exception of SW3 in the first half of 2010.

The **BOD** level at all monitoring points was below the upper limit of 5 mg/l respectively for 2011. This is an improvement on results obtained in 2010 where the BOD level at SW3 was above the recommended upper limit of 5mg/l in H1. This is consistent with results from the monitoring period in 2009 where the BOD level at all surface water sampling points was below the limit set by the standards.

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

A visual inspection of the water quality monitoring points was completed. Weed growth was noted in SW3 in H2 '11. No discolouration of water was noted at any monitoring point on either occasion. Weed growth and 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, 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 2010. There has been a notable change in levels of iron which increased from a mean of 207.33µg/l in '10 to 905.1µg/l for this monitoring period. The level of zinc has increased from a mean of 13.77mg/l in H2 '10 to 51mg/l for this monitoring period. The level of manganese has decreased from a mean of 55.63µg/l in H2 '10 to 0µg/l for this monitoring period. The levels of phenols detected at SW7 above the required limit of 0.0005mg/l as set by the FW Fish Directive 78/659/EEC in H2 '11. The level of 0.15mg/l recorded at SW7 is significantly above the limit value. This is the first time phenols have been detected at surface water monitoring points since being a level of 0.09mg/l was recorded at SW1 in H2 '07. The only exceeding parameters were iron at SW3 and SW7 and iron at SW3 and SW7 and phenols at SW7 which were above the relevant standards.

The standard limit for manganese is 50µg/l. Exceedances of manganese were noted in SW3 and SW7 in H2 2010. However, manganese was below the detectable limit at all monitoring points during this monitoring period.

The standard limit for iron is 200µg/l. Levels recorded for this parameter were 2323µg/l at SW3 and 270.4µg/l at SW7. The concentration of iron has increased significantly at SW3 from 211µg/l in H2 2010 to 2323µg/l for this monitoring period and has increased at SW7 from 264µg/l in H2 2010 to 270.4µg/l for this monitoring period. The mean iron level has increased from 207.33µg/l in H2 2010 to 905.1µg/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.

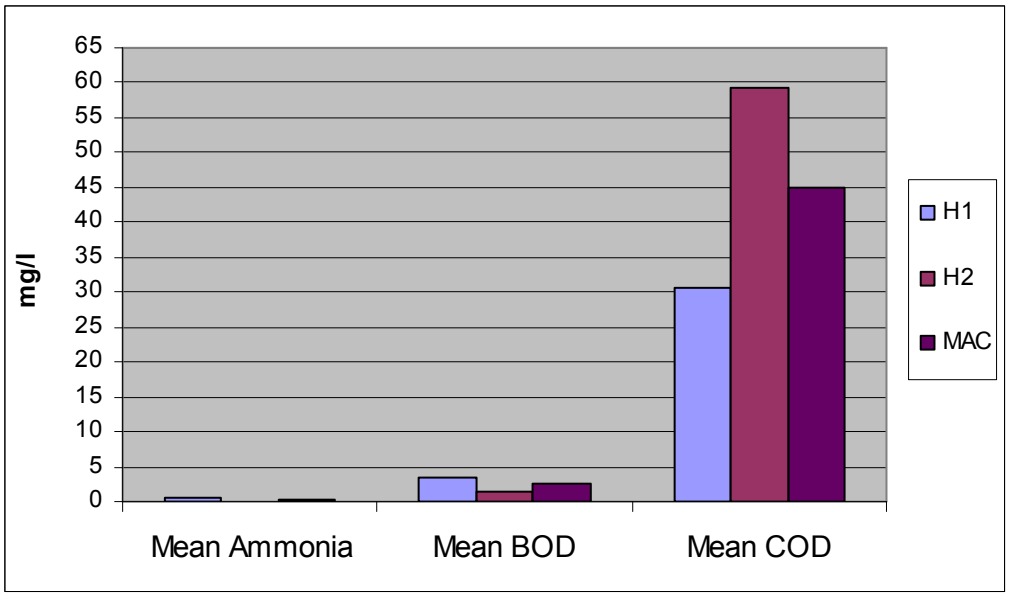


Figure 4.1 Mean Concentrations of Key Parameters for Surface Water for the Reporting Period

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 2011, the results of which are contained within **Appendix C**. Those parameters which require to be analysed on an annual basis were monitored in October 2011. 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 ’11 and H2 ‘11. This is consistent with results from H1 and H2 ’10. The ammonia level has increased at GW4 from 1.13mg/l in H1 ’11 to 2.0mg/l in H2 ’11 and at GW6 from 3.61mg/l in H1 ’11 to 4.1mg/l in H2 ’11. GW6 was also non compliant in 2008, 2009 and 2010. Sampling point GW2 was compliant with the

guideline values throughout 2011. This was also the case with GW2 in 2010. A summary of the results obtained in H2 '11 compared against results obtained in H2 '10 and H2 '09 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 2011 monitoring period were 2.33, 4.9 and 3.81mg/l, while the minimum, maximum and mean concentrations for H2 '10 were 4.4, 7.4 and 6.2mg/l. There has been a notable decrease 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 '10.

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

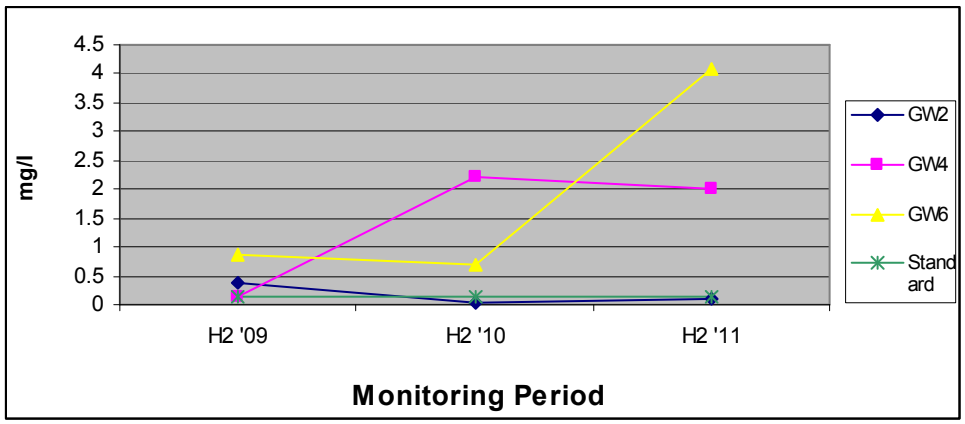


Figure 4.2 Ammonia Levels in Groundwater for the Reporting Period

Additional parameters were tested in the second half of 2011. The concentrations of cadmium, chromium, copper, lead, magnesium, manganese, mercury, sodium, sulphate, phosphorus and zinc were all below the standard guideline values set.

The mean concentration of iron decreased slightly from the levels recorded in 2010. The iron level at monitoring locations GW4 and GW6 exceeded the standard of 200µg/l in this monitoring period, with a concentration of 2866µg/l at GW4 and 1607µg/l at GW6. The concentration of iron at GW2 is within the limit of 200 µg/l in H2 '11. The concentration of lead at all monitoring locations is within the guideline limit value of

10µg/l specified by the guidelines. The level of lead at GW2 has decreased from 25.4µg/l in H2 2010 to 0.8µg/l for this monitoring period.

Concentrations of manganese were below the limit of 50µg/l at all three locations. Manganese concentrations were above the limit of 50µg/l at all monitoring locations during the same monitoring period in 2010.

The level of potassium at GW2 and GW4 is greater than the limit of 5mg/l specified by the guidelines increasing at GW2 from 15.6mg/l in H2 2010 to 28.8mg/l for this monitoring period and at GW4 from 2.5mg/l in H2 2010 to 14.7mg/l for this monitoring period.

The level of total phosphorus was within the standard limit at all monitoring locations. Total phosphorus was below the detectable limit in all monitoring locations which is an improvement on results from H2 ’10.

Concentrations of phenols were detected at all monitoring locations during this monitoring period. Levels detected at all monitoring locations are in exceedance of the 0.5µg/l guideline limit value. The level of phenols detected has increased at GW2 from being below the detectable limit in H2 ’10 to 2.6µg/l in this monitoring period, at GW4 from being below the detectable limit in H2 ’10 to 2µg/l in this monitoring period and at GW6 from being below the detectable limit in H2 ’10 to 1.4µg/l in this monitoring period.

Groundwater levels are tabulated in **Appendix C**. On comparing groundwater levels recorded in H2 ‘11 period with those recorded in H1 ‘11, levels have decreased at all sampling points with levels decreasing by 0.3, 0.3 and 0.2 meters for GW2, GW4 and GW6 respectively.

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 2011 decreasing from 3.7m to 4.6m for this monitoring period. The leachate level in LMH2 has decreased from 3.8m in H1 2011 to 3.9m for this monitoring period. The leachate level in LMH3 has decreased from 3.0m in H1 2011 to 4.3m for this monitoring period. 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, COD, electrical conductivity and chloride recorded at LMH1, LMH2 and LMH3 in H2 ’11 decreased significantly from levels recorded in H1 ‘11. In H1 ’11, ammonia, COD, chloride and electrical conductivity levels were overall consistent at LMH1 and LMH2 when compared against the corresponding monitoring period in 2010. The level of ammonia, COD, chloride and electrical conductivity at LMH3 increased substantially from H1 ’10 to H1 ’11.

The mean COD level of the three leachate chambers has decreased from 177mg/l in H1 ’11 to 39.33mg/l in H2 ‘11. The highest COD value for the sampling period was recorded at LMH1 (61mg/l) which is a decrease on the result recorded for LMH1 in H1 ‘11 (118mg/l). The COD level has decreased at LMH2 from 232mg/l in H1 ‘11 to 25mg/l for this monitoring period. The COD level has decreased at LMH3 from 199.4mg/l in H1 ’11 to 4.7mg/l for this monitoring period. The mean level of COD has increased from the level recorded in 2010.

For all leachate monitoring locations the BOD results were deemed 'result not valid' in H1 '11. At sampling locations LMH1 and LMH3 the BOD level has increased slightly in comparison to levels detected during the same monitoring period in 2010. The BOD level increased at LMH1 from 1.98mg/l in H2 '10 to 4.6mg/l for this monitoring period and at LMH 3 from 0.8mg/l in H2 '11 to 5.5mg/l for this monitoring period. Overall the mean level of BOD has decreased slightly from the level recorded in 2010.

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 0.104 was recorded in the second half of 2011 which is an increase on the value recorded in the corresponding monitoring period of 2010 (0.034). 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 2011
pH	-	6-8	6-8	7.02
Conductivity	µS/cm	5,000-20,000	2,500-10,000	828
COD	mg/l	8,000-12,000	4,000-6,000	39.33
BOD_5	mg/l	7,000-10,000	2,000-3,000	4.1
Tot – P	mg/l	10-25	1-5	0.09
Chloride	mg/l	1,000-5,000	100-1,000	15.53
Magnesium	mg/l	50-1,500	10-50	17.07
Potassium	mg/l	500-1,500	50-200	7.67
Chromium	mg/l	<1	<0.1	0.0023
Manganese	mg/l	<5	<0.5	N/T
Iron	mg/l	10-150	1-5	6.826
Copper	mg/l	<1	<1	0.001

Determinant	Unit	High values (young landfill)	Low values (old landfill)	Values at Roscommon Landfill for H2 2011
Zinc	mg/l	10	1-5	0.08
Cadmium	mg/l	<0.1	<0.01	0.0001
Mercury	mg/l	<0.01	<0.001	0.00009
Lead	mg/l	1-2	<1	0.0034

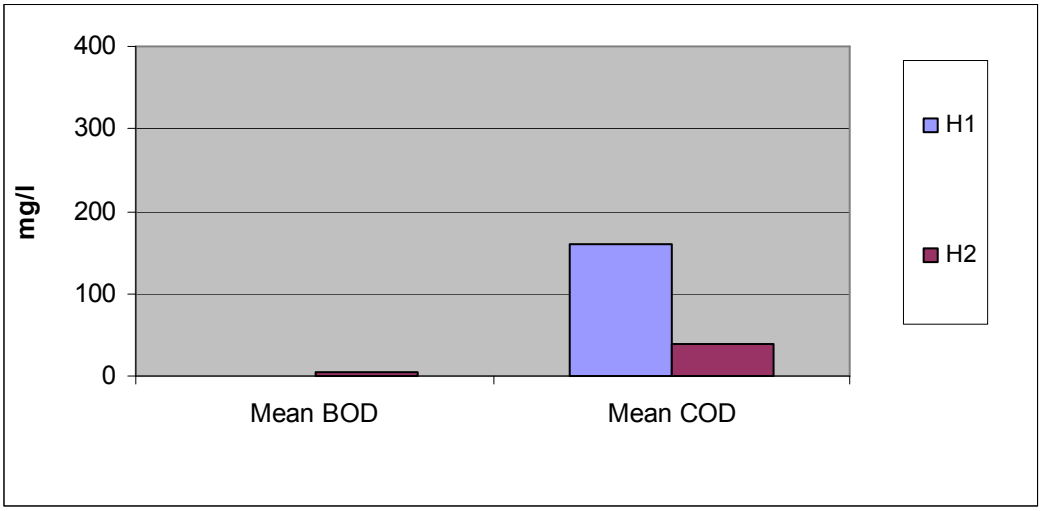


Figure 4.3 Mean Concentrations of Key Leachate Parameters Over the Reporting Period

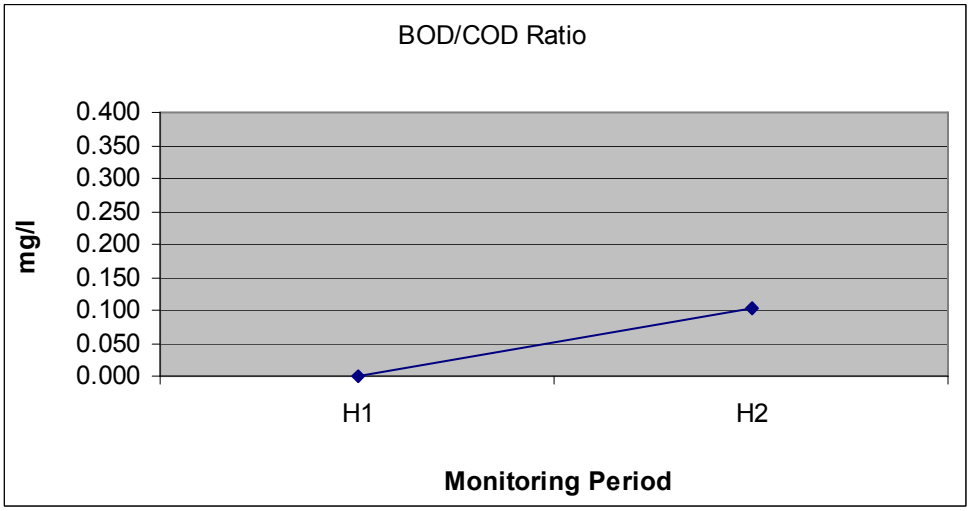


Figure 4.4 BOD/COD Ratio in Leachate over the Reporting Period

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 (CH_4), carbon dioxide (CO_2), oxygen (O_2), 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 52.1% and 76.8% v/v and carbon dioxide concentrations between 20.1% v/v and 35.3% 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.

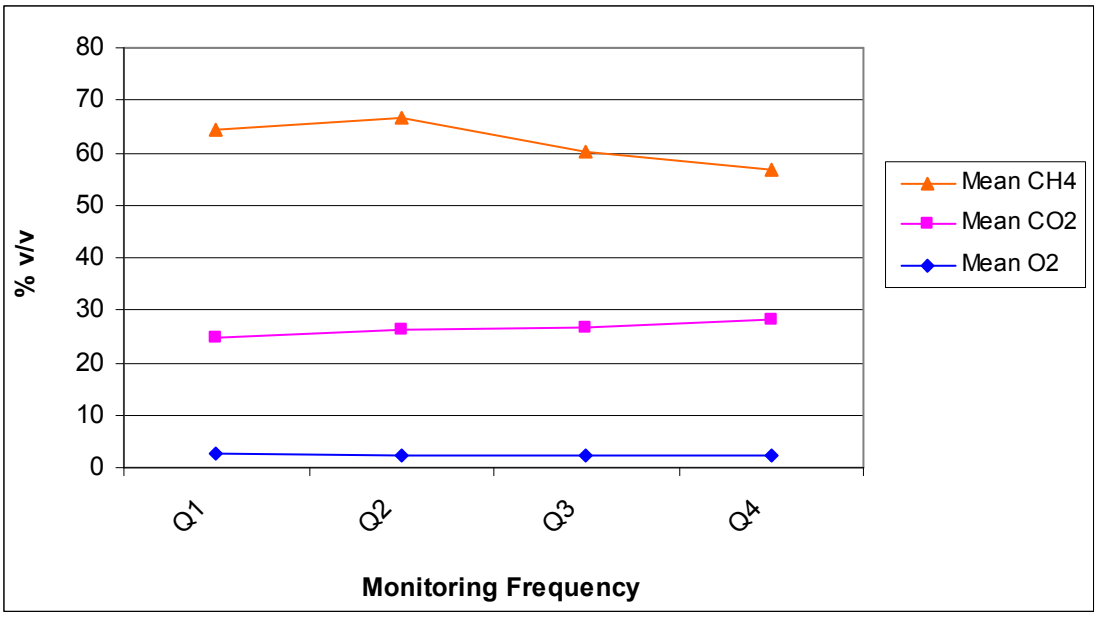


Figure 4.5 Summary of Mean Concentrations of Main Components of Landfill Gas

4.6 METEOROLOGICAL DATA

The daily meteorological data for 2011 from Knock Airport 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 2011. A total of 1,442.6mm of rain fell at Knock Airport in 2011.

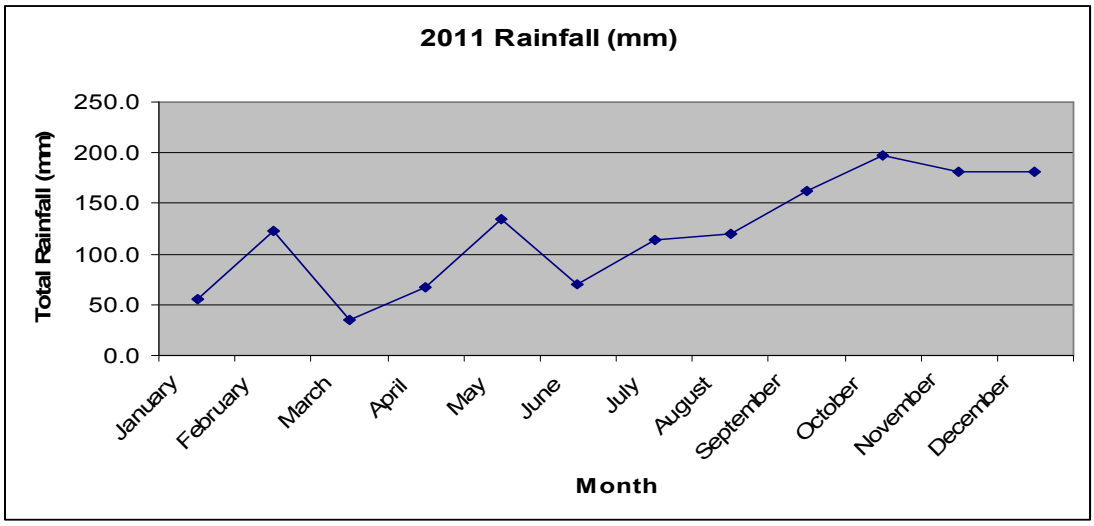


Figure 4.6 Monthly Rainfall Data for 2011 from Knock Airport Weather Station

5. MASS BALANCE OF SPECIFIED SUBSTANCES

5.1 RESOURCE AND ENERGY CONSUMPTION SUMMARY

9,689.8 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 Knock Airport estimated that the site received approximately 1,442.6mm of rainfall for the year 2011.

Prior to capping, it is estimated that, on average, approximately 22,700 m^3 of leachate was generated on an annual basis at Roscommon Landfill. Records for 2011 indicate that 4,715.46 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 400-500m^3 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 Nm^3 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 79m^3/hr as shown in **Figure 5.1**.

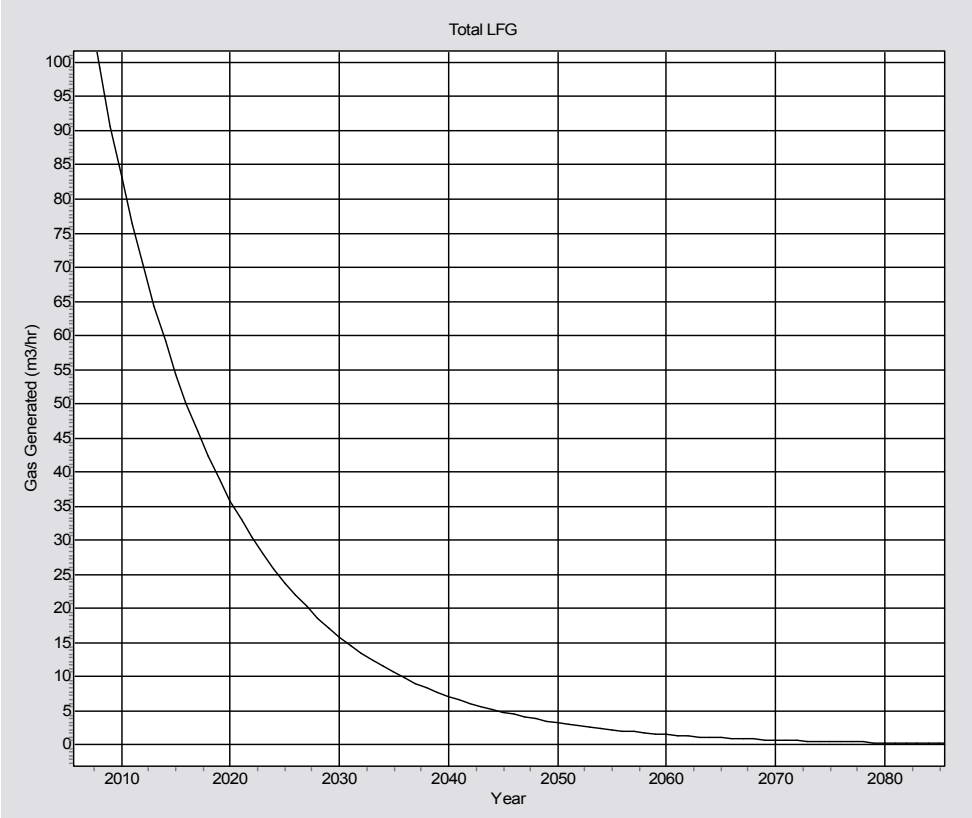


Figure 5.1 Estimated Total Gas Generation from Roscommon Landfill

A 100 m^3/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 2011 is estimated to be **28.2m^3/hr**, which equates to 247,032m^3/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

There were no development works during the reporting period for 2011.

6.2 PROPOSED DEVELOPMENT WORKS

There were no proposals for works at the facility for 2011.

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 Engineer Mr. John O Rourke		Environmental Section, Roscommon County Council, Courthouse, Roscommon.
Senior Staff Officer Sarah Scott	Senior Executive Engineer Mr. John Mockler	Environmental Section, Roscommon County Council, Courthouse, 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.

Position	Employee Contact details
Site Operatives Mr. Jim Egan/Brian Dervan	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 is 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

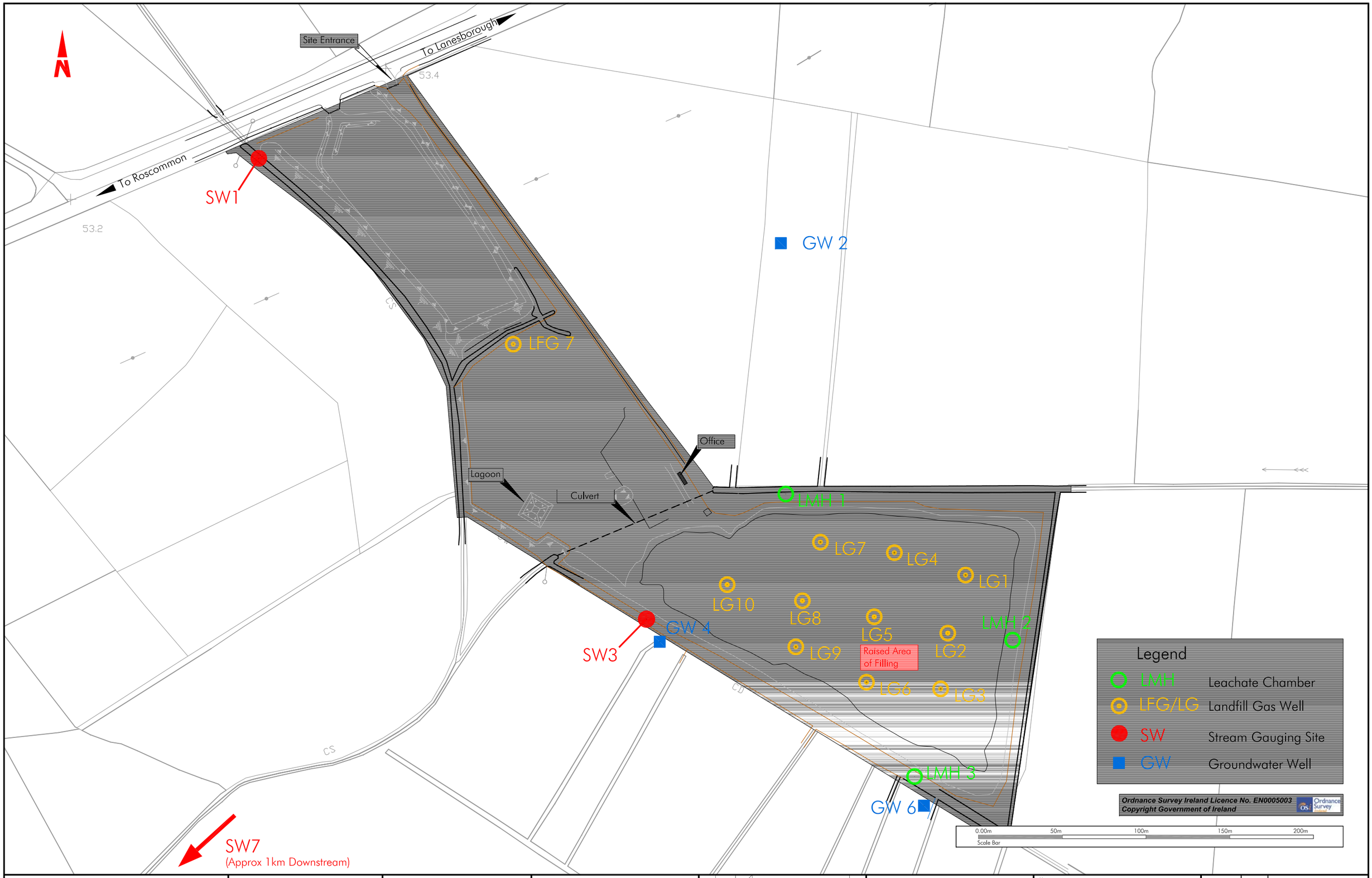
Roscommon County Council allocates funding on an annual basis from general resources. The funding will be maintained in an amount always sufficient to underwrite the current Restoration and Aftercare Plan in accordance with Condition 11 of the Waste Licence.

11. ENVIRONMENTAL INCIDENTS AND COMPLAINTS

No incidents or complaints were reported for the year 2011.

APPENDIX A

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



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

CONNAUGHT
managing our waste better

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

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.N.	Final Issue	W.M.

Roscommon County Council

Roscommon Landfill Environmental Monitoring

Title: Site Layout Locations of Monitoring Points

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

APPENDIX B

AER/PRTR Emissions 2011

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2011.xls | Return Year : 2011 |

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.13

REFERENCE YEAR	2011

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	##
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.3	Recycling or reclamation of metals and metal compounds.
4.4	Recycling or reclamation of other inorganic materials.

Address 1	Killarney Townland
Address 2	Roscommon
Address 3	
Address 4	
	Roscommon
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	
AER Returns Contact Email Address	
AER Returns Contact Position	
AER Returns Contact Telephone Number	
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)	Installations for the disposal of non-hazardous waste
50.1	General

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

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

4.1 RELEASES TO AIR Link to previous years emissions data | PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2011.xls | Return Year : 2011 | 10/04/2012 16:24

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR						Please enter all quantities in this section in KGs			
POLLUTANT		METHOD					QUANTITY		
			Method Used						
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0
01	Methane (CH4)	E	ESTIMATE	Landfill Gas survey	54659.0	54659.0	0.0	0.0
03	Carbon dioxide (CO2)	E	ESTIMATE	GasSIM and Site Reords	70666.0	70666.0	0.0	0.0
02	**Carbon monoxide (CO)**	E	ESTIMATE	GasSIM and Site Reords	10.68	10.68	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 AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD				QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

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

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

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

Additional Data Requested from Landfill operators

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

Landfill: Roscommon Landfill Facility

Please enter summary data on the quantities of methane flared and / or utilised	**T (Total) kg/Year**	**M/C/E**	**Method Used** – **Method Code**	**Method Used** – **Designation or Description**	**Facility Total Capacity m3 per hour**	
Total estimated methane generation (as per site model)	83991.0	E	ESTMATE	GasSim and Site records	N/A	
Methane flared	29332.0	E	ESTMATE	Landfill Gas Survey 2011	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)	54659.0	E	ESTMATE	Generation - Flared = Emiss	N/A	

4.2 RELEASES TO WATERS

Link to previous years emissions data

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2011.xls | Return Year : 2011 | 10/04/2012 16:24

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 or

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 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					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

4.3 RELEASES TO WASTEWATER OR SEWER

Link to previous years emissions data

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			
			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 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			
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

4.4 RELEASES TO LAND

Link to previous years emissions data

SECTION A : PRTR POLLUTANTS

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

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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : W0073 | Facility Name : Roscommon Landfill Facility | Filename : W0073_2011.xls | Return Year : 2011 |

10/04/2012 16:24

Please enter all quantities on this sheet in Tonnes

						Method Used						
Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	M/C/E	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)
Within the Country	20 01 01	No	242.8	paper and cardboard	R3	M	Weighed	Offsite in Ireland	Barna Waste,W0106-02	Carrowbrowne,Headford Road,Galway,.,Ireland		
Within the Country	15 01 02	No	118.02	plastic packaging	R3	M	Weighed	Offsite in Ireland	Barna Waste,W0106-02	Carrowbrowne,Headford Road,Galway,.,Ireland		
Within the Country	20 01 35	Yes	90.54	discarded electrical and electronic equipment other than those mentioned in 20 01 21 and and 20 01 23 containing hazardous components	R4	M	Weighed	Offsite in Ireland	KMK Metal Recycling Ltd.,W01130-03	Cappincure Industrial Estate,Daingean Road,Tullamore,Co. Offaly,Ireland	Abroad (commercially sensitive information),".",".",".",".",".","."	".",".",".",".","."
Within the Country	20 01 33	Yes	3.08	batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries	R4	M	Weighed	Offsite in Ireland	Enva W0184-01 / WEEE Ireland,.	Portlaoise / Suite 18,. / The Mall Beacon court,Co. Laois / Dublin 18,.,Ireland	Enva Ireland,W0184-01,Portlaoise,".",Co. Laois,".",Ireland	Portlaoise,".",Co. Laois,".",Ireland
Within the Country	**20 01 27**	**Yes**	16.74	paint, inks, adhesives and resins containing dangerous substances	R5	M	Weighed	Offsite in Ireland	Indaver / Barna Waste,W0036-02 / W0106-02	Dublin Port / Carrowbrowne,Dublin 1/ Headford Road,Dublin / Galway,.,Ireland	Nehsen GmBH and Co,430U,Louise-Krages-Strasse,10-28237,Bremen,".",Germany	Louise-Krages-Strasse,10-28237,Bremen,".",Germany
Within the Country	15 01 02	No	0.739	plastic packaging	R5	M	Weighed	Offsite in Ireland	Barna Waste,W0106-02	Carrowbrowne,Headford Road,Galway,.,Ireland		
Within the Country	20 01 11	No	11.99	textiles	R3	M	Weighed	Offsite in Ireland	Textile Recycling Ltd./Barna Waste,W0106-02	Glen Abbey Complex / Carrowbrowne,Belgard Road Tallaght / Headford Road,Dublin 24 / Galway,.,Ireland		
Within the Country	20 01 02	No	69.93	glass	R5	M	Weighed	Offsite in Ireland	Glassdon Recycling,.	52 Creagh Road,Toomebridge,Co. Antrim,BT41 3SE,United Kingdom		
Within the Country	20 01 40	No	18.42	metals	R4	M	Weighed	Offsite in Ireland	Barna Waste,W0106-02	Carrowbrowne,Headford Road,Galway,.,Ireland		
Within the Country	20 01 38	No	19.86	wood other than that mentioned in 20 01 37	R3	M	Weighed	Offsite in Ireland	Barna Waste,W0106-02	Carrowbrowne,Headford Road,Galway,.,Ireland		
Within the Country	19 07 03	No	4715.0	landfill leachate other than those mentioned in 19 07 02	D8	M	Weighed	Offsite in Ireland	Roscommon Wastewater Treatment Plant,"."	".",".",Roscommon,".",Ireland		

APPENDIX C

Monitoring Results

Surface Water Results

Roscommon County Council,
Roscommon Landfill
Date of Monitoring : 21st June 2011

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	NT	NT	NT	NT	NT	NT	NT	NT	NT
SW3	0.300	4.70	61.0	16.49	640	14.60	7.86	50.00	15.3
SW7	0.590	2.10	BLD	18.14	686	6.41	7.86	8.00	14.6

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	0.45	3.40	30.5	17.32	663	10.51	7.86	29	14.95
Min	0.300	2.10	61	16.49	640	6.41	7.86	8	14.60
Max	0.590	4.70	61	18.14	686	14.60	7.86	50	15.30

[1]Surface Water Regulations 1989 A1 unless otherwise specified
[2]Freshwater 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)
*NT Not Tested

Surface Water Visual Inspection/Odour Results

Roscommon County Council,

Roscommon Landfill **Licence No. 73-01**

Date of Monitoring : 21st June 2011
Weather Conditions : Wet & Mild

Surface water Monitoring Point	Time	Results / Findings
SW1	-	NT
SW3	11:00	Clear/No Odour
SW7	11:00	Clear/No Odour

*NT Not Tested

Ground Water Results

Roscommon County Council,
Roscommon Landfill
Date of Monitoring : 21st June 2011

Sampling point	Ammonia mg/l N	Conductivity @ 20°C	Levels mbgl	DO mg/l	pH	Temperature °C
GW2	0.098	801	1.3	4.90	7.25	13.6
GW4	1.13	738	0.9	4.28	7.08	14.5
GW6	3.61	817	0.7	4.52	6.97	13.8

Standard	0.15	1000.00	-	No abnormal change	6.5-9.5	25.00
Mean	1.61	785.33	0.97	4.57	7.10	13.97
Min	0.10	738.00	0.70	4.28	6.97	13.60
Max	3.61	817.00	1.30	4.90	7.25	14.50
Mean	1.61	785.33	0.97	4.57	7.10	13.97

Leachate Results

Roscommon County Council,
Roscommon Landfill
Date of Monitoring : 21st June 2011

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	105.9	RNV	118.0	150.70	2110	3.7	7.53	14.6
LMH2	176.0	RNV	232.0	317.30	3310	3.8	7.24	13.2
LMH3	199.40	RNV	181.00	324.80	3380	3.0	7.30	13.9

Mean	160.43	0.00	177.00	264.27	2933.33	3.50	7.36	13.90
Min	105.90	0.00	118.00	150.70	2110.00	3.00	7.24	13.20
Max	199.40	0.00	232.00	324.80	3380.00	3.80	7.53	14.60

Mean	160.43	RNV	177.00	264.27	2933.33	3.50	7.36	13.90

*RNV Result Not Valid

Roscommon Landfill Gas Monitoring. January-June 2011

Quarterly Analysis : Date : 30th March 2011

Sampling Pt	Time	Temp	CH_4	CO_2	O_2	Atm Pressure
		(˚C)	(% v/v)	(% v/v)	(% v/v)	(m/bars)
LFG 1	14:45	NT	57.2	25.5	1.2	998
LFG 2	14:50	NT	59.7	29.0	0..4	998
LFG 3	14:52	NT	60.4	29.2	0.9	998
LFG 4	14:54	NT	58.9	28.8	0.5	998
LFG 5	15:00	NT	67.5	30.8	0.4	998
LFG 6	15:02	NT	53.1	27.5	0.4	998
LFG 7	15:04	NT	64.7	27.9	0.7	998
LFG 8	15:06	NT	76.8	22.3	0.6	998
LFG 9	15:08	NT	75.9	20.1	0.8	998
LFG 10	15:10	NT	68.3	29.1	0.5	998
Site Office	15:25	NT	0.1	1.0	21.6	998
		Mean	**64.25**	**24.6545**	**2.76**	

Quarterly Analysis : Date : 21st June 2011

Sampling Pt	Time	Temp	CH_4	CO_2	O_2	Atm Pressure
		(˚C)	(% v/v)	(% v/v)	(% v/v)	(m/bars)
LFG 1	12:45	NT	68.9	32.1	0.3	998
LFG 2	12:50	NT	69.0	30.8	0.6	998
LFG 3	12:52	NT	68.2	31.5	0.4	998
LFG 4	12:54	NT	68.9	29.9	0.6	998
LFG 5	13:00	NT	57.3	27.3	0.7	998
LFG 6	13:02	NT	76.2	20.1	0.3	998
LFG 7	13:04	NT	59.7	31.6	0.4	998
LFG 8	13:06	NT	62.8	30.2	0.7	998
LFG 9	13:08	NT	70.0	26.5	0.7	998
LFG 10	13:10	NT	66.6	31.0	0.5	998
Site Office	13:25	NT	0.0	0.0	20.6	998
		Mean	**66.76**	**26.4545**	**2.35**	

Overall results	CH_4 (%v/v)	CO_2 (%v/v)	O_2 (%v/v)
Mean	65.51	25.51	2.43
Min	53.1	20.1	0.3
Max	76.8	32.1	1.2

Surface Water Results

Roscommon County Council,
Roscommon Landfill
Date of Monitoring : 27th October 2011

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
SW1	0.05	1.30	24.00	12.20	654.00	7.40	7.53	10.00	10.90	BLD	BLD	BLD	121.90	0.30	8.00	NT	0.03	2.30	12.50	8.40	0.05	BLD	24.90
SW3	0.100	1.70	97	13.60	549	4.55	7.34	14	11.20	BLD	BLD	4.00	2323.00	0.80	7.50	NT	0.02	NT	23.70	NT	0.20	BLD	95.30
SW7	0.180	1.50	57	13.50	558	5.70	7.31	BLD	11.70	BLD	1.00	BLD	270.40	BLD	7.20	NT	0.02	2.40	21.70	7.80	0.07	0.15	32.80

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	5	50	50	200	50	-	50	1	-	200	-	0.5	0.0005	3000
Mean	0.11	1.50	59.33	13.10	587.00	5.88	7.39	8.00	11.27	0.00	0.33	1.33	905.10	0.37	7.57	0.00	0.02	1.57	19.30	5.40	0.11	0.05	51.00
Min	0.050	1.30	24.0	12.20	549	4.55	7.31	10	10.90	0.000	1.00	4.00	121.90	0.30	7.20	0.00	0.02	2.30	12.50	7.80	0.05	0.15	24.90
Max	0.180	1.70	97	13.60	654	7.40	7.53	14	11.70	0.000	1.00	4.00	2323.00	0.80	8.00	0.00	0.03	2.40	23.70	8.40	0.20	0.15	95.30

[1]Surface Water Regulations 1989 A1 unless otherwise specifiec
[2]Freshwater 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)
*NT Not Tested

Surface Water Visual Inspection/Odour Results

Roscommon County Council,

Roscommon Landfill **Licence No. 73-01**

Date of Monitoring : 27th October 2011
Weather Conditions : Wet & Mild

Surface water Monitoring Point	Time	Results / Findings
SW1	11:15:00	Clear/No Odour
SW3	11:30:00	Slightly Overgrown/No Odour
SW7	11:50:00	Clear/No Odour

*NT Not Tested

Ground Water Results

Roscommon County Council,
Roscommon Landfill
Date of Monitoring : 27th October 2011

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	0.1	754.0	1.00	4.40	7.24	11.10	BLD	BLD	BLD	38.2	0.8	17.6	NT	0.0	2.6	28.8	14.1	0.0	BLD	17.50
GW4	2.0	829.0	0.60	2.40	7.12	12.00	BLD	BLD	BLD	2866.0	0.3	17.0	NT	0.0	2.0	14.7	14.5	0.1	BLD	27.90
GW6	4.1	859.0	0.50	2.33	7.07	11.70	BLD	BLD	BLD	1607.0	1.2	13.9	15.2	0.0	1.4	BLD	16.0	0.1	BLD	39.00

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	2.05	814.00	0.70	3.04	7.14	11.60	0.00	0.00	0.00	1503.73	0.77	16.17	5.07	0.02	2.00	14.50	14.87	0.05	0.00	28.13
Min	0.08	754.00	0.50	2.33	7.07	11.10	0.00	0.00	0.00	38.20	0.30	13.90	15.20	0.02	1.40	14.70	14.10	0.02	0.00	17.50
Max	4.07	859.00	1.00	4.40	7.24	12.00	0.00	0.00	0.00	2866.00	1.20	17.60	15.20	0.02	2.60	28.80	16.00	0.08	0.00	39.00

Leachate Results

Roscommon County Council,
Roscommon Landfill
Date of Monitoring : 27th October 2011

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	10.90	4.60	61.00	22.80	1049.00	4.60	7.07	12.30	0.10	2.50	BLD	10140.00	4.60	24.90	NT	0.05	18.30	53.10	35.20	0.08	76.60
LMH2	0.81	2.20	25.00	9.40	618.00	3.90	7.00	12.60	BLD	2.40	BLD	1176.00	2.00	9.70	NT	0.06	4.70	BLD	8.80	0.06	61.60
LMH3	4.70	5.50	32.00	14.40	817.00	4.30	6.99	12.70	0.20	2.10	3.00	9161.00	3.50	16.60	NT	0.15	NT	25.50	NT	0.12	101.00

Mean	5.47	4.10	39.33	15.53	828.00	4.27	7.02	12.53	0.10	2.33	1.00	6825.67	3.37	17.07	0.00	0.09	7.67	26.20	14.67	0.09	79.73
Min	0.81	2.20	25.00	9.40	618.00	3.90	6.99	12.30	0.10	2.10	3.00	1176.00	2.00	9.70	0.00	0.05	4.70	25.50	8.80	0.06	61.60
Max	10.90	5.50	61.00	22.80	1049.00	4.60	7.07	12.70	0.20	2.50	3.00	10140.00	4.60	24.90	0.00	0.15	18.30	53.10	35.20	0.12	101.00

*RNV Result Not Valid

Roscommon Landfill Gas Monitoring. July-December 2011

Quarterly Analysis : Date : 30th September 2011

Sampling Pt	Time	Temp	CH_4	CO_2	O_2	Atm Pressure
		(˚C)	(% v/v)	(% v/v)	(% v/v)	(m/bars)
LFG 1	10:00	NT	74.0	34.0	0.4	1003
LFG 2	10:02	NT	66.6	30.9	0.4	1003
LFG 3	10:04	NT	69.0	32.6	0.5	1003
LFG 4	10:06	NT	68.9	30.0	0.3	1003
LFG 5	10:08	NT	62.3	28.7	0.9	1003
LFG 6	10:10	NT	70.3	20.5	0.4	1003
LFG 7	10:20	NT	60.1	31.0	0.5	1003
LFG 8	10:22	NT	63.7	26.6	0.6	1003
LFG 9	10:24	NT	69.3	30.5	0.8	1003
LFG 10	10:30	NT	59.3	29.8	0.4	1003
Site Office	10:45	NT	0.0	0.0	20.9	1003
		Mean	**60.3**	**26.8**	**2.37**	

Quarterly Analysis : Date : 27th October 2011

Sampling Pt	Time	Temp	CH_4	CO_2	O_2	Atm Pressure
		(˚C)	(% v/v)	(% v/v)	(% v/v)	(m/bars)
LFG 1	12:00	NT	54.2	31.9	0.6	1002
LFG 2	12:02	NT	63.3	34.5	0.5	1002
LFG 3	12:04	NT	65.0	35.1	0.3	1002
LFG 4	12:06	NT	52.1	32.8	0.4	1002
LFG 5	12:08	NT	59.3	29.3	0.7	1002
LFG 6	12:10	NT	70.2	25.0	0.4	1002
LFG 7	12:20	NT	65.1	35.3	0.4	1002
LFG 8	12:22	NT	60.9	29.6	0.8	1002
LFG 9	12:24	NT	68.3	25.3	0.6	1002
LFG 10	12:30	NT	65.5	30.9	0.6	1002
Site Office	12:45	NT	0.0	0.0	20.6	1002
		Mean	**56.7**	**28.1545**	**2.35**	

Overall results	CH_4	CO_2	O_2
	(%v/v)	(%v/v)	(%v/v)
Mean	64.37	27.47	2.36
Min	52.1	20.5	0.3
Max	74.0	35.3	0.9

APPENDIX D

Meteorological Data

Knock Airport								
Year	Month	Day	Rainfall (mm)	Wind Speed (Knots)	Relative Humidity (%)	MSL Pressure (hPa)	Max. Temp. (Degrees Celsius)	Min. Temp. (Degrees Celsius)
2011	1	1	0.7	4.5	95	1029.6	7.1	1.3
2011	1	2	0.0	3.0	78	1031.8	2.4	-1.7
2011	1	3	0.0	3.7	80	1024.5	0.7	-3.7
2011	1	4	5.0	10.6	96	1006.1	4.8	0.2
2011	1	5	4.1	7.9	93	993.6	5.9	-0.4
2011	1	6	0.0	5.0	91	998.9	3.0	-1.2
2011	1	7	0.0	6.6	86	998.0	-0.1	-3.7
2011	1	8	2.7	9.9	93	995.6	3.9	-3.3
2011	1	9	0.3	8.6	92	1008.2	4.1	-0.5
2011	1	10	6.5	7.5	100	998.5	4.9	0.8
2011	1	11	5.1	9.6	93	1007.0	5.8	0.5
2011	1	12	1.1	9.9	99	1002.0	9.8	1.7
2011	1	13	4.9	10.7	99	1001.6	9.8	8.4
2011	1	14	2.3	13.9	92	999.3	8.6	3.8
2011	1	15	15.8	20.1	99	994.4	10.6	6.9
2011	1	16	1.8	12.9	89	1003.5	8.9	2.9
2011	1	17	0.0	5.3	93	1018.6	6.3	0.8
2011	1	18	0.0	5.3	92	1030.8	6.2	0.1
2011	1	19	0.0	5.3	96	1035.8	2.9	-2.9
2011	1	20	0.0	3.0	100	1038.9	1.7	-3.2
2011	1	21	0.0	3.0	87	1042.4	5.1	-0.6
2011	1	22	0.0	4.0	86	1043.6	5.3	1.0
2011	1	23	0.0	4.3	83	1042.4	6.8	2.5
2011	1	24	0.3	7.1	92	1037.5	6.1	2.3
2011	1	25	2.6	14.8	99	1023.5	8.1	6.1
2011	1	26	0.0	7.7	87	1019.4	6.7	0.6
2011	1	27	0.0	6.0	87	1025.3	3.5	-0.6
2011	1	28	0.0	3.9	78	1026.7	3.0	-1.2
2011	1	29	0.0	3.1	77	1026.6	2.5	-1.2
2011	1	30	0.0	6.8	86	1024.2	4.0	-1.1
2011	1	31	3.0	13.1	98	1019.2	8.5	1.4
2011	2	1	2.1	11.6	94	1019.8	8.9	3.9
2011	2	2	8.8	17.4	94	1012.1	9.5	1.5
2011	2	3	12.7	18.7	93	1009.7	8.7	0.3
2011	2	4	20.8	18.0	96	1001.0	10.7	4.3
2011	2	5	6.1	6.7	98	1007.4	7.2	4.7
2011	2	6	16.5	4.4	98	1008.7	5.9	3.7
2011	2	7	19.6	12.0	95	1006.3	9.1	0.2
2011	2	8	1.8	10.2	95	1013.4	8.2	-0.7
2011	2	9	6.3	8.1	100	1007.1	8.2	4.2
2011	2	10	0.0	6.7	92	1009.7	6.9	1.9
2011	2	11	0.9	7.6	96	1004.5	10.0	2.4
2011	2	12	2.0	10.7	95	1003.1	6.3	-0.9
2011	2	13	0.2	3.0	97	992.9	5.4	1.2
2011	2	14	1.2	8.3	93	993.4	4.9	-1.0

2011	2	15	1.1	10.5	97	981.2	4.6	-0.2
2011	2	16	0.0	6.5	91	989.0	7.6	-0.1
2011	2	17	0.0	5.0	95	1003.5	5.7	1.2
2011	2	18	5.0	12.2	99	1001.7	7.3	2.8
2011	2	19	0.0	8.9	96	1004.1	10.0	4.5
2011	2	20	4.6	13.3	96	1004.9	9.7	5.0
2011	2	21	0.2	4.8	98	1007.7	9.2	4.6
2011	2	22	0.9	8.9	100	1009.5	9.5	6.5
2011	2	23	0.2	13.2	94	1008.4	12.7	8.1
2011	2	24	0.6	15.5	95	1013.4	11.5	7.9
2011	2	25	8.4	13.3	91	1013.2	11.3	5.9
2011	2	26	0.9	9.2	85	1017.8	8.0	2.0
2011	2	27	1.7	10.7	84	1026.6	8.6	2.4
2011	2	28	0.2	3.5	87	1035.1	8.8	1.5
2011	3	1	0.0	4.5	91	1039.0	9.9	1.9
2011	3	2	0.0	7.2	92	1037.3	7.7	-0.9
2011	3	3	0.0	2.2	85	1038.0	11.8	1.6
2011	3	4	0.0	2.2	92	1034.4	9.4	1.8
2011	3	5	0.0	3.7	87	1032.3	10.0	5.4
2011	3	6	0.0	5.7	87	1030.4	6.5	3.1
2011	3	7	0.1	5.4	91	1027.8	9.0	2.7
2011	3	8	1.2	11.7	93	1016.1	8.1	2.0
2011	3	9	2.7	18.0	84	1011.7	8.5	2.9
2011	3	10	2.7	16.5	85	1008.3	7.9	1.0
2011	3	11	10.3	5.3	96	1007.6	3.7	-0.2
2011	3	12	3.7	5.6	97	998.7	4.3	-0.5
2011	3	13	5.8	12.5	96	1003.4	4.4	-0.1
2011	3	14	0.5	6.9	91	1014.5	5.2	0.7
2011	3	15	0.0	3.0	80	1016.8	8.6	0.0
2011	3	16	0.0	7.3	81	1015.0	10.1	-1.0
2011	3	17	0.5	6.5	79	1017.5	6.8	1.1
2011	3	18	0.1	6.7	80	1023.6	8.5	-0.7
2011	3	19	2.6	8.7	87	1028.6	9.8	1.5
2011	3	20	0.1	8.8	95	1026.1	11.3	6.9
2011	3	21	0.0	8.3	94	1031.5	12.3	7.5
2011	3	22	0.0	4.1	90	1038.1	14.4	7.5
2011	3	23	0.0	3.4	79	1039.5	15.2	5.4
2011	3	24	0.0	4.7	77	1034.4	14.9	4.0
2011	3	25	0.0	5.9	79	1023.4	12.4	3.7
2011	3	26	0.0	5.4	78	1017.2	11.2	3.9
2011	3	27	0.0	2.8	78	1016.5	11.7	5.6
2011	3	28	0.0	5.0	78	1015.1	11.8	4.2
2011	3	29	0.0	5.5	96	1009.1	9.7	5.8
2011	3	30	1.4	12.2	86	1002.2	13.4	6.5
2011	3	31	3.6	17.6	86	1000.3	12.9	8.0
2011	4	1	20.9	18.0	95	999.5	12.5	5.2
2011	4	2	2.8	9.3	90	1003.2	12.1	4.2
2011	4	3	0.1	9.2	81	1010.4	10.4	3.8
2011	4	4	11.7	17.1	92	1007.5	13.6	4.7
2011	4	5	4.3	14.7	99	1008.6	11.9	10.4

2011	4	6	8.3	16.6	98	1017.3	11.3	9.6
2011	4	7	0.3	5.8	83	1029.0	14.6	6.0
2011	4	8	0.0	5.3	79	1027.7	17.6	3.9
2011	4	9	0.0	9.9	70	1020.9	17.3	5.5
2011	4	10	0.0	8.3	93	1022.8	13.8	9.2
2011	4	11	4.6	12.2	86	1025.0	10.6	2.3
2011	4	12	4.1	10.2	82	1028.8	10.4	2.3
2011	4	13	7.8	11.3	96	1013.1	13.5	4.4
2011	4	14	0.1	4.5	85	1016.6	12.8	6.3
2011	4	15	0.7	6.6	84	1018.6	13.4	5.4
2011	4	16	0.0	5.4	81	1023.5	12.8	6.3
2011	4	17	0.0	4.2	78	1024.2	15.1	6.2
2011	4	18	0.0	8.0	78	1015.8	17.2	4.1
2011	4	19	0.0	4.4	68	1015.2	16.9	5.9
2011	4	20	0.2	4.8	76	1016.0	17.6	8.1
2011	4	21	0.6	7.1	80	1012.1	19.7	8.3
2011	4	22	0.2	10.0	83	1004.2	16.8	7.6
2011	4	23	0.1	7.4	76	1015.3	13.5	4.1
2011	4	24	0.8	7.3	82	1021.7	12.7	6.5
2011	4	25	0.0	6.1	72	1030.1	12.9	6.0
2011	4	26	0.0	6.4	73	1029.0	14.6	5.6
2011	4	27	0.1	4.9	89	1026.8	15.4	6.9
2011	4	28	0.0	6.5	72	1022.2	17.7	7.8
2011	4	29	0.0	8.8	69	1017.1	18.3	4.8
2011	4	30	0.0	13.1	66	1013.4	18.0	7.6
2011	5	1	0.0	14.4	55	1012.0	17.0	6.6
2011	5	2	0.0	15.1	53	1012.2	15.9	6.7
2011	5	3	0.0	13.6	66	1014.8	13.3	4.9
2011	5	4	2.7	13.8	86	1013.0	11.2	6.1
2011	5	5	4.6	11.1	92	1008.3	15.0	9.3
2011	5	6	1.4	12.6	86	1005.0	16.1	8.5
2011	5	7	7.6	12.0	89	1002.4	16.7	8.6
2011	5	8	7.0	16.7	83	999.6	15.6	7.5
2011	5	9	9.2	15.0	90	1006.0	14.5	8.7
2011	5	10	4.7	14.6	91	1013.6	12.4	8.3
2011	5	11	8.1	11.5	94	1018.0	11.5	7.0
2011	5	12	5.6	13.7	86	1018.9	12.8	6.5
2011	5	13	4.1	8.9	89	1017.8	11.1	5.4
2011	5	14	3.8	12.1	84	1024.3	11.5	5.9
2011	5	15	3.0	14.4	97	1025.3	11.5	7.6
2011	5	16	4.7	15.4	96	1021.4	11.8	9.5
2011	5	17	3.4	11.1	97	1016.1	14.5	8.3
2011	5	18	1.1	13.8	81	1012.5	12.0	5.6
2011	5	19	0.5	10.2	86	1015.8	12.1	3.2
2011	5	20	3.3	12.7	78	1013.7	11.9	6.1
2011	5	21	12.2	14.3	91	1005.8	12.4	6.4
2011	5	22	8.6	15.3	85	1008.0	13.1	5.7
2011	5	23	12.3	22.7	80	1007.3	11.4	5.2
2011	5	24	0.5	13.8	71	1022.8	12.4	5.1
2011	5	25	9.1	15.4	92	1008.5	12.3	7.7

2011	5	26	8.5	20.0	84	1013.8	11.1	6.0
2011	5	27	4.0	11.7	92	1018.0	10.7	5.0
2011	5	28	0.7	14.0	84	1009.0	12.5	7.2
2011	5	29	1.5	15.6	77	1005.9	12.7	6.4
2011	5	30	2.4	9.2	80	1010.5	11.3	4.3
2011	5	31	0.2	11.3	83	1019.7	13.1	4.5
2011	6	1	0.0	12.0	90	1025.5	17.1	10.3
2011	6	2	0.0	4.6	80	1034.9	20.6	11.0
2011	6	3	0.0	7.7	79	1034.6	22.0	9.2
2011	6	4	0.0	9.3	84	1029.6	14.0	7.9
2011	6	5	1.4	10.5	88	1017.4	10.2	5.8
2011	6	6	4.5	7.3	96	1005.5	11.5	3.3
2011	6	7	4.8	7.2	87	997.1	13.8	5.9
2011	6	8	5.0	14.6	91	1003.8	11.4	5.2
2011	6	9	1.3	8.6	79	1012.4	11.0	3.4
2011	6	10	0.1	6.4	80	1014.2	12.4	2.6
2011	6	11	0.0	5.2	78	1016.2	14.0	4.0
2011	6	12	9.5	9.5	90	1006.3	9.6	5.8
2011	6	13	0.0	9.6	80	1010.6	15.3	7.8
2011	6	14	3.0	10.4	80	1013.4	17.8	4.0
2011	6	15	0.7	10.6	79	1007.8	15.4	7.1
2011	6	16	0.3	9.6	83	1005.2	14.2	5.9
2011	6	17	0.7	5.9	86	996.8	14.9	6.8
2011	6	18	9.7	7.3	91	1000.7	15.0	7.6
2011	6	19	0.0	6.0	84	1011.1	14.3	5.9
2011	6	20	0.0	6.2	81	1008.8	14.9	7.6
2011	6	21	5.4	7.9	90	1002.7	16.6	9.1
2011	6	22	2.7	11.5	87	1008.1	15.3	8.8
2011	6	23	0.0	10.2	77	1017.5	14.1	6.5
2011	6	24	12.4	9.3	95	1016.2	13.3	5.3
2011	6	25	1.8	11.0	99	1013.5	15.4	12.3
2011	6	26	1.1	9.9	92	1014.9	16.6	9.3
2011	6	27	0.0	6.1	79	1016.6	14.9	6.8
2011	6	28	0.6	8.4	80	1019.7	15.3	6.2
2011	6	29	3.6	7.3	88	1023.3	14.4	6.7
2011	6	30	1.5	5.8	83	1028.0	14.1	8.5
2011	7	1	0.0	4.8	81	1026.8	16.3	8.6
2011	7	2	0.0	6.8	79	1019.3	18.3	8.2
2011	7	3	0.0	5.9	88	1016.8	17.1	9.1
2011	7	4	0.6	8.8	80	1011.7	19.4	11.0
2011	7	5	6.4	10.5	92	1002.4	16.5	9.7
2011	7	6	34.9	6.1	86	998.2	17.2	6.1
2011	7	7	12.8	6.3	97	993.9	13.9	9.6
2011	7	8	3.7	5.6	91	998.8	16.8	10.1
2011	7	9	0.1	7.0	86	1011.7	16.1	9.3
2011	7	10	0.0	5.5	87	1019.0	15.9	9.9
2011	7	11	0.0	4.8	79	1022.8	15.6	9.9
2011	7	12	0.0	4.3	75	1022.4	19.2	10.4
2011	7	13	0.0	6.2	75	1021.5	20.3	10.4
2011	7	14	1.3	4.9	92	1020.4	15.8	9.5

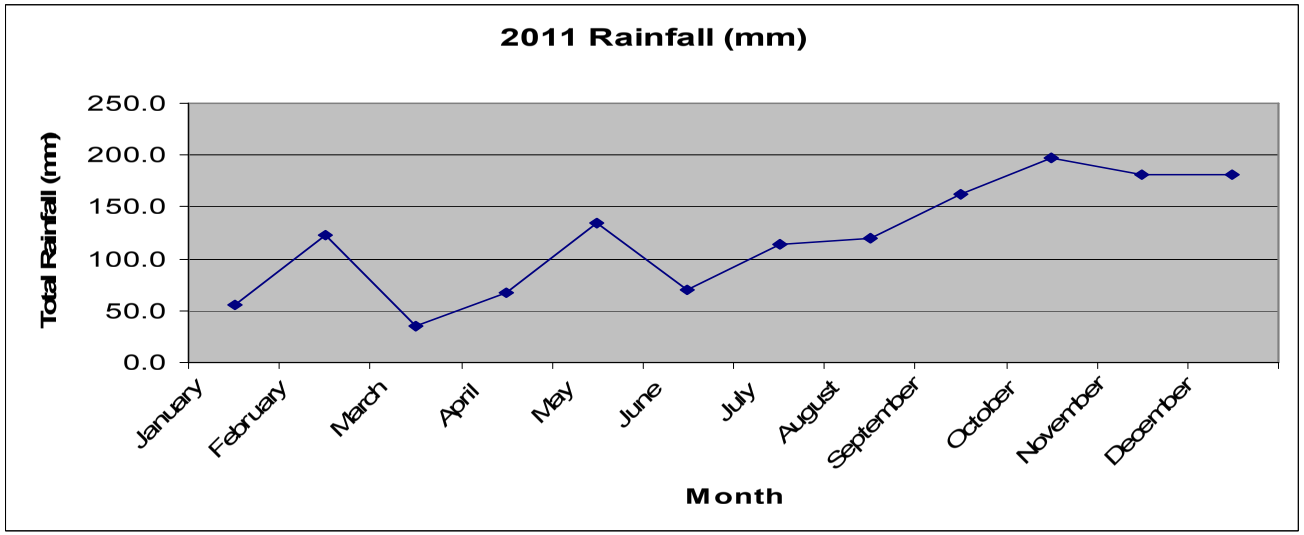
2011	7	15	2.4	8.5	95	1010.9	15.1	11.1
2011	7	16	18.5	14.6	97	995.9	14.3	10.6
2011	7	17	10.0	17.6	98	997.9	11.8	10.4
2011	7	18	10.5	15.6	99	1000.1	12.4	9.9
2011	7	19	0.6	10.3	86	1008.8	15.0	9.6
2011	7	20	0.0	6.9	81	1012.5	14.6	9.4
2011	7	21	0.0	6.6	78	1019.4	14.2	8.3
2011	7	22	0.0	6.7	78	1021.3	16.0	7.6
2011	7	23	0.0	3.0	88	1017.2	17.2	9.1
2011	7	24	0.7	2.8	92	1013.2	20.8	11.7
2011	7	25	2.1	5.9	97	1012.8	16.9	11.9
2011	7	26	1.3	5.4	88	1018.5	18.8	11.2
2011	7	27	4.5	5.8	98	1022.1	15.5	10.0
2011	7	28	0.0	9.8	83	1028.0	14.6	11.1
2011	7	29	0.0	4.8	83	1026.1	17.1	10.5
2011	7	30	1.0	8.8	90	1018.0	16.6	11.9
2011	7	31	2.3	9.5	96	1009.6	16.8	11.1
2011	8	1	0.1	3.7	82	1011.4	16.1	10.1
2011	8	2	0.0	4.8	78	1014.0	16.4	8.4
2011	8	3	3.8	7.4	83	1011.5	18.5	9.8
2011	8	4	1.7	8.2	92	1007.9	18.7	9.3
2011	8	5	0.5	4.8	89	1011.9	14.6	8.4
2011	8	6	18.2	4.2	91	1003.1	17.3	9.1
2011	8	7	0.2	5.7	85	1000.5	17.1	8.7
2011	8	8	3.5	11.6	90	1013.0	14.7	9.3
2011	8	9	1.3	8.1	81	1025.3	16.2	8.9
2011	8	10	31.8	13.2	99	1013.3	16.2	11.6
2011	8	11	1.4	9.4	98	1007.5	17.4	13.3
2011	8	12	8.1	9.7	99	1004.7	16.6	11.9
2011	8	13	0.9	9.7	92	1001.3	16.1	11.4
2011	8	14	1.9	10.5	85	1006.5	16.1	9.7
2011	8	15	9.4	6.9	93	1011.6	14.7	8.6
2011	8	16	0.4	9.1	84	1013.3	15.8	8.1
2011	8	17	0.1	5.0	82	1019.0	14.5	7.2
2011	8	18	0.5	3.7	79	1018.4	16.2	9.5
2011	8	19	6.8	10.9	92	1012.7	14.8	8.1
2011	8	20	0.4	8.2	83	1011.0	17.9	8.4
2011	8	21	1.1	6.6	87	1013.0	16.4	11.0
2011	8	22	0.0	3.3	79	1019.9	16.5	10.9
2011	8	23	6.4	6.0	81	1012.8	16.7	10.4
2011	8	24	5.2	7.0	88	1007.2	14.4	7.3
2011	8	25	4.9	7.6	92	1003.3	15.2	6.7
2011	8	26	0.0	9.5	84	1008.9	15.3	8.5
2011	8	27	9.3	10.5	93	1014.5	15.1	9.3
2011	8	28	1.8	9.3	83	1019.0	14.1	7.9
2011	8	29	0.2	7.0	88	1021.7	12.6	6.9
2011	8	30	0.0	4.1	86	1018.8	14.6	8.5
2011	8	31	0.0	5.2	77	1016.4	16.1	9.5
2011	9	1	1.9	9.3	87	1010.1	16.2	8.1
2011	9	2	9.2	8.8	93	1005.3	15.6	11.1

2011	9	3	2.4	7.5	93	1002.3	14.4	7.9
2011	9	4	4.6	8.3	94	999.8	14.3	6.5
2011	9	5	13.5	12.1	95	1002.8	13.8	8.2
2011	9	6	14.8	18.7	90	997.7	12.9	9.7
2011	9	7	6.1	12.8	95	1007.2	12.3	9.4
2011	9	8	2.8	6.0	91	1004.3	13.8	9.4
2011	9	9	0.5	12.7	93	1000.4	19.0	11.5
2011	9	10	13.9	18.3	91	988.0	16.8	10.8
2011	9	11	18.0	16.4	97	989.5	15.0	10.8
2011	9	12	2.0	25.3	86	991.3	15.0	9.9
2011	9	13	3.2	17.7	84	1007.4	13.1	8.7
2011	9	14	0.3	8.8	92	1017.5	13.0	9.1
2011	9	15	0.0	8.4	85	1016.8	15.5	6.7
2011	9	16	10.8	12.1	97	1005.0	13.9	9.6
2011	9	17	13.7	12.4	96	1002.1	12.3	8.1
2011	9	18	3.3	11.7	90	1009.6	13.7	9.8
2011	9	19	8.3	9.2	96	1008.4	14.5	8.6
2011	9	20	0.8	9.1	88	1012.0	13.5	7.2
2011	9	21	5.6	15.9	85	1008.9	13.9	8.2
2011	9	22	0.1	9.1	89	1015.6	14.4	5.6
2011	9	23	3.8	14.5	91	1007.9	14.9	11.3
2011	9	24	0.6	10.9	89	1006.1	14.8	8.9
2011	9	25	2.7	14.3	90	1003.8	14.8	6.9
2011	9	26	1.7	8.4	94	1015.8	14.4	5.4
2011	9	27	0.6	13.8	93	1019.0	17.9	11.7
2011	9	28	1.7	15.0	89	1014.8	20.6	13.3
2011	9	29	2.9	12.7	96	1014.6	17.3	12.7
2011	9	30	12.6	8.3	96	1015.5	16.0	9.8
2011	10	1	4.0	5.3	95	1023.3	13.2	8.8
2011	10	2	0.6	4.9	98	1020.2	14.4	9.4
2011	10	3	1.3	13.8	89	1012.9	13.7	8.7
2011	10	4	1.1	11.2	84	1015.1	13.7	9.5
2011	10	5	10.6	16.1	96	1006.3	13.9	6.0
2011	10	6	10.3	18.9	86	1010.6	10.2	5.4
2011	10	7	1.6	11.7	89	1024.4	11.9	7.6
2011	10	8	2.8	13.1	99	1022.2	14.7	8.8
2011	10	9	14.0	15.0	98	1013.7	14.2	12.9
2011	10	10	20.8	15.6	98	1010.9	14.6	10.5
2011	10	11	8.3	13.4	100	1015.4	14.2	13.0
2011	10	12	2.2	6.7	97	1020.5	13.5	10.3
2011	10	13	0.2	6.3	98	1025.8	13.5	9.1
2011	10	14	2.8	11.9	96	1022.5	14.0	12.3
2011	10	15	4.9	8.2	94	1019.0	12.9	7.9
2011	10	16	5.3	9.3	91	1017.6	11.6	5.6
2011	10	17	32.7	12.1	93	1006.3	10.3	3.0
2011	10	18	4.6	12.4	87	1010.4	9.9	3.3
2011	10	19	1.6	9.5	85	1023.2	9.1	3.3
2011	10	20	1.7	10.1	96	1023.2	11.6	3.5
2011	10	21	4.6	15.7	98	1012.0	12.2	9.1
2011	10	22	6.3	11.1	94	1000.7	10.7	6.0

2011	10	23	19.7	11.6	97	990.1	13.0	6.9
2011	10	24	4.8	9.6	98	983.6	13.3	6.7
2011	10	25	1.7	3.7	98	990.5	9.4	3.2
2011	10	26	1.9	10.6	94	994.5	9.5	1.8
2011	10	27	0.2	6.1	92	1006.4	10.6	4.1
2011	10	28	3.9	14.3	93	1014.0	11.0	2.9
2011	10	29	13.9	14.4	97	1005.6	12.9	10.0
2011	10	30	3.6	13.0	98	1007.1	14.2	9.6
2011	10	31	5.2	12.6	96	999.3	14.3	6.1
2011	11	1	0.8	11.0	91	1000.9	10.8	4.3
2011	11	2	7.2	19.5	96	986.0	12.2	10.1
2011	11	3	1.8	11.3	97	980.5	12.6	7.4
2011	11	4	0.4	5.1	95	993.0	11.0	3.3
2011	11	5	0.0	5.2	88	1013.4	9.7	2.7
2011	11	6	0.0	6.0	92	1025.7	10.5	1.8
2011	11	7	0.1	8.6	96	1022.9	8.8	2.0
2011	11	8	2.3	12.0	99	1010.1	9.0	5.8
2011	11	9	1.2	12.0	98	1003.6	11.5	7.0
2011	11	10	0.3	11.0	95	1009.4	12.3	6.1
2011	11	11	11.9	17.9	91	1001.2	13.0	7.2
2011	11	12	1.1	10.6	90	1016.7	10.4	5.5
2011	11	13	0.4	15.0	90	1019.1	14.1	7.3
2011	11	14	0.0	12.0	93	1018.7	12.0	6.5
2011	11	15	0.1	9.6	97	1015.5	10.0	6.4
2011	11	16	2.0	8.5	98	1010.9	11.3	6.1
2011	11	17	22.5	15.9	99	1002.7	11.9	4.5
2011	11	18	11.2	12.9	98	1002.5	11.9	10.2
2011	11	19	6.6	5.3	99	1009.4	11.7	5.9
2011	11	20	0.7	8.6	99	1012.1	10.6	5.7
2011	11	21	3.1	6.1	95	1012.1	9.6	5.1
2011	11	22	0.0	10.2	89	1017.6	10.0	2.0
2011	11	23	10.5	13.5	97	1016.3	11.1	8.2
2011	11	24	13.0	17.2	93	1011.9	11.1	5.1
2011	11	25	2.6	12.2	87	1019.0	8.1	3.2
2011	11	26	21.0	19.6	96	1012.6	11.7	7.8
2011	11	27	2.1	13.0	85	1018.3	10.2	4.0
2011	11	28	24.9	15.9	93	1008.0	11.3	5.3
2011	11	29	16.9	12.1	91	996.5	9.9	2.3
2011	11	30	16.1	15.5	95	1002.3	8.0	2.2
2011	12	1	0.2	5.9	92	1004.2	6.7	0.6
2011	12	2	6.4	10.7	97	1006.0	9.1	0.6
2011	12	3	3.9	13.0	88	1002.4	7.3	3.1
2011	12	4	4.0	12.0	92	1001.5	4.4	0.5
2011	12	5	5.7	12.7	92	1005.6	3.5	0.3
2011	12	6	8.2	10.9	93	1004.1	6.6	1.6
2011	12	7	5.4	15.9	86	1008.9	5.3	1.5
2011	12	8	17.1	20.4	89	1000.7	9.8	0.8
2011	12	9	0.9	10.1	87	1010.7	3.7	-0.8
2011	12	10	2.8	8.8	96	1010.6	7.8	-0.6
2011	12	11	5.3	8.3	95	1000.1	5.8	1.1

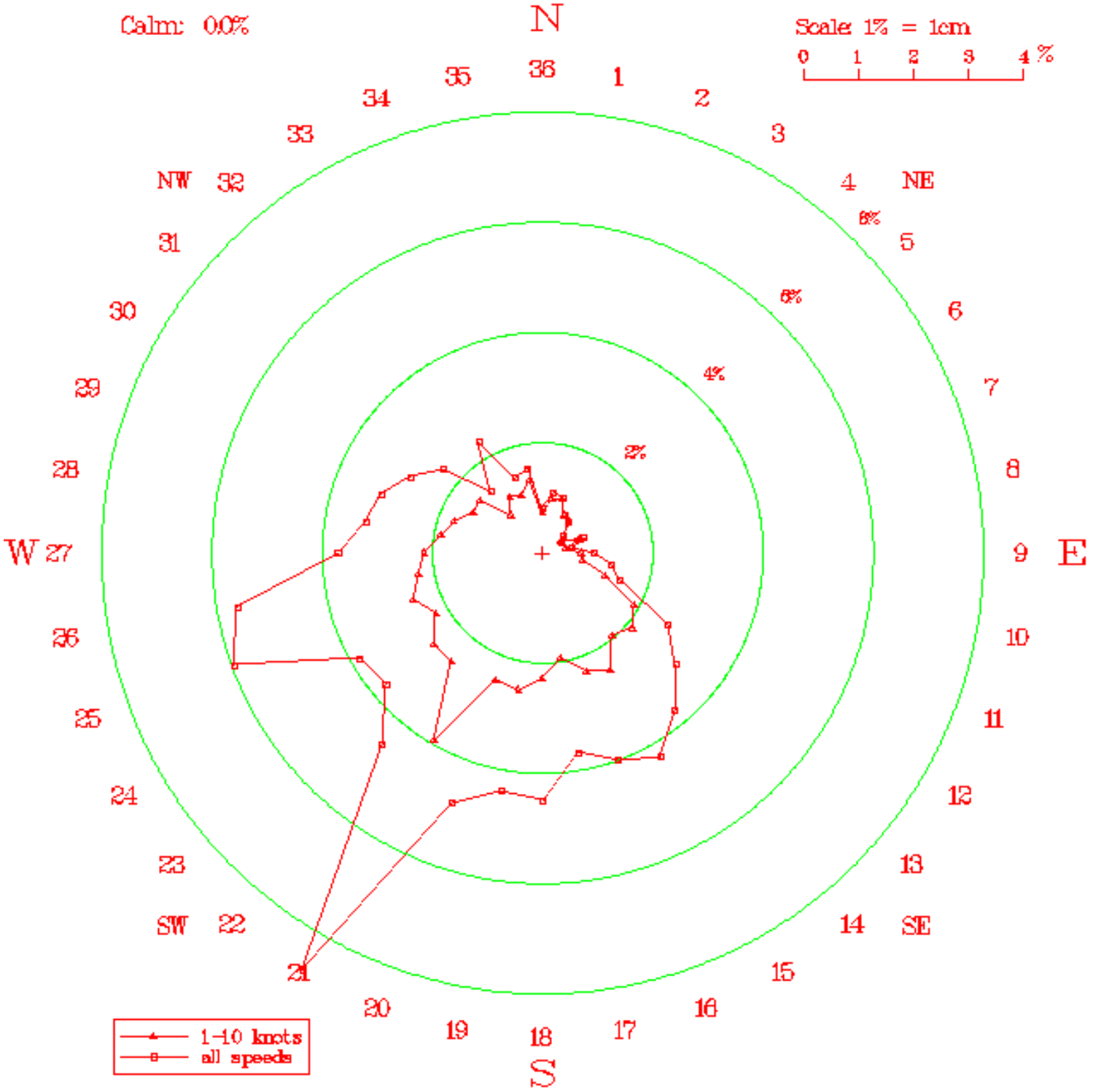
2011	12	12	8.2	11.8	94	989.7	7.3	1.2
2011	12	13	6.6	22.7	83	976.5	4.0	0.2
2011	12	14	0.9	9.9	94	985.3	3.5	-0.1
2011	12	15	1.8	7.8	95	993.7	4.0	-1.7
2011	12	16	7.4	11.0	95	995.7	4.7	-1.8
2011	12	17	3.4	10.4	88	1015.3	4.4	-0.3
2011	12	18	0.7	7.0	93	1020.1	4.8	0.3
2011	12	19	10.8	11.6	95	1012.1	8.7	3.0
2011	12	20	10.1	9.6	96	1015.2	9.9	4.3
2011	12	21	0.6	18.3	96	1018.0	11.4	9.2
2011	12	22	7.0	15.0	96	1017.8	11.0	6.9
2011	12	23	3.3	10.9	90	1018.3	7.2	1.3
2011	12	24	6.7	14.0	95	1020.4	9.6	3.6
2011	12	25	7.5	16.7	99	1017.2	11.1	9.2
2011	12	26	5.4	19.8	98	1020.9	10.7	5.7
2011	12	27	7.8	12.4	96	1021.1	8.5	5.2
2011	12	28	7.3	19.5	83	1016.5	6.8	2.5
2011	12	29	9.2	19.5	87	1020.6	7.8	4.2
2011	12	30	6.7	13.9	98	1013.4	10.8	5.6
2011	12	31	10.4	12.5	98	1002.8	10.4	5.8

Month	Rainfall (mm)
January	56.2
February	122.8
March	35.3
April	67.7
May	134.8
June	70.1
July	113.7
August	119.9
September	162.4
October	197.2
November	180.8
December	181.7
Total	1442.6



Knock Airport 2011

Percentage Frequency of Occurrence of Wind Directions



Percentage Frequency of Occurrence of Wind Speeds

+ less than 0.1

0	1-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	41-47	over 48	knots
+	7.9	24.0	26.4	29.7	9.2	2.5	0.4	+	0.0	0.0	%

mean wind speed: 10.0 knots
standard deviation: 5.3 knots
anemometer height: 12m

Met Eireann, Glasnevin Hill, Dublin 9.