Wexford County Council

Killurin Landfill
W0016-02

Annual Environmental Report 2017

Quality Control Sheet

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Kill16-02_EPA_2017 AER	1	Compliance with Waste Licence W0016-02	Fran Hobbs Facility Technician	Sean Meyler, Executive Engineer, Facility Manager

Contents Page

APPENDICES

A1 PRTR 2015

A2 Topographical and Monitoring location drawings

A3 Meteorological Data

A4 Air emission report

A5 Water Balance Calculation

EXECUTIVE SUMMARY

This *Annual Environmental Report* has been prepared for Killurin Landfill, Waste Licence 16-2, for the reporting period from **1 January 2017 to 31 December 2017 inclusive**. The report includes the information specified in Schedule G of the Waste Licence, Content of the Annual Environmental Report, in accordance with Waste Licensing - *Draft Guidance on Environmental Management Systems (EMS) and Reporting to the Agency, 1999'.* The main topics discussed with this report are as follows:

- General Site Information
- Management and Staffing
- Reported Incidents and Complaints
- Development Works
- Waste Acceptance and Handling
- Emissions Management
- Environmental Nuisances
- Resource and Energy Consumption
- Environmental Monitoring and Emissions

Killurin Landfill was closed to accepting waste on the 07 June 2008. No waste was accepted to landfill in 2017.

Wexford County Council continued to carry out a comprehensive environmental monitoring programme during 2017, in compliance with the waste licence conditions (Schedule D), to assess the significance of emissions. The monitoring programme included Landfill Gas, Leachate Level & Quality, Surface Water Quality, Groundwater Level & Quality, Odour monitoring and Meteorological monitoring.

1 INTRODUCTION

1.1 General Information

The Annual Environmental Report (AER) for Killurin Landfill includes the information specified in Schedule G of the Waste Licence W0016-2, *Content of Annual Environmental Report* and has been prepared in accordance with the Environmental Protection Agency (EPA) publication *'Waste Licensing – Draft Guidance on Environmental Management Systems (EMS) and Reporting to the Agency, 1999'.*

The reporting period for this AER is **1st January 2017 to 31st December 2017 inclusive**.

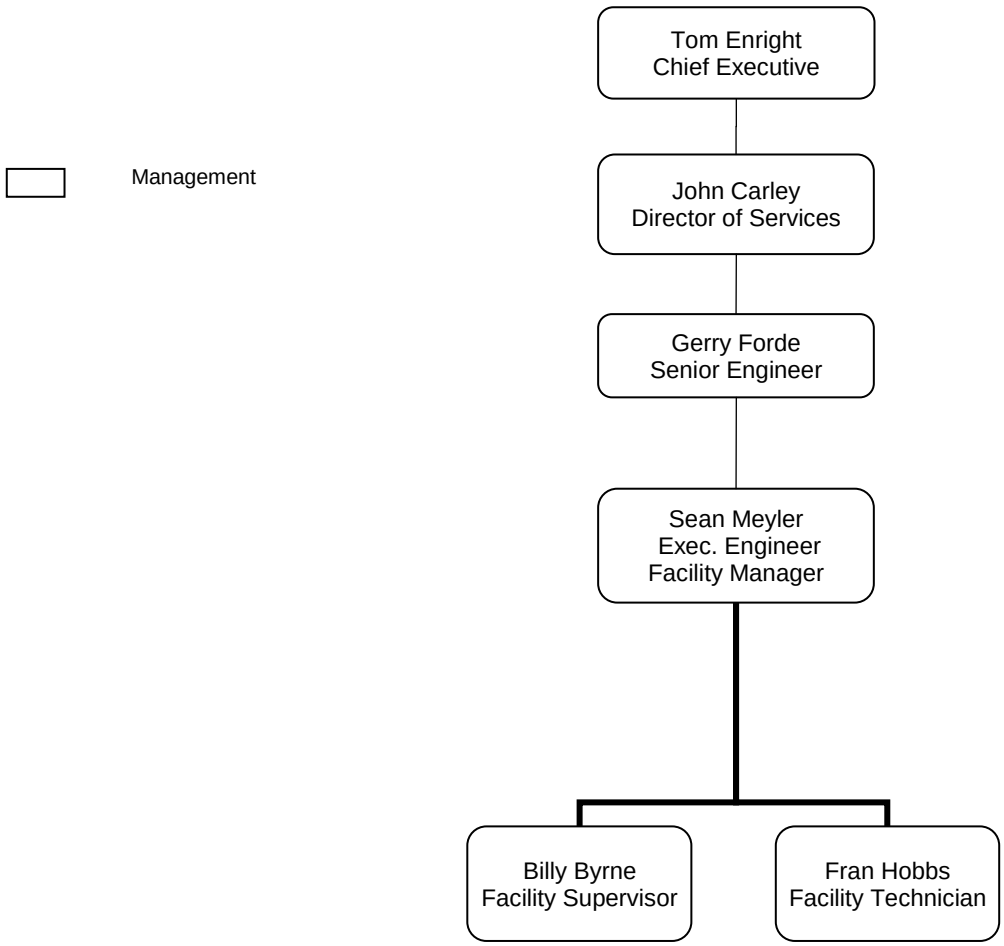
1.2 Site information

Table 1 Site information for Killurin Landfill

KILLURIN LANDFILL	
Waste licence register no:	W0016-2
Name and address of operator:	Wexford County Council Carricklawn Wexford Y35 WY93
Name and address of facility:	Killurin Landfill Killurin Crossabeg County Wexford
Site Description:	Killurin Landfill site is located in the town land of Newtown lower, Killurin, close to Deeps Bridge on a meander of the eastern bank of the River Slaney. The site is approximately 11km from Wexford town and covers an area of 10.7 hectares, of which 4.9 hectares are landfill and the remainder is CA site, buildings, car parking and buffer zones/screening. The facility is located in what once was a sand and gravel quarry. The area surrounding the site is rural with a mixed pattern of highly productive pasture and arable land use, with the River Slaney being the prominent landscape feature. Landfilling and CA site operations ceased in June 2008.

2 MANAGEMENT & STAFFING STRUCTURE

2.1 Management and staffing structure for Killurin Landfill on 31st December 2017



Killurin Landfill was operated by Wexford County Council during 2017 with support provided by Irish Biotech Services.

2.2 Financial provisions

In accordance with Condition 12.1 Wexford County Council paid a sum of €15,699 to the Environmental Protection Agency for the management and monitoring of the waste licence.

2.2.1 *Provision for the Closure, Restoration and Aftercare*

Wexford County Council (WCC), as a Local Authority, has made the necessary provisions, for the development, management, restoration and aftercare of Killurin Landfill. WCC has assigned engineering and technical staff to manage the facility. Wexford County Council is committed to the ongoing provision of funding for all site development works, environmental monitoring costs and restoration and aftercare works at Killurin Landfill for the duration of the Waste Licence.

2.3 Environmental Management System

2.3.1 *Environmental Management Programme*

The site has an operational environmental management system (EMS) in accordance with the Waste Licence condition 2.3.2.1. Implementation of the EMS continued during this reporting period (January 2017 - December 2017). The Objectives and Targets of the EMS were reviewed and revised for the reporting period 2017.

2.3.2 *Environmental objectives and targets.*

Table 2 below provides the Objectives and Targets for 2017 and details progress made regarding each objective. Table 3 provides the Objectives and Targets for 2018 and the methods by which they will be achieved.

An environmental management plan (EMP) was prepared as part of the EMS for the facility. The EMP comprises information on the following topics:

- Site description
- Site infrastructure
- Leachate Collection and treatment Leachate Management System
- Landfill Gas Abatement Methods
- Surface water Control Measures
- Environmental Monitoring
- Site Security and Site Offices
- Operational Matters
- Vermin control
- Fires
- Restoration and Aftercare

Table 2 **Achievements of Objectives and Targets for 2017**

Achievement of Objectives and Targets for 2017			
	Comments	Date	Responsibility
Objective No 1:			
1.1 Install new low calorific flare	Pumping trials completed to evaluate current gas yield. Gas Model completed by external consultants	Nov 2017	Facility Manager / Facility Technician
Objective No 2:			
2.1 Compile enhanced data set in accordance with the leachate management plan	Ongoing. Data discussed in GW Technical Assessment Report, submitted in June 2015	Dec 2017	Facility Manager / Facility Technician
Objective No 3:			
3.1 Complete the Groundwater Technical Assessment and Implement any recommendations	The GWTA report was submitted in June 2015. RFI response report was submitted in December 2015. Waiting on comments from EPA	Dec 2017	Facility Manager / Facility Technician

Table 3 **Objectives and Targets for 2018**

Objectives and Targets for 2018			
	Comments	Target	Responsibility
Objective No 1:			
1.1 Resolve landfill gas flare issues	Submit proposals for revised LFG flaring infrastructure, and procure and install infrastructure as appropriate	December 2018	Facility Manager / Facility Technician
Objective No 2:			
2.1 Continued monitoring of groundwater data	Interrogate environmental monitoring data and abstracted leachate data to evaluate effectiveness of the capping works and enhanced leachate abstraction system	December 2018	Facility Manager / Facility Technician
Objective No 3:			
3.1 Analysis of leachate volumes	Ongoing. Examine leachate volumes extracted, with a view to better aligning predicted volumes with extracted volumes	December 2018	Facility Manager / Facility Technician

2.3.3 *Corrective action Procedure*

Procedures are in place in accordance with Condition 2.3.2.3 of the licence to monitor, measure, audit and record the environmental performance of the environmental management system. These procedures establish how non-conformance within the system is dealt with and how any corrective and preventive action is carried out. A corrective action procedure was prepared in October 2008 (reviewed in 2010) and is included in the overall EMS report.

2.3.4 *Awareness and Training Programme*

In accordance with Condition 2.3.2.4 of the licence, an awareness and training programme has been developed to increase environmental awareness among staff and identify training needs of all personnel working at Killurin Landfill. The facility manager has overall responsibility for reviewing training needs on an annual basis to ensure that all staff have the necessary skills and level of awareness to carry out their duties to the highest environmental and safety standards. Training records are kept on file at Holmestown Waste Management Facility.

2.3.5 *Full title of any procedures developed by the licensee in the year which relates to the facility operation*

No additional procedures were developed or submitted during the reporting period.

2.3.6 *Report on communication programme*

The site's EMS includes a procedure for communication. In addition Wexford County Council provides the following documentation for public viewing at Holmestown Waste Management Facility:

Table 4 List of records available for public access in relation to the landfill

List of records available for public viewing
Waste Licence W0016-2
Waste Licence application
Correspondence with the EPA
Incident / complaints records
Audit records
All monitoring records
Leachate removal records
Vermin control reports

3 REPORTED INCIDENTS & COMPLAINTS SUMMARIES

3.1 Incidents

No incidents were reported during this reporting period. However ongoing elevated levels of ammonia (which are decreasing over time) are still being recorded in downstream groundwater boreholes, all boreholes were within Interim Trigger levels and all were below the 2016 levels. Refer to quarterly monitoring reports and the Leachate Management Plan for further details.

3.2 Complaints

No complaints were received during this reporting period.

4 DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD & THOSE PROPOSED FOR THE COMING YEAR

4.1 Landfill Engineering Works

4.1.1 *Completed Engineering Works 2017*

Engineering works for 2017 as detailed in the Leachate Management Plan were progressed as follows:

- Continue the leachate extraction infrastructure maintenance works programme
- Purchased 24 number GeoPumps to replace the older leachate pumps on site

We completed the landfill gas pumping trial with a view to ascertaining the actual gas yield from the waste mass in Q1 2017, we also completed a landfill gas model in Nov. 2017.

4.1.2 *Proposed Engineering Works 2018*

Proposed engineering works for 2018 as follows:

- Continue the leachate extraction infrastructure maintenance works programme
- Submit SEW to replace existing flare with a new low calorific flare to EPA for approval
- Procure and install low calorific flare

4.2 Restoration and Aftercare

A revised restoration and aftercare plan was submitted to the EPA for approval in July 2013.

Restoration works are now complete at the facility.

5 WASTE ACCEPTANCE & HANDLING

5.1 Waste Activities carried out at the Facility

No waste disposal operations took place on site at Killurin Landfill during the reporting period 1st January 2017 to 31st December 2017

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5.2 Total Quantity of Waste Consigned Off Site

A summary of the total quantity of leachate consigned off site at Killurin Landfill for the period 1st January 2017 to 31st December 2017 is presented below in Table 5.

The total volume of leachate transported off site for treatment at Wexford Wastewater Treatment Works was 2,600 Tonnes.

5.3 Remaining capacity of the site

Killurin Landfill closed at the end of June 2008. There is no remaining landfill capacity.

Table 5 **Waste consigned off-site from Killurin Landfill from 1st January to 31st December 2017 (tonnes)**

Waste Out	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly totals
LEACHATE	345	397	358	202	186	131	59	59	231	124	382	126	2600
Total													2600

6 ENVIRONMENTAL NUISANCES

6.1 Review of environmental nuisance control at the facility for the reporting period

Nuisances at Killurin Landfill are logged in a monthly tick-box report and action is taken immediately to address any identified issues. Table 7 below summarises the measures implemented on site to combat environmental nuisances during 2017.

Table 6 Environmental Nuisance Control during 2017

Nuisance	Mitigation Measures in Place
Vermin	Permanent bait points set up on site (internal and external). Inspections carried out on a monthly basis. If infection found then weekly inspections until rodent free. Monthly reports produced and kept at Holmestown site office.
Litter	Killurin landfill is litter free.
Flies	No flies present.
Odour	No odour emissions

7 RESOURCE & ENERGY CONSUMPTION

7.1 Electricity and Energy Usage

Electricity usage for the reporting period was estimated at 80,000 kWh.

7.2 Water

Domestic water usage data was not recorded.

7.3 Diesel

Total diesel fuel consumption (for operations) is estimated to be 0 litres from 1st January to 31st December 2017.

8 ENVIRONMENTAL MONITORING & EMISSIONS SUMMARY

8.1 Summary report on emissions

A summary of emissions monitoring at Killurin Landfill carried out during this reporting period (January 2017 – December 2017) is contained in Table 7 below. The E-PRTR Regulation (EC) No. 166/2006 concerning the establishment of a European Pollutant Release and Transfer Register came into force in February 2006 and was brought into Irish law through SI No 123 of 2007. As a result all industries have to annually report environmental emissions and waste transfer data through a web-based form as part of their AER. The PRTR 2017 document is included in Appendix A1.

Table 7 **A summary of Emissions monitoring as specified in Waste Licence W0016-2**

Emission Monitoring	Frequency
Landfill Gas	Continuously (Dwellings adjacent to Landfill, Flare) Weekly (Site Accommodation) Monthly (Landfill Gas monitoring Wells)
Leachate	Quarterly (Level & Analysis Note 2) Annually (Analysis)
Surface water	Weekly (Visual) Quarterly (Analysis) Annually (Analysis)
Groundwater Levels	Quarterly (Borehole Level)
Groundwater	Quarterly (Analysis) (Note 2) Annually (Analysis)
Noise	As required (Note 1)
Dust	As required (Note 1)
River Water	Quarterly (Analysis)

Note 1: When specific engineering works are being carried out

Note 2: As detailed in the Leachate Management Plan additional monitoring of groundwater and leachate around and within the Landfill footprint took place during 2017

8.2 Environmental Monitoring

Wexford County Council carries out a comprehensive environmental monitoring programme, in compliance with the waste licence conditions, to assess the significance of emissions. The monitoring programme includes Landfill Gas, Leachate Level & Quality, Surface Water Quality, Groundwater Level & Quality, Noise and Dust monitoring (as required), Odour monitoring and Meteorological monitoring and Topographical.

Monitoring during this reporting period was carried out according to Schedule D of Waste Licence W0016-2, Quarters 1, 2, 3 and 4 results for 2017 are summarised in this chapter. Additional monitoring was also carried out as detailed in the Leachate Management Plan. A monitoring point location plan is provided see Appendix A2.

8.2.1 *Landfill gas*

In accordance with Schedule D.1 of the Waste Licence W0016-2, the following monitoring has been carried out and reported to the Agency.

- Monitoring boreholes boundary locations GW1, GW9, GW10, GBH1 and GBH2
- Perimeter boreholes T1, T2, T3, T5, T6, T7, T9, T10, T11, T12, T13, T14, T15, T16, T17, T18 and T19 were monitored on a monthly basis by Wexford County Council site staff.
- In waste landfill gas extraction wells series W, A and LE wells were monitored on a monthly basis by Irish Biotech Systems.

The majority of boreholes have varying levels of gas quality over the reporting period and no particular trend could be identified. Gas monitoring details are provided in Table 8 below.

Table 8 Gas Monitoring Points

Off site and on site gas boreholes		
CO2, O2 and CH4 levels (monthly)	23 boundary locations 97 in waste locations	Boundary gas monitoring wells T1 –T3, T5- T7, T9-T19 GW1, GW9, GW10 In waste landfill gas extraction wells series W, A & LE wells
		Resident gas boreholes: GB1 and GB2
Residential Dwelling gas alarms		
CO2 and CH4 levels (continuously)	2 points	Two closest residences
CO2 and CH4 levels (As required)	4 points	All site buildings

Perimeter boreholes

No exceedences of licence limits were recorded at T17, T18, T19, GBH1 or GBH2 which would indicate that landfill gas migration off site has not taken place.

Carbon Dioxide levels inT2, T3, T5, T6, T9, T11, and T12 are slightly elevated. The most likely cause of the slightly elevated readings is their location in a mature wooded area. The exceedences are low (max 2.8% at T12 in Feb).

No exceedences of licence limits were recorded at any of the remaining peripheral gas monitoring wells. This indicates that landfill gas migration off site has not taken place.

Methane (CH_4)

Resident's boreholes

The following was recorded at resident's boreholes during this reporting period:

- **GB1 at Carley's:** Methane levels at this monitoring location were seen to be below the 1.0% volume per volume (v/v) trigger-level throughout the reporting period.

- **GB2 at Kelly's:** Methane levels at this monitoring location were seen to be below the 1.0% volume per volume (v/v) trigger-level throughout the reporting period.

The CH_4 trigger level at the gas monitoring wells is 1.0% volume by volume (v/v).

Carbon Dioxide (CO_2)

Resident's boreholes

The following was recorded at resident's boreholes during this reporting period:

- **GB1 at Carley's:** All results were below the 1.5% volume per volume (v/v) trigger-level.

- **GB2 at Kelly's:** All results were below the 1.5% volume per volume (v/v) trigger-level.

The CO_2 trigger level at the gas monitoring wells is 1.5% volume by volume ` (v/v).

Monitoring boreholes GBH1 and GBH2 are located on the resident's side of the gas migration cut off trench. The cut off trench consists of an excavated trench along the landfill boundary adjacent to Carley's and Kelly's residents. Installed in this trench is an impermeable geotextile membrane with a series of gas extraction wells installed on the landfill side. The results indicate that the gas migration cut off trench combined with the gas abstraction system is operating as designed. Continuous monitoring for the detection of landfill gas was carried out at Carley's and Kelly's residents. Landfill gas was not detected at either residence in 2017.

Methane and Carbon Dioxide levels (as expected) remain elevated in the dual leachate/Gas extraction wells which are located in the waste body (Series W, A & LE). This gas is being continuously extracted and flared off. The monthly results are available for inspection at the Holmestown waste Management Facility site office.

8.2.2 *Flare Emissions*

Landfill gas is being flared off using a 150M^3 open flare; it is not possible to carry out an emission test on this flare unit.

8.2.3 *Leachate levels and monitoring*

Leachate monitoring points

Leachate Monitoring			
Level	16 points	LE12-1 to LE12-16	Quarterly
Analysis	1 point 48 points	Leachate storage tanks Series W, A & LE wells	Monthly / Annually Quarterly

Leachate levels

Samples for analysis were obtained from the leachate storage tanks in 2017 in compliance with Schedule D.5. The levels were recorded using a dip meter on a quarterly basis by Wexford County Council staff at the landfill. The annual analysis results of the leachate removed from the tanks in 2017 is detailed in Table 10. The quantity exported off-site in 2017 was 2,600 tonnes compared to 4,998 tonnes in 2016.

Leachate is collected from 40 extraction wells located around the site within the waste boundary. This leachate is directed to the three holding tanks located in the northwest of the landfill. It is then removed by road tanker on a routine basis and transported to Wexford Wastewater Treatment Plant and to Holmestown leachate treatment plant for treatment in accordance with Waste Licence Condition 6.6.

Leachate monitoring

Annual monitoring was undertaken on 13th September 2017. A leachate sample was collected from the leachate storage tanks. The sample was analysed for a range of parameters as defined in Table D.5.1 of the Waste Licence 16-2.

The typical characteristics of leachate generated on site are presented in Table 10. The results are similar to those obtained for the last reporting period and are in general indicative of a landfill in the methanogenic stage of decomposition of organic compounds i.e. conversion of organic compounds to landfill gas.

Table 9

Table 10 **Leachate analysis results 20115.97**

Sampling Points		Tanks
Sampling Date		13/09/2017
Parameters	**Units**	Annual
Temperature	^{o}C	15.9
Ammonia	mg/l N	157
BOD	mg/l 02	26
COD	mg/l 02	174
Chloride	mg/l Cl	300
Conductivity	µS/cm	3150
Fluoride	mg/l F	<0.05
Mercury	µg/l	<0.01
Ortho-Phosphate	mg/l P	0.112
pH	pH	8
Sulphate	mg/l SO4	<10
Total Oxidised Nitrogen	mg/l N	12.9
Nickel	µg/l	25.5
Boron	µg/l	681
Cadmium	µg/l	<0.08
Calcium	mg/l	85.4
Chromium	µg/l	13.5
Copper	µg/l	9.47
Iron	µg/l	3060
Lead	µg/l	<0.2
Magnesium	mg/l	25.6
Manganese	µg/l	294
Potassium	mg/l	125
Sodium	mg/l	245
Cyanide	mg/l	<0.05
Zinc	µg/l	9.77

Additional leachate analysis was undertaken during 2017 from 48 number leachate wells located within the waste body, the results of this analysis is to be submitted as part of the Leachate Management Plan review reports.

Inspection and testing of leachate storage tanks

The leachate tanks were tested in 2017; the tanks passed the integrity test and were assessed as being fit for the storage of leachate. The tanks are due to be re-tested in 2020.

8.2.4 *Surface Water*

Under Schedule D.5 of the Waste Licence 16-2, surface water monitoring was required in the locations listed below. SW1 is located upstream of the site, SW2 is situated downstream of the site SW3 is located on the eastern side of the site adjacent to the landfill flare compound and SW4 is located at the southern tip of the facility (see monitoring point location drawing in Appendix A2). The site streams /

drains regularly run dry during the drier months of the year and consequently surface water samples cannot be obtained. These are discussed in subsequent sections.

Table 11 Surface water monitoring locations and frequency

Surface water monitoring locations and frequency			
Parameter	**Location**	**Name**	**Frequency**
Visual Inspection/ Odour	Off site (River Slaney)	S1, S2, S3	Quarterly
Chemical analysis	Off site (River Slaney)	S1, S2, S3	Quarterly
Visual inspection	On site	SW1, SW2, SW3 and SW4	Weekly
Chemical analysis	On site	SW1, SW2, SW3 and SW4,	Quarterly and Annual

Visual inspection of surface water

Surface water on site consists of a series of open and piped drains. Weekly visual inspections of surface water were conducted for monitoring points SW1, SW2, SW3 (SW 3 is a surface water manhole that collects surface water from the upper cap subsurface drainage layer and is adjacent to the flare compound, monitoring commenced in Q4, 2012) and SW4, and quarterly at off-site locations (River Slaney) S1, S2 and S3. All surface water details are included in previously submitted monitoring reports for the landfill. No visual abnormalities were recorded for any of the surface water inspection points during the reporting period.

Surface water quality analysis

Results for all surface water monitoring carried out in 2017 was submitted to the Agency in the annual monitoring report. Due to dry periods it was not always possible to retrieve samples from all of the monitoring points. No sample was obtainable from SW3 and SW4 in Q2. No sample was obtainable from SW3 in 2017.

All sampling and analysis was carried out in accordance with recognised quality assurance and control procedures. The detailed monitoring results are presented in the annual monitoring report. The range of analysis is as specified in Schedule D.5 of the Waste Licence 16-2 and includes parameters such as ammoniacal nitrogen, BOD, COD, dissolved oxygen, pH, electrical conductivity, suspended solids and temperature. No atypical results were recorded during the quarterly monitoring in 2017.

River water

The river water monitoring results for the river Slaney are presented in the annual monitoring report. Monitoring location S1 is located upstream of the landfill, monitoring location S2 in the river adjacent to the landfill and monitoring location S3 is located downstream of the landfill and all are located within the tidal zone of the river estuary. No atypical results were recorded during the quarterly monitoring in 2017. There is no evidence from the upstream and downstream river results that the landfill is impacting negatively on the Slaney.

8.2.5 *Groundwater*

Table 12 **Groundwater monitoring locations**

Groundwater Monitoring Locations		
Downgradient	1 point	GW1
Downgradient (border of reed beds)	1 point	GW9
Downgradient (border of reed beds)	1 point	GW10
Upgradient	1 point	GBH1
Upgradient	1 point	GBH2

Groundwater levels

Groundwater levels were measured on a quarterly basis using a dip meter. The groundwater dip levels are included in the annual monitoring report. Groundwater levels remained relatively constant throughout the monitoring period, with only minor variations in groundwater levels in accordance with prevailing weather conditions. During the drier months the groundwater levels were seen to gradually decrease while during wetter periods where prolonged rain was evident.

Groundwater quality boreholes

No significant variation from historical result trends was noted in 2017. The highest levels of contaminants have been recorded in the boreholes located along the south east side of the landfill. These BH's are on the maximum hydraulic groundwater gradient that falls from the landfill towards the river. Samples were taken from both soil and underlying rock layers. In both cases the distribution of contamination was not even, with certain boreholes recording higher results than others. This may be due to preferential flow paths caused by gravel/sand lenses in the soils and increased permeability due to higher levels of fracturing or faults in the underlying rock. The result trends show that leachate management on site has had a beneficial effect on these wells and Ammonal, Chloride and Conductivity levels have been decreasing since 2006. Boreholes with low contaminant readings have exhibited little change since 2006. This may be due to the lower permeability and recharge in these zones. Further information on the above can be found in the annual monitoring report and the Leachate Management Plan review report.

Private Well water analysis

Table 13 **Private well monitoring locations**

Drinking water		
Private residence	UV treated	Kitchen tap

Quarterly and annually monitoring was carried out on drinking water samples from our neighbour’s private well.

8.2.6 *Noise*

No noise monitoring was undertaken during 2017.

8.2.7 *Meteorological monitoring*

All 2017 meteorological monitoring information was obtained from the Met Éireann weather station located at Johnstown Castle, Wexford; this station is within 10km of the Killurin Landfill site. The monitoring data is contained in Appendix A3.

8.2.8 *Topographical Survey*

The latest topographical survey of the site was carried out by Capital Surveys Ltd in November 2014. The topographical survey drawing is contained in Appendix A2.

Given that the landfill has not accepted waste since 2008, and that the site has been fully capped the enclosed topographical survey was carried out for the purpose of checking settlement in the waste body.

We propose to carry out the next topographical survey during 2018.

8.2.9 *Slope Stability Assessment*

Walkover slope stability assessments were conducted weekly in 2017 to check for any visible signs of slippage or instability on the flanks of the waste body. None were noted. It was concluded that the waste body remained stable during 2017.

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9 Water Balance Calculations

The objective of the assessment of water balance calculations is to understand and predict the liquid inputs and outputs of the facility. Water balance calculations have been calculated for the period 1st January 2017 to 31st December 2017 to estimate the approximate volume of leachate generated on site. This volume can then be compared to the volume of leachate leaving site, by tanker over the weighbridge.

The water balance addressed the volume of leachate generated at the site including the estimated annual infiltration of rainfall. The water balance methodology is described below and the calculation is shown in Appendix A5.

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

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

Lo = leachate produced (m^3)

ER = effective rainfall (m) (Use actual rainfall (R) for active cells)

A = area of cell (m^2)

LW = liquid waste (m^3)

IRCA = infiltration through restored and capped areas (m)

l = surface area of lagoon (m^2)

a = absorptive capacity of new waste (m^3/t)

w = weight of waste deposited (t/a)

An absorptive capacity of 0.025 m^3 per tonne was assumed.

The meteorological data used was obtained from the nearby Met Eireann meteorological station at Johnstown Castle. The total rainfall from 1st January 2017 to the 31st December 2017 was approximately 1063 mm. Meteorological data is presented in Appendix A3.

The water balance calculation considers the infiltration types influencing leachate generation:

- Infiltration directly through the permanently capped areas, estimated at 5%
- Infiltration due to run-off from the upper capped areas onto the capped perimeter access road, and infiltration through that capped road. This is treated separately to overall cap filtration as it is a relatively flat surface.

The estimated volume of leachate generated for the period 1st January 2017 to the 31st December 2017 is 1,771 m^3 (a calculation summary is included in Appendix A5). During the same period 2,600 m^3 of leachate was removed from the site for treatment in the waste water treatment plant at Wexford Town WWTP and the leachate treatment plant at Holmestown WMF. A monthly breakdown of leachate volumes removed is presented in Table 5 above. It is expected that the additional volume of leachate removed over that generated is due to the additional deeper leachate extraction boreholes installed during 2014. While the process of reducing the elevation of the leachate water table is ongoing, a surplus of leachate extracted each year (over that generated) can be expected.

The fact that more leachate was removed off-site than was estimated to be generated in 2017 is a positive development.

APPENDICES

A1 PRTR 2017

| PRTR# : W0016 | Facility Name : Killurin Landfill Site | Filename : Killurin_PRTR_W0016_2017.xls | Return Year : 2017 |

Guidance to completing the PRTR workbook

PRTR Returns Workbook

Version 1.1.19

REFERENCE YEAR	2017

1. FACILITY IDENTIFICATION

Parent Company Name	Wexford County Council
Facility Name	Killurin Landfill Site
PRTR Identification Number	W0016
Licence Number	W0016-02

Classes of Activity

No.	class_name
-	Refer to PRTR class activities below

Address 1	Newtown Lower
Address 2	Killurin
Address 3	
Address 4	
	Wexford
Country	Ireland
Coordinates of Location	-6.56116 52.3816

River Basin District	IESE
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Sean Meyler
AER Returns Contact Email Address	sean.meyler@wexfordcoco.ie
AER Returns Contact Position	waster Operations Manager
AER Returns Contact Telephone Number	053 9196000
AER Returns Contact Mobile Phone Number	087 6846089
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	1
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. WASTE IMPORTED/ACCEPTED ONTO SITE Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	No

4.1 RELEASES TO AIR

Link to previous years emissions data

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in Kilos			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01 - Methane (CH4)		C		ALT GasSim model	376810.84484965	376810.84484965	0.0	0.0

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

SECTION B : REMAINING PRTR POLLUTANTS

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

* Select a row by double-clicking on the Pollutant Name (Column II) 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: Kilurin Landfill Site

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)	474065.788825	C	EST	Gassim Lite	N/A	
Methane flared	97254.941778945	M	OTH	Continuous Analyser	1250.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0	C	OTH	Not applicable	0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	376810.84484965	C	EST	Total Estimated Methane	N/A	

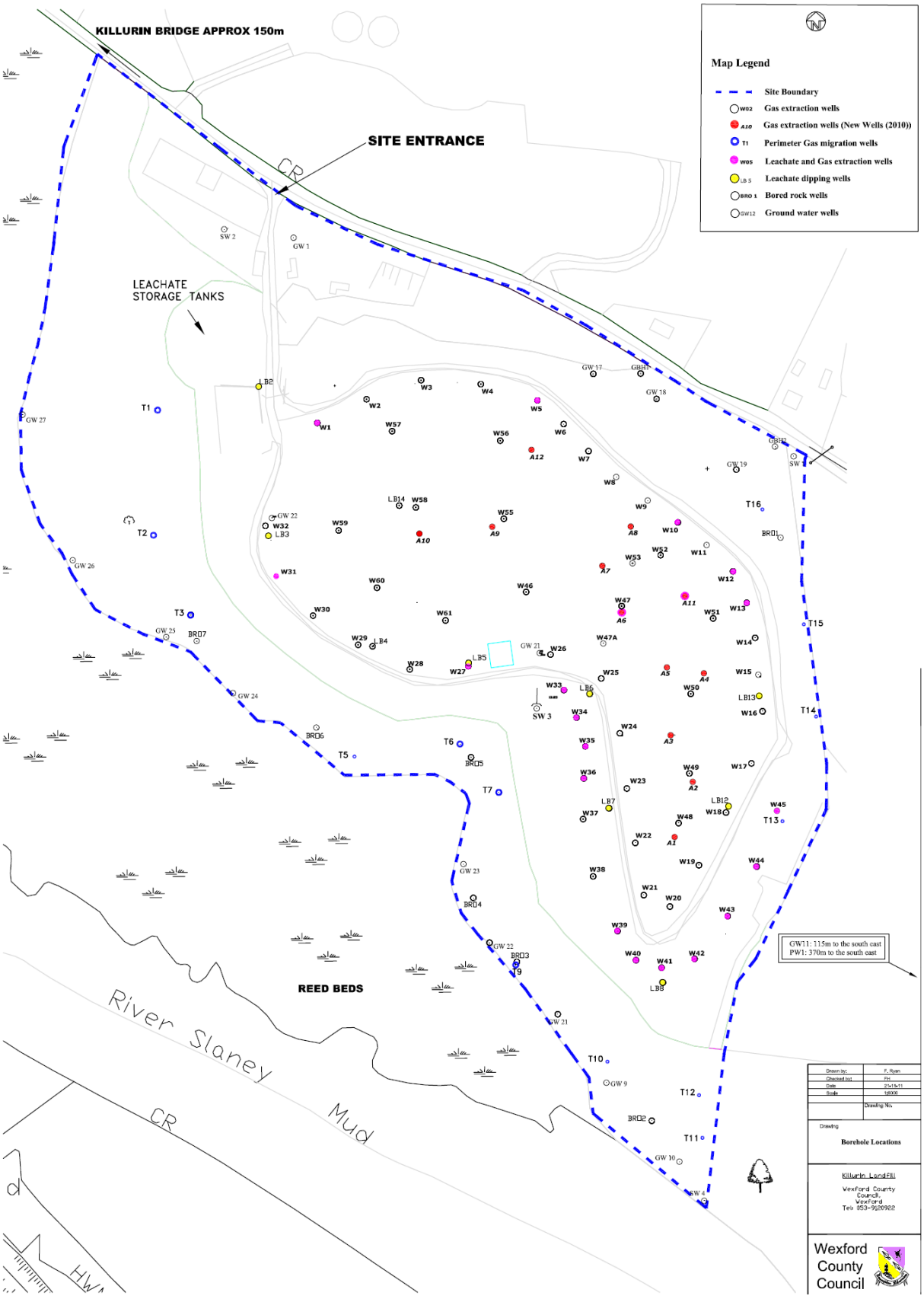
5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

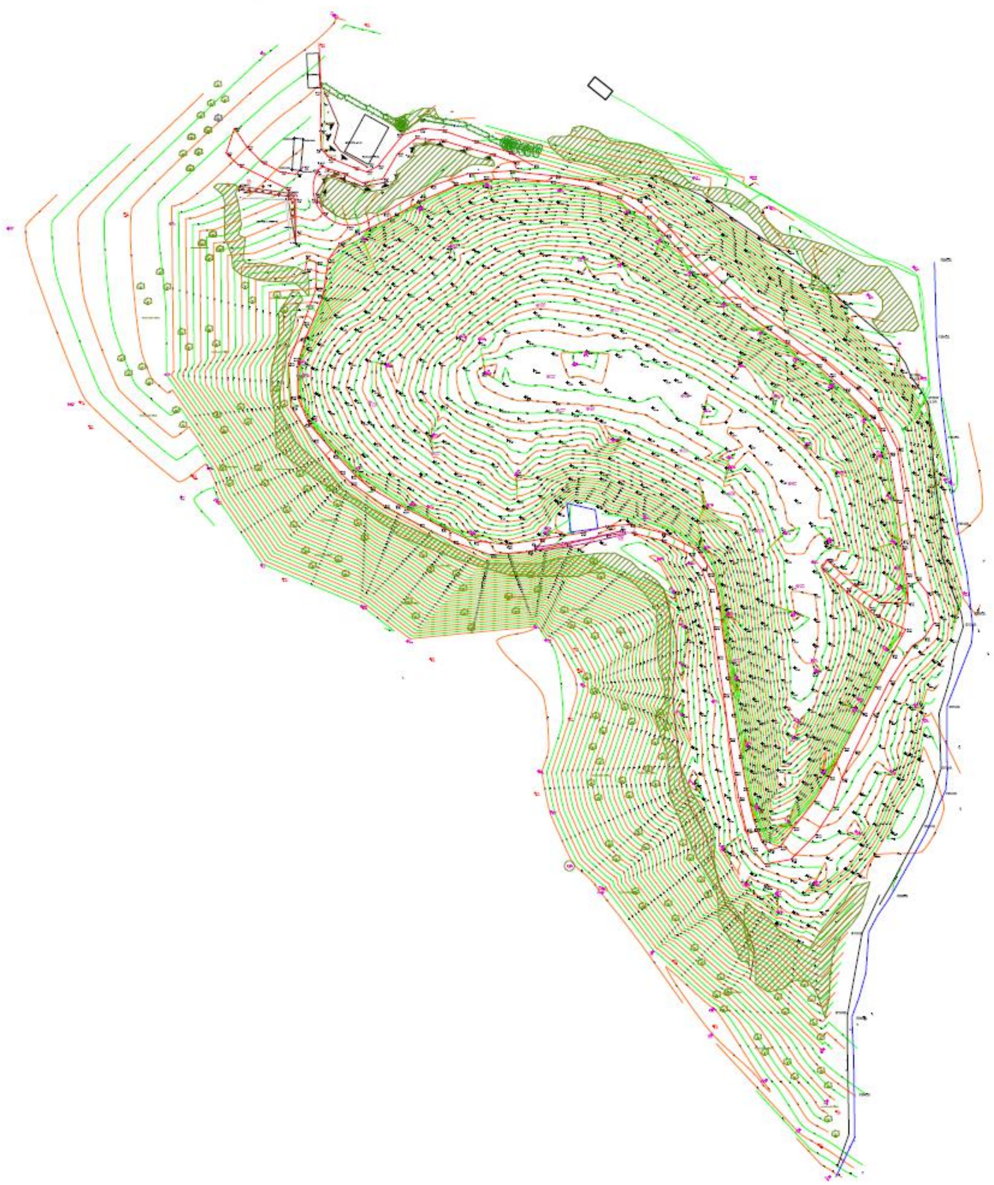
Please enter all quantities on this sheet in Tonnes

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste: Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	02 02 02	No		animal-tissue waste	D10	M	Weighed	Offsite in Ireland	Waterford Proteins Ltd. ,Dept of Agriculture R919	Ferrybank, ,Waterford ,,Ireland		
Within the Country	19 07 03	No	0.0	landfill leachate other than those mentioned in 19 07 02	D9	M	Volume Calculation	Offsite in Ireland	Wexford WWTP Wexford County Council,","	Pumping Station,,Trinity Street ,Wexford,,Ireland		
Within the Country	19 07 03	No	2600.0	landfill leachate other than those mentioned in 19 07 02	D9	M	Volume Calculation	Offsite in Ireland	Holmestown Waste Management Facility,W0191-02	Wexford County Council,Holmestown,Bamtown,Co. Wexford,Ireland		
Within the Country	20 01 40	No	0.0	metals	R4	M	Weighed	Offsite in Ireland	Mulligan Dismantling and Salvage Ltd,WP/05/20	Mulligan Dismantling and Salvage Ltd,Lower Inch,Gorey,County Wexford,,Ireland		

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

A2 Topographical and Monitoring location drawings


KILLURIN BRIDGE APPROX 150m
SITE ENTRANCE
CR
LEACHATE STORAGE TANKS
Map Legend
Site Boundary
Gas extraction wells
Gas extraction wells (New Wells (2010))
Perimeter Gas migration wells
Leachate and Gas extraction wells
Leachate dipping wells
Bored rock wells
Ground water wells
REED BEDS
River Slaney
Mud
CR
GW11: 115m to the south east
PW1: 370m to the south east
Drawn by: F. Ryan
Checked by: Fin
Date: 21x15x11
Scale: 1@500
Drawing No.
Drawing
Borehole Locations
Killurin Landfill
Wexford County Council,
Wexford
Tel: 053-9120922
Wexford County Council



A :			
Rev :	Date :	Description :	By :

Capital Surveys

Land Surveyors & Civil Engineers.

Engineers Ireland

Society of Chartered Surveyors Ireland

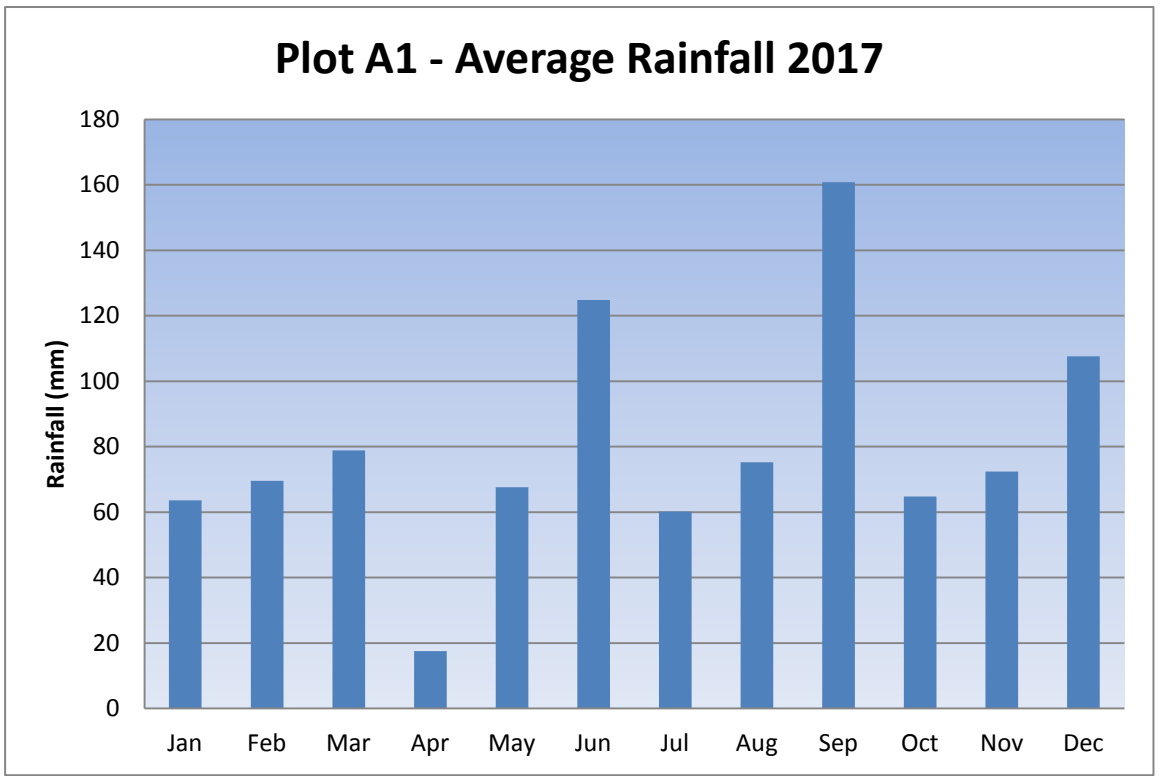
Brickeistown, Taghmon, Co. Wexford.
Phone: (053) 34218 or (087) 6857464

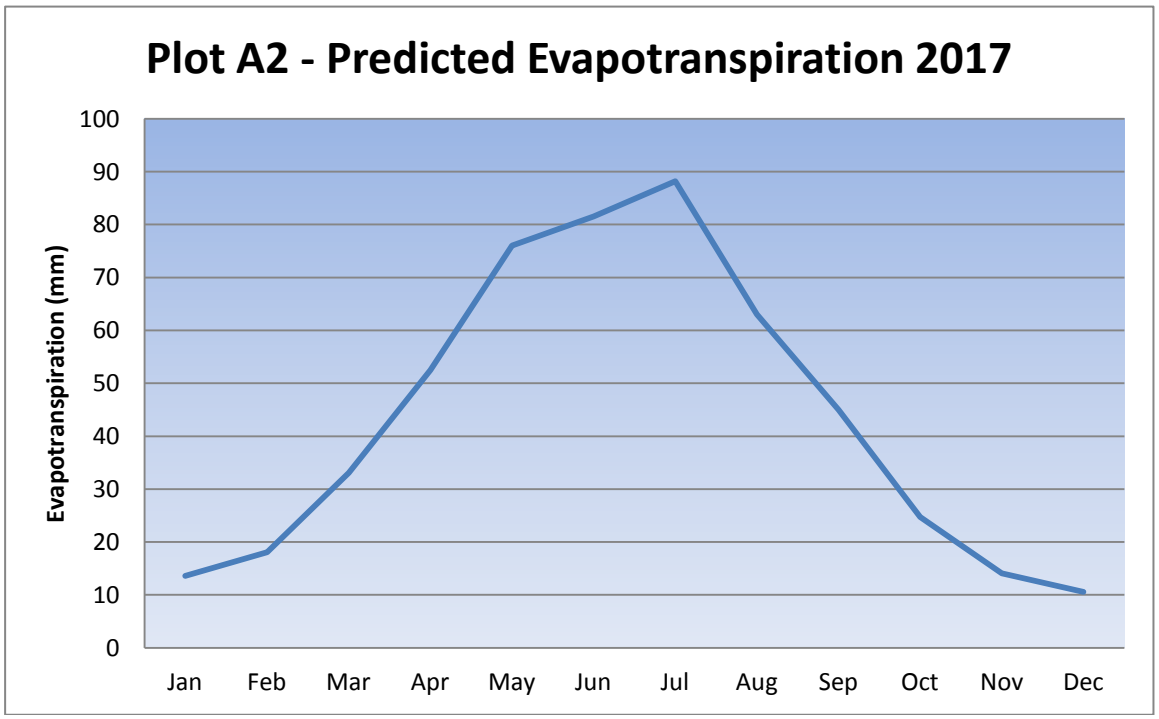
email : info@capitalsurveys.ie
webmail : www.capitalsurveys.ie

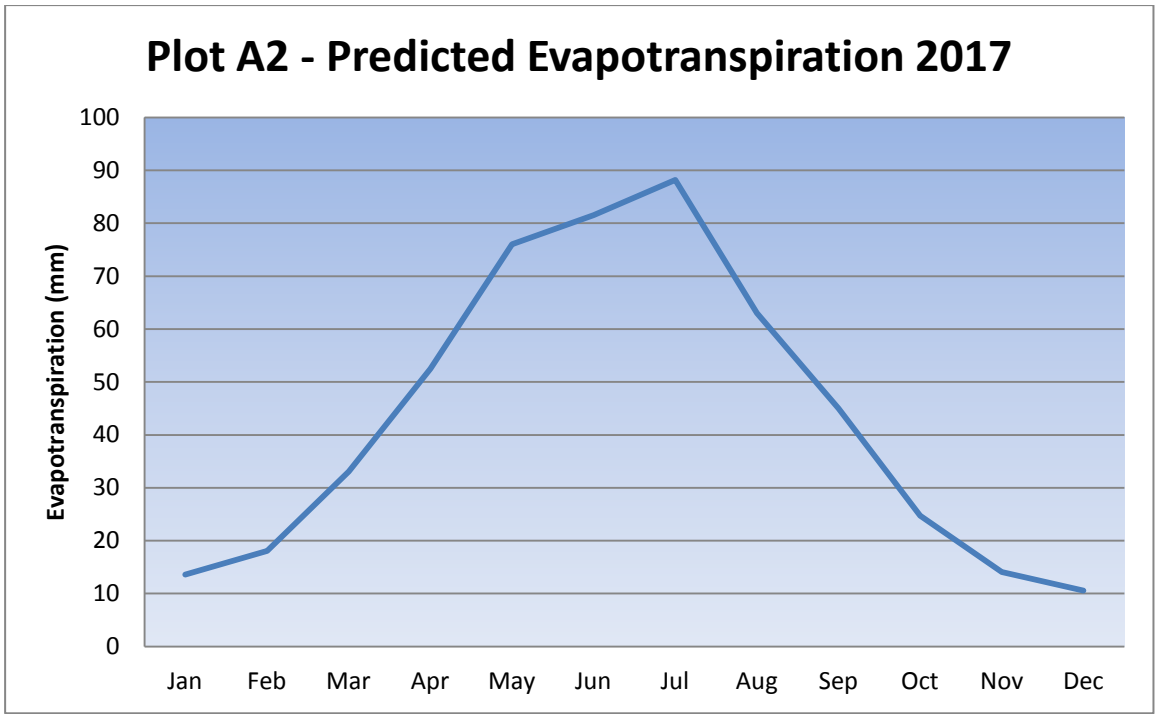
Project: Killurin Land Fill Topo Survey.	Client : Frab Hobbs. Wexford County Council Homestown Land Fill Facility. Homestown, Co Wexford.
Dwg Title : Site Plan.	

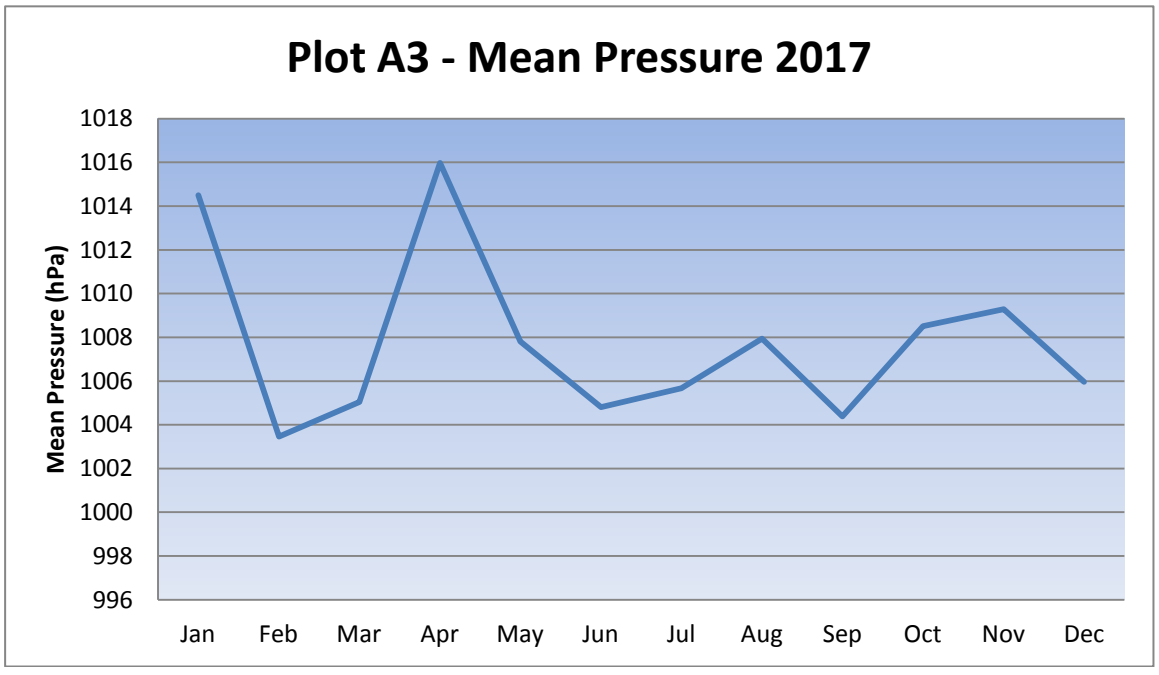
Scale :	Date :	Job no :	Dwg no :	Dr'by :	Rev.
1 : 500.	Nov 14	12-77.	12-77/1.	J K..	A

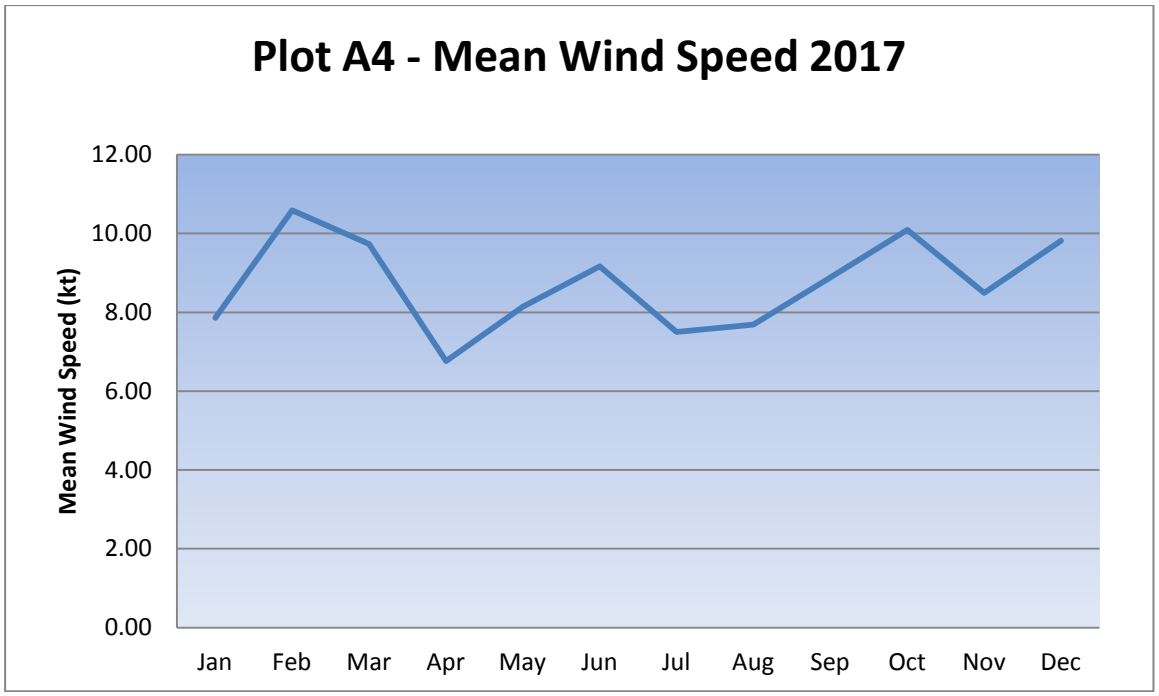
A3 Meteorological Data

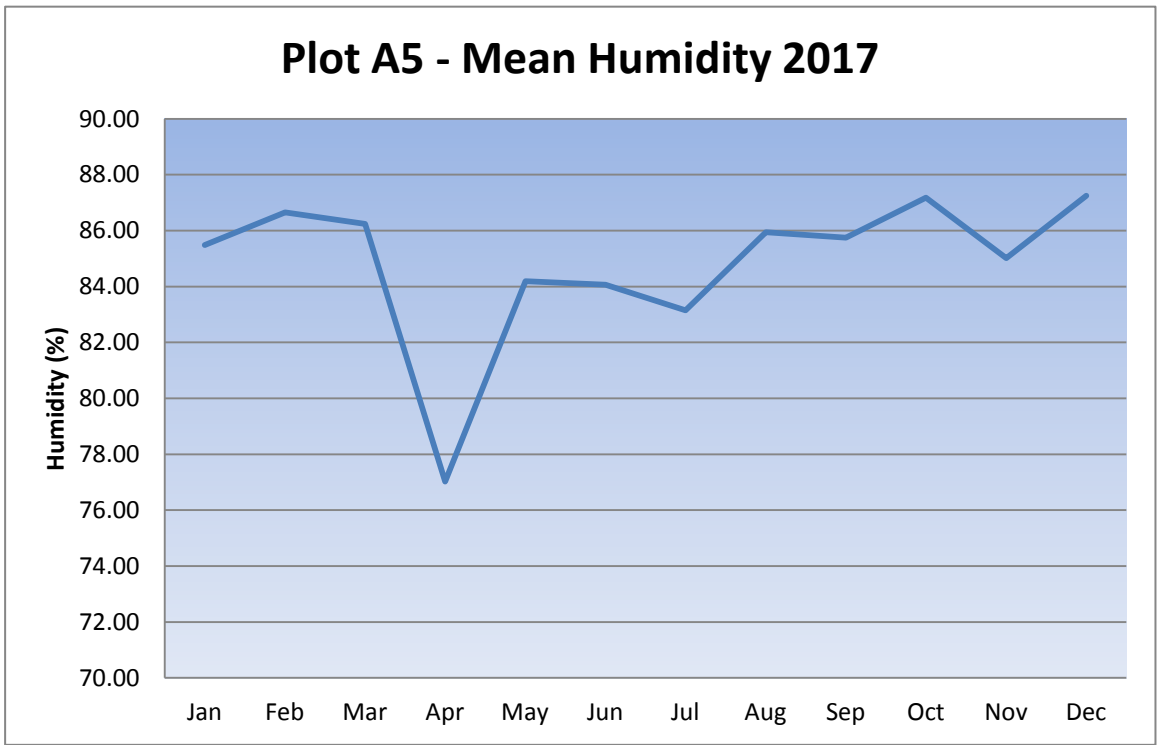





Plot A2 - Predicted Evapotranspiration 2017
Evapotranspiration (mm)
100
90
80
70
60
50
40
30
20
10
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Plot A3 - Mean Pressure 2017
Mean Pressure (hPa)
1018
1016
1014
1012
1010
1008
1006
1004
1002
1000
998
996
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Plot A4 - Mean Wind Speed 2017
Mean Wind Speed (kt)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Plot A5 - Mean Humidity 2017
Humidity (%)
90.00
88.00
86.00
84.00
82.00
80.00
78.00
76.00
74.00
72.00
70.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

A4 Air emission report

No air emission report was carried out in 2017

Water Balance Calculation

Appendix A5

Water Balance Calculation for Killurin Landfill 2017

Month	Rainfall	Evaporation	Effective Rainfall	Capped Area (above road)	Capped Area (Below road)	Capped Area (Haul Road)	Additional runoff to haul road (effective area)	Capped Infiltration	Infiltration through incident rain on haul road	Infiltration from runoff to haul road	Total Leachate Production	Cumulative Leachate Production	Leachate Tankered Offsite
	(mm)	(mm)	(mm)	(m^2)	(m^2)	(m^2)	(m^2)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
Jan	63.6	17.7	45.9	39,282	15,340	6,600	39,282	125.4	30.3	54.1	209.7	209.7	344.5
Feb	69.6	26.3	43.3	39,282	15,340	6,600	39,282	118.3	28.6	51.0	197.9	407.6	396.9
Mar	78.8	50.8	28	39,282	15,340	6,600	39,282	76.5	18.5	33.0	127.9	535.6	358.0
Apr	17.5	75.2	0	39,282	15,340	6,600	39,282	-	-	-	-	535.6	202.3
May	67.6	114.4	0	39,282	15,340	6,600	39,282	-	-	-	-	535.6	186.4
Jun	124.8	121.6	3.2	39,282	15,340	6,600	39,282	8.7	2.1	3.8	14.6	550.2	130.7
Jul	60.2	126.8	0	39,282	15,340	6,600	39,282	-	-	-	-	550.2	59.0
Aug	75.2	90.4	0	39,282	15,340	6,600	39,282	-	-	-	-	550.2	59.0
Sep	160.8	65.5	95.3	39,282	15,340	6,600	39,282	260.3	62.9	112.3	435.5	985.7	231.0
Oct	64.8	35.2	29.6	39,282	15,340	6,600	39,282	80.8	19.5	34.9	135.3	1,120.9	124.0
Nov	72.4	18.7	53.7	39,282	15,340	6,600	39,282	146.7	35.4	63.3	245.4	1,366.3	382.0
Dec	107.6	13.7	93.9	39,282	15,340	3,960	39,282	256.5	37.2	110.7	404.3	1,770.6	126.0
Total	963	756	393					1,073	235	463	1,771		2,600

Notes:
The calculation was carried out using MS Excel following the method from the EPA Landfill Manual on Landfill Site Design, as shown:

Lo = [ER(A) + LW + IRCA + ER(I)] - a(W);

where:
- Lo = leachate produced(m^3)
- ER = effective rainfall, [(ER) is defined as Total Rainfall (R) minus Actual Evapotranspiration (AE) i.e. ER=R-AE]
- A = area of cell (m^2)
- LW = liquid waste (m^3)
- IRCA = infiltration through restored and capped areas (m^2)
- I = surface area of lagoons (m^2)
- a = absorptive capacity of waste (m^3/t)
- W = weight of waste deposited (t/a)

* Infiltration Rates (%)

Infiltration (%)	Description
5	Stage 1 capping area, steep slopes below haul road
5	Stage 2-5 capping areas
10	Haul road
3	Runoff from Stage 2-5 capping areas discharging to haul road