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ANNUAL ENVIRONMENTAL REPORT 2011

KTK Landfill, Brownstown, Kilcullen, W0081-04

Submitted to:

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REPORT



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Table of Contents

1.0	INTRODUCTION	1
2.0	SITE HISTORY	1
3.0	REPORTING PERIOD	1
4.0	WASTE ACTIVITIES CARRIED OUT AT THE SITE DURING THIS PERIOD	1
5.0	QUANTITIY AND COMPOSITION OF WASTE RECEIVED, DISPOSED OF AND RECOVERED DURING THE REPORTING PERIOD AND EACH PREVIOUS YEAR	2
6.0	METHODS OF DEPOSITION OF WASTE	3
7.0	SUMMARY REPORT ON EMISSIONS	3
7.1	Dust Deposition	3
7.2	Noise Emissions	4
7.3	Landfill Gas Emissions	4
7.3.1	Locations and methods	4
7.3.2	Results	5
8.0	SUMMARY OF ALL REMAINING ENVIRONMENTAL MONITORING DATA	7
8.1	Introduction	7
8.2	Depositional Dust Monitoring	8
8.2.1	Dust monitoring methods	8
8.2.2	Dust monitoring results	8
8.3	Groundwater Monitoring	9
8.3.1	Groundwater monitoring locations	9
8.3.2	Groundwater Levels	10
8.3.2.1	Groundwater Level Measurement Methodology	10
8.3.2.2	Groundwater Level Measurements 2011	10
8.3.2.3	Methods for Determining Groundwater Quality	12
8.3.2.4	Groundwater Quality Results 2011	12
8.4	Private Wells Monitoring	19
8.5	Landfill Gas Monitoring	19
8.5.1	Landfill Gas Monitoring Locations	19
8.5.2	Landfill Gas Monitoring Methodologies	20
8.5.3	Site Buildings	20
8.5.4	Landfill Gas Monitoring Results	20



8.6 Leachate Monitoring 22

8.6.1 Leachate Monitoring Locations 22

8.6.2 Leachate levels 23

8.6.2.1 Methods for Measuring Leachate Levels 23

8.6.2.2 Leachate Level Results During 2011 23

8.6.2.3 Leachate Levels from Gas Extraction Wells Results During 2011 24

8.6.3 Leachate Composition and Analysis 25

8.6.3.1 Leachate Analysis Results 25

8.6.3.2 Leachate emissions to sewer 27

8.7 Environmental Noise Monitoring 28

8.7.1 Environmental noise monitoring locations 28

8.7.2 Environmental Noise Monitoring Methodology 28

8.7.3 Environmental Noise Monitoring Survey Results 29

8.8 Surface Water Monitoring 30

8.8.1 Surface water monitoring locations 30

8.8.2 Surface water quality sampling methodology and results 2011 30

8.8.3 Surface Water Visual Inspections 33

8.9 Meteorological Reporting 33

8.10 Asbestos Fibre Monitoring 33

8.10.1 Methodology 33

8.10.2 Results 33

9.0 RESOURCE AND ENERGY CONSUMPTION SUMMARY 2011 34

9.1 Resource Recovery and Energy Production Summary 34

10.0 VOLUME OF LEACHATE TRANSPORTED AND DISCHARGED OFF SITE. 35

**11.0 REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD, AND A
TIMESCALE FOR THOSE PROPOSED DURING THE COMING YEAR..... 35**

11.1 Developments During 2011 35

11.2 Proposed Development During 2012 36

11.3 Landfill Leachate Management 36

11.4 Restoration 36

11.5 Landfill Gas Management and Utilisation 36

11.6 Monitoring Infrastructure 36

**12.0 SITE SURVEY SHOWING EXISTING LEVELS OF THE FACILITY AT THE END OF THE REPORTING
PERIOD. 36**



13.0 ESTIMATED AND ANNUAL CUMULATIVE QUANTITIES OF LANDFILL GAS EMITTED FROM THE FACILITY..... 36

14.0 ESTIMATED ANNUAL AND CUMULATIVE QUANTITY OF INDIRECT EMISSIONS TO GROUNDWATER. 37

15.0 ANNUAL WATER BALANCE CALCULATION AND INTERPRETATION..... 38

16.0 METEROLOGICAL REPORT 2011 40

17.0 SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS FOR THE FORTHCOMING YEAR 40

 17.1 Definitions 40

18.0 FULL TITLE AND WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE WHICH RELATES TO THE FACILITY OPERATION..... 46

19.0 REPORTED INCIDENTS AND COMPLAINTS SUMMARY 47

 19.1 Reported Incidents and Complaints Summary..... 48

 19.2 Complaints..... 50

20.0 REVIEW OF NUISANCE CONTROLS AT KTK LANDFILL DURING 2011..... 51

 20.1 Bird Control..... 51

 20.2 Vermin Control..... 51

 20.3 Mud Control 51

21.0 REPORTS ON FINANCIAL PROVISION MADE UNDER THIS LICENCE, MANAGEMENT AND STAFFING STRUCTURE OF THE FACILITY, AND A PROGRAMME FOR PUBLIC INFORMATION..... 51

 21.1 Financial Provision..... 51

 21.2 Closure Restoration and Aftercare Costs (Known Environmental Liabilities)..... 51

 21.3 Financial Provisions for Unknown Environmental Liabilities 51

22.0 MANAGEMENT STRUCTURE AT KTK LANDFILL DURING THE REPORTING PERIOD 52

 22.1 Programme for Public Information 53

23.0 POLLUTION RELEASE TRANSFER RECORD..... 53

TABLES

Table 1: Wastes Received for Disposal during 2011..... 2

Table 2: Materials received for engineering and restoration purposes 2011 2

Table 3: Depositional Dust Emission Limit Value 3

Table 4: Environmental Noise Emission Limit Values 4

Table 5: Landfill Gas Concentration ELV's (measured in any building on or adjacent to the facility) 4

Table 6: Emission value results from landfill gas flare No. 1 (2,500 HAASE) monitored at KTK Landfill..... 5

Table 7: Emission value results from landfill gas flare No. 2 (1,500 HAASE) monitored at KTK Landfill..... 5

Table 8: Emission value results from gas utilisation engine GE01 monitored at KTK Landfill..... 5

Table 9: Emission value results from gas utilisation engine GE02 monitored at KTK Landfill 5



Table10: Emission value results from gas utilisation engine GE03 monitored at KTK Landfill. 6

Table11: Emission value results from landfill gas flare No. 1 (2,500 HAASE) monitored at KTK Landfill. 6

Table 12: Emission value results from landfill gas flare No. 2 (1,500 HAASE) monitored at KTK Landfill. 6

Table 13: Emission value results from gas utilisation engine GE01 monitored at KTK Landfill. 6

Table 14: Emission value results from gas utilisation engine GE02 monitored at KTK Landfill. 7

Table 15: Emission value results from gas utilisation engine GE03 monitored at KTK Landfill. 7

Table 16: Environmental Monitoring and Reporting Frequency 7

Table 17: Depositional Dust Monitoring Locations 8

Table18: Dust Monitoring Results 2011 9

Table 19: Groundwater Monitoring Locations..... 9

Table 20: Landfill Gas Monitoring Locations at KTK Landfill 20

Table 21: Leachate Level and Sampling locations at KTK Landfill 23

Table 22: Average Leachate Levels recorded at KTK Landfill during 2011 24

Table 23: Summary Table of Parameters recorded at Leachate Location LP1 during 2011 26

Table 24: Summary Table of Parameters recorded at Leachate Location LP3 during 2011 26

Table 25: Summary Table of Parameters recorded at Leachate Location LP6 during 2011 26

Table 26: Summary Table of Parameters recorded at Leachate Location LP7 during 2011 27

Table 27: Summary of Leachate Emissions to Sewer concentrations (Permeate Values). 27

Table 28: Environmental Noise Monitoring Locations including Noise Sensitive Locations surveyed at KTK Residual Landfill. 28

Table 29: Environmental Noise Monitoring Results from a survey conducted in September 2011 at KTK Landfill 29

Table 30: Surface Water Monitoring Locations at KTK Landfill 30

Table 31: Asbestos Fibre Monitoring Results 34

Table 32: Consumption of Energy and Resources during 2011 at KTK Landfill 34

Table 33: Material Recovery and Electricity Production during 2011 35

Table 34: Volume of leachate transported or discharged off-site during 2011 35

Table 35: Key works undertaken during 2011 35

Table 36: Summary of Annual Quantities of Landfill Gas Collected for Utilisation and Flaring at KTK Landfill during 2011 37

Table 37: Climatological Data (mm) at KTK Landfill during 2011 38

Table 38: Programme of Objective and Targets 2007 to 2012 - Progress Quarter 4 (December 2011) 41

Table 39: Procedures and Written Summary of any Procedures Developed by the Licensee which Relate to the Operation of the Facility 46

Table 40: List of Incidents during 2010 48

Table 41: Record of Complaints Received during 2011 50

FIGURES

Figure 1: Static Groundwater Levels at KTK Landfill January - December 2011 10



Figure 2: Static Groundwater Levels in Up-Gradient monitoring wells at KTK Landfill during 2011 11

Figure 3: Static Groundwater Level in Down-Gradient monitoring wells at KTK Landfill during 2011 11

Figure 4: pH levels detected in up-gradient groundwater monitoring wells at KTK Landfill during 2011 12

Figure 5: pH levels detected in down-gradient groundwater monitoring wells at KTK Landfill during 2011 13

Figure 6: Electrical Conductivity levels detected in up-gradient groundwater monitoring wells KTK Landfill during 2011 14

Figure 7: Electrical Conductivity levels detected in down-gradient groundwater monitoring wells at KTK Landfill during 2011. 15

Figure 8: Chloride Levels detected in up-gradient groundwater monitoring wells at KTK Landfill during 2011 16

Figure 9: Chloride levels detected in down-gradient groundwater monitoring wells at KTK Landfill during 2011 17

Figure 10: Sulphate levels detected in up-gradient groundwater monitoring wells at KTK Landfill during 2011 18

Figure 11: Sulphate levels detected in down-gradient groundwater monitoring wells at KTK Landfill during 2011 19

Figure 12: Graph showing Methane concentrations detected in boundary landfill gas monitoring wells at KTK Landfill during 2011 21

Figure 13: Carbon Dioxide levels detected in boundary landfill gas monitoring locations during 2011 22

Figure 14: Summary of Landfill Leachate Levels in Gas Extraction Wells during 2011 25

Figure 15: pH Levels Detected in Surface Water Samples Retrieved from SW4 - SW7 during 2011 31

Figure 16: Electrical Conductivity Levels Detected in Surface Water Samples taken from locations at KTK Landfill during 2011 32

Figure 17: Chloride Levels Detected in Surface Water Samples Retrieved from Monitoring Locations SW4 - SW7 at KTK Landfill during 2011 32

Figure 18: Dissolved Oxygen Levels detected in Surface Water samples retrieved from Monitoring Locations SW4 - SW7 at KTK Landfill during 2011 33

Figure 19: Annual Water Balance 39

Figure 20: Management Structure at KTK Landfill 52

APPENDICES

Appendix A Site Layout and Monitoring Locations



1.0 INTRODUCTION

This Annual Environmental Report (AER) has been prepared in accordance with Condition 11.8 of Waste Licence Register No. W0081-04, issued on 25/7/2011 prior to this date W0081-03 was in effect, and contains the information listed in Schedule F of the Licence for the reporting period 1 January 2011 to 31 December 2011.

2.0 SITE HISTORY

KTK Landfill Ltd. (KTK), a wholly owned subsidiary company of Greenstar Ltd., is currently developing and operating the KTK Landfill under Waste Licence Register Number W0081-04. KTK Landfill was granted a Waste Licence (W0081-01) by the Environmental Protection Agency (EPA) in April 1999. In July 2001, KTK Landfill submitted an application for a Review of Waste Licence W0081-01. An amended licence,(W0081-02) was granted by the Agency on 8 April 2002. In November 2004 an application for revision of Waste Licence W0081-02 was submitted and an amended Licence,(Register No. W0081-03) was granted on 16 February 2006. Acceptance of construction material containing asbestos ceased in October 2008. During 2011 the site was in an operational, closure and restoration phase. In December 2011, KTK Landfill, ceased waste acceptance and is now in the closure, restoration and aftercare phase. A detailed site map showing all monitoring locations at the site is presented in Appendix A.

3.0 REPORTING PERIOD

The reporting period for the Annual Environmental Report (AER) is from 1 January 2011 to 31 December 2011. During this reporting period Waste Licence Register Numbers W0081-03 and W0081-04 were in effect.

4.0 WASTE ACTIVITIES CARRIED OUT AT THE SITE DURING THIS PERIOD

KTK Landfill is a fully engineered facility with a composite lining system on the base and side walls of a large excavation. The licensed waste activities are as follows:

Licensed Waste Disposal Activities in Accordance with the Third Schedule of the Waste Management Act, 1996 to 2003:

Class 1	Deposit on, in or under land (including landfill).
Class 5	Specially engineered landfill, including placement into lined discrete cells, which are capped and isolated from one another and the environment.
Class 11	Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule.
Class 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.

The licensed waste recovery activities for the site in Accordance with the Fourth Schedule of the Waste Management Act, 1996 to 2003 were as follows:



Class 3	Recycling or reclamation of metals and metal compounds.
Class 4	Recycling or reclamation of other inorganic materials
Class 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.

5.0 QUANTITY AND COMPOSITION OF WASTE RECEIVED, DISPOSED OF AND RECOVERED DURING THE REPORTING PERIOD AND EACH PREVIOUS YEAR.

Table 1: Wastes Received for Disposal during 2011

Waste Type	Description	Total Accepted 2011 (tonnes)	Licence Limit (tonnes)
Commercial and Industrial	Mixed Commercial and Industrial	83,087	222,750
Industrial	Misc. Non-Hazardous Industrial solid wastes	27,713	24,750
Industrial	Industrial Non-Hazardous sludges and filtercakes	-	13,750
Asbestos	Construction materials containing Asbestos.	-	3,000
Total Waste Intake		110,800	275,000

Table 2: Materials received for engineering and restoration purposes 2011

Description	Quantity (Tonnes)
Shredded Timber – Reused on site.	3,006
Compost – Reused on site.	-
Filter cakes from the clarification of water intended for human consumption.	10,196
Soil and Fines material – Reused on site for daily cover, intermediate cover and profiling site for final capping.	64,365
Stone	3,298
Soils received for use in final capping layer including Subsoil & Topsoil	67,067
Combined Total of Received and Recovered	147,952



6.0 METHODS OF DEPOSITION OF WASTE

The process for waste deposition is described below:

Waste was delivered to the site in heavy goods vehicles (HGV) with the appropriate covers to prevent loss of load. Each HGV passed through the weighbridge prior to proceeding to the active waste disposal/recovery areas. The weighbridge operator and/or the facility manager could at their own discretion request the load to be tipped in the Waste Inspection Area. Waste vehicles would then proceed to the active waste disposal/recovery areas where waste was deposited under the direction of waste inspection personnel.

Waste was deposited directly on a surface of waste close to and above the advancing tipping face. In accordance with Condition 6.19.2, the active working face was confined to a height of 3.5 metres after compaction and a width of 35 metres. Deposited waste was spread in shallow layers on the inclined surface and compacted. Steel-wheeled compactors operated on the gradient of the more shallow face, pushing thin layers of wastes and applying compaction pressure to them. Wastes were covered with approved daily cover material or covered with permeable soil drawn from stockpiles of heavy inert materials delivered to the site. Alternative fabric cover systems were also utilised where appropriate.

7.0 SUMMARY REPORT ON EMISSIONS

This summary report has been compiled in accordance with Emission Limit Values (ELV's) for the following media as detailed in Condition 6 and Schedule B of the current licence:

- Dust;
- Noise;
- Landfill Gas; and
- Leachate.

Environmental media for which no ELV's have been set under Waste Licence Register No. W0081-04 are discussed in Section 8.0.

7.1 Dust Deposition

The dust deposition emission limit values as established in Schedule B.1 of Waste Licence Register No. W0081-04 is detailed in Table 3 below.

Table 3: Depositional Dust Emission Limit Value

Level (mg/m ² /day) ^{Note 1}
350

Note 1: 30 day composite sample

Dust monitoring was conducted at six locations on two occasions during the 2011 reporting period. A third dust monitoring event, as per the licence requirement, was not carried out due to a logistical error on the consultant's part. Emerald Environmental Ltd. conducted the analysis of dust deposition results from the KTK facility. Dust reports were included in the subsequent 2nd and 3rd Quarterly monitoring reports of 2011. Dust deposition did not exceed the ELV during the reporting period. Refer to Section 8 for details.



7.2 Noise Emissions

Noise ELVs as established in Waste Licence Register No. W0081-04 is detailed in Table 4 below:

Table 4: Environmental Noise Emission Limit Values

Day dB(A) L_{Aeq} (30 minutes)	Night dB(A) L_{Aeq} (30 minutes)
55	45

Noise monitoring was conducted by Golder Associates Ireland Ltd. at six on-site locations and four sensitive receptors in September 2011. The complete noise monitoring report was included in Quarter 3 2011 submission to the Agency.

The survey revealed a number of sources on site and off site. Levels were detected that were above the specified licence limit of 55 dB(A). During the survey the dominant source detected by the sound level metre, was of onsite noise which was associated with plant and vehicles involved in the capping and restoration process at the site. Traffic movements at N1 (main Naas to Kilcullen Rd R448) and N6 located close to the main road at the site also indicated the passing of heavy vehicles which added to the noise environment on site. The dominant off-site noise locations N14 and N16, were found to be effected by traffic also on the Naas to Kilcullen Rd, the R448. However this was on an intermittent basis and was not experienced for long periods during the survey.

7.3 Landfill Gas Emissions

Landfill Gas ELV's as established in Waste Licence Register No. W0081-04 is detailed in Table 5 below:

Table 5: Landfill Gas Concentration ELV's (measured in any building on or adjacent to the facility)

Methane	Carbon Dioxide
20% LEL (1% v/v)	1.5% v/v

Landfill Gas Monitoring was conducted at 14 monitoring well locations on a monthly basis during the 2011 reporting period. KTK Landfill staff conducted the landfill gas monitoring and reporting for 11 months of the year with Golder Associates conducting one sampling event in November 2011. Collated landfill gas emission summary reports were included in the subsequent quarterly monitoring reports for 2011. Category 3 non-urgent incident reports were also forwarded to the Agency not later than 24 hours after a landfill gas emission level value was breached.

7.3.1 Locations and methods

Waste Licence Register No. W0081-04 stipulates that Monitoring of any emissions to air is carried out at the enclosed gas Flare No. 1 (HAASE 2500) and No. 2 (HAASE 1500) and at the gas Utilisation Plant Engines GE01, GE02 and GE03 at KTK Landfill. Odour Monitoring Ireland Ltd undertook this monitoring on two occasions, on 9 / 10 June 2011 and 3 November 2011. These reports are presented in Appendix B.



7.3.2 Results

Table 6: Emission value results from landfill gas flare No. 1 (2,500 HAASE) monitored at KTK Landfill.

Parameter	09/10 June 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg N/m ³)
Nitrogen oxides (NO _x)	87.6	150
Sulphur Dioxide (SO ₂)	531.01	-

Table 7: Emission value results from landfill gas flare No. 2 (1,500 HAASE) monitored at KTK Landfill.

Parameter	09/10 June 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
Nitrogen oxides (NO _x)	77.66	150
Sulphur Dioxide (SO ₂)	980.44	-

Table 8: Emission value results from gas utilisation engine GE01 monitored at KTK Landfill.

Parameter	09/10 June 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
NO _x	468.88	500
CO	556.03	1,400
TNMVOCs	27.45	75
SO ₂	0	-
Particulates	-	-

Table 9: Emission value results from gas utilisation engine GE02 monitored at KTK Landfill

Parameter	09/10 June 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
NO _x	293.66	500
CO	502.25	1,400
TNMVOCs	61	75
SO ₂	24.28	-
Particulates	-	-

**Table10: Emission value results from gas utilisation engine GE03 monitored at KTK Landfill.**

Parameter	09/10 June 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
NO _x	475.34	500
CO	334.78	1,400
TNMVOCs	29.98	75
SO ₂	17.31	-
Particulates	-	-

Table11: Emission value results from landfill gas flare No. 1 (2,500 HAASE) monitored at KTK Landfill.

Parameter	3 November 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
Nitrogen oxides (NO _x)	136.57	150
Sulphur Dioxide (SO ₂)	4433	-

Table 12: Emission value results from landfill gas flare No. 2 (1,500 HAASE) monitored at KTK Landfill.

Parameter	3 November 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
Nitrogen oxides (NO _x)	190.70	150
Sulphur Dioxide (SO ₂)	1403.54	-

Table 13: Emission value results from gas utilisation engine GE01 monitored at KTK Landfill.

Parameter	3 November 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
NO _x	495.67	500
CO	891.96	1,400
TNMVOCs	14.06	75
SO ₂	435.20	-
Particulates	79.63	-



Table 14: Emission value results from gas utilisation engine GE02 monitored at KTK Landfill.

Parameter	3 November 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
NO _x	467	500
CO	703.67	1,400
TNMVOCs	9.19	75
SO ₂	16.41	-
Particulates	87.1	-

Table 15: Emission value results from gas utilisation engine GE03 monitored at KTK Landfill.

Parameter	3 November 2011	
	Normalised Emission Conc. (mgN/m ³)	Emission Limit Value (mg Nm ⁻³)
NO _x	479.19	500
CO	575.22	1,400
TNMVOCs	31.60	75
SO ₂	446.53	-
Particulates	88.28	-

8.0 SUMMARY OF ALL REMAINING ENVIRONMENTAL MONITORING DATA

8.1 Introduction

Monitoring was conducted at the KTK Landfill in accordance with Schedule D of Waste Licence Register No. W0081-04. However, in some cases additional monitoring was carried out at the discretion of KTK, e.g. leachate quality etc. Details of monitoring and reporting frequencies of environmental data are presented in Table 16 below.

The locations of all environmental monitoring points as well as current topographic conditions are illustrated on Drawing KTK/602, Rev B1 (Appendix A).

Table 16: Environmental Monitoring and Reporting Frequency

Environmental Monitoring Data	Monitoring Frequency	Reporting Frequency
Groundwater Quality	Quarterly	Quarterly
Groundwater Levels	Monthly	Quarterly
Surface Water Quality	Quarterly	Quarterly
Surface Water Visual Inspection	Weekly	Quarterly
Leachate Quality	Monthly*	Quarterly
Leachate Quality – RO plants	Quarterly	Quarterly
Leachate Levels	Weekly	Quarterly



Environmental Monitoring Data	Monitoring Frequency	Reporting Frequency
Landfill Gas (Boreholes)	Monthly	Quarterly
Landfill Gas (Site Offices)	Weekly	Quarterly
Dust	Three times per year*	Subsequent Quarterly
Noise	Annually	Annually
Meteorological Data	Daily	Annually
Asbestos Fibre Monitoring	Annually	Annually

*Schedule C 2.1 of the licence (W0081-04) specifies annual monitoring of leachate quality for all parameters with the exception of BOD and COD which are monitored on a quarterly basis.

*Twice during the period May to September.

8.2 Depositional Dust Monitoring

Dust Monitoring was conducted on two occasions at six monitoring locations in 2011: 26 April 2011 to 26 May 2011, 21 July 2011 to 19 August 2011 in accordance with Table C.3 of Schedule C of the Licence.

Co-ordinates for all monitoring locations are detailed in Table 17 below with locations illustrated on KTK/602 Rev. B1.

Table 17: Depositional Dust Monitoring Locations

Monitoring Element	Location	Eastings	Northings
Dust Monitoring	D1A	285663	211440
	D2A	285883	211396
	D3A	286122	211102
	D4A	286032	210960
	D5A	285612	211021
	D6A	285550	211230

8.2.1 Dust monitoring methods

Total dust deposition was measured at the site using Bergerhoff gauges as specified in the Standard Method VDI 2119 (German Engineering Institute). The dust gauges were set up such that the glass containers were approximately 2 m above the ground surface. In order to inhibit the growth of algae in the dust jars 20 ml of 5% 2-methoxyethanol was added to each jar during warm months. The glass jars containing the dust were submitted to Emerald Environmental Services Ltd for analysis.

8.2.2 Dust monitoring results

The results of dust monitoring conducted at KTK landfill during 2011 are presented in Table 18 below. Dust concentrations and ELV's as detailed in Schedule B.1 of Waste Licence W0081-04 are discussed below.

The Dust ELV of 350 mg/m²/day was not exceeded during the reporting period. The results from Quarter 2 and Quarter 3 monitoring round show levels of depositional dust below the licence limit of 350 mg/m²/day in all dust gauges. Dust suppression techniques are utilised at the site and each vehicle must drive through a wheel wash on leaving the site.



Table18: Dust Monitoring Results 2011

Location	26 April to 26 May 2011- Quarter 2	21 July to 19 August 2011- Quarter 3
	mg/m ² /day	
D1A	229	149.9
D2A	98.7	94.6
D3A	79.9	.*
D4A	64.7	66.4
D5A	21.2	62.3
D6A	55.9	126.4
Average	91.6	83.3

Sample D3A not submitted to Laboratory due to damaged jar

8.3 Groundwater Monitoring

8.3.1 Groundwater monitoring locations

Groundwater monitoring was conducted at twelve locations during 2011 in accordance with Schedule C.3 of the current licence. Co-ordinates for all monitoring locations are detailed in Table 19 with locations illustrated on Drawing KTK/602, Rev B1, Appendix A.

Table 19: Groundwater Monitoring Locations

Media	Location	Eastings	Northings
Groundwater	BH11d	286157	211305
	97-4d	285441	211146
	97-5d	285534	211075
	97-6d	285612	211019
	97-7d	285916	210979
	KTK-10	285787	211045
	KTK-11	285518	211116
	KTK-15d	285884	211394
	KTK-16	285728	211444
	KTK-19	285819	210997
	KTK-20	285665	211078
	KTK-21	286065	210999



8.3.2 Groundwater Levels

Groundwater levels were monitored on a monthly basis in accordance with Schedule C of Waste Licence Register No. W0081-04. The results of groundwater level monitoring were furnished to the Agency in the subsequent Quarterly reports (Quarter 1 to Quarter 4, 2011).

8.3.2.1 Groundwater Level Measurement Methodology

Groundwater levels were measured using a standard dip-meter probe, which upon contact with water emits an audible signal. Measurements were made to the nearest centimetre relative to the top of the steel casing that protects each monitoring pipe.

8.3.2.2 Groundwater Level Measurements 2011

Figure 1, Figure 2 and Figure 3 illustrate the annual water level data recorded from groundwater monitoring wells up-gradient and down-gradient of the facility during 2011. The groundwater flows in a south-westerly direction.

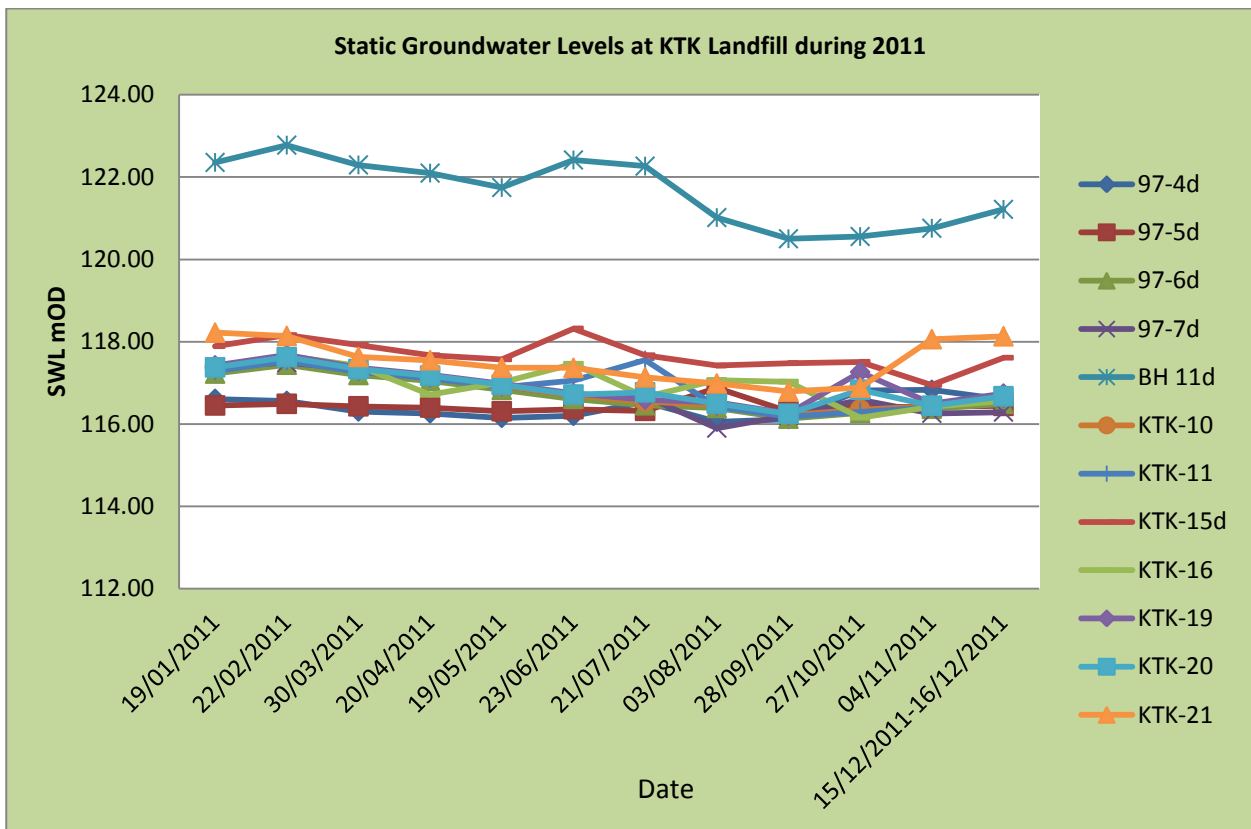


Figure 1: Static Groundwater Levels at KTK Landfill January - December 2011

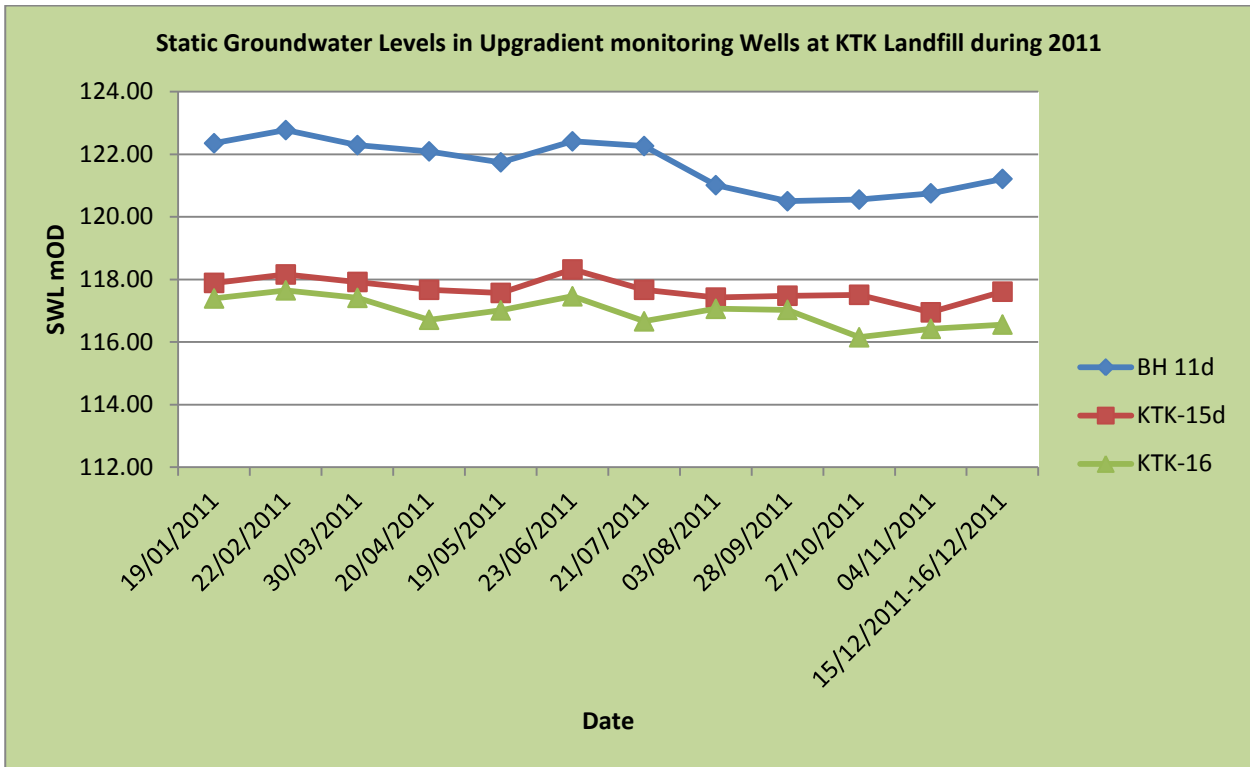


Figure 2: Static Groundwater Levels in Up-Gradient monitoring wells at KTK Landfill during 2011

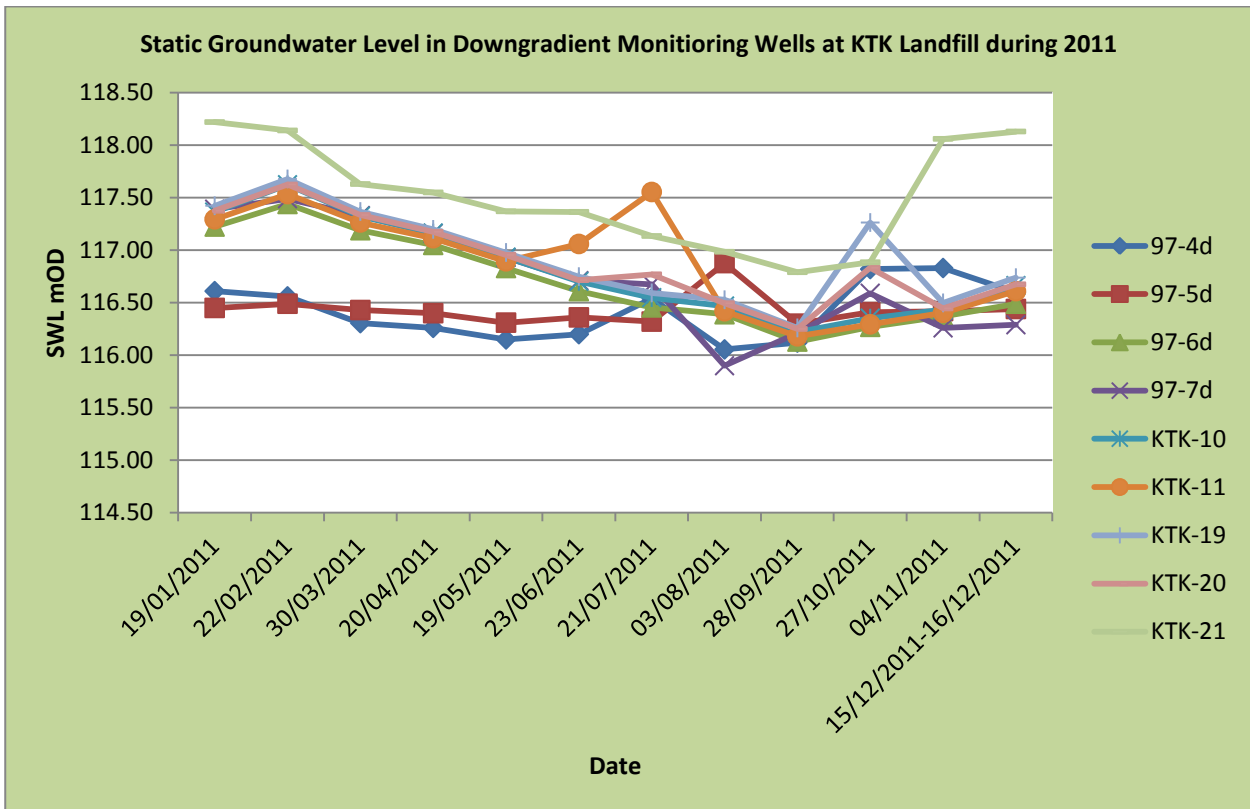


Figure 3: Static Groundwater Level in Down-Gradient monitoring wells at KTK Landfill during 2011



8.3.2.3 Methods for Determining Groundwater Quality

Groundwater samples were collected by purging a minimum three borehole volumes prior to sample collection. This allowed stagnant water to be removed and representative groundwater to be drawn into the hole. Dedicated sampling equipment was used to prevent cross contamination between sampling locations. Field measurements of temperature, pH and conductivity were recorded. Samples were decanted into laboratory designated containers and stored in cooler boxes to maintain sample temperature at approximately 4°C. All samples were submitted to the laboratory within 24 hours of sampling.

8.3.2.4 Groundwater Quality Results 2011

Groundwater quality monitoring is carried out at KTK Landfill on a quarterly basis with annual parameters analysed during one of these quarters. Groundwater quality has been monitored at twelve locations during 2011 in accordance with Schedule C.3 of the current licence. The results of all quarterly monitoring have been presented to the Agency in the Quarterly reports of 2011.

A summary of concentrations from a number of indicator parameters up-gradient and down-gradient of the facility recorded during the reporting period are presented in Figure 4 to Figure 11. These include ph, conductivity, chloride and sulphate.

It can be seen that up-gradient monitoring location KTK-16 continue to be impacted from the groundwater contamination plume from the adjacent, partially lined, Silliot Hill landfill. The KTK-16 is a deep well with screens located in medium to coarse sand.

Elevated levels of Chloride and Conductivity have also been detected at monitoring location KTK-11, which is down gradient of both KTK landfill, KTK-16 and Silliot Hill. This is also a deep well screened in coarse sands and gravels at a depth of 5 m below that of KTK-16. Figures 4 to 11 illustrate the concentration patterns at both the up-gradient and down gradient monitoring wells, for pH, Conductivity, Chloride and Sulphate during the reporting period..

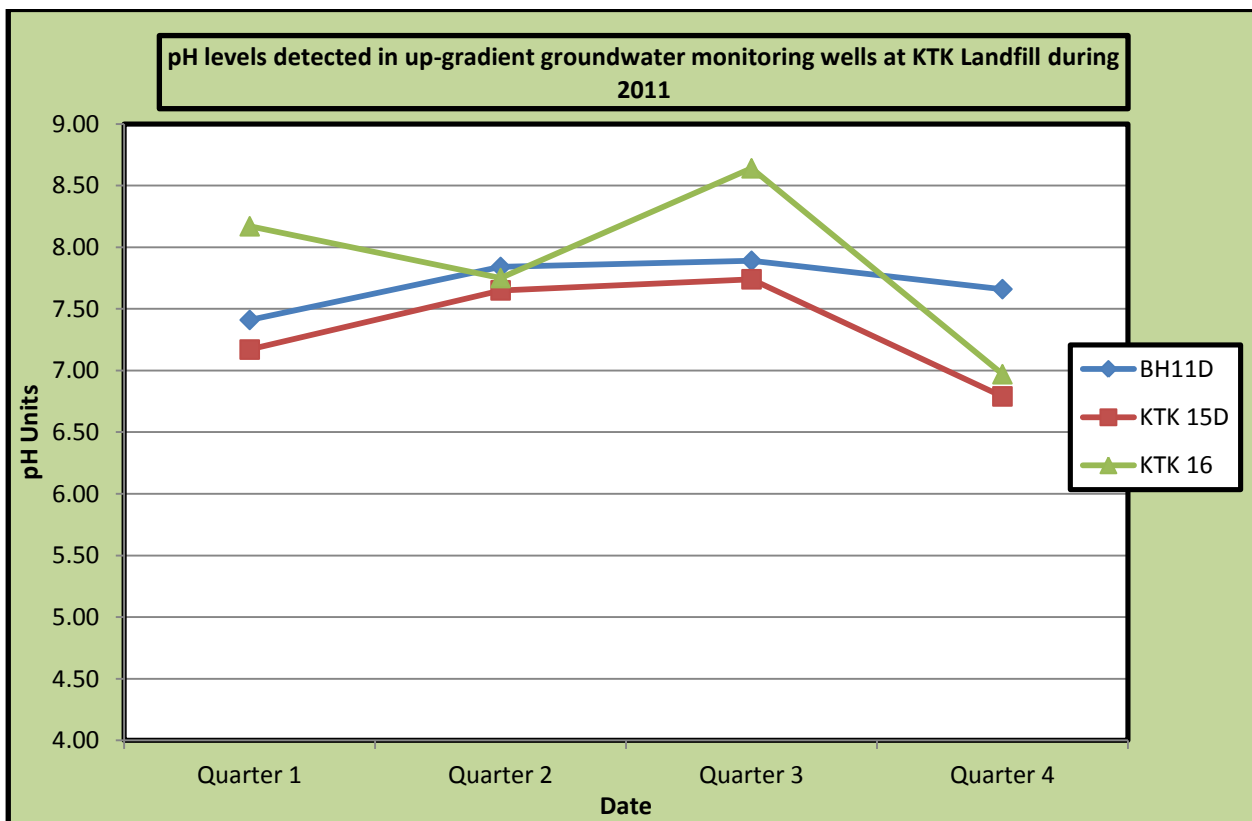


Figure 4: pH levels detected in up-gradient groundwater monitoring wells at KTK Landfill during 2011

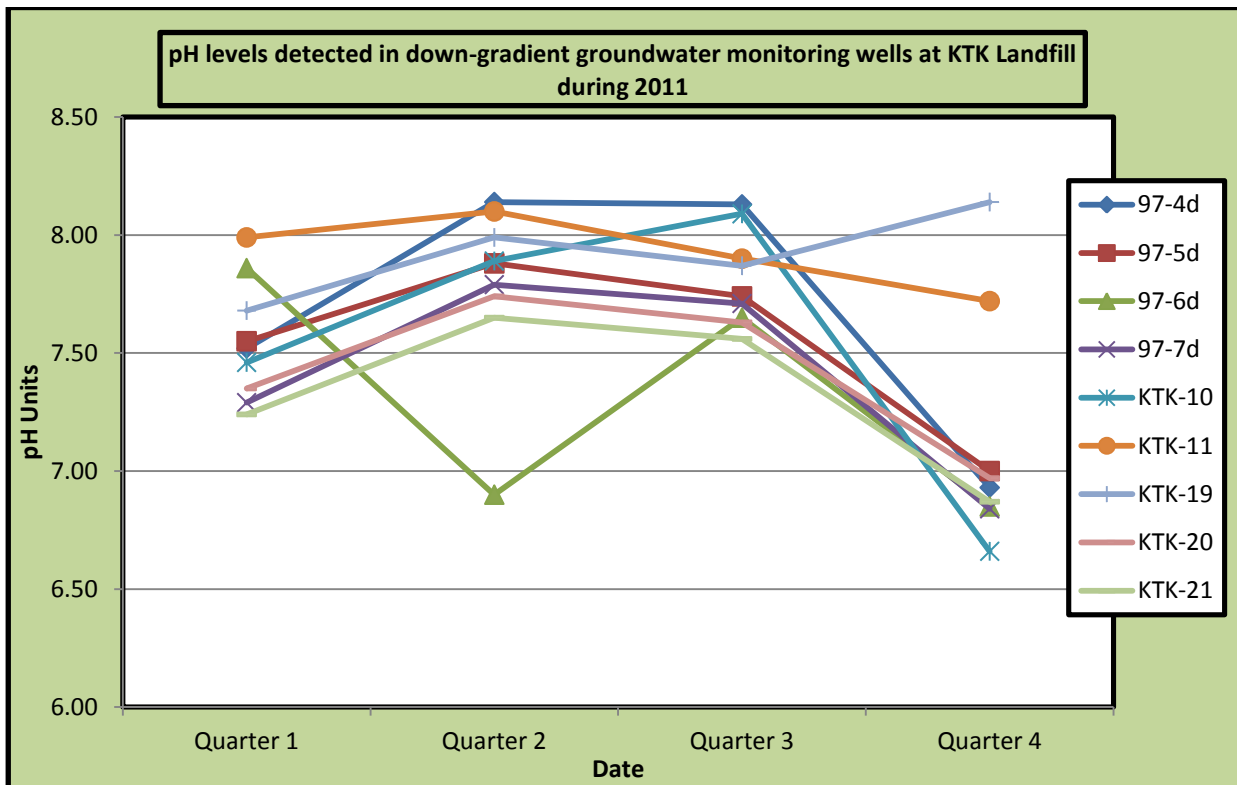


Figure 5: pH levels detected in down-gradient groundwater monitoring wells at KTK Landfill during 2011

Note: 97-5D : Q4 Data for pH calculated from the mean results from samples analysed on 26 October 2011 (additional testing) , Q4 monitoring round from the 7 November 2011, and additional testing December 15 2011, as three rounds of sampling occurred during the reporting period.

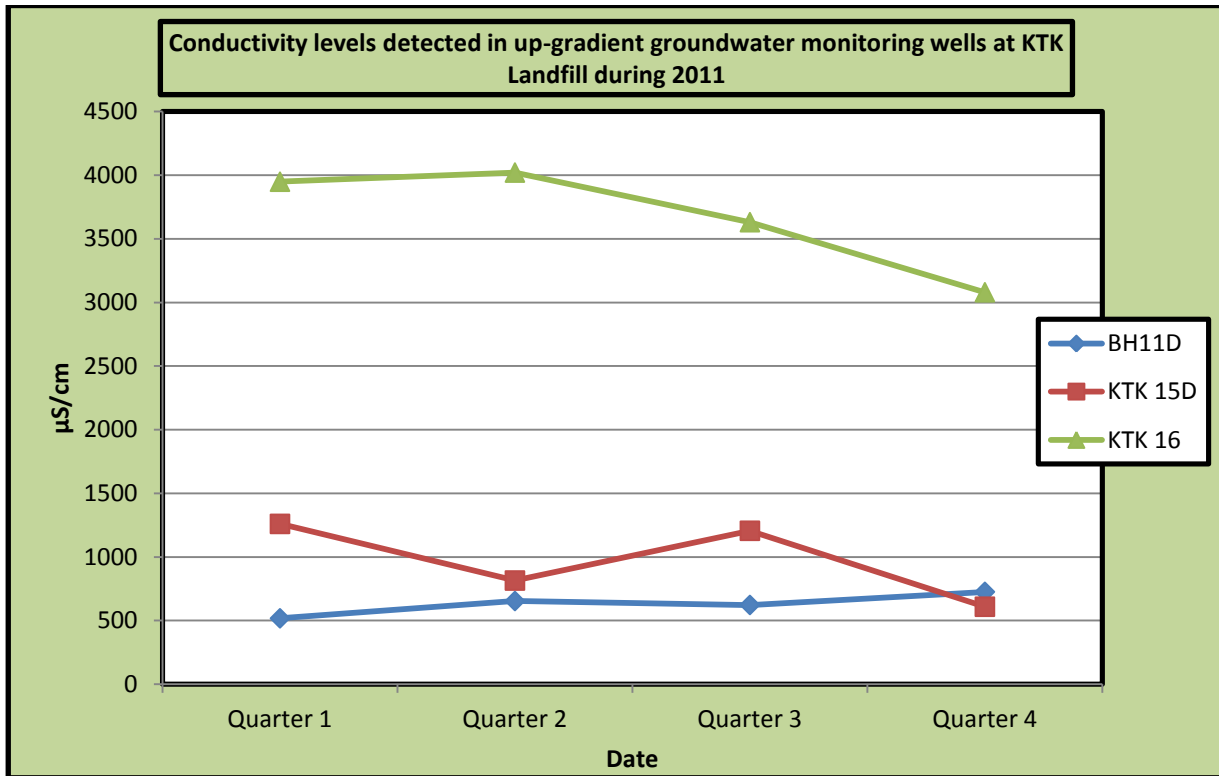


Figure 6: Electrical Conductivity levels detected in up-gradient groundwater monitoring wells KTK Landfill during 2011

Note: Q4 data for KTK 16 was taken from the additional data analysed on 26 October 2011 as the well was too shallow for sampling on 7 November 2011 when Q4 monitoring took place

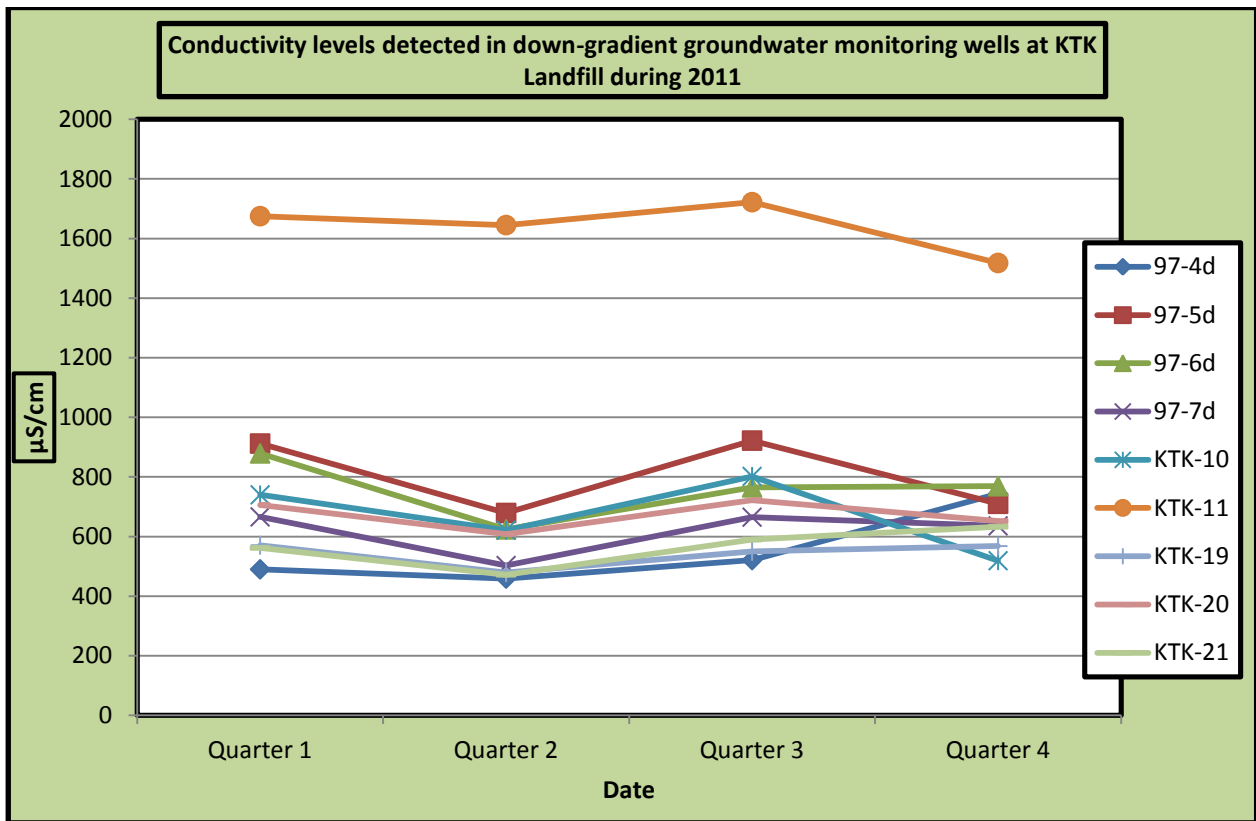


Figure 7: Electrical Conductivity levels detected in down-gradient groundwater monitoring wells at KTK Landfill during 2011.

Note: Q4 Data for Conductivity calculated from the mean results from samples analysed on 26 October 2011 (additional testing). Q4 monitoring round from 7 November 2011, and additional testing December 15 2011, as three rounds of sampling occurred during the reporting period

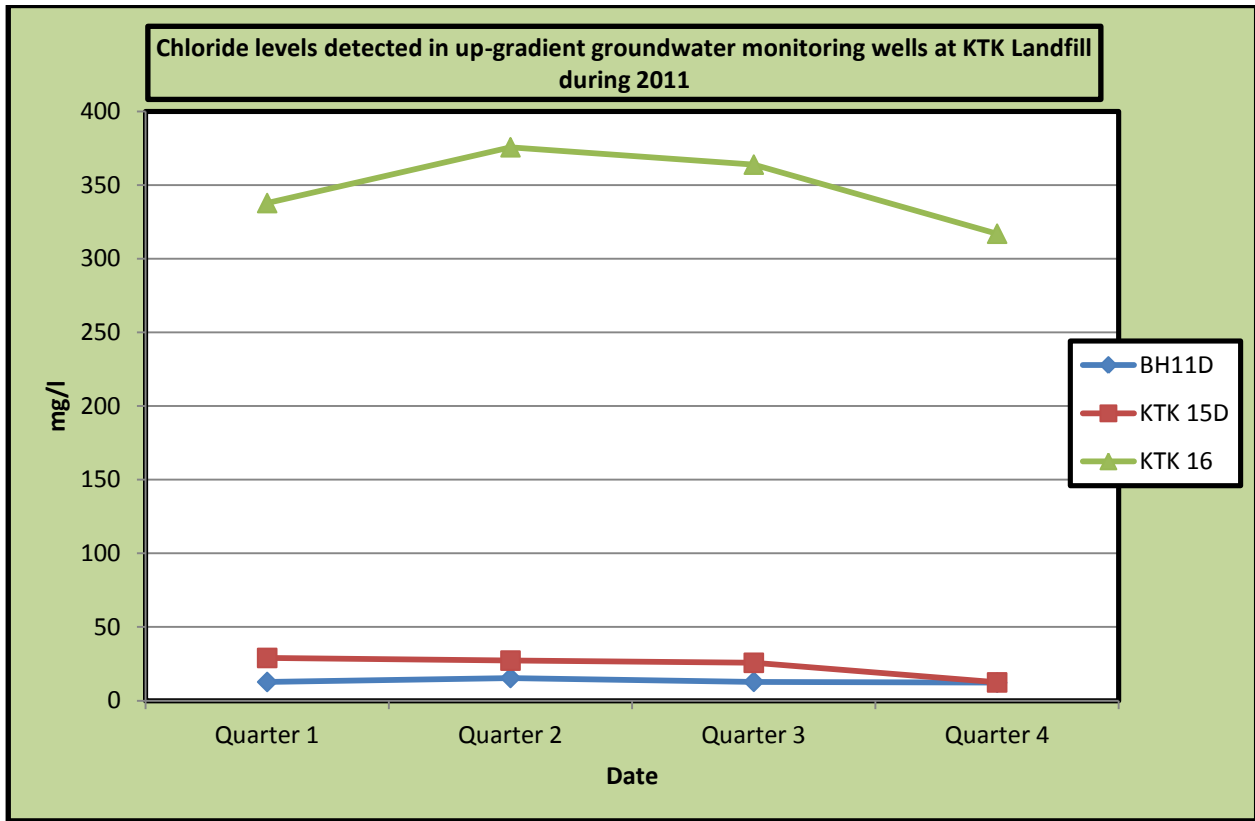


Figure 8: Chloride Levels detected in up-gradient groundwater monitoring wells at KTK Landfill during 2011

Note: Q4 data for KTK 16 was taken from the additional data analysed on 26 October 2011 as the well was too shallow for sampling on 7 November 2011 when Q4 monitoring took place.

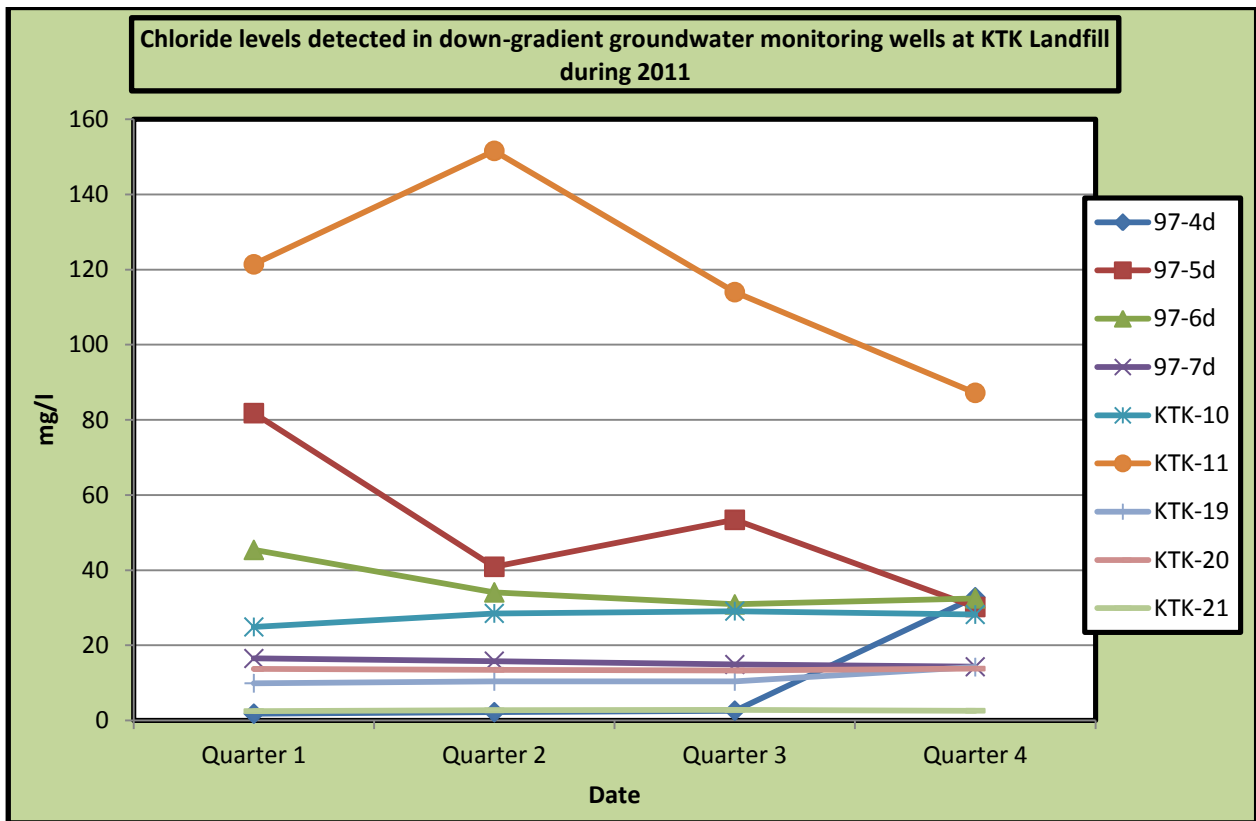


Figure 9: Chloride levels detected in down-gradient groundwater monitoring wells at KTK Landfill during 2011

97-5D : Q4 Data for Chloride calculated from the mean results from samples analysed on 26 October 2011 (additional testing) , Q4 monitoring round from 7 November 2011, and additional testing December 15 2011, as three rounds of sampling occurred during the reporting period

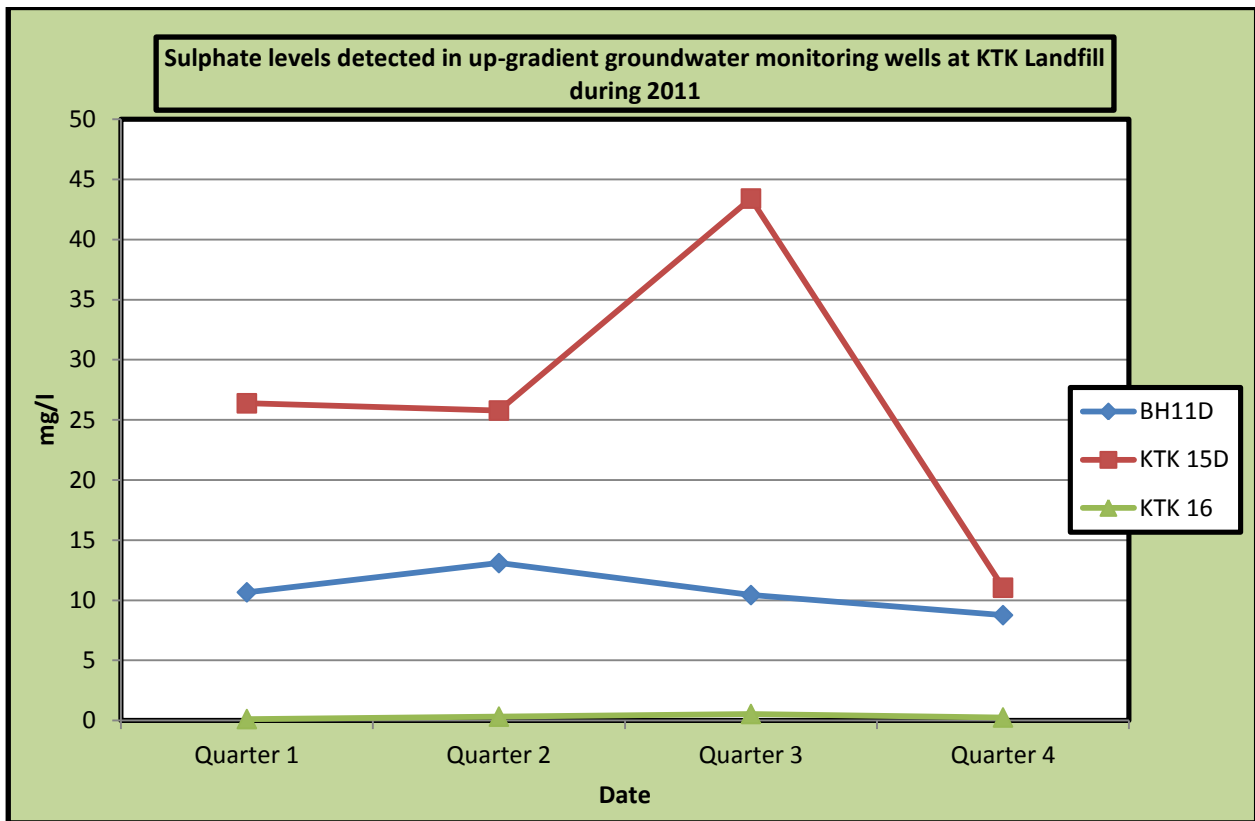


Figure 10: Sulphate levels detected in up-gradient groundwater monitoring wells at KTK Landfill during 2011

Note: Q4 data for KTK 16 was taken from the additional data analysed on 26 October 2011 as the well was too shallow for sampling on 7 November 2011 when Q4 monitoring took place.

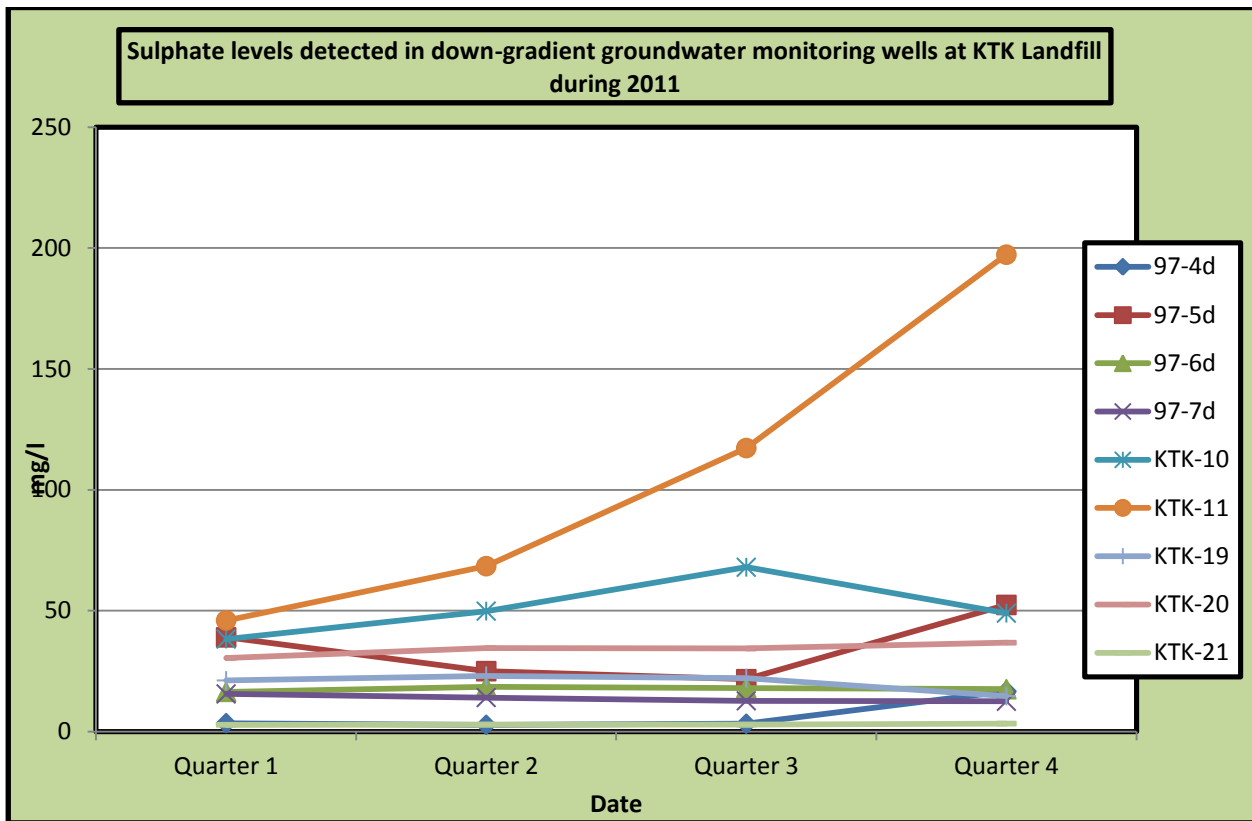


Figure 11: Sulphate levels detected in down-gradient groundwater monitoring wells at KTK Landfill during 2011

97-5D : Q4 Data for Sulphate calculated from the mean results from samples analysed on 26 October 2011 (additional testing) , Q4 monitoring round from 7 November 2011, and additional testing December 15 2011, as three rounds of sampling occurred during the reporting period.

8.4 Private Wells Monitoring

In accordance with Condition 6.10 the current licence, Private Well monitoring was conducted at two locations (DW8 and DW10) on 31 May 2011. The locations of these private wells are illustrated on Drawing KTK/602, Rev B1, Appendix A. The results were issued by letter to the private well landowners, and the results are presented in Appendix C.

8.5 Landfill Gas Monitoring

Gas Monitoring was conducted at the facility in accordance with Table C.1.3 of Schedule C of the current waste licence (W0081-04). Co-ordinates for all monitoring locations are detailed in Table 20 with locations illustrated on Drawing KTK/602, Rev B1 (Appendix A).

8.5.1 Landfill Gas Monitoring Locations

Monthly gas monitoring was conducted at 15 no. gas monitoring wells. The general site offices are monitoring on a continuous basis via a fixed monitoring system. Details of gas monitoring from the mobile monthly monitoring and continuous fixed systems are shown below.



Table 20: Landfill Gas Monitoring Locations at KTK Landfill

Media		Location	Eastings	Northings
Landfill Gas	Landfill Gas Monitoring Boreholes	G1	285726	211444
		G2	285695	211452
		G3	285653	211437
		G4	285623	211382
		G5	285591	211330
		G6	285565	211279
		G7	285537	211214
		G8	286116	211093
		G9	286135	211239
		G10	285894	211395
		G11	286160	211305
		G14	285513	211146
		G15	285600	211093
		G16	285720	211060

8.5.2 Landfill Gas Monitoring Methodologies

Landfill gas measurements were undertaken using a GA2000 Landfill Gas Analyser. The gas is analysed for its content by % volume of the following constituents:

- Methane CH₄;
- Carbon Dioxide CO₂; and
- Oxygen O₂

The LEL (lower explosive limit of methane), atmospheric pressure (millibars) and temperature (°C) were also recorded by the GA2000 Landfill Gas Analyser. Each gas monitoring location was sampled for 1 minute and the results were then recorded.

8.5.3 Site Buildings

The main site offices are monitored on a continuous basis by two fixed monitoring systems (GMI Landsurveyor II and Monicon MC4000). Gas monitoring results from the fixed systems have been submitted to the Agency in Quarterly Reports 1 to 4 of 2011.

8.5.4 Landfill Gas Monitoring Results

Gas monitoring results were forwarded to the Agency on a quarterly basis during 2011. A summary of carbon dioxide (CO₂) and methane (CH₄) monitoring results for 2011 is presented in Figure 12 and Figure 13 respectively. The trigger level breaches were reported to the Agency as category 3 non-urgent incidents were reported to the Agency within 24 hours of occurring.

Moreover, in response to a recommendation by the inspector following an Agency audit on 23 November 2004, a full report on the assessment of landfill gas migration in the vicinity of KTK Landfill and Silliot Hill Landfill was submitted to the Agency on 7 April 2005.

This assessment concluded that the most likely source of elevated landfill gas levels in monitoring wells located outside the body of waste at KTK Landfill are attributable to the historical uncontained landfilling



operations at the adjacent Silliot Hill facility and are therefore not in any way connected with KTK Landfill. Full details of landfill gas trigger level breaches can be found in Table 40: Reported Incidents – 2011.

Historical monitoring at KTK Landfill has identified elevated gas levels at monitoring locations on the western and southern boundaries of the site, particularly at G2, G3, G4, G5 and G7. Significant works at Silliot Hill were carried out during 2009 which included the capping of that facility and the installation of large diameter gas extraction wells. Despite these works, elevated levels of CH₄ persisted into the first Quarter of 2011, reducing during the second, spiking slightly at one location in the third quarter before reducing again in the fourth Quarter 2011. It is understood that Silliot Hill commenced a gas pumping trial in April of 2011 and during this trial, levels recorded were noticeably reduced. The CO₂ levels followed a similar pattern during the reporting period, spiking in Quarter 1, reducing significantly in Quarter 2, rising slightly at two locations in Quarter 3 and spiking again in Quarter 4.

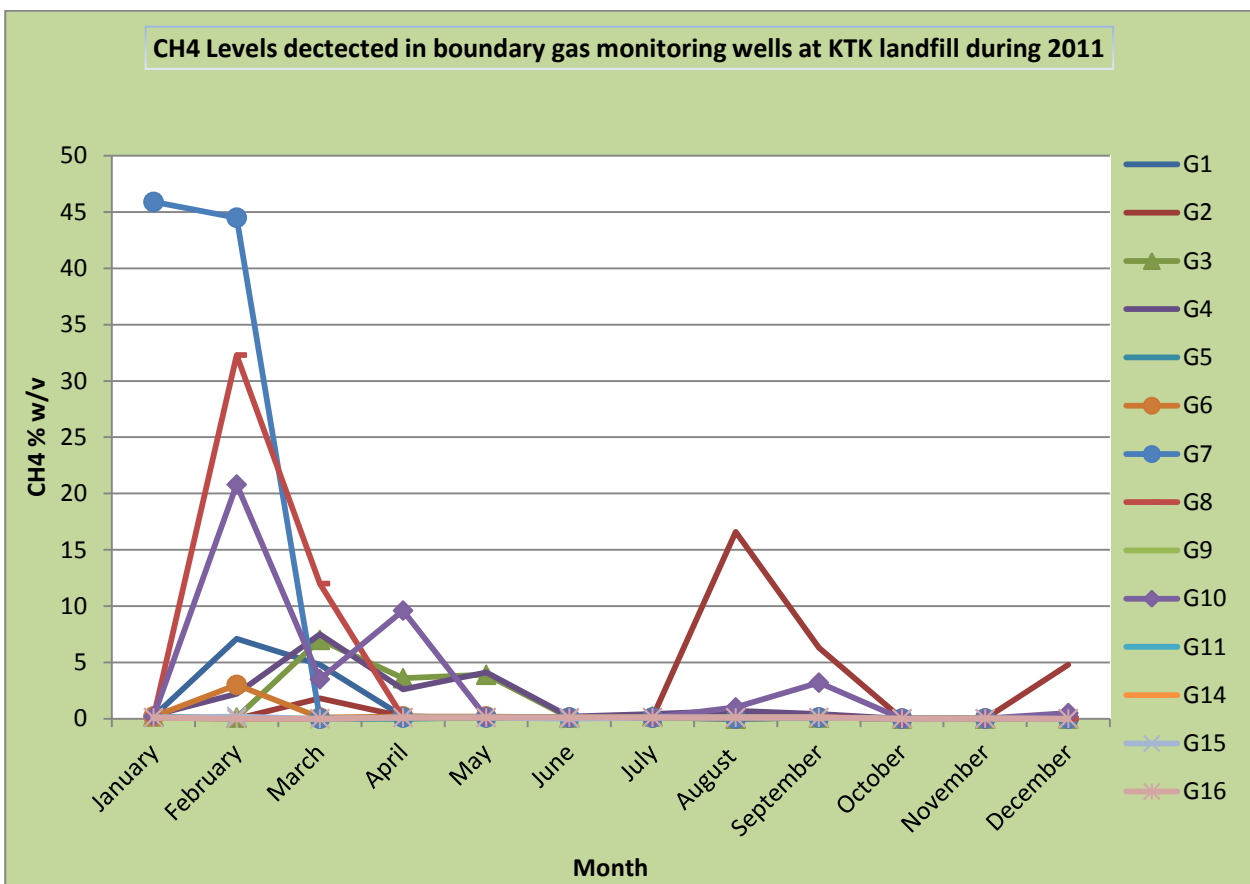


Figure 12: Graph showing Methane concentrations detected in boundary landfill gas monitoring wells at KTK Landfill during 2011

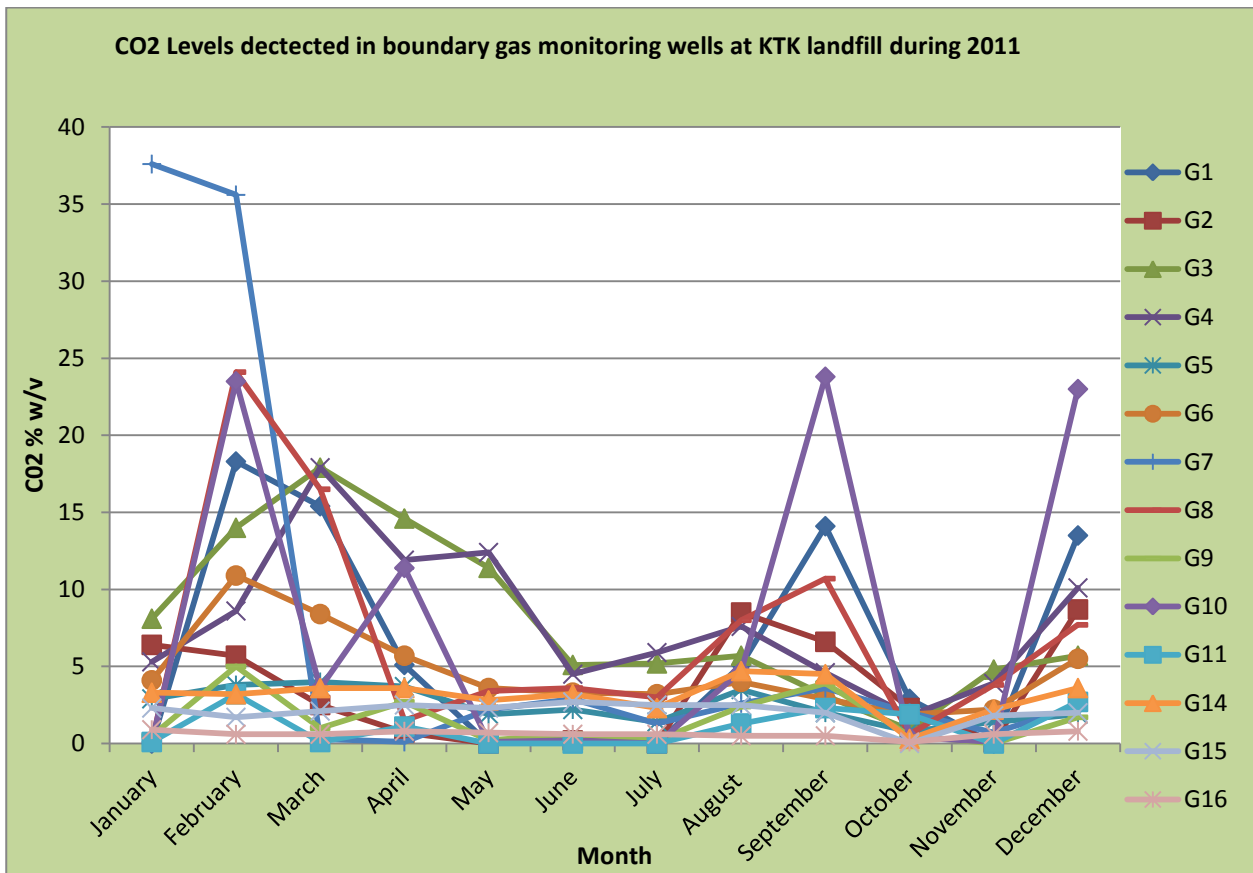


Figure 13: Carbon Dioxide levels detected in boundary landfill gas monitoring locations during 2011

8.6 Leachate Monitoring

8.6.1 Leachate Monitoring Locations

In accordance with Condition 6.13.1, Condition 6.13.2 and as outlined in Table C2.1 of Schedule C of the Waste Licence Register No. W0081-04, leachate composition and level monitoring are conducted at locations detailed in Table 21 below.



Table 21: Leachate Level and Sampling locations at KTK Landfill

Media	Location	Eastings	Northings
Leachate Sampling Locations	LP1	285761	211123
	LP3	285783	211092
	LP6	285805	211086
	LP7	285881	211163
Leachate Levels	VWP1	285724	211113
	VWP2	285767	211144
	VWP3	285751	211149
	VWP4	285746	211195
	VWP5	285760	211244
	VWP6	285799	211140
	VWP7	285881	211163
	VWP8	285990	211081

8.6.2 Leachate levels

8.6.2.1 Methods for Measuring Leachate Levels

Leachate levels have been recorded using the data collection method known as DataTaker. The leachate data acquisition system employs one data logger and three pressure sensors. The pressure sensors measure the pressure of the leachate in three locations, Sump 1 (Phase 1 & 2), Sump 3 (Phase 3, 4 & 5) and Sump 6 (Phase 6). The DataTaker is a data logger, which takes measurements of a number of fundamental parameters from the pressure sensors, such as voltage, current, resistance and frequency; readings are taken every 30 minutes. It then converts the pressure readings into meaningful quantities such as metres depth of leachate. Data recorded from the data logger is downloaded to a USB stick and saved in project specific folder on the site network.

8.6.2.2 Leachate Level Results During 2011

Leachate levels have been reported to the Agency in each of the monitoring reports from Quarter 1 to Quarter 4 of 2011. A summary of sump 1, sump 3 and sump 6 leachate levels recorded during 2011 is presented in Table 22 below. It is noted that the data presented in Table 22 represents the leachate head over the base of the landfill. Results from leachate monitoring conducted at the facility during the reporting period have been reported to the Agency in the quarterly reports for Quarter 1 to Quarter 4 2011.



Table 22: Average Leachate Levels recorded at KTK Landfill during 2011

Date	Sump 1 (LP1) Average Level for Month (metres above liner)	Sump 3 (LP3) Average Level for Month (metres above liner)	Sump 6 (LP6) Average Level for Month (metres above liner)
January 2011*	1.3868	1.454	0.300
February 2011*	1.348	1.455	0.566
March 2011*	1.17	1.279	0.225
April 2011*	0.948	1.04	0.125
May 2011*	0.7084	0.816	0.09
June 2011*	0.8588	0.982	0.281
July 2011*	0.918	0.990	0.165
August 2011*	0.777	0.824	0.235
September 2011*	0.711	0.743	0.253
October 2011*	0.576	0.600	0.264
November 2011*	0.788	0.79	0.356
December 2011*	0.8576	0.832	0.331

* = These are monthly averages taken from weekly readings.

8.6.2.3 Leachate Levels from Gas Extraction Wells Results During 2011

Leachate levels in gas extraction wells have been reported to the Agency in each of the monitoring reports from Quarter 1 to Quarter 3 of 2011. The Agency was advised in writing that recording of leachate levels in Gas wells would cease after Quarter 3 of 2011. A summary of the results is shown below in Figure 14.

Please note that some of the points were inaccessible due to the some wells being raised during capping construction works and therefore too high to measure.

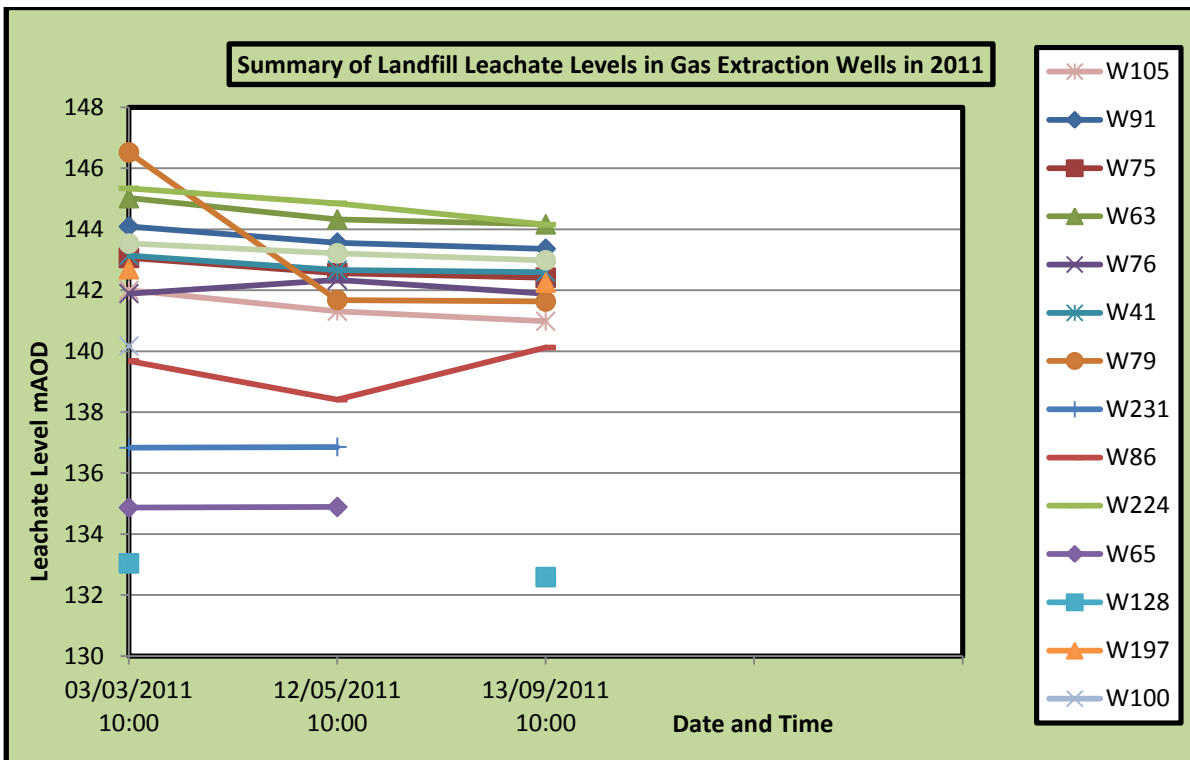


Figure 14: Summary of Landfill Leachate Levels in Gas Extraction Wells during 2011

8.6.3 Leachate Composition and Analysis

Monthly leachate monitoring includes sampling to be taken from three sumps (LP1, LP3, LP6) and from the leachate holding tank (LP7). Monthly monitoring of leachate quality in 2011 was conducted at LP1, LP3, LP6 and LP7. Leachate samples are analysed for parameters as stipulated in Table C 2.1 of Schedule C of Waste Licence Register No. W0081-04. All samples were filled directly into laboratory designated containers and transported to the laboratory. KTK staff also carried out analysis of selected parameters at the Reverse Osmosis Plants each quarter. KTK staff also monitored the leachate levels each week. These results were included in the Quarterly reports.

8.6.3.1 Leachate Analysis Results

Results from leachate monitoring conducted at the facility during the reporting period have been presented to the Agency in each of the Quarterly reports. Summary tables for selected parameters are presented below in Table 23 to Table 26.



Table 23: Summary Table of Parameters recorded at Leachate Location LP1 during 2011

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
BOD	227	270	214	303	326	231	261	231	316	337	500	279
COD	4210	3910	4310	4380	4380	4520	3870	4210	4960	4310	4270	3910
Chloride	1750	1400	1886	1908	1786	2067	1848	1901	1923	1182	2040	1748
NH ₄ -N	1849	1706	1464	1965	2059	2294	1973	1368	1933	1827	2223	1826

Table 24: Summary Table of Parameters recorded at Leachate Location LP3 during 2011

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
BOD	318	243	226	209	215	270	246	229	260	316	328	169
COD	3980	4010	3850	4070	4050	4530	4310	4030	4530	4680	4500	4330
Chloride	1572	1200	1512	1645	1498	2005	1803	1752	1638	1953	2147	1619
NH ₄ -N	1832	1650	1339	2035	1738	2103	1804	1470	1905	2208	2325	2017

Table 25: Summary Table of Parameters recorded at Leachate Location LP6 during 2011

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
BOD	146	101	310	257	226	188	242	103	188	179	221	519
COD	1610	1570	3220	3580	3340	3410	3820	1110	3410	1960	2680	2970
Chloride	826	730	1506	1621	1570	1611	1699	664	1611	982	1022	1043
NH ₄ -N	851	800	1104	1707	1642	1531	1806	668	1531	1421	141	1136



Table 26: Summary Table of Parameters recorded at Leachate Location LP7 during 2011

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
BOD	235	182	299	251	283	600	251	257	287	294	299	345
COD	3490	2500	3730	4170	4110	-	4220	3850	-	4010	2610	3860
Chloride	1580	950	1659	1613	1455	4277	1804	1788	1798	1790	967	1660
NH ₄ -N	1753	1050	1256	1878	1633	4557	1943	1371	1910	1891	951	1825

8.6.3.2 Leachate emissions to sewer

KTK Landfill operates two reverse osmosis treatment plants on site which treats landfill leachate before discharging it to the sewer system. Treated leachate from the reverse osmosis plants is referred to as permeate and reported as such in the Quarterly reports. Concentrate from the reverse osmosis units is recirculated within the waste mass, as per the agreement with the Agency. This is a common practice in Europe when Reverse Osmosis Units operate on landfills and sewer discharge of treated effluent (permeate) limit is 150m³/day. KTK Landfill have also supplied chemical results from the Reverse Osmosis plants at the site detailing analysis of Reverse Osmosis leachate input, permeate output and concentrate output. These results are included in Appendix D of the Quarterly Reports 2011 (Q1 to Q4) along with graphical representations of levels of NH₄, BOD and COD and in Table 27 below.

Table 27: Summary of Leachate Emissions to Sewer concentrations (Permeate Values).

Parameter	Unit	WL ELV	Quarter 1		Quarter 2		Quarter 3		Quarter 4	
			Plant No 1	Plant No 2	Plant No 1	Plant No 2	Plant No 1	Plant No 2	Plant No 1	Plant No 2
pH		6 - 9	6.31	6.19	5.96	5.66	7.18	4.49	6.14	5.92
Electrical Conductivity	uS/cm	-	-	1142	379	361	3790	47100	819	1269
BOD	mg/l	250	22	6	11	9	14	4	10	4
COD		750	35	8	19	14	39	8	39	8
Suspended Solids		300	2	2	2	5	4	2	2	2
Total Organic Carbon		300	1.22	1.75	0.7	0.7	5	1.36	17	28
Chloride (as Cl)		2,000	50	50	50	50	52	50	50	50



Ammonia (as N)	5	2.82	3.8	1.97	4.36	2.92	4.12	3.52	2.25
Nitrate (as N)	1,000	4.8	4.8	30.5	29.14	0.66	0.66	4.8	4.8
Orthophosphate (as P)	20	2	2	2	2	2	2	2	2
Dissolved Methane	-	0.99	0.34	0.13	0.03	0.27	0.17	0.36	0.49

8.7 Environmental Noise Monitoring

8.7.1 Environmental noise monitoring locations

Annual noise monitoring was conducted at the facility on 20 September 2011 in accordance with Condition 6.11.1 and Schedule B.4 of Waste Licence Register No. W0081-04. Monitoring was conducted at six locations on the site; N1, N2, N3, N4, N5 and N6 and at four Noise Sensitive Locations; N8, N12, N14 and N16 as detailed in Table 28. The locations of all noise monitoring stations are detailed on Drawing KTK/602, Rev B1 (Appendix A). The results and interpretations of the monitoring exercise were reported in the Quarterly Report for Quarter 3 to the EPA.

Table 28: Environmental Noise Monitoring Locations including Noise Sensitive Locations surveyed at KTK Residual Landfill.

Media	Location	Eastings	Northings
Noise Monitoring	N1A	285661	211438
	N2A	285878	211396
	N3A	286123	211106
	N4A	286029	210959
	N5A	285618	211022
	N6A	285550	211230
	N8A	285461	211459
	N12A	285710	210641
	N14A	286258	210888
	N16A	286389	211154

8.7.2 Environmental Noise Monitoring Methodology

A Cirrus CR:831A sound level meter was used to take the noise measurements at the facility. This instrument is a Type 1 data logging integrated sound level meter and is in accordance with the requirements of IEC Publication 651. The meter is calibrated annually.

However, prior to monitoring at each location a field calibration is carried out, to calibrate the meter at 97.3 dB, using the Cirrus CR:513A acoustic calibrator. The instrument had its annual calibration in November 2010.

Prior to each measurement the instrument was mounted on a tripod at approximately 1.4 – 1.5 metres above ground level and 3.5 m away from any sound reflecting objects as specified in ISO 1996: Acoustics – Description and Measurement of Environmental Noise (Part 1). The Time Weighting used was ‘fast’ and the Frequency Weighting was ‘A’ weighted.



In addition, a wind shield was used to reduce potential wind interference during measurements. The wind speed at each location during the monitoring period was less than 5 m/s as required in ISO 1996: Acoustics – Description and Measurement of Environmental Noise (Part 2).

Cognisance was given to the following documents during preparation for the noise survey and writing of this report:

- Environmental Noise Survey Guidance Document, 2nd Edition. EPA 2006;
- Integrated Pollution Control Licensing – Guidance Note for Noise in Relation to Scheduled Activities, EPA 1995;
- Landfill Manuals – Landfill Monitoring, 2nd Edition, EPA 2003;
- ISO 1996-1:2003 Acoustics Description, Measurement and Assessment of Environmental Noise – Part 1: Basic quantities and assessment procedures; and
- ISO 1996-2: 2007 Acoustics – Description and Measurement and Assessment of Environmental Noise – Part 2: Determination of environmental noise levels.

The following parameters were measured at the nine monitoring locations in compliance with Schedule 6.1.1 and Table B.4 of waste licence W0081-04.

- **LAeq**, 30 min - the equivalent continuous noise level in dB(A) over a specified measurement interval i.e. 30 minutes;
- **LA10**, 30 min - the noise level in dB(A) equalled or exceeded for 10% of the measurement interval i.e. 30 minutes;
- **LA90**, 30 min – the noise level in dB(A) equalled or exceeded for 90% of the measurement interval i.e. 30 minutes; and
- Frequency Analysis i.e. 1/3 octave band analysis.

8.7.3 Environmental Noise Monitoring Survey Results

The results of noise monitoring conducted at the KTK Landfill facility in September 2011 are presented in Table 29 below. Interpretation of these results were included as part of the Quarter 3 2011 environmental monitoring report submitted to the Agency. The report concluded that elevated noise levels were attributed to traffic noise on adjacent public roads and plant movements within the site.

Table 29: Environmental Noise Monitoring Results from a survey conducted in September 2011 at KTK Landfill

Location	Date & Time	Wind Speed m/s	LAeq dB(A)	LA10 dB(A)	LA90 dB(A)
N1A	20/09/11 14.42 hrs	2.3	61	84	50
N2A	20/09/11 13.44 hrs	3.6	54	53	47
N3A	20/09/11 12.35 hrs	3.5	52	55	47
N4A	20/09/11 11.44 hrs	3.6	46	48	43
N5A	20/09/11 10.43 hrs	4.5	43	45	40



Location	Date & Time	Wind Speed m/s	LAeq dB(A)	LA10 dB(A)	LA90 dB(A)
N6A	20/09/11 09.45 hrs	3.2	60	54	44
N8	20/09/11 15.31 hrs	2.2	63	59	43
N12	20/09/11 18.00 hrs	2.6	62	53	40
N14	20/09/11 17.11 hrs	3.1	63	55	43
N16	20/09/11 16.21 hrs	2.9	58	51	44

8.8 Surface Water Monitoring

8.8.1 Surface water monitoring locations

Surface water monitoring was conducted at the facility in accordance with Schedule C.3 of Waste Licence Register No. W0081-04. Down-gradient surface water monitoring stations SW4, SW5, SW6 and SW7 are detailed in Table 30 with monitoring locations illustrated on Drawing KTK/602 Rev B1 (Appendix A). Monitoring of surface water at the facility comprised weekly visual inspections and quarterly sampling and analyses, which are discussed in more detail below.

Table 30: Surface Water Monitoring Locations at KTK Landfill

Media	Location	Eastings	Northings
Surface Water	SW4	285512	211006
	SW5	285612	211014
	SW6	285664	211014
	SW7	285533	211140

8.8.2 Surface water quality sampling methodology and results 2011

Surface water monitoring was conducted on a quarterly basis at the four locations detailed in Table 29. Surface water sampling involved the submergence of the designated sample container into the surface water body. During submergence every effort is made to keep the container steady so as to prevent sediment disturbance.

Quarterly surface water samples were analysed for parameters stipulated in Table C.3 Storm Water/Surface Water Monitoring of Waste Licence Register No. W0081-04. Details and analyses of all surface water sampling were forwarded to the Agency in Quarterly reports 1 to 4 of 2011. During 2011, sampling was carried out by KTK Landfill Staff during Quarters 1, 2 and 3. Golder completed the sampling in Quarter 4 and included analysis for annual parameters as required by the Licence.

A summary of concentrations from a number of indicator parameters down-gradient of the facility recorded during the reporting period are presented in Figures 15 to 18. Overall, most of the results for SW4, SW5 and SW6 during 2011 were below EPA EQS limits for surface waters, with some exceptions including iron, manganese and ammoniacal nitrogen and zinc. These sampling locations are located in boggy areas which can negatively impact results in dry periods, and iron and manganese are noted by the Agency as being naturally occurring in surface waters in Ireland. SW7 at an upgradient location is located at an oil water



separator outlet for the surface water management system and over the reporting period showed elevations of iron, manganese and sulphate.

The Geological Survey has acknowledged that elevated concentrations of iron and manganese in groundwater are common in Ireland. Iron is found in surface and groundwater due to dissolution from soils or sediments under reducing conditions; whilst manganese concentrations tend to be elevated in waters which have been in contact with humic acids and other naturally occurring organic compounds.

The surface water management system at the south west corner had been isolated in 2010 with all waters collected been pumped to a temporary storage lagoon. However, on 7 July 2011 following improvement in water quality parameters the surface water management system at the south west corner was reinstated to normal working conditions. The temporary storage lagoon located on the landfill was removed and the area has been lined as part of the overall capping works on site. Since the reinstatement of normal surface water working conditions, parameters have remained normal.

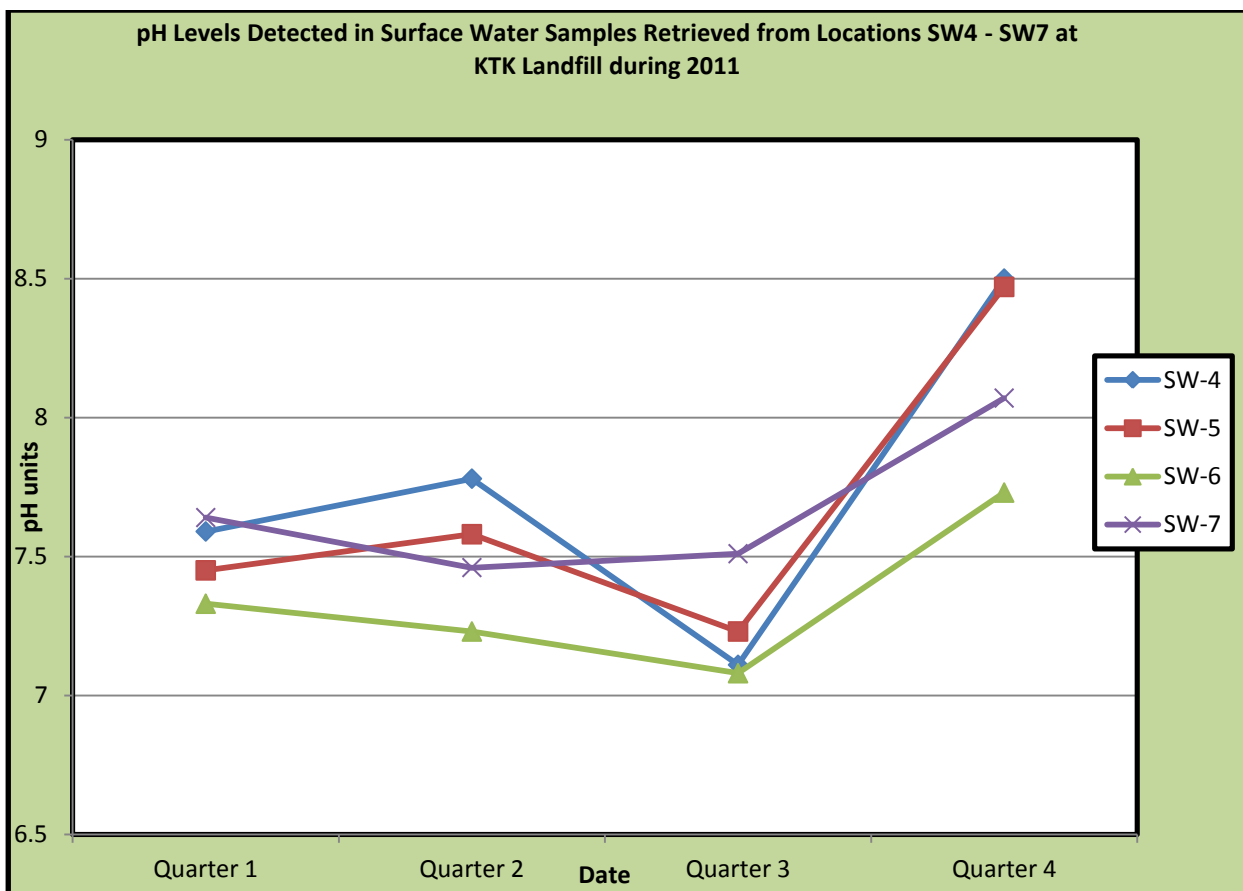


Figure 15: pH Levels Detected in Surface Water Samples Retrieved from SW4 - SW7 during 2011

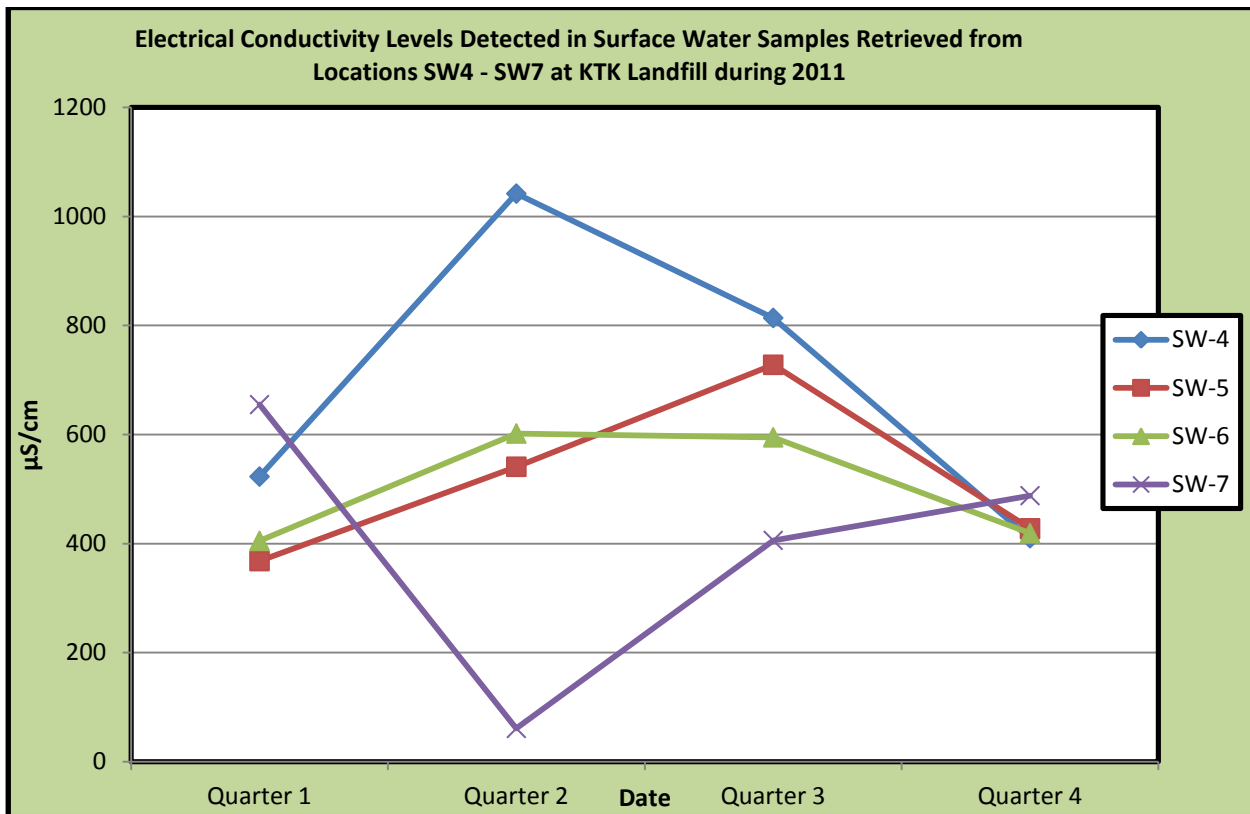


Figure 16: Electrical Conductivity Levels Detected in Surface Water Samples taken from locations at KTK Landfill during 2011

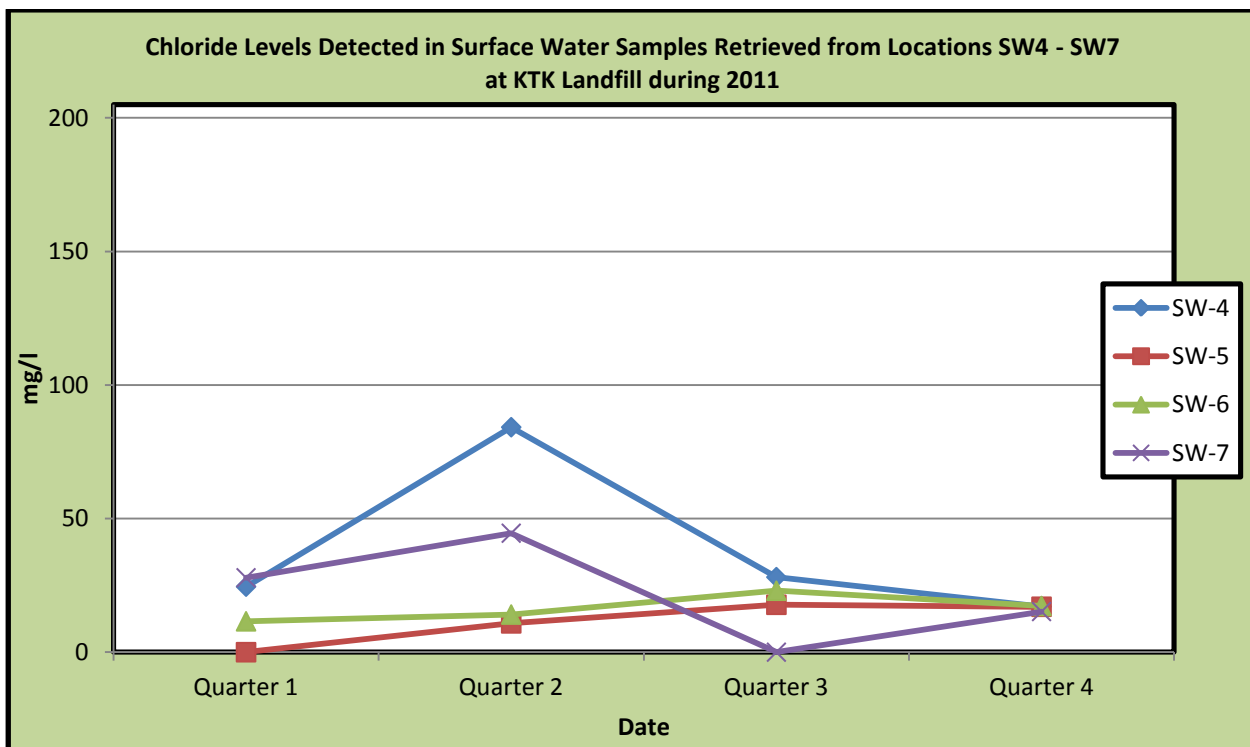


Figure 17: Chloride Levels Detected in Surface Water Samples Retrieved from Monitoring Locations SW4 - SW7 at KTK Landfill during 2011

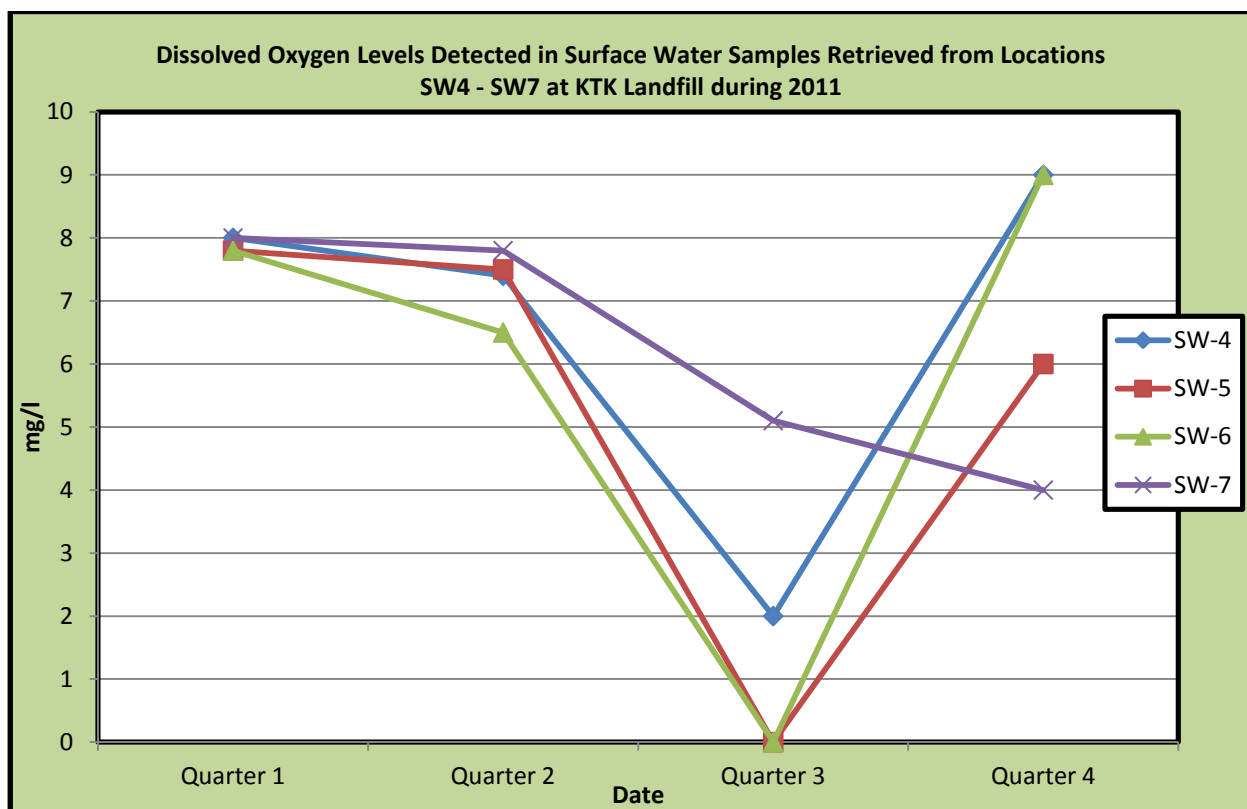


Figure 18: Dissolved Oxygen Levels detected in Surface Water samples retrieved from Monitoring Locations SW4 - SW7 at KTK Landfill during 2011

8.8.3 Surface Water Visual Inspections

A visual inspection of surface water was carried out towards the southern end of the landfill during each Quarter. Surface water visual inspections comprise four locations down-gradient of the landfill (SW4, SW5, SW6 and SW7).

The inspection entailed walking along the stream banks and checking for any signs of potential pollution such as littering, iridescence or odour. Details of all visual inspections have been furnished to the Agency in the subsequent quarterly reports.

8.9 Meteorological Reporting

Details of meteorological monitoring conducted at the facility during 2011 are outlined in Section 18: "Meteorological Report".

8.10 Asbestos Fibre Monitoring

Schedule C.3 Asbestos Fibre Monitoring of the Waste Licence W0081-04, for KTK Landfill, specifies that asbestos fibre monitoring be completed annually. The monitoring was carried out on 7 December 2011.

8.10.1 Methodology

Asbestos fibre monitoring was carried out on 7 December 2011. The monitoring was carried out by ACS Ltd. Seven air tests were taken in accordance with U.K. Health and Safety Executive procedure HSG 248 (2005).

8.10.2 Results

The results of the asbestos monitoring for the reported period are outlined below. In 3 of the samples fibres were detected while no fibres were detected in 4 of the samples. There was no evidence of asbestos fibres in the samples analysed. A summary of the validated results is presented in Table 31 below.

**Table 31: Asbestos Fibre Monitoring Results**

Filter ID	Slide Ref.	No. of Fibres Counted	Air Volume (Litres)	Fibre Conc. (Fibres/ml)
ESB Sub Station	11/pb/658	0	500	<0.01
CLM Canteen	11/pb/659	0	500	<0.01
Weighbridge	11/pb/660	2	500	<0.01
Wheel Wash	11/pb/661	0	500	<0.01
Jeep Track	11/pb/662	1	500	<0.01
Gas Compund	11/pb/663	3	500	<0.01
Office Area	11/pb/664	0	500	<0.01

9.0 RESOURCE AND ENERGY CONSUMPTION SUMMARY 2011

The main resources consumed at the facility during the reporting period were electricity, water for potable supply, vehicle wheel cleaning and dust suppression, diesel fuel and hydraulic oils. The details are listed in Table 32.

Table 32: Consumption of Energy and Resources during 2011 at KTK Landfill

Resource	Units	Consumption
Electricity	kWhr	845,910
Water, Potable Supply	Litres	74,326
Water, Wheel Cleaning Unit	Litres	475,710
Total Water (dust suppression, potable & wheel cleaning)	Litres	550,036
Diesel	Litres	205,190
Hydraulic Oils	Litres	1,765
Grease	kg	50
Imported Aggregates	Tonnes	645.76

9.1 Resource Recovery and Energy Production Summary

KTK Landfill Ltd landfill gas utilisation plant exported 21,352,200 kWhr of electricity to the national grid during 2011. This is down 11.2% on 2010 exported energy of 24,039,100 kWhr.

The main materials recovered at the facility during the reporting period were cover materials, soils, woodchip and stone. The details are listed in Table 33 below.



Table 33: Material Recovery and Electricity Production during 2011

Resource	Units	Recovered
Electricity Produced	kWhr	2,135,200
Waste lubricating oil recovered from landfill gas utilisation engines	Litres	40,400
Woodchip recovered for roadway construction	Tonnes	3006.06
Stones recovered for roadway construction	Tonnes	3,298
Material recovered for internal engineering purposes (cover and profiling for final capping)	Tonnes	74,560
Soil and topsoil recovered for final capping	m ³	43,885

10.0 VOLUME OF LEACHATE TRANSPORTED AND DISCHARGED OFF SITE.

In 2011, leachate was transported off site to licensed facilities and treated leachate from the reverse osmosis treatment plants was discharged directly to the sewer. The tankering of leachate off site ceased in September 2011. The volumes are detailed below in Table 34.

Table 34: Volume of leachate transported or discharged off-site during 2011

Type	Volume (m ³)
Sewer Discharge (treated leachate)	38,541
Tankering Off site	14,125
Total removed from site	52,666

11.0 REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD, AND A TIMESCALE FOR THOSE PROPOSED DURING THE COMING YEAR.

11.1 Developments During 2011

The key works undertaken during the reporting period 1 January – 31 December 2011 are presented in Table 35 below.

Table 35: Key works undertaken during 2011

Date	Event
January – December 2011	Placement of waste to fill out remaining landfill void and shallow areas and the placement of the site regulating layer to form profiles suitable for placement of final capping.
March - December 2011	Commenced stage 2 final permanent capping(90,000 m ³). Total LDPE placed as of 31 December 2011 was 79,000m ² . A total of 149,000m ² out of total site area of 160,000m ² has now LDPE placed. i.e. 93% of the total site is lined. In addition restoration soils and topsoil were placed over the lined area in stage 2 with 41,000m ² of area complete with subsoil placement and 22,000m ² complete with topsoil placement. The topsoil area was seeded with grass established pre winter.



11.2 Proposed Development During 2012

It is the policy of KTK Landfill to continuously improve the infrastructure and operating standards of the facility where possible. To this end a number of significant improvements are proposed to be undertaken during 2011, subject (where appropriate) to the Agency's approval. Primarily our focus will be to complete the capping of the landfill and restoration of the site for the operation of the facility in the aftercare phase.

11.3 Landfill Leachate Management

Leachate treatment capacity by Reverse Osmosis and sewer discharge of treated effluent (permeate) of 150m³/day to be maintained for 2012. Upgrade data logger system to incorporate a scada viewing system of information recorded.

11.4 Restoration

At the end of 2010 42% of the site had the final cap completed. KTK continued with the restoration capping of the site in 2011, with major works undertaken. The remaining 58%, 90,000 m² was profiled and prepared for lining. Of this 79,000 m² was lined with 41,000 m² of area complete with subsoil placement and 22,000 m² complete with topsoil placement and seeded. Final gas extraction and leachate recirculation systems were installed in the subsoil completed 41,000m² area. The remaining capping works will be completed in 2012, with additional auxiliary restoration works also completed.

11.5 Landfill Gas Management and Utilisation

Landfill Gas Management at KTK Landfill comprises collection, flaring and utilisation of gas. It started in 2003 as a joint venture company between G.A.S Energietechnologie GmbH and Greenstar Ltd to form Greenstar Gas Energy. Its aims were to supply, operate and maintain a Landfill Gas Utilisation Plant at the KTK Landfill Ltd. Site. Bioverda, a Greenstar company, then took over the running of the gas plant in January 2010. The electricity produced is sold to a private utility company at pre-agreed rates and the plant burns 1,950 m³/hr of landfill gas at 50% methane and has a maximum electrical output of 3.6MW. Furthermore the site has a total operational flaring capacity of 4,000 m³/hr.

11.6 Monitoring Infrastructure

No changes to the monitoring infrastructure are planned for 2012.

12.0 SITE SURVEY SHOWING EXISTING LEVELS OF THE FACILITY AT THE END OF THE REPORTING PERIOD.

Please refer to Drawing KTK/602, Rev. B1 presented in Appendix A. The annual topographical survey was conducted at the site in January 2011.

13.0 ESTIMATED AND ANNUAL CUMULATIVE QUANTITIES OF LANDFILL GAS EMITTED FROM THE FACILITY.

It is estimated that approximately 11,717,119 m³ of landfill gas were extracted during 2011 for utilisation and flaring. Please refer to the summary in Table 36 overleaf. Full details are presented in Appendix D.



Table 36: Summary of Annual Quantities of Landfill Gas Collected for Utilisation and Flaring at KTK Landfill during 2011

Month	Total Quantity of LFG Collected	Quantity of CH ₄ Collected	Quantity of CO ₂ Collected	Gas Quality (% v/v) (Total figure is averaged)		
	(m ³)	(kg CH ₄)	(kg CO ₂)	CH ₄	CO ₂	O ₂
Jan-11	1,238,856	343,234	833,148	43.3	31.6	1.3
Feb-11	1,006,968	275,769	641,990	42.4	30.2	1.1
Mar-11	1,178,344	320,525	709,895	42.2	29.7	1.3
Apr-11	1,065,020	295,447	710,536	43.3	30.6	1.7
May-11	970,265	261,288	706,130	42.2	31.7	1.4
Jun-11	549,275	149,312	524,705	43.8	31.7	2.2
Jul-11	772,599	215,326	705,412	45.2	32.6	2.2
Aug-11	909,267	265,167	741,118	35.1	26	2.4
Sep-11	892,862	269,623	788,441	44.9	33.1	2.6
Oct-11	1,143,186	324,590	804,850	36.2	24.8	3.7
Nov-11	975,025	291,408	759,189	44.8	31.5	1.9
Dec-11	1,015,452	294,722	746,046	47	30.9	2.2
Total Collected	11,717,119	3,306,412	8,671,460	42.5	30.4	2

14.0 ESTIMATED ANNUAL AND CUMULATIVE QUANTITY OF INDIRECT EMISSIONS TO GROUNDWATER.

The potential sources of indirect emissions into groundwater are:

Landfill Base

The landfill site has a composite base lining system comprising a HDPE geomembrane and one metre thick layer of compacted clay. A leak location survey of the HDPE geomembrane after placement of the drainage stone layer was completed and defects to the HDPE liner were repaired in accordance with industry standards.

Surface Water Collection and Treatment System

Surface water from the paved access road and service platform is collected and discharged into a surface water infiltration area. However, prior to final discharge into the ground, surface water is conveyed via a buried PVC sewer pipe to a concrete silt settlement tank and a Class 1 Klargest surface water bypass separator. The quality of the surface water discharge downstream of the separator is measured quarterly at the monitoring manhole identified as SW7.

Treated Sewage Effluent

There are two BioCycle waste water treatment units on the site which treat the canteen and office waste water prior to discharge into a percolation area.

In summary as the landfill is fully contained there will be minimal to nil indirect emissions to ground water.



15.0 ANNUAL WATER BALANCE CALCULATION AND INTERPRETATION

The weather data, used for the purposes of the annual water balance calculations is derived from the weather station at KTK Landfill and Casement Aerodrome (Evapotranspiration and Evaporation). This data is depicted in the following Table 37.

Table 37: Climatological Data (mm) at KTK Landfill during 2011

Month	KTK Rainfall Data (mm)	Evapotranspiration (Casement) (mm)	Evaporation (Casement) (mm)	Average Monthly Temperature (KTK) (°C)
January 2011	37.2	8.9	12.4	3.24
February 2011	83.8	16.8	24.4	6.78
March 2011	17.4	35.5	52.6	6.32
April 2011	23.2	66.8	100.8	10.78
May 2011	46.4	78.4	122.8	10.66
June 2011	69.2	80.0	116.4	11.93
July 2011	46	79.3	109.9	13.96
August 2011	25.2	62.8	87.6	13.27
September 2011	67.8	49.8	71.4	13.02
October 2011	92.4	29.6	41.3	11.24
November 2011	61.2	19.4	25.0	9.79
December 2011	53	13.4	17.6	7.69
Total 2011	622.8	540.7	782.1	
Average 2011	51.9	45.058	65.175	9.89

A water balance is used to calculate the difference between rainfall on landfilled areas and the various losses prior to leachate generation. See Figure 19 for the water balance calculations.

Concentrate from the Reverse Osmosis treatment plants is re-circulated within the waste mass, a common practise in Europe where Reverse Osmosis units are operated on landfills and is as per agreement with the Agency.

Operating experience on the site has revealed that some of the incident rainfall or leachate that is re-circulated from the landfill sumps can be absorbed by the dry C&I wastes deposited in KTK Landfill. Absorption rates are estimated to be in the range of 0.11 and 0.15 cubic metres per tonne of waste.



KTK LANDFIL AER 2011

Figure 19 - Leachate Generation Calculations

Actual Rainfall from on-site Weather Station.

Evaporation Data (Class A Pan Totals) from Met Eireann Casement Aerodrome Weather Station

Evapotranspiration Data From Met Eireann Casement Aerodrome Weather Station

Site Name: KTK Landfill Site, Brownstown and Carnalway, Kilcullen, Co. Kildare

Irish National Grid Reference:

East 285680.75

North 211471.37

Annual Environmental Report: From 1st January 2011 to 31st December 2011

Operator: KTK Landfill Ltd

Site Status: Licence No. W081-04

Period	Capped Area m2	(1)Active Fill Area	Total Area of Active Fill (m ²)	Evaporation (m)	Total Penman Potential Evapotranspiration (m)	Actual Rainfall (m)	(2)Infiltration through Active Area (m ³)	Vegetated Restored Area (uncapped)	Vegetated Restored Area (m ²)	(3)Effective Rainfall (mm)	(2)Infiltration Vegetated Area (m ³)	(4)Weight of Waste Material Deposited (Tonnes)	(5)Absorbive Capacity of the waste (m ³ /t)	Volume of Water Absorbed (m ³)
Jan - 11	70,000	Phase 1/3/4	76,973	0.0098	0.0067	0.0441	3,017	phase 6	13,027	0.0375	244	2,486	0.05	124
Feb - 11	70,000	Phase 1/3/4	76,973	0.0175	0.0117	0.0366	2,144	phase 6	13,027	0.0249	162	1,732	0.05	87
Mar - 11	70,000	Phase 1/3/4	76,973	0.0517	0.0357	0.0593	2,575	phase 6	13,027	0.0236	154	8,800	0.05	440
Apr - 11	70,000	Phase 1/3/4/5/6	90,000	0.0841	0.0580	0.0327	-839	no vegation	0	0.0000	0	8,574	0.05	429
May - 11	85,000	Phase 1/3/4/5/6	75,000	0.1080	0.0761	0.0449	-681	no vegation	0	0.0000	0	14,680	0.05	734
June - 11	97,000	Phase 1/3/4/5/6	63,000	0.1234	0.0900	0.0452	-1,040	no vegation	0	0.0000	0	20,675	0.05	1034
July - 11	100,000	Phase 1/3/4/5	60,000	0.1144	0.0788	0.0817	1,470	no vegation	0	0.0029	0	21,456	0.05	1073
Aug - 11	117,500	Phase 1/3/4	42,500	0.0975	0.0680	0.0435	-224	no vegation	0	0.0000	0	24,419	0.05	1221
Sept - 11	124,000	Phase 3/4	36,000	0.0639	0.0450	0.1027	2,546	no vegation	0	0.0577	0	2,590	0.05	130
Oct - 11	125,000	Phase 3/4	35,000	0.0390	0.0275	0.0377	637	no vegation	0	0.0102	0	2,456	0.05	123
Nov - 11	138,500	Phase 3/4	21,500	0.0150	0.0108	0.1200	2,419	no vegation	0	0.1092	0	2,934	0.05	147
Dec - 11	142,179	Phase 3/4	17,821	0.0061	0.0042	0.0662	4,860	no vegation	0	0.0620	0	-	0.05	0
Total	-	-	-	0.7304	0.5125	0.7146	16,883	-	-	0.3279	560	110,800	-	5,540

Notes:

(1) The active area is assumed to be that area of the site where no vegetation has been planted and is uncapped.

(2) The actual rainfall data less 50% of evaporation were used to calculate the infiltration through the active fill area, and 50% of the effective rainfall was assumed to infiltrate through the vegetated restored area.

(3) Effective Rainfall is assumed to be actual rainfall minus evapotranspiration

(4) Weight of waste deposited includes all covering and engineering material used, including woodchip.

(5) An absorbive capacity of 0.15m³/t was used based on site experiences, i.e. dry absorbive wastes (paper, cardboard) and cover material (woodchip, fines)

(6) Assumes anaerobic fermentation of wastes consumes 27 litres of water for every tonne of waste over the life time of the waste - "The Engineering of a Sustainable Landfill" Jonathan Derham, MCOS, 1995.

(7) The storage capacity of the basal area of landfill, assuming level does not exceed 1.0m above liner, is 4,300m³/hr.

Notes

Only used waste deposited for absorbive capacity

Phase 6 was the only veagative area , but this was cleared in March to allow for capping, hence increase in active area before decrease in active area.

Capped area

Capped areas are not included in this table as rainfall on capped areas does not influence leachate generation

Figure 19: Annual Water Balance



16.0 METEROLOGICAL REPORT 2011

The site is equipped with a Davis Vantage Pro 2 meteorological station, which produces monthly climatological summaries comprising wind speed (km/hr), rain (mm) and temperature (°C). Other data is collected from the Casement Aerodrome met station. Monthly Rainfall, Evapotranspiration and Temperature data are depicted in Table 36.

17.0 SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS FOR THE FORTHCOMING YEAR

This Schedule of Objectives and Targets and Environmental Management Programme has been developed by Golder Associates Ireland, in conjunction with KTK Landfill Limited.

The Schedule of Objectives and Targets and the Environmental Management Programme, has been developed in accordance with Conditions 2.2.2.2 and 2.2.2.3 of Waste Licence W0081-3 and, Clause 4.3.3 of ISO 14001:2004 Environmental Management Systems – Requirements with Guidance for Use, and with reference to KTK Landfill's Environmental Management System.

The aim of the Schedule of Objectives and Targets and the Environmental Management Programme, is to outline a set of achievable objectives and targets, aimed at meeting the commitments set out in the KTK Landfill Ltd Environmental Policy (see Appendix 1) and to mitigate the significant environmental aspects associated with KTK Landfill Ltd operations.

KTK Landfill has decided not to maintain the ISO accreditation as they are now entering the closure and aftercare phase. However, it is the policy of KTK Landfill Ltd to continually seek to improve its environmental performance. This commitment is outlined in the Company's Environmental Policy. This Policy commits the organisation to setting targets and objectives, aimed at improving environmental performance and mitigating the potential impacts that the Facility may have on the environment.

KTK Landfill Ltd is licensed under the Waste Management Act 1996. Conditions 2.2.2.2 and 2.2.2.3 of Waste Licence W0081-4 require that KTK Landfill Ltd maintain a Schedule of Objectives and Targets and an Environmental Management Programme.

The Schedule of Objectives and Targets and the Environmental Management Programme shall 'as a minimum provide for a review of all operations and processes, including an evaluation of practical options, for energy and resource efficiency, the use of cleaner technology cleaner production, and the prevention, reduction and minimisation of waste, and shall include waste reduction targets'. The Schedule of Objectives and Targets and the Environmental Management Programme 'shall consider a five year period as a minimum.'

17.1 Definitions

Condition 2.2.2.3 of Waste Licence W0081-4 sets out that an Environmental Management Program shall consist of a timed schedule for achieving the (Licensee's) Environmental Objectives and Targets. The EMP shall include; the designation of responsibility for targets, the means by which they will be achieved and the time within which they will be achieved.

An Environmental Objective; as defined by ISO 14001:2004 is an 'overall environmental goal, consistent with the (Company's) environmental policy, that an organisation sets itself to achieve.'

An Environmental Target; as defined by ISO 14001:2004, is a 'detailed performance requirement, applicable to the organisation or part thereof, that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.'



KTK LANDFIL AER 2011

Table 38: Programme of Objective and Targets 2007 to 2012 - Progress Quarter 4 (December 2011)

Ref. No.	Objective	Ref. No.	Target	ENV Aspect	Resources Required	Person Responsible	Time Frame for Completion	Progress as of 6 th January 2012.
O - 1	Lower the environmental impacts associated with fugitive landfill gas emissions by continually developing the Facility's Gas Utilisation Infrastructure and landfill gas management techniques.	T - 1.1	Undertake quarterly VOC surveys of the waste surface over the next 5 years, to establish the areas where fugitive emissions are most prevalent.	1,9	External Consultant (circa €1,800 per survey)	Site Manager	Ongoing	
		T - 1.2	Installation of gas extraction boreholes where fugitive emissions have been identified from the VOC surveys.	1,9	Circa €1,700 per borehole.	Site Manager	Ongoing	
		T - 1.3	Achieve 70% utilisation of landfill gas extracted by 2012 by undertaking landfill gas modelling of the waste body to establish the most environmentally beneficial method for managing landfill gas. i.e. By maximising landfill gas utilisation and minimising flaring.	1,9	External Consultant (circa €2,500 per model)	Site Manager	2012	Current utilisation December 2011 at 89%
		T - 1.4	Support University College Dublin Research Project commissioned to investigate the most effective cover material for achieving maximum odour neutralisation.	1,9	UCD €10,000	GM Landfill Group	Project Completed Dec 2009	



KTK LANDFIL AER 2011

Ref. No.	Objective	Ref. No.	Target	ENV Aspect	Resources Required	Person Responsible	Time Frame for Completion	Progress as of 6 th January 2012.
		T - 1.5	Monitor and review the effectiveness of the perimeter odour neutralising infrastructure installed in 2005 and maintain record of performance.	1,9	Assistant Site Manager (80 man hours)	Site Manager	Project Completed	Removed following final waste placement and capping progress
		T - 1.6	Reduce fugitive emissions by completion of final permanent capping. 40% completed in 2009. 65% to be completed by end 2011.	1, 9	Site management , consultants, contractor (est €4M)	Site Manager	2012	As of Dec 2011 92% the permanent cap installed. Target is to complete restoration of the site in 2012.
O - 2	Lower the potential environmental impacts (i.e. risk of spillage, CO ₂ emissions) associated with the off site transport of	T - 2.1	Divert leachate disposal from tankering offsite to direct discharge to sewer, by on-site treatment with agreement of EPA and KCC Achieve 50% diversion rate by 2010 and a 75% diversion rate by 2012	2	External Consultant (€2,500)	Site Manager	Complete Tankering to sewer ceased in Spetember 2011	Total volume of leachate removed Q4 2011 is 0m ³ Total that went to sewer 5459m ³ 100% went to sewer.



KTK LANDFIL AER 2011

Ref. No.	Objective	Ref. No.	Target	ENV Aspect	Resources Required	Person Responsible	Time Frame for Completion	Progress as of 6 th January 2012.
	leachate.	T - 2.2	Design and commission on-site leachate treatment plant to reduce leachate to domestic strength and dissolved methane levels in leachate to below the regulatory requirement of 0.14 mg/l. Increase plant capacity to 150m ³ /day	2	Circa €600,000	Site Manager	December 2009 July 2010	Completed Completed
O - 3	Lower the potential environmental nuisance associated with dust by improving dust management techniques	T - 3.1	Source road washing/sweeping plant for permanent operation on site	7	Circa €8,000 pa	Site Manager	Complete	
		T - 3.2	Investigate available technology options for dust suppression activities, that minimises water usage.	7	Assistant Site Manager (20 man hours)	Site Manager	Complete	
O - 4	Implement CRAMP	T - 4.1	Complete design, contractor selection, and engineering works associated with stage 1 area of final permanent capping of approx 70,000m ²	1, 9	External consultants and contractors	Site Manager	June 2010	Completed
			Complete design, contractor selection, and engineering works associated with stage 2 area of final permanent capping of approx 45,000m ²				July 2012	On Target



KTK LANDFIL AER 2011

Ref. No.	Objective	Ref. No.	Target	ENV Aspect	Resources Required	Person Responsible	Time Frame for Completion	Progress as of 6 th January 2012.
O - 5	Minimise the amount of natural resources (water, power etc) consumed at the Facility.	T - 5.1	Update the existing utilities report on an annual basis so as to identify operational resource consumption	4	External Consultant (circa €1,000 pa)	Site Manager	Ongoing	
		T - 5.2	Review Energy Audit of Facility and identify opportunities for improved energy efficiency.	4	Site Manager (20 man hours)	Site Manager	Jan 2011	Received from OCM. FM to implement policy and recommendations
		T - 5.3	Carry out assessment of the use of raw material at the Facility and identify opportunities for the improved efficiency in the use of raw materials.	4	Assistant Site Manager (40 man hours)	Site Manager	December 2010	Defer to June 2012
		T - 5.4	Carry out assessment of water usage at the facility and identify opportunities for improved efficiency of water usage.	4	Assistant Site Manager (40 man hours)	Site Manager	Ongoing	
		T - 5.5	Use storm water for dust suppression activities when available.	4	Tanker Trailer and bowser	Site Supervisor	Ongoing	
O - 6	Improve Health, Safety and Welfare	T - 6.1	Review and amend site safety statement so that it is consistent with other sites within the Greenstar Landfill Group	8	Assistant Site Manager (40 man hours)	Site Manager GM Landfill Group	June 2010	Complete
		T - 6.2	Reduce lost time injuries by	8		All site	Ongoing	



KTK LANDFIL AER 2011

Ref. No.	Objective	Ref. No.	Target	ENV Aspect	Resources Required	Person Responsible	Time Frame for Completion	Progress as of 6 th January 2012.
			5% over the next five years			Personnel		
		T - 6.3	Develop Accident Prevention Plan	8	Assistant Site Manager (80 man hours)	Site Manager GM Landfill Group	Project Completed June 2007	
O-7	Training	T - 7.1	Continue to train staff on a regular basis in EMS system, waste licence and Emergency Response.		Assistant Site Manager	Site Manager	Ongoing Annual Basis	
O-8	Operations	T - 8.1	Encourage all site hauliers to comply fully with the Waste Collection Permit Regulations		Site Manager	Site Manager	Ongoing	



18.0 FULL TITLE AND WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE WHICH RELATES TO THE FACILITY OPERATION

KTK Landfill Ltd achieved ISO 14001:2004 certification on 12 December 2005 (certificate number IE05/66145). The awarding body was SGS Ltd Systems and Service Certification in association with UKAS Environmental Management.

While KTK landfill no longer holds ISO14001 certification all procedures were reviewed and amended to comply with requirements of ISO 14001. A full list of all procedures is outlined in Table 39 below.

Table 39: Procedures and Written Summary of any Procedures Developed by the Licensee which Relate to the Operation of the Facility

Ref.	Titles
KTKP 1	Environmental Aspects
KTKP 2	Legislation & Other Requirements
KTKP 3	Training & Awareness
KTKP 4	Communication
KTKP 5	Control of Documents
KTKP 6	Emergency Preparedness & Response
KTKP 7	Monitoring & Measurement
KTKP 8	Objectives, Targets & Programme
KTKP 9	Non-conformance, corrective & preventative action
KTKP 10	Control of Records
KTKP 11	Internal Audit
KTKP 12	Management Review
KTKP 13	Complaints
KTKP 15	Control of Contractors & Visitors (Safe Systems of Work)
KTKP 18	Suppression of Dust
KTKP 19	Construction of Site Roads
KTKP 20	Fuel Storage & Distribution
KTKP 21	Vermin Control
KTKP 22	Handling Tipping Vehicles on site
KTKP 25	Completion of Daily Site Condition Reports
KTKP 26	Waste Acceptance Procedures
KTKP 27	Recyclable material leaving site
KTKP 28	Maintenance
KTKP 29	Permit To Work Systems
KTKP 37	1500 Haase Flare Operation - Start-up
KTKP 38	1500 Haase Flare Operation - Shutdown
KTKP 39	1500 Haase Flare Operation – Startup Troubleshooting
KTKP 40	2500 Haase Flare Operation – Startup
KTKP 41	2500 Haase Flare Operation - Shutdown
KTKP 42	Deutz Gas Engine TGB 620 – Start Up Procedure
KTKP 43	Deutz Gas Engine TGB 620 – Shut Down Procedure
KTKP 44	Deutz Gas Engine TGB 620 – Start Up Procedure Following Common Fault Acknowledgement



Ref.	Titles
KTKP 45	Blower Station Rosemount Analyser (CH ₄ , CO ₂ & O ₂) Calibrations
KTKP 46	Drilling and Installation of a Landfill Gas Extraction Well
KTKP 47	Gas Collection Pipework Fusion Welding
KTKP 48	Landfill Gas Management Plan
KTKP 49	Odor Management Plan
KTKP 50	Engineering Materials Management Plan
KTKP 51	Ammonia Delivery Procedure
KTKP 52	Leachate and Landfill Gas Condensate Management
KTKP 53	Acceptance of Soil Material Containing Non-Infectious Sharps
KTKP 54	Emptying Bunds
KTKP 55	Combined Space Entry
KTKP 56	Ro Plant Operation and Maintenance
KTKP 57	Procedure on emptying leachate bunded area
KTKP 58	Delivery of Bulk Caustic 30% ww
KTKP 59	Delivery of Bulk Sulphuric Acid 96-98%

19.0 REPORTED INCIDENTS AND COMPLAINTS SUMMARY

A record for reported incidents during the 2011 reporting period is presented in Table 40. A total of 14 No. incidents were recorded during the reporting period. Of the reported incidents for 2011, 11 No. related to elevated levels of landfill gas in perimeter monitoring wells and two (2 No) related to elevated leachate levels and one (1 No) for a contained Sulphuric Acid internal tank leak into outer tank bund. As per the recommendations of the Agency inspectors during an audit of KTK Landfill Site on 23 November 2004 a full report on the assessment of landfill gas migration in the vicinity of KTK Landfill and Silliot Hill Landfill was submitted to the Agency on 7 April 2005. This assessment concluded that the most likely source of elevated landfill gas levels in monitoring wells located outside the body of waste at KTK Landfill is from the historical uncontained landfilling operations at the Silliot Hill facility and are therefore not in any way connected with KTK landfill.

Significant reductions in gas levels measured from April 2007 to June 2008 was attributed to ongoing works at Silliot Hill during 2007 and 2008 including the installation of additional gas extraction wells at that facility. It is understood that significant works at Silliot Hill were carried out and completed during 2009 which included the capping of that facility and the installation of large diameter gas extraction wells. Despite these works, elevated levels of CH₄ persisted throughout 2010 and into 2011. However there was a noted reduction in recorded levels since April 2011 which coincided with a continuous gas pumping trial at the adjacent Silliot Hill facility. All incidents were communicated by faxes submitted to the Agency in 2011.

A register of complaints recorded during the reporting period is attached in Table 39. A total of 22 complaints were received from 12 complainants during the reporting period. Any minor gas infrastructure malfunctions identified at the KTK facility with the potential to generate odours were quickly corrected as part of the site daily monitoring and inspections regime. All complaints were resolved to the satisfaction of complainants. The facility is located in proximity to Silliot Hill Integrated Waste Management Facility which includes a civic amenity area, an open air transfer station and a completed partially lined landfill site with a history of landfill gas migration, all of which have potential to generate odours.



19.1 Reported Incidents and Complaints Summary

Incidents

The lists of Incidents at KTK Landfill for the reporting period 1 January 2011 to 31 December 2011 are outlined in Table 39.

Table 40: List of Incidents during 2010

Number	Date	Description	Action
I 164	21/01/2011	Elevated CH ₄ levels at G7. Elevated CO ₂ levels at G2, G3, G4, G5, G6, G7, G14, & G15.	Incident Report Submitted.
I 165	23/02/2011	Elevated CH ₄ levels at G1, G4, G6, G7, G8 & G10 . Elevated CO ₂ levels at G1, G2, G3, G4, G5, G6, G8, G10, G14 & G15.	Incident Report Submitted.
I 166	28/03/2011	Elevated CH ₂ levels at G1, G2, G3, G4, G8, & G10. Elevated CO ₂ levels at G1, G2, G3, G4, G5, G6, G8, G10, G14, & G15.	Incident Report Submitted.
I 167	20/04/2011	Elevated CH ₄ levels at G3, G4, & G10. Elevated CO ₂ levels at G3, G4, G5, G6, G8, G9, G10, G14 & G15.	Incident Report Submitted.
I 168	21/06/2011	Sulphuric Acid seepage into outer bund of Sulphuric Acid Storage Tank.	Incident Report Submitted.
I 169	27/06/2011	Leachate Levels in LP1 above one metre.	Incident Report Submitted.
I 170	29/06/2011	Elevated CO ₂ levels at G3, G4, G5, G6, G7, G8, G14, & G15.	Incident Report Submitted.



KTK LANDFIL AER 2011

Number	Date	Description	Action
I 171	19/07/2011	Elevated CO ₂ levels at G3, G4, G6, G7, G8, G14, & G15.	Incident Report Submitted.
I 172	26/05/2011	Elevated CH ₄ levels at G3 & G4 Elevated CO ₂ levels at G3, G4, G5, G6, G8, G14, & G15.	Incident Report Submitted.
I 173	24/08/2011	Elevated CH ₄ Levels at G2, & G10. Elevated CO ₂ levels at G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G14 & G15.	Incident Report Submitted.
I 174	28/10/2011	Elevated CO ₂ levels at G1, G2, G4, G6, G7, & G11.	Incident Report Submitted.
I 175	04/11/2011	Elevated CO ₂ levels at G3, G4, G6, G8, G14, & G15.	Incident Report Submitted.
I 176	12/12/2011	Elevated CH ₄ Levels at G2. Elevated CO ₂ levels at G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11, G14 & G15	Incident Report Submitted.
I 177	28/12/2011	Leachate Levels in LP1 above one metre.	Incident Report Submitted.



19.2 Complaints

KTK Landfill maintains a register of complaints received in compliance with Condition 10.4 of the waste licence. A total of 22 complaints were received for the reporting period. Complaints received by the facility in are summarised in Table 41.

Table 41: Record of Complaints Received during 2011

Number	Date	Complainant	Description
2011-1	07/02/2011	Mrs Mary Charlton	Litter on by- road
2011-2	20/03/2011	Mr Angus Dunlop	Odour
2011-21	24/03/2011	Mr. Ger Peacock	Odour and Operations
2011-3	23/09/2010	Mrs Jane Russell	Puncture to car
2011-4	18/05/2011	Mr Angus Dunlop	Odour
2011-5	20/05/2011	Mrs Tracey Dunlop	Odour
2011-6	15/06/2011	Angus and Tracey Dunlop	Odour
2011-7	23/06/2011	Mr Simon Durham	Odour
2011-8	18/07/2011	Mrs Helen Murphy	Odour/visual impact
2011-9	21/07/2011	Mr Simon Durham	Odour
2011-10	21/07/2011	Mrs Marie Gorman	Odour
2011-11	28/07/2011	Mrs Angela Tynan	Odour
2011-12	02/08/2011	Mr Simon Durham	Odour
2011-13	04/08/2011	Mr Simon Durham	Odour
2011-14	15/08/2011	Mrs Mary Charlton	Odour
2011-15	16/08/2011	Mr Angus Dunlop	Odour
2011-16	16/08/2011	Mr Simon Durham	Odour
2011-17	17/08/2011	Mr Donal Hogan	Odour
2011-18	24/08/2011	Mrs Mary Charlton	Odour
2011-19	23/08/2011	Mr Ger Peacock	Odour/impacts
2011-20	02/09/2011	Mrs Mary Charlton	Odour
2011-22	08/12/2011	Mrs Judy Baker	Noise/lights/visual impact



20.0 REVIEW OF NUISANCE CONTROLS AT KTK LANDFILL DURING 2011

KTK Landfill Ltd is committed to operating KTK landfill in the best possible manner using best available techniques to minimise impacts to the environment and local residential neighbours. KTK Landfill Ltd welcome communications from local residents and any interested parties and all reasonable and practical measures will be implemented to eliminate or minimise any issues or nuisances. All nuisance control measures continue to be implemented so as to ensure licence compliance.

20.1 Bird Control

Bird control measures employed at the site continued as necessary to comply with site waste licence conditions. This involved the use of third party bird control services and on site kites, distress calls and flare pistol.

20.2 Vermin Control

Site personnel regularly checked for evidence of vermin on-site during regular routine inspections. Rentokil were employed throughout the duration of the reporting period in order to control potential nuisance caused by rodents. Continuous baiting was carried out by Rentokil and adjusted as necessary to prevent any infestation of vermin.

20.3 Mud Control

A high pressure jet wheel wash system is employed on the site since February 2004 and uses a series of pressure sprayers to power wash vehicles from the wheels up to the cab. A self drive road sweeper is maintained on the site and is utilised as and when necessary to maintain all site roads in a clean condition.

21.0 REPORTS ON FINANCIAL PROVISION MADE UNDER THIS LICENCE, MANAGEMENT AND STAFFING STRUCTURE OF THE FACILITY, AND A PROGRAMME FOR PUBLIC INFORMATION

21.1 Financial Provision

Under condition 12.3.3 of the site licence KTK Landfill is required to maintain a financial provision to cover any liabilities incurred whilst carrying on the activities to which this licence relates. Detailed below are the financial provisions made for the facility

21.2 Closure Restoration and Aftercare Costs (Known Environmental Liabilities)

A capital provision for closure, restoration and aftercare continued to be deducted from Gate Revenues during 2011. As of the end of this reporting period a total amount of € 8,151,221 has been accrued for closure, restoration and aftercare costs.

KTK Landfill Ltd. is owned through its parent company Greenstar Ltd., by National Toll Roads plc. The company has a secure financial backing.

21.3 Financial Provisions for Unknown Environmental Liabilities

As part of Condition 12.3.2, the Licensee has completed a fully costed Environmental Liabilities Risk Assessment for the site. This document outlines the potential unknown environmental liabilities associated with the landfill and estimates the possible cost of these liabilities. Greenstar Ltd have accidental pollution liability insurance to the value of €6.5 million, which is well in excess of the cost that may arise from unknown liabilities.



22.0 MANAGEMENT STRUCTURE AT KTK LANDFILL DURING THE REPORTING PERIOD

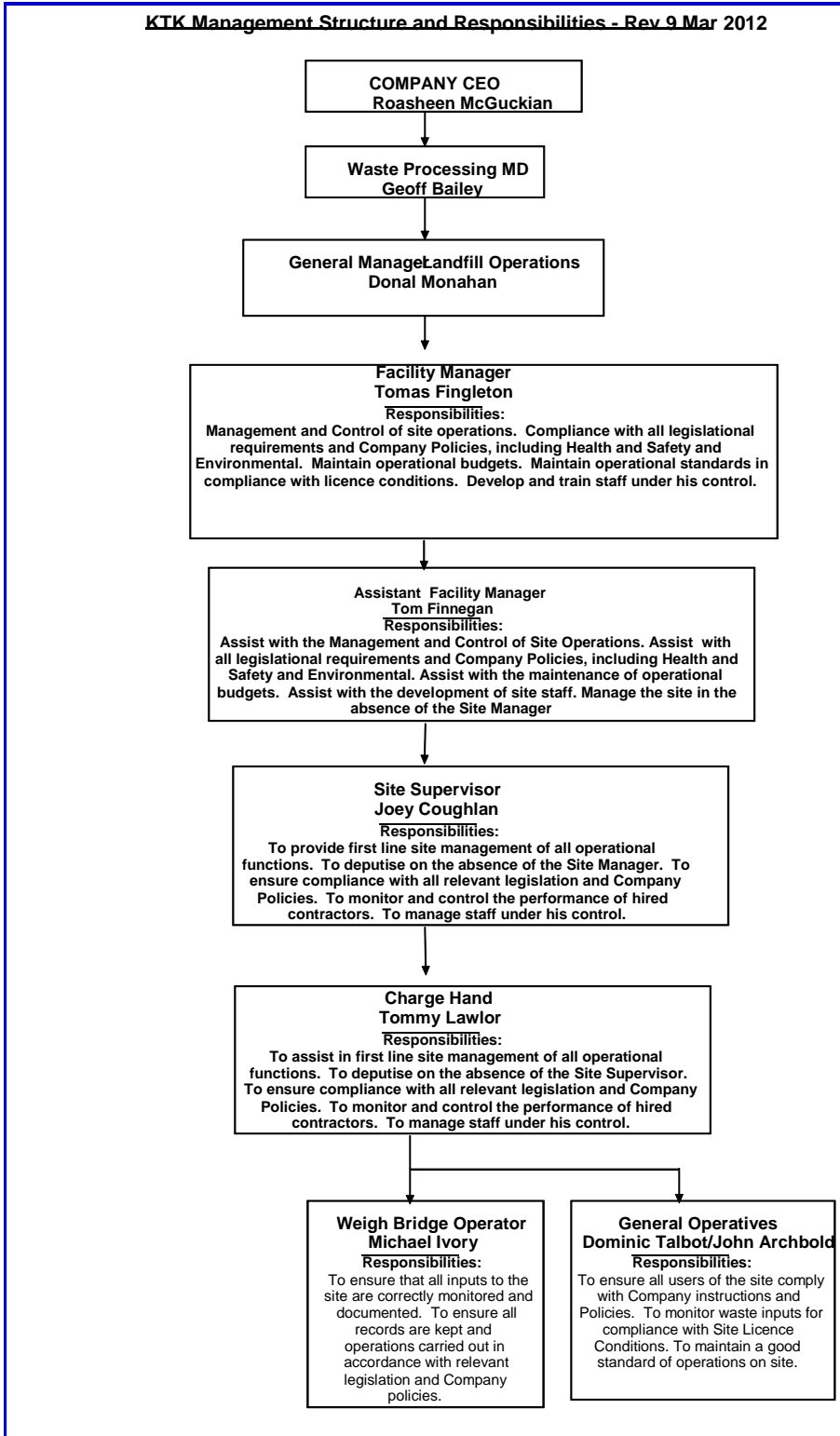


Figure 20: Management Structure at KTK Landfill



22.1 Programme for Public Information

KTK pursues an active programme of disseminating information on its operations to interested parties. This is undertaken through a variety of means including site tours, the company website, presentations and open days.

KTK's community development fund made significant donations to a number of local groups during the course of 2011 including Kilcullen community groups and sport facilities. A comprehensive public information programme developed in April 2000 continues to be used.

The communications programme contains 8 specific objectives:

- To promote public awareness of the Company's activities and environmental policies;
- To maintain an ongoing dialogue with authorities that have direct involvement with waste disposal activities;
- To make available Environmental Performance Data relating to KTK Landfill Ltd;
- To disseminate information relating to the operational and management of the site as appropriate;
- To encourage liaison between KTK Landfill Ltd, and local residents and those who may be affected by the sites operations;
- To provide general information on Waste Management Issues;
- To ensure all users and customers of the site are conversant with the requirements of the Site Licence; and
- To ensure that all objectives are, where possible, measurable and quantifiable.

The objectives of the programme are met through the following elements as appropriate:

- Personal Contact;
- Residents Meetings/Liaison Groups;
- Information Displays;
- Information Packs;
- Site Visits;
- Web Page;
- Educational Links; and
- Published Information.

23.0 POLLUTION RELEASE TRANSFER RECORD

Under EU Regulation 166/2006, all licensed facilities are obliged to prepare a PRTR which details all releases of pollutants and off-site transfer of pollutants and waste. Figures for releases to air, releases to storm-water and wastes transferred off-site were sent to the Agency in April 2011. The complete PRTR document was also uploaded to the dedicated EPA PRTR website.



Report Signature Page

GOLDER ASSOCIATES IRELAND LIMITED

Handwritten signature of Mark Butler in blue ink.

Mark Butler
Environmental Scientist

Handwritten signature of Thomas Vainio-Mattila in blue ink.

Thomas Vainio-Mattila
Senior Environmental Consultant

MB/TVM/aw

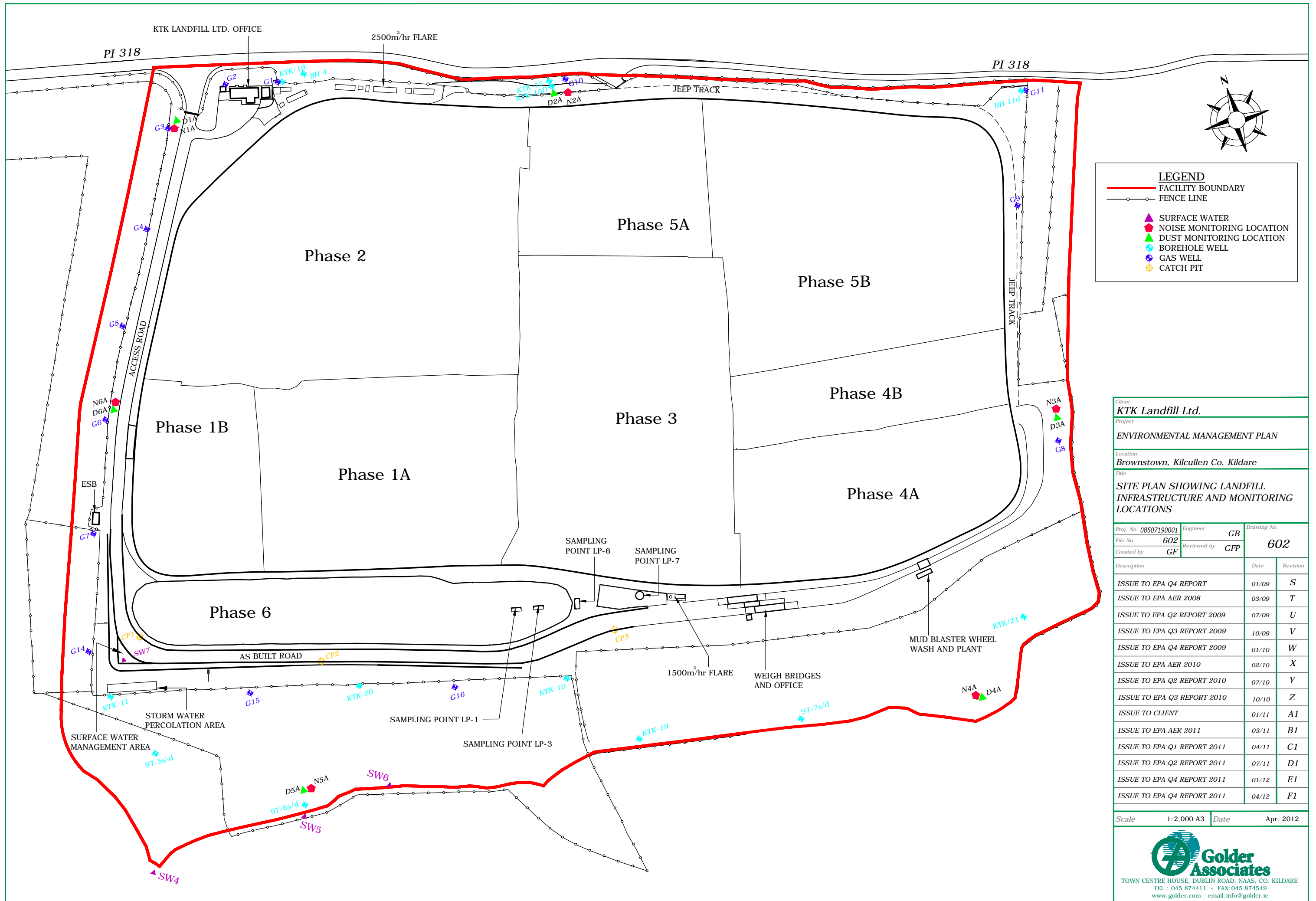
24 April 2012

Registered in Ireland Registration No. 297875
Town Centre House, Dublin Road, Naas, Co. Kildare, Ireland
Directors: M. Gilligan, A. Harris (British)
VAT No.: 8297875W



APPENDIX A

Site Layout and Monitoring Locations



LEGEND

- FACILITY BOUNDARY
- FENCE LINE
- ▲ SURFACE WATER
- ◆ NOISE MONITORING LOCATION
- ▲ DUST MONITORING LOCATION
- ◆ BOREHOLE WELL
- ◆ GAS WELL
- ◆ CATCH PIT

Client KTK Landfill Ltd.		
Project ENVIRONMENTAL MANAGEMENT PLAN		
Location Brownstown, Kilkullen Co. Kildare		
Title SITE PLAN SHOWING LANDFILL INFRASTRUCTURE AND MONITORING LOCATIONS		
Proj. No. 08507190001	Engineer GB	Drawing No.
File No. 602	Reviewed by GFP	602
Created by GF		
Description	Date	Revision
ISSUE TO EPA Q4 REPORT	01/09	S
ISSUE TO EPA AER 2008	03/09	T
ISSUE TO EPA Q2 REPORT 2009	07/09	U
ISSUE TO EPA Q3 REPORT 2009	10/09	V
ISSUE TO EPA Q4 REPORT 2009	01/10	W
ISSUE TO EPA AER 2010	02/10	X
ISSUE TO EPA Q2 REPORT 2010	07/10	Y
ISSUE TO EPA Q3 REPORT 2010	10/10	Z
ISSUE TO CLIENT	01/11	A1
ISSUE TO EPA AER 2011	03/11	B1
ISSUE TO EPA Q1 REPORT 2011	04/11	C1
ISSUE TO EPA Q2 REPORT 2011	07/11	D1
ISSUE TO EPA Q4 REPORT 2011	01/12	E1
ISSUE TO EPA Q4 REPORT 2011	04/12	F1

Scale 1:2,000 A3 Date Apr. 2012

Golder Associates
 TOWN CENTRE HOUSE, DUBLIN ROAD, NAAS, CO. KILDARE
 TEL.: 045 874411 - FAX: 045 874549
 www.golder.com - email: info@golder.ie

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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Co. Kildare
Ireland
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[Guidance to completing the PRTR workbook](#)

AER Returns Workbook

Version 1.1.13

REFERENCE YEAR	2011
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1. FACILITY IDENTIFICATION

Parent Company Name	KTK Landfill Limited
Facility Name	KTK Landfill Limited
PRTR Identification Number	W0081
Licence Number	W0081-04

Waste or IPPC Classes of Activity

No.	class_name
3.5	Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
3.1	Deposit on, in or under land (including landfill).
3.11	Blending or mixture 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.
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.
4.3	Recycling or reclamation of metals and metal compounds.
4.4	Recycling or reclamation of other inorganic materials.
Address 1	Brownstown and Carnalway
Address 2	Kilcullen
Address 3	Co. Kildare
Address 4	
	Kildare
Country	Ireland
Coordinates of Location	-6.71785 53.1451
River Basin District	IEEA
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Tomas Fingleton
AER Returns Contact Email Address	tomas.fingleton@greenstar.ie
AER Returns Contact Position	landfill manager
AER Returns Contact Telephone Number	045 482600
AER Returns Contact Mobile Phone Number	0867741813
AER Returns Contact Fax Number	045 482629
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	0
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

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

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

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

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

POLLUTANT		METHOD			Please enter all quantities in this section in KGs						QUANTITY		
No. Annex II	Name	M/C/E	Method Code	Designation or Description	FLARE 01 (2500)	FLARE 02 (1500/2500)	ENGINES GE01-03				T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
03	Carbon dioxide (CO2)	E	ESTIMATE	Gas sim estimate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
01	Methane (CH4)	E	ESTIMATE	Gas sim estimate	0.0	0.0	0.0	0.0	0.0	0.0	3200000.0	0.0	3200000.0
02	Carbon monoxide (CO)	M	OTH	Flue gas analyser, Testo 350/454 MXL	9.57	1.96	11049.42	0.0	0.0	0.0	11060.95	0.0	0.0
08	Nitrogen oxides (NOx/NO2)	M	OTH	Flue gas analyser, Testo 350/454 MXL	203.13	86.64	5358.69	0.0	0.0	0.0	5648.46	0.0	0.0
11	Sulphur oxides (SOx/SO2)	M	OTH	Impinger train containing 0.10 molar sodium hydroxide and deionised water solution in accordance EN1911, EPA 26A and EN15713:2006	3922.47	656.08	1719.31	0.0	0.0	0.0	6297.86	0.0	0.0
07	Non-methane volatile organic compounds (NMVOC) Particulate matter (PM10)	M	OTH	Signal FID 3030PM and TNMHC analyser	0.0	0.0	212.57	0.0	0.0	0.0	212.57	0.0	0.0

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

SECTION B : REMAINING PRTR POLLUTANTS

POLLUTANT		METHOD			Please enter all quantities in this section in KGs			
No. Annex II	Name	M/C/E	Method 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)

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

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

Additional Data Requested from Landfill operators

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

Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used		Facility Total Capacity m3 per hour
			Method Code	Designation or Description	
Total estimated methane generation (as per site model)	4300000.0	E	Estimate	Gas Sim estimate	N/A
Methane flared	604817.0	C	calculated	EPA - Bernard Hyde method	6500.0 (Total Flaring Capacity)
Methane utilised in engine/s	2701596.0	C	calculated	EPA - Bernard Hyde method	1800.0 (Total Utilising Capacity)
Net methane emission (as reported in Section A above)	993587.0	E	Estimate	Gas Sim estimate	N/A

4.2 RELEASES TO WATERS

[Link to previous years emissions data](#)

| PRTR# : W0081 | Facility Name : KTK Landfill Limited | Filename : w0081 PRTR 2011.xlsm | Return Year : 2011 |

16/05/2012 12:41

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

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

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

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

4.3 RELEASES TO WASTEWATER OR SEWER

[Link to previous years emissions data](#)

| PRTR# : W0081 | Facility Name : KTK Landfill Limited | Filename : w0081 PRTR 2011.xlsm | Return

16/05/2012 12:41

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
No. Annex II	Name	M/C/E	Method 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			
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

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

4.4 RELEASES TO LAND

[Link to previous years emissions data](#)

| PRTR# : W0081 | Facility Name : KTK Landfill Limited | Filename : w0081 PRTR 2011.xlsm | Return Year : 2011 |

16/05/2012 12:41

SECTION A : PRTR POLLUTANTS

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

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

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

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

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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR#: W0081 | Facility Name : KTK Landfill Limited | Filename : w0081 PRTR 2011.xlsm | Return Year : 2011 |

16/05/2012 12:41

Please enter all quantities on this sheet in Tonnes

5

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: Address of Next Destination Facility	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						Haz Waste: Name and Licence/Permit No of Recover/Disposer			Non Haz Waste: Address of Recover/Disposer				
											Kildare County Council Headquarters		
Within the Country	19 07 03	No	38541.0	landfill leachate other than those mentioned in 19 07 02	R3	C	Volume Calculation	Offsite in Ireland	Osberstown wwtp Kildare Coco ,D00**		, , , ,Aras Chill Dara Devoy Park Naas Co. Kildare		
Within the Country	19 07 03	No	144.08	landfill leachate other than those mentioned in 19 07 02	R3	M	Weighed	Offsite in Ireland	Navan WWTP,DOO**		*,*,*,Ireland		
Within the Country	19 07 03	No	4744.55	landfill leachate other than those mentioned in 19 07 02	R3	M	Weighed	Offsite in Ireland	Riita,DOO***		Greenogue Inds estate,,,,,Ireland		
Within the Country	19 07 03	No	9,236.58	landfill leachate other than those mentioned in 19 07 02	R3	M	Weighed	Offsite in Ireland	Leixlip WWTP,DOO**		Kildare County Council,,,,,Ireland		

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

[Link to previous years waste data](#)

[Link to previous years waste summary data & percentage change](#)